

Injury-related pediatric emergency department visits during the first 2 years of the COVID-19 pandemic Department Workflow

Emilie Groulx-Boivin¹ | Francesca del Giorgio² | Jocelyn Gravel³ |
Antonio D'Angelo³ | Olivier Drouin³

¹Montreal Children's Hospital, McGill University, Montréal, Québec, Canada

²McGill University, Montréal, Québec, Canada

³Centre Hospitalier Universitaire Sainte-Justine, Université de Montréal, Montréal, Québec, Canada

Correspondence

Olivier Drouin

Email: o.drouin@umontreal.ca

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ABSTRACT

Objectives: To quantify the impact of COVID-19 and public health measures on pediatric injury-related Emergency Department (ED) visits during the first two years of the pandemic.

Methods: Retrospective longitudinal study assessing changes in monthly incidence of injury-related ED visits during the first two years of the COVID-19 pandemic (March 2020-February 2022) at a large Canadian tertiary pediatric hospital. Monthly fluctuations were assessed overall and by age categories (0-4, 5-11, 12-17 years). Secular time-trends and seasonality were accounted for by modelling the pre-pandemic trend using a 4-year historical control (April 2016-February 2020). We examined the impact of confinement periods (March-May 2020, October 2020-February 2021, December 2021-January 2022) on monthly fluctuations.

Results: Injury-related pediatric ED visits fell sharply at the onset of the pandemic, reaching a 45% reduction in March 2020 (Incidence Risk Ratio (IRR): 0.55; 95% CI 0.50-0.61), and peaked 30% above expected levels in January 2021 (IRR: 1.30; 95% CI 1.20-1.41). Each confinement period coincided with an initial reduction in visits, followed by a re-increase as restrictions eased. Age-specific fluctuations in injury-related ED visits varied, with no major change among 0-4-year-olds, a 56% reduction in visits at the pandemic onset among 5-11-year-olds (IRR: 0.44; 95% CI 0.37-0.54) and a 64% reduction among 12-17-year-olds (IRR: 0.36; 95% CI 0.28-0.45).

Conclusion: The consequences of COVID-19 on pediatric injury extended far beyond the first few months of the pandemic and varied according to age. Understanding how confinement influences pediatric injury may assist the development of injury prevention strategies and improve resource allocation.



KEYWORDS

COVID-19, Emergency Department, Injuries, Pediatric, Trauma

1 | INTRODUCTION

More than three years after the outbreak of COVID-19, the extent of its consequences, both direct and indirect, on the health and well-being of children and their families are still being revealed. The onset of the pandemic was associated with a marked decrease in pediatric Emergency Department (ED) utilization worldwide. (1) This has been attributed to a combination of changes in the incidence of infectious diseases such as influenza and respiratory syncytial virus infections, (2, 3) as well as changes in health-seeking behaviors. (4) A similar trend has also been observed with regards to pediatric injury-related ED visits. Specifically, Canadian studies found a 58% reduction in the total number of pediatric ED visits, and a 37-62% decrease in injury-related visits during the early pandemic period (March-May 2020) relative to the same time interval in preceding years. (5, 6)

However, it is becoming apparent that the impact of COVID-19 on pediatric ED utilization has extended beyond the early months of the pandemic. For example, pediatric ED visits in the United States declined by 51% in 2020 and remained about 22% lower than expected in 2021 and January 2022 compared to historical controls. (7) While reductions in pediatric injury in the early pandemic period have been documented in many countries, (6, 8-14) there is a paucity of data describing changes in the rates of injury-related ED presentations beyond the first 3-6 months of the pandemic. The gap in literature about longer time horizons is particularly important given that after the first wave, additional lockdown periods and school closures were implemented in many areas including in Quebec, and the peak number of daily cases of COVID-19 saw a 7.5-fold increase in December 2021 relative to April 2021. (15) This underlines the need to further evaluate changes in the incidence of pediatric injury throughout the duration of the pandemic. Additionally, the disruption of school and organized sports during the pandemic has affected children of different age groups disproportionately, which may translate into age-specific variations in ED visits for injury. (6, 7)

Therefore, this study aimed to quantify the impact

of COVID-19 and associated public health measures on injury-related pediatric ED visits during the first two years of the pandemic in Montreal, Canada. We also aimed to determine if children of all ages were similarly affected and evaluate changes in the rates of hospitalization due to injury.

2 | METHODS

2.1 | Study Population

We conducted a longitudinal retrospective observational study using the electronic ED database of the Centre Hospitalier Universitaire Sainte-Justine (CHUSJ), a university-affiliated pediatric hospital in Montreal, Quebec. This database has been previously used and validated in multiple research projects. (16, 17) Patients 0-17 years old who consulted the pediatric ED of the CHUSJ between April 2016 and February 2022 and received a primary ED diagnosis related to injury were included in the study. Cases of pediatric injury were identified from a previously validated drop-down menu of 632 diagnostic criteria from the ED database (Supplementary materials). Patients who left the ED prior to being assessed by a physician were not included in the main analysis but were added in a sensitivity analysis. This study was approved by the CHUSJ Research Ethics Committee and informed consent was waived due to its retrospective and observational design.

2.2 | Outcomes and Variables

The primary outcome of interest was the change in monthly incidence of pediatric injury-related ED visits during the first two years of the COVID-19 pandemic relative to the pre-pandemic trend, overall and by age categories (preschool: 0-4 years, elementary school: 5-11 years, high school: 12-17 years). The 6-year study period was divided into the pre-pandemic period (April 2016-February 2020) and the pandemic period (March 2020-February 2022). The start of the pandemic period was defined as March 1st 2020, in keeping with the introduction of the first COVID-19-associated public

health measures in Quebec in early March 2020. (18) In a secondary analysis, we investigated seasonal changes in the risk of injury-related ED visits leading to hospitalization during the first two years of the pandemic relative to the pre-pandemic trend.

In a descriptive analysis, we investigated the incidence of COVID-19 infections and the implementation of public health measures such as lockdown periods (March-May 2020, October 2020-February 2021, and December 2021-January 2022) as potential factors associated with changes in injury-related ED visits. (18) We also compared the acuity of presentation using the Canadian Paediatric Triage and Acuity Scale (Paed-CTAS). (19) Injury diagnoses were subsequently grouped by site of injury and by type of injury using similar categories to those previously used in the literature. (9, 12) Yearly counts during the pandemic period were compared to the pre-pandemic trend.

2.3 | Statistical Analysis

Negative binomial regression with monthly indicator terms and a slope-parameter to account for any secular time-trends was used to model the monthly incidence of injury-related pediatric ED visits in the pre-pandemic trend. The change in monthly incidence during the pandemic was captured via interaction terms between the pre-pandemic and pandemic months, overall and stratified by age categories. As the catchment area of the CHUSJ was not expected to vary substantially within the months of this study, an offset parameter was not included in the model. In the secondary analysis, change in seasonal risk of hospitalization from the pediatric ED due to injury was assessed via logistic regression using seasonal indicator terms (spring=March-May, summer=June-August, fall=September-November, winter=December-February) and a slope-parameter to model the pre-pandemic trend. The analysis was aggregated by seasons due to the low monthly frequency of hospitalizations. (20) In all analyses, autocorrelation was assessed by inspection of the autocorrelated and partial autocorrelated function (ACF and PACF) plots and the Dublin Watson test. (21) Statistical analyses

were performed using R statistical software version 2022.12.0+353 and all analyses were evaluated at $\alpha=0.05$.

2.4 | Sensitivity Analysis

We identified patients who had a chief complaint related to injury at triage but left the ED prior to being assessed by a physician and, accordingly, never received a formal diagnosis of injury. As part of a sensitivity analysis, these patients were added to the patients who received a formal diagnosis of injury (included in this study) and the primary analysis investigating monthly fluctuations in injury-related ED visits was repeated.

3 | RESULTS

3.1 | Patient Characteristics

Of 458,799 pediatric ED visits during the 6-year study period, 65,364 (14.2%) were associated with injuries. There were 43,790 injury-related ED visits during the pre-pandemic period (mean 11,173 visits per year, interval March-February, standard deviation 99), compared to 10,179 and 11,395 visits in the first and second year of the pandemic, respectively. Patient and visit characteristics are summarized in Table 1. Together, children ages 0-4 and 5-11 accounted for approximately three quarters of injury-related ED visits across all periods studied. In both the pre-pandemic and pandemic periods, cranial injuries were the most common site of injury, and fractures were the most common type of injury, representing nearly 20% and 30% of injury-related ED visits, respectively (Supplementary Table 1).

3.2 | Monthly incidence of injury-related pediatric ED visits

Overall, injury-related ED visits reached a nadir in March 2020 (457 visits) and a peak in May 2021 (1,337 visits) (Figure 1). At the onset of the COVID-19 pandemic, visits fell 45% below expected levels (March 2020: Incidence Risk Ratio [IRR]: 0.55; 95% Confidence Interval

	Pre-Pandemic Period	Pandemic Year 1	Pandemic Year 2*
	Apr 2016 – Feb 2020	Mar 2020 – Feb 2021	Mar 2021 – Feb 2022
	N (%)	N (%)	N (%)
Total visits	43790	21574	11238
Visits per year	11173 [†]	10179	11395
Age			
0–4 years	16654 (38.0)	4444 (43.7)	3916 (34.8)
5–11 years	16493 (37.7)	3809 (37.4)	4400 (39.2)
12–17 years	10643 (24.3)	1926 (18.9)	2922 (26.0)
Paed-CTAS level			
1– Resuscitation	242 (0.6)	72 (0.7)	73 (0.6)
2– Emergency	3453 (7.9)	636 (6.2)	786 (6.9)
3– Urgent	15080 (34.3)	3492 (34.3)	3856 (33.8)
4– Less Urgent	24663 (56.3)	5867 (57.6)	6569 (57.6)
5– Non-Urgent	352 (0.8)	112 (1.1)	111 (1.0)
Hospitalizations	1899 (4.3)	517 (5.1)	575 (5.0)

*Of all children who received a diagnosis of injury, 157 were missing information on age in pandemic year 2.

[†]Represents the mean number of visits per year interval March–February over the pre-pandemic period.

Paed-CTAS level = Paediatric Canadian Triage and Acuity Scale.

TABLE 1 Characteristics of pediatric patients and injury-related emergency department visits by period

[CI] 0.50-0.61) (Table 2). This decrease was followed by a sustained surplus in visits from December 2020 to May 2021, with visits rising 30% above expected in January 2021 (IRR: 1.30; 95% CI 1.20-1.41) and 27% above expected in April 2021 (IRR: 1.27; 95% CI 1.17-1.37), before returning to predicted levels in June 2021. Injury-related visits decreased again in September and October 2021 (September: IRR: 0.79; 95% CI 0.73-0.85, October: IRR: 0.84; 95% CI 0.78-0.91) but returned to the predicted incidence by the end of the study period.

While there was evidence of seasonality in the pre-pandemic period, with peaks between May and September (May: IRR: 1.39; 95% CI 1.32-1.46, September: IRR: 1.37; 95% CI 1.30-1.45) and a nadir in the winter months (December: IRR: 0.85; 95% CI 0.80-0.90), this seasonal pattern was not observed during most of the

pandemic period (Table 2).

3.3 | Sensitivity Analysis

The sensitivity analysis included 5,415 patients who received a triage diagnosis of injury but left the ED before seeing a physician. The monthly fluctuations in injury-related ED visits of this sensitivity analysis were very similar to those of the primary analysis (Supplementary Table 2).

3.4 | Age-stratified analysis

Among the 0-4-year-olds, there was no major change from predicted counts of injury-related ED visits throughout the first two years of the pandemic (Figure 2,

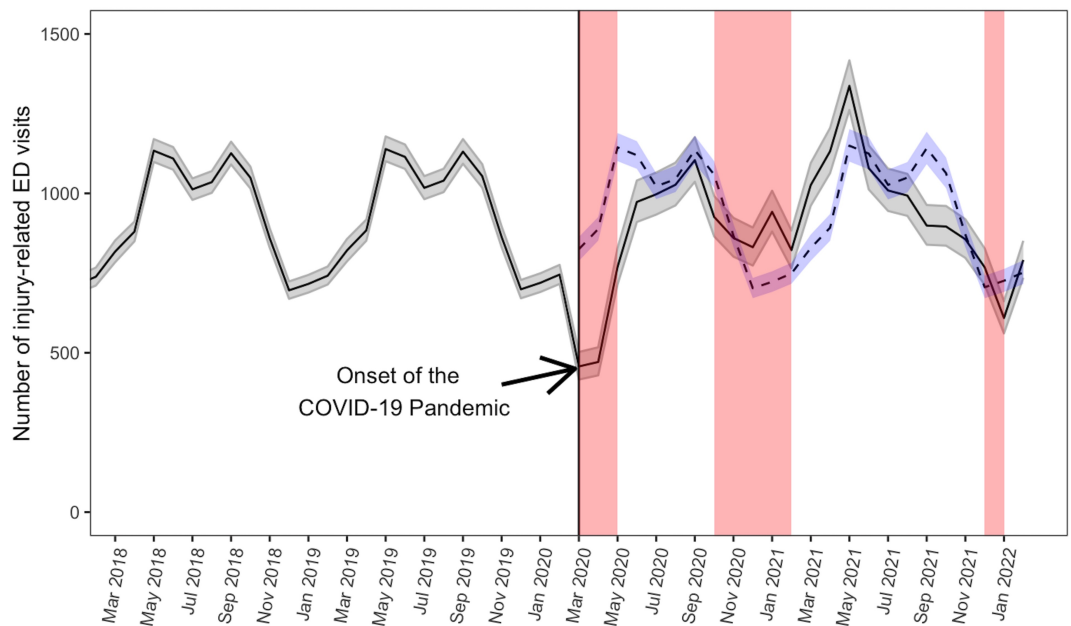


FIGURE 1 Frequency of injury-related pediatric emergency department visits and confinement periods. Solid black line: modelled trend for the pre-pandemic period (April 2016-February 2020; only February 2018-February 2020 shown for figure simplicity, as the modelled trend is identical across all pre-pandemic years) and observed incidence during the pandemic period (March 2020-February 2022); dotted black line: predicted incidence had the pandemic not occurred based on 4-year comparator period; grey region: 95% confidence interval for the fitted values; purple region: 95% confidence interval for the predicted values; pink regions: periods of confinement in Quebec (March-May 2020, October 2020-February 2021 and December 2021-January 2022). (18) ED = Emergency Department.

Table 2). In contrast, there was a 56% reduction in visits in children 5-11 years old (March 2020: IRR: 0.44; 95% CI 0.37-0.54) and a 64% reduction in children 12-17 years old (March 2020: IRR: 0.36; 95% CI 0.28-0.45) at the onset of the pandemic. While visits subsequently remained lower or similar to expected until the end of the study period in children aged 12-17 years, the monthly incidence in children aged 5-11 years reflects the patterns observed in the overall analysis.

3.5 | Risk of hospitalization

The risk of hospitalizations due to injury remained as expected at the onset of the pandemic (spring 2020: RR:

1.14; 95% CI 0.91-1.41), but increased in the summer of 2020 (+40%, RR: 1.40; 95% CI 1.10-1.77) as well as in the spring (+36%, RR: 1.36; 95% CI 1.07-1.72) and fall (+34%, RR: 1.34; 95% CI 1.08-1.66) of 2021 relative to expected risk (Supplementary Table 3, Supplementary Figure 1).

3.6 | COVID-19 cases and confinement periods

In Montreal, the daily number of new COVID-19 cases peaked in April 2020 and January 2021, before reaching an all-time high in late December 2021. (15) While injury-related ED visits decreased significantly during

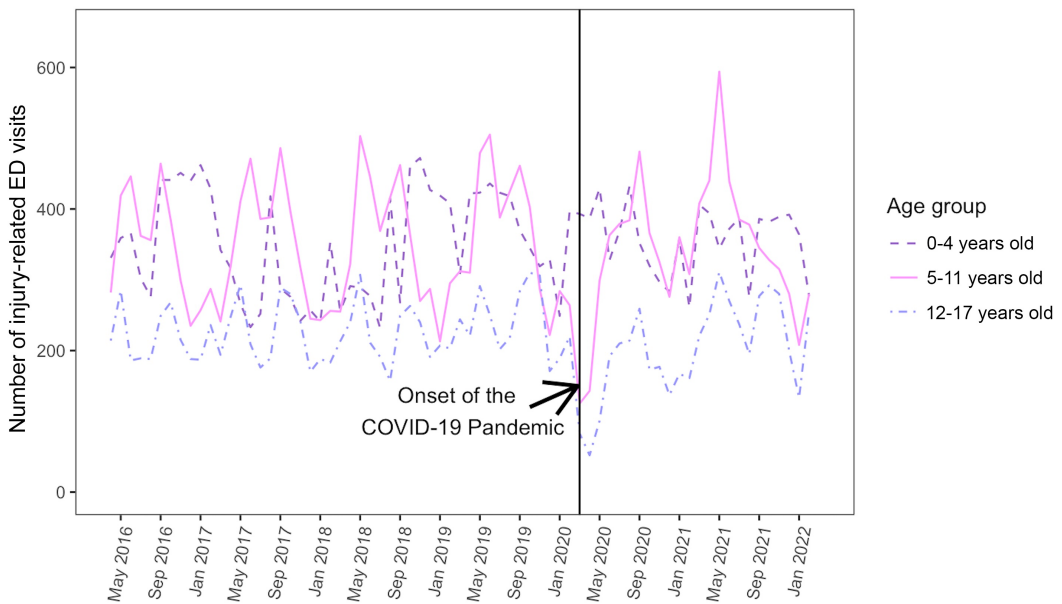


FIGURE 1 Frequency of injury-related pediatric emergency department visits by age category. ED = Emergency Department.

the first peak of COVID-19 cases in April 2020 (IRR: 0.53; 95% CI 0.48-0.59), the number of visits was higher than expected during the second peak of January 2021 (IRR: 1.30; 95% CI 1.20-1.41) and similar to expected in December 2021 (IRR: 1.09; 95% CI 0.99-1.19). We observed a reduction in injury-related ED visits at the onset of all three periods of confinement in Quebec (March-May 2020, October 2020-February 2021, and December 2021-January 2022, (18) followed by a re-increase toward the end of each confinement period or shortly after restrictions were lifted (Figure 1).

4 | DISCUSSION

This retrospective longitudinal study demonstrated that the impact of COVID-19 on pediatric injury was not uniform during the first two years of the pandemic. Indeed, important changes in injury-related ED visits occurred beyond the initial six months of the pandemic. Our results showed a 45% reduction in injury-related pediatric

ED visits at the onset of the pandemic (March 2020) compared to historical controls, a finding similar to studies in the United States, (8, 9) Italy, (10, 11) France, (12) Germany, (13) and Korea. (22) However, we also found evidence of marked increases in injury-related ED visits in January 2021 (+30%) and April 2021 (+27%). Additionally, while we observed known seasonality in injury-related ED visits (with peaks in summer and troughs in winter) during the pre-pandemic period, (23), this seasonal pattern was absent in the first year of the pandemic and seemed to slowly resume by the end of the second year.

Our findings suggest that the observed changes in pediatric injury-related ED visits during the pandemic coincide less with reported incidence of COVID-19 cases and more with associated public health measures. (24) Indeed, there was a reduction in injury-related ED visits during all three periods of confinement in Quebec, followed by a rapid increase in visits as restrictions were lifted. As proposed by other groups, this observation could have been caused by minimized motor vehicle use,

	Complete model IRR (95% CI)	0–4 years old IRR (95% CI)	5–11 years old IRR (95% CI)	12–17 years old IRR (95% CI)
(Intercept=Mar)*	809.88 (773.75–847.36)	297.88 (243.17–367.79)	257.82 (239.17–277.35)	202.89 (186.31–220.57)
Pre-Pandemic				
April	1.08 (1.02–1.14)	1.13 (0.88–1.45)	1.15 (1.06–1.26)	1.08 (0.97–1.19)
May	1.39 (1.32–1.46)	1.11 (0.86–1.42)	1.69 (1.56–1.84)	1.37 (1.24–1.51)
June	1.36 (1.29–1.43)	1.09 (0.85–1.40)	1.74 (1.60–1.89)	0.99 (0.90–1.10)
July	1.24 (1.17–1.30)	1.00 (0.78–1.29)	1.40 (1.29–1.53)	0.88 (0.79–0.97)
August	1.26 (1.20–1.33)	1.26 (0.98–1.62)	1.47 (1.35–1.60)	0.87 (0.78–0.96)
September	1.37 (1.30–1.45)	1.13 (0.88–1.45)	1.74 (1.60–1.89)	1.23 (1.12–1.36)
October	1.28 (1.21–1.35)	1.26 (0.98–1.61)	1.44 (1.32–1.56)	1.29 (1.17–1.42)
November	1.05 (0.99–1.11)	1.23 (0.95–1.57)	1.09 (0.99–1.19)	1.15 (1.04–1.27)
December	0.85 (0.80–0.90)	1.20 (0.93–1.54)	0.91 (0.83–1.00)	0.82 (0.74–0.91)
January	0.87 (0.82–0.92)	1.13 (0.88–1.45)	0.92 (0.84–1.01)	0.88 (0.79–0.98)
February	0.90 (0.85–0.96)	1.31 (1.02–1.68)	1.01 (0.93–1.11)	0.96 (0.86–1.06)
Pandemic Year 1				
March 2020	0.55 (0.50–0.61)	1.28 (0.89–1.80)	0.44 (0.37–0.54)	0.36 (0.28–0.45)
April 2020	0.53 (0.48–0.59)	1.12 (0.77–1.65)	0.44 (0.37–0.52)	0.21 (0.15–0.27)
May 2020	0.67 (0.62–0.73)	1.26 (0.87–1.86)	0.63 (0.55–0.71)	0.32 (0.26–0.39)
June 2020	0.87 (0.80–0.94)	0.98 (0.68–1.45)	0.74 (0.65–0.83)	0.83 (0.70–0.97)
July 2020	0.98 (0.90–1.05)	1.20 (0.83–1.77)	0.95 (0.85–1.07)	1.02 (0.87–1.19)
August 2020	0.98 (0.91–1.06)	1.11 (0.77–1.64)	0.92 (0.82–1.03)	1.05 (0.89–1.22)
September 2020	0.97 (0.90–1.05)	1.01 (0.70–1.49)	0.97 (0.87–1.08)	0.89 (0.77–1.02)
October 2020	0.87 (0.81–0.95)	0.83 (0.57–1.22)	0.90 (0.79–1.01)	0.57 (0.48–0.67)
November 2020	0.99 (0.91–1.08)	0.79 (0.54–1.16)	1.05 (0.92–1.19)	0.65 (0.55–0.76)
December 2020	1.18 (1.09–1.29)	1.07 (0.73–1.53)	1.06 (0.92–1.21)	0.70 (0.58–0.84)
January 2021	1.30 (1.20–1.41)	1.03 (0.71–1.52)	1.37 (1.21–1.55)	0.80 (0.67–0.95)
February 2021	1.10 (1.01–1.19)	0.65 (0.44–0.96)	1.06 (0.93–1.21)	0.70 (0.59–0.84)
Pandemic Year 2				
March 2021	1.24 (1.14–1.34)	1.32 (0.89–1.97)	1.42 (1.25–1.61)	0.92 (0.78–1.08)
April 2021	1.27 (1.17–1.37)	1.13 (0.77–1.69)	1.32 (1.17–1.49)	0.97 (0.83–1.13)
May 2021	1.16 (1.08–1.25)	1.00 (0.68–1.50)	1.22 (1.09–1.35)	0.94 (0.82–1.08)
June 2021	0.96 (0.89–1.04)	1.11 (0.76–1.65)	0.87 (0.78–0.98)	1.12 (0.97–1.30)
July 2021	0.98 (0.91–1.06)	1.25 (0.85–1.87)	0.95 (0.84–1.07)	1.11 (0.95–1.30)
August 2021	0.95 (0.87–1.02)	0.71 (0.48–1.06)	0.88 (0.78–1.00)	0.92 (0.78–1.09)
September 2021	1.07 (0.73–0.85)	1.10 (0.75–1.65)	0.68 (0.60–0.77)	0.92 (0.80–1.06)
October 2021	0.84 (0.78–0.90)	0.98 (0.67–1.46)	0.79 (0.69–0.89)	0.93 (0.80–1.07)
November 2021	0.98 (0.90–1.07)	1.02 (0.70–1.53)	0.99 (0.87–1.14)	0.99 (0.86–1.15)
December 2021	1.09 (0.99–1.19)	1.05 (0.72–1.57)	1.05 (0.91–1.21)	0.99 (0.83–1.17)
January 2022	0.84 (0.76–0.92)	1.04 (0.70–1.55)	0.77 (0.66–0.90)	0.61 (0.50–0.74)
February 2022	1.05 (0.96–1.15)	0.68 (0.46–1.02)	0.94 (0.82–1.08)	1.08 (0.92–1.25)

*Represents the average number of injury-related emergency department visits in March of the pre-pandemic period.

Pre-pandemic period: April 2016–February 2020.

CI = Confidence interval; IRR = Incidence Rate Ratio.

TABLE 2 Changes in monthly incidence of injury-related pediatric emergency department visits during the COVID-19 pandemic, overall and by age group

fewer organized sports, and reduced time spent outside the home during lockdowns. (6, 25, 26) Similarly, the increase in injury-related ED visits shortly after confinement periods may be explained by a sudden return to sport and activities after a prolonged period of inactivity and deconditioning. (27, 28) While the described trend was preserved across all three confinement periods, there was an additional peak in injury-related ED visits in the latter half of the second lockdown period (January 2021) which was not observed in the other two lockdowns. Although the etiology of this additional peak remains unclear, it could be related to the fact that the second confinement period was the only one during which schools remained opened, or that it was substantially longer than the other two. (18) With indoor gatherings being highly restricted during the holiday period, it is also possible that families increased their participation in outdoor activities and winter sports, resulting in an increase in pediatric injuries. This would be analogous to the increase in cycling-related injuries that was noted in the literature during the summer months of the first confinement period. (6)

Our results, and those of others, established that children from distinct age groups were affected differently by the pandemic. (6, 7) While monthly injury-related ED visit rates among preschoolers (0-4 years old) remained close to predicted levels, the initial decline in visits at the start of the pandemic was greater among teenagers (12-17 years old; -64%) than among school-aged children (5-11 years old; -56%). Similarly, the decrease in injury-associated ED visits to another tertiary pediatric ED in Montreal in the early pandemic period was found to be smallest in the 2-5-year-olds and greatest in the 12-17-year-olds. (6) Changes in the incidence of injury-related ED visits among school-age children and teenagers, but not preschoolers, during the pandemic demonstrate that the associated public health measures, including lockdowns, restriction from organized sport activities, and school closures, are a major contributor to the described fluctuations in pediatric injury.

The decrease in injury-related ED visits at the onset of the pandemic has been previously attributed to caregiver avoidance of the ED and an associated reduction

in presentations for minor injuries. (4) The proposed decline in presentations for minor injuries has been supported by studies demonstrating a reciprocal increase in relative injury severity in the early pandemic period, as measured by the acuity of presentation (Paed-CTAS level) and rates of hospitalization. (5, 24, 29) In contrast, we found no change from predicted in the rate of hospitalization due to injury at the onset of the pandemic (spring 2020), suggesting that the initial decrease in injury-related ED visits is unlikely to be driven by a reduction in low-acuity presentations.

The main strengths of our study include longitudinal data collection and the robustness of our findings, as exemplified by the results of our sensitivity analysis. We also evaluated changes in injury-related ED visits on a monthly rather than yearly basis, thus better delineating the impact of each period of the pandemic on pediatric injury and allowing for easier interpretation of the factors underlying these changes. Nonetheless, the single-center and administrative nature of our study has inherent limitations. Although our results reflect the experience of the largest tertiary pediatric center in Quebec, our findings may not be generalizable to other clinical settings or to other provinces where different public health measures were implemented to curtail the spread of COVID-19. In addition, injury-related ED visits are influenced by both the incidence of pediatric injury and health-seeking behaviours; however, their individual contribution cannot be disentangled. Lastly, our ability to collect detailed information on patient characteristics and types of injuries was limited by data availability and dependent upon the diagnostic criteria attributed in the ED.

5 | CONCLUSION

The impact of COVID-19 on pediatric injury extends well beyond the first few months of the pandemic. Public safety measures, including disruption of school and organized sports, appear to be associated with the observed fluctuations in pediatric injury-related ED visits. Our findings add to the growing body of evidence

demonstrating the multifaceted and long-term consequences of the pandemic and associated public health measures on the health and well-being of children. Understanding changes in the incidence of pediatric injury, both during confinement and in early de-confinement periods, may assist in the development of injury prevention strategies as well as help forecast resource needs.

REFERENCES

- Kruizinga MD, Peeters D, van Veen M, van Houten M, Wieringa J, Noordzij JG, et al. The impact of lockdown on pediatric ED visits and hospital admissions during the COVID19 pandemic: a multicenter analysis and review of the literature. *Eur J Pediatr*. 2021;180(7):2271-9. doi:10.1007/s00431-021-04015-0
- Olsen SJ, Azziz-Baumgartner E, Budd AP, Brammer L, Sullivan S, Pineda RF, et al. Decreased influenza activity during the COVID-19 pandemic-United States, Australia, Chile, and South Africa, 2020. *Am J Transplant*. 2020;20(12):3681-5. doi:10.1111/ajt.16381
- Most ZM, Holcomb M, Jamieson AR, Perl TM. A silver lining? Fewer non-severe acute respiratory syndrome coronavirus 2 respiratory viruses during the coronavirus disease 2019 pandemic. *J Infect Dis*. 2021;224(10):1751-5. doi:10.1093/infdis/jiab191
- Macy ML, Smith TL, Cartland J, Golbeck E, Davis MM. Parent-reported hesitancy to seek emergency care for children at the crest of the first wave of COVID-19 in Chicago. *Acad Emerg Med*. 2021;28(3):355-8. doi:10.1111/acem.14214
- Finkelstein Y, Maguire B, Zemek R, Osmanliu E, Kam AJ, Dixon A, et al. Effect of the COVID-19 pandemic on patient volumes, acuity, and outcomes in pediatric emergency departments: a nationwide study. *Pediatr Emerg Care*. 2021;37(8):427-34. doi:10.1097/pec.0000000000002484
- Keays G, Friedman D, Gagnon I. Pediatric injuries in the time of COVID-19. *Health Promot Chronic Dis Prev Can*. 2020;40(11-12):336-41. doi:10.24095/hpcdp.40.11/12.02
- Radhakrishnan L, Carey K, Hartnett KP, Kite-Powell A, Zwald M, Anderson KN, et al. Pediatric emergency department visits before and during the COVID-19 pandemic - United States, January 2019-January 2022. *MMWR Morb Mortal Wkly Rep*. 2022;71(8):313-8. doi:10.15585/mmwr.mm7108e1
- Haddadin Z, Blozinski A, Fernandez K, Vittetoe K, Greeno AL, Halasa NB, et al. Changes in pediatric emergency department visits during the COVID-19 pandemic. *Hosp Pediatr*. 2021;11(4):e57-e60. doi:10.1542/hpeds.2020-005074
- Sethuraman U, Kannikeswaran N, Singer A, Krouse CB, Cloutier D, Farooqi A, et al. Trauma visits to a pediatric emergency department during the COVID-19 quarantine and "stay at home" period. *Am Surg*. 2021;89(11):4262-70. doi:10.1177/00031348211047497
- Valitutti F, Zenzeri L, Mauro A, Pacifico R, Borrelli M, Muzzica S, et al. Effect of population lockdown on pediatric emergency room demands in the era of COVID-19. *Front Pediatr*. 2020;8:521. doi:10.3389/fped.2020.00521
- Raucci U, Musolino AM, Di Lallo D, Piga S, Barbieri MA, Pisani M, et al. Impact of the COVID-19 pandemic on the emergency department of a tertiary children's hospital. *Ital J Pediatr*. 2021;47(1):21. doi:10.1186/s13052-021-00976-y
- Rougereau G, Guedj R, Irtan S, Qasemyar Q, Vialle R, Langlais T. Emergency department visits for pediatric traumatic injuries during general confinement: a single-center study in an urban setting. *Arch Pediatr*. 2021;28(3):249-51. doi:10.1016/j.arcped.2021.02.012
- Dopfer C, Wetzke M, Zychlinsky Scharff A, Mueller F, Dressler F, Baumann U, et al. COVID-19 related reduction in pediatric emergency healthcare utilization - a concerning trend. *BMC Pediatr*. 2020;20(1):427. doi:10.1186/s12887-020-02303-6
- Sherman WF, Khadra HS, Kale NN, Wu VJ, Gladden PB, Lee OC. How did the number and type of injuries in patients presenting to a regional level I trauma center change during the COVID-19 pandemic with a stay-at-home order? *Clin Orthop Relat Res*. 2021;479(2):266-75. doi:10.1097/corr.0000000000001484
- Gouvernement du Québec [Internet]. Situation of the Coronavirus (COVID-19) in Montréal 2022; [cited 2023 Sept 4]. Available from: <https://santemontreal.qc.ca/en/public/coronavirus-covid-19/situation-of-the-coronavirus-covid-19-in-montreal/c43710>
- Drouin O, D'Angelo A, Gravel J. Impact of wait time during a first pediatric emergency room visit on likelihood of revisit in the next year. *Am J Emerg Med*. 2020;38(5):890-4. doi:10.1016/j.ajem.2019.07.005
- Gravel J, Manzano S, Arsenault M. Validity of the Canadian Paediatric Triage and Acuity Scale in a tertiary care hospital. *CJEM*. 2009;11(1):23-8. doi:10.1017/s1481803500010885
- Institut national de santé publique du Québec [Internet]. Ligne du temps COVID-19 au Québec: 2022 Oct 5; [cited 2025 Dec 17]. Available from: <https://www.inspq.qc.ca/covid-19/donnees/ligne-du-temps>
- Warren DW, Jarvis A, LeBlanc L, Gravel J. Revisions to the Canadian Triage and Acuity Scale paediatric guidelines (PaedCTAS). *CJEM*. 2008;10(3):224-43.
- Hawley S, Ali MS, Berencsi K, Judge A, Prieto-Alhambra D. Sample size and power considerations for ordinary least squares interrupted time series analysis: a simulation study. *Clin Epidemiol*. 2019;11:197-205. doi:10.2147/clep.s176723
- Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. *Int J Epidemiol*. 2017;46(1):348-55. doi:10.1093/ije/dyw098
- Choi A, Bae W, Kim K, Kim S. Impact of Covid-19 on the visit of pediatric patients with injuries to the emergency department in Korea. *Children*. 2021;8(7):568. doi:10.3390/children8070568
- Green RS, Butler MB, Kureshi N, Erdogan M. A retrospec-

tive evaluation of pediatric major trauma related to sport and recreational activities in Nova Scotia. *CJEM*. 2016;18(2):106-11. doi:10.1017/cem.2015.69

24. Goldman RD, Grafstein E, Barclay N, Irvine MA, Portales-Casamar E. Paediatric patients seen in 18 emergency departments during the COVID-19 pandemic. *Emerg Med J*. 2020;37(12):773-7. doi:10.1136/emered-2020-210273

25. Shack M, Davis A, Zhang E, Rosenfield D. Bicycle injuries presenting to the emergency department during COVID-19 lockdown. *J Paediatr Child Health*. 2022;58(4):600-3. doi:10.1111/jpc.15775

26. Heitz PH, Gravel J, Jourdain N, Hupin M, Nault ML. Are outdoor playgrounds the real culprit for elbow fractures in children? A lesson learned from COVID-19 sanitary measures. *Can J Surg*. 2023;66(3):E282-e8. doi:10.1503/cjs.022521

27. Bullock G, Prats-Urbe A, Thigpen CA, Boyer L, Varnado K, Pequette J, et al. The Impact of statewide limitations of practice on high school injury incidence during the COVID-19 season: an ecological study. *Sports Health*. 2022;14(5):656-64. doi:10.1177/19417381221106693

28. Wang C, Vander Voort W, Haus BM, Carter CW. COVID-19 and youth sports: what are the risks of getting back on the field too quickly? *Pediatr Ann*. 2021;50(11):e465-e9. doi:10.3928/19382359-20211019-01

29. Wells JM, Rodean J, Cook L, Sills MR, Neuman MI, Kornblith AE, et al. Injury-related pediatric emergency department visits in the first year of COVID-19. *Pediatrics*. 2022;150(4):e2021054545. doi:10.1542/peds.2021-054545