





# BMJ Open Examining the impact of the first wave of COVID-19 on equitable access to emergency care across Alberta demographic groups: a retrospective observational study

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**To cite:** McLane P, Gray M, Barnabe C, *et al.* Examining the impact of the first wave of COVID-19 on equitable access to emergency care across Alberta demographic groups: a retrospective observational study. *BMJ Open* 2025;**15**:e104487. doi:10.1136/bmjopen-2025-104487

► Pre-publication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2025-104487>).

Received 30 April 2025  
Accepted 01 October 2025



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## ABSTRACT

**Background** During the first wave of the COVID-19 pandemic, there was a notable decline in emergency department (ED) usage in many jurisdictions. This study assessed changes in ED use during this period and explored how the pandemic may have aggravated existing healthcare access inequities.

**Objectives** Our primary objective was to assess pandemic-related changes to ED visits and emergency hospitalisations for distinct demographic groups.

**Design** We conducted a retrospective observational study using population-based provincial administrative data.

**Setting** We analysed data from all the 109 EDs and urgent care centres in Alberta, Canada, during the first wave of the COVID-19 pandemic (15 March 2020 to 30 June 2020), and during the corresponding (control) period 1 year earlier. We conducted subgroup analyses by age, First Nations status, sex, location and material deprivation. We repeated all analyses for pre-selected life-threatening emergency diagnoses.

**Populations** We examined outcomes for a priori subgroups, including female and 'other' sex patients, paediatric patients (age 0–17 years), seniors (age 65 years and older), patients living in remote areas (greater than 200 km from an urban centre), First Nations members and patients living in materially deprived postal codes falling into the two most deprived Pampalon Index quintiles.

**Primary and secondary outcome measures** Primary outcomes were number of ED visits, number of ED visits with admission to hospital and number of ED visits resulting in patient death in the ED. A secondary outcome was change in ED use for life-threatening diagnoses (eg, cardiac conditions and hepatic disease).

**Results** ED visits in the COVID-19 period decreased by 34% (Poisson means test  $p < 0.001$ ) and hospitalisations decreased by 15% ( $p < 0.001$ ) compared with 2019. Multivariable models showed an average decrease of 79.9 ( $p < 0.001$ ) ED visits, and 7.7 ( $p < 0.001$ ) fewer average admissions per facility for the COVID-19 period (vs 2019) in our 'baseline' group (non-First Nations, male, adult and metropolitan residents who were not materially deprived). First Nations patients, seniors and remote residents

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A strength of this study is the use of a population-based provincial administrative dataset.
- ⇒ A weakness is that the administrative data does not capture gender, but only biological sex data.
- ⇒ Due to reliance on administrative data, some patients who may identify as First Nations or be recognised by their community as First Nations members are miscategorised as non-First Nations within our data. We did not have access to data on other Indigenous groups in Canada (Métis or Inuit) and so cannot specify outcomes for these populations. No race data is routinely collected within the Alberta healthcare system, and so we could not analyse data by race.
- ⇒ Dichotomisation of material deprivation in models may have obscured differences between the most and least deprived areas.
- ⇒ Pre-selected life-threatening diagnoses are less applicable to the paediatric population than to the overall population.

experienced smaller declines in ED visits compared with the baseline group. Females, seniors and children experienced larger reductions in emergency admissions, while First Nations patients had smaller reductions.

**Conclusion** Reductions in critical emergency care and emergency hospital admissions were unequally distributed across demographic groups during the COVID-19 period. Study methods could be used to monitor and support equitable access to emergency care among distinct populations.

## BACKGROUND

The first wave of the COVID-19 pandemic was associated with decreases in emergency department (ED) use in many jurisdictions.<sup>1–4</sup> This has been proposed to reflect several factors, such as a true decrease in



non-COVID-19 conditions,<sup>5</sup> ED avoidance by people who perceived hospitals as high-risk environments,<sup>6–8</sup> changes in societal activity or changes resulting from public health measures. For example, public health restrictions resulted in fewer sports injuries, motor vehicle accidents and trauma-related presentations,<sup>9–11</sup> as well as profoundly reducing the incidence of other infectious illnesses like influenza.<sup>12</sup> Little is known about how ED use reductions were distributed across population groups, raising the possibility that aggregate numbers conceal important differences.

In Canada, public healthcare provides primary and acute care at no cost to patients. Federal funds support provinces to administer these services.<sup>13</sup> This study focuses on the province of Alberta, where about 110 hospitals and urgent care centres (varying slightly year to year)<sup>14</sup> serve a growing population of over 4 million persons,<sup>15</sup> and two metropolitan centres of Edmonton and Calgary. The first wave of the COVID-19 pandemic disrupted access to traditional forms of care in Alberta. Operating room closures led to surgery cancellations.<sup>16</sup> Many providers eliminated in-person visits. Medical offices and clinics closed or shifted to virtual consultations, reducing already limited access to in-person primary and speciality care. Fear of contracting COVID-19 likely also impacted care-seeking behaviours. The Health Quality Council of Alberta has found that 30% of all Albertans delayed seeking care during COVID-19, while 22% of all Albertans said that delaying care impacted their health.<sup>17</sup> Davis *et al* found fear of contracting COVID-19 to be a major reason among parents for delaying emergency care for paediatric patients.<sup>18</sup> Recent Alberta research has found that, for the general population, virtual care visits (mostly by telephone) replaced in-person visits in terms of visit volumes.<sup>19</sup> Yet questions about the relative quality and outcomes of those visits remain.<sup>19</sup>

This study considers the effect of the first wave of the pandemic on ED use and hospitalisation by a number of population groups for whom administrative data was available. Together, ED visits and hospitalisation statistics highlight pandemic-driven impacts on access to ED and hospital-based care that may aggravate existing healthcare inequities. Demographic groups considered include female and other sex patients, children, seniors, residents of remote areas, residents of materially deprived areas and First Nations patients. First Nations are Indigenous peoples with distinct legal status in the Constitution Act, 1982.<sup>20–21</sup> In Alberta, First Nations members make up about 4% of the population.<sup>14</sup> First Nations persons suffer severe health disparities due to effects of colonialism and longstanding inequities in Canada—including within healthcare.<sup>22–25</sup>

Previous research shows that ED use is influenced by social determinants of health, and EDs disproportionately serve marginalised people facing barriers to healthcare, such as lack of primary care services,<sup>26</sup> lack of transportation to access preferred services<sup>27</sup> and inability to afford services (eg, dental care). Frequent ED users in Alberta are

more likely to be female, older, within the lowest-income quintile and living in rural areas.<sup>28</sup> First Nations-directed research has determined that the age-and-sex-adjusted per capita rate of ED use is nearly three times higher for First Nations populations in Alberta.<sup>14</sup> This study aimed to understand the impact of the pandemic on ED use across demographic groups, and demonstrate the potential for intersectional analysis of acute care use.

## METHODS

We conducted a retrospective observational study using population-based administrative data. Ethics approval was granted by the University of Alberta Health Research Ethics Board (Pro00102142). The project was funded by the Canadian Institutes of Health Research (VR5 - 172703). The funder had no role in the design, conduct or reporting of results.

We analysed data from all the 109 Alberta EDs and urgent care centres (hereafter EDs) during the first wave of the COVID-19 pandemic (15 March 2020 to 30 June 2020), and during the corresponding (control) period 1 year earlier. We focused on a single wave due to uniformity of restrictions across populations. In subsequent waves, government programmes, public health restrictions, vaccine effects and COVID-19 disease incidence varied over time and by population, making comparisons complex.

## Patient and public involvement

A research agreement was signed between the University of Alberta and the Alberta First Nations Information Governance Centre (AFNIGC). Co-author LB is a Cree knowledge holder and Executive Director of AFNIGC. She co-interpreted the data and ensured compliance with Ownership, Control, Access and Possession principles during each stage of the study.<sup>29–30</sup> Two First Nations organisations, Blackfoot Confederacy Tribal Council Health and AFNIGC, supported our grant application for funding. As this project began through a rapid funding call for COVID-19 research, patients were not engaged in study design. Two nominal group technique meetings were held with non-First Nations patient advisors to interpret the results. A First Nations-specific data interpretation small-group meeting was also held.

## Data sources

Individual de-identified data were obtained from Alberta administrative health databases. The National Ambulatory Care Reporting System contains records of ED visits.<sup>31</sup> The Alberta Health Services (AHS) postal code dataset contains information on patient residence, as well as material deprivation based on the Pampalon Index. This is a five-level area-based ‘deprivation’ score.<sup>32</sup> Material deprivation refers to a lack of goods and social services, such as adequate housing, transportation or neighbourhood recreational spaces.<sup>33</sup> We were concerned about changes to ED use among patients living in deprived

areas, as we were aware frequent users of ED tend to have lower incomes. AHS postal code data also allowed us to classify patients on a rural–urban continuum.<sup>34</sup> We chose to consider rural–urban residence as we were aware of higher rates of ED use among remote patients. The Alberta Health Care Insurance Plan Population Registry includes records for all persons eligible for healthcare coverage in Alberta. It contains information on First Nations status.<sup>35</sup> This data identifies First Nations patients based on 2009 healthcare registration data, as fees for healthcare coverage were charged to patients at that time but paid by the Federal government for First Nations persons.<sup>36</sup> The First Nations identifier is updated to include the children of persons identified as First Nations. Government of Alberta and AFNIGC continue to use this dataset for reporting on First Nations health. See McLane *et al* for a more detailed description of this data source.<sup>14</sup>

### Populations

We defined a priori subgroups, including female and ‘other’ sex patients, paediatric patients (age 0–17 years), seniors (age 65 years and older), patients living in remote areas (>200 km from an urban centre), First Nations members and patients living in materially deprived postal codes falling into the two most deprived Pampalon Index quintiles. Our choice to group ‘other’ sex patients with female sex patients was based on the fact that ‘other’ sex was recorded for <30 patients and our belief that those not identified as male may experience disparities in care.

### Outcomes

We examined change in total ED visits and ED visits leading to hospitalisation. We repeated these analyses for pre-selected potentially life-threatening diagnoses that require emergency care and that we did not expect to be impacted by pandemic-related public health measures. The selection of conditions was based on leading causes of death in Alberta in 2019, with additions and validation by clinician scientist team members (online supplemental appendix 1).<sup>37</sup> Examples of life-threatening diagnoses include selected cardiac diagnoses, substance poisoning and kidney failure, among others. Life-threatening conditions that we expected to be mitigated by pandemic health measures (eg, masking, working from home, limits on vehicular travel and cessation of recreational sport) were excluded. Examples include trauma and most respiratory illnesses.

### Analysis

Descriptive statistics summarise patient characteristics and visit data for each time period. Figures show absolute and relative change for each intersection of populations of interest (eg, male, non-First Nations and children in metro areas). This follows Canadian Institutes of Health Research guidance to examine all ‘intersections’ of dimensions of identity included in the study.<sup>38</sup> Material deprivation is not included in figures, to simplify figures

and because it was not consistently linked to outcomes in descriptive statistics or significant in models (below).  $\chi^2$  tests and t-tests report significance of observed differences in patient demographics between the two study periods and Poisson means tests compare differences in study outcomes between study periods within populations of interest. Change scores were calculated by facility as the outcome in the pre-COVID period (eg, ED visits) minus the outcome in the COVID-19 period. Multivariable linear regression models with change scores per facility were produced to adjust for the impact of intersections among populations of interest (eg, a patient may be a senior and live within a materially deprived area). Models included each demographic variable of interest. All analyses were performed in R (R. Core Team. R: a language and environment for statistical computing (2019). R Foundation for Statistical Computing, Vienna, Austria (<https://www.R-project.org/>)).<sup>39</sup> Due to space limitations and small numbers in some categories, we have not modelled outcomes for each intersection of population groups.

## RESULTS

### ED visits

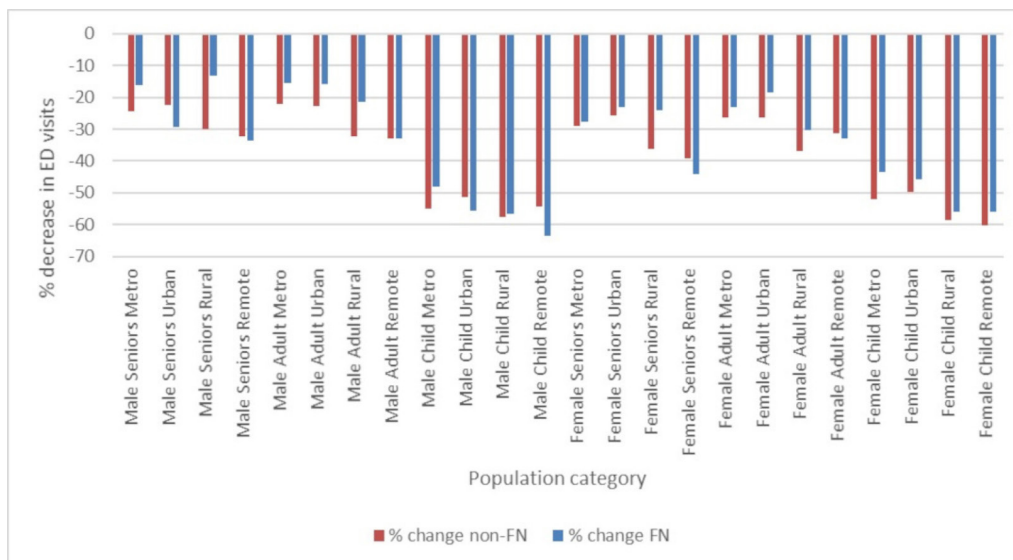
**Table 1** shows visit characteristics for the 2019 and 2020 periods. There was 34% relative reduction in ED visits between the two periods. Patients during the pandemic period were older, more likely to have high Canadian Triage Acuity Scale (1–3) presentations and were more frequently hospitalised or transferred for care. Fewer patients left before discharge, and mortality within the ED was similar between the two periods. **Figures 1 and 2** show absolute and relative change in ED visits for each population of interest.

Nearly all categories saw greater relative reductions than adult, male, metropolitan residents. Especially large absolute reductions are apparent for male children and male adults in metropolitan areas, female adults in metropolitan and rural areas and female children in metropolitan areas (online supplemental appendix 2). For most groups, rural and remote geography residents had greater relative reductions than metropolitan and urban residents. Changes for First Nations largely follow the patterns of other demographic groups. In cases where they differ (eg, male seniors living in rural areas), small absolute changes may explain this difference (as % changes are magnified where counts are small).

**Table 2** shows adjusted average results per each of the 109 facilities. Model results can be interpreted relative to change in our comparison group. There was an adjusted change of –79.9 in ED visits per each of the 109 facilities for the COVID period compared with the pre-COVID period in our ‘baseline’ group (non-First Nations, male, adult, metropolitan residents who were not residing in materially deprived areas). First Nations patient visits (adjusted by other demographic factors) changed by –31.1 per facility. Seniors adjusted visits also decreased by less than the comparison group, as did visits in each of the non-metropolitan geographies.

**Table 1** Patient demographics in the pre-COVID and COVID periods

	15 March 2019 to 30 June 2019		15 March 2020 to 30 June 2020		Significance between periods
	n=6,99,253		n=4,58,322		<0.001
Patient age in years, median (IQR)	37 (20, 59)		41 (25, 61)		<0.001
Age (years) categorical					
Paediatric patients (0–17)	172,717	24.7%	78,508	17.1%	<0.001
Adult (18–64)	396,307	56.7%	287,585	62.7%	<0.001
Seniors (65+)	130,224	18.6%	92,229	20.1%	<0.001
Missing	5	0.0%	0	0.0%	
Patient sex					
Female or 'other'	362,028	51.8%	233,447	50.9%	<0.001
Male	337,220	48.2%	224,869	49.1%	
Missing	5	0	6	0	
Triage acuity level					
Canadian Triage Acuity Scale (CTAS) 1-resuscitation	4241	0.62%	3795	0.85%	<0.001
CTAS 2-emergent	108,041	15.9%	79,334	17.8%	
CTAS 3-urgent	269,312	39.6%	187,474	42.0%	
CTAS 4-less urgent	240,641	35.4%	141,571	31.7%	
CTAS 5-non-urgent	57,284	8.4%	34,482	7.7%	
CTAS missing	19,734	2.8%	11,666	2.5%	
Disposition					
Admitted	57,831	8.3	49,069	10.7	<0.001
Discharged	578,814	82.8	373,383	81.5	
Left before discharge	34,924	5.0	14,164	3.1	
Transferred	23,391	3.3	18,015	3.9	
Death	385	0.1	373	0.1	
Unknown	3908	0.6	3318	0.7	
Urban–rural continuum					
Metro and metro influence areas	338,415	48.4%	231,800	50.6%	<0.001
Urban and urban influence areas	85,217	12.2%	59,261	12.9%	
Rural and rural centre	220,647	31.6%	135,268	29.5%	
Remote	37,107	5.3%	22,350	4.9%	
Missing	17,867	2.6%	9643	2.1%	
Material deprivation					
1 (least deprived)	93,186	13.3%	63,712	13.9%	<0.001
2	108,975	15.6%	72,380	15.8%	
3	121,771	17.4%	78,592	17.1%	
4	145,147	20.8%	94,298	20.6%	
5 (most deprived)	168,534	24.1%	109,709	23.9%	
Missing	61,640	8.8%	39,631	8.6%	
First Nations status					
First Nations	66,870	9.6%	44,977	9.8%	<0.001
Non-First Nations	632,383	90.4%	413,345	90.2%	
Missing	0	0.0	0	0.0	
Missing data were not included in significance tests.					



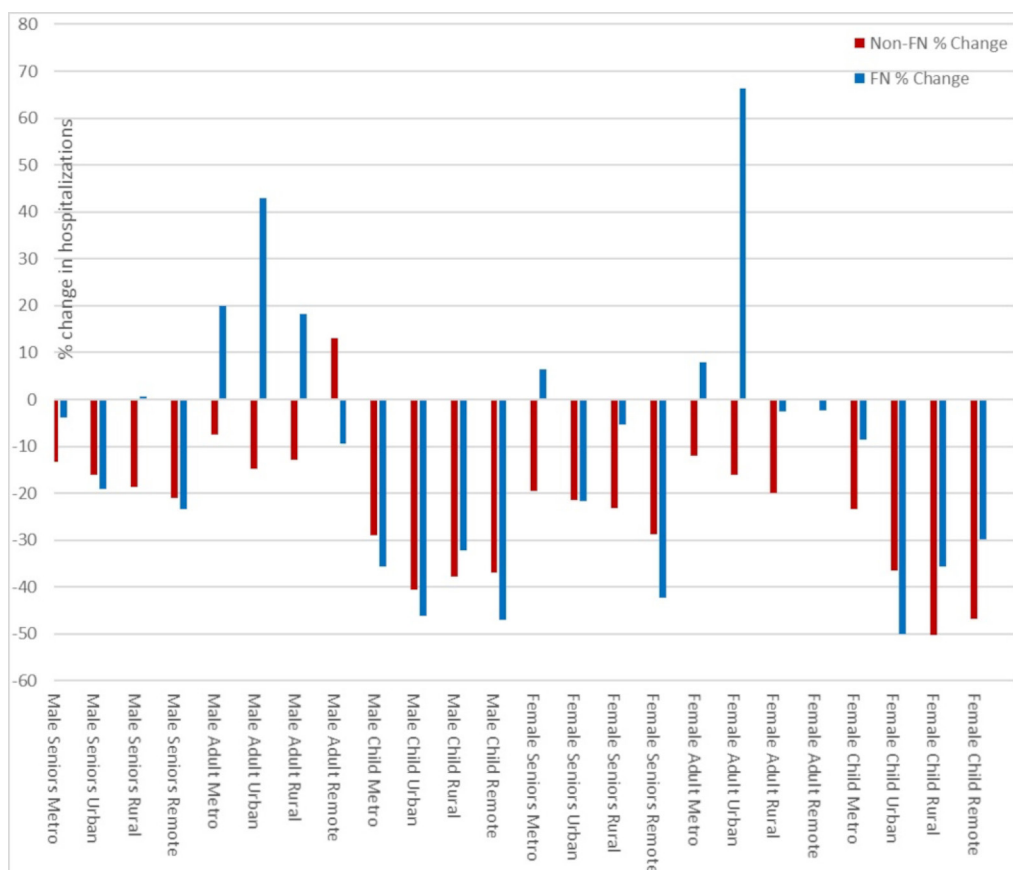
**Figure 1** Relative (%) change in ED visits by population intersection between COVID and pre-COVID periods. ED, emergency department; FN, First Nations.

### Hospitalisations

Hospital admissions decreased from 57,831 to 49,069 or 15% ( $p < 0.001$ ) in the COVID period, compared with the pre-COVID period. Online supplemental appendix 3 shows descriptive statistics for hospital admissions following ED visits. Most groups saw

reductions in hospitalisations, but First Nations hospitalisations were statistically unchanged between the two periods.

Figure 2 shows relative (%) change in hospitalisations by population intersection between COVID and pre-COVID periods for each intersectional group.



**Figure 2** Relative (%) change in hospitalisations by population intersection between COVID and pre-COVID periods. FN, First Nations.

**Table 2** Model results showing average change in ED visits per facility across 109 facilities

	Average change in ED visits leading to hospitalisation per ED	Significance
Model intercept (non-First Nations, male, adult, metropolitan residents who were not residing in materially deprived areas)	-79.9	<0.001
First Nations (reference category, non-First Nations)	-33.1	<0.001
Female and other sex (reference category, male)	-85.8	0.07
Age (reference category, adult)		
Children	-82.1	0.57
Seniors	-54.2	<0.001
Geography (reference category, metro)		
Urban	-34.5	<0.001
Rural	-60.7	<0.001
Remote	-38.3	<0.001
Material deprivation (levels 4–5 'most deprived' compared with levels 1–3)	-79.9	0.99

ED, emergency department.

These percentages should be interpreted with caution because smaller absolute changes are involved than with ED visits (online supplemental appendix 4 for absolute change numbers). This is especially true for small groups, including First Nations groups. We note that some groups saw increases in hospitalisations during the COVID-19 period, and this was more common among First Nations groups. Both male and female First Nations adults in metro and urban areas saw increased hospitalisations. **Table 3** shows adjusted average results for each of the 95 inpatient facilities.

First Nations populations experienced a smaller reduction in hospitalisations than the non-First Nations population. Overall, female and 'other' sex patients experienced

a greater reduction in hospitalisations than male patients. Paediatric patients and seniors each experienced a greater reduction than adults. All non-metro geographic areas had a smaller decrease in hospitalisations than the metropolitan centres.

#### Life-threatening diagnoses sub-analysis

There was a decrease from 21,222 to 18,074 or 15% ( $p < 0.001$ ) in ED visits for selected life-threatening diagnoses during the first wave of the COVID-19 pandemic. Overall, the largest relative reduction was observed for selected cardiac conditions (20% relative reduction), self-harm (19%), diabetes (18%), sepsis (14%) and central nervous system conditions (7%). Each of these decreases was

**Table 3** Average adjusted change in ED visits leading to hospitalisation for each group of interest per facility across each of the 95 inpatient facilities

	Average change in ED visits per ED	Significance
Model intercept (non-First Nations, male, adult, metropolitan residents who were not residing in materially deprived areas)	-7.70	<0.0001
First Nations (reference category, non-First Nations)	-3.28	<0.001
Female and other sex (reference category, male)	-8.83	0.04
Age (reference category, adult)		
Children	-9.46	0.02
Seniors	-10.13	<0.001
Geography (reference category, metro)		
Urban	-0.80	<0.001
Rural	-1.43	<0.001
Remote	-3.69	<0.001
Material deprivation (levels 4–5 'most deprived' compared with levels 1–3)	-8.15	0.41

ED, emergency department.

**Table 4** Average change in ED visits for life-threatening diagnoses per facility across each of the 109 facilities

	Average change in life-threatening diagnoses per ED	Significance
Model intercept (non-First Nations, male, adult, metropolitan residents who were not residing in materially deprived areas)	-3.20	<0.001
First Nations (reference category, non-First Nations)	-1.79	<0.001
Female and other sex (reference category, male)	-4.02	<0.001
Age (reference category, adult)		
Children	-2.87	0.34
Seniors	-3.90	0.01
Geography (reference category, metro)		
Urban	-1.62	<0.001
Rural	-1.00	<0.001
Remote	-1.51	<0.001
Material deprivation (levels 4–5 ‘most deprived’ compared with levels 1–3)	-2.74	0.07

As an aid to contextualising findings, we provide a breakdown of all ED visits by ‘Episode Disease Category Groups’<sup>60</sup> in each period (online supplemental appendix 6).  
ED, emergency department.

significant at the  $p < 0.05$  level. No significant decreases were found for gastrointestinal bleeding, hepatic conditions, renal conditions, severe respiratory conditions or substance poisoning. Online supplemental appendix 5 gives descriptive statistics of patient demographics for ED visits for life-threatening diagnoses.

Table 4 provides modelling results for ED visits for life-threatening diagnoses. First Nations patients experienced a smaller adjusted reduction in these visits than non-First Nations patients. Female and ‘other’ sex patients experienced a greater reduction than male patients. Seniors experienced a greater reduction compared with adults. All geographic areas experienced smaller reductions in ED visits for life-threatening conditions than metropolitan centres.

## DISCUSSION

We found that reductions in ED visits and hospitalisations were not evenly distributed across population groups. Our life-threatening diagnoses sub-analyses show that these reductions were not solely confined to conditions (such as trauma and respiratory illness) expected to be impacted by public health measures or societal changes.

Changes in numbers of ED visits and hospital admissions may not mean the same thing for all populations. While some groups may have been able to reduce avoidable use of acute care services (to their benefit) in the context of COVID-19, other groups may have simply missed out on needed care. Determining the direction and magnitude of changes for different groups, as we do in this study, is a first step toward considering this issue.

### Results for First Nations

In our results, ED visits, hospitalisations and visits for life-threatening diagnoses for First Nations patients

declined less than those of the non-First Nations population. We were surprised to find a smaller reduction for First Nations patients, given lockdowns and travel restrictions imposed by many Nations during the first wave of the COVID-19 pandemic.<sup>40 41</sup> Our descriptive statistics (figure 2 and online supplemental appendix 4) show that urban and metro First Nations adults saw increase in hospitalisations, while other First Nations groups saw a reduction in hospitalisations.

In a meeting to review findings with Elders and First Nations health professionals, attendees suggested that lack of alternatives to ED and acute care may explain the First Nations findings. Statistics Canada has now reported that off-reserve First Nations members were more likely than non-Indigenous people to report barriers to accessing health services during the pandemic.<sup>42</sup> Interpreting our acute care findings for First Nations members as related to a lack of alternate care options would fit with reports of poor access to primary care among First Nations generally<sup>43–45</sup> and counters widespread stereotypes<sup>25 46–48</sup> that First Nations ‘misuse’ acute care. One may also question whether virtual primary care visits (which replaced in-person visits for many Albertans) were as accessible and acceptable to First Nations populations compared with non-First Nations populations.<sup>49</sup>

### Results for female sex patients

In our models, ED visits by female and ‘other’ sex patients did not change significantly more or less than visit by male patients, but female and ‘other’ sex patients experienced greater reductions in hospitalisations and visits for life-threatening diagnoses. This raises concerns regarding healthcare access by women during the pandemic, particularly if women were disproportionately delaying their own care to fill pandemic-related needs



(eg, disproportionately taking on day-to-day parenting while schools were closed).

### Results for seniors

Seniors experienced a lesser reduction in ED visits than adults, but greater reductions for admissions and visits for serious diagnoses. Greater reductions in hospitalisations and ED visits by seniors for life-threatening diagnoses raise concerns about potential missed care. We believe some seniors may have been reluctant to seek care, and perhaps especially reluctant to accept hospitalisation, given concerns about exposure to COVID-19. Providers may have been less likely to admit seniors to hospital, given the perceived risk of hospital-acquired COVID-19 and efforts to protect hospital capacity.

### Results for paediatric patients

Despite large relative reductions in paediatric ED visits in descriptive results, which align with recent descriptive findings from neighbouring British Columbia,<sup>50</sup> our modelling results did not show a significant change for paediatric ED visits. This may be due to geography accounting for a greater proportion of change than age. Paediatric patients experienced a greater reduction in hospitalisation than adults in modelling. Paediatric findings may reflect acute care use by children being largely related to trauma and respiratory illness, which are conditions that would be expected to be reduced by societal changes and public health measures during the first wave of COVID-19.

### Results for geographic areas

We found that the greatest reduction in ED visits and hospitalisations occurred in metropolitan areas, compared with other geographic areas, possibly reflecting greater access to alternatives to acute care in metro centres. Residence in materially deprived areas had little relationship with any outcome in our descriptive statistics and models. We did not have specific preconceptions about what impact material deprivation would have on seeking care and access during the COVID-19 pandemic.

### Implications

Overall, data suggest lack of alternatives to acute care for First Nations populations while raising concerns about acute care access by women, seniors and, to some extent, children during the first wave of COVID-19. Results also enhance our understanding of the role of geography in healthcare access and seeking care during pandemic times.

Population health impacts of missed and delayed care have been reported. In Alberta, we now know there was a small but statistically significant rise in mortality for persons with heart failure, hypertension and diabetes in the year following the pandemic.<sup>51</sup> A systematic review of hospital outcomes for non-COVID-19 illness involving 167 studies found an increase in mortality for a range of conditions, with a majority of studies also reporting an increase in morbidity (although with very low certainty

of evidence).<sup>52</sup> A number of studies report disease-specific findings that may suggest delayed presentations. A systematic review of 43 studies has found that diagnoses of colorectal cancer have decreased while emergency visits and emergency surgeries related to this cancer have increased.<sup>53</sup> Similarly, a retrospective study has found that bladder cancers were more often detected at the advanced stage during COVID-19.<sup>54</sup> In the domain of women's health, ectopic pregnancies more frequently presented to ED with rupture and increased blood loss during the pandemic.<sup>55</sup> Among the few studies we are aware of to examine delayed care by racial group, a study in delayed kidney failure treatment has found that black patients were more likely to experience delays during COVID-19 than white patients.<sup>56</sup> Findings of the impact of delayed care are important in the context of our study as they suggest that decreased ED presentations across a range of conditions were not simply due to a decrease in population health need but due to patients not presenting as early in their disease course as they might have outside a pandemic context. Studies are needed to consider outcomes of missed care for distinct demographic groups, to consider how COVID-19 may have exacerbated health inequities for non-COVID-19 illnesses.

In Alberta, ED visit volumes have now rebounded to pre-pandemic levels.<sup>57</sup> Across Canada, there is now a crisis in EDs with staff and physician shortages resulting in bed and department closures, while lack of access to hospital beds drives up ED crowding and increases wait times.<sup>58</sup> COVID-19, coupled with the return of seasonal respiratory illness since fall 2022, has only exacerbated this crisis. Health systems should be measuring how the crisis is impacting not just the overall population, but stratified by demographic categories, with attention paid to equitable access to primary, emergency and hospital-based care for distinct populations. Our analysis demonstrates the extent to which this is feasible and could form a cornerstone of a well-resourced equity-oriented care system.<sup>59</sup> Visualisation of relative and absolute change in ED visits, visits for selected diagnoses and hospitalisations for each demographic group, over time, would allow ongoing monitoring. In addition, new work is needed to validate or improve the quality of existing demographic data and to develop data for important population groups that were not denoted in the administrative data we relied on (eg, members of visible minority groups, new residents of Canada and persons with disabilities).

### Strengths and limitations

A strength of our analysis is use of a provincial dataset that includes all ED visits and hospitalisations in our region, as well as our ability to identify persons living in materially deprived areas and First Nations members. Our administrative data does not capture gender. The 'other' sex category was rarely used, and we do not believe that it adequately includes all patients who would not identify their sex as female or male. As such, our sex data fails to reflect important patient groups who are likely to

suffer healthcare inequities. In addition, some patients who may identify as First Nations or be recognised by their community as First Nations members are miscategorised as non-First Nations within our data. We did not have access to data of other Indigenous groups in Canada (Métis or Inuit) and so cannot specify outcomes for these populations. No race data is routinely collected within the Alberta healthcare system, and so we could not analyse data by race. Dichotomisation of material deprivation in models may have obscured differences between the most and least deprived areas. Finally, it is likely that our pre-selected life-threatening diagnoses are less applicable to the paediatric population than to the overall population, and this means we may not have detected medically important changes to paediatric emergency care.

## CONCLUSION

During the first wave of the COVID-19 pandemic, reduced emergency care and hospitalisation events were not equally distributed across the population and disproportionately affected those living in metropolitan areas, females and seniors, raising potential healthcare equity concerns. Results, as interpreted by First Nations members, also suggest lack of alternatives to acute care for First Nations populations and suggest a need for allocation of resources in these areas. Methods used in this manuscript could be used in routine health system monitoring and future studies to consider the need for and use of emergency care among distinct populations—to plan for and implement initiatives to support equitable access to care.

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**Contributors** All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by RR and staff within the Biostatistics Research Group, and PM. The first draft of the manuscript was written by PM and MG. All authors contributed to interpretation of the data and drafting the manuscript. PM is the guarantor.

**Funding** This research was funded by the Canadian Institutes for Health Research (VR5-172703).

**Competing interests** Patrick McLane receives his salary from Acute Care Alberta. All other authors have no competing interests to declare.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** Not applicable.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data may be obtained from a third party and are not publicly available. Data may be requested through Alberta Health Services and Government of Alberta.

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