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Underlying Causes of Ethnocultural Inequality in Pregnancy Outcomes: Role of Hospital Proximity

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Abstract

We evaluated the contribution of place of birth to ethnocultural inequality in pregnancy outcomes. We analyzed a cohort of 1,487,723 births between 1998 and 2019 among minority Anglophones and majority Francophones in Quebec, Canada. We estimated the association (adjusted risk ratio, RR; 95% confidence interval, CI) of language with preterm birth and stillbirth, and incorporated interaction terms to determine the contribution of place of birth and distance traveled. Compared with Francophones, minority Anglophones had a greater risk of preterm birth (RR 1.03; 95% CI 1.01–1.06) and were less likely to deliver farther from home (RR 0.95; 95% CI 0.94–0.95). Anglophones who delivered close to home had a higher risk of preterm birth (RR 1.07; 95% CI 1.04–1.11), whereas Anglophones who delivered farther had a lower risk (RR 0.69; 95% CI 0.64–0.75). Patterns were similar for stillbirth. Ethnocultural inequality in adverse birth outcomes may be influenced by place of birth.

Keywords Health services accessibility · Language · Minority health · Premature birth · Stillbirth

Introduction

Ethnocultural minorities are at risk of adverse birth outcomes [1], but the possibility that place of birth underlies the excess risk has received only limited attention. Studies suggest that place of birth may influence birth outcomes, with delivery in birth centers associated with a higher risk of preterm birth [2], but a potentially lower risk of stillbirth compared with delivery in hospitals [3]. Ethnocultural minorities have limited access to birth centers [4, 5], and are up to 50% less likely to deliver in out-of-hospital settings than the rest of the population [4]. Minorities are also more likely to travel farther for delivery [5]. Studies have shown that longer travel times are associated with a greater risk of perinatal mortality [6–8]. Women who deliver more than 30 min away from home have up to 3 times the risk of stillbirth compared with delivery closer to home [6, 7], and every 15 min increase of travel time is associated with 13% greater risk of neonatal death [8]. These data suggest that barriers accessing obstetric services may contribute to adverse birth outcomes in minority populations.

Stillbirth is gaining attention in perinatal research. Despite progress in maternal health, stillbirth rates remain elevated worldwide compared with improvements made for other indicators such as neonatal and under-five mortality. Stillbirth is associated with a persistent and unperceived perinatal health burden [9, 10]. Ethnicity and culture are established determinants of stillbirth [11]. Black women have more than 3 times the risk of stillbirth compared with White women [11]. In addition, Black women have two times the risk of preterm birth [11], while immigrant women who migrated more than 15 years ago and women who speak a foreign language are also at risk of preterm birth [12, 13]. Ethnocultural disparities are widespread, but the reason for the inequality is unclear and the possibility that access to

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perinatal care interacts with cultural factors has not been assessed.

Inequality in maternal and infant outcomes may be influenced by geographic barriers that affect access to antenatal care [14]. Social determinants such as ethnicity and longer travel times to access prenatal care are associated with an increased risk of preterm birth and neonatal hospitalization [14]. Our objective was to determine if the place of delivery and distance traveled to reach the delivery location contribute to the risk of adverse birth outcomes among ethnocultural minorities.

Methods

Data

We analyzed a cohort of 1,487,723 births among Anglophones and Francophones of Quebec, Canada using data from live birth and stillbirth registration certificates between 1998 and 2019. The data contain information on maternal mother tongue, postal code of residence, and place of birth. Linguistic status is a measure of ethnicity, social status, and cultural norms in Quebec, and is comparable to measures of race or ethnicity used in other countries [15]. Anglophones represent 9% of the population [16], and previous studies have shown that Anglophones are increasingly at risk of adverse perinatal outcomes [17, 18]. Stillbirth rates among Anglophones are rising [17], and a growing number of Anglophone women are at risk of delayed fetal growth compared with Francophones [18]. There is more evidence of Anglophone–Francophone inequality in Quebec than of other ethnocultural inequality.

The main exposure measure was self-reported language on birth registration certificates, including French or English. We considered bilingual mothers as Anglophone because they share sociocultural characteristics. Other exposures of interest included the place of birth and distance traveled to reach the place of birth. We defined the place of birth as a hospital, birth center, or other location. We calculated the distance in kilometers between the postal code of residence and of the place of birth. To do so, we geocoded the centroid of postal codes using ArcGIS version 10.7.1 (RRID:SCR_011081, Esri Inc., Redlands, CA), and used roadway maps to determine the travel distance between the postal code of residence and postal code of birth [19]. In urban areas, postal codes usually cover one side of a street block, while in rural areas postal codes can be larger. We classified distance as <10, 10–29.9, or ≥ 30 km between the home and delivery location.

Pregnancy Outcomes

We examined two main outcomes, including preterm birth and stillbirth. We defined preterm birth as less than 37 completed weeks of gestation (yes, no), and stillbirth as the death in utero of a fetus weighing 500 g or more. There was no minimum gestational age criterion for stillbirth until the end of 2019, when a cutoff of 20 weeks was introduced. A total of 608 live births and 38 stillbirths had missing gestational age and were excluded from analyses of preterm birth.

Covariates

Available covariates included maternal age (<25, 25–34, ≥ 35 years), parity (0, 1, ≥ 2), civil status (married, single, unknown), maternal region of origin (Canada, Middle East & North Africa, South Asia, East Asia & Pacific, East Europe, West Europe & USA, Sub-Saharan Africa, Latin America, Caribbean, unspecified), education (no high school diploma, high school diploma, university training, unknown), rural residence (yes, no, unknown), socioeconomic deprivation (low, middle-low, middle, middle-high, high, unknown), and period of birth (1998–2005, 2006–2012, 2013–2019). Socioeconomic deprivation was measured as a neighborhood index of the employment rate, proportion of individuals without a high school diploma, and average personal income based on the census [20]. Rural residence included areas with less than 10,000 inhabitants.

Data Analysis

We computed rates of preterm birth and stillbirth and examined the place of birth for Anglophones and Francophones (n, %). We used log-binomial regression to estimate risk ratios (RR) and 95% confidence intervals (CI) for the association of language with preterm birth and stillbirth, adjusted for place of birth, distance between the residence and place of birth, maternal age, parity, civil status, education level, maternal region of origin, socioeconomic deprivation, and period of birth. We stratified the analyses by rural residence because the distance to a hospital or birth center can be greater in rural areas.

We investigated if the place of birth and distance traveled mediated or interacted with the association between language and adverse pregnancy outcomes. We first verified that these place characteristics were associated with the risk of preterm birth and stillbirth. We then determined if language was associated with the place of birth or distance traveled. Through interaction terms, we determined if language and place of birth, or language and distance traveled, impacted the risk of preterm birth and stillbirth. To determine if there was evidence of mediation, we decomposed the

effect of language into components, including the effect due to interaction with place of birth or distance traveled, effect due to mediation of these variables, and combined effect of interaction and mediation [21].

We conducted the analysis in SAS version 9.4 (RRID:SCR_008567, SAS Institute Inc., Cary, NC). The data used in this study were anonymous, thus the review board of our research institution provided an ethics waiver.

Results

Maternal Characteristics

This study comprised 1,327,081 births among Francophones (89.2%) and 160,642 births among Anglophones (10.8%) (Table 1). About 12% of Anglophones and 22% of Francophones lived in rural areas. Anglophones in rural areas had a higher rate of preterm birth than Francophones (8.5% vs. 7.8%), and somewhat more stillbirths (0.6% vs. 0.4%). In urban areas, however, Anglophones had a similar rate of preterm birth (7.7% vs. 7.5%) and stillbirth (0.5% vs. 0.4%) as Francophones. Anglophones and Francophones were both more likely to have no high school diploma or high socioeconomic deprivation in rural areas. A greater proportion of women were foreign born in urban areas compared with rural areas.

Place of Birth

Anglophones and Francophones delivered mostly in hospitals (Fig. 1). Only 1 to 2% delivered in birth centers. Distance between the residence and place of birth was similar for Anglophones and Francophones in urban areas, with about half traveling less than 10 km and 40% traveling between 10 and 29.9 km for delivery. In rural areas, however, a greater proportion of Francophones traveled between 10 and 29.9 km compared with Anglophones (35% vs. 16%), while a greater proportion of Anglophones traveled 30 km or more compared with Francophones (55% vs. 45%).

Risk of Preterm Birth and Stillbirth

Anglophones had a greater risk of preterm birth than Francophones, but in urban areas only (Table 2). Compared with Francophones, Anglophones had 1.03 times the risk of preterm birth in urban areas (95% CI 1.01–1.06), but 0.90 times the risk in rural areas (95% CI 0.85–0.94). There was no difference in the risk of stillbirth. However, place of birth and distance traveled were strongly associated with the risk of preterm birth and stillbirth. Women who delivered in birth centers had a lower risk of these outcomes compared with hospitals, while women who delivered farther from home had an elevated risk. There appeared to be a dose-response effect, as women who traveled 10 to 29.9 km for delivery in urban areas had 1.15 times the risk (95% CI 1.13–1.16) and women who traveled 30 km or more had 2.19 times the risk (95% CI 2.14–2.24) of preterm birth, compared with less than 10 km.

Place of Birth and Distance Traveled

Anglophones were more likely to deliver in birth centers (Table 3). Compared with Francophones, Anglophones in urban areas were 1.13 times more likely to deliver in a birth center (95% CI 1.09–1.17), whereas Anglophones in rural areas were 2.16 times more likely (95% CI 1.97–2.37). Anglophones in urban areas were also less likely to deliver farther from home compared with Francophones. However, Anglophones in rural areas were somewhat more likely to travel 30 km or more for delivery compared with Francophones (RR 1.04, 95% CI 1.02–1.05).

Interaction of Language with Distance Traveled

Decomposition analyses indicated that language interacted with distance traveled (Table 4). Compared with Francophones, Anglophones who delivered close to home (less than 10 km) had a higher risk of preterm birth and stillbirth, while Anglophones who traveled 30 km or more had a lower risk of these outcomes. In urban areas, Anglophones who traveled less than 10 km had 1.07 times the risk of preterm birth (95% CI 1.04–1.11) and 1.18 times the risk of stillbirth (95% CI 1.05–1.33) compared with Francophones. In contrast, Anglophones who traveled 30 km or more had 0.69 times the risk of preterm birth (95% CI 0.64–0.75) and 0.63 times the risk of stillbirth (95% CI 0.46–0.86) compared with Francophones. Trends were similar in rural areas. Anglophones in rural areas who delivered in birth centers or out-of-hospital also had 3.77 times the risk of preterm birth compared with Francophones (95% CI 2.45–5.81). Decomposition of these effects suggested that place of birth and distance traveled did not mediate the association between language and adverse birth outcomes.

Discussion

Birth Characteristics

In this study of more than 1.4 million births in Canada, distance traveled to reach the place of birth had a modifying effect on the association between language and adverse birth outcomes. Anglophones who delivered close to home had an elevated risk of preterm birth and stillbirth compared with Francophones; however, Anglophones who traveled farther

Table 1 Characteristics of Anglophone and Francophone births

	No. births (%)			
	Urban		Rural	
	Anglophone	Francophone	Anglophone	Francophone
Preterm birth				
Yes	10,914 (7.7)	77,231 (7.5)	1675 (8.5)	23,320 (7.8)
No	130,030 (92.2)	952,165 (92.5)	17,930 (91.4)	273,812 (92.1)
Stillbirth				
Yes	713 (0.5)	4000 (0.4)	108 (0.6)	1109 (0.4)
No	140,312 (99.5)	1,025,817 (99.6)	19,509 (99.4)	296,155 (99.6)
Place of birth				
Hospital	138,169 (98.0)	1,011,117 (98.2)	18,974 (96.7)	292,016 (98.2)
Birth center	1965 (1.4)	13,658 (1.3)	566 (2.9)	4052 (1.4)
Other	891 (0.6)	5042 (0.5)	77 (0.4)	1196 (0.4)
Distance between residence and place of birth, km				
< 10	74,893 (53.1)	514,297 (49.9)	1941 (9.9)	32,597 (11.0)
10–29.9	54,965 (39.0)	393,320 (38.2)	3166 (16.1)	104,867 (35.3)
≥ 30	7814 (5.5)	70,429 (6.8)	10,834 (55.2)	135,755 (45.7)
Maternal age, years				
< 25	17,699 (12.6)	181,103 (17.6)	6719 (34.3)	71,675 (24.1)
25–34	87,208 (61.8)	694,366 (67.4)	10,166 (51.8)	194,920 (65.6)
≥ 35	36,118 (25.6)	154,348 (15.0)	2732 (13.9)	30,669 (10.3)
Parity				
0	63,598 (45.1)	486,905 (47.3)	7121 (36.3)	126,338 (42.5)
1	48,635 (34.5)	372,345 (36.2)	5841 (29.8)	107,400 (36.1)
≥ 2	28,792 (20.4)	170,567 (16.6)	6655 (33.9)	63,526 (21.4)
Civil status				
Married	120,989 (85.8)	921,098 (89.4)	15,288 (77.9)	268,642 (90.4)
Single	12,972 (9.2)	82,293 (8.0)	3024 (15.4)	19,593 (6.6)
Maternal region of origin				
Canada	97,206 (68.9)	930,996 (90.4)	18,095 (92.2)	291,275 (98.0)
Middle East & North Africa	6739 (4.8)	15,077 (1.5)	77 (0.4)	152 (0.1)
South Asia	4875 (3.5)	483 (0.0)	22 (0.1)	12 (0.0)
East Asia & Pacific	5857 (4.2)	1883 (0.2)	127 (0.6)	121 (0.0)
East Europe	2269 (1.6)	1640 (0.2)	47 (0.2)	58 (0.0)
West Europe & USA	8724 (6.2)	20,114 (2.0)	642 (3.3)	2061 (0.7)
Sub-Saharan Africa	2984 (2.1)	18,470 (1.8)	32 (0.2)	279 (0.1)
Latin America	2097 (1.5)	2195 (0.2)	67 (0.3)	158 (0.1)
Caribbean	4224 (3.0)	13,540 (1.3)	27 (0.1)	273 (0.1)
Education				
No high school diploma	6181 (4.4)	72,677 (7.1)	4161 (21.2)	31,266 (10.5)
High school diploma	63,305 (44.9)	516,913 (50.2)	11,117 (56.7)	184,996 (62.2)
University training	61,877 (43.9)	390,033 (37.9)	2814 (14.3)	66,458 (22.4)
Socioeconomic deprivation				
Low	42,388 (30.1)	227,277 (22.1)	547 (2.8)	8035 (2.7)
Middle-low	29,417 (20.9)	242,988 (23.6)	1281 (6.5)	28,593 (9.6)
Middle	22,838 (16.2)	217,467 (21.1)	2286 (11.7)	56,779 (19.1)
Middle-high	20,124 (14.3)	179,794 (17.5)	3839 (19.6)	89,344 (30.1)
High	20,709 (14.7)	135,442 (13.2)	10,734 (54.7)	107,522 (36.2)
Period				
1998–2005	44,743 (31.7)	342,668 (33.3)	6855 (34.9)	104,074 (35.0)
2006–2012	47,853 (33.9)	349,305 (33.9)	6615 (33.7)	98,410 (33.1)

Table 1 (continued)

	No. births (%)			
	Urban		Rural	
	Anglophone	Francophone	Anglophone	Francophone
2013–2019	48,429 (34.3)	337,844 (32.8)	6147 (31.3)	94,780 (31.9)
Total	141,025 (100.0)	1,029,817 (100.0)	19,617 (100.0)	297,264 (100.0)

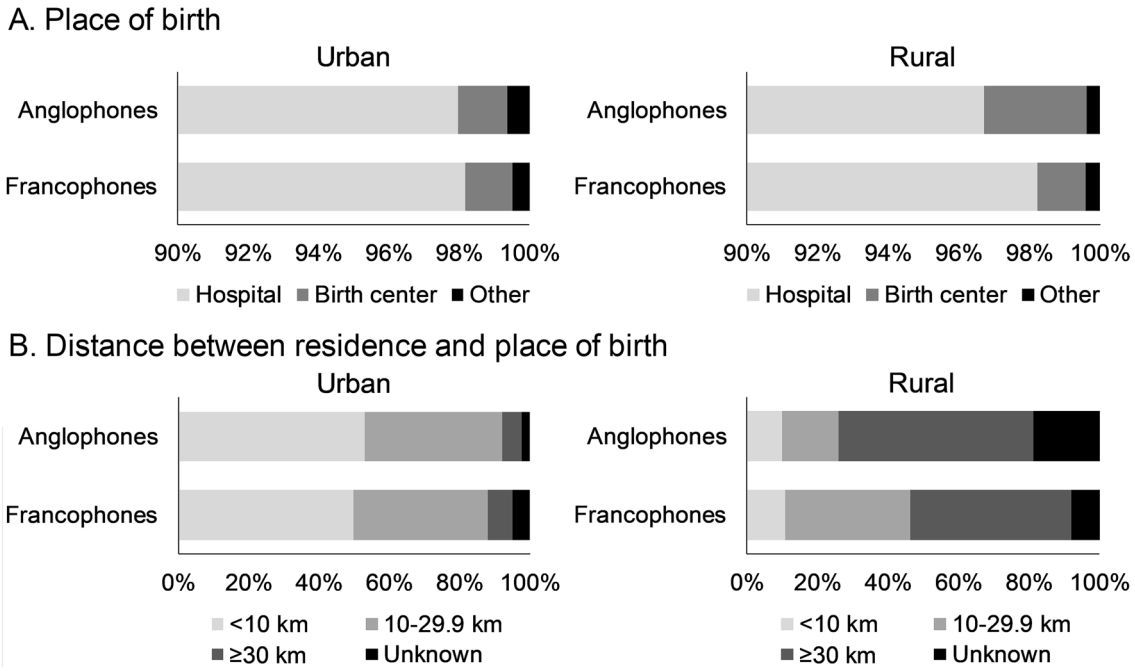

Fig. 1 Characteristics at birth for Anglophones and Francophones

Table 2 Association of language, place of birth, and distance traveled with risk of preterm birth and stillbirth

	Risk ratio (95% confidence interval)[a]			
	Preterm birth		Stillbirth	
	Urban	Rural	Urban	Rural
Linguistic group				
Anglophone	1.03 (1.01–1.06)	0.90 (0.85–0.94)	1.01 (0.93–1.10)	1.01 (0.82–1.24)
Francophone	Reference	Reference	Reference	Reference
Place of birth				
Hospital	Reference	Reference	Reference	Reference
Birth center	0.11 (0.09–0.13)	0.24 (0.19–0.29)	0.03 (0.01–0.14)	0.11 (0.03–0.43)
Other	0.39 (0.33–0.45)	0.61 (0.45–0.84)	0.53 (0.30–0.93)	1.68 (0.74–3.85)
Distance between residence and place of birth, km				
< 10	Reference	Reference	Reference	Reference
10–29.9	1.15 (1.13–1.16)	1.13 (1.07–1.19)	1.14 (1.07–1.22)	1.17 (0.91–1.52)
≥ 30	2.19 (2.14–2.24)	2.00 (1.90–2.11)	2.60 (2.38–2.84)	2.20 (1.73–2.80)

[a]Adjusted for place of birth, distance traveled, age, parity, civil status, education, region of origin, socio-economic deprivation, and period

Age and time period were not correlated (Pearson's r = 0.1)

Table 3 Association of language with place of birth and distance traveled

	No. births (%)		Anglophone vs. Francophone Risk ratio (95% confidence interval)[a]	
	Anglophone	Francophone	Urban	Rural
Place of birth				
Hospital	138,169 (98.0)	1,011,117 (98.2)	Reference	Reference
Birth center	1965 (1.4)	13,658 (1.3)	1.13 (1.09–1.17)	2.16 (1.97–2.37)
Other	891 (0.6)	5042 (0.5)	1.12 (1.08–1.16)	0.93 (0.79–1.10)
Distance between residence and place of birth, km				
< 10	74,893 (53.1)	514,297 (49.9)	Reference	Reference
10–29.9	54,965 (39.0)	393,320 (38.2)	0.96 (0.95–0.97)	0.82 (0.79–0.85)
≥ 30	7814 (5.5)	70,429 (6.8)	0.95 (0.94–0.95)	1.04 (1.02–1.05)

[a]Adjusted for age, parity, civil status, education, region of origin, socioeconomic deprivation, and period

Table 4 Interaction of language with place of birth and distance traveled: association with preterm birth and stillbirth

	Anglophone vs. Francophone Risk ratio (95% confidence interval)[a]			
	Preterm birth		Stillbirth	
	Urban	Rural	Urban	Rural
Interaction with place of birth				
Among hospital deliveries	1.03 (1.00-1.05)	0.97 (0.92–1.02)	1.00 (0.91–1.08)	1.10 (0.89–1.35)
Among birth centers and other delivery locations	0.98 (0.67–1.43)	3.77 (2.45–5.81)	2.01 (0.52–7.73)	2.30 (0.41–12.82)
P value interaction of language with place of birth	0.8	< 0.0001	0.2	0.3
Interaction with distance traveled				
Among patients traveling < 10 km	1.07 (1.04–1.11)	1.16 (0.95–1.41)	1.18 (1.05–1.33)	1.67 (0.83–3.37)
Among patients traveling < 30 km	1.08 (1.06–1.11)	1.00 (0.89–1.13)	1.07 (0.97–1.17)	1.35 (0.87–2.11)
Among patients traveling ≥ 30 km	0.69 (0.64–0.75)	0.73 (0.63–0.85)	0.63 (0.46–0.86)	0.73 (0.41–1.28)
P value interaction of language with distance traveled	< 0.0001	< 0.0001	0.001	0.02

[a]Adjusted for age, parity, civil status, education, region of origin, socioeconomic deprivation, and period

had lower risks. Anglophones were more likely to deliver out-of-hospital and closer to home than Francophones. The results suggest that distance traveled for delivery may underlie ethnocultural inequality. More consideration should be given to improving access to quality obstetric care as a strategy to reduce perinatal inequalities among minorities.

Risk of Preterm Birth and Stillbirth

Preterm birth and stillbirth are indicators of health inequality. Several studies have shown that ethnic or cultural minorities are at risk of adverse birth outcomes compared with majority populations [11–13]. Quebec is no exception as minority Anglophones in our data had a greater risk of preterm birth than the Francophone majority. Yet, studies have not attempted to determine if place of birth could be targeted to reduce perinatal inequalities. Part of the reason may be that the association of place of birth with pregnancy outcomes conflicts in previous research [3, 22, 23]. In one study, adverse infant outcomes were more frequent in hospital deliveries than planned home births [23]. A separate report found that women with planned home births were at higher risk of perinatal death [3], while a meta-analysis of 6 studies suggested that planned place of birth was not associated with stillbirth [22]. As findings are inconsistent, there has been little effort to determine the extent to which place of birth may contribute to ethnocultural inequalities.

Place of Birth and Distance Traveled

The data are more consistent for distance to the place of birth [5–8]. Several studies have shown that longer travel times are associated with a greater risk of stillbirth and preterm birth [6, 8]. In France, women who deliver within 5 km of home or farther than 45 km have a higher risk of stillbirth [5]. A study of 1 million term singletons from the

Netherlands found that traveling more than 20 min was associated with 1.22 times the risk of stillbirth and neonatal mortality [7]. However, travel time did not interact with ethnicity [7]. In our study, distance traveled interacted significantly with language: compared with Francophones, Anglophones who traveled shorter distances had a higher risk of adverse birth outcomes, while Anglophones who traveled farther had a lower risk.

Different factors could explain the interaction. Socioeconomic status is a well known determinant of preterm birth and stillbirth [24], and Anglophones who deliver close to home may have characteristics that increase the risk of these outcomes. In one study, women with shorter travel times were more likely to live in low socioeconomic areas [7]. Housing close to hospitals may be more accessible to low income Anglophones owing to lower rents. Anglophones with lower socioeconomic status may be limited to using perinatal services that are close to home owing to prohibitive costs of transportation. However, socioeconomic factors are not a sufficient explanation because we accounted for education and socioeconomic deprivation in our analysis.

Interaction with Language

Another contributing factor relates to the language of provision of healthcare. Quebec hospitals offer services in French mostly. While some provide services in English, these hospitals are not available in all parts of Quebec. Communication barriers in hospitals offering fewer English services may affect quality of care, including understanding of medical procedures and choice of appropriate care [25]. Studies from the United States indicate that Spanish and Chinese speakers are more likely to be readmitted to hospital 30 days after discharge compared with English speakers [26], and that children of parents with low English-proficiency have longer lengths of stay [27]. Anglophones without the means to travel may encounter language barriers that prevent communication with care providers, despite availability of publicly funded healthcare. Language barriers may be an underrecognized determinant of adverse birth outcomes in settings where cultural status is measured by race, ethnicity, or immigration.

In our data, Anglophones who traveled longer distances for delivery had lower risks of preterm birth and stillbirth than Francophones. Reasons for using a farther hospital may vary, but include medical conditions requiring higher level of care [28]. Women who travel farther for delivery are more likely to have conditions such as preeclampsia or gestational diabetes that are risk factors for preterm birth and stillbirth [29, 30]. Nevertheless, Anglophones may opt to travel farther to access better quality care [28, 31], rather than high-risk services. These Anglophones may have fewer morbidities and consequently a lower risk of preterm birth or stillbirth. Anglophones could also travel farther to receive services in English, minimizing language barriers. In contrast, Francophones may be less likely to select a hospital for its language, and thus more likely to have high-risk pregnancies. Overall, ethnocultural minorities may not have the same reasons for accessing farther care as the rest of the population.

Birth Outcomes According to Rural/Urban Residence

The association between language and preterm birth varied by urban residence. Anglophones had a greater risk of preterm birth than Francophones, but in urban areas mainly. Distance to a hospital is frequently shorter in urban areas than in rural places, where residents may have to travel to a different city for obstetric services [32]. Interaction analyses indicated that Anglophones in urban areas who delivered close to home had a greater risk of preterm birth compared with Francophones. This association was less strong in rural areas. The difference may relate to the characteristics of highly urbanized areas, as socioeconomic opportunities may differ compared with rural areas. Anglophones in urban areas may find it harder to receive incomes allowing them to access suitable perinatal services. Anglophones may also be underemployed in large cities where French proficiency is a prerequisite. In contrast, proficiency may be less needed in rural areas. These types of disparities may be important to consider in efforts to improve healthcare access for ethnocultural minorities.

Limitations

This study had limitations. We used administrative data in which we cannot rule out coding errors or conservative estimates of association due to nondifferential misclassification of language, place of birth, distance traveled, or birth outcomes. As the data were de-identified and the residential address was not available, we used the postal code of residence to calculate the distance between home and the place of birth. Distances may be misestimated. We could not account for preeclampsia and other pregnancy morbidity as this information was unavailable. We lacked data on individual income and employment, maternal morbidities, level of care, and planned place of birth. We could not identify recent migrants or account for acculturation. Quebec provides universal healthcare. Results may not be generalizable to minorities in other settings where healthcare is not publicly funded.

Conclusion

In this study of ethnocultural inequality in a large Canadian province, distance traveled to reach the delivery location had a strong modifying effect on the association between language status and adverse birth outcomes. Compared with Francophones, Anglophones who delivered close to home had a greater risk of preterm birth and stillbirth, while Anglophones who traveled farther had lower risks. The findings suggest that ethnocultural inequality may be influenced by the accessibility of perinatal care, and has implications for research in other countries. Health interventions to reduce perinatal inequality and improve access to obstetric services should not exclude minorities who live close to hospital.

Author Contributions NA and MB-B conceived and designed the study. MB-B analysed the data, and NA, NL, and AL helped interpret the results. MB-B and NL drafted the manuscript, and NA and AL revised it critically for important intellectual content. All authors approved the submitted manuscript, and are responsible for all aspects of the work.

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Data Availability Access to the data may be requested from the Institut de la statistique du Québec (https://statistique.quebec.ca/research/#/accueil).

Code Availability Access to the statistical code for analyses are available upon request.

Declarations

Competing interest The authors have no relevant financial or non-financial interests to declare.

Ethical Approval The institutional review board of the University of Montreal Hospital provided an ethics wavier for this study.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

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