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COVID-19 mortality among First Nations people and Métis in private dwellings in Canada: An analysis of social determinants of health and health inequalities

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COVID-19 mortality among First Nations people and Métis in private dwellings in Canada: An analysis of social determinants of health and health inequalities

by **Amanda Kopp, Mohan B. Kumar and Nicole Aitken**

Introduction

The COVID-19¹ pandemic has played a large role in the lives of Canadians and brought about negative mental and physical health consequences, and reductions in life expectancy (O'Brien, et al. 2020; Statistics Canada, 2022a; Yang & Aitken, 2021; Helliwell, et al. 2020; Hahmann, 2021; Upshaw, et al. 2021). However, research has shown that the distribution of COVID-19 effects has been unequal, and certain groups have been at greater risk of death than others (Public Health Agency of Canada, 2022; Yang & Aitken, 2021; Subedi & Aitken, 2022). Studies have found that various factors can influence the risk of death from COVID-19, including a variety of social determinants of health, such as advanced age, comorbidities, being male, living in an apartment, living in unsuitable housing, being a current smoker, lower levels of income, being a member of a racialized group, or living in neighbourhoods with high proportions of seniors, institutionalized populations, immigrants and low-income families (Dessie & Zewotir, 2021; Albitar et al., 2020; Gupta & Aitken, 2022; O'Brien et al., 2020; Subedi & Aitken, 2022).

Currently, there is a knowledge gap in understanding the impact of the COVID-19 pandemic on Indigenous Peoples,² particularly in rates of mortality disaggregated by Indigenous population groups (First Nations people, Métis and Inuit). Disaggregating the rates of COVID-19 mortality among Indigenous Peoples is critical, as recent studies have shown that health outcomes vary by Indigenous group during the pandemic (Hahmann & Kumar, 2022 ; Williams et al., 2022). For many Indigenous Peoples and communities, the burden and impact of COVID-19 may have been particularly exacerbated by a higher prevalence of comorbidities, poor housing conditions, historic and contemporary inadequate access to health services, and other socioeconomic inequities (Yangzom et al., 2023; Loppie & Wien, 2022). These are rooted in multigenerational colonial practices and policies, including forced displacement to remote communities, experiences of racism in the health care system, historic and contemporary systemic discrimination and marginalization, and reduced access to care (Yangzom et al., 2023; Smylie et al., 2022; Loppie & Wien, 2022; Mashford-Pringle et al., 2021; Huyser et al., 2022; Williams et al., 2022).

In the face of the COVID-19 pandemic, Indigenous Peoples and communities showed leadership, resiliency, and strength. Indigenous Peoples used wholistic knowledge of health and previous pandemics to pivot quickly to protect vulnerable community members and reduce the spread of the virus, through actions such as Indigenous-led contact tracing, vaccination, and public health initiatives, as well as community-led shutdowns, modified ceremonies, and virtual activities (Mashford-Pringle et al., 2021; Richardson & Crawford, 2020; Auduzhe, n.d.; Clark et al., 2024). In addition, the federal and provincial governments and private agencies prioritized Indigenous Peoples for access to personal protective equipment, vaccines, and health care (Indigenous Services Canada, n.d.; Indigenous Services Canada, 2022). Nonetheless, the impact of COVID-19 was disproportionately higher among Indigenous Peoples, including COVID-19 infections, hospitalizations, and intensive care unit admission rates (Indigenous Services Canada, 2023; Province of Manitoba, 2021; Williams et al., 2022).

1. Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus.
2. In this document, "Indigenous peoples" is a collective name for the Indigenous Peoples of Canada. Canada's *Constitution Act, of 1982*, section 35 (2), recognizes the existing Aboriginal and treaty rights of Indian (now referred to as First Nations peoples), Métis, and Inuit of Canada. Similarly, "First Nations peoples" is a collective name that respecting the heterogeneity of First Nations and communities in Canada, while the term "First Nations people" refers to individuals.



The Truth and Reconciliation Commission of Canada (2015) Call to Action #19 urged the federal government to annually publish data and assess trends in health indicators, to identify and close disparities in the health care for Indigenous Peoples, which includes, but is not limited to, emerging infectious diseases such as COVID-19. This study seeks to report the national rates of COVID-19 mortality and explore the risk factors among First Nations people and Métis living in private dwellings.³ Using the 2016 Canadian Census Health and Environment Cohort (CanCHEC), linking data from the 2016 Census of Population to the 2016–2021 Canadian Vital Statistics – Death database (CVSD), allowed for the disaggregation of COVID-19 deaths among First Nations people and Métis from 2020 to 2021, to understand disparities in mortality rates and the impact of the social determinants of health on COVID-19 mortality. Limited data restricted the examination of COVID-19 mortality among Inuit.

Further details about the data and methods can be found below.

First Nations people and Métis living in private dwellings had higher COVID-19 mortality rates compared to non-Indigenous people in 2020 and 2021

Among the three groups studied, First Nations people⁴ living in private dwellings had the highest two-year age-standardized rates of COVID-19 mortality, followed by Métis⁵ and non-Indigenous people (Table 1). Overall, First Nations people had an age-standardized COVID-19 mortality rate that was 4.5 times higher than the rate among non-Indigenous people (85.5 deaths versus 19.1 deaths per 100,000 population) (Table 1). Among First Nations people, rates of COVID-19 mortality were highest among males (99.7 deaths per 100,000 population, Rate Ratio=4.0), those who lived on reserve (134.8 deaths per 100,000 population, Rate Ratio=7.1) and those with Registered or Treaty Indian status (104.5 deaths per 100,000 population, Rate Ratio=5.5) compared to non-Indigenous people. For Métis, the age standardized COVID-19 mortality rate was 29.4 deaths per 100,000 population (Rate Ratio=1.5), though this was not significantly different relative to non-Indigenous people (Table 1).

Disparities in COVID-19 mortality rates were higher among First Nations and Métis females relative to their non-Indigenous counterparts. The age-standardized COVID-19 mortality rate among First Nations females (74.3 deaths per 100,000 population) was over five times higher than the COVID-19 mortality rate among non-Indigenous females (14.0 deaths per 100,000 population), while the COVID-19 death rate among Métis females (29.4 deaths per 100,000 population) was more than double the mortality rate of non-Indigenous females (Table 1).

3. This article presents rates of COVID-19 mortality among self-identifying First Nations people, Métis and non-Indigenous people who live in private dwellings, excluding those who lived in collective dwellings and institutions (rooming houses, seniors' homes, and correctional facilities) at the time of the Census of Population in May 2016.

4. First Nations identity was defined through responses to the Aboriginal identity question on the 2016 Census of Population. Those who responded "Yes, First Nations (North American Indian)" were classified as First Nations people in this study. Respondents who had multiple Indigenous identities were excluded from the study.

5. Métis identity was defined through responses to the Aboriginal identity question on the 2016 Census of Population. Those who responded "Yes, Métis" were classified as Métis in this study. Respondents who had multiple Indigenous identities were excluded from the study.



Table 1
Two-year age standardized COVID-19 mortality rates (per 100,000 people) and rate ratios (RR) for age-standardized mortality rates (per 100,000), by sex, residence on reserve (First Nations people only), Status (First Nations people only) and population group, household population, Canada (excluding Yukon), 2020-2021

Variable	Age standardized mortality rates (per 100,000 population)			Rate Ratios for Age-standardized rates		
	Age-standardized rate	95% Confidence Interval		Rate ratios	95% Confidence Interval	
		lower	upper		lower	upper
First Nations people						
Both sexes	85.5*	70.3	100.7	4.5	3.7	5.4
Males	99.7*	76.7	122.8	4.0	3.2	5.1
Females	74.3*	57.1	91.4	5.3	4.2	6.7
Status First Nations, both sexes	104.5*	85.4	123.6	5.5	4.5	6.6
Residence on a reserve, both sexes	134.8*	105.9	163.8	7.1	5.7	8.8
Residence off reserve, both sexes	64.5*	47.2	81.8	3.4	2.6	4.4
Métis						
Both sexes	29.4	19.7	39.2	1.5	1.1	2.1
Males	29.0	15.5	42.6	1.2	0.7	1.9
Females	29.4*	16.4	42.4	2.1	1.4	3.3
Non-Indigenous people (reference)						
Both sexes (ref.)	19.1	18.3	19.9	...	...	...
Males (ref.)	25.0	23.6	26.4	...	...	...
Females (ref.)	14.0	13.0	15.0	...	...	...

... not applicable

* indicates statistically different compared to the reference categories, non-Indigenous people (by sex) ($p < 0.05$)

Notes: ASMR = Age standardized mortality rate (standardized to the 2016 Indigenous population estimated by Census in 5-year age groups). Age standardized mortality rates were calculated using the census age adjusted to 2021 (+5 years) or the age at death if the person died within the follow-up time.

Two-year follow-up period: January 1, 2020, to December 31, 2021.

Yukon data are not available in the Canadian Vital Statistics death database from 2017 onward; therefore estimates for Canada exclude Yukon.

Excluded: Inuit, multiple and other Indigenous identity responses, those under the age of 1, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population (including unhouseholded individuals). Estimates for Inuit and for non-Status First Nations were not publishable.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.

Among younger age groups, rates of COVID-19 mortality were higher for First Nations people and Métis compared to non-Indigenous people

As found by other research (Dessie & Zewotir, 2021; Albitar et al., 2020; Statistics Canada, 2021), COVID-19 disproportionately affected those of advanced age (80 years and up) for all groups (Table 2). A consistent pattern was apparent among the older age groups within all three populations, with increasing rates of mortality with age. However, First Nations people aged 80 and older had the highest risk of mortality, at almost double the rate for non-Indigenous people (1232.8 deaths per 100,000 compared to 702.8 deaths per 100,000) (Table 2). Métis aged 80 and older had the lowest rate of COVID-19 mortality among the three groups at 516.8 deaths per 100,000 people (Table 2).

A different pattern is evident for the younger age groups. Rates of COVID-19 mortality were significantly higher for First Nations people and Métis in younger age groups compared to non-Indigenous people (Table 2). For instance, First Nations people in all age groups below the age of 60 had between 6.7 and 7.7 times the rate of COVID-19 deaths compared to non-Indigenous people within the same age groups (Table 2). While counts were too low to disaggregate the data among Métis in the youngest age groups (5-49 years of age), Métis between the ages of 50 and 79 had between 1.5 and 2.2 times the rate of dying from COVID-19 relative to non-Indigenous people (Table 2).



Table 2
Two-year rounded age specific COVID-19 mortality rates (per 100,000 population) and rate ratios by age group, First Nations people, Métis and non-Indigenous people, Canada (excluding Yukon), 2020-2021

Age Group (years)	Age-specific COVID-19 Mortality rates			Rate Ratio for Age-specific rates		
	Age-specific COVID-19 Mortality rates	95% Confidence Interval		Rate ratios	95% Confidence Interval	
		lower	upper		lower	upper
First Nations people						
5-29	4.6*	2.6	6.7	7.5	4.5	12.5
30-39	21.9*	14.1	29.8	7.6	5.1	11.4
40-49	43.6*	31.5	55.7	6.7	4.9	9.0
50-59	152.8*	130.2	175.4	7.7	6.6	9.1
60-69	272.3*	236.8	307.8	5.7	5.0	6.6
70-79	577.9*	503.4	652.4	3.9	3.4	4.4
80+	1232.8*	1051.3	1414.4	1.8	1.5	2.0
Métis						
5-29	x	x	x	x	x	x
30-39	x	x	x	x	x	x
40-49	x	x	x	x	x	x
50-59	43.3*	29.0	57.7	2.2	1.6	3.1
60-69	87.1*	65.1	109.1	1.8	1.4	2.4
70-79	221.2*	171.2	271.2	1.5	1.2	1.9
80+	516.8*	386.4	647.2	0.7	0.6	0.9
Non-Indigenous people (reference)						
5-29	0.6	0.5	0.8	...	...	...
30-39	2.9	2.4	3.4	...	...	...
40-49	6.5	5.8	7.3	...	...	...
50-59	19.7	18.5	21.0	...	...	...
60-69	47.6	45.6	49.6	...	...	...
70-79	148.4	144.1	152.7	...	...	...
80+	702.8	690.3	715.2	...	...	...

... not applicable

x suppressed to meet the confidentiality requirements of *The Statistics Act*

* indicates statistically different compared to the reference category, non-Indigenous people by age group (p < 0.05)

Notes: Rates are based on randomly rounded counts in accordance with disclosure guidelines.

Yukon data are not available in the Canadian Vital Statistics death database from 2017 onward; therefore estimates for Canada exclude Yukon.

Excluded: Inuit, multiple and other Indigenous identity responses, those under the age of 1, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population. Estimates for Inuit were not publishable.

Age-specific mortality rates (per 100,000 population) were calculated using the census age adjusted to 2021 (+5 years) or the age at death if the person died within the follow-up time.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.

Most COVID-19 deaths among First Nations people and Métis were concentrated among those with three or more comorbidities at death

In Canada, deaths are classified and tabulated by a single underlying cause of death,⁶ which is the disease or injury that initiated the events which led to the death, as defined by the World Health Organization (n.d.). However, in many instances, multiple conditions or diseases are reported on the death certificate as contributing to the death. Data on multiple causes of death can shed light into the relationship between comorbidities and COVID-19 mortality. Previous studies in Canada have identified that the majority (90%) of reported COVID-19 deaths occurred among those with comorbidities listed on the death certificate (O'Brien et al., 2020), emphasizing the importance of preventative measures among those with pre-existing health conditions. This was also evident among First Nations people and Métis.

6. There are different ways to measure mortality associated with the COVID-19 pandemic. This research uses death certificates where COVID-19 is listed as the underlying cause of death. Statistics Canada and provincial and territorial vital statistics agencies use two International Statistical Classification of Diseases and Related Health Problems (ICD), 10th Revision codes for COVID-19 disease outbreak: U07.1 for COVID-19 specified as confirmed by a positive test result, and U07.2 for COVID-19 described as "possible," "probable," or "pending a (positive) test result."



Table 3 illustrates the critical role comorbidities can play in COVID-19 mortality, as more than half of First Nations people and Métis who died of COVID-19 between 2020 and 2021 had at least three comorbidities listed on the death certificate. This finding is particularly notable given the higher prevalence of chronic conditions and multimorbidity among First Nations people and Métis including, diabetes, cardiovascular disease, and chronic respiratory disease (Earle, 2011; Halseth, 2019; Reading & Wien, 2009; Loppie & Wien, 2022; Hahmann et al., 2019; Kuwornu, et al. 2014).

Table 3
Percentage of COVID-19 deaths which list comorbidities on death certificate, First Nations people, Métis and non-Indigenous people in Canada (excluding Yukon), 2020-2021

	First Nations people			Métis			Non-Indigenous people (reference)		
	Percent	95% Confidence Interval		Percent	95% Confidence Interval		Percent	95% Confidence Interval	
		lower	upper		lower	upper		lower	upper
No additional comorbidities/conditions listed on the death certificate	3.9*	2.6	5.2	x	x	x	9.5	9.1	9.9
1-2 additional comorbidity/condition listed on the death certificate	38.9*	37.7	42.1	x	x	x	44.2	43.5	44.8
3 or more additional comorbidities/conditions listed on the death certificate	56.7*	53.4	59.9	58.0*	51.9	64.1	46.3	45.6	47.0

x suppressed to meet the confidentiality requirements of *The Statistics Act*; Data points might not add up to 100% due to rounding

* indicates statistically different compared to the reference category, non-Indigenous people ($p < 0.05$)

Notes: Yukon data are not available in the Canadian Vital Statistics death database from 2017 onward; therefore estimates for Canada exclude Yukon.

Excluded: Inuit, multiple and other Indigenous identity responses, those under the age of 1, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population. Estimates for Inuit were not publishable.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.

Unsuitable, crowded housing and lower income were common risk factors for COVID-19 mortality among First Nations people and Métis living in private dwellings

Binary logistic regression models (Table 4) were conducted to measure the association between the key social determinants of health and the odds of COVID-19 mortality among First Nations people and Métis living in private dwellings. This analysis tested models separately to determine which social determinants of health are associated with COVID-19 death uniquely for First Nations people and for Métis. To inform the multivariable analysis, select sociodemographic characteristics and COVID-19 mortality were examined. The findings of this analysis are shown in the Appendix. The final models include sex, age, residence on or off reserve (for First Nations people only), household income quintile, population centre type, housing suitability and dwelling type.



Table 4
Binary logistic regression modelling of COVID-19 death among First Nations people and Métis living in private dwellings, Canada (excluding Yukon), 2020-2021

Variable	First Nations people				Métis			
	Adjusted Odds Ratio	95% Confidence Interval		P-value	Adjusted Odds Ratio	95% Confidence Interval		P-value
		lower	upper			lower	upper	
Sex								
Female (ref.)	1.0	...	...	...	1.0	...	...	...
Male	1.4*	1.2	1.6	<0.05	1.1	0.8	1.4	0.6
Age								
Age (continuous)	1.1*	1.1	1.1	<0.05	1.1*	1.1	1.1	<0.05
Residence on or off reserve								
Living off reserve (ref.)	1.0	...	...	...	...	...	...	...
Living on reserve	2.4*	2.0	2.8	<0.05	...	...	...	...
Income Quintile (adjusted for household size)								
Not in the lowest income quintile (ref.)	1.0	...	...	...	1.0	...	...	...
Lowest income quintile (quintile 1)	1.7*	1.5	2.0	<0.05	3.1*	2.4	4.0	<0.05
Living in a population centre								
Living in a small population centre or rural area (ref.)	1.0	...	...	...	1.0	...	...	...
Living in a medium or large population centre	1.2	1.0	1.4	0.08	1.3*	1.0	1.7	<0.05
Housing Suitability for the number of inhabitants								
Suitable housing (ref.)	1.0	...	...	...	1.0	...	...	...
Unsuitable housing (1+ bedroom shortfall)	2.8*	2.4	3.2	<0.05	2.8*	1.9	4.2	<0.05
Dwelling type								
Houses and other dwelling types (ref.)	1.0	...	...	...	1.0	...	...	...
Apartments	1.5*	1.2	1.8	<0.05	1.1	0.8	1.5	0.41

... not applicable

* indicates statistically different compared to the reference category ($p < 0.05$)

Notes: Yukon data are not available in the Canadian Vital Statistics death database from 2017 onward; therefore estimates for Canada exclude Yukon.

Excluded: Inuit, multiple and other Indigenous identity responses, those under the age of 1, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population. Modelling for Inuit was not publishable.

Medium to large urban population centres are defined as those with a Census population of over 30,000. Small population centres and rural areas include population centres with Census populations less than 29,999, or areas outside of population centres.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.

When all the selected determinants are taken into account, significantly higher odds of dying from COVID-19 were observed for First Nations people (Table 4, model 1) who lived in unsuitable, crowded housing (one or more bedroom shortfall) (OR=2.8, 95% CI: 2.4-3.2), lived on a reserve or settlement (OR=2.4, 95% CI: 2.0-2.8), and were in the lowest income quintile (OR=1.7, 95% CI: 1.5-2.0) (Table 4). Other factors statistically associated with higher odds of dying of COVID-19 included living in an apartment (OR=1.5; 95% CI: 1.2-1.8), being male (OR=1.4, 95% CI: 1.2-1.6) and increasing age (OR=1.1; 95% CI: 1.1-1.1) (Table 4, model 1).

Among Métis, significantly higher odds of dying from COVID-19 were observed among those who were in the lowest household income quintile (OR=3.1; 95% CI: 2.4-4.0), living in unsuitable, crowded housing (OR=2.8; 95% CI: 1.9-4.2), living in a medium or large population centre (OR=1.3; 95% CI: 1.0-1.7), and increasing age (OR=1.1; 95% CI: 1.1-1.1) (Table 4, model 2). Being male and living in an apartment were not significant predictors of COVID-19 mortality for Métis (Table 4, model 2).

Discussion

This report aimed to examine national prevalence rates and relevant social determinants of COVID-19 mortality for First Nations people and Métis living in private dwellings in Canada. Higher COVID-19 mortality rates were observed among both First Nations people and Métis compared to non-Indigenous people, though First Nations people had the largest rates of COVID-19 death. Furthermore, there were larger disparities in rate ratios of COVID-19

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mortality among First Nations and Métis females relative to First Nations and Métis males. This may be due to sex-differences in the intersection of various social and structural determinants of health, including colonization, poverty, economic opportunities, and access to safe and culturally relevant health care for First Nations and Métis females (Bourassa et al., 2004; Hu & Hajizadeh, 2023; Srugo et al., 2023; Loppie & Wien, 2022).

Overall, COVID-19 mortality was highest for those of advanced age (80 years and up) in all groups. In younger age groups (below the age of 80), First Nations people and Métis faced a disproportionate risk of COVID-19 death, relative to non-Indigenous people. These findings highlight the need for targeted and culturally safe vaccination strategies and other prevention measures to all age groups among Indigenous peoples. Furthermore, among those who died from COVID-19 a higher prevalence of multiple comorbidities at death was found for First Nations people and Métis relative to non-Indigenous people who died of COVID-19. While there was limited ability to disaggregate the type of comorbidities and chronic conditions at death, this finding suggests that comorbidities may have played a key role in the increased risk of COVID-19 mortality for these groups.

There are many intersecting elements which may explain the higher rates of COVID-19 mortality among First Nations people and Métis. This includes variations in available resources and public health measures during the pandemic, such as masking, stay-at-home orders, testing, contact tracing, and vaccine availability and uptake (Detsky & Bogoch, 2021; Indigenous Services Canada, n.d.; Indigenous Services Canada 2022; Anderson & MacKinnon, 2023; Smylie, et al., 2022; McDonald, 2021; Guay, et al. 2022; Pickering, et al., 2023; Mosby & Swidrovich, 2021). In addition, other studies have emphasized systematic issues, including the ongoing impacts of colonization, that play a role in the higher prevalence of chronic conditions and multimorbidity for First Nations people and Métis, as well as result in poorer socioeconomic conditions, discrimination, and worse access to resources, such as health care and poorer infrastructure, all of which have also been linked to COVID-19 deaths (Earle, 2011; Albitar et al., 2020; Dessie & Zewotir, 2021; O'Brien et al., 2020; Reading & Wien, 2009; Loppie & Wien, 2022; Hahmann & Kumar, 2022).

Binary logistic regression modelling was used to investigate the risk factors for COVID-19 mortality among First Nations people and Métis in private dwellings. Results underlined many interlinked social vulnerabilities, including the physical environment and lower income, which were linked to higher odds of dying from COVID-19.

Among First Nations people, living on reserve almost doubled the odds of COVID-19 death, which may be a result of many interconnected factors, including higher burden of preexisting conditions including diabetes, lower access to appropriate health care and specialist care, inadequate access to suitable housing, food, water, as well as barriers to secure economic and social resources (Williams et al., 2022). One report identified correlations between COVID-19 outbreaks and the use of cisterns for storing water in several First Nations communities (Beaudin, 2021). Furthermore, poor housing conditions on reserve have been previously shown to be associated with other respiratory conditions (Kovesi et al., 2022).

First Nations people and Métis who lived in medium and large population centres had higher odds of dying from COVID-19 compared to those in rural or small population centres, though the impact of this was modest (20-30% higher odds) compared to other variables controlled for in the model. While this study was not able to measure health care usage or access, other work has highlighted that the pandemic may have worsened existing health care disparities and access to care for Indigenous groups (Richardson & Crawford, 2020; Hahmann, 2021).

In addition, lower housing suitability or crowding was a risk factor for both First Nations people and Métis. Research has highlighted that First Nations people and Métis are more likely to live in crowded, unsuitable housing compared to non-Indigenous people⁷ (Statistics Canada, 2018; Loppie & Wien, 2022; Kovesi et al., 2022; Statistics Canada, 2017).

7. According to the 2016 Census of Population, Indigenous people were more likely to live in unsuitable housing for the number of inhabitants, at 18.3% compared to 8.5% of non-Indigenous people (Statistics Canada, 2017).





This may have increased the chance of contracting COVID-19, which spreads more easily through close proximity to others (World Health Organization, 2020; Public Health Agency of Canada, 2023).

Both models for First Nations people and Métis also found that lower household income increased the odds of dying of COVID-19. While Métis had lower rates of low income relative to First Nations people (Table A1), the impact of having the lowest income was greater for Métis, who had 3.1 times the odds of dying from COVID-19 compared to those in the upper income quintiles. Other studies (Statistics Canada, 2022a; Statistics Canada, 2022b; Public Health Agency of Canada, 2022) have also identified a link between COVID-19 mortality and lower income, which may increase vulnerability to food insecurity and crowded housing for Indigenous peoples (Loppie & Wien, 2022).

Overall, this study has highlighted disparities in COVID-19 mortality among First Nations people and Métis living in private dwellings. It is likely these disparities are underestimated due to the exclusion of those in collective dwellings such as correctional facilities, long-term care facilities and retirement homes, and those who were unhoused. The results also highlight potential risk factors and social vulnerabilities of COVID-19 death including living on reserve for First Nations people, as well as crowded housing, and lower household income for First Nations people and Métis. Future studies could continue to monitor the impacts of the COVID-19 pandemic on Indigenous people, including Inuit, who have unique social vulnerabilities and risk factors for contracting and transmitting the virus, including poor housing quality, crowding, as well as limited primary and specialist care in Inuit Nunangat (Inuit Tapiriit Kanatami, 2020). In addition, analysis could expand knowledge on the influence of chronic conditions in COVID-19 mortality, as well as impacts by geography, vaccination status, hospitalizations, and access to care.

Data and Methodology

The authors would like to acknowledge the review of preliminary findings and versions of the study by the Congress of Aboriginal Peoples, the Assembly of First Nations, and the Métis National Council.

This study used the 2016 Canadian Census Health and Environment Cohort (CanCHEC) linking Canadian Vital Statistics – Death Database (CVSD) 2016 to 2021⁸ to the long-form 2016 Census of Population to examine the rates of COVID-19 mortality among First Nations people and Métis. The CanCHECs are a series of de-identified population-based probabilistically linked datasets that follow the private household population alive on census day for different health outcomes, such as mortality, hospitalizations, and cancer (Tjepkema, et al., 2019).

While there are different ways to measure mortality due to the pandemic, this analysis used death certificates where COVID-19 is listed as the underlying cause of death. Statistics Canada and provincial and territorial vital statistics agencies use two International Statistical Classification of Diseases and Related Health Problems 10th Revisions (ICD-10) codes to identify COVID-19 reported as a cause of death: U071 for COVID-19 specified as confirmed by a positive test result, and U072 for COVID-19 described as “possible,” “probable,” or “pending a (positive) test result” (World Health Organization, n.d.; O’Brien et al., 2020).

The dataset included de-identified information on deaths attributed to various causes that occurred from 2016 to 2021 including COVID-19. Counts and rates were calculated using cohort weights, while variance estimation and tests of significance were carried out using Taylor linearization and the Fay adjustment method employing 100 replicate weights developed for the 2016 Can CHEC. All counts and crude rates were random rounded to base 5, to protect the confidentiality of respondents.

Deaths that occurred within the cohort before 2020 (January 1, 2016, to December 31, 2019) were excluded from the population to better capture the population at risk of dying from COVID-19 in 2020 and 2021. Additionally, this cohort excludes data from the Yukon, as data from the Canadian Vital Statistics - Death database do not have

8. Statistics presented in this paper reflect the versions of the mortality database released on November 27, 2023.



data from 2017 onward. The 2019 to 2021 death data are considered preliminary and may be subject to further revision. Age standardized mortality rates (per 100,000 population) were calculated with two years of follow up using SAS-callable SUDAAN, using the direct standardization method. The 2016 Indigenous population was chosen for the standard population and derived from the 2016 Census of Population microdata. Age-standardized and age-specific mortality rates (per 100,000 population) were calculated using the census age adjusted to 2021 (+5 years) or the age at death if the person died within the follow-up time. Death age was calculated using the date of death from the Canadian Vital Statistics and the date of birth from the 2016 Census.

Binary logistic regression modelling was used to examine the association between social determinants of health and COVID-19 mortality (yes/no). Variables included in the model were age (continuous), sex (male and female), income quintiles derived from household income adjusted for household size, living on a reserve or settlement (First Nations model only), dwelling type (apartment type dwelling compared to houses and other types of dwellings), and housing suitability for the number of people living in the house (measuring household crowding). Household income quintiles were generated for each census subdivision (CSD) from the short form census to account for regional differences in income.

Limitations

The CanCHEC cohorts face several limitations. Firstly, data included in the cohort include only those who completed the long-form census. This may result in inclusion bias, as it does not include specific populations (such as institutionalized populations and the unhoused at the time of the 2016 Census) who may have poorer health than the rest of the population (Tjepkema et al., 2019). Moreover, Indigenous groups may be overrepresented among excluded populations, such as those living on reserves that were incompletely enumerated, and in correctional facilities, as well as the unhoused (Reading & Wien, 2009; Department of Justice Canada, 2017; Rotondi, et al. 2017; Tjepkema et al., 2019). This may mean that rates of COVID-19 mortality among the different Indigenous groups are underrepresented in the linked datasets, compared to non-Indigenous people.

Furthermore, these results should not be used to estimate overall mortality due to COVID-19. The COVID-19 data in this study are preliminary, as they are not based on all deaths that occurred during the reference period because of reporting delays and because Yukon data are not available. In addition, deaths in this study do not capture mortality where COVID-19 may have only played a contributing role. Thus, data may not match figures from other sources, or from counts and estimates from provincial or territorial health authorities and other agencies.

In addition, this study was not able to examine key predictors of COVID-19 mortality, including underlying conditions or health status, access to safe and culturally competent health care, COVID-19 vaccination rates, and other social determinants of health, including food insecurity and nutritional status. Indigenous identity is self-reported and may not be in line with other estimations using different datasets or cohorts. The social determinants studied in this research were collected at the time of the 2016 Census of Population and may have changed over time. Finally, the study is limited in ability to disaggregate by Indigenous group, which resulted in the exclusion of Inuit, as well as other and multiple Indigenous identities.



Appendix

Table A1
Distribution of select socioeconomic and demographic characteristics among First Nations people, Métis and non-Indigenous people in private dwellings at baseline (May 2016), Canada (excluding Yukon), 2020-2021

Characteristics	First Nations people			Métis			Non-Indigenous people (reference)		
	Percent	95 % confidence interval		Percent	95% confidence interval		Percent	95% confidence interval	
		lower	upper		lower	upper		lower	upper
Sex									
Female	52.0*	51.9	52.1	50.7*	50.6	50.8	50.9	50.9	50.9
Male	48.0*	47.9	48.1	49.3*	49.2	49.4	49.1	49.1	49.1
Residence on or off reserve									
Living off reserve	69.0	68.9	69.1	...	...	...	...	...	...
Living on reserve	31.0	30.9	31.1	...	...	...	...	...	...
Income Quintile (adjusted for household size)									
Highest income quintile (Quintile 5)	14.9*	14.8	15.0	18.8*	18.7	18.9	22.5	22.5	22.5
Quintile 4	17.7*	17.6	17.7	20.9*	20.8	21.0	22.1	22.1	22.1
Quintile 3	19.3*	19.2	19.4	20.9	20.8	21.0	21.1	21.0	21.1
Quintile 2	21.5*	21.4	21.6	19.6*	19.5	19.7	19.1	19.1	19.1
Lowest income quintile (quintile 1)	26.7*	26.6	26.8	19.8*	19.7	19.9	15.3	15.3	15.3
Living in a population centre									
Living in a small population centre or rural area	60.3*	60.2	60.4	50.1*	49.9	50.2	29.7	29.7	29.7
Living in a medium or large population centre	39.7*	39.6	39.7	49.9*	49.8	50.1	70.3	70.3	70.3
Housing Suitability for the number of inhabitants									
Suitable housing	77.9*	77.9	78.0	91.7	91.6	91.7	91.6	91.6	91.6
Unsuitable housing (1+ bedroom shortfall)	22.1*	22.0	22.1	8.3	8.3	8.4	8.4	8.4	8.4
Dwelling type									
Houses and other dwelling types	82.0*	81.9	82.1	81.3*	81.2	81.4	73.9	73.9	73.9
Apartment	18.0*	17.9	18.1	18.7*	18.6	18.8	26.1	26.1	26.1

... not applicable

* indicates statistically different compared to the reference category, non-Indigenous people (p < 0.05)

Notes: Data points may not add to 100 due to random rounding.

Excluded: Inuit, multiple and other Indigenous identity responses, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.

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Table A2

Distribution of select socioeconomic and demographic characteristics among First Nations people, Métis and non-Indigenous people who died of COVID-19 in private dwellings at baseline (May 2016), Canada (excluding Yukon), 2020-2021

Characteristics	First Nations people			Métis			Non-Indigenous people (reference)		
	Percent	95% confidence interval		Percent	95% confidence interval		Percent	95% confidence interval	
		lower	upper		lower	upper		lower	upper
Sex									
Female	48.3*	45.1	51.6	54.0*	47.8	60.2	43.5	42.8	44.1
Male	51.7*	48.4	54.9	46.0*	39.8	52.2	56.5	55.9	57.2
Residence on or off reserve									
Living off reserve	52.2	49.0	55.5	...	...	...	...	...	...
Living on reserve	47.8	44.5	51.0	...	...	...	...	...	...
Income Quintile (adjusted for household size)									
Not in the lowest income quintile	70.6*	67.6	73.5	56.0*	49.8	62.2	77.8	77.2	78.4
Lowest income quintile (quintile 1)	29.4*	26.5	32.4	44.0*	37.8	50.2	22.2	21.6	22.8
Living in a population centre									
Living in a small population centre or rural area	66.7*	63.6	69.7	46.0*	39.8	52.2	20.1	19.6	20.7
Living in a medium or large population centre	32.8*	29.7	35.8	54.0*	47.8	60.2	79.9	79.3	80.4
Housing Suitability for the number of inhabitants									
Suitable housing	71.1*	68.1	74.1	90.0	86.3	93.7	93.6	93.2	93.9
Unsuitable housing (1+ bedroom shortfall)	28.9*	25.9	31.9	10.0	6.3	13.7	6.4	6.1	6.8
Dwelling type									
Houses and other dwelling types	76.1*	73.3	78.9	68.0*	62.2	73.8	54.1	53.4	54.8
Apartment	23.9*	21.1	26.7	32.0*	26.2	37.8	45.9	45.2	46.6

... not applicable

* indicates statistically different compared to the reference category, non-Indigenous people ($p < 0.05$)

Notes: Data points might not add up to 100% due to rounding.

Excluded: Inuit, multiple and other Indigenous identity responses, institutional population at time of census collection (e.g. nursing homes, jails), population living in collective households (e.g. motels, hotels, rooming houses), persons not enumerated by the 2016 Census of Population.

Source: Canadian Census Health and Environmental Cohort (CanCHEC) 2016 linked to Canadian Vital Statistics – Death Database from 2016-2021.



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