Stillbirth and infant mortality in Aboriginal communities in Quebec

by Nicolas L. Gilbert, Nathalie Auger and Michael Tjepkema

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- . not available for any reference period
- .. not available for a specific reference period
- ... not applicable
- 0 true zero or a value rounded to zero
- 0' value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
- p preliminary
- r revised
- x suppressed to meet the confidentiality requirements of the Statistics Act
- E use with caution
- F too unreliable to be published
- * significantly different from reference category (p < 0.05)
Stillbirth and infant mortality in Aboriginal communities in Quebec

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Abstract

Background
Infant mortality and stillbirth rates among Aboriginal people are higher than in the rest of Canada, but little is known on the perinatal health status of First Nations people living on reserves. This study examines stillbirth and infant mortality rates among Aboriginal people in Quebec, notably, First Nations people living on reserves, and compares these rates with those of the province’s non-Aboriginal population.

Data and methods
Data on live births and stillbirths in Quebec from 1989 to 2008 were extracted from Statistics Canada’s Infant Birth-Death Linked File. Postal codes were used to identify births and stillbirths on First Nations reserves, in the Cree and Naskapi communities (not on reserves), and in Inuit communities. Associations between type of community and mortality were measured using logistic regression models.

Results
Aboriginal people had a higher stillbirth rate than non-Aboriginal people in Quebec, but this difference was not significant after adjusting for socio-demographic characteristics (mothers’ age and education, community size and isolation). Neonatal mortality was also higher among the Inuit. Post-neonatal mortality was higher among Aboriginal people, and was unrelated to differences in the mothers’ age and education or to community size and isolation. Adjusted odds ratios (95% confidence intervals) for post-neonatal mortality on reserves, in the Cree and Naskapi communities, and in Inuit communities were, respectively, 1.57 (1.16 - 2.12), 3.01 (2.14 - 4.24) and 4.29 (3.09 - 5.97).

Interpretation
Stillbirth and infant mortality are higher among Aboriginal people than non-Aboriginal people in Quebec. The differences in post-neonatal mortality are particularly pronounced.

Keywords
Databases, data linkage, First Nations, Inuit, vital statistics

Authors
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Several studies have shown that infant mortality and stillbirth rates are higher among First Nations and Inuit people than in the rest of the Canadian population.1-4 In these studies, Aboriginal people were identified on the basis of residence in an area with a large percentage of Aboriginal people, census data, self-identification on birth records (British Columbia), or mother tongue of the mother (Quebec). However, these studies do not distinguish First Nations people who live on reserves. It is useful to determine the health status of First Nations people living on reserves, whose socio-economic conditions are often more precarious than those of the rest of the population.5 In addition, health services on reserves are managed under a separate health system. Health Canada provides funding for prevention and health promotion as well as for home and community care services for people living on reserves. Health Canada is also responsible for primary health care on remote reserves, whereas the responsibility is provincial for the rest of the population. Determining the health status of the on-reserve population would facilitate planning of health programs. Identifying members of this population based on language has the disadvantage of excluding Aboriginal people who adopted English or French as their home language.

This analysis was undertaken to measure stillbirth and infant mortality rates of Aboriginal people in Quebec, in particular, First Nations people living on reserves, and compares them with rates for non-Aboriginal people in the province.

Data and methods
Data on live births and stillbirths in Quebec from 1989 to 2008 were extracted from Statistics Canada’s Infant Birth-Death Linked File, which was created by linking the death records of infants younger than one year of age with birth records.6 At the time of this study, 2008 was the most recent year for which record linkage was completed.

Births that took place in Aboriginal communities were identified by postal code. The validity of the postal codes was verified using Statistics Canada’s Postal Code Conversion File Plus (PCCF+).7 Only records containing a valid postal...
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The following outcomes were analyzed:

- Stillbirths of fetuses weighing 500 grams or more (after exclusion of pregnancy terminations);
- Neonatal deaths (0 to 27 days after birth);
- Post-neonatal deaths (28 to 364 days after birth);
- Infant deaths (sum of neonatal and post-neonatal deaths).

The following variables, obtained from birth records, were included in the analysis:

- Mothers’ age (10 to 19, 20 to 34, and 35 or older), because infant mortality and stillbirth rates are higher for children of mothers younger than 20 and 35 or older;
- Mothers’ years of education (9 or less, 10 to 12, and 13 or more), because less education is associated with higher stillbirth and infant mortality rates;
- Multiple births, a risk factor for stillbirth and infant mortality;
- Year of birth, grouped by five-year periods, to account for the decline in infant mortality during the 1990s and 2000s.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Live births†</th>
<th>Stillbirths</th>
<th>Infant deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of community (shared postal codes included with First Nations)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Nations reserve</td>
<td>16,240</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Cree or Naskapi</td>
<td>6,860</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>Inuit</td>
<td>5,350</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Non-Aboriginal</td>
<td>1,591,820</td>
<td>5,400</td>
<td>7,820</td>
</tr>
<tr>
<td>Type of community (shared postal codes included with non-Aboriginal)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Nations reserve</td>
<td>12,170</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Cree or Naskapi</td>
<td>6,860</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>Inuit</td>
<td>5,350</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>Non-Aboriginal</td>
<td>1,595,890</td>
<td>5,420</td>
<td>7,850</td>
</tr>
</tbody>
</table>

Mothers’ age

- 10 to 19: 1,358,790 (83.9), 4,290 (72.2), 6,400 (79.0)
- 20 to 34: 196,000 (12.1), 950 (17.1), 1,140 (14.1)
- 35 or older: 12,170 (0.8), 70 (1.3), 100 (1.2)

Mothers’ education

- 9 years or less: 98,580 (6.1), 400 (7.2), 750 (9.3)
- 10 to 12 years: 510,680 (31.5), 1,520 (27.3), 2,780 (34.3)
- 13 years or more: 831,080 (51.3), 2,160 (38.8), 3,330 (41.1)

Birth

- Single: 1,580,670 (97.6), 5,180 (93.2), 7,010 (86.5)
- Multiple: 39,600 (2.4), 380 (6.8), 1,090 (13.5)

Size of community and metropolitan influence

- 1,500,000 or more: 813,900 (50.2), 2,830 (50.9), 3,860 (47.7)
- 500,000 to 1,499,999: 203,150 (12.5), 630 (11.3), 950 (11.7)
- 100,000 to 499,999: 98,850 (6.1), 310 (5.6), 550 (6.8)
- 10,000 to 99,999: 184,120 (11.4), 640 (11.5), 900 (11.1)
- 10,000 or less (strong metropolitan influence): 86,400 (5.3), 300 (5.4), 430 (5.3)
- 10,000 or less (moderate metropolitan influence): 142,450 (8.8), 480 (8.6), 760 (9.4)
- 10,000 or less (weak metropolitan influence): 91,410 (5.6), 360 (6.5), 640 (7.9)

Notes:

- Numbers are rounded to nearest 10.
- Note: † includes infant deaths.
Two variables derived from the PCCF+ were included in the analyses, because they are associated with stillbirth and infant mortality rates in Canada:

- Community size and the influence of metropolitan zones (a measure of rural isolation), combined into one variable;
- North-south gradient.

Mortality rates for the different outcomes were calculated. Associations between the outcomes and risk factors (Aboriginal status, mothers’ age and education, multiple birth, north-south gradient, size and isolation of communities) were examined. Unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using logistic regression models.

In accordance with Statistics Canada’s rules on disclosure, counts were rounded to the nearest 10, and rates were calculated based on rounded values. However, odds ratios were calculated based on the exact numbers.

### Results

A total of 1,620,270 live births and 5,560 stillbirths were included in the analysis (Table 1). Of the live births, 8,100 were linked to death records. The number of births on First Nations reserves, including reserves with a shared postal code, was estimated at 16,240. When births occurring on reserves with shared postal codes were excluded, the number declined to 12,170. The numbers of births in Cree and Naskapi communities and Inuit communities were 6,860 and 5,350, respectively. Aboriginal mothers were substantially younger and had less education than non-Aboriginal mothers (Table 2).

For most outcomes, rates and odds ratios were not substantially different if communities with shared postal codes were included as Aboriginal, compared with including shared postal codes with reserves. Consequently, only the results based on the former approach are shown in Tables 2 to 6. Post-neonatal mortality was the only outcome for which the approach used changed the results noticeably.

Stillbirth rates for Aboriginal people living on First Nations reserves, in Cree and Naskapi communities and in Inuit communities were significantly higher than for non-Aboriginal people, but differences were not statistically significant after adjustment for maternal characteristics, multiple birth and geographic isolation (Table 3).

Infant mortality was higher for all Aboriginal groups. However, on First Nations reserves, the difference disappeared after adjustment for maternal characteristics, multiple birth and geographic isolation (Table 4).

Neonatal mortality was significantly higher for Inuit than for non-Aboriginal people, but no significant difference in neonatal mortality emerged between First Nations people and non-Aboriginal people (Table 5).

Finally, post-neonatal mortality was significantly higher for all Aboriginal groups than for non-Aboriginal people. Excess mortality remained significant.

### Table 2

**Distribution of socio-demographic characteristics of births, by type of community, Quebec, 1989 to 2008**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>First Nations reserve</th>
<th>Cree or Naskapi</th>
<th>Inuit</th>
<th>Non-Aboriginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers’ age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 or younger</td>
<td>2,880</td>
<td>1,470</td>
<td>1,260</td>
<td>59,830</td>
</tr>
<tr>
<td>20 to 35</td>
<td>12,190</td>
<td>4,930</td>
<td>3,840</td>
<td>1,342,130</td>
</tr>
<tr>
<td>35 or older</td>
<td>1,260</td>
<td>490</td>
<td>270</td>
<td>194,930</td>
</tr>
<tr>
<td>Mothers’ education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 years or less</td>
<td>3,730</td>
<td>2,010</td>
<td>1,340</td>
<td>91,890</td>
</tr>
<tr>
<td>10 to 12 years</td>
<td>5,050</td>
<td>2,930</td>
<td>1,790</td>
<td>502,440</td>
</tr>
<tr>
<td>13 years or more</td>
<td>3,920</td>
<td>1,150</td>
<td>800</td>
<td>827,380</td>
</tr>
<tr>
<td>Unknown</td>
<td>3,630</td>
<td>810</td>
<td>1,450</td>
<td>175,520</td>
</tr>
<tr>
<td>Birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>15,950</td>
<td>6,740</td>
<td>5,270</td>
<td>1,557,880</td>
</tr>
<tr>
<td>Multiple</td>
<td>380</td>
<td>150</td>
<td>110</td>
<td>39,340</td>
</tr>
<tr>
<td>North-South gradient</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>520</td>
<td>4,250</td>
<td>5,380</td>
<td>610</td>
</tr>
<tr>
<td>Northern transition</td>
<td>1,180</td>
<td>2,630</td>
<td>0</td>
<td>5,940</td>
</tr>
<tr>
<td>Southern transition</td>
<td>7,110</td>
<td>10</td>
<td>0</td>
<td>126,950</td>
</tr>
<tr>
<td>South</td>
<td>7,530</td>
<td>46.1</td>
<td>0</td>
<td>1,463,730</td>
</tr>
<tr>
<td>Size of community and metropolitan influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,500,000 or more</td>
<td>2,720</td>
<td>0</td>
<td>0</td>
<td>813,970</td>
</tr>
<tr>
<td>500,000 to 1,499,999</td>
<td>370</td>
<td>0</td>
<td>0</td>
<td>203,420</td>
</tr>
<tr>
<td>100,000 to 499,999</td>
<td>140</td>
<td>0</td>
<td>0</td>
<td>99,020</td>
</tr>
<tr>
<td>10,000 to 99,999</td>
<td>4,860</td>
<td>0</td>
<td>0</td>
<td>179,870</td>
</tr>
<tr>
<td>10,000 or less (strong metropolitan influence)</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>86,840</td>
</tr>
<tr>
<td>10,000 or less (moderate metropolitan influence)</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>142,670</td>
</tr>
<tr>
<td>10,000 or less (weak metropolitan influence)</td>
<td>8,080</td>
<td>49.5</td>
<td>100.0</td>
<td>71,440</td>
</tr>
</tbody>
</table>

Notes: Values shown are number of births (including stillbirths). Numbers are rounded to nearest 10.

Table 3
Stillbirths in Aboriginal and non-Aboriginal communities, Quebec, 1989 to 2008

<table>
<thead>
<tr>
<th>Type of community</th>
<th>Rate per 1,000 births</th>
<th>Unadjusted odds ratio</th>
<th>95% confidence interval</th>
<th>Adjusted odds ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Nations reserve</td>
<td>5.5</td>
<td>1.60*</td>
<td>1.29 – 1.97</td>
<td>1.22</td>
<td>0.98 – 1.52</td>
</tr>
<tr>
<td>Cree or Naskapi</td>
<td>4.4</td>
<td>1.46*</td>
<td>1.04 – 2.05</td>
<td>1.26</td>
<td>0.88 – 1.80</td>
</tr>
<tr>
<td>Inuit</td>
<td>5.6</td>
<td>1.76*</td>
<td>1.25 – 2.50</td>
<td>1.25</td>
<td>0.86 – 1.81</td>
</tr>
<tr>
<td>Non-Aboriginal†</td>
<td>3.4</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

* significantly different from reference category (p < 0.05)
† reference category
‡ denominator includes live births and stillbirths
§ adjusted for mothers’ age and education; community size and metropolitan influence; and period
... not applicable

Notes: Rates were calculated based on numbers rounded to nearest 10. Odds ratios were calculated based on unrounded numbers.

Table 4
Infant mortality (0 to 364 days after birth) in Aboriginal and non-Aboriginal communities, Quebec, 1989 to 2008

<table>
<thead>
<tr>
<th>Type of community</th>
<th>Rate per 1,000 births</th>
<th>Unadjusted odds ratio</th>
<th>95% confidence interval</th>
<th>Adjusted odds ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Nations reserve</td>
<td>6.2</td>
<td>1.31*</td>
<td>1.08 – 1.59</td>
<td>1.00</td>
<td>0.82 – 1.23</td>
</tr>
<tr>
<td>Cree or Naskapi</td>
<td>11.7</td>
<td>2.24*</td>
<td>1.78 – 2.82</td>
<td>1.63*</td>
<td>1.28 – 2.10</td>
</tr>
<tr>
<td>Inuit</td>
<td>18.7</td>
<td>3.86*</td>
<td>3.16 – 4.71</td>
<td>2.62*</td>
<td>2.10 – 3.28</td>
</tr>
<tr>
<td>Non-Aboriginal†</td>
<td>4.9</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

* significantly different from reference category (p < 0.05)
† reference category
‡ adjusted for mothers’ age and education; community size and metropolitan influence; and period
§ adjusted for mothers’ age and education; community size and metropolitan influence; and period
... not applicable

Notes: Rates were calculated based on numbers rounded to nearest 10. Odds ratios were calculated based on unrounded numbers.

Table 5
Neonatal mortality (0 to 27 days after birth) in Aboriginal and non-Aboriginal communities, Quebec, 1989 to 2008

<table>
<thead>
<tr>
<th>Type of community</th>
<th>Rate per 1,000 births</th>
<th>Unadjusted odds ratio</th>
<th>95% confidence interval</th>
<th>Adjusted odds ratio</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Nations reserve</td>
<td>3.7</td>
<td>0.95</td>
<td>0.73 – 1.24</td>
<td>0.77</td>
<td>0.59 – 1.01</td>
</tr>
<tr>
<td>Cree or Naskapi</td>
<td>4.4</td>
<td>1.21</td>
<td>0.84 – 1.73</td>
<td>0.97</td>
<td>0.66 – 1.41</td>
</tr>
<tr>
<td>Inuit</td>
<td>9.3</td>
<td>2.55*</td>
<td>1.92 – 3.38</td>
<td>1.86*</td>
<td>1.37 – 2.54</td>
</tr>
<tr>
<td>Non-Aboriginal†</td>
<td>3.6</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

* significantly different from reference category (p < 0.05)
† reference category
‡ adjusted for mothers’ age and education; community size and metropolitan influence; and period
§ adjusted for mothers’ age and education; community size and metropolitan influence; and period
... not applicable

Notes: Rates were calculated based on numbers rounded to nearest 10. Odds ratios were calculated based on unrounded numbers.

Discussion
The differences in perinatal health between Aboriginal and non-Aboriginal people in Quebec are already known.1-4 This study sheds new light by describing the perinatal health status of First Nations people living on reserves and in Cree and Naskapi communities, and comparing them with non-Aboriginal people.

The significantly higher rates of stillbirth, neonatal mortality and post-neonatal mortality before adjustment (for mothers’ age and education, size and isolation of community and period) indicate that Aboriginal communities are disadvantaged in relation to the rest of the province's population. The significantly higher rates of post-neonatal mortality among Aboriginal people, and of stillbirth among Inuit, even after adjustment, show that regardless of differences in mothers’ age and education, a gap persists. Some behaviours associated with stillbirth or infant mortality are also associated with mothers’ age and education, including smoking during pregnancy, which is a risk factor, and breastfeeding, a protective factor.14

First Nations people living on reserves had a higher stillbirth rate but a lower neonatal mortality rate than non-Aboriginal people. It is possible that the apparently low neonatal mortality among First Nations people reflects under-registration of non-viable newborns. This phenomenon has been observed in Ontario5 and might exist in some health care institutions in other provinces.
Excess mortality associated with stillbirths in Aboriginal communities was attenuated and ceased to be significant after adjustment for age, mother’s education and the size and isolation of communities, suggesting that the excess was partly due to these factors. Post-neonatal mortality was also higher among Aboriginal people than in the rest of the population, and the differences remained statistically significant after adjustment. In fact, post-neonatal mortality is the outcome for which the gap between Aboriginal and non-Aboriginal people was greatest. Other studies have found that differences between socio-economic classes were greater for post-neonatal mortality than for stillbirths and neonatal mortality. The small number of events (approximately 100 infant deaths for on-reserve populations, 60 for Cree and Naskapi, and 110 for Inuit) made it difficult to examine specific causes of mortality.

In the absence of data on behaviours and other individual risk and protective factors, it was impossible to identify possible causes of the differences observed in this study. However, several known risk factors are more prevalent among Aboriginal people than in the rest of the population. For example, Inuit and First Nations women in Quebec smoke more than do other women in the province; the rate of macrosomia (birth weight exceeding 4,000 grams) is higher for First Nations people than for non-Aboriginal people; and the prematurity rate is higher for Inuit. Furthermore, the unfavourable socio-economic conditions that prevail in a number of communities may be associated with other risk factors that are not captured in vital statistics and health surveys.

Limitations

The main limitation of this study is the use of postal codes to identify Aboriginal people, which does not precisely distinguish between Aboriginal and non-Aboriginal people living in the same community. Other limitations are the lack of information on stillbirths under 500 grams (for which registration is not required), possible under-registration of neonatal deaths, and the small number of events with the associated need to round numbers, which made it impossible to study mortality rates by cause of death. Finally, use of vital statistics data limited the analysis to data collected during birth and death registration; behavioural factors such as breastfeeding and smoking could not be taken into account.

Conclusion

Stillbirth and post-neonatal mortality are higher on First Nations reserves, in Cree and Naskapi communities, and in Inuit communities than in the rest of the Quebec population. Neonatal mortality is also higher among Inuit. In the case of post-neonatal mortality, the difference between Aboriginal and non-Aboriginal people persisted after adjustment for socio-demographic differences (mothers’ age and education), which indicates that other mechanisms may contribute to the observed difference.

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References


