

Urban Living is Not Associated with Better Birth and Infant Outcomes among Inuit and First Nations in Quebec

Fabienne Simonet¹, Russell Wilkins^{2,3}, Maureen Heaman⁴, Janet Smylie⁵, Patricia Martens⁶, Nancy G.L. Mchugh⁷, Elena Labranche⁸, Spogmai Wassimi¹, William D. Fraser¹ and Zhong-Cheng Luo^{*1}

¹Department of Obstetrics and Gynecology, Sainte-Justine Hospital, University of Montreal, Montreal, Canada

²Health Analysis Division, Statistics Canada, Ottawa, Canada

³Department of Epidemiology and Community Medicine, University of Ottawa, Ottawa, Canada

⁴Faculty of Nursing, University of Manitoba, Winnipeg, Canada

⁵Centre for Research on Inner City Health, St. Michael's Hospital, Department of Public Health Sciences, University of Toronto, Toronto, Canada

⁶Manitoba Centre for Health Policy, Department of Community Health Sciences, University of Manitoba, Winnipeg, Canada

⁷First Nations of Quebec and Labrador Health and Social Services Commission, Wendake, Canada

⁸Nunavik Regional Board of Health and Social Services, Nunavik, Quebec, Canada

Abstract: *Objective:* There is limited and inconsistent evidence concerning rural versus urban differences in birth and infant outcomes for Indigenous peoples. We assessed birth and infant outcomes among Inuit, First Nations and French mother tongue groups by rural versus urban residence in Quebec, Canada.

Study Design: A retrospective birth cohort study of 5,184 First Nations, 2,527 Inuit and 652,940 French mother tongue (the majority reference) births in Quebec, 1991-2000.

Results: In general, rural living was associated with slightly less favorable birth outcomes for French mother tongue women, but somewhat better outcomes for Indigenous women. For both Inuit and First Nations, rural births were half as likely to be small-for-gestational-age compared to urban births. Among First Nations, the difference in infant mortality rates comparing urban to rural areas was not statistically significant. Compared to infants of French mother tongue women, Inuit and First Nations infants were much less likely to be small-for-gestational-age in rural areas, while such an "advantage" diminished for First Nations and reversed for Inuit in urban areas. The disparities in infant mortality among First Nations versus French mother tongue births were greater in urban than in rural areas. These patterns of results remained after adjusting for maternal characteristics.

Conclusion: Living in urban areas was not associated with better birth and infant outcomes for Inuit and First Nations in Quebec despite universal health insurance coverage, strongly indicating a need for improved socioeconomic conditions, perinatal and infant care for Indigenous people living in urban areas.

Keywords: Indigenous health, infant mortality, fetal growth restriction, rural, urban.

INTRODUCTION

Indigenous populations experience worse health outcomes than their non-Indigenous counterparts worldwide [1-3]. Indigenous women are much more vulnerable to poor birth outcomes even in developed countries including the United States, Australia and Canada [1-14]. In Canada, significant gaps persist in various health indicators comparing First Nations and Inuit to other Canadians [15]. Childbearing

is a particularly pressing health issue facing Canadian Aboriginal women [8,11,16], as they tend to have their children at an earlier age than other Canadians, and also face greater socioeconomic challenges [8].

In general, urban centres provide greater job and educational opportunities, as well as much better entertainment and health care facilities. Increasingly more young Indigenous people are migrating to urban areas. Indeed, large numbers of Aboriginal people have moved from on-reserve communities to urban areas over recent decades in Canada [17,18]. There remains limited and inconsistent evidence on rural versus urban differences in birth and infant outcomes for Indigenous peoples, and in Indigenous versus non-Indigenous disparities in birth and infant outcomes within

*Address correspondence to this author at the Department of Obstetrics and Gynecology, Sainte-Justine Hospital, Bureau 4986, 3175, chemin Côte-Sainte-Catherine, Montreal, Quebec, H3T 1C5, Canada; Tel: 1-514-345-4931, Ext. 6706; Fax: 1-514-345-2195; E-mail: zhong-cheng.luo@recherche-ste-justine.qc.ca

rural and urban areas. A study in the Canadian province of British Columbia revealed that infant mortality was lower in urban compared to rural areas among First Nations, but the reduction in disparities in infant mortality among First Nations versus non-First Nations has been less substantial over time in urban compared to rural areas [9]. In some regions of the United States, studies have found greater disparities in infant mortality comparing Indigenous to non-Indigenous infants in urban than in rural areas [3,7]. In contrast, a Western Australian study found greater Indigenous versus non-Indigenous disparities in infant mortality in rural areas, and a much higher infant mortality for Indigenous infants in rural areas [4]. Except for infant mortality, few studies have addressed Indigenous versus non-Indigenous disparities in other birth outcomes by urban versus rural residence. Virtually no data are available on birth and infant outcomes among Indigenous sub-groups within rural and urban areas. We assessed birth and infant outcomes comparing Inuit, First Nations and French mother tongue populations by rural versus urban residence in Quebec - the only province in Canada where two Indigenous sub-population groups - First Nations and Inuit - can be identified by self-reported mother tongue on birth registrations.

STUDY DESIGN

Subjects

This was a retrospective birth cohort study of all births with birth weight ≥ 500 g and gestational age ≥ 20 completed weeks in Quebec 1991-2000, using Statistics Canada's linked stillbirth, live birth and infant death databases. The validity of the Canadian linked vital data has been well documented [19]. The study was approved by the research ethics board of Sainte-Justine Hospital, University of Montreal, the First Nations of Quebec and Labrador Health and Social Service Commission, and the Nunavik Nutrition and Health Committee. Informed consent was not sought from individual participants because the study was based on anonymized linked birth data.

Identification of First Nations and Inuit Births

We identified First Nations and Inuit births by the maternal mother tongue as recorded on birth registrations [8]. If maternal mother tongue was missing and the paternal mother tongue was not missing, then the maternal mother tongue was taken to be the same as the paternal mother tongue. A total of 2,528 births to Inuit mother tongue women and 5,193 births to First Nations mother tongue women were identified during the study period. We excluded 1 Inuit and 9 First Nations births lacking sufficient information to determine if maternal place of residence was rural or urban. Therefore, 2,827 births to Inuit and 5,184 births to First Nations women remained in the final study cohort for comparisons to 652,940 births to French mother tongue (the majority language group in Quebec) women during the study period.

Geocoding Maternal Place of Residence

Using a geocoding program developed by Statistics Canada [20], we determine whether a birth was to a mother of rural or urban residence in Quebec, primarily based on the postal code as recorded on the birth registration. If postal codes were unavailable ($<5\%$), municipality codes were used instead. Urban areas were defined as any census metropoli-

tan area or census agglomeration with a population of $\geq 10,000$ persons, including the central community (urban centre) plus those adjacent census sub-divisions with high work force commuting flows ($>50\%$) to the urban centre, while all the remaining residual areas (census sub-divisions not in any census metropolitan area or census agglomeration) were considered rural areas [21].

Outcomes and Analyses

Birth and infant outcomes under study included preterm (<37 completed weeks in gestational age), small-for-gestational-age ($<10^{\text{th}}$ percentile in birth weight for gestational age using the Canadian standards [22]), low birth weight (<2500 g) and large-for-gestational-age ($>90^{\text{th}}$ percentile) births, stillbirth (fetal deaths ≥ 20 weeks and ≥ 500 g), neonatal death (0-27 days of postnatal life), postneonatal death (28-364 days of life), and infant death (0-364 days of life). Crude rates and relative risks (RR) with 95% confidence intervals (CI) were calculated for comparing birth and infant outcomes comparing rural versus urban areas among Inuit, First Nations and French mother tongue women, and comparing the outcomes among First Nations or Inuit versus French mother tongue groups within rural and urban areas. Stillbirth rates were calculated per 1000 total births (live births plus stillbirths). Infant and neonatal mortality rates were calculated per 1000 live births. Postneonatal mortality rates were calculated per 1000 neonatal survivors. Rural versus urban differences in mortality-based outcomes were not calculated for Inuit births because of the relatively small number of Inuit births in urban areas ($n=107$). Crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) were compared to assess whether the risk differences could be explained by the differences in observed maternal characteristics. The adjusted odds ratios (aOR) were obtained from logistic regression controlling for maternal age (<20 , 20-29, 30-34, ≥ 35 y), parity (primiparous, multiparous), education (<11 y, 11 y [completed high school in Quebec], ≥ 12 y [some college or higher]), marital status (legally married, in a common-law union, or single [living alone, neither married nor in a common-law union]), infant sex (male, female) and plurality (singleton, multiple). All data analyses were carried out using Statistical Analysis System (SAS), Version 9.1.

RESULTS

Maternal Characteristics

Compared to French mother tongue women, Inuit and First Nations mothers were about 5 times as likely to be <20 years of age or not having completed high school, 2.5 to 3.5 times as likely to be single, but less likely to be ≥ 35 years of age or primiparous (Table 1). The percentages of births to rural mothers were 96% for Inuit, 85% for First Nations, and 25% for French mother tongue women.

Outcomes for Rural Versus Urban Infants

Comparing rural versus urban residence for French mother tongue women, preterm and low birth weight rates were virtually identical, while rural infants were slightly and significantly more likely to be small-for-gestational-age or to die during their 1st year of life (Table 2, Fig. 1). In contrast, for Inuit mother tongue women, rural births were surprisingly less than half as likely to be small-for-gestational-age

Table 1. Maternal Characteristics for Births to Inuit, First Nations and French Mother Tongue Women in Quebec, 1991-2000

Characteristic [§] (%)	Births by maternal mother tongue*		
	Inuit (n=2,527)	First Nations (n=5,184)	French (n=652,940)
Maternal age			
<20 y	24.6	24.1	4.6
20-34 y	71.1	70.6	85.6
≥35 y	4.3	5.3	9.8
Marital status			
Single	36.6	25.8	10.7
Common law union	43.3	36.6	47.2
Married	20.0	37.6	42.1
Education			
<11 y	62.7	66.0	13.4
11 y (High school grad)	15.9	12.3	11.5
≥12 y	21.4	21.7	75.1
Primiparous	32.0	29.6	45.0
Rural residence	95.8	84.7	24.5

[§]Results are presented as % in column.

*Differences in all characteristics for Inuit or First Nations as compared to French mother tongue births were significant at P<0.001.

Table 2. Crude Rates and Relative Risks (RR) of Adverse Birth and Infant Outcomes Comparing Rural versus Urban Births among Inuit, First Nations and French Mother Tongue Women, Quebec, 1991-2000

Outcome	Inuit mother tongue [§]			First Nations mother tongue			French mother tongue		
	Rural Rate	Urban Rate	RR (95% CI)	Rural Rate	Urban Rate	RR (95% CI)	Rural Rate	Urban Rate	RR (95% CI)
N (total births)	2,420	107		4,389	795		160,018	492,922	
Births, %									
Preterm	10.7	13.1	0.82 (0.50, 1.35)	6.8	5.8	1.18 (0.87, 1.59)	7.3	7.3	0.99 (0.98, 1.02)
Small-for-gestational-age	5.5	13.1	0.42 (0.25, 0.70)*	3.2	5.9	0.52 (0.37, 0.74)*	11.2	10.7	1.05 (1.03, 1.06)*
Low birth weight	5.8	13.1	0.44 (0.26, 0.74)*	3.0	3.9	0.77 (0.53, 1.13)	6.1	6.0	1.02 (0.99, 1.04)
Large-for-gestational-age	15.1	15.9	0.95 (0.61, 1.48)	28.4	22.9	1.24 (1.08, 1.42)*	8.0	8.4	0.95 (0.93, 0.97)*
Deaths, per 1000									
Stillbirth				7.3	6.3	1.16 (0.45, 2.97)	3.9	3.6	1.06 (0.97, 1.16)
Neonatal death				3.0	3.8	0.79 (0.22, 2.75)	3.2	2.9	1.07 (0.97, 1.19)
Postneonatal death				5.5	6.4	0.87 (0.33, 2.27)	1.6	1.4	1.16 (1.00, 1.34)*
Infant death				8.5	10.1	0.84 (0.39, 1.79)	4.8	4.3	1.10 (1.01, 1.20)*

Small for gestational age (<10th percentile); large-for-gestational-age (>90th percentile); low birth weight (<2500 g). RR=risk ratio; CI=confidence interval.

[§]Mortality results for births to Inuit mother tongue women were not calculated due to the small number of Inuit births in urban areas.

* P<0.05.

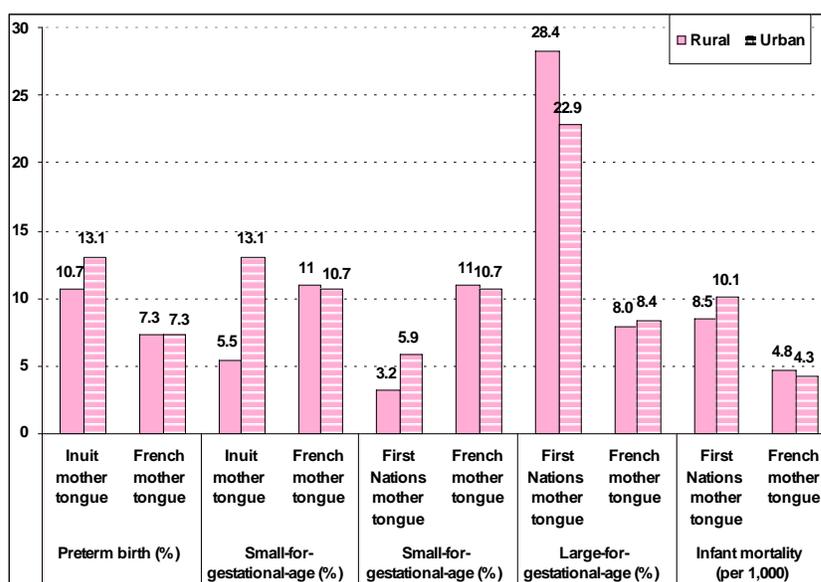


Fig. (1). Rates of Preterm, Small-for-Gestational-Age and Large-for-Gestational-Age Births and Infant Mortality for Births to First Nation, Inuit, and French (Majority) Mother Tongue Women by Rural versus Urban Residence in Quebec, 1991-2000.

or low birth weight than urban births. For First Nations, rural infants were also only half as likely to be small-for-gestational-age than urban infants. Stillbirth rates were not statistically significantly different comparing rural versus urban areas for births to both First Nations and French mother tongue women.

The rural urban differences in birth and infant outcomes remained after adjusting for observed maternal characteristics. The adjusted ORs were similar to the crude ORs comparing rural versus urban birth outcomes among Inuit, First Nations, or French mother tongue women (Table 3).

Outcomes Comparing Inuit and First Nations Versus French Mother Tongue Infants

In rural areas, as compared to births among French mother tongue women, Inuit births were about 1.5 fold as likely to be preterm, but only half as likely to be small-for-gestational-age (RR=0.49) (Table 4). In contrast, in urban areas, Inuit births were 1.8-fold as likely to be preterm, and 1.2-fold as likely to be small-for-gestational-age. In both rural and urban settings, Inuit women were 1.9-fold as likely

to have a large-for-gestational-age birth as French mother tongue women.

Compared to births among French mother tongue women, First Nations births were much less likely to be small-for-gestational-age in both rural (RR=0.28) and urban (RR=0.55) areas, but to a greater extent in rural areas (Table 4). First Nations infants were much more likely to die during their 1st year of life, to a greater extent in urban areas (RR=1.8 in rural, RR=2.3 in urban), especially during the postneonatal period (RR=3.4 in rural, RR=4.6 in urban). There were no significant differences in preterm birth rates comparing First Nations to French mother tongue women.

Adjusted ORs showed generally similar patterns as the crude ORs comparing births to Inuit or First Nations versus French mother tongue women within rural or urban areas (Table 5). In both rural and urban areas, the disparities in the odds of infant death especially for postneonatal death among infants of First Nations versus French mother tongue women became smaller but persisted after adjusting for maternal characteristics. The lower odds of small-for-gestational-age but higher odds of large-for-gestational-age birth were even

Table 3. Crude and Adjusted Odds Ratio (OR) of Adverse Birth and Infant Outcomes Comparing Rural versus Urban Births among Inuit, First Nations and French Mother Tongue Women, Quebec, 1991-2000

Outcome	Inuit mother tongue#		First Nations mother tongue		French mother tongue	
	Crude OR (95% CI)	Adjusted OR [§] (95% CI)	Crude OR (95% CI)	Adjusted OR [§] (95% CI)	Crude OR (95% CI)	Adjusted OR [§] (95% CI)
Births						
Preterm	0.80 (0.45, 1.42)	0.98 (0.49, 1.95)	1.20 (0.86, 1.64)	1.30 (0.92, 1.82)	1.00 (0.98, 1.02)	0.99 (0.97, 1.02)
Small-for-gestational-age	0.39 (0.21, 0.70)*	0.35 (0.18, 0.67)*	0.52 (0.37, 0.74)*	0.55 (0.38, 0.78)*	1.05 (1.03, 1.07) *	1.05 (1.03, 1.07)*
Low birth weight	0.41 (0.23, 0.73)	0.40 (0.21, 0.78)	0.76 (0.51, 1.14)	0.84 (0.55, 1.28)	1.02 (1.00, 1.05)*	1.02 (0.99, 1.05)
Large-for-gestational-age	0.94 (0.55, 1.60)	0.85 (0.48, 1.51)	1.34 (1.12, 1.60)	1.22 (1.02, 1.47)*	0.95 (0.93, 0.97)	0.94 (0.92, 0.96)*
Deaths						
Stillbirth			1.16 (0.45, 2.99)	1.24 (0.42, 3.66)	1.06 (0.97, 1.17)	1.16 (1.04, 1.29) *
Neonatal death			0.79 (0.22, 2.76)	1.00 (0.28, 3.66)	1.08 (0.97, 1.19)	1.09 (0.98, 1.21)
Postneonatal death			0.87 (0.33, 2.28)	0.59 (0.22, 1.63)	1.16 (1.00, 1.34) *	1.11 (0.96, 1.29)
Infant death			0.84 (0.39, 1.80)	0.73 (0.33, 1.61)	1.10 (1.01, 1.20) *	1.10 (1.01, 1.20)*

OR=odds ratio; CI=confidence interval.

[§]The ORs were adjusted for maternal age (<20, 20-29, 30-34, >35 years), education (<high school, high school, and some college or higher), marital status (single, common-law union, married), parity (primiparous, multiparous), plurality (singleton, multiple) and infant sex (boy, girl).

Mortality results for births to Inuit mother tongue women were not calculated due to the small number of Inuit births in urban areas.

* P<0.05.

Table 4. Crude Relative Risks (RR) of Adverse Birth and Infant Outcomes Comparing Births to Inuit or First Nations versus French Mother Tongue Women in Rural and Urban Areas, Quebec, 1991-2000

Outcome	Inuit versus French mother tongue [§]		First Nations versus French mother	
	Rural Areas RR (95% CI)	Urban Areas RR (95% CI)	Rural Areas RR (95% CI)	Urban Areas RR (95% CI)
Births				
Preterm	1.47 (1.30, 1.64) *	1.79 (1.10, 2.91) *	0.93 (0.84, 1.04)	0.79 (0.60, 1.05)
Small-for-gestational-age	0.49 (0.42, 0.58) *	1.22 (0.75, 1.99)	0.28 (0.24, 0.34) *	0.55 (0.42, 0.73)*
Low birth weight	0.94 (0.80, 1.11)	2.18 (1.34, 3.55) *	0.49 (0.41, 0.53) *	0.65 (0.46, 0.92) *
Large-for-gestational-age	1.89 (1.72, 2.08) *	1.89 (1.22, 2.93) *	3.56 (3.39, 3.74)	2.73 (2.40, 3.10)*
Deaths				
Stillbirth			1.89 (1.33, 2.69)	1.73 (0.72, 4.19)
Neonatal death			0.94 (0.54, 1.63)	1.29 (0.42, 3.99)
Postneonatal death			3.43 (2.26, 5.20)*	4.57 (1.90, 11.98)*
Infant death			1.78 (1.28, 2.49)*	2.34 (1.17, 4.66)*

RR=risk ratio; CI=confidence interval.

[§]Mortality results were not calculated for Inuit births in urban areas due to the small number of births.

* P<0.05.

Table 5. Crude and Adjusted Odds Ratio (OR) of Adverse Birth and Infant Outcomes Comparing Births to Inuit or First Nations versus French Mother Tongue Women in Rural and Urban Areas, Quebec, 1991-2000

Outcome	Inuit versus French mother tongue		First Nations versus French mother	
	Rural Areas cOR, aOR (95% CI) §	Urban Areas cOR, aOR (95% CI) §	Rural Areas cOR, aOR (95% CI) §	Urban Areas cOR, aOR (95% CI) §
Births				
Preterm	1.52, 1.26 (1.07, 1.47) *	1.91, 1.37 (0.71, 2.63) *	0.93, 0.84 (0.74, 0.95) *	0.78, 0.61 (0.45, 0.83)*
Small-for-gestational-age	0.46, 0.38 (0.31, 0.47) *	1.26, 1.07 (0.58, 1.97)	0.26, 0.22 (0.19, 0.26) *	0.52, 0.42 (0.31, 0.56)*
Low birth weight	0.94, 0.73 (0.59, 0.90)	2.35, 1.89 (1.03, 3.49) *	0.47, 0.40 (0.34, 0.48) *	0.63, 0.46 (0.32, 0.67) *
Large-for-gestational-age	2.05, 2.23 (1.95, 2.55) *	2.06, 2.54 (1.48, 4.37) *	4.58, 4.95 (4.59, 5.33)*	3.24, 3.83 (3.23, 4.54)*
Deaths				
Stillbirth			1.90, 1.47 (0.95, 2.26)	1.74, 1.36 (0.51, 3.67)
Neonatal death			0.94, 0.96 (0.54, 1.68)	1.29, 1.15 (0.37, 3.59)
Postneonatal death			3.44, 2.12 (1.30, 3.45)*	4.59, 2.75 (1.13, 6.71)*
Infant death			1.79, 1.43 (0.99, 2.06)	2.35, 1.82 (0.90, 3.67)

OR=odds ratio; CI=confidence interval.

§The ORs adjusted for maternal age (<20, 20-29, 30-34, ≥35 years), education (<high school, high school, and some college or higher), marital status (single, common-law union, married), parity (primiparous, multiparous), plurality (singleton, multiple) and infant gender (boy, girl).

* P<0.05.

more striking among First Nations after the adjustments. An even greater risk of large-for-gestational-age birth was also observed for Inuit births after the adjustments. The elevated risk of low birth weight for Inuit persisted in urban areas (adjusted OR=1.89).

DISCUSSION

Major Findings

While living in rural areas was associated with slightly worse birth outcomes among French mother tongue women indicating some urban “advantage”, the reverse seemed true for Inuit and First Nations women in Quebec. Rural living was associated with much lower rates of poor fetal growth among both Inuit and First Nations infants. Living in urban areas was not associated with better birth and infant outcomes for both Inuit and First Nations women in Quebec, despite universal health insurance coverage and improved geographic proximity to high-quality tertiary health care services. Higher postneonatal death rates were observed for First Nations versus French mother tongue infants in both urban and rural areas, to a greater extent in urban areas. This strongly indicates a need for improved socioeconomic conditions, perinatal and infant care for Indigenous people living in urban areas.

Comparisons with Findings from Previous Studies

A number of studies have compared birth outcomes between rural and urban areas in the general population. Most studies in developing countries reported worse birth outcomes in rural areas [23-25], while in developed countries the findings have been inconsistent [26-32]. In contrast, there have been only a few studies examining rural versus urban differences in birth and infant outcome among Indigenous populations, all in developed countries [4,6,9]. Our study showed a somewhat reverse pattern for Indigenous and non-Indigenous populations in Quebec. Urban birth outcomes seemed slightly better for French mother tongue women, but worse for both Inuit and First Nations mother tongue women.

Compared to births to French mother tongue women, we observed greater disparities in preterm birth rates for Inuit, and in infant mortality rates for First Nations in urban than in

rural areas. This finding is consistent with several previous studies indicating greater urban disparities in Indigenous and non-Indigenous birth outcomes in some regions of Canada and United States [3,7,9]. The observed higher rates of large-for-gestational-age birth among Inuit and First Nations are consistent with previous reports of higher rates of macrosomic birth among Canadian First Nations populations [33-36]. Moreover, we found that among First Nations, such macrosomic births were more prevalent in rural versus urban areas, indicating that life style factors as well as social and community conditions may have partly accounted for the high prevalence of macrosomia among First Nations in Quebec.

It is somewhat worrisome that living in urban areas, where health care facilities are considered better, was not associated with better birth and infant outcomes for Inuit and First Nations. The underlying causes are unclear. Low socioeconomic status may be an important contributor, especially in the postneonatal period. Also, urban living may present significant new challenges owing to the lack of traditional community support, poor access to traditional nutritious diets, and a possible lack of access to high-quality perinatal care due to various barriers in urban centers. There may be a shortage of culturally appropriate and accessible resources for meeting the perinatal care needs of Indigenous women in urban areas [7]. According to a recent Canadian study, inadequate prenatal care use seems more common for Aboriginal women than for non-Aboriginal women [37]. In addition, the urban-rural hypothesis may require a more sophisticated analysis as urban and rural areas have contextual features that foster advantage or create disadvantage (e.g. remoteness, SES) that have not been addressed in our study.

Limitations

Some Inuit and First Nations women may not report a native (Inuit or First Nations) mother tongue, resulting in being classified into the French or English mother tongue group. According to the 2001 census, about 86% of Inuit and 60% of First Nations (classified by self identification) people in Quebec spoke a native mother tongue. However, because of the much larger size of the French mother tongue reference group, such misclassifications (the presence of a relatively small number of Indigenous persons within the reference

group) would have had little effect on our comparisons. We had only limited information on maternal and pregnancy characteristics, but no information on many other potential confounders or effect mediators such as maternal smoking, alcohol use and gestational complications. More studies are needed to understand the impacts of these potential effect mediators.

SYNOPSIS

Living in urban areas is associated with worse birth and infant outcomes for Inuit and First Nations in Quebec despite universal health insurance coverage and geographic proximity to high-quality tertiary health care services, strongly indicating a need for improved socioeconomic conditions, perinatal and infant care for Indigenous people living in urban areas.

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