Prevalence and Risk Factors for Excess Weight Gain in Pregnancy: A Population-Based Cross-Sectional Study in Canada

Jamie L. Benham MD[1], Jane E. Booth MSc[2], Lois E. Donovan MD[3], Alexander A. Leung MD MPH[4], Ronald J. Sigal MD MPH[5], Doreen M. Rabi MD MSc[6]

1) Departments of Medicine and Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada
2) Department of Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada
3) Alberta Children's Hospital Research Institute and Departments of Medicine and Obstetrics and Gynecology, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada
4) Department of Community Health Sciences, Cumming School of Medicine, University of Calgary, Calgary, AB, Canada
5) Departments of Medicine, Community Health Sciences and Cardiac Sciences, Cumming School of Medicine, and Faculty of Kinesiology, University of Calgary, Calgary, AB, Canada
6) Departments of Medicine, Community Health Sciences and Cardiac Sciences, Cumming School of Medicine University of Calgary, Calgary, AB, Canada

Corresponding Author:

Jamie L. Benham, MD

jlbenham@ucalgary.ca

FUNDING

No funding was provided for this study.

CONFLICTS OF INTEREST

All authors declare they have no conflicts of interest.

ABSTRACT

Objective: Maternal weight gain during pregnancy is required for fetal development, however excess gestational weight gain is associated with increased maternal and neonatal morbidity. Our objectives were to determine the proportion of Canadian women who gain excess weight during pregnancy and to identify risk factors for excess gestational weight gain.

Methods: Self-reported data on maternal weight gain were collected in the 2015-2018 Canadian Community Health Survey, a cross-sectional population-based survey. Excess gestational weight gain was defined according to the 2009 Institute of Medicine guidelines for recommended weight gain during pregnancy by pre-conception body mass index. The analysis was based on frequency estimates and associated 95% confidence intervals (95%CI). Potential risk factors for excess gestational weight gain were evaluated using logistic regression.

Results: Overall, 31.6% (95%CI 30.1%-33.1%) of Canadian women gained excess weight during pregnancy. Women with obesity prior to conception had lower odds of gaining excess weight than those with normal body mass index (BMI; odds ratio 0.52, 95%CI 0.47-0.57, $p<0.001$). Risk factors for excess gestational weight gain were identified as younger age, lower education level, mood disorder, and anxiety disorder.

Conclusions: Excess gestational weight gain occurred in one-third of pregnancies in Canadian women. Compared to women with normal BMI, those with obesity prior to conception had lower odds of gaining excess weight during pregnancy. Strategies are needed to reduce the proportion of Canadian women who gain excess weight during pregnancy regardless of preconception BMI.

BACKGROUND

While maternal weight gain in pregnancy is vital to fetal development, excess gestational weight gain is associated with adverse pregnancy-related outcomes for mothers and neonates including gestational hypertension, caesarean delivery, and large-for-gestational-age neonates[1-4]. In addition, the effects of excess gestational weight gain can affect the mother across the lifetime with post-partum weight retention, excess weight gain in subsequent pregnancies, and obesity leading to increased cardiometabolic risk[5-9]. Excess gestational weight gain can be associated with overweight and obesity in the offspring and associated cardiometabolic sequelae[10].

In 2009, the Institute of Medicine (IOM) updated the recommendations for gestational weight gain to reflect the differential effect of body mass index (BMI) by providing specific gestational weight gain recommendations for each BMI category[11]. These recommendations were designed to reduce adverse maternal and neonatal outcomes associated with insufficient and excess gestational weight gain[11]. The IOM guidelines on optimal gestational weight gain have been integrated into clinical practice guidelines for women during pregnancy[12,13]. Since these gestational weight gain recommendations were implemented, the reported proportion of women who gain more gestational weight than recommended during pregnancy has varied from 35 to 74.3%[3,14-20]. Data from the 2006-2007 Statistics Canada Maternity Experiences Survey showed 48.7% of Canadian women gained excess weight per the 2009 IOM guidelines during pregnancy[15]. The extent to which Canadian women have gained more than the recommended upper limit for gestational weight gain since the current IOM guidelines were published is unknown.

The primary objective of this study was to determine the proportion of Canadian women who gain excess weight during pregnancy using a population-based cross-sectional survey. The secondary objective was to identify risk factors for excess gestational weight gain.

RESEARCH DESIGN AND METHODS

Data Sources

Data from the 2015-2016 and 2017-2018 cycles of the Canadian Community Health Survey (CCHS) were used in this analysis. Detailed information regarding the CCHS data sources, methodology and data accuracy has been previously published[21]. In brief, the CCHS is a national cross-sectional survey designed to provide population estimates on the health status of Canadians. The target population was Canadians 12 years of age and older who lived in private occupied dwellings in all provinces and territories (approximately 97% of the Canadian population). The CCHS excludes persons living on reserves or other Indigenous settlements, persons who are institutionalized and full-time members of the Canadian Armed forces, which represents <3% of the Canadian population 12 years of age and older. A multi-stage sample allocation strategy was employed to select participants. Participation was voluntary. The response rate was 57.5% for the 2015-2016[22] cycle and 60.8% for the 2017-2018 cycle[23].

Sample

In this cross-sectional study, respondents who reported giving birth in the five years prior to survey administration were considered for inclusion. Participants were excluded if data were missing on height, pre-pregnancy weight and/or weight gain during the most recent pregnancy.

Excess Gestational Weight Gain

Survey respondents self-reported height and pre-pregnancy weight, from which BMI in kilograms per meters squared was calculated. The calculated BMI was adjusted using a correction formula (corrected BMI = -0.12 + 1.05 x BMI)[24] from reported and measured values in previously administered surveys to minimize potential misclassification bias. BMI was then divided into pre-specified categories: underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2) and obese (≥30 kg/m^2). Respondents were classified as gaining excess gestational weight in their most recent pregnancy if they reported gaining more than the recommended upper limit for their preconception BMI consistent with the IOM guidelines[11]: underweight (>18.2 kg), normal weight (>15.9 kg), overweight (>11.4 kg) and obese (>9.1 kg).

Potential Risk Factors

Potential risk factors for excess gestational weight gain include biologic, socioeconomic and lifestyle factors[25,26]. Demographic characteristics assessed in this study included age (<35 years; ≥35 years), area of residence (urban; rural), citizenship status (Canadian citizen; permanent resident), education level (less than secondary education; secondary education; post-secondary education), household income (<$50,000; $50,000-$99,999; $100,000-$149,999; ≥$150,0000), and race (Indigenous; White; Black; Latin American; Southeast Asian; Other). A history of each of the following medical conditions was coded dichotomously as present or absent: gestational diabetes mellitus, diabetes mellitus, heart disease, hypertension, mood disorder, anxiety disorder, bowel disease, asthma and arthritis. Behaviours during pregnancy were also evaluated as risk

factors. Smoking, alcohol and folic acid consumption during pregnancy were coded dichotomously as any or no consumption during pregnancy.

Data Analysis

Population-representative estimates were obtained by applying respondent-specific survey weights, and bootstrap techniques were used to estimate 95% confidence intervals (95%CI)[9]. The proportion of pregnant women in each preconception BMI category and the proportion of those who gained excess weight were calculated and presented with associated 95%CI. Logistic regression was used to assess the odds ratios (OR) for excess gestational weight in each BMI category (underweight, overweight and obese) compared with normal preconception BMI. Logistic regression was also used to calculate the OR for excess weight gain given each of the risk factors independently. The OR for each logistic regression was reported with the associated 95%CI and p-value. Participants with missing data on any specific variable were excluded from analyses involving that variable. All analyses were completed using Stata Statistical Software (StataCorp, College Station, TX, USA, Version 14). The level of statistical significance was pre-determined as $p<0.05$.

RESULTS

The weighted sample included 1,335,615 Canadian women. Demographic, socioeconomic, maternal and pregnancy-related characteristics are presented in Table 1. Overall, 31.6% (95%CI 30.1-33.1%) of women gained more weight than recommended by the IOM based on their preconception BMI. The mean age of women who gained excess weight during pregnancy was 32.6 years (95%CI 32.3-32.9 years) compared with 33.4 years (95%CI 33.2-33.6 years) for

women who did not gain excess weight in pregnancy. Mean weight gain during pregnancy for all included women was 15.9 kg (95%CI 15.4-16.5 kg; Table 2). Women with obesity had 48% lower odds of gaining excess weight compared to women with a normal BMI (OR 0.52, 95%CI 0.47-0.57, p<0.001).

Factors Associated with Excess Weight Gain in Pregnancy

Associations between biologic, sociodemographic and pregnancy-related factors and excess gestational weight gain are presented in Table 3. Biologic factors that were associated with excess weight gain during pregnancy were age, and a history of mood disorder, anxiety disorder, bowel disorder or asthma. Women <35 years of age had higher odds of gaining excess gestational weight than women ≥35 years of age (OR 1.20, 95%CI 1.06-1.47, p=0.02). A medical history of mood disorder, anxiety disorder, bowel disorder or asthma were associated with increased odds of gaining excess weight during pregnancy compared with not having a history of these medical conditions.

Sociodemographic factors associated with excess weight gain in pregnancy included education level and race. Women who did not have a post-secondary certificate or degree had increased odds of gaining excess gestational weight than women who did (OR 1.25, 95%CI 1.06-1.47, p=0.01). Women of South Asian, Chinese, Filipino, Arab, West Asian, Korean, Japanese or more than one racial origin had 36% lower odds of excess gestational weight gain than women who identified as White (OR 0.64, 95%CI 0.51-0.81, p<0.001). Household income, citizenship status and rural versus urban location were not associated with excess gestational weight gain.

Smoking, alcohol consumption and folic acid intake during pregnancy were not associated with excess weight gain.

DISCUSSION

The findings from this study indicate that nearly one-third of Canadian women gained more weight than recommended in pregnancy using the IOM criteria[11]. The prevalence of excess gestational weight gain per IOM criteria among Canadian women has declined within the last decade from an estimate of 48.7% using data from the 2006-2007 Statistics Canada Maternity Experiences Survey[15] to our estimate of 31.6% using data collected between 2015-2018, especially among women with obesity. While this is a positive trend, almost one-third of Canadian women continue to gain more than the recommended amount of weight during pregnancy, and are therefore at increased risk for associated maternal and neonatal complications[2,3], increased post-partum weight retention[5,6], further cumulative weight gain with subsequent pregnancies[27] and cardiometabolic disease associated with obesity[8,9].

While pregnancy has been identified as a trigger for cumulative weight gain in the life course of a woman[27,28]; many women are not aware of gestational weight gain recommendations[29,30]. Furthermore, women who are informed of the recommendations are often not provided with strategies to reduce the risk of excess weight gain[31]. Studies of Canadian healthcare providers[32,33] and women receiving care during pregnancy[31,34-36] reveal a discordance between the proportion of healthcare providers who report making recommendations about gestational weight gain and the information women report receiving. A survey found that 95% of healthcare providers report counselling pregnant women on gestational weight gain[32] while between 5 and 50% of pregnant

women recall receiving counselling on appropriate gestational weight gain[34,36]. An opportunity is being missed in antenatal care to improve women's health that needs to be addressed to ensure all women receive ongoing information and counselling with respect to healthy weight gain throughout pregnancy.

Previous studies found that women with obesity were more likely to gain excess gestational weight than those with a normal BMI preconception[14-16,18,19,25,31,37]. These studies included pregnant women who gave birth between 2001 and 2013, before or around the time of publication of the 2009 IOM guidelines. More recently, some studies have found that higher pre-pregnancy BMI is associated with less excess gestational weight gain[38,39]. In our study, which included women who experienced pregnancy between 2010 and 2018 after the publication of the 2009 IOM guidelines, we found that a lower proportion of women with obesity gained excess weight in pregnancy than those in other preconception BMI categories. This finding may reflect improvements in counseling for pregnant women with obesity coinciding with the publication of several clinical practice guidelines within the last decade specifically address management of pregnancy in women with obesity including education regarding the risks associated with obesity and recommendations for gestational weight gain consistent with the 2009 IOM guidelines[40]. As risks of excess gestational weight gain affect all women during pregnancy[1,2], concerted efforts should be made to address weight gain in all women regardless of preconception BMI.

Several antenatal interventions have been designed to encourage appropriate weight gain during pregnancy. These include motivational interviewing[41], and behavioural interventions including education, exercise[42] and diet[43]. In general, these interventions were shown to be superior to

standard care, with fewer women gaining excess gestational weight during pregnancy, indicating that antenatal interventions are effective when employed. However, these interventions can require more resources in terms of qualified staff, time and/or funding. A meta-analysis found that in-person interventions were more effective than standard of care, while eHealth interventions were not clearly more effective than standard of care[43]. While it may not be feasible to offer in-person interventions to all women during pregnancy, targeted interventions to women with characteristics that make them more susceptible to excess gestational weight gain who may benefit most might be considered.

We identified socioeconomic and maternal characteristics that were associated with excess gestational weight gain. These include lower education level, younger age, and medical conditions including mood disorder, anxiety, bowel disorder or asthma. Education level has consistently been associated with gestational weight gain with studies showing women with less education have higher odds of gaining excess gestational weight, which is consistent with what we found[15,37]. Our findings are consistent with other studies that have reported younger age as a risk factor for excess gestational weight gain[25,37]. Advanced maternal age (≥35 years of age during pregnancy) is associated with an increased risk of stillbirth, fetal growth restriction, gestational diabetes and neonatal death[44]. Therefore, less excess weight gain in women of advanced maternal age compared with women <35 years of age may reflect an attempt to minimize the added risk of gaining excess weight in pregnancy.

The strengths of this study include the use of a large sample that is nationally-representative. This study has several limitations. Weight and height were self-reported, potentially leading to

incorrect BMI category classification, as weight is often underestimated and height overestimated. There also may have been recall bias as women were asked to recall the amount of weight gained in a pregnancy that occurred up to five years prior. Potential confounders that we could not evaluate included prenatal visit frequency and type of care provider (i.e., family physician, obstetrician, midwife), which could affect the proportion of women that gained excess weight if increased education and monitoring of gestational weight gain led to more appropriate weight gain. Several other risk factors for excess gestational weight gain have been identified in the literature such as lower self-efficacy[45], higher parity[15,19,37], lower physical activity during pregnancy[19] and less healthcare provider advice[37] that we were unable to evaluate because these questions not being administered in the Canadian Community Health Survey[21].

CONCLUSIONS

Approximately one-third of Canadian women gained more gestational weight than is recommended. While this finding is an improvement from a decade earlier, a considerable number of women continue to be at risk not only from pregnancy associated complications, but of weight retention, diabetes and also future cardiometabolic complications related to overweight and obesity. The IOM clinical guidelines have been helpful in so far as they have outlined clear targets for gestational weight gain, but more needs to be done to ensure women can be successful in achieving appropriate weight gain in pregnancy. This work has also identified that women who are younger, have lower educational attainment or that have a comorbid anxiety or mood disorder are at increased risk for excess gestational weight gain. Effective, acceptable and accessible strategies to encourage healthy weight gain during pregnancy are available and should be implemented more broadly and used specifically in high risk groups.

REFERENCES

1. Faucher MA, Barger MK. Gestational weight gain in obese women by class of obesity and select maternal/newborn outcomes: A systematic review. *Women Birth.* 2015;28:e70-9.
2. Crane JM, White J, Murphy P, Burrage L, Hutchens D. The effect of gestational weight gain by body mass index on maternal and neonatal outcomes. *J Obstet Gynaecol Can.* 2009;31:28-35.
3. Johnson J, Clifton RG, Roberts JM, et al. Pregnancy outcomes with weight gain above or below the 2009 institute of medicine (IOM) gestational weight. *Obs Gynecol.* 2013;121:969-75.
4. Gaillard R, Durmus B, Hofman A, Mackenbach JP, Steegers EA, Jaddoe VW. Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. *Obesity (Silver Spring).* 2013;21:1046-55.
5. Amorim AR, Rossner S, Neovius M, Lourenco PM, Linne Y. Does excess pregnancy weight gain constitute a major risk for increasing long-term BMI? *Obesity (Silver Spring).* 2007;15:1278-86.
6. Nehring I, Schmoll S, Beyerlein A, Hauner H, von Kries R. Gestational weight gain and long-term postpartum weight retention: a meta-analysis. *Am J Clin Nutr.* 2011;94:1225-31.
7. Linne Y, Rossner S. Interrelationships between weight development and weight retention in subsequent pregnancies: the SPAWN study. *Acta Obstet Gynecol Scand.* 2003;82:318-25.
8. McClure CK, Catov JM, Ness R, Bodnar LM. Associations between gestational weight gain and BMI, abdominal adiposity, and traditional measures of cardiometabolic risk in mothers 8 y postpartum. *Am J Clin Nutr.* 2013;98:1218-25.
9. Rooney BL, Schauberger CW. Excess pregnancy weight gain and long-term obesity: one decade later. *Obstet Gynecol.* 2002;100:245-52.
10. Gaillard R, Steegers EA, Franco OH, Hofman A, Jaddoe VW. Maternal weight gain in different periods of pregnancy and childhood cardio-metabolic outcomes. The Generation R Study. *Int J Obes (Lond).* 2015;39:677-85.
11. Institute of Medicine. *Weight gain during pregnancy: reexamining the guidelines.* Washington, DC: National Academies Press;2009.
12. American College of Obstetricians and Gynecologists. Weight gain during pregnancy. Committee Opinion No. 548. *Obstet Gynecol.* 2013;121:210–2.
13. Government of Canada. Prenatal Nutrition Guidelines for Health Professionals: Gestational Weight Gain. 2014; https://www.canada.ca/en/health-canada/services/canada-food-guide/resources/prenatal-nutrition/eating-well-being-active-towards-healthy-weight-gain-pregnancy-2010.html. Accessed August 13, 2020.
14. Chung JG, Taylor RS, Thompson JM, et al. Gestational weight gain and adverse pregnancy outcomes in a nulliparous cohort. *Eur J Obstet Gynecol Reprod Biol.* 2013;167:149-53.
15. Kowal C, Kuk J, Tamim H. Characteristics of weight gain in pregnancy among Canadian women. *Matern Child Health J.* 2012;16:668-76.

16. Park S, Sappenfield WM, Bish C, Salihu H, Goodman D, Bensyl DM. Assessment of the Institute of Medicine recommendations for weight gain during pregnancy: Florida, 2004-2007. *Matern Child Health J.* 2011;15:289-301.
17. Durie DE, Thornburg LL, Glantz JC. Effect of second-trimester and third-trimester rate of gestational weight gain on maternal and neonatal outcomes. *Obstet Gynecol.* 2011;118:569-75.
18. Woolcott C, Dodds L, Ashley-Martin J, Piccinini-Vallis H. Distribution of pregnancy-related weight measures. *Can Fam Physician.* 2016;62:e400-e6.
19. Herring SJ, Nelson DB, Davey A, et al. Determinants of excessive gestational weight gain in urban, low-income women. *Womens Health Issues.* 2012;22:e439-46.
20. Goldstein RF, Abell SK, Ranasinha S, et al. Gestational weight gain across continents and ethnicity: systematic review and meta-analysis of maternal and infant outcomes in more than one million women. *BMC Med.* 2018;16:153.
21. Statistics Canada. Canadian Community Health Survey – Annual Component (CCHS). http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226. Accessed October 9, 2020.
22. Statistics Canada. *Canadian Community Health Survey (CCHS) Annual Component – User Guide 2015-2016 Microdata File.*2017.
23. Canada. S. Canadian Community Health Survey (CCHS) Annual Component – User Guide 2017-2018 Microdata File. 2019.
24. Dzakpasu S, Duggan J, Fahey J, Kirby RS. Estimating bias in derived body mass index in the Maternity Experiences Survey. *Health Promot Chronic Dis Prev Can.* 2016;36:185-93.
25. Restall A, Taylor RS, Thompson JM, et al. Risk factors for excessive gestational weight gain in a healthy, nulliparous cohort. *J Obes.* 2014;2014:148391.
26. Campbell EE, Dworatzek PD, Penava D, et al. Factors that influence excessive gestational weight gain: moving beyond assessment and counselling. *J Matern Fetal Neonatal Med.* 2016;29:3527-31.
27. Linne Y, Dye L, Barkeling B, Rossner S. Weight development over time in parous women--the SPAWN study--15 years follow-up. *Int J Obes Relat Metab Disord.* 2003;27:1516-22.
28. Umberson D, Liu H, Mirowsky J, Reczek C. Parenthood and trajectories of change in body weight over the life course. *Soc Sci Med.* 2011;73:1323-31.
29. Shub A, Huning EY, Campbell KJ, McCarthy EA. Pregnant women's knowledge of weight, weight gain, complications of obesity and weight management strategies in pregnancy. *BMC Res Notes.* 2013;6:278.
30. Gaudet LM, Gruslin A, Magee LA. Weight in Pregnancy and Its Implications: What Women Report. *Journal of Obstetrics and Gynaecology Canada.* 2011;33:227-34.
31. Vinturache A, Winn A, Mannion C, Tough S. Women's recall of health care provider counselling on gestational weight gain (GWG): a prospective, population-based study. *BMC Pregnancy Childbirth.* 2019;19:136.
32. Ferraro ZM, Boehm KS, Gaudet LM, Adamo KB. Counseling about gestational weight gain and healthy lifestyle during pregnancy: Canadian maternity care providers' self-evaluation. *Int J Womens Health.* 2013;5:629-36.
33. Lutsiv O, Bracken K, Pullenayegum E, Sword W, Taylor VH, McDonald SD. Little congruence between health care provider and patient perceptions of counselling on

gestational weight gain. *Journal of Obstetrics and Gynaecology Canada.* 2012;34:518-24.
34. McDonald SD, Pullenayegum E, Bracken K, et al. Comparison of midwifery, family medicine, and obstetric patients' understanding of weight gain during pregnancy: a minority of women report correct counselling. *J Obstet Gynaecol Can.* 2012;34:129-35.
35. Ferraro Z, Rutherford J, Keely EJ, Dubois L, Adamo KB. An assessment of patient information channels and knowledge of physical activity and nutrition during pregnancy. *Obstet Med.* 2011;4:59-65.
36. Ledoux T, Van Den Berg P, Leung P, Berens PD. Factors associated with knowledge of personal gestational weight gain recommendations. *BMC Res Notes.* 2015;8:349.
37. Stotland NE, Haas JS, Brawarsky P, Jackson RA, Fuentes-Afflick E, Escobar GJ. Body mass index, provider advice, and target gestational weight gain. *Obstet Gynecol.* 2005;105:633-8.
38. Salmon C, Sauve RS, LeJour C, Fenton T, Metcalfe A. A single gestational weight gain recommendation is possible for all classes of pregnant women with obesity. *Obes Res Clin Pract.* 2020;14:66-72.
39. Enomoto K, Aoki S, Toma R, Fujiwara K, Sakamaki K, Hirahara F. Pregnancy Outcomes Based on Pre-Pregnancy Body Mass Index in Japanese Women. *PLoS One.* 2016;11:e0157081.
40. Vitner D, Harris K, Maxwell C, Farine D. Obesity in pregnancy: a comparison of four national guidelines. *J Matern Fetal Neonatal Med.* 2019;32:2580-90.
41. Bogaerts AF, Devlieger R, Nuyts E, Witters I, Gyselaers W, Van den Bergh BR. Effects of lifestyle intervention in obese pregnant women on gestational weight gain and mental health: a randomized controlled trial. *Int J Obes (Lond).* 2013;37:814-21.
42. Ruchat SM, Mottola MF, Skow RJ, et al. Effectiveness of exercise interventions in the prevention of excessive gestational weight gain and postpartum weight retention: a systematic review and meta-analysis. *Br J Sports Med.* 2018;52:1347-56.
43. Walker R, Bennett C, Blumfield M, et al. Attenuating Pregnancy Weight Gain-What Works and Why: A Systematic Review and Meta-Analysis. *Nutrients.* 2018;10.
44. Lean SC, Derricott H, Jones RL, Heazell AEP. Advanced maternal age and adverse pregnancy outcomes: A systematic review and meta-analysis. *PLoS One.* 2017;12:e0186287.
45. Halili L, Liu RH, Weeks A, Deonandan R, Adamo KB. High maternal self-efficacy is associated with meeting Institute of Medicine gestational weight gain recommendations. *PLoS One.* 2019;14:e0226301.

Table 1. Demographic, socioeconomic, maternal and pregnancy-related characteristics by gestational weight gain

	N*	Excess Weight Gain % (95%CI)
All Women Included in Study	1,335,615	31.6 (30.1-33.1)
Age < 35 years	910,048	32.9 (31.1-34.6)
Age ≥ 35 years	425,567	28.9 (25.9-31.8)
Lives in a Rural Community	220,461	31.6 (28.9-34.3)
Lives in an Urban Community	1,115,154	31.6 (29.8-33.4)
Permanent Resident	361,008	25.3 (21.8-28.8)
Race		
Indigenous	71,747	39.2 (33.2-45.3)
White	851,833	33.6 (31.9-35.4)
Black	49,849	25.6 (17.4-33.9)
Latin American	25,117	24.7 (13.8-35.7)
Southeast Asian	20,726	26.6 (12.7-40.5)
Other[a]	316,343	24.6 (20.7-28.5)
Highest Level of Education		
Less than Secondary Education	79,240	39.7 (33.5-45.9)
Completed Secondary Education	227,086	34.0 (30.4-37.5)
Completed Post-Secondary Certificate or Degree	1,022,021	30.5 (28.7-32.2)
Household Income		
< $50 000	344,270	33.3 (30.6-36.1)
$50 000 to $99 999	428,114	31.0 (28.4-33.6)
$100 000 to $149 999	311,769	32.0 (28.6-35.4)
≥ $150 000	251,462	29.8 (26.3-33.3)
Maternal Medical Conditions		
Gestational Diabetes Mellitus	14,604	24.1 (10.9-37.3)
Diabetes Mellitus	23,791	25.9 (16.3-35.5)
Bowel Disorder	36,090	40.0 (29.6-50.4)
Heart Disease	7,436	43.9 (26.2-61.6)
Hypertension	34,125	32.3 (22.3-42.2)
Anxiety Disorder	145,880	39.4 (34.9-43.8)
Asthma	113,997	37.4 (32.2-42.6)
Arthritis	53,258	32.9 (25.9-39.9)
Mood Disorder	129,238	38.1 (33.4-42.8)
Behaviours During Pregnancy		
Smoked	65,535	39.5 (33.1-45.8)
Used Alcohol	178,423	28.8 (19.8-37.8)
Took Folic Acid	1,194,539	32.0 (30.4-33.6)

*Sample size is estimated using population weights; [a]South Asian, Chinese, Filipino, Arab, West Asian, Korean, Japanese, Other, or More than one racial Origin

Table 2. Weight Gain in Pregnancy by BMI Category

BMI Category Before Pregnancy	N[+]	Mean Weight Gain (kg, 95% CI)	Proportion Who Gained Excess Weight (%, 95% CI)	Odds Ratio[#] (95% CI, p-value)
Underweight (<18.5 kg/m^2)	52,560	17.5 (15.0-20.0)	36.5 (28.1-45.0)	1.1 (0.8-1.6) p=0.57
Normal (18.5-24.9 kg/m^2)	739,362	17.3 (16.4-18.1)	34.0 (31.9-36.2)	1
Overweight (25-29.9 kg/m^2)	327,006	15.2 (14.3-16.1)	32.3 (29.2-35.4)	0.9 (0.8-1.1) p=0.38
Obese (≥30 kg/m^2)	216,687	12.2 (11.0-13.3)	21.0 (17.7-24.3)	0.5* (0.5-0.6) p<0.001
Any BMI	1,335,615	15.9 (15.4-16.5)	31.6 (30.1-33.1)	-

[+]Sample size is estimated using population weights; [#]calculated using logistic regression for excess weight gain in pregnancy compared to normal BMI; *statistically significant as defined by p<0.05

Table 3. Univariate Analysis Examining the Association between Characteristics of Pregnant Women in Canada and Excess Weight Gain

	Odds Ratio	95%CI	p-Value
Age < 35 years	1.20*	1.02-1.43	0.02
Lives in an Urban Community	0.99	0.86-1.16	0.99
Permanent Resident	1.21	0.76-1.95	0.43
Did Not Complete Post-Secondary Certificate or Degree	1.25*	1.06-1.47	0.01
Household Income			
< $50 000	1 (REF)		
$50 000 to $99 999	0.90	0.75-1.07	0.22
$100 000 to $149 999	0.94	0.77-1.15	0.55
≥ $150 000	0.85	0.69-1.04	0.11
Race			
White	1 (REF)		
Indigenous	1.27	0.98-1.65	0.07
Black	0.68	0.44-1.05	0.08
Latin American	0.64	0.36-1.18	0.16
Southeast Asian	0.72	0.35-1.47	0.36
Other[a]	0.64*	0.51-0.81	<0.001
History of the Following Medical Conditions:			
Gestational Diabetes Mellitus	0.88	0.28-2.76	0.83
Diabetes Mellitus	0.75	0.45-1.26	0.27
Heart Disease	1.70	0.80-3.61	0.17
Hypertension	1.03	0.64-1.66	0.89
Mood Disorder	1.38*	1.11-1.71	0.01
Anxiety Disorder	1.47*	1.20-1.80	<0.001
Bowel Disorder	1.60*	1.01-2.53	0.04
Asthma	1.33*	1.05-1.70	0.02
Arthritis	1.06	0.77-1.47	0.70
Behaviours During Pregnancy:			
Smoked During Pregnancy	1.00	0.73-1.38	0.98
Used Alcohol During Pregnancy	0.87	0.55-1.38	0.56
Took Folic Acid During Pregnancy	1.21	0.94-1.56	0.14

*statistically significant as defined by $p<0.05$; [a]South Asian, Chinese, Filipino, Arab, West Asian, Korean, Japanese, Other, or More than one racial Origin