



Paediatric ED utilisation in the early phase of the COVID-19 pandemic

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ABSTRACT

Background Past epidemics, including influenza, have resulted in increased paediatric patient volume in EDs. During the early weeks of the COVID-19 pandemic, it was unclear how ED volume would be impacted in paediatric hospitals. The objective of this study was to examine differences in the international experience of paediatric ED utilisation and disposition at five different children's hospitals.

Methods We obtained data on ED volume, acuity level and disposition (hospitalisation and intensive care unit (ICU) admission) for the time period 1 December–10 August for the years 2017–2020 from hospitals in five cities (Boston, Massachusetts, USA; Singapore; Melbourne, Australia; Seattle, Washington, USA; and Paris, France). Per cent change was analysed using paired t-tests or Wilcoxon signed rank test.

Results Overall ED volume dramatically decreased in all five hospitals during the early months of COVID-19 compared with prior years. There was a more varied response of decreases in ED volume by acuity level, hospitalisation and ICU admission among the five hospitals. The one exception was a 2% increase in ICU admissions in Paris. As of August 2020, all hospitals have demonstrated increases in ED volume; however, they are still below baseline.

Conclusion Paediatric EDs in these five cities demonstrated differential decreases of ED volume by acuity and disposition during the early months of the COVID-19 pandemic.

INTRODUCTION

Past epidemics such as H1N1 have resulted in patient volume surges in the paediatric ED. Based on the early adult COVID-19 experiences in Asia¹ and subsequently around the world, the prevailing concern was the potential for paediatric hospitals to become overwhelmed. However, data on COVID-19 in children describe this disease as less prevalent and, overall, less severe than in adults.^{2,3}

The objective of this study was to examine differences in paediatric ED utilisation at major international children's hospitals in five cities during the COVID-19 pandemic.

METHODS

We obtained daily ED volume, ED acuity level, inpatient floor hospitalisation and intensive care unit (ICU) admission census data for the time periods of 1 December–10 August for the years 2017–2020 from five paediatric hospitals, chosen based on geography and pre-existing collaborations: Boston

Key messages

What is already known on this subject

- ▶ Paediatric ED volume surges have occurred in past epidemics (eg, H1N1). In the current COVID-19 pandemic, areas of high COVID-19 prevalence have experienced overwhelming ED volume and acuity in adults.

What this study adds

- ▶ This multisite, international study of paediatric EDs in five cities (Boston, Massachusetts; Singapore; Melbourne, Australia; Seattle, Washington; Paris, France) demonstrated dramatic decreases in ED volume from March to August of 2020 during the COVID-19 pandemic. The timing of these decreases varied and correlated with stay-at-home orders/advisories in those cities. The full extent or causes of these decreases will not be fully understood for months or years into the future.

Children's Hospital (Boston, USA), KK Women's and Children's Hospital (Singapore), The Royal Children's Hospital (Melbourne, Australia), Seattle Children's Hospital (Seattle, USA) and Hôpital Armand-Trousseau (Paris, France). The sources of the data were the electronic ED visit databases at the hospitals; therefore, there is a low likelihood for misclassification of visit type, duplicate visits or disposition category. The daily change average was calculated by comparing the 7-day rolling average of ED volumes for each hospital in 2019–2020 to the 7-day rolling average volumes over the equivalent time periods in 2017–2019. We performed descriptive statistics to depict per cent change with 95% CIs. Per cent change in ED volume by acuity level and disposition was analysed using paired t-tests or Wilcoxon signed rank, as appropriate ($p < 0.05$ statistically significant).

RESULTS

There were dramatic decreases in ED volume in all five hospitals at different times (**figure 1**). The initial decreases in Singapore (33% decrease in volume for February, 95% CI 29% to 35%) predated other settings by approximately 6 weeks and then levelled off. Singapore had a second drop nearly 2 months later when COVID-19 cases increased in Singapore, and a broader social isolation order was enacted (50% decrease in April, 95% CI 46% to 55%). In contrast, the other four cities did not experience a

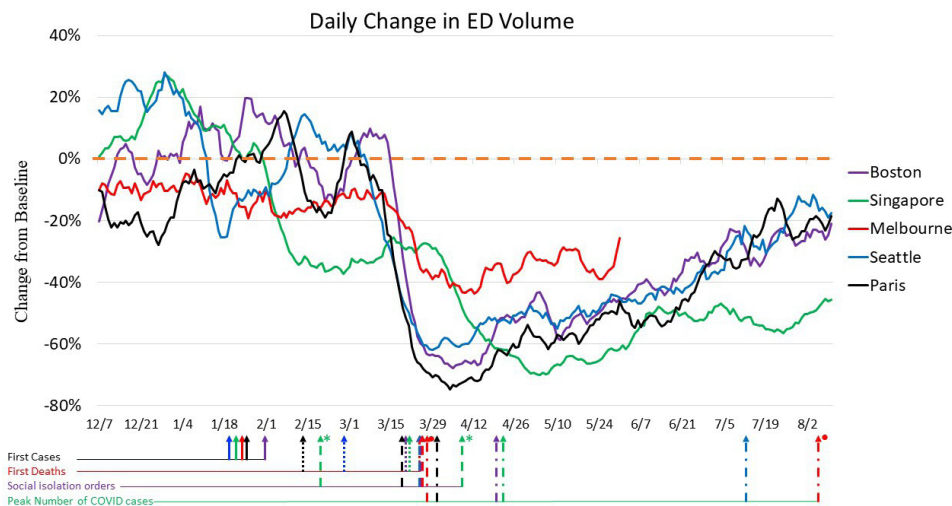


Figure 1 Percentage change of ED volume, comparing 2019–2020 visits to the average of the 2017–2018 and 2018–2019 periods; data averaged over prior 7 days to account for daily variability. *Singapore had initial 14-day stay-home notice for returnees from China (19 February) then circuit breaker for universal strict stay-home rules (7 April). •Melbourne with biphasic peaks. Melbourne data 15 March–31 May because of COVID-19 testing in ED beginning in June.

major drop in volume until March–April with a 73% decrease in Paris in April (95% CI 70% to 75%), 66% in Boston (95% CI 63% to 69%) and 59% in Seattle (95% CI 56% to 61%). Starting in late April (Boston, Seattle, Paris and Melbourne) or May (Singapore), all hospitals demonstrated increases in volume, although no hospital's ED volume returned to baseline (2017–2019 average volumes).

Changes in ED acuity, hospitalisations and ICU admissions demonstrated a more varied pattern. Overall, there were initial decreases in hospitalisations and ICU admissions at all sites, except for a 2% increase in ICU admission in Paris (table 1). Comparing the first 4 weeks (15 March–12 April) to the next 3 weeks (13 April–4 May), there were slight increases in admission rates compared with prior years in Boston and Seattle, but Singapore, Melbourne and Paris continued their decline in admission overall.

DISCUSSION

In this multisite international consortium of paediatric hospitals, we found substantial decreases in paediatric ED patient volume over the span of the initial 10–12 weeks of the COVID-19 pandemic, combined with decreased hospital and ICU admissions. These decreases occurred at all sites, despite varying stringency and timing of 'stay at home' directives in the five cities.⁴ Since the week of 12 April, all study hospitals, except Singapore,

started to see increases in ED volume, although volumes are still substantially below baseline. By August, ED volumes in all cities increased from their lowest volumes in March (Boston, Melbourne, Paris and Seattle) and May (Singapore). However, none have returned to their baseline, with Singapore still experiencing a near 50% decrease in patient volume. These data regarding declining ED volumes are consistent with a study in Italy.⁵ Decreased paediatric ED volume during an infectious epidemic was also noted during the SARS epidemic in Toronto in March–May 2003. ED volume did not return to normal until September of 2003, after the last reported case in June.⁶

In Seattle, the first COVID-19 infection was detected on 20 January,⁴ while the first patient in Singapore was detected on 23 January.¹ Singapore immediately started aggressive tracking and quarantine measures after the first case,⁷ and the ED volume started to decline about 1 week later. In contrast, Seattle's ED volume did not consistently begin to decrease until the beginning of March, 1 month after Singapore. Paris and Melbourne also exhibited decreasing volume in the beginning of March, followed by Boston about 1 week later. More widespread social distancing measures in the USA did not occur until 15 March when the CDC (Centers for Disease Control and Prevention) recommended halting all gatherings of 50.

Likely both psychology as well as pathophysiology contribute to the acute, and subacute, decreases in paediatric ED volume during COVID-19. People will initially hesitate to come to the ED for less acute conditions, as patients have vocalised concerns for potential exposure to COVID-19 in the hospital setting.⁸ Pathophysiology is also at play because social distancing decreases the prevalence of other, less acute, communicable disease as well as some types of injuries among children as they spend less time in cars and participating playing sports. In addition, hospital-level mitigation measures, including cancelling elective surgeries and outpatient visits, also contribute to overall decreased hospital utilisation, including return visits to EDs after a surgery.

There have concomitant decreases in ED visits for adults during the pandemic and concern that adult patients with serious illnesses are delaying care.⁹ Over time volumes are likely to return to normal. However, it is unclear how long this pandemic will last, and there is potential for surges to recur in a cyclical

Table 1 Per cent change in paediatric ED volume by acuity and disposition

Hospital city	ED acuity level*		Disposition from ED*	
	High acuity	Low acuity	Hospitalisations	ICU
Boston	-55	-60	-41	-12
Singapore	-63	-44	-49	-38
Melbourne	-40	-35	-32	-34
Seattle	-44	-58	-41	-36
Paris	-49	-70	-37	2

Comparison of ED patients from 15 March 2020 to 4 May 2020, compared with average of the same time periods in 2017 and 2019, using paired t-tests and Wilcoxon signed rank test.

*All data statistically significant at $p < 0.01$ value.

ICU, intensive care unit.

fashion. Paediatric EDs can work in the medical system to potentially offload paediatric patients from EDs who care for both adults and children. Use of paediatric resources as part of the approach in the larger medical system response is one strategy to consider.¹⁰

These data demonstrate paediatric EDs are differentially affected by the COVID-19 pandemic. Although we are seeing the short-term consequences now, there will be long-term clinical consequences from delayed care¹¹ and financial consequences from lost revenue from decreased patient volumes at the hospital.¹² The full extent of these effects will only be revealed in the coming months and years.

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