

Paediatric patients seen in 18 emergency departments during the COVID-19 pandemic

Ran D Goldman ,^{1,2} Eric Grafstein,^{3,4} Neil Barclay,^{4,5} Michael A Irvine,² Elodie Portales-Casamar^{2,6}

Handling editor Katie Walker

¹The Pediatric Research in Emergency Therapeutics (PRETx) Program, Division of Emergency Medicine, Department of Pediatrics, University of British Columbia, Vancouver, British Columbia, Canada

²BC Children's Hospital Research Institute, Vancouver, British Columbia, Canada

³Department of Emergency Medicine, University of British Columbia, Vancouver, British Columbia, Canada

⁴Vancouver Coastal Health Authority, Vancouver, British Columbia, Canada

⁵Fraser Health, Vancouver, British Columbia, Canada

⁶Division of Allergy & Immunology, Department of Pediatrics, University of British Columbia, Vancouver, British Columbia, Canada

Correspondence to

Dr Ran D Goldman, Pediatrics, The University of British Columbia, Vancouver, BC V4H 3B8, Canada; rgoldman@cw.bc.ca

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ABSTRACT

Background Public health mitigation strategies in British Columbia during the pandemic included stay-at-home orders and closure of non-essential services. While most primary physicians' offices were closed, hospitals prepared for a pandemic surge and emergency departments (EDs) stayed open to provide care for urgent needs. We sought to determine whether ED paediatric presentations prior and during the COVID-19 pandemic changed and review acuity compared with seasonal adjusted prior year.

Methods We analysed records from 18 EDs in British Columbia, Canada, serving 60% of the population. We included children 0–16 years old and excluded those with no recorded acuity or discharge disposition and those left without being seen by a physician. We compared prepandemic (before the first COVID-19 case), early pandemic (after first COVID-19 case) and peak pandemic (during public health emergency) periods as well as a similar time from the previous year.

Results A reduction of 57% and 70% in overall visits was recorded in the children's hospital ED and the general hospitals EDs, respectively. Average daily visits declined significantly during the peak-pandemic period (167.44±40.72) compared with prepandemic period (543.53±58.8). Admission rates increased mainly due to the decrease in the rate of visits with lower acuity. Children with complaints of 'fever' and 'gastrointestinal' symptoms had both the largest overall volume and per cent reduction in visits between peak-pandemic and prior year (79% and 74%, respectively).

Conclusion Paediatric emergency medicine attendances were reduced to one-third of normal numbers during the 2020 COVID-19 lockdown in British Columbia, Canada, with the reduction mainly seen in minor illnesses that do not usually require admission.

INTRODUCTION

The SARS-CoV-2 illness is an unprecedented global event resulting in the death of greater 400 000 people.¹ Public health mitigation strategies in British Columbia during the pandemic included practising physical distancing, stay-at-home orders, closure of non-essential services and restrictions on gatherings of people, resulting in significant changes in the life of the community. While most primary physicians' offices were closed, hospitals prepared for a pandemic surge and emergency departments (EDs) stayed open to provide care for urgent needs.²

Several previous reports have suggested a decline in ED visits during the pandemic,^{3–5} but whether this decline represents a decrease across all acuities

Key messages

What is already known on this subject

- ▶ During the peak of the COVID-19 pandemic, primary physician offices and other healthcare services have been limited, resulting in abridged availability of healthcare providers. emergency departments continued to operate.
- ▶ Reports suggested that stay-at-home orders and lockdown could result in underutilisation of paediatric emergency departments for non-COVID19 issues, and presentations would have higher acuity.

What this study adds

- ▶ During the peak of the COVID-19 pandemic, emergency department visits by families of children in 18 hospitals across British Columbia, Canada were significantly lower, compared with the prior year at a similar time.
- ▶ Among children who presented to the emergency department, the proportion of serious illness was higher and minor illness lower, compared with the prior year.

and reports, and at all hospitals, is unclear. There is concern that acutely ill patients will avoid attendance in similar proportions to those with less serious reports. Our objective was to determine whether visits by children during the pandemic declined, whether the decline was similar at general EDs and children's EDs and whether the distribution of acuity had changed. We hypothesised that declines in use of EDs would be greater at general EDs, and that there would be a higher proportion of acutely ill patients.

METHODS

Study design and setting

We analysed data for paediatric cases in emergency from three sources: (1) the single tertiary care Children's Hospital in the Province of BC (BCCH), caring for children up to their 17th birthday, (2) Vancouver Coastal Health (VCH), serving a geographic population in BC encompassing about 1.25 million people and 13 hospitals, of whom 6 are urban hospitals located in Vancouver and (3) Fraser Health (FH), serving a geographic population in BC encompassing about 1.8 million people in 12 hospitals, including 1 (Surrey Memorial Hospital) having a dedicated paediatric ED. Together, the population seen by these organisations encompass 60% of all

people in the Province of BC, Canada and is commonly referred to as the Lower Mainland.

We included all records of visits of children 0–16 years of age and variables included were age in years, presenting report, triage level and discharge disposition. We excluded children seen in one hospital that typically does not accept children in the ED (N=52; 15, 11, 19 and 7 across the peak prior year, prepandemic, early pandemic and peak pandemic periods, respectively), records with no valid triage acuity level or discharge disposition (N=685; 160, 268, 225 and 32 across the peak prior year, prepandemic, early pandemic and peak pandemic periods, respectively) and those categorised as left without being seen by a physician (LWBS; N=3874; 1142, 1428, 1242 and 62 across the peak prior year, prepandemic, early pandemic and peak pandemic periods, respectively).

All hospitals used the 5-level Canadian Triage and Acuity Scale (CTAS, 1=resuscitation to 5=non-urgent),⁶ a well-recognised and validated triage system that prioritises patient care by severity of illness, and we further aggregated the data into three levels—high acuity (CTAS 1 and 2), medium acuity (CTAS 3) and low acuity (CTAS 4 and 5).

Discharge disposition included the following options: ‘admitted to inpatient from ED’, ‘discharged from ED’, ‘transferred’ (including transfers to surgical day care, ambulatory clinic or another hospital) and ‘deceased’. Deceased cases are not reported in [table 1](#) as these were two or less in each period.

Presenting report was coded using standard Canadian Emergency Department Information System⁷ with the exception of ‘fever’ that we present separately due to the high prevalence of this presenting report in the paediatric population.

In order to be able to interpret our results within the wider context of public health measures in BC and internationally, we decided to analyse our data within specific periods highlighting specific events. We defined the COVID-19 pandemic periods as follows: (1) prepandemic (before the first COVID-19 case in BC): 1 December 2019 to 27 January 2020 (58 days), (2) early pandemic (after the first COVID-19 case in BC was reported): 28 January 2020 to 16 March 2020 (47 days) and (3) peak pandemic (after public health emergency and stay-at-home orders were declared): 17 March 2020 to 30 April 2020 (43

days). For previous year comparisons, we used similar data for visits during 17 March 2019 to 30 April 2019.

We also compared visits of children in the paediatric hospital ED to visits of children in general EDs.

Patient involvement statement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

Key outcome and measurements

Our primary outcome was the rate of ED utilisation by children, and secondary outcomes were acuity when arriving to the ED, discharge disposition (including admission or discharge) and presenting reports.

Data analysis

Daily visits are presented as mean±SD, differences in daily visits are presented as mean with 95% CIs, and age is presented as median with IQR across each period, including visits from those who were LWBS. The different categories of triage level and discharge disposition are presented as frequency and percentage (rate) of visits across each period, after removing visits from those who LWBS. In addition, we present the frequency and percentage (rate) of admissions across each triage level and pandemic period.

To examine the differences between the described pandemic periods, we performed a series of independent t tests on the number of daily visits. We also performed χ^2 tests of independence on the number of visits at each triage level or for each discharge disposition to assess differences in proportions across the different periods. Adjustment for multiple testing was not performed and a p value of less than 0.05 was considered statistically significant. R V.3.5.1 was used for all data analysis and visualisation.

RESULTS

As depicted in [figure 1](#), a total of 65 714 ED recorded visits of children were captured at BC Children’s Hospital (17 465) and

Table 1 Summary of daily visits, age, triage level and discharge disposition across all periods of study

	17 March to 30 April 2019	Prepandemic 1 December 2019 to 27 January 2020	Early pandemic 28 January to 16 March 2020	Peak pandemic 17 March to 30 April 2020
Total number of visits	22 654	31 525	26 654	7535
Number of daily visits Mean±SD	503.42±50.16	543.53±58.8	543.96±63.81	167.44±40.72
Age median (IQR)	5 (2–11)	5 (2–10)	6 (2–11)	5 (1–11)
Triage level				
CTAS 1+2	3571 (16%)	5747 (18%)	4781 (18%)	1488 (20%)
CTAS 3	9711 (43%)	14 420 (46%)	12 054 (45%)	3408 (45%)
CTAS 4+5	9372 (41%)	11 358 (36%)	9819 (37%)	2639 (35%)
Disposition				
Admitted	893 (4%)	1319 (4%)	1098 (4%)	535 (7%)
Discharged	21 663 (96%)	30 079 (95%)	25 432 (95%)	6952 (92%)
Transferred	96 (0%)	126 (0%)	124 (0%)	46 (1%)
Admissions per triage level				
CTAS 1+2	570 (16%)	894 (16%)	752 (16%)	338 (23%)
CTAS 3	286 (3%)	376 (3%)	313 (3%)	180 (5%)
CTAS 4+5	37 (0%)	49 (0%)	33 (0%)	17 (1%)

The percentages presented in brackets for triage level and disposition represent the per cent of visits in that category (eg, CTAS 1+2) as compared with all visits during that period. The percentages presented in brackets for admissions per triage level represent the per cent of admissions in that category as compared with all visits in that category. CTAS, Canadian Triage and Acuity Scale.

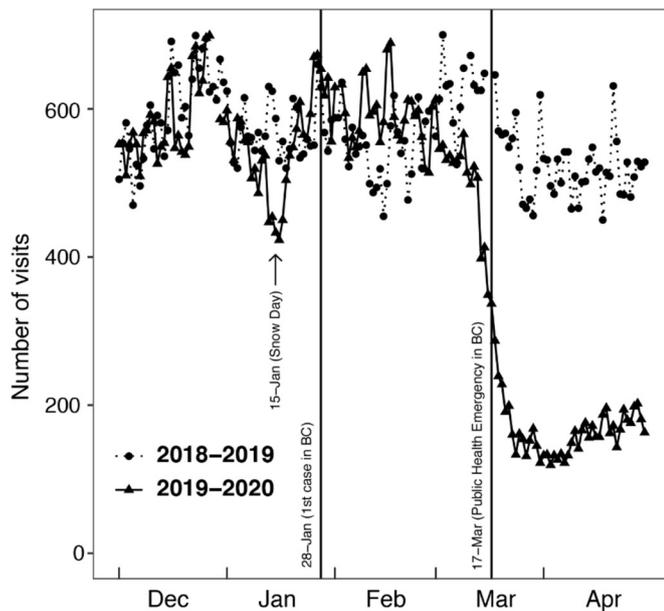


Figure 1 Number of daily emergency department (ED) visits by children before and during the pandemic to all 18 hospital EDs in our cohort. The number of daily ED visits is plotted from 1 December to 30 April during the years 2018–2019 and 2019–2020. The pandemic periods are defined based on defining events in BC, the first COVID-19 reported case on 28 January 2020 and the declaration of public health emergency on 17 March 2020. Also noted is a snow day where schools were closed on 15 January 2020 and which resulted in a drop in daily ED visits.

17 general hospitals across VCH and FH regions (48 249) from 1 December 2019 to 30 April 2020. During the peak pandemic (17 March 2020 to 30 April 2020), a total of 2581 and 4954 visits were documented, compared with the same period the prior year with 5943 and 16711 visits at BCCH and general hospitals, respectively. These represent a reduction of 57% and 70% in visits at BCCH and general hospitals, respectively. An overall decline of 66.7% of ED visits was documented during the peak COVID-19 period.

Average daily visits (table 1) declined significantly during the peak pandemic period compared with prepandemic period across the entire provincial area studied (mean difference, 376.09 visits; 95% CI 356.6 to 395.58; $p < 0.001$) as well as between peak and early pandemic periods (mean difference, 376.52 visits; 95% CI 354.73 to 398.3; $p < 0.001$) and between peak pandemic and same period the prior year (mean difference, 335.98 visits; 95% CI 316.82 to 355.13; $p < 0.001$).

Admission proportion almost doubled for the entire cohort, from 4% during the prepandemic, early pandemic or prior year, to 7% during the peak pandemic period ($p < 0.001$; table 1). Average acuity of illness was higher during the peak pandemic period compared with all prior periods (all statistically significant). The absolute number of admissions decreased for all CTAS categories, but the admission rates increased in all triage categories, compared with the prior year. When we adjusted for triage level, the χ^2 test of independence for the number of admissions observed across the different periods was no longer significant, meaning that the increase in admission rate was mainly due to the increase in the proportion of visits with higher acuity.

Median age of children was similar across periods (table 1). Children of 1 year and older had a greater reduction in visits than those under 1 (table 2).

Table 2 Reduction in paediatric visits to EDs during the peak pandemic period (17 March to 30 April 2020) as compared with the same time the prior year, based on age of children

	Prior year 17 March to 30 April 2019	Peak pandemic 17 March to 30 April 2020	Reduction in visits	Per cent reduction
Child's age (years)				
0	2686	1123	1563	58
1–4	7840	2508	5332	68
5–10	6298	2002	4296	68
11–16	5830	1902	3928	67

ED, emergency department.

When we compared the reduction of visits to the paediatric hospital and the 17 general hospitals, we found that general EDs have seen a much larger reduction in rate of children (57% and 70%, respectively) attending (table 3). The differences were across all acuity categories, and similarly admission rates for children reduced much more in the general EDs (45%) compared with the paediatric hospital (34%).

The top five presenting reports were similar across the periods studied; greatest reductions were seen in fever and gastrointestinal reports (figure 2).

DISCUSSION

The SARS-CoV-2 illness that started spreading in humans in the end of 2019 (COVID-19) has been a global pandemic that has affected millions of families,⁸ including their utilisation of healthcare resources.

We report the significant decline in utilisation of EDs across the majority of the Province of British Columbia, Canada, during the peak of COVID-19 pandemic, compared with prepandemic period and the same period in the prior year. Interestingly, the decline was observed in the peak period only, after BC public health emergency and stay-at-home orders were declared and not during the early pandemic phase even though COVID-19 cases were rising. We discovered that admission rate increased significantly compared with prior year, despite admission beds conservation plans in the hospital.

While absolute admissions were less than in prior year, this increase in admission rate, especially at times of bed conservation for pandemic surge, reflects the fact that children with lower acuity were less likely to present to the ED. The significant decline in our Province was similar to global trends reported in five hospitals in Italy, a hard-hit country during COVID-19 pandemic, with a reduction of 73%–88% in presentation to paediatric EDs during confinement, compared with the same time period in 2019 and 2018,⁹ in England with a 25% reduction in visits to general EDs during lockdown compared with a week earlier,¹⁰ and in Spain during the first 20 days of State of Emergency, when a significant decrease in injury-related ED visits was documented in a tertiary hospital within the Spanish National Health System.¹¹

Initial reports and concerns about secondary effects of the pandemic on adults who present late to EDs with non-COVID related symptoms¹² and potential associated harms¹⁰ suggest a need for evaluation of paediatric access to care. We found the proportion of children presenting with CTAS acuity 1 and 2 was 25% greater in the peak lockdown period compared with the proportion in those categories in the prior year, and the proportion of presenting with a low acuity (CTAS 4 and 5)

Table 3 Reduction in paediatric visits to EDs during the peak pandemic period (17 March to 30 April 2020) as compared with the same time the prior year for a paediatric ED and general hospital EDs

	Total	Paediatric hospital	General hospitals	P value (χ^2 test)
Total reduction in number of visits (%)	15 119 (67%)	3362 (57%)	11 757 (70%)	<0.001
Triage level reduction				
CTAS 1+2	2083 (58%)	731 (52%)	1352 (62%)	<0.001
CTAS 3	6303 (65%)	1223 (54%)	5080 (68%)	<0.001
CTAS 4+5	6733 (72%)	1408 (62%)	5325 (75%)	<0.001
Reduction in number of admissions to inpatient unit	358 (40%)	152 (34%)	206 (46%)	=0.07 (n.s.)

The percentages presented in brackets represent the per cent reduction in number of visits in that category between the peak pandemic period and the same period the prior year.

CTAS, Canadian Triage and Acuity Scale; ED, emergency department.

was 15% lower in the peak in the peak period compared with the prior year.

Some reduction of ED visits is expected, since no outdoor sport or school activity was allowed, reducing the rate of injuries seen in EDs. Visits with reports related to 'orthopaedic' issues dropped 69%, among the biggest drop during the peak pandemic, compared with the prior year. It is also possible that physical distancing and closure of schools, aimed to reduce the spread of the virus causing COVID-19, reduced the spread of other viral illnesses, resulting in decrease in over 70% of visits related to 'fever', 'gastrointestinal', 'ENT' and 'ophthalmology' reports. It was not surprising that rate of reports associated with children having 'respiratory' symptoms, one of the mainstays of COVID-19 illness, fell by 'only' 56%.

There could be several possible explanations to why families avoided EDs during the peak pandemic. First, parents may have been concerned about contracting COVID-19 in the hospital setting. With limited movement during an emergency, parents may have decided to stay home and avoid any excursion with their children, including to the hospital. Parents may have had altruistic considerations of avoiding overburdening a system already at capacity and support the notion of 'flattening the curve' (ie, slow the spread and prevent hospitals from

becoming overwhelmed). Also, there was an enhanced telephone advice line, and ancillary COVID-19 screening centres and that were seeing upwards of double their usual volumes. Finally, it is possible that frequent care for minor illnesses was abridged at time of the peak pandemic, and overutilisation of our system during non-COVID time reduced significantly.

When we compared the ED parents chose to come to, we found that parents decided to avoid EDs at general hospitals much more often than avoid visiting the ED in the single Children's Hospital in the Province (reduction of 70% and 57%, respectively). This was especially true for those with low acuity conditions (CTAS 4 and 5) with significant reduction in visits to the paediatric ED and further decline to general EDs. This also likely resulted in decline in admission to the hospital. Parents may have felt more secure visiting a paediatric hospital ED with their children and may have wanted to avoid the general EDs potentially busy seeing adults with COVID-19. Parents of children with complex chronic health conditions likely continued to choose that ED for their urgent health needs.

While we did not capture ED visits by the entire population of the Province, the depiction includes about 60% of all visits to 18 EDs and is likely to provide a good representation of all ED care utilisation by children in the Province. We compared the pandemic period to a single prior year, and including more historical cohorts may add to understanding of the meaningful decline in visits and increase in acuity we documented here. Finally, our peak period may not be the same period as in other EDs across the globe but generalisable information can likely be generated adjusting the peak period in other jurisdictions.

Many families stayed at home and did not arrive to EDs across the Province of BC, and those coming needed more admission. It is important to provide an appraisal of the health risk EDs pose to patients during a pandemic and to provide trusted communication to the community that EDs are continuing to safely serve families during a pandemic period.

Contributors All five authors designed the methodology, reviewed the draft paper and approved the submitted version. RG wrote the first draft of the paper. MI and EP-C analysed the data and conducted the statistical analyses.

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Competing interests None declared.

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

Patient consent for publication Not required.

Ethics approval The study was approved by the Institutional Review Boards (Research Ethics Boards) of BC Children's Hospital, Vancouver Coastal Health and Fraser Health.

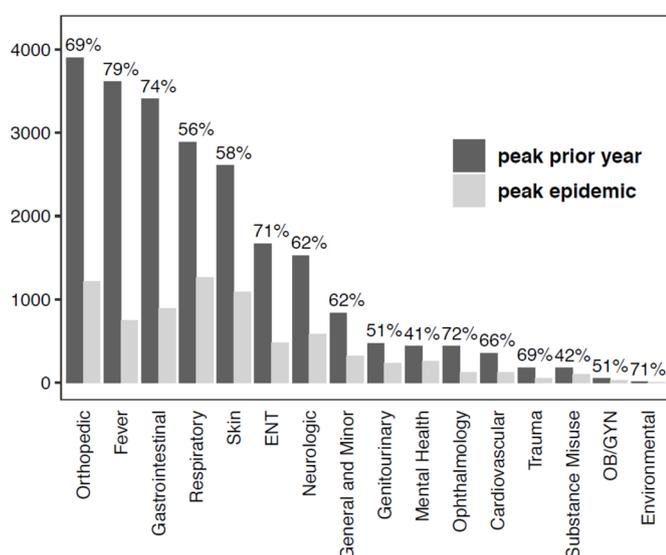


Figure 2 Number of emergency department visits by presenting complaint during the peak pandemic (17 March to 30 April 2020) and the same period the prior year (17 March to 30 April 2019), both 45 days long. The percentage indicates the per cent reduction in visits between the two periods.

Provenance and peer review Not commissioned; externally peer reviewed.

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ORCID iD

Ran D Goldman <http://orcid.org/0000-0001-8318-5415>

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