Research

Diabetes during pregnancy among Métis people in Alberta: a retrospective cohort study

Britt Voaklander MSc, Omolara Sanni PhD, Jesus Serrano-Lomelin PhD, Ashton James MSc, Claire Cordingley MPH, Reagan Bartel MPH, Dean T. Eurich PhD, Maria B. Ospina PhD

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Abstract

Background: Diabetes in pregnancy is an important public health concern for Indigenous populations. We sought to evaluate the prevalence and outcomes of pre-existing and gestational diabetes among Métis pregnancies compared with other pregnancies in Alberta, Canada.

Methods: We conducted a retrospective cohort study using administrative health data from 2006 to 2016 and the Métis Nation of Alberta Identification Registry to compare the prevalence of pre-existing and gestational diabetes among all singleton Métis births with non-Métis births. We compared 10 maternal and neonatal outcomes using adjusted odds ratios (ORs) and 95% confidence intervals (CIs) in multivariable analyses.

Results: The study population included 7902 Métis and 471 886 non-Métis births. The age-standardized prevalence of pre-existing diabetes was 1.7% (95% CI 1.4%–2.1%) for Métis and 1.1% (95% CI 1.1%–1.2%) for non-Métis pregnancies. For gestational diabetes, the age-standardized prevalence was 6.3% (95% CI 5.6%–6.9%) for Métis and 5.4% (95% CI 5.3%–5.4%) for non-Métis pregnancies. After adjusting for parity, maternal weight, age, smoking during pregnancy and material and social deprivation, Métis pregnancies had 1.72 times higher prevalence of pre-existing diabetes (adjusted OR 1.72, 95% CI 1.15–2.56) and 1.30 times higher prevalence of gestational diabetes (adjusted OR 1.30, 95% CI 1.08–1.57) than non-Métis pregnancies. Métis pregnancies with pre-existing diabetes had nearly 3 times the odds of developing preeclampsia (adjusted OR 2.96, 95% CI 1.27–6.90), while those with gestational diabetes had 48% higher odds of large-for-gestational-age infants (adjusted OR 1.48, 95% CI 1.00–2.19).

Interpretation: Métis pregnancies have an increased prevalence of pre-existing and gestational diabetes than non-Métis pregnancies and an elevated risk of some perinatal outcomes. Interventions to tackle these health inequities should address both physiologic and cultural dimensions of health, informed by Métis perspectives.

Pregnancy and birth (which can be expressed with the Michif word *Ehawawisit*, meaning "with child") can be a special time of reflection and connection with Métis heritage and identity. Métis pregnant people face unique challenges and needs stemming from the historical and ongoing manifestations of colonialization, which have contributed substantially to perinatal disparities within their communities.[1] Throughout history, colonial policies and practices have resulted in the disruption of traditional Métis ways of life, leading to the loss of cultural practices and knowledge. These disruptions have had a profound impact on the overall health and well-being of Métis pregnant people, affecting their access to essential health care, nutrition and resources during pregnancy. Furthermore, the intergenerational trauma resulting from colonial violence and forced assimilation has created complex chronic health issues, which can have lasting effects on perinatal health outcomes.[2]

Previous studies have shown that Indigenous pregnant people, particularly First Nations people, have a higher risk of pre-existing and gestational diabetes and adverse birth outcomes.[3–5] Both pre-existing diabetes and gestational diabetes are serious conditions associated with adverse pregnancy and perinatal outcomes such as preeclampsia, cesarean delivery, preterm birth, macrosomia, stillbirth and birth injuries.[6–8] Métis people in Canada have a higher prevalence of type 2 diabetes than the general population;[9,10] however, Métis people have been underrepresented in Indigenous perinatal health research, and the knowledge gap about diabetes during pregnancy and its complications among Métis people is substantial. Evidence is required to address their unique challenges and needs for prenatal care, including diabetes management.

In this study, we aimed to assess the prevalence and outcomes of pre-existing and gestational diabetes among Métis pregnancies and compare these findings with non-Métis pregnancies.

Methods

Study design and setting

We conducted a population-based, retrospective cohort study using Alberta's provincial health data from 2006 to 2016. Alberta has the largest number of Métis people in Western Canada, with about 114 370 people identifying as Métis, which accounts for 19.5% of the total Métis population in Canada.[11] The Métis Nation of Alberta (MNA) was an essential partner in all aspects of this research, from formulating the research question, developing the study design, accessing Métis-specific data and interpreting the results. This partnership was facilitated by a research agreement between the academic researchers (M.B.O.) and the MNA. The research team consisted of Métis (B.V., R.B.), and MNA representatives (C.C., A.J.), as well as academic researchers (M.B.O., D.T.E., O.S., J.S.-L.).

Study population

The study population was all singleton births (≥ 22 wk of gestation) that occurred in Alberta between Apr. 1, 2006, and Mar. 31, 2016. We excluded multiple births, which made up a small proportion of the total births (about 3.4%), because they have distinct birth outcomes compared with singleton births.

Data sources

An information sharing agreement between the MNA and the Government of Alberta enabled data linkage between the Alberta Perinatal Health Program (APHP), the MNA Identification Registry, the Alberta Health Care Insurance Plan (AHCIP), and the Pharmaceutical Information Network. The APHP is a validated provincial registry that collects clinical data from the delivery record on maternal and delivery characteristics, pregnancy complications and neonatal outcomes for all hospital births and those attended at home by registered midwives.[12] The APHP uses clinical data recorded by the care provider attending the delivery and is usually obtained from prenatal records and the patient. The MNA Identification Registry, maintained by the MNA, holds demographic information for around 49 000 Métis people in Alberta. This database provides an accurate identification of Métis citizens and ensures verified connections to historic and contemporary Métis communities, addressing the issue of Métis identity in Canada. The AHCIP contains registration and demographic information of residents of Alberta. The Pharmaceutical Information Network collects drug dispensing information from community and outpatient pharmacies in Alberta using the Anatomic Therapeutic Chemical classification codes for categorizing medications.

From all singleton births identified in the APHP, we created a Métis birth cohort using probabilistic linkage between the MNA Identification Registry and the AHCIP.[13,14] This linkage achieved 98% accuracy in correctly identifying births that were Métis. All other births in the study population acted as the non-Métis comparison group. After identifying Métis and non-Métis births, we used the unique life identifier, a number assigned to everyone who receives health services in Alberta and that is shared between the APHP and the Pharmaceutical Information Network, to gather information on the characteristics and outcomes of the cohort.

The study outcomes were the prevalence of pre-existing and gestational diabetes in the cohorts. Pre-existing diabetes was defined in the APHP as either type 1 or type 2 diabetes managed by diet or insulin, or the presence of retinopathy as recorded in the antenatal risk assessment. We identified gestational diabetes based on the clinical diagnosis recorded in the APHP, which has been the gold-standard method for identifying gestational diabetes in Alberta.[15] We also evaluated obstetric and neonatal outcomes for both pre-existing and gestational diabetes, including preeclampsia (gestational hypertension and proteinuria), obstetric hemorrhage, induction of labour, admission to the neonatal intensive care unit (NICU), preterm birth (< 37 wk gestation; induced and spontaneous),[16] low infant birth weight (< 2500 g), small-for-gestational-age infant (< 10th percentile) and large-for-gestational-age infant (> 90th percentile) using Canadian sex-specific reference values.[17]

We obtained data on clinical characteristics recorded in the perinatal clinical registry, including parity, pre-pregnancy weight (< 91 kg or ≥ 91 kg), pre-existing hypertension, antenatal risk score (assigned as low [< 3], moderate [3–6] or high [> 6] by the attending care provider on admission for delivery based on information recorded in the Alberta Perinatal Record regarding pre-pregnancy factors, obstetrical history, issues in current pregnancy and other risk factors),[18,19] insulin prescriptions within 4 months before delivery, smoking and substance use during pregnancy (alcohol or drug), maternal age at birth and area of residence (urban or rural). We also analyzed the Pampalon Material and Social Deprivation Index, which is an area-level measure that integrates Census data based on the pregnant person's postal code at the time of delivery for area-level income, education, employment (for the material component), marital status, 1-person household and single-parent families (for the social component) among people aged 15 years and older.[20,21] The index is reported in quintiles, where Q1 and Q5 correspond to the least and most deprived groups, respectively.[20,21] We obtained information on all study variables from the APHP, except for insulin use during pregnancy, which was obtained from the Pharmaceutical Information Network using the Anatomic Therapeutic Chemical code A10A.

Statistical analysis

We described demographics, clinical characteristics and study outcomes using frequencies and proportions for categorical data and using means with standard deviations (SDs) for continuous data. We compared the Métis and non-Métis cohorts using either *t* tests for continuous data or the χ^2 test or Fisher exact test for categorical data. We calculated the period prevalence of pre-existing and gestational diabetes for both cohorts over a 10-year study period, dividing the number of pregnancies with diabetes by the total number of births for each cohort. We calculated the age-standardized prevalence of diabetes with the direct standardization method using all births in Canada in 2006 as reference.[22] We conducted a multivariable logistic regression to calculate the odds ratio (OR)[23] of pre-existing and gestational diabetes between Métis and non-Métis pregnancies, adjusting for parity, pre-pregnancy weight, maternal age, smoking, pre-existing hypertension, material and social deprivation and area of residence.[24–26]

We used multilevel logistic mixed-models with random effects to account for instances of more than 1 singleton birth to the same study participant over the study period. We structured the models such that births (level 1) were nested within individual study participants (level 2). We evaluated model fit using the likelihood ratio test, comparing the fit of the multilevel model to that of a single-level logistic model. A significant likelihood ratio test indicates a better fit of the multilevel model.[27] In addition, we calculated intracluster correlation coefficients to quantify the proportion of outcome variance attributable to differences between study participants, represented by the level 2 variable.[27] We calculated adjusted ORs with 95% confidence intervals (CIs) to compare the study outcomes between Métis and non-Métis births complicated by pre-pregnancy diabetes and gestational diabetes after adjusting for theoretically important covariates (i.e., maternal age, pre-pregnancy weight, insulin use, parity, smoking during pregnancy and material and social deprivation). We conducted the statistical analyses using SAS software version 9.4 (SAS Institute) and Stata Statistical Software version 15 (StataCorp).

Ethics approval

The study was approved by the University of Alberta's Health Research Ethics Board (no. Pro00085391), and followed the Reporting of Studies using Observational Routinely Collected Health Data (RECORD) checklist for observational epidemiological studies[28] and the Consolidated Criteria for Strengthening the Reporting of Health Research Involving Indigenous Peoples (CONSIDER) statement.[29]

Results

From 2006 to 2016, 497 400 singleton births in Alberta were recorded in the APHP. Of these, we excluded 14 100 (2.8%) births because it was not possible to verify whether the pregnancy belonged to a Métis or a non-Métis person. After merging data sets, 3512 (0.7%) of these births had missing information on diabetes status during pregnancy, and were excluded from the analysis. The final study population consisted of 7902 Métis and 471 886 non-Métis births (Figure 1). Demographic and clinical characteristics are shown in Table 1.

Métis people with pre-existing diabetes and those with gestational diabetes were younger at delivery than non-Metis people, and had higher proportions of high-risk pregnancies, pre-pregnancy weight of 91 kg or more and smoking use during pregnancy (Table 2). They were also more likely to live in rural areas and in areas with high material deprivation.

Pre-existing diabetes

The age-standardized period prevalence of pre-existing diabetes was 1.7% (95% CI 1.4%–2.1%) for Métis pregnancies and 1.1% (95% CI 1.1%–1.2%) for non-Métis pregnancies. Métis pregnancies had a higher prevalence of pre-existing diabetes than non-Métis pregnancies after adjusting for maternal age, overweight status (≥ 91 kg), parity, smoking during pregnancy and material and social deprivation (adjusted OR 1.72, 95% CI 1.15–2.56).

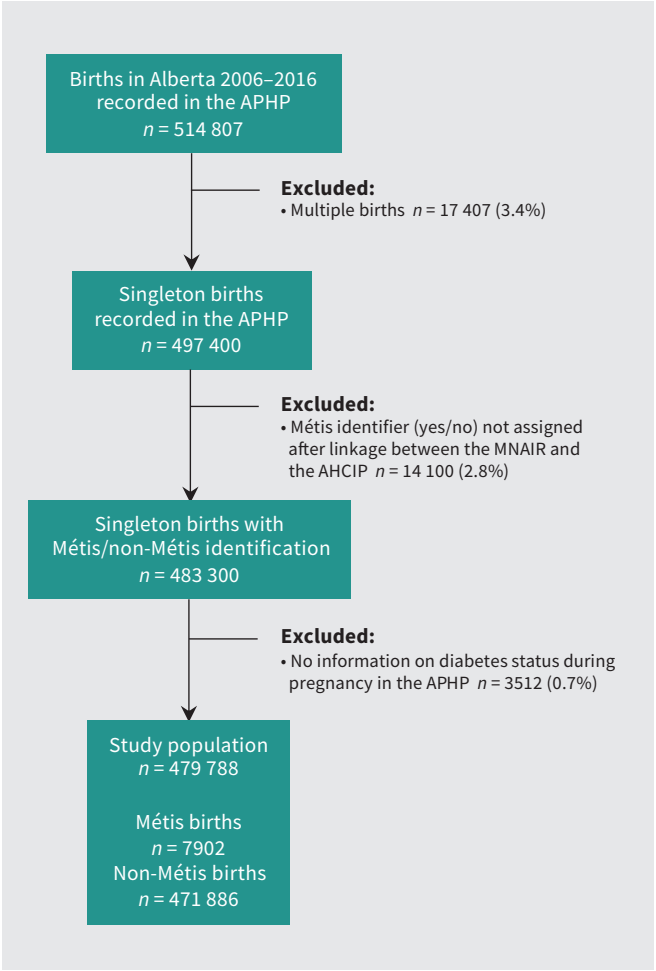

Figure 1: Study flow diagram. Note: AHCIP = Alberta Health Care Insurance Plan, APHP = Alberta Perinatal Health Program, MNAIR = Métis Nation of Alberta Identification Registry.

Métis pregnancies complicated by pre-existing diabetes had almost a 3 times higher odds of developing preeclampsia than non-Métis pregnancies after adjusting for maternal age, overweight pregnancy (≥ 91 kg), insulin use, parity, smoking during pregnancy and material and social deprivation (adjusted OR 2.96, 95% CI 1.27–6.90) (Table 3). Results for other maternal (i.e., gestational hypertension, obstetric hemorrhage, induction of labour and cesarean delivery) and neonatal outcomes (i.e., preterm birth, low birth weight, large-for-gestational-age infants, small-for-gestational-age infants and NICU admissions) were inconclusive (Figure 2).

Gestational diabetes

The age-standardized period prevalence of gestational diabetes was 6.3% (95% CI 5.6%–6.9%) for Métis pregnancies and 5.4% (95% CI 5.3–5.4) for non-Métis pregnancies. The prevalence of gestational diabetes was higher among Métis pregnancies than non-Métis pregnancies after adjusting for maternal age, overweight (≥ 91 kg), parity, smoking during pregnancy and material and social deprivation (adjusted OR 1.30, 95% CI 1.08–1.57).

Table 1 (part 1 of 2): Characteristics of Métis and non-Métis pregnancies in Alberta (2006–2016)

Characteristic	No. (%) of pregnancies*	
	Métis *n* = 7902	Non-Métis *n* = 471 886
Maternal age, yr		
< 20	745 (9.4)	18 378 (3.9)
20–34	6349 (80.4)	368 209 (78.0)
≥ 35	727 (9.2)	81 226 (17.2)
Missing	81 (1.0)	4073 (0.9)
Weight, kg		
< 91	6765 (85.6)	428 573 (90.8)
≥ 91	1136 (14.4)	43 309 (9.2)
Missing	1 (0.0)	4 (0.0)
Multiparous		
No	5979 (75.7)	370 713 (78.5)
Yes	1889 (23.9)	99 429 (21.1)
Missing	34 (0.4)	1744 (0.4)
Pre-existing hypertension		
No	7826 (99.0)	468 538 (99.3)
Yes	76 (1.0)	3348 (0.7)
Antenatal risk score		
Low (< 3)	4881 (61.8)	302 208 (64.0)
Moderate (3–6)	2483 (31.4)	143 562 (30.4)
High (> 6)	538 (6.8)	26 116 (5.5)
Insulin prescription		
No	7705 (97.5)	462 448 (98.0)
Yes	197 (2.5)	9438 (2.0)
Smoking during pregnancy		
No	5467 (69.2)	403 099 (85.4)
Yes	2435 (30.8)	68 787 (14.6)
Substance use during pregnancy		
No	7421 (93.9)	457 931 (97.0)
Yes	481 (6.1)	13 955 (3.0)
Area of residence		
Urban	4908 (62.1)	356 337 (75.5)
Rural	2906 (36.8)	111 232 (23.6)
Missing	88 (1.1)	4317 (0.9)

Table 1 (part 2 of 2): Characteristics of Métis and non-Métis pregnancies in Alberta (2006–2016)

Characteristic	No. (%) of pregnancies*	
	Métis *n* = 7902	Non-Métis *n* = 471 886
Material deprivation, quintiles		
Q1 (least deprived)	794 (10.1)	87 405 (18.5)
Q2	1315 (16.6)	89 583 (19.0)
Q3	1495 (18.9)	88 911 (18.8)
Q4	1789 (22.6)	87 114 (18.5)
Q5 (most deprived)	2095 (26.5)	94 953 (20.1)
Not classified	414 (5.2)	23 920 (5.1)
Social deprivation (quintiles)		
Q1 (least deprived)	985 (12.5)	61 311 (13.0)
Q2	1127 (14.3)	89 103 (18.9)
Q3	1618 (20.5)	102 756 (21.8)
Q4	2139 (27.1)	103 753 (22.0)
Q5 (most deprived)	1619 (20.5)	91 043 (19.3)
Not classified	414 (5.2)	23 920 (5.1)
Pregnancy outcome		
Live birth	7846 (99.3)	468 955 (99.4)
Stillbirth	56 (0.7)	2931 (0.6)
Neonatal death		
No	7874 (99.7)	470 262 (99.7)
Yes	28 (0.3)	1624 (0.3)

*Compared groups using χ^2 test (or the Fisher exact test when counts were < 5). We excluded the missing data category from the test when zeros were found in both Métis and non-Métis groups. For all comparisons, *p* values were less than 0.01 except for pregnancy outcome ($p = 0.326$) and neonatal death ($p = 0.878$).

Métis pregnancies with gestational diabetes had lower odds of obstetric hemorrhage (adjusted OR 0.56, 95% CI 0.35–0.90), small-for-gestational-age babies (adjusted OR 0.53, 95% CI 0.29–0.98) and NICU admissions (adjusted OR 0.66, 95% CI 0.44–0.99) than their non-Métis counterparts after adjusting for maternal age, overweight pregnancy (≥ 91 kg), parity, smoking during pregnancy and material and social deprivation. However, Métis pregnancies with gestational diabetes had higher odds of large-for-gestational-age babies (adjusted OR 1.68, 95% CI 1.09–2.59) than non-Métis pregnancies (Table 4). Results for gestational hypertension, preeclampsia, induction of labour, cesarean delivery, preterm birth and low birth weight were inconclusive (Figure 3).

Interpretation

In this population-based study of pregnant Metis and non-Metis people in Canada, we found a higher prevalence of both pre-existing and gestational diabetes among Métis pregnancies after adjusting for important covariates. Furthermore, we observed an increased risk of preeclampsia among Métis pregnancies with pre-existing diabetes, possibly influenced by higher pre-pregnancy weight. These findings align with existing research linking pre-existing diabetes and maternal obesity to pre-eclampsia.[30,31] Results for other obstetric and neonatal outcomes were inconclusive.

The elevated use of insulin among Métis pregnancies with gestational diabetes is consistent with findings from studies involving non-pregnant First Nations people.[32] In-depth pharmacological analyses incorporating clinical measures such as the

Table 2: Characteristics of Métis and non-Métis pregnancies with pre-existing or gestational diabetes in Alberta (2006–2016)

Variable	No. (%) of pregnancies with pre-existing diabetes			No. (%) of pregnancies with gestational diabetes		
	Métis *n* = 112	Non-Métis *n* = 5509	*p* value*	Métis *n* = 384	Non-Métis *n* = 25 285	*p* value*
Maternal age, yr			0.003			< 0.001
< 20	< 10	71 (1.3)		12 (3.1)	239 (1.0)	
20–34	82 (73.2)	3648 (66.2)		271 (70.6)	16 457 (65.1)	
≥ 35	22 (19.6)	1701 (30.9)		97 (25.3)	8457 (33.4)	
Missing	3 (2.7)	89 (1.6)		4 (1.0)	132 (0.5)	
Weight, kg			< 0.001			< 0.001
< 91	66 (58.9)	4235 (76.9)		259 (67.5)	21 027 (83.2)	
≥ 91	46 (41.1)	1274 (23.1)		125 (32.5)	4258 (16.8)	
Multiparous			0.198			0.071
No	92 (82.1)	4130 (75.0)		272 (70.8)	18 990 (75.1)	
Yes	20 (17.9)	1359 (24.7)		112 (29.2)	6218 (24.6)	
Missing	0	20 (0.3)		0	77 (0.3)	
Pre-existing hypertension			0.098			0.113
No	102 (91.1)	5214 (94.6)		376 (97.9)	24 983 (98.8)	
Yes	10 (8.9)	295 (5.4)		< 10	302 (1.2)	
Antenatal risk score			0.012			0.039
Low (< 3)	15 (13.4)	589 (10.7)		115 (30.0)	8049 (31.8)	
Moderate (3–6)	38 (33.9)	2647 (48.0)		196 (51.0)	13 595 (53.8)	
High (> 6)	59 (52.7)	2273 (41.3)		73 (19.0)	3641 (14.4)	
Insulin prescription			0.367			< 0.001
No	54 (48.2)	2893 (52.5)		251 (65.4)	18 788 (74.3)	
Yes	58 (51.8)	2616 (47.5)		133 (34.6)	6497 (25.7)	
Smoking in pregnancy			< 0.001			< 0.001
No	80 (71.4)	4685 (85.0)		262 (68.2)	22 424 (88.7)	
Yes	32 (28.6)	824 (15.0)		122 (31.8)	2861 (11.3)	
Substance use in pregnancy			0.150			0.094
No	107 (95.5)	5379 (97.6)		375 (97.4)	24 896 (98.5)	
Yes	< 10	130 (2.3)		< 10	389 (1.5)	
Area of residence			0.019			< 0.001
Urban	74 (66.1)	4232 (76.8)		277 (72.1)	21 452 (84.8)	
Rural	36 (32.1)	1238 (22.5)		107 (27.9)	3622 (14.3)	
Missing	2 (1.8)	39 (0.7)		0	211 (0.8)	
Material deprivation			0.028			< 0.001
Q1 (least deprived)	10 (8.9)	912 (16.6)		27 (7.0)	4522 (17.9)	
Q2	12 (10.7)	996 (18.1)		71 (18.5)	4610 (18.2)	
Q3	24 (21.4)	991 (18.0)		87 (22.7)	4694 (18.6)	
Q4	25 (22.3)	1057 (19.2)		77 (20.0)	4829 (19.1)	
Q5 (most deprived)	35 (31.2)	1225 (22.2)		109 (28.4)	5431 (21.5)	
Not classified	6 (5.4)	328 (5.9)		13 (3.4)	1199 (4.7)	
Social deprivation			0.576			< 0.001
Q1 (least deprived)	15 (13.4)	658 (11.9)		47 (12.2)	3127 (12.4)	
Q2	14 (12.5)	1025 (18.6)		46 (12.0)	5328 (21.1)	
Q3	23 (20.5)	1211 (22.0)		90 (23.4)	5393 (21.3)	
Q4	29 (25.9)	1193 (21.7)		113 (29.4)	5219 (20.6)	
Q5 (most deprived)	25 (22.3)	1094 (19.9)		75 (19.5)	5019 (19.9)	
Not classified	6 (5.4)	328 (5.9)		13 (3.4)	1199 (4.7)	

*Compared groups using χ^2 test (or the Fisher exact test when counts were < 5). We excluded the missing data category from the test when zeros were found in both Métis and non-Métis groups. Exact numbers for variables with fewer than 10 observatons are suppressed.

Table 3: Maternal and neonatal outcomes of pre-existing diabetes from Métis and non-Métis pregnancies in Alberta (2006–2016)

Outcome	No. (%) of pregnancies		Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	ICC† (95% CI)
	Métis *n* = 112	Non-Métis *n* = 5509			
Maternal					
Gestational hypertension	20 (17.9)	687 (12.5)	1.77 (0.88–3.54)	1.56 (0.80–3.03)	0.34 (0.21–0.50)
Preeclampsia	11 (9.8)	189 (3.4)	3.50 (1.57–7.81)	2.96 (1.27–6.90)	0.34 (0.15–0.61)
Obstetric hemorrhage	10 (8.9)	567 (10.3)	0.81 (0.36–1.82)	0.86 (0.36–2.04)	0.39 (0.20–0.62)
Induction of labour	51 (45.5)	2321 (42.1)	1.26 (0.68–2.35)	1.12 (0.58–2.15)	0.28 (0.16–0.46)
Cesarean delivery	59 (52.7)	2630 (47.7)	1.57 (0.51–4.82)	1.78 (0.49–6.48)	0.82 (0.80–0.84)
Neonatal					
Preterm birth	30 (26.8)	1089 (19.8)	1.73 (0.94–3.17)	1.24 (0.63–2.44)	0.43 (0.31–0.57)
Low birth weight	15 (13.4)	490 (8.9)	1.87 (0.92–3.81)	1.97 (0.91–4.26)	0.39 (0.20–0.63)
Large for gestational age	35 (31.3)	1481 (26.9)	1.56 (0.78–3.12)	0.96 (0.47–1.97)	0.54 (0.42–0.65)
Small for gestational age	10 (8.9)	374 (6.8)	1.35 (0.70–2.60)	1.57 (0.78–3.17)	‡
NICU admission	19 (17.0)	1079 (19.6)	0.88 (0.53–1.46)	0.72 (0.42–1.23)	‡

Note: CI = confidence interval, ICC = intracluster correlation, NICU = neonatal intensive care unit, OR = odds ratio.
*Adjusted for maternal age, overweight (≥ 91 kg), insulin use, parity, smoking during pregnancy and material and social deprivation.
†The variance in the outcome variable that was explained by differences in the level 2 variable (pregnant person), estimated for multilevel models when the likelihood ratio test comparing the multilevel model with single-level logistic model was significant ($p < 0.05$).
‡The single-level model was applied when the multilevel model did not reach convergence.

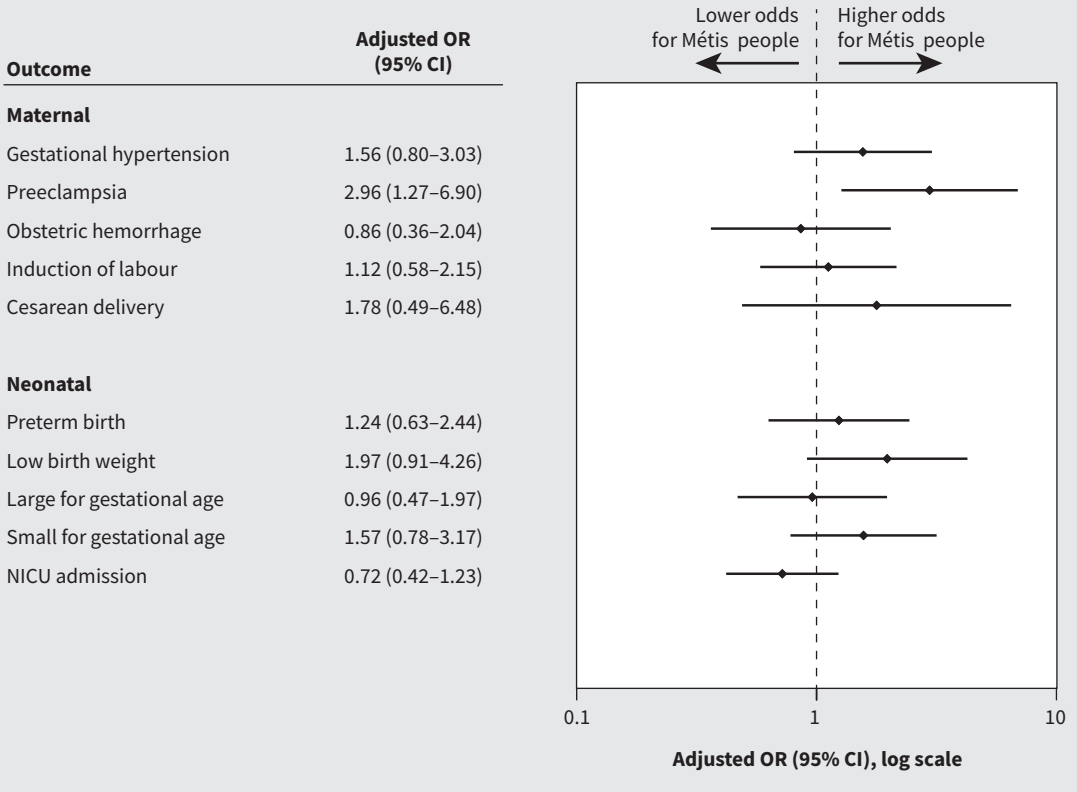

Figure 2: Forest plot comparing maternal and neonatal outcomes among Métis and non-Métis pregnancies with pre-existing diabetes. Note: CI = confidence interval, NICU = neonatal intensive care unit, OR = odds ratio.

Table 4: Maternal and neonatal outcomes of gestational diabetes from Métis and non-Métis pregnancies in Alberta (2006–2016)

Outcome	No. (%) of pregnancies		Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	ICC† (95% CI)
	Métis *n* = 384	Non-Métis *n* = 25 285			
Maternal					
Gestational hypertension	46 (12.0)	2487 (9.8)	1.25 (0.91–1.70)	1.17 (0.85–1.61)	‡
Preeclampsia	10 (2.6)	534 (2.1)	1.24 (0.58–2.64)	1.09 (0.52–2.27)	0.40 (0.26–0.55)
Obstetric hemorrhage	23 (6.0)	2578 (10.2)	0.53 (0.33–0.85)	0.56 (0.35–0.90)	0.28 (0.20–0.38)
Induction of labour	190 (49.5)	11 332 (44.8)	1.35 (0.98–1.87)	1.08 (0.78–1.49)	0.31 (0.25–0.37)
Cesarean delivery	140 (36.5)	9734 (38.5)	0.92 (0.74–1.13)	0.95 (0.76–1.18)	‡
Neonatal					
Preterm birth	38 (9.9)	2754 (10.9)	0.90 (0.64–1.26)	0.82 (0.58–1.16)	‡
Low birth weight	21 (5.5)	1794 (7.1)	0.69 (0.38–1.27)	0.70 (0.37–1.32)	0.55 (0.27–0.79)
Large for gestational age	88 (22.9)	3606 (14.3)	1.79 (1.40–2.27)	1.68 (1.09–2.59)	0.57 (0.36–0.76)
Small for gestational age	20 (5.2)	2297 (9.1)	0.55 (0.35–0.86)	0.53 (0.29–0.98)	0.47 (0.27–0.68)
NICU admission	37 (9.6)	3243 (12.8)	0.69 (0.46–1.03)	0.66 (0.44–0.99)	0.35 (0.27–0.44)

Note: CI = confidence interval, ICC = intracluster correlation, NICU = neonatal intensive care unit, OR = odds ratio.
*Adjusted for maternal age, overweight (≥ 91 kg), insulin use, parity, smoking during pregnancy and material and social deprivation.
†The variance in the outcome variable that was explained by differences in the level 2 variable (pregnant person), estimated for multilevel models when the likelihood ratio test comparing the multilevel model with single-level logistic model was significant ($p < 0.05$).
‡The single-level model was applied when the multilevel model did not reach convergence.

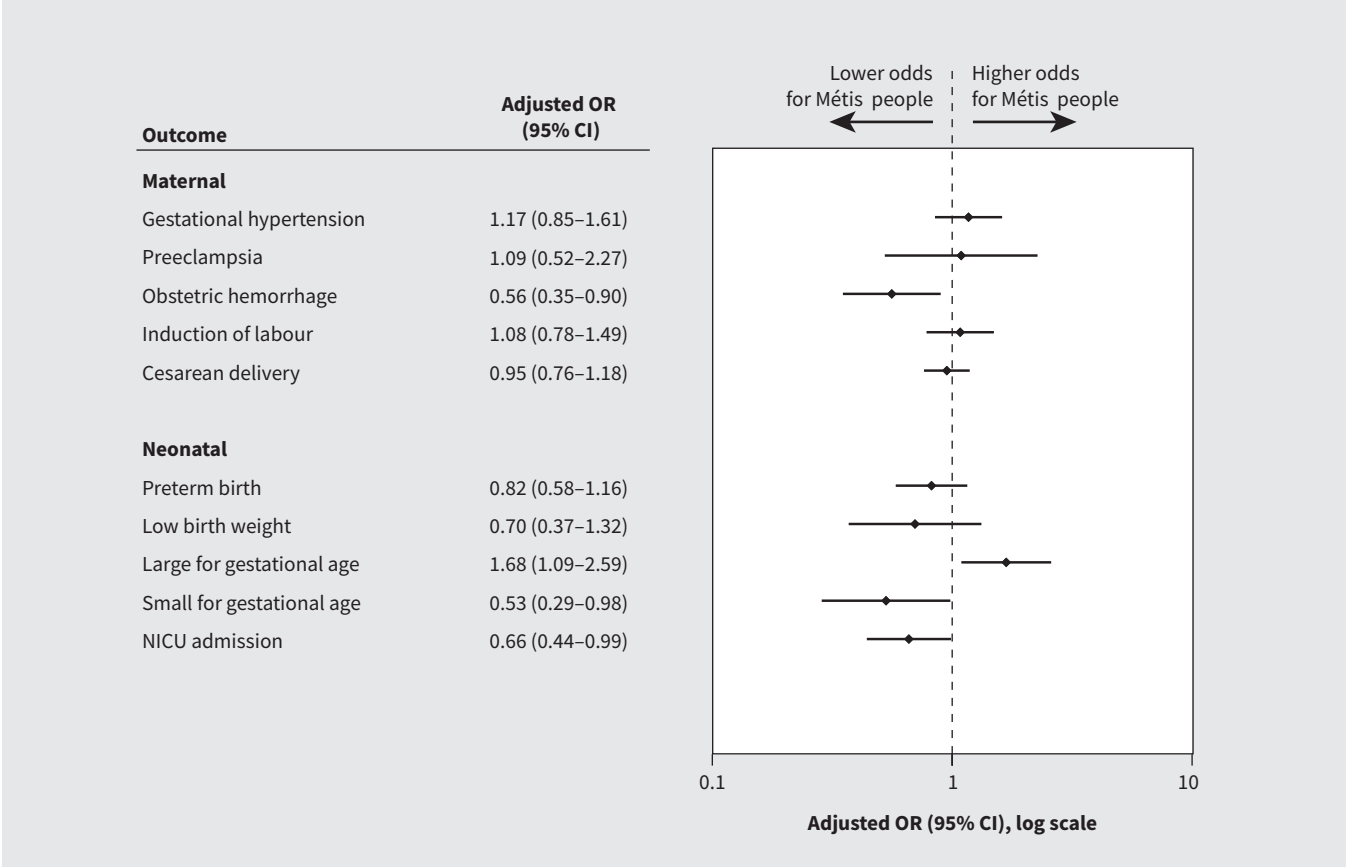

Figure 3: Forest plot comparing maternal and neonatal outcomes among Métis and non-Métis pregnancies with gestational diabetes. Note: CI = confidence interval, NICU = neonatal intensive care unit, OR = odds ratio.

glucose challenge test, oral glucose tolerance tests, glycated hemoglobin, fasting blood glucose or postprandial blood glucose would provide insights into whether these findings suggest increased severity of the condition or differences in physician prescription practices. The association between gestational diabetes and large-for-gestational-age infants persisted in Métis pregnancies after accounting for insulin use; this is concerning because of the link between high birth weight and type 2 diabetes and obesity later in life.[33] Various factors — including emotional distress related to intergenerational chronic trauma that can trigger negative eating patterns, poor home conditions and economic and social pressures — could influence poor glucose control in gestational diabetes, potentially leading to adverse maternal and fetal health outcomes if not effectively managed and addressed.[34] Despite Métis pregnancies with gestational diabetes having increased odds of resulting in large-for-gestational-age infants, results were inconclusive regarding the occurrence of obstetric hemorrhage or birth injury, which are outcomes typically associated with large-for-gestational-age births.[30]

Existing literature has highlighted the elevated prevalence of diabetes during pregnancy among Indigenous Peoples globally, including First Nations people in Canada,[3–5] Aboriginal and Torres Strait Islanders in Australia, and Native Americans and Alaska Natives in the United States.[35,36] These health disparities have a complex origin that involve a blend of genetic, lifestyle, environmental and social factors, such as economic barriers, housing insecurity, lack of food sovereignty and a growing reliance on market and ultra-processed foods.[26,37–40] In addition, the impact of these determinants on Métis people's health and well-being has — and continues to be — magnified by the effect of colonial legacies.[41–43] Structural factors such as systemic discrimination, racism, loss of culture and self-determination and rapid transitions to Westernized lifestyles have deeply affected Indigenous Peoples' mental, spiritual and physical well-being over many generations, and may be important contributors to the higher risk of diabetes during pregnancy among Métis people at younger ages and with greater risk profiles.[44]

Limitations

The non-Métis comparison group included births from other Indigenous groups, such as those of First Nations and Inuit people, and Métis people who were not registered as Métis Nation citizens, as well as from people of diverse racial backgrounds who may also experience health disparities because of racism and discrimination. This could lead to misclassification bias toward the null. The use of probabilistic data linkage to identify Métis people does not entirely remove the possibility of incorrect allocation of pregnancies to the study cohorts.[14] The findings of the study are limited to Métis Nation citizens and may not be representative of self-identified Métis who are not MNA citizens. One-third of the Métis population in Canada is affiliated with a Métis organization. Among these organizations, the MNA has the largest membership.[45] To our knowledge, no study has yet documented any differences between MNA citizens and other Métis people residing in Alberta. Given that administrative health databases do not include an Indigenous identifier specifically for Métis people, it remains impossible to distinguish Métis people that are not MNA members within these data sets.

The APHP definition of pre-existing diabetes does not differentiate between type 1 and type 2 diabetes, so we could not determine the proportion of people with diabetes of each type and whether outcomes differed by type. The APHP does not collect data on pre-pregnancy weight on a continuous scale but rather collects weight as above or below a threshold of 91 kg, thus, preventing the calculation of body mass index. The measures of material and social deprivation were based on dissemination area, with the possibility of misclassification of individual births to a deprivation quintile that may not reflect their circumstances. The data used in this study are from 2006 to 2016, and diabetes trends, clinical management and demographics may have changed in the intervening years. Finally, the absence of data about gender identity, dietary patterns and exercise patterns, and the exclusion of children born through traditional childbirth methods, did not allow us to include these factors in the study, highlighting the challenges associated with using health care data sets designed for and by the Western population in research involving Métis people.

Conventional epidemiological methods often focus on Indigenous perinatal health "deficits,"[46] while overshadowing the strengths and resilience of Indigenous pregnant people.[47] Epidemiological comparisons with a non-Indigenous group are still valid, but they necessitate a nuanced approach that acknowledges the sociopolitical determinants of health inequities, how they are embodied and reproduced and how they can be challenged and overcome.[48] Addressing these health inequities requires culturally sensitive, collaborative research approaches that genuinely involve Métis people in the production and mobilization of evidence. This study recognizes the intricate relationships between Métis identity, diabetes in pregnancy and adverse birth outcomes, and underscores the importance of epidemiological research in shedding light on sociopolitical determinants of inequitable health, informing policy, guiding advocacy and driving practice changes toward Métis health equity.[47]

Conclusion

The findings from this study underscore pivotal implications for health care practices and policies. With an increased prevalence of both pre-existing diabetes and gestational diabetes among Métis pregnancies, targeted interventions promoting healthy weight before and during pregnancy are critical. These strategies should encompass not just the physiologic aspects but also the cultural dimensions of health. For instance, championing Métis' cultural restoration of traditional foodways serves a dual purpose as it reconnects Métis pregnant people with their heritage while also encouraging healthier dietary habits. By intertwining holistic, self-affirming and strength-based approaches to nutrition and diet, grounded in Métis ways of knowing and being, these interventions can pave the way for more comprehensive and culturally sensitive care. This holistic approach may lead to enhanced health outcomes for Métis pregnant people and their offspring. Collaborative efforts with Métis people are vital to ensure care is both relevant and respectful, especially when managing diabetes in pregnancy.

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Affiliations: School of Public Health (Voaklander, Eurich), and Department of Obstetrics and Gynecology (Sanni, Serrano-Lomelin, Ospina), University of Alberta; Métis Nation of Alberta (James, Cordingley, Bartel), Edmonton, Alta.; Department of Public Health Sciences (Ospina), Queen's University, Kingston, Ont.

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Correspondence to: Maria Ospina, jmb40@queensu.ca