Pregnancy Outcomes of First Nations Women in Relation to Pregravid Weight and Pregnancy Weight Gain

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Abstract

Objective: To determine the effect of pregravid weight and pregnancy weight gain on pregnancy outcomes in Cree women.

Methods: We reviewed maternal and infant outcomes of the first pregnancy in Cree women living in James Bay, Quebec, from 1994 to 2000. We examined data from women who had a full-term singleton birth and a maternal pregravid body mass index (BMI) ≥18.5 kg/m^2 and whose weight had been recorded in the first trimester and within one month prior to delivery. Weight in the first trimester was used to estimate pregravid BMI.

Results: Data were available for 603 women. At the beginning of pregnancy, 23.1% of the women had normal weight (BMI 18.5–24.9 kg/m^2), 27.9% were overweight (BMI 25–29.9 kg/m^2), and 49.1% were obese (BMI ≥30 kg/m^2). Nearly one-half of the women gained excessive weight in pregnancy. Adverse outcomes were less common in women with a normal pregravid BMI than in women with a pregravid BMI in the overweight or obese range. Obese women with excessive weight gain had a higher prevalence of preeclampsia (14.9%) than obese women with low (3.7%) or acceptable (6.3%) weight gain; however, obese women with excessive weight gain had a lower prevalence of gestational diabetes mellitus.

Conclusion: Interventions must be developed to prevent pregravid obesity and excessive weight gain in pregnancy in Cree women to improve maternal and fetal outcomes.

Résumé

Objectif : Déterminer l'effet du poids avant la grossesse et du gain pondéral durant la grossesse sur les issues de grossesse chez les Cries.

Méthodes : Nous avons analysé les issues maternelles et néonatales de la première grossesse chez les Cries vivant à la baie James, au Québec, entre 1994 et 2000. Nous nous sommes penchés sur les données issues des femmes ayant connu un accouchement unique à terme, ayant présenté un indice de masse corporelle (IMC) maternel avant la grossesse = 18,5 kg/m^2, et dont le poids avait été consigné au cours du premier trimestre et du mois précédant l'accouchement. Le poids au cours du premier trimestre a été utilisé pour estimer l'IMC avant la grossesse.

Résultats : Des données étaient disponibles au sujet de 603 femmes. Au début de la grossesse, 23,1 % des femmes présentaient un poids normal (IMC 18,5–24,9 kg/m^2), 27,9 % présentaient une surcharge pondérale (IMC 25–29,9 kg/m^2) et 49,1 % étaient obèses (IMC = 30 kg/m^2). Près de la moitié des femmes ont connu un gain pondéral excessif au cours de la grossesse. Les issues indésirables étaient moins courantes chez les femmes ayant présenté un IMC normal avant la grossesse que chez celles dont l'IMC avant la grossesse se situait dans la zone « surcharge pondérale » ou « obésité ». Les femmes obèses ayant connu un gain pondéral excessif ont présenté une prévalence de prééclampsie (14,9 %) plus importante que les femmes obèses ayant connu un gain pondéral faible (3,7 %) ou acceptable (6,3 %); cependant, les femmes obèses ayant connu un gain pondéral excessif ont présenté une prévalence de diabète sucré gestationnel moindre.

Conclusion : Des interventions doivent être élaborées en vue de prévenir l'obésité avant la grossesse et le gain pondéral excessif durant la grossesse chez les Cries, et ce, afin d'entraîner une amélioration des issues maternelles et fœtales.

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INTRODUCTION

In 1990, the Institute of Medicine (IOM) published guidelines for recommended weight gain in pregnancy in order to prevent adverse outcomes caused by fetal undernourishment.[1] Weight gain recommendations were based on a woman's pregravid body mass index (BMI). Although abnormally low pregravid weight complicated by low weight gain is potentially a high-risk combination, both high pregravid weight and excessive weight gain in pregnancy also contribute to poor maternal-fetal outcomes.[2] Women with pregravid obesity are at increased risk for developing gestational diabetes mellitus (GDM), developing hypertensive disorders, requiring a Caesarean section (CS), and having a macrosomic infant.[3,4] The offspring of women with pregravid obesity are at increased risk for type 2 diabetes

mellitus and obesity as they grow older.[5–8] Because of limited knowledge about the weight gain required for the most favourable outcome in an obese woman and her fetus, the IOM recommended a minimum weight gain during pregnancy of 7.0 kg for women with a BMI of 30 kg/m^2 or higher but did not advise an upper limit for weight gain. In women considered overweight (defined by the IOM as a BMI of 26.1–29.0 kg/m^2), a weight gain of between 7.0 kg and 11.5 kg was recommended.[1] Current Health Canada recommendations for healthy weight gain during pregnancy for women in the general population, as well as for First Nations women, are based on IOM guidelines.[9,10] In 2003, Health Canada changed the threshold for a definition of "overweight" in adults from a BMI of 27.0 kg/m^2 to a BMI of 25.0 kg/m^2 and continued to define obesity as a BMI of ≥30.0 kg/m^2 [11]; however, guidelines for weight gain in pregnancy were not revised to reflect this reclassification. Furthermore, despite an increase in extreme obesity in the adult population,[12] there are no specific recommendations for weight gain during pregnancy in women whose BMI is 35.0 kg/m^2 or higher.

Since the implementation of the IOM guidelines, the proportion of women beginning pregnancy either overweight or obese has substantially increased.[13] Recommendations for optimal weight gain in obese women during pregnancy are controversial.[2] Although weight gain of between 7.0 kg and 11.5 kg in pregnancies complicated by obesity appears to be associated with healthy outcomes for both mother and baby,[14] a lower than recommended weight gain in obese women also appears to be compatible with an optimal birth weight.[15]

We explored the issue of weight gain in pregnancy in First Nations women in Canada, among whom there is a high prevalence of overweight and obesity, type 2 diabetes mellitus, GDM, and infant macrosomia.[16–20] The effects of both maternal pregravid weight and maternal weight gain in pregnancy on outcomes such as GDM, hypertension, CS, and macrosomia have not been well documented in First Nations women. In the present study, we report the relationship between pregravid weight, weight gain in pregnancy, and adverse maternal-fetal outcomes in Cree women living in James Bay, Quebec.

METHODS

The Cree people reside throughout much of northern and western Canada. The 14 000 Eastern James Bay (Eeyou Istchee) Cree live in nine remote or rural communities in northern Quebec. Most communities are accessible by road year-round. Prenatal care is available to all women at local community clinics. Deliveries often take place in hospitals outside the region; thus, many women leave their communities up to one month prior to giving birth.

Data on pregnancy and childbirth were abstracted from the medical records of Cree women in James Bay who gave birth in the seven-year period between January 1994 and December 2000. Variables of interest related to pregnancy and the neonate were maternal diabetes status, hypertensive disorders, delivery type, first and final recorded weight in pregnancy, maternal height, and infant birth weight. Pregnancy-induced hypertension was defined as abnormally high blood pressure that began during pregnancy in previously normotensive mothers. Women were considered preeclamptic if they had two or more of hypertension, edema, or proteinuria occurring after a gestational age of 20 weeks. Infant macrosomia was defined both as a birth weight > 4000 g and > 4500 g (grade 2 and beyond), the latter of which is more predictive of neonatal morbidity.[21] Maternal weight was considered to estimate pregravid weight if obtained within the first 14 weeks of gestation. Because many women leave their communities to give birth, the final weight in pregnancy was considered to be the last weight recorded within four weeks of delivery. Weight gain in pregnancy was derived by subtracting the first from the final weight in pregnancy. When height was recorded in a woman's medical chart, her BMI was calculated. When height was not reported, the average recorded female height (1.63 m, standard deviation [SD] 0.06) was used to calculate an estimated pregravid BMI. The 2003 Health Canada body weight classification, with a decreased threshold for excessive weight,[11] has been established in prior obstetric research and was used in our study.[22–26] Because new recommendations for weight gain in pregnancy have not been published since the change in body weight classification, the 1999 Canadian guidelines for weight gain in pregnancy[9] were applied to the currently recognized (stricter) BMI definitions and were used to classify weight gain in pregnancy as low, acceptable, or excessive for each body weight category (Table 1).

The Figure shows a summary of how pregnancies were selected for this study. To ensure that only one pregnancy was included for each woman, the first birth recorded in the time interval between January 1994 and December 2000 (index pregnancy) was chosen for analysis. Pregnancies with factors that may have influenced maternal weight gain, such as one parent being non-Cree, preterm deliveries, and twin pregnancies, were not included in the analysis. Women whose first and final weights in pregnancy were recorded outside the specified time range were not included in the analysis. Women with glycemic abnormalities before pregnancy were removed from analysis because these disorders could affect some of the outcomes of interest independent

Table 1. Weight gain classification in pregnant women

Pregravid weight category	Recommended weight gain in pregnancy
Underweight (BMI < 18.5)	12.5–18 kg
Normal weight (BMI 18.5–24.9)	11.5–16 kg
Overweight (BMI 25.0–29.9)	7–11.5 kg
Obese (BMI ≥ 30)	7–11.5 kg

BMI: body mass index (kg/m^2).

of pregnancy weight gain. Records with undefined glycemic status in pregnancy, due either to poor medical charting or to abnormal screening tests that were not adequately followed, were also not included. Also not included in the analysis were the few women classified as underweight (n = 5), because meaningful statistics could not be generated for this group.

Results are reported as percentages, unadjusted odds ratios with 95% confidence intervals (CIs), and mean ± 1 SD. Statistical methods used included analysis of variance (ANOVA), chi-square, and logistic regression to identify predictors of adverse pregnancy outcomes. When the results of ANOVA were considered statistically significant ($P < 0.05$), Bonferroni post hoc tests were used to identify group differences. Data analyses were performed using SPSS for Windows (Version 12.0, Chicago, IL).

The Human Research Ethics Board of the Faculty of Agriculture, Forestry and Home Economics at the University of Alberta approved the study. The study was supported by the Cree Board of Health and Social Services of James Bay (Quebec). Members of the Research Committee of the Cree Health Board reviewed and accepted the study and were given the opportunity to comment on the manuscript.

RESULTS

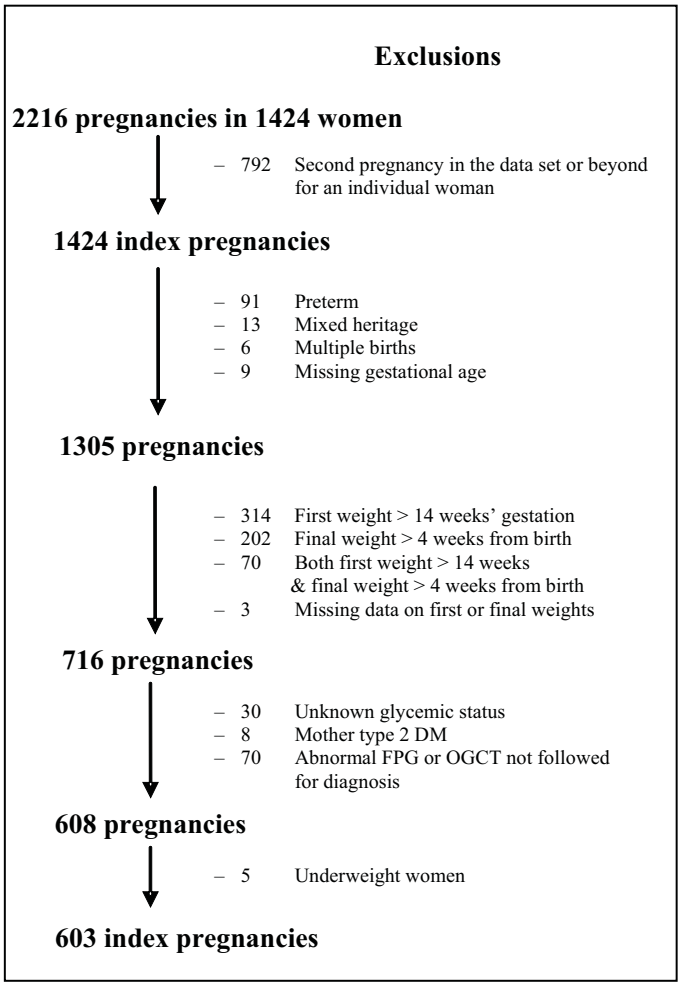
Of index pregnancies, 42.3% (603 of 1424) were included for analysis (Figure). The major reason for exclusion of an index pregnancy was that pregravid and final weights were recorded outside the specified range. To determine if included and excluded index pregnancies were similar, we compared maternal age, pregravid weight, pregravid BMI (actual or estimated), final weight, smoking status, and pregnancy outcomes where data were available. With the exception of weight gain in pregnancy, which was higher for included than for excluded index pregnancies (13.1 ± 7.0 kg vs. 11.7 ± 7.1 kg, $P = 0.001$), no significant differences were found (results not shown). The comparison was repeated without the 119 excluded index pregnancies that were preterm, multigravid, of mixed heritage, or with missing gestational age, as these pregnancies might be anticipated to have differences in pregnancy weight gain. Once again, weight gain in pregnancy was higher for included than for excluded index pregnancies (13.1 ± 7.0 kg vs. 11.8 ± 7.2 kg, $P = 0.003$). Height had been measured in 238 of the 603 (39.5%) index pregnancies. The correlation coefficient between actual and estimated BMI for women who had height recorded was very high ($r = 0.939$).

On average, the 603 women included in the study began pregnancy with a weight of 80.0 ± 16.9 kg and gained 13.1 ± 7.0 kg during gestation. The distribution of women who gained low, acceptable, and excessive weight in each pregravid BMI group is shown in Table 2. Almost one-half (46.8%) of women had excessive weight gain for their BMI group, and almost one-half (49.1%) began pregnancy obese. Of those obese women, most (57.8%) were in class I (BMI 30–34.9 kg/m^2), 25% were in class II (BMI 35–39.9 kg/m^2), and 17.2% were in class III (BMI ≥ 40 kg/m^2).

Differences in pregnancy outcomes between pregravid BMI groups are shown in Table 3. There was a general increase in the prevalence of adverse outcomes with increasing pregravid BMI. The unadjusted odds ratios for pregnancy outcomes in overweight and obese women compared with women with normal pregravid weight are shown in Table 4. In almost all cases, overweight and obese women had a greater risk of adverse outcomes than did women of normal weight.

To determine whether excessive weight gain in pregnancy increased the risk for adverse maternal-fetal health outcomes more than high pregravid weight alone, we explored the relationship between weight gain class in obese women and adverse maternal-fetal outcomes (Table 5). Among obese women, those who gained excessive weight were younger than women who had low or acceptable weight gain, and those who gained the least weight had the highest pregravid weight. In obese women, weight gain in pregnancy was significantly associated with the prevalence of preeclampsia and GDM, but not with impaired glucose tolerance, CS, or infant macrosomia. Whereas the prevalence

Selection of pregnancies 1994–2000 for study



DM: diabetes mellitus.

FPG: fasting plasma glucose.

OGCT: oral glucose challenge test.

of preeclampsia rose with increasing weight gain in pregnancy, the prevalence of GDM decreased with increasing weight gain. The relationship between weight gain and pregnancy outcomes was analyzed for both normal weight and overweight women; however, meaningful statistics on outcomes could not be calculated in many cases because of the limited number of adverse pregnancy events.

DISCUSSION

In this study, we explored the association of pregravid BMI class and weight gain in pregnancy with pregnancy complications in Cree women. Despite their relatively young age, more than two-thirds of women (77%) included in the present study began pregnancy overweight (27.9%) or obese (49.1%). These rates are higher than in the general population of Canadian women of childbearing age, in which 32.8% are overweight or obese.[27] The overall rate of excessive weight gain in pregnancy for Cree women (46.8%) was comparable to rates of excessive weight gain in pregnancy for women in the United States.[28–30] We found that the Cree women who were overweight or obese before pregnancy were at increased risk for CS, GDM, impaired glucose tolerance, preeclampsia, and infant macrosomia, compared with women who began pregnancy with normal weight.

Macrosomic infants are at risk for birth injuries and may be predisposed to being overweight both at one year of life and in adolescence.[31,32] The rate of infant macrosomia in Cree women in this study was 37.2%, considerably higher than the rate in the North American general population (approximately 10%).[33] In Cree women of normal weight, the rate of infant macrosomia was 20.1%; in overweight women, 31.5%; and in obese women, 48.5%. Obese women had a greater risk of having a baby with grade 2 macrosomia. Despite reports of an increased risk of Caesarean sections for macrosomic deliveries,[21,34] the overall CS rate of 17.4%

Table 2. Weight gain trends for each pregravid BMI class

	Pregravid BMI classification			
	BMI 18.5–24.9 Normal weight	BMI 25–29.9 Overweight	BMI ≥ 30 Obese	Total
N	139 (23.1%)	168 (27.9%)	296 (49.1%)	603 (100%)
Weight gain in pregnancy				
Low weight gain (%)	20.1	10.1	28.0	21.2
Acceptable weight gain (%)	28.8	32.1	33.4	32.0
Excessive weight gain (%)	51.1	57.7	38.5	46.8
	100	100	100	100

BMI: body mass index (kg/m^2).

Table 3. Pregnancy complications and outcomes by pregravid BMI class

	Pregravid BMI classification				
	Normal	Overweight	Obese	*P*	Total population
N	139	168	296		603
First weight in pregnancy (kg)*	59.7 ± 5.0[a]	73.0 ± 4.3[b]	93.6 ± 12.3[c]	< 0.001	80.0 ±16.9
Age (years)	20.8 ± 5.2[a]	23.8 ± 5.4[b]	25.5 ± 5.5[c]	< 0.001	24.0 ± 5.7
Hypertensive disorders	3.6%	7.8%	13.7%	0.002	9.7%
Pregnancy-induced hypertension	1.4%	1.8%	4.8%	0.086	3.2%
Preeclampsia	2.2%	6.0%	8.9%	0.028	6.5%
Abnormal glycemic status in pregnancy	8.6%	22.6%	38.9%	< 0.001	27.4%
Gestational diabetes mellitus	4.3%	14.9%	27.4%	< 0.001	18.6%
Impaired glucose tolerance	4.3%	7.7%	11.5%	0.041	8.8%
Caesarean section	10.8%	11.3%	24.1%	< 0.001	17.4%
Macrosomia					
> 4000 g	20.1%	31.5%	48.5%	< 0.001	37.2%
> 4500 g	6.5%	7.1%	16.9%	0.001	11.8%

*First weight recorded in the first trimester (< 14 weeks' gestation).

BMI: body mass index (kg/m^2).

a, b, c: significantly different by ANOVA. Chi-square statistics used for other analyses.

in Cree mothers was comparable to the overall CS rate of 19.1% in the general population of Canada.[35]

Cree women in James Bay experience high rates of GDM,[17] which may predispose women and their infants to type 2 diabetes mellitus.[36] In the present study, the rate of GDM of 4.3% in Cree women with normal pregravid BMI was comparable to the rate of 2% to 4% in the general population.[36,37] The prevalence of GDM was 14.9% in women who were overweight at the onset of pregnancy and 27.4% in those who were obese. The odds of developing GDM were 3.9 times greater for overweight women and 8.3 times greater for obese women than for women of normal weight.

When the relationship between weight gain in pregnancy and developing GDM was explored in those women who began pregnancy obese, GDM was found to be more prevalent in women with low weight gain. The relationship was probably modified by the fact that obese women with low weight gain had the highest weight at the onset of pregnancy, and GDM may be more influenced by maternal weight at the onset of pregnancy than by weight gain during pregnancy.[4] The higher prevalence of GDM in the women who began pregnancy obese and had low weight gain could also be a function of maternal age, as obese women with low weight gain in general were older than obese women

Table 4. Unadjusted odds ratios of adverse outcomes for women in normal versus high pregravid BMI categories

	Odds ratios (95% confidence interval)		
	Pregravid BMI classification		
	Normal	Overweight	Obese
Hypertensive disorder	1.00	2.25 (1.44, 3.06)*	4.25 (2.80, 5.70)*
Pregnancy-induced hypertension	1.00	1.25 (1.03, 1.47)*	3.45 (2.21, 4.69)*
Preeclampsia	1.00	2.87 (1.82, 3.92)*	4.43 (2.94, 5.92)*
Abnormal glucose tolerance in pregnancy	1.00	3.09 (1.96, 4.22)*	6.72 (4.81, 8.63)*
GDM	1.00	3.86 (2.51, 5.21)*	8.32 (6.20, 10.44)*
IGT	1.00	1.86 (1.24, 2.48)*	2.88 (1.82, 3.94)*
Caesarean section	1.00	1.05 (1.00, 1.10)	2.62 (1.66, 3.58)*
Macrosomia			
Infant > 4000 g	1.00	1.83 (1.20, 2.43)*	3.73 (2.41, 5.05)*
Infant > 4500 g	1.00	1.11 (1.01, 1.21)*	2.95 (1.87, 4.03)*

BMI: body mass index (kg/m^2).

GDM: gestational diabetes mellitus.

IGT: impaired glucose tolerance.

* Statistically significant.

with excessive weight gain. Increased age is a risk factor for GDM.[36,37]

Preeclampsia predisposes a pregnant woman and her fetus to numerous adverse outcomes. The condition usually requires prompt hospitalization for evaluation and delivery, which is the ultimate treatment for this condition.[38] In the general Canadian population, preeclampsia complicates about 2.6% of pregnancies.[39] The prevalence of preeclampsia was high for Cree women who were overweight (6.0%) and obese (8.9%), but not for women who had a normal weight at the onset of pregnancy (2.2%). Obese women were 4.4 times more likely than normal weight women to have preeclampsia. In women who began pregnancy obese, preeclampsia was most prevalent in women with excessive weight gain (14.9%). These findings support the conclusion that excessive weight is a risk factor for preeclampsia.[4,14] The costs associated with preeclampsia and maternal stress are additional reasons why avoiding high pregravid weight and excessive weight gain in obese women should be a priority both for health care providers and for women in this population.

There are several potential limitations to the present study. A large number of index pregnancies had to be excluded because of missing data; however, given virtually no difference for maternal characteristics or pregnancy outcomes between included and excluded pregnancies, we are confident that our results can be generalized to the entire population of pregnant Cree women. We did not control for parity prior to the index pregnancy in this study. Although we realize that the number of pregnancies a woman has experienced may play a contributing role in adverse outcomes such as GDM, it is difficult to separate the effects of parity from those of advancing maternal age and maternal weight. We used the first weight recorded in the first trimester of pregnancy as a proxy measure for pregravid weight. Women, in general, gain little weight in the first trimester.[40] Because height had not been recorded for most women, BMI was estimated from the average stature of women whose height had been recorded. This value of 1.6 meters has been used previously to estimate BMI in Cree women, as height is not commonly recorded in medical charts documenting prenatal care.[18] Since there is a high correlation between actual and estimated BMI, we felt that estimated BMI was an acceptable substitute for actual BMI in women who did not have height recorded; however, there were likely errors that occurred in placing women in weight classes. The classification of women into weight gain categories was based on the final weight recorded in pregnancy rather than absolute weight gain in pregnancy because many women had to leave their home community several weeks prior to delivery. It has been reported that women will gain between 1.14 and 3.01 kg during the last month of a full-term pregnancy.[40] For this reason, we likely underestimated the number of women who gained excessive weight in pregnancy and overestimated the number of

Table 5. Pregnancy complications by weight gain category for women with pregravid BMI in the obese range

	Low weight gain	Acceptable weight gain	Excessive weight gain	*P*	Total
N	83	99	114		296
Age (years)	26.9 ± 4.8[a]	26.9 ± 5.6[a]	23.4 ± 5.2[b]	< 0.001	25.5 ± 5.5
Pregravid weight (kg)	96.8 ± 13.1[a]	92.2 ± 12.0[b]	92.4 ± 11.6[b]	0.021	93.6 ± 12.3
Hypertensive disorders	7.3%	12.5%	19.3%	0.051	13.7%
Pregnancy-induced hypertension	3.7%	6.3%	4.4%	0.698	4.8%
Preeclampsia	3.7%	6.3%	14.9%	0.013	8.9%
Abnormal glucose tolerance in pregnancy	50.6%	42.4%	27.2%	0.003	38.9%
GDM	38.6%	27.3%	19.3%	0.011	27.4%
IGT	12.0%	15.2%	7.9%	0.249	11.5%
Caesarean section	25.3%	23.5%	23.7%	0.952	24.1%
Macrosomia					
> 4000 g	47.0%	42.9%	54.4%	0.234	48.5%
> 4500 g	16.9%	15.3%	18.4%	0.834	16.9%

BMI: body mass index (kg/m^2).

GDM: gestational diabetes mellitus.

IGT: impaired glucose tolerance.

a, b, c: significantly different by ANOVA. Chi-square statistics used for other analyses.

women who had low weight gain. It is difficult to predict how misclassification might have influenced the interpretation of data, but it is possible that the relationships between excessive gain and adverse outcomes would have been strengthened if women near the maximum of acceptable gain had been shifted into the high-gain category.

In Cree communities in James Bay, Quebec, height and weight are recorded on standardized prenatal forms, but there is no mention of the calculation of BMI. That so few women had height recorded means that health care providers are not following the recommended measurement protocol. If BMI is not calculated, there can be no discussion of appropriate weight gain based on pregravid or early pregnancy BMI. On the forms, under the section entitled intrauterine growth restriction (IUGR), risk factors mentioned include a mother who is short (< 1.5 m), has low pregravid weight (< 45 kg), or who has had inadequate weight gain in pregnancy (< 8 kg). No mention is made of monitoring women with excess weight gain. From this, we can gather that clinicians are more concerned with low than with high weight gain. Given the finding of a correlation between excess weight gain in pregnancy and adverse maternal outcomes, prenatal care should include attention to appropriate weight gain based on calculated BMI.

Low weight gain in obese women may be associated with healthy maternal-fetal outcomes.[15] Except for an increase in GDM, which might have been due to factors such as maternal age and weight, obese Cree women with low weight gain appeared to have a healthier pregnancy in terms of infant birth weight and lower rates of preeclampsia. Obese women may not lose weight following delivery; this would put them at further risk in subsequent pregnancies. It may be appropriate to recommend a weight gain in pregnancy at the lower end of the recommended range, as studies have shown that postpartum weight retention is more of a problem for women who gain excessive amounts of weight during pregnancy.[41,42] The IOM's aim to decrease the effects of fetal malnourishment may be misdirected because obesity in women of reproductive age is increasingly a greater problem. Focusing instead on the nutritional content of their diet while aiming to keep weight gain at a minimum might serve obese women better than the current weight gain recommendations; however, further study of the fetal consequences of weight restriction in obese pregnant women is required before it can be advised.

CONCLUSION

Our findings indicate that both pregravid obesity and excessive weight gain in pregnancy are risk factors for a number of poor maternal and infant outcomes. For this reason, we recommend that health care providers calculate maternal BMI and stress to pregnant women the importance of staying within Health Canada's suggested weight gain guidelines

to prevent added risks associated with excessive weight gain. There is some indication that women who receive instruction from their physicians to gain weight within the recommended ranges are more likely to do so.[29,43] For obese women, minimal weight gain may be beneficial, but this needs to be evaluated further before it can be recommended. In Cree women, as well as in the general population of women of childbearing age in Canada, prenatal counselling and interventions to ensure a healthy weight prior to the onset of pregnancy would be beneficial. Counselling and interventions in the postpartum period to promote weight loss and healthy living may decrease the risk of pregravid obesity in subsequent pregnancies. A prior intervention described in the literature for this population failed to meet its objective of optimal weight gain in pregnancy,[44] so the appropriate form of intervention for this population remains unclear. More research into the nature of effective programs for this population is required.

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