

# Health Inequalities, Deprivation, Immigration and Aboriginality in Canada: A Geographic Perspective

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## ABSTRACT

**Objective:** This study explores the contribution of deprivation, immigration and Aboriginal status to survival in various parts of Canada. It is hypothesized that differences in the magnitude of survival inequalities according to deprivation across Canada are attenuated when immigration and Aboriginal status are accounted for.

**Methods:** The study is based on a file linking the 1991 census and a follow-up of mortality from 1991 to 2001. Geographic areas are the Canadian regions, the census metropolitan areas (CMAs) of Montréal, Toronto and Vancouver as well as the metropolitan-influenced zones. Deprivation is measured through a Canadian deprivation index. Immigration is based on declared place of birth and Aboriginal status on ethnic origin, registered treaty Indian status and Band or First Nation membership. Survival is modeled through Cox regression and two sets of models are produced for every geographic area.

**Results:** Survival is associated with deprivation, immigration and Aboriginal status in most parts of Canada. After accounting for immigration and Aboriginal status, differences in the magnitude of survival inequalities related to deprivation across Canada are attenuated. Such inequalities are highly reduced in the Prairies and remote hinterland and slightly increased in the CMA of Toronto. Nevertheless, high survival inequalities related to deprivation remain in Canada, namely in the Prairies and, to a lesser degree, in British Columbia and the CMA of Vancouver.

**Conclusion:** After accounting for immigration and Aboriginal status, differences in the magnitude of survival inequalities according to deprivation across Canada are attenuated but not completely eliminated.

**Key words:** Health inequalities; deprivation; immigration; Aboriginal people; survival; Canada

La traduction du résumé se trouve à la fin de l'article.

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The presence of social inequalities in health is well documented in Canada. For several health outcomes, many studies report strong relationships with people's socio-economic conditions, whether these are measured through income, education or deprivation indices.<sup>1-6</sup> Such relationships can be found everywhere in Canada, from East to West, in urban and rural areas.<sup>5-12</sup> However, it appears that the magnitude of social inequalities in health can vary greatly between regions and metropolitan areas, and within the countryside. Hence, premature mortality gaps according to a deprivation index are higher in the Western regions, namely the Prairies and British Columbia, than in the rest of Canada.<sup>13</sup> Similarly, the census metropolitan area (CMA) of Vancouver exhibits higher premature mortality discrepancies than those found in the CMA of Toronto.<sup>13</sup> Finally, in the countryside, as we move from areas bordering urban centres to the outermost fringes of Canada, inequalities in survival according to deprivation increase.<sup>14</sup>

Such differences in the magnitude of health inequalities according to deprivation across Canada might be associated with other social determinants of health, namely immigration and aboriginality.

Since 1990, nearly 250,000 individuals have moved to Canada each year and have mainly settled in large cities such as Toronto, Vancouver and Montréal.<sup>15</sup> As of 2006, immigrants accounted for 46%, 40% and 21% of these cities' populations, respectively. Most immigrants are educated, married or living with a common-law partner, and have professional skills.<sup>15</sup> However, since 1990, new-

comers have experienced higher unemployment and lower income than Canadian-born individuals<sup>16,17</sup> and are over-represented in the most multiply-deprived urban neighbourhoods.<sup>18</sup> Research in Canada also reveals that immigrants, especially recent arrivals, enjoy better health than their counterparts born in the country.<sup>19,20</sup> Hence, because immigrants can be simultaneously socio-economically disadvantaged and healthy, their presence might mitigate the relationship observed between deprivation and health in some parts of the country, especially where immigrants represent a fair share of the population.

There are more than 1 million people of Aboriginal ancestry in Canada, the highest concentrations being in the North, the remote hinterland, the Prairies and, to a lesser degree, British Columbia.<sup>21,22</sup> Research reveals that the socio-economic conditions and health status of Aboriginals living on or off reserve are generally lower than those of non-Aboriginal Canadians.<sup>21,23,24</sup> Therefore, as with immigration, the presence of Aboriginal peoples in some parts of the country might have an impact on the relationship between deprivation and health.

In this study, we explore the contribution of deprivation, immigration and Aboriginality to survival in various parts of Canada.

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**Table 1.** Population Aged 25-74 in 1991 and Deaths From 1991 to 2001 by Immigration and Aboriginal Status, Region, Census Metropolitan Area (CMA) and Metropolitan Influenced Zone (MIZ), Canada

Region	Population					Deaths				
	Total N	Immigration N	Immigration %	Aboriginal Status N	Aboriginal Status %	Total N	Immigration N	Immigration %	Aboriginal Status N	Aboriginal Status %
<b>Region</b>										
Atlantic	209,200	9,200	4.4	5,800	2.8	14,265	645	4.5	352	2.5
Québec	654,200	70,700	10.8	14,600	2.2	42,995	3,716	8.6	702	1.6
Ontario	934,900	288,400	30.8	21,100	2.3	62,910	18,002	28.6	1,130	1.8
Prairies	436,200	69,000	15.8	37,500	8.6	27,142	4,398	16.2	2,520	9.3
British Columbia	305,400	86,800	28.4	17,000	5.6	19,906	5,581	28.0	1,048	5.3
<b>CMA</b>										
Montréal	298,000	62,600	21.0	3,800	1.3	19,308	3,213	16.6	153	0.8
Toronto	351,000	175,000	49.9	2,800	0.8	20,252	9,156	45.2	142	0.7
Vancouver	146,400	56,400	38.5	3,200	2.2	8,846	3,130	35.4	197	2.2
<b>MIZ</b>										
Strong MIZ	134,000	13,100	9.8	3,200	2.4	9,064	1,119	12.3	183	2.0
Moderate MIZ	222,500	14,200	6.4	12,800	5.8	16,718	1,298	7.8	835	5.0
Weak-no MIZ	240,400	14,000	5.8	46,000	19.1	16,716	1,193	7.1	3,005	18.0
Canada	2,562,800	526,500	20.5	105,400	4.1	168,077	32,445	19.3	6,209	3.7

Source: The Canadian census mortality follow-up study, 1991-2001.

Until now, these social determinants have been scrutinized separately for Canada as a whole or for particular areas. More specifically, we formulate the following hypotheses:

- 1) Immigration and Aboriginality have a significant impact on survival, above and beyond that of deprivation, everywhere in Canada. Immigration increases survival, while being Aboriginal reduces it.
- 2) Immigration and Aboriginality are confounding factors influencing the relationship between deprivation and survival in parts of the country where high proportions of such peoples are found, namely in the remote hinterland, Western Canada (Prairies and British Columbia), Toronto and Vancouver.

Overall, we hypothesize that differences in the magnitude of survival inequalities according to deprivation across Canada are attenuated when immigration and Aboriginal status are accounted for.

## METHODS

This study made use of a recent file linking the 1991 Canadian census and a follow-up of mortality from June 4, 1991 to December 31, 2001.<sup>25</sup> The file constitutes a 15% sample of the non-institutionalized population aged 25 and older. It includes all socio-economic variables drawn from the census long-form questionnaire and data on the underlying cause and date of death. In this study, people aged 25-74 at baseline (1991) and all-cause mortality are considered.

### Geography

In accordance with previous findings on the variability of health inequalities related to deprivation in Canada, three sets of geographic areas are examined: the Canadian regions (the Atlantic provinces, Québec, Ontario, the Prairies and British Columbia); the largest CMAs (Montréal, Toronto and Vancouver); and the metropolitan influenced zones (MIZs) (strong MIZs, moderate MIZs and weak or no MIZs),<sup>26</sup> which cover small towns and rural areas (population <10,000) and extend gradually from the periphery of large urban centres (strong MIZs) to the outermost fringes of Canada (weak or no MIZs).

### Deprivation

This study is based on a Canadian deprivation index.<sup>13,14,27</sup> This index is inspired by Peter Townsend's proposal to distinguish material and social deprivation, the former referring to the goods and

conveniences of everyday life and the latter to the fragility of social networks, from family to the community.

This study is based on the individual version of the deprivation index.<sup>27</sup> The index includes six indicators from the 1991 census, namely having a high school diploma; being employed; personal income; living alone; being separated, divorced or widowed; and being a member of a lone-parent family. Indicators are in binary form except for income, which is continuous. These indicators were grouped along two separate deprivation dimensions: a material dimension (education, employment and income) and a social dimension (marital status, living alone and lone-parent families), based on the standardized scoring coefficients derived from area-based principal component analyses carried out in every geographic setting considered here. For the material dimension, the population was distributed into quintiles, from the least (Q1) to the most deprived group (Q5). For the social dimension, as the three indicators were binary and some combinations impossible, only two groups were differentiated: least (Q1 to Q4) and most (Q5) deprived.

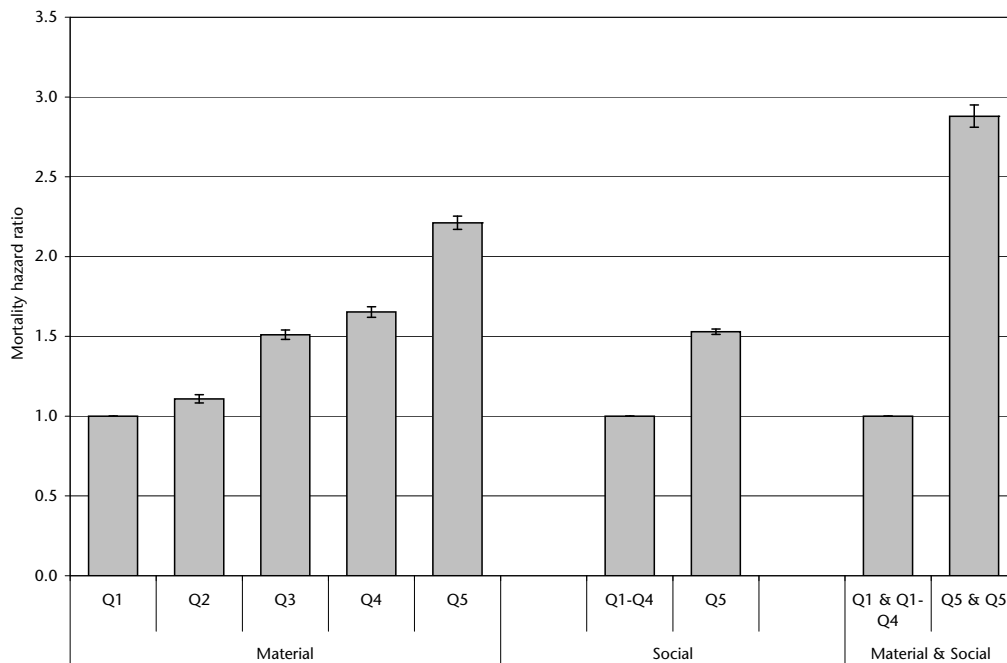
In this study, the two deprivation dimensions are considered separately and jointly, by combining extreme groups (most favoured group: material Q1 and social Q1Q4; most deprived group: material Q5 and social Q5).

### Immigration and Aboriginality

Immigration is based on declared place of birth in the 1991 census, and all permanent residents born outside Canada are considered immigrants. Aboriginal peoples in Canada include three groups: First Nations (North American Indians), Métis (descendants from European and Indian unions) and Inuit. In the 1991 census, Aboriginal status is derived from responses to questions on ethnic origin (ancestry), registered treaty Indian status and Band or First Nations membership.

### Survival

Survival is modeled through *proportional hazard ratios*, using Cox regression.<sup>28</sup> This ratio expresses the relative risk of mortality between the various deprivation quintiles and the most favoured one (material Q1 and/or social Q1Q2Q3Q4), which is the reference group. Models are produced for every geographic setting and are

**Figure 1.** Mortality hazard ratio\* by quintile of material and social deprivation, Canada, 1991-2001

\* Ratios are adjusted for age, sex, the other form of deprivation and large geographic areas.  
Source: The Canadian census mortality follow-up study, 1991-2001.

adjusted for age, sex and the other form of deprivation. Models for Canadian regions are also adjusted for large geographic areas, namely the three major CMAs, other CMAs, midsize cities (population between 100,000 and 10,000), small towns and rural areas. To test our hypotheses, two models were calculated: Model 1, with deprivation only; and Model 2, with deprivation, immigration and Aboriginality, simultaneously.

## RESULTS

This study is based on more than 2.5 million individuals and 168,000 deaths (Table 1). As expected, high proportions of immigrants can be found in Ontario and British Columbia, especially in the CMAs of Toronto and Vancouver. Also, high proportions of Aboriginal people characterize the Prairies (9%) and more specifically the outermost parts of Canada, the weak-no MIZ category (19%).

In Canada as a whole, the relative risk of mortality increases gradually with deprivation quintile for material and social deprivation (Figure 1). Between the extreme quintiles of material and social deprivation (Q5 and Q5 versus Q1 and Q1-Q4), the relative risk of mortality (hazard ratio-HR) is nearly 3. Regionally, the risk of mortality between extreme groups of deprivation is higher in the Prairies (HR: 3.34) and, to a lesser degree, in British Columbia than elsewhere in Canada (Figure 2). In the CMAs, this risk is higher in Vancouver (HR: 2.81) whereas in the countryside, it goes up steadily as we move from the surroundings of urban centres (strong MIZ) to the remote hinterland (weak-no MIZ).

When introduced in the models, immigration and Aboriginal status exert a significant impact on the risk of mortality above and beyond that of deprivation, and this is true everywhere in Canada (Table 2). Immigrants have a lower mortality risk and Aboriginal peoples a higher mortality risk than other Canadians. The only exception is in the CMA of Montréal, where Aboriginality is not

associated with mortality. However, in the CMA of Montréal more than elsewhere, being an immigrant reduces the risk of mortality, above and beyond deprivation (HR: 0.61). Conversely, in the CMA of Vancouver, being Aboriginal has the highest impact on mortality after controlling for deprivation (HR: 1.74).

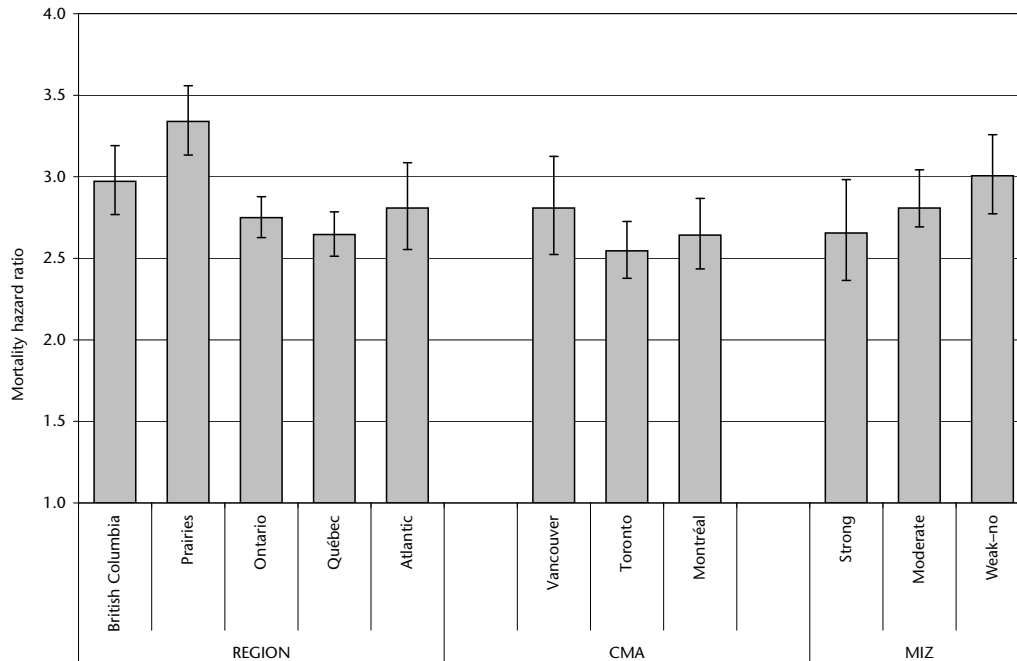
Adding immigration and Aboriginal status in the models reduces the risk of mortality associated with deprivation. In some places, however, their confounding effect is substantial. This is true in the Prairies (HR: 3.34 to 2.95) and the remote hinterland (weak-no MIZ; HR: 3.01 to 2.55). Conversely, the risk of mortality related to deprivation is slightly but not significantly increased in the CMA of Toronto. Still, throughout Canada, the contribution of deprivation to survival is significant and substantially higher than that of immigration and Aboriginal status.

## DISCUSSION

This study shows that survival (or risk of mortality) in Canada results from the independent contribution of deprivation, immigration and Aboriginal status and that this generally holds true no matter the region, major CMA or area within the countryside. These conclusions are in agreement with previous studies that considered these determinants separately with various health outcomes for Canada as a whole or for a specific geographic area.<sup>2,3,6,8-11,19-21,23-25</sup> Indeed, this study demonstrates the “healthy immigrant effect” and the poor health conditions of Aboriginal peoples.

Differences in the magnitude of survival inequalities related to deprivation across Canada are in accordance with previous studies,<sup>13,14</sup> with higher gaps in the Prairies, British Columbia and the remote hinterland and lower disparities in Eastern regions and the CMA of Toronto. However, after accounting for immigration and Aboriginal status, those differences are attenuated. Hence, survival disparities related to deprivation are significantly reduced in the Prairies and the outermost fringes of Canada (weak-no MIZ) where

**Figure 2.** Mortality hazard ratio\* between extreme quintiles of material and social deprivation† by region, census metropolitan area (CMA) and metropolitan influence zone (MIZ), Canada, 1991-2001



\* Ratios are adjusted for age, sex and, when regions are concerned, by large geographic areas.

† Material Q5 & Social Q5 / Material Q1 & Social Q1Q4

Source: The Canadian census mortality follow-up study, 1991-2001.

large native populations are settled. Conversely, such disparities are slightly (but not significantly) increased in the CMA of Toronto, where immigrants account for about half of the population. Overall, after accounting for immigration and Aboriginal status, differences in the magnitude of survival inequalities related to deprivation are attenuated across Canada, but they are not completely eliminated. High disparities remain in the Prairies and, to a lesser degree, in British Columbia and the CMA of Vancouver.

All models presented here were also calculated with the area-based version of the Canadian deprivation index. Apart from the size of survival inequalities according to deprivation (which is smaller than with the individual version of the index), no noticeable difference was found. For the CMA models, recent immigration (less than 10 years) was also considered and led to lower risks of mortality than those obtained for all immigrants (as shown in Table 2). However, these lower risks did not change the magnitude of inequalities related to deprivation. Finally, Aboriginal status is derived from responses to three questions, including ethnic origin (ancestry). A study based on the 1996 census shows that more than 94% of those persons declaring Aboriginal ancestry also identify themselves as Aboriginals.<sup>29</sup> Therefore, there is no reason to believe that confining our analyses to self-identified Aboriginals would produce different results.

As far as we know, this study represents a first attempt to disentangle the role of deprivation, immigration and Aboriginal status on health inequalities observed in various locations across Canada. It explores the contribution of compositional factors associated with the individuals living in those locations. It does not consider contextual factors whose impact on health is well known and may differ according to where one lives.<sup>30</sup> These contextual factors are related to the physical environment (namely climate, air or water

pollution, area size), the built environment (housing, urban design, local infrastructures, etc.), cultural dimensions (beliefs about health) and access to medical and health services. Future research should consider these compositional and contextual factors simultaneously.

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**Table 2.** Mortality Hazard Ratio (HR) and Its 95% Confidence Interval (CI) Between Extreme Quintiles of Deprivation\* for Deprivation Alone and for Deprivation, Immigration and Aboriginal Status, Simultaneously, by Region, Census Metropolitan Area (CMA) and Metropolitan Influenced Zone (MIZ), Canada, 1991-2001

Region	Deprivation Alone		Deprivation		Immigration		Aboriginal Status	
	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Atlantic	2.81	2.55-3.09	2.69	2.45-2.96	0.76	0.71-0.83	1.58	1.42-1.76
Québec	2.65	2.51-2.78	2.63	2.49-2.76	0.62	0.60-0.64	1.20	1.11-1.29
Ontario	2.75	2.63-2.88	2.75	2.63-2.88	0.73	0.72-0.74	1.27	1.20-1.35
Prairies	3.34	3.13-3.56	2.95	2.76-3.15	0.82	0.79-0.85	1.61	1.54-1.68
British Columbia	2.97	2.77-3.19	2.86	2.67-3.07	0.78	0.76-0.81	1.49	1.40-1.59
<b>CMA</b>								
Montréal	2.64	2.43-2.87	2.62	2.41-2.84	0.61	0.58-0.63	1.07	0.91-1.26
Toronto	2.55	2.38-2.73	2.72	2.54-2.91	0.68	0.66-0.70	1.34	1.13-1.58
Vancouver	2.81	2.52-3.12	2.80	2.52-3.11	0.75	0.72-0.79	1.74	1.51-2.01
<b>MIZ</b>								
Strong MIZ	2.66	2.36-2.98	2.58	2.30-2.90	0.84	0.79-0.90	1.53	1.32-1.77
Moderate MIZ	2.81	2.59-3.04	2.66	2.45-2.88	0.81	0.76-0.86	1.45	1.35-1.56
Weak-no MIZ	3.01	2.77-3.26	2.55	2.34-2.77	0.88	0.83-0.93	1.44	1.38-1.50
Canada	2.88	2.81-2.95	2.79	2.72-2.85	0.74	0.73-0.75	1.41	1.38-1.45

\* Material Q5 &amp; Social Q5 / Material Q1 &amp; Social Q1Q4

Source: The Canadian census mortality follow-up study, 1991-2001.

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## RÉSUMÉ

**Objectifs :** Cette étude explore la contribution de la défavorisation, de l'immigration et du statut Autochtone à la survie dans divers milieux géographiques du Canada. L'hypothèse de recherche est la suivante : les différences observées dans l'ampleur des inégalités de survie selon la défavorisation à travers le Canada sont réduites lorsque l'immigration et le statut d'Autochtone sont pris en compte.

**Méthode :** L'étude repose sur un fichier jumelant le recensement de 1991 et un suivi de la mortalité de 1991 à 2001. Les milieux géographiques sont les régions canadiennes, les régions métropolitaines de recensement (RMR) de Montréal, Toronto et Vancouver et les zones d'influence métropolitaine. La défavorisation est mesurée par un indice canadien de défavorisation. L'immigration est fondée sur le lieu de naissance et le statut d'Autochtone sur l'origine ethnique, le statut d'Indien inscrit ou d'Indien des traités, et l'appartenance à une bande ou à une Première nation. La survie est modélisée par la régression de Cox et deux modèles sont produits pour chaque milieu géographique.

**Résultats :** La survie est associée à la défavorisation, l'immigration et le statut Autochtone presque partout au Canada. Après contrôle de l'immigration et du statut Autochtone, les différences notées dans l'ampleur des inégalités de survie selon la défavorisation entre milieux géographiques au Canada sont réduites. De telles inégalités sont fortement atténuées dans les Prairies et l'arrière-pays rural et légèrement amplifiées dans la RMR de Toronto. Il reste cependant de grandes disparités de survie reliées à la défavorisation au Canada, notamment dans les Prairies et, à un degré moindre, en Colombie-Britannique et dans la RMR de Vancouver.

**Conclusion :** En tenant compte de l'immigration et du statut Autochtone, les différences observées dans l'ampleur des inégalités de survie selon la défavorisation à travers le Canada sont réduites mais non complètement éliminées.

**Mots clés :** Inégalités de santé; défavorisation; immigration; peuples Autochtones; survie; Canada