Birth outcomes and infant mortality among First Nations Inuit, and non-Indigenous women by northern versus southern residence, Quebec

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Abstract

Background—In circumpolar countries such as Canada, northern regions represent a unique geographical entity climatically, socioeconomically and environmentally. There is a lack of comparative data on birth outcomes among Indigenous and non-Indigenous subpopulations within northern regions and compared with southern regions.

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Competing interests None.

Ethics approval This study was conducted with the approval of the research ethics board of Sainte-Justine Hospital, University of Montreal, the Nunavik Nutrition and Health Committee and First Nations of Quebec and Labrador Health and Social Services Commission.

Contributors All authors contributed to the development of the study framework, interpretation of the results, revisions of successive drafts of the manuscript, and approved the version submitted for publication. RW and ZCL conducted the data analyses. ZCL drafted and finalised the manuscript, with input from the co-authors.

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Methods—A cohort study of all births by maternal mother tongue to residents of northern (2616 First Nations (North American Indians), 2388 Inuit and 5006 non-Indigenous) and southern (2563 First Nations, 810 643 non-Indigenous) Quebec, 1991–2000.

Results—Compared with births to southern non-Indigenous mother tongue women, births to northern women of all three mother tongue groups were at substantially elevated risks of infant death (adjusted OR (aOR) 1.7–2.9), especially postneonatal death (aOR 2.2–4.4) after controlling for maternal education, age, marital status and parity. The risk elevation in perinatal death was greater for southern First Nations (aOR 1.6) than for northern First Nations (aOR 1.2). Infant macrosomia was highly prevalent among First Nations in Quebec, especially in the north (31% vs 24% in the south). Within northern regions, Inuit births were at highest risk of preterm delivery (aOR 1.4) and infant death (aOR 1.6).

Conclusion—All northern infants (First Nations, Inuit or non-Indigenous) were at substantially elevated risk of infant death in Quebec, despite a universal health insurance system. Southern First Nations newborns have not benefited from the more advanced perinatal care facilities in southern regions. Environmental influences may partly account for the very high prevalence of macrosomia among First Nations in northern Quebec.

In circumpolar countries such as Canada, northern regions represent a unique geographical entity climatically, socioeconomically and environmentally. The vast and sparsely populated northern areas of Canada are characterised by frigid winters, substantial Indigenous populations, transportation challenges, generally poor infrastructure and a relative shortage of tertiary care facilities. Many studies have reported that birth outcomes and infant mortality are much worse among Indigenous versus non-Indigenous populations even in developed countries such as Australia, the USA and Canada.— However, there remains a lack of data comparing birth outcomes and infant mortality among Indigenous and non-Indigenous subpopulations living in northern regions, or among residents of northern versus southern regions. Quantifying the features of Aboriginal birth and infant outcomes by northern versus southern place of residence may be important for identifying at-risk subpopulations and for designing targeted health promotion programmes to improve maternal and infant health for Indigenous peoples.

The Constitution Act (1982) recognises three groups of Indigenous peoples in Canada: First Nations (North American Indians), Inuit and Métis. According to the 2001 census, the total Indigenous population (by self-identification) in Canada numbered approximately 976 000, including 609 000 First Nations, 292 000 Métis, 45 000 Inuit and 30 000 Indigenous peoples of multiple or undefined origins. Approximately half of all Aboriginal peoples in Canada lived in urban areas, mostly (>90%) in southern regions. Urban (and mostly southern) residents accounted for approximately 43% of First Nations, 58% of Métis and 27% of Inuit populations. Canadian Indigenous peoples were the original residents of northern Canada, and they still account for a high proportion (often the majority) of the population in northern regions. Indigenous peoples in Quebec numbered approximately 79 000, including 52 000 First Nations, 17 000 Métis and 10 000 Inuit. Approximately 72% of First Nations and 94% of Inuit in Quebec lived in rural (mostly northern) areas. Among pregnant women in Quebec, low socioeconomic status is much more prevalent comparing First Nations and Inuit with non-Indigenous populations. Quebec is the only Canadian province where two

Indigenous subpopulation groups—First Nations and Inuit—can be identified by self-reported mother tongue on birth registrations. Taking advantage of this Aboriginal birth identifier, we assessed birth outcomes and infant mortality among First Nations, Inuit and non-Indigenous women by northern versus southern residence.

METHODS

Data

This was a cohort study of all births at gestational age 20 weeks or greater and birth weight 500 g or heavier to residents of Quebec, based on Statistics Canada's linked stillbirth, live birth and infant death data for 1991–2000. The validity of the Canadian linked vital data has been well documented. The study was approved by the research ethics board of Sainte-Justine Hospital, University of Montreal, the Nunavik Nutrition and Health Committee and the First Nations of Quebec and Labrador Health and Social Services Commission. Informed consent was not sought from individual participants because the study was based on anonymised linked birth data.

Geocoding the maternal place of residence

Geocoding techniques were applied to identify all births to Quebec women by northern versus southern residence, using software developed at Statistics Canada. The geocoding was primarily based on maternal residential postal codes as recorded on birth registrations. When postal codes were missing (<5%), municipality codes were used instead. The Canadian landscape can be divided into four areas from north to south: north, north transition, south transition and south, according to Statistics Canada's classification of geographical areas. The boreal forest, beyond which to the north are vast barren tundra and polar deserts, can be used as an approximate geographical north–south demarcation line. In the present study, we combined north and north transition areas into a single 'northern' category because of the relatively small number of births to northern Quebec residents. We did not make a distinction between rural and urban, because the whole of northern Quebec is rural, based on Statistics Canada's definition of rural and small-town Canada. In southern Quebec, approximately 30% of First Nations births were to urban mothers.

Identification of First Nations, Inuit births

Maternal mother tongue as recorded on birth registrations was used as a surrogate measure of ethnicity to define the subpopulations. If maternal mother tongue was missing and paternal mother tongue was not missing, maternal mother tongue was imputed from paternal mother tongue (such cases were rare, <5%). We grouped births into three maternal mother tongue groups: First Nations, Inuit and non-Indigenous—the last category including French (the majority), English and other mother tongue groups because their birth outcomes were all much better than those among First Nations and Inuit women. After excluding 2144 births (0.25%) with insufficient information to determine northern versus southern residence and 138 births to southern Quebec Inuit mother tongue women (because there were too few births in that category to form a separate study group), a total of 823 216 births constituted the final study cohort, including 10 010 births (2388 Inuit, 2616 First Nations and 5006 non-Indigenous maternal mother tongue) to northern Quebec residents, and 813 206 births (2563

First Nations, 810 643 non-Indigenous maternal mother tongue) to southern Quebec residents.

Outcomes and analyses

Main outcomes were preterm (<37 completed weeks in gestational age), small-for-gestational-age (SGA, <10th percentile in birth weight for gestational age using the Canadian standards) or large-for-gestational-age (LGA, >90th percentile) birth, peri-natal death [stillbirths (fetal deaths 20 weeks and 500 g) plus neonatal deaths (died at 0–27 days of postnatal life)] and infant death (died during the first year (0–364 days) of life). We also examined other outcomes including low birth weight (LBW, <2500 g) or high birth weight (HBW, >4000 g) birth, stillbirth and components of infant death (neonatal death and postneonatal death (at 28–364 days of life)). Causes of infant death were assessed according to the classification of the International Collaborative Effort on Perinatal and Infant Mortality. The cause categories included congenital anomalies, immaturity-related conditions, asphyxia, infections, sudden infant death syndrome (SIDS), external causes, other specific conditions and remaining causes.

Crude rates and OR with 95% CI were calculated for comparing birth outcomes across subpopulations. Perinatal mortality and stillbirth rates were calculated per 1000 total births (live births plus stillbirths). Infant and neonatal mortality rates were calculated per 1000 live births. Post neonatal mortality rates were calculated per 1000 neonatal survivors. Logistic regression was used to obtain the adjusted OR (aOR) for assessing whether the risk differences could be explained by available maternal and pregnancy characteristics, including maternal age (<20, 20–29, 30–34, 35 years), parity (primiparous, multiparous), education [<11 years, 11 years (completed high school in Quebec), 12 years (some college or university)], marital status [legally married, common-law union, or single (neither married nor in a common-law union)], infant sex (male, female) and plurality (singleton, multiple), and further controlling for rural versus urban residence for the comparisons of First Nations versus non-Indigenous groups in the south. All data analyses were carried out using SAS, version 9.1.

RESULTS

Maternal characteristics

Substantial differences in maternal characteristics were observed among the five study groups by northern versus southern residence and maternal mother tongue (table 1). Approximately one quarter of births to Inuit and First Nations (northern or southern) women were to mothers of less than 20 years of age, a much higher proportion than for non-Indigenous mother tongue women (northern 9%, southern 4%). The proportion of single mothers was highest among births to Inuit women (38%), and higher among births to First Nations (northern 24%, southern 27%) compared with non-Indigenous women (northern 13%, southern 11%). Approximately two-thirds of Inuit and First Nations (northern or southern) mothers had not completed high school, a much higher proportion than for non-Indigenous women (northern 28%, southern 14%). Conversely, over 60% of births to non-Indigenous women were to mothers who had some college or university education,

compared with 19–24% of births to Inuit and First Nations women. Across these mother tongue groups, there were no statistically significant differences in the proportions of male infants or multiple births.

Preterm, LBW, SGA, HBW and LGA birth

In northern Quebec, rates of preterm birth were much higher among Inuit (10.6%), but lower among First Nations (6.0%) compared with non-Indigenous mother tongue women (7.7%). In both northern and southern Quebec, births to First Nations women were much less likely to be LBW or SGA, but much more likely to be HBW or LGA compared with births to non-Indigenous mother tongue women. The highest rate of macrosomic (defined as HBW or LGA) birth was observed among northern First Nations women (31%), more than double the rates for births to northern Inuit or non-Indigenous mother tongue women, and more than triple the rate for births to southern non-Indigenous women. Among First Nations women, births to northern mothers were significantly less likely to be SGA, but more likely to be LGA or HBW compared with births to southern mothers ($p<0.0001$).

Perinatal and infant mortality

Perinatal and infant mortality were all substantially higher among births to all three mother tongue groups (Inuit, First Nations, non-Indigenous) in northern Quebec, and to First Nations women in southern Quebec compared with births to non-Indigenous mother tongue women in southern Quebec (table 2). The excess infant mortality was mainly due to high postneonatal mortality. Within northern Quebec, both stillbirth and infant mortality rates were lowest for births to non-Indigenous women, but stillbirth and perinatal mortality rates were not significantly different among the three mother tongue groups. Births to Inuit women had the highest infant mortality (19.4 per 1000)—2.2 and 4.5 times the rates for births to non-Indigenous mother tongue women in northern and southern Quebec, respectively. Among First Nations births, there were no statistically significant northern versus southern differences in any mortality-based birth outcome indicators. Compared with southern non-Indigenous infants, crude risk ratios for infant mortality were 2.3 for northern First Nations, 1.7 for southern First Nations and 4.4 for northern Inuit infants (no results are reported for southern Inuit infants—excluded due to small numbers).

For high-risk (preterm, LBW, SGA) births, perinatal mortality rates were significantly higher (2–4 times) among births to Inuit and northern or southern First Nations women versus southern non-Indigenous women ($p<0.001$), but did not differ significantly across the three mother tongue groups in northern Quebec ($p=0.42$). Neonatal mortality was marginally significantly higher ($p=0.05$) among Inuit (34.2 per 1000) compared with First Nations (11.5) or non-Indigenous (18.3) mother tongue infants in northern Quebec.

Among macrosomic (HBW or LGA) births to First Nations women, rates of perinatal death were not significantly different from rates for births with normal birth weight (2500–3999 g) or weight appropriate for gestational age in northern or southern Quebec. For macrosomic (HBW or LGA) births, perinatal mortality rates were non-significantly lower for births to First Nations versus non-Indigenous mother tongue women.

Analyses of cause-specific infant mortality (data not shown) revealed that, compared with infants born to southern non-Indigenous mother tongue women, Inuit infants of northern Quebec were at significantly elevated risk of infant death due to congenital anomalies (OR 2), immaturity-related conditions (OR 3), infections (OR 12) and postneonatal SIDS (OR 16). First Nations infants (northern or southern) were at significantly higher risk of infant death due to postneonatal SIDS (OR 3–4) and infections (OR 6–9). Within northern Quebec, Inuit infants were much more likely to die of post-neonatal SIDS (6.8 per 1000) compared with infants of First Nations (1.2 per 1000) and non-Indigenous (0.4 per 1000) mother tongue women. Other cause-specific infant mortality rates were not significantly different among the three mother tongue groups in northern Quebec, although infants born to Inuit women had the highest death rates due to congenital anomalies (3.8 per 1000) and immaturity-related conditions (3.4 per 1000).

The crude and adjusted OR

Compared with infants of non-Indigenous mother tongue women in southern Quebec, infants of northern mothers of any mother tongue group were at a substantially elevated risk of infant death after adjusting for observed maternal characteristics (table 3). The aOR of infant death were substantially smaller than the crude OR: aOR 1.7 for First Nations, 2.9 for Inuit and 1.8 for non-Indigenous mother tongue groups in northern Quebec. The elevated risks of infant death for northern infants were largely due to much higher risks of postneonatal death. In southern Quebec, First Nations births were not at significantly elevated risk of infant death (aOR 1.1), but were at substantially elevated risk of stillbirth (aOR 2.1) compared with births to non-Indigenous mother tongue women after the adjustments. The much lower risks of LBW and SGA birth but much higher risks of HBW and LGA birth among First Nations women (northern or southern) were even more pronounced after the adjustments.

Within northern Quebec, the differences in birth outcomes among women of Inuit, First Nations and non-Indigenous mother tongue largely remained after adjusting for maternal characteristics (table 3). The crude and adjusted OR were similar for preterm, SGA, LBW, HBW and LGA birth. Inuit women remained at a significantly higher risk of preterm birth (aOR 1.4). Inuit infants remained at a higher risk of infant death (aOR 1.6) especially during the postneonatal period (aOR 2.5) after the adjustments, although the aOR were smaller than the crude OR. Within northern regions, compared with births to non-Indigenous mother tongue women, First Nations births remained much more likely to be large in birth size (aOR 2.3 for LGA or HBW) but without significantly elevated risks of perinatal or infant death.

DISCUSSION

Main findings

To our knowledge, our study is the first report on birth outcomes and infant mortality among Indigenous and non-Indigenous subpopulations classified by northern versus southern residence. We observed that northern infants of each of the three maternal mother tongue groups were at substantially elevated risks of infant death (aOR 1.7–2.9) especially

postneonatal death (aOR 2.2–4.4) compared with southern non-Indigenous infants in Quebec. The risk elevation in perinatal death was even greater for First Nations in the south, despite the better healthcare facilities in southern regions. Infant macrosomia was highly prevalent among First Nations births in Quebec, especially in the north. Within northern regions, Inuit births were most vulnerable to preterm delivery and infant death.

Comparisons with findings from previous studies

Preterm birth, SGA and LBW—Our findings of higher rates of preterm delivery but lower rates of SGA birth among Inuit women are consistent with reports in other recent studies. By contrast, rates of preterm birth for First Nations women were similar to those for non-Indigenous women in southern Quebec, and even modestly lower than for non-Indigenous women in northern Quebec. First Nations infants were much less likely to be SGA or LBW regardless of the place of residence. However, First Nations high-risk (preterm, SGA or LBW) births had two to four times the risk of infant death compared with such births among non-Indigenous women, indicating a need for improved access to high-quality neonatal care. The relatively lower rates of high-risk births (SGA or LBW) to First Nations women could partly account for the relatively small disparity in infant mortality compared with births to non-Indigenous mother tongue women in northern regions. Had First Nations had similar rates of high-risk births, their infant mortality rate would have been higher. Also, the percentages of pregnant women with low educational levels were strikingly high among both Inuit and First Nations. Improved socioeconomic conditions, medical and infant care for First Nations and Inuit peoples could be important to reduce their high infant mortality rates.

Macrosomia—Variably high (16–36%) macrosomic birth rates (defined by HBW >4000 g, or LGA >90th percentile) have been reported for some Canadian First Nations communities. We observed a markedly higher prevalence of macrosomia (31% by either definition) among First Nations births in northern Quebec. Rates of macrosomic birth were also very high for southern First Nations women (24% by either definition), but substantially lower than for northern First Nations women, indicating that extrinsic or ‘environmental’ factors could partly account for the very high prevalence of macrosomic births among First Nations in northern Quebec. However, among First Nations births, we did not observe any elevated risk of perinatal death comparing macrosomic versus normal weight births. That is, macrosomia did not appear to affect fetoinfant survival, and so could be considered largely ‘physiological’ among First Nations. Macrosomic births are more likely to end in perinatal death if macrosomia is secondary to diabetic complications—a well-known cause of perinatal death. Gestational diabetes was reported to be more frequent in pregnant women of some Quebec and Ontario First Nations communities, but was relatively less frequent in some other Canadian First Nations communities, probably because Aboriginal pregnant women tended to be young. Unfortunately, we had no data on gestational diabetes. Further studies are warranted to understand the causes of the northern versus southern differences in the prevalence of macrosomia among First Nations.

Perinatal and infant mortality—Studies have consistently documented much higher risks of perinatal and infant mortality among First Nations and Inuit compared with non-

Indigenous births in Canada. . . . We observed that northern infants of all three mother tongue groups were at significantly elevated risks of infant death (aOR 1.7–2.9) compared with southern non-Indigenous infants, indicating a need for improved medical and infant care in northern regions. Furthermore, the risk elevation in perinatal death was even greater for First Nations in the south (aOR 1.6), indicating that First Nations newborns have not benefited equally from the more advanced perinatal and neonatal care resources available in southern regions. The similarly unfavourable maternal characteristics (much higher proportions of low education, young and unmarried mothers) for both southern and northern First Nations could partly account for their higher perinatal and infant mortality rates, as indicated by the decreases in OR after the adjustments. The observed relative disparities in infant mortality comparing Indigenous versus non-Indigenous populations were roughly similar to the recently reported disparities in adult mortality during the study period (age standardised mortality rate ratio 2.4). Within northern Quebec, Inuit infants were most vulnerable to the risk of infant death especially during the postneonatal period. The much higher risks of postneonatal death and SIDS among Inuit infants indicates a significant need for improving socioeconomic and living conditions for families with infants, and for promoting maternal smoking cessation programmes and more effective ‘back-to-sleep’ campaigns in Inuit communities to reduce postneonatal death, especially SIDS.–

Limitations

Some First Nations and Inuit women would not have reported an Indigenous mother tongue, resulting in being misclassified with respect to their Aboriginal identity. According to the 2001 census, approximately 86% of Inuit and 60% of First Nations in Quebec (by self-identification) reported an Indigenous mother tongue. Such mixing of Indigenous and non-Indigenous women in the non-Indigenous mother tongue group would have resulted in smaller observed than true disparities in fetal and infant mortality, had we been able to compare Indigenous versus non-Indigenous women by Aboriginal identity. Our estimates of the Indigenous versus non-Indigenous disparities in birth outcomes are thus likely to be conservative. Second, we had information on only a limited number of maternal characteristics (education, age, marital status, parity), but no information on many other risk factors such as maternal smoking, alcohol use and complications of pregnancy. More studies are needed to understand whether these factors may have mediated the observed risk differences.

In conclusion, our data reveal important north–south disparities in birth outcomes in a setting with universal health insurance, indicating a need to improve perinatal and infant health for all northern residents. Despite the better healthcare resources in the south, living in southern regions was associated with even worse perinatal outcomes among First Nations, indicating a need to improve their effective access to high-quality perinatal care in southern regions. Infant macrosomia was highly prevalent among First Nations in Quebec. Environmental factors may partly account for the very high prevalence of macrosomia among First Nations in northern Quebec. These risk differences warrant further investigations, and should be taken into consideration in designing public health programmes for improving maternal and infant health in the northern regions of Canada and perhaps also in other circumpolar countries.

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Table 1

Characteristics of births to residents of Quebec, 1991–2000, classified by northern versus southern residence and maternal mother tongue

Characteristic	Northern residents by mother tongue			Southern residents by mother tongue		
	First Nations	Inuit	Non-Indigenous	First Nations	Non-Indigenous	p Value [†]
All births (n)	2616	2388	5006	2563	810643	
Boys, %	49.9	52.1	52.4	50.6	51.3	0.45
Multiple births, %	1.7	1.4	2.0	2.1	2.3	0.48
Primiparous mothers, %	30.4	32.5	41.1	28.7	44.2	<0.0001
Maternal age (years), %						<0.0001
<20	25.2	25.3	9.4	22.9	4.3	<0.0001
20–29	56.6	59.4	64.1	56.9	55.9	
30–34	13.3	11.3	20.4	14.6	28.7	
35	4.9	4.0	6.1	5.6	11.1	
Marital status, %						<0.0001
Single	24.1	37.7	12.7	27.4	10.7	
Common-law union	28.3	42.6	49.1	45.0	47.1	
Married	47.6	19.7	38.2	27.6	42.2	
Education (years), %						<0.0001
<11	63.6	62.6	27.7	68.5	14.1	
11	12.2	16.0	12.1	12.4	12.0	
12	24.2	21.3	60.1	19.1	73.9	

* In Quebec, high school graduation requires 11 years; 12 years indicates some college or university.

[†] p Values in χ^2 tests for differences among the three mother tongue groups in northern Quebec and between the two mother tongue groups in southern Quebec.

[‡] p Values in χ^2 tests for differences among all five study groups.

Numbers and crude rates of birth outcomes to residents of Quebec, 1991–2000, classified by northern versus southern residence and maternal mother tongue

Table 2

Outcome*	Northern residents by mother tongue			Southern residents by mother tongue		
	First Nations	Inuit	Non-Indigenous	First Nations	Non-Indigenous	p Value [†]
Births, N (%)						
Total (live plus still)	2616 (100.0)	2388 (100.0)	5006 (100.0)	2563 (100.0)	810643 (100.0)	
Preterm	158 (6.0)	254 (10.6)	386 (7.7)	187 (7.3)	58716 (7.2)	0.92 <0.0001
SGA	69 (2.6)	131 (5.5)	500 (10.0)	118 (4.6)	86867 (10.7)	<0.0001 <0.0001
LBW	71 (2.7)	137 (5.7)	318 (6.4)	92 (3.4)	48464 (6.0)	<0.0001 <0.0001
HBW	821 (31.4)	304 (12.7)	756 (15.1)	608 (23.7)	82561 (10.2)	<0.0001 <0.0001
LGA	820 (31.4)	357 (14.9)	705 (14.1)	610 (23.8)	68945 (8.5)	<0.0001 <0.0001
Deaths, N (per 1000)						
Perinatal	25 (9.6)	31 (13.0)	50 (10.0)	28 (10.9)	5239 (6.5)	0.005 <0.0001
Stillbirth	17 (6.5)	14 (5.9)	25 (5.0)	20 (7.8)	2905 (3.6)	0.0004 <0.0001
Neonatal	8 (3.1)	17 (7.2)	25 (5.0)	8 (3.1)	2334 (2.9)	0.81 0.0002
Postneonatal	18 (6.9)	29 (12.3)	19 (3.8)	11 (4.3)	1181 (6.5)	0.0002 <0.0001
Infant	26 (10.0)	46 (19.4)	44 (8.8)	19 (7.5)	3515 (4.4)	0.02 <0.0001

* Outcome rates are per 100 births for preterm, SGA, LBW, LGA or HBW, per 1000 total births for stillbirth, per 1000 live births for neonatal death and infant death and per 1000 neonatal survivors for postneonatal death.

[†] p Values in χ^2 tests for differences among the three mother tongue groups in northern Quebec and between the two mother tongue groups in southern Quebec.

[‡] p Values in χ^2 tests for differences among all the five study groups.

HBW, high birth weight (>4000 g); LBW, low birth weight (<2500 g); LGA, large-for-gestational-age (>90th percentile); SGA, small-for-gestational-age (<10th percentile).

Table 3

Crude and adjusted OR of birth outcomes for births to residents of northern versus southern Quebec, by maternal mother tongue, Quebec, 1991–2000

	Within northern Quebec [†]			All Quebec [‡]			
	North First Nation	North Inuit		South First Nations	North First Nations	North Inuit	North non-Indigenous
Crude OR (95% CI)							
Births							
Preterm	0.77 (0.64 to 0.93) *	1.43 (1.21 to 1.69) *		1.01 (0.87 to 1.11)	0.82 (0.70 to 0.97) *	1.52 (1.34 to 1.74) *	1.07 (0.96 to 1.19)
SGA	0.24 (0.19 to 0.32) *	0.52 (0.43 to 0.64) *		0.40 (0.33 to 0.48) *	0.23 (0.18 to 0.29) *	0.48 (0.41 to 0.58) *	0.92 (0.84 to 1.01)
LBW	0.41 (0.32 to 0.53) *	0.90 (0.73 to 1.10)		0.59 (0.48 to 0.72) *	0.44 (0.35 to 0.56) *	0.96 (0.81 to 1.14)	1.07 (0.95 to 1.20)
HBW	2.57 (2.30 to 2.88) *	0.82 (0.71 to 0.95) *		2.74 (2.50 to 3.00) *	4.03 (3.71 to 4.38) *	1.29 (1.14 to 1.45) *	1.57 (1.45 to 1.70) *
LGA	2.79 (2.48 to 3.13) *	1.07 (0.93 to 1.23)		3.36 (3.07 to 3.68) *	4.91 (4.52 to 5.34) *	1.89 (1.69 to 2.12) *	1.76 (1.63 to 1.91) *
Deaths							
Perinatal	0.96 (0.59 to 1.55)	1.30 (0.83 to 2.05)		1.70 (1.17 to 2.47) *	1.48 (0.99 to 2.20)	2.02 (1.42 to 2.88) *	1.55 (1.17 to 2.05) *
Stillbirth	1.30 (0.70 to 2.42)	1.17 (0.61 to 2.26)		2.19 (1.41 to 3.40) *	1.82 (1.13 to 2.93) *	1.64 (0.97 to 2.78)	1.40 (0.94 to 2.07)
Neonatal	0.61 (0.28 to 1.36)	1.43 (0.77 to 2.65)		1.09 (0.54 to 2.18)	1.07 (0.53 to 2.14)	2.49 (1.54 to 4.02) *	1.74 (1.17 to 2.58) *
Postneonatal	1.82 (0.95 to 3.47)	3.24 (1.81 to 5.78) *		2.97 (1.64 to 5.38) *	4.76 (2.99 to 7.60) *	8.48 (5.86 to 12.3) *	2.62 (1.66 to 4.13) *
Infant	1.13 (0.70 to 1.85)	2.22 (1.46 to 3.36) *		1.72 (1.10 to 2.71) *	2.31 (1.57 to 3.41) *	4.52 (3.37 to 6.06) *	2.04 (1.51 to 2.75) *
Adjusted OR (95% CI) [§]							
Births							
Preterm	0.72 (0.58 to 0.91) *	1.35 (1.09 to 1.68) *		0.86 (0.74 to 1.01)	0.69 (0.59 to 0.82) *	1.21 (1.02 to 1.42) *	1.07 (0.98 to 1.18)
SGA	0.28 (0.21 to 0.36) *	0.59 (0.47 to 0.76) *		0.33 (0.27 to 0.39) *	0.19 (0.15 to 0.24) *	0.39 (0.32 to 0.48) *	0.91 (0.83 to 0.99) *
LBW	0.43 (0.32 to 0.58) *	0.92 (0.70 to 1.21)		0.46 (0.38 to 0.57) *	0.36 (0.28 to 0.45) *	0.72 (0.58 to 0.88) *	1.08 (0.97 to 1.19)
HBW	2.33 (2.05 to 2.65) *	0.79 (0.66 to 0.93) *		3.40 (3.09 to 3.73) *	4.76 (4.36 to 5.19) *	1.55 (1.35 to 1.78) *	1.49 (1.38 to 1.60) *
LGA	2.29 (2.01 to 2.61) *	0.94 (0.79 to 1.11)		3.82 (3.47 to 4.19) *	5.34 (4.89 to 5.82) *	2.09 (1.83 to 2.39)	1.66 (1.54 to 1.79)
Deaths							
Perinatal	0.67 (0.37 to 1.19)	0.70 (0.38 to 1.31)		1.55 (1.04 to 2.30) *	1.19 (0.75 to 1.87)	1.29 (0.79 to 2.12)	1.29 (0.84 to 1.90)
Stillbirth	0.87 (0.40 to 1.91)	0.60 (0.23 to 1.60)		2.09 (1.29 to 3.39) *	1.35 (0.75 to 2.46)	0.93 (0.42 to 2.08)	1.11 (0.83 to 1.62)
Neonatal	0.54 (0.23 to 1.27)	0.90 (0.40 to 2.02)		1.00 (0.50 to 2.00)	1.02 (0.51 to 2.04)	1.70 (0.91 to 3.18)	1.50 (0.91 to 2.72)

	Within northern Quebec [†]		All Quebec [‡]		
	North First Nation	North Inuit	South First Nations	North First Nations	North Inuit
Postneonatal	1.31 (0.62 to 2.75)	2.45 (1.20 to 5.00) [*]	1.44 (0.74 to 2.79)	2.62 (1.59 to 4.33) [*]	4.41 (2.81 to 6.94) [*]
Infant	0.88 (0.51 to 1.53)	1.56 (1.03 to 2.62) [*]	1.13 (0.70 to 1.83)	1.72 (1.15 to 2.59) [*]	2.90 (2.01 to 4.18) [*]
					2.18 (1.43 to 3.33) [*]
					1.79 (1.35 to 2.37) [*]

^{*} p<0.05.

[†] Births to northern non-Indigenous mother tongue women served as the reference group, within northern Quebec.

[‡] Births to southern non-Indigenous mother tongue women served as the reference group, all Quebec.

[§] The adjusted OR were controlled for infant sex, plurality (singleton, multiple), parity (primiparous, multiparous), maternal age (<20, 20–29, 30–34, 35 years), education (<11, 11, 12 years) and marital status (single, common-law union, married), and further controlled for rural versus urban residence for the comparisons of First Nations versus non-Indigenous groups in the south.

HBW, high birth weight (>4000 g); LBW, low birth weight (<2500 g); LGA, large-for-gestational-age (>90th percentile); SGA, small-for-gestational-age (<10th percentile).