

Trends in Paediatric Emergency Medical Presentations

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Abstract

Aims

This study aims to quantify the trends in medical presentations to the Paediatric Emergency Department at University Hospital Limerick (UHL) from 2017 to 2022 inclusive, including the periods throughout social restrictions due to the Covid-19 pandemic.

Methods

This is a retrospective analysis of (N= 80,232) paediatric visits to a single paediatric Emergency Department [ED] between January 2017-December 2022 inclusive. Microsoft excel was used to categorize these data.

Results

Annual attendances were similar for each year of 2017-2019 and 2021 with a clinically meaningful decrease in 2020 and a clinically significant increase in 2022.

Within the category of the unwell child, there was a year-on-year decrease of forty-five percent in 2020 with a year-on-year increase in 2021 of thirty-four percent.

In the category of respiratory problems, there was a significant decrease in presentations from 994 in 2019 to 498 in 2020 with an increase in 2021 of fifty-one percent

Paediatric mental health visits significantly increased by twenty-five percent between 2019 and 2020.

The probable reasons for the decrease in paediatric ED presentations to UHL are multifactorial, including parental hesitancy, misunderstanding of public health measures and changes in health seeking. This study provides accurate data on the trend of paediatric presentations in a single representative paediatric ED of a paediatric population over 90,000.

Introduction

In early 2020, the novel coronavirus infectious disease (COVID-19), caused by SARS-CoV-2 virus, began to disseminate throughout the world¹. This caused the World Health Organization (WHO) to declare a pandemic on 11 March 2020. With growing concern over the spread of COVID-19, governments throughout the globe introduced public health measures in order to contain the virus such as social distancing and country-wide lockdowns². Coupled with public health campaigns discouraging unnecessary visits to hospitals, the government of Ireland imposed its countrywide stay-at-home order on 27 March 2020, imposing bans on non-essential travel and contact with others.

Historically, during pandemics, ED presentations decrease, with evidence of this during the H1N1 outbreak in Hong Kong, approximately two-thirds of people avoided going to hospital³. While decreased transmission of disease certainly accounts for a number of the decreased presentations, there is also worry that children are not presenting due to a change in behaviours and concerns of parents caused by the pandemic⁴. There have been cases of the avoidance of hospitals due to fear of attending and contracting COVID-19⁵. This can have significant implications for the health of children needing urgent care with an increase in complications associated with delayed care^{4,6}.

As lockdowns have been known to reduce the transmission of disease, it was not surprising to see a decrease in other transmissible diseases alongside COVID-19⁷. Transmissible disease accounts for a high percentage of emergency department (ED) visits and thus as lockdowns continued international reports described a reduction in overall presentations to paediatric EDs^{8,9}.

The purpose of this study is to quantify the impact of COVID-19 on the trend in total presentations to the Paediatric ED at University Hospital Limerick (UHL). A study of the factors leading to decreased presentations and the outcomes of delayed presentations is beyond the scope of this study.

The Paediatric ED at UHL is the only ED for paediatric medical presentations in the University of Limerick Hospital Group (ULHG) and under the clinical governance of the department of paediatrics. It provides the only first point of emergency hospital contact for paediatric medical presentations to hospital throughout the catchment area of this hospital group, which includes Limerick City and County, County Clare and North County Tipperary. ULHG Paediatric ED is co-located with an adult ED. Children presenting to ED are triaged as medical or surgical/trauma. This report pertains to children triaged as medical presentations. Census Data from 2022 shows that this covers a total paediatric population of 98,106 under the age of 16¹⁰. This study does not include trauma or surgical presentations to the Paediatric ED.

Methods

This study was a retrospective analysis of prospectively collected data in a single centre conducted on medical presentations to the Paediatric Emergency Department at the UHL. UHL paediatric ED covers a catchment area of Limerick, Clare and North Tipperary. Census Data 2020 shows that this covers a total paediatric population of 98,106. This study received formal ethical approval from the local research ethics board (REC ref; 008/2022). Graphical and statistical analysis included medical paediatric emergency presentations from January 2017 to December 2022. This study size encompassed the 3 years prior to the onset of COVID 19 (2017-2019), covering the various phases of lockdowns (2020) up to the end of 2022 (at time of collection). This identified baseline yearly trends before the onset of the lockdown in March 2020. In this study, we used the calendar year (January to December) rather than from the beginning of the lockdown (March 2020) to maintain homogeneity between all of the 6 years. This study used the STROBE checklist for cohort studies to ensure inclusion of full information (Appendix A).

Data from the paediatric ED was collected manually from non-identifiable monthly patient data reports and stored on Microsoft Excel spreadsheets. These contained the total number of admitted and non-admitted patients, the total number of patients presenting and the triage category these patients presented in. At the point of triage, the triage nurse assigns the patient to a presenting complaint category, based on a pre-existing system that has been in place for some time. Based on these categories, data pertaining to individual children were entered into Microsoft excel. When each individual child presents to Paediatric ED and is triaged as a medical presentation, they are assigned to pre-defined categories based on their presenting complaint. ULHG supported this study with no external state funding. Potential bias was addressed through the use of this anonymised data.

Emergency presentations were coded according to the presenting complaint at the point of triage, and were then grouped into categories from January 2017 to December 2022 and tabulated; a list of 15 medical emergencies were included. The data was organised into yearly trends to determine how COVID-19 impacted total medical presentations. The groups were then compared in terms of monthly changes in total presentations.

Using Microsoft excel, repeated measures ANOVA were conducted to test for statistically significant differences between the time periods. Two-tailed, paired samples T-tests were conducted for 2019 and 2021 comparing the same months on record to measure for any significant difference in medical presentations: this was to explore if there was a return to baseline in presentations after the cessation of lockdowns.

'Abdominal pain', 'Respiratory problems', 'The unwell child' (as an undifferentiated presentation) and paediatric 'Mental health', each as a subset of paediatric presentations, were analysed using repeated measures ANOVA across the three time periods. Independent samples T-tests were used for a comparison between 2019 and 2021 was to establish if there was a return to baseline (pre-Covid) in these medical presentations.

Results

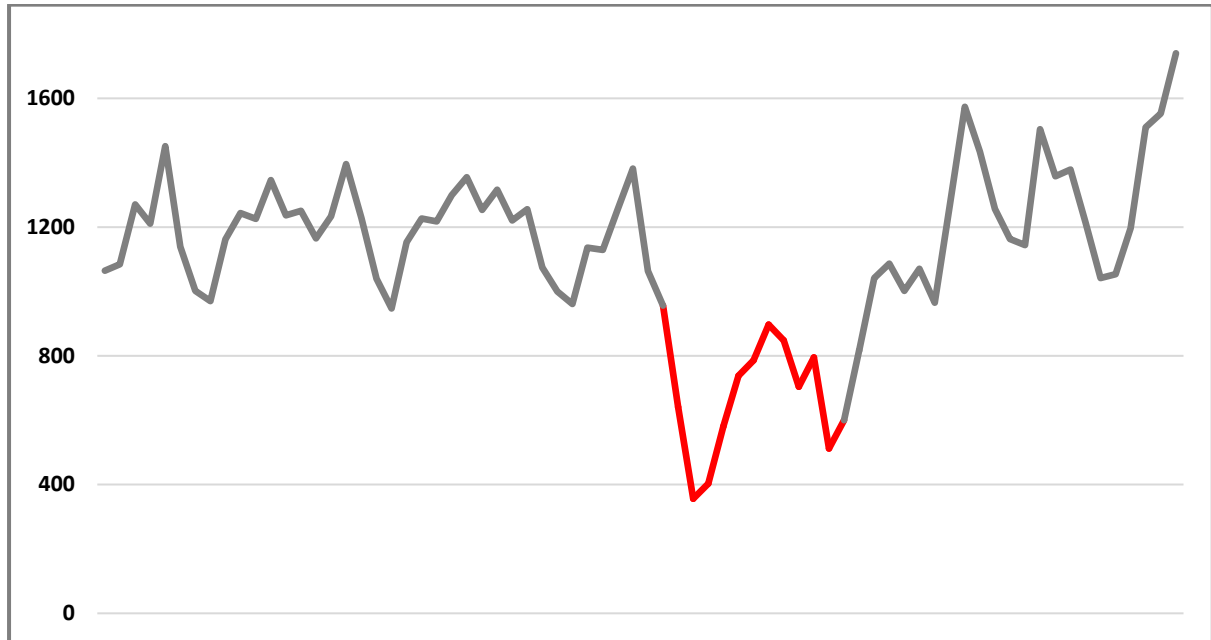
Overall trends

The total number of medical attendances from 2017 to 2022 was 80,232 patients. Annual breakdown was 2017 (N=14,170) 2018 (N= 14,394), 2019 (N = 14,338), 2020 (N = 8769), 2021 (N= 12,625) and 2022 (N = 15, 936) (see Graph 1). Annual attendances were similar for each year on record with a significant decrease for the corresponding time period of 2020. There were 38.8% fewer emergency presentations in 2020 than in 2019 with a 30.9% rebound from 2020 to 2021 with a further 25.6% increase in 2022.

Using a one-way repeated measures ANOVA to compare differences in presentation pre, during and post Covid, there was a statistically significant difference between the time periods ($F = 2.9104$, $p < 0.001$).

Using independent samples T-tests to compare 2 time points, there were also 3 significant results within these trends. There was a significant decrease in medical presentations when comparing the total presentations from the year 2019 to 2020 (N= 14338, $p = 0.00$, $p < 0.05$) with a significant rebound in presentations between 2021 and 2020 (N= 8769, $p = 0.02$, $p < 0.05$) and a further significant increase between 2021 and 2022 (N= 12,625, $p = 0.01$, $p < 0.05$). There was no significant difference between 2019 (before social restrictions N= 14338) and 2021 (after social restrictions N= 12625), $p = 0.20$, $p > 0.05$

*Graph 1: Total Paediatric Emergency Department Presentations 2017-2022
January 2017 to December 2022 (March 2020 to February 2021 highlighted in red*)*



*Table 1. Total monthly presentations March 2019 to February 2021
* covering 3 waves of COVID 19 and subsequent lockdowns*

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Mar 2019 to Feb 2020	1316	1221	1255	1074	1000	961	1136	1129	1256	1382	1064	956
Mar 2020 to Feb 2021	641	356	403	581	738	786	897	848	704	795	512	600
YoY %	-51.3%	-70.8%	-67.9%	-45.9%	-26.2%	-18.2%	-21.0%	-24.9%	-43.9%	-42.5%	-51.9%	-37.2%

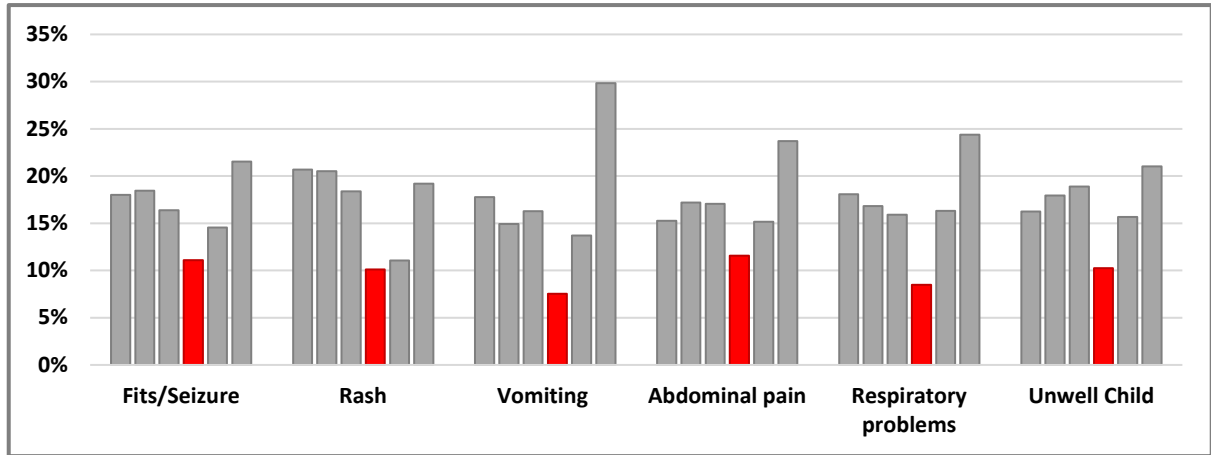
Source of Variation	F	P-value
Columns	14.9664907	2.9104E-09

Medical Conditions

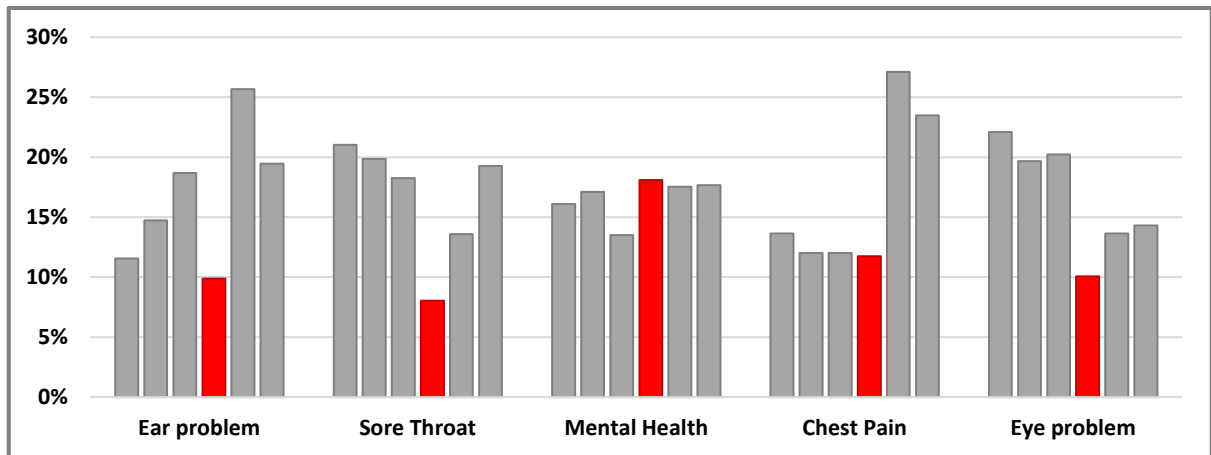
Medical presentations followed a similar trend, decreasing in number from 2019 to 2020. There were three subcategories that increased from 2019 to 2020. These included 'skin infections', and 'urinary issues' and 'mental health', the latter comprising the majority of cases of increased presentations to Paediatric ED in this time period. Presentations in these categories increased 41.67%, 4.35% and 25.4% from 2019 to 2020 respectively

Graph 2: Medical Conditions of Paediatric Emergency Presentations 2017-2022
Comparing annual presentations to 2020

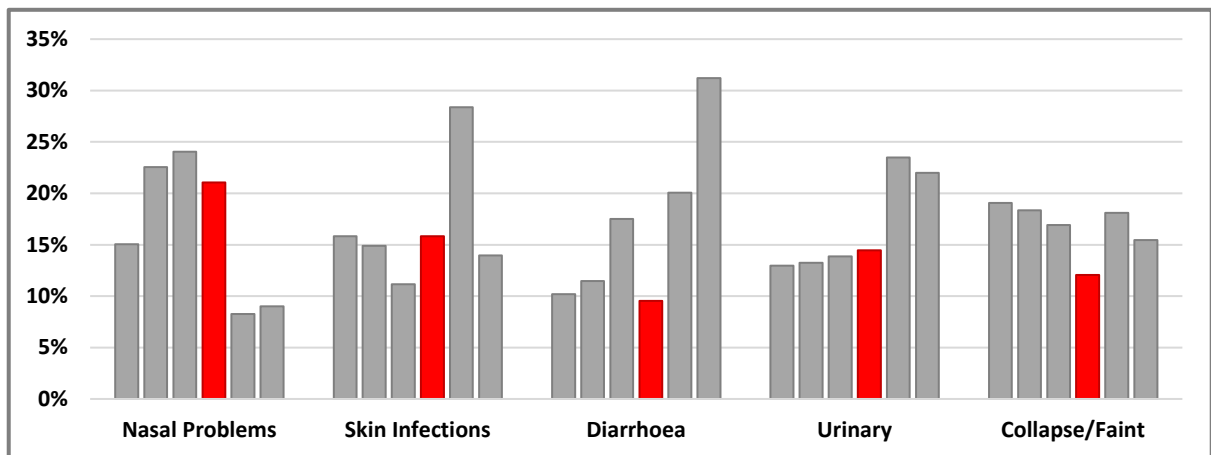
>= 1400 total presentations



>= 500 & < 1400 total presentations



< 500 total presentations



Comparing the relative presentation change in medical conditions from 2019 to 2020

Medical Condition	2019	2020	YoY Change*
Nasal Problems	32	28	-14.3%
Skin Infections	24	34	29.4%
Diarrhoea	55	30	-83.3%
Urinary	46	48	4.2%
Collapse/Faint	70	50	-40.0%
Ear problem	123	65	-89.2%
Sore Throat	125	55	-127.3%
Mental Health	94	126	25.4%

Medical Condition	2019	2020	YoY Change
Chest Pain	89	87	-2.3%
Eye problem	215	107	-100.9%
Fits/Seizure	232	157	-47.8%
Rash	405	223	-81.6%
Vomiting	385	178	-116.3%
Abdominal Pain	726	492	-47.6%
Respiratory Problems	994	531	-87.2%
Unwell Child	6165	3341	-84.5%

*Year on Year change

Presentations in bold highlight the presentations which increased in the time frame

Abdominal pain

A one-way repeated measures ANOVA was performed to compare the effect of pre, during and post Covid on Abdominal pain presentations to the paediatric ED. This revealed that there was a statistically significant difference between at least two time periods ($F = 14.69157$, $p < 0.001$)

Based on the independent samples t test, there was no significant result between the years of 2020 and 2021 ($p = 0.08$, $p < 0.05$) although the total presentations increased in that time from 492 to 645. Furthermore, there was no significant difference between presentations between 2019 ($n = 726$) and 2021 ($n = 645$).

Source of Variation	F	P-value
Columns	14.6915761	3.86E-09

Unwell child

A one-way repeated measures ANOVA was performed to compare the differences pre, during and post Covid on the presentation of 'The Unwell child'. This showed a statistically significant difference between at least two time periods ($F = 11.64823$, $p < 0.001$).

There was no significant difference between total presentations of the unwell child between 2019 ($n = 6165$) and 2021 ($n = 5113$), $p = 0.16$, > 0.05 .

Source of Variation	F	P-value
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Columns 11.6482683 1.065E-07

Mental Health

These encompassed deliberate self-harm (DSH), overdose and other psychiatric problems. A one-way repeated measures ANOVA was performed to compare the effect of pre, during and post Covid on Mental health presentations to the paediatric ED. This revealed that there was a statistically significant difference between at least two time periods ($F = 0.68387$, $p < 0.05$). There was also a 25.4% increase in presentations between 2019 and 2020 during governmental social restrictions.

<i>Source of Variation</i>	<i>F</i>	<i>P-value</i>
Columns	0.68638734	0.63575137

Respiratory

A one-way repeated measures ANOVA was performed to compare the differences pre, during and post Covid on the Respiratory presentations to the paediatric ED. Results showed statistically significant differences between at least two time points ($F = 7.74706$, $p < 0.001$). Furthermore, there was no significant difference between total presentations for respiratory problems in 2019 ($n = 994$) and 2021 ($n = 1021$), $p = 0.90$, $p > 0.05$.

<i>Source of Variation</i>	<i>F</i>	<i>P-value</i>
Columns	7.74705569	1.4231E-05

Discussion

The decision to seek healthcare is complex and requires parents to weigh up numerous factors regarding their child's need for healthcare including the risk of their child catching COVID-19 and listening to government public health advice¹¹. In this study there were 38.8% fewer total emergency admissions during 2020 compared with the same period in 2019 (before lockdown). This implies that fewer children were brought to hospitals for emergency concerns.

This study referred only to data at the time of presentation to the paediatric ED not to information at the time of discharge from the paediatric ED. Our data has shown statistically significant differences between the three time points with decreases in total paediatric presentations to the emergency department between 2019 and 2020 and re-increase between 2020 and 2021. This can be attributed to the beginning of lockdowns in Ireland in March 2020 and subsequently to reintegration following the cessation of lockdowns. A previous study has shown that almost 10% of parents who believed their child needed healthcare during the pandemic did not attend¹². These trends may be due to the lockdowns leading to a decrease in help seeking behaviours^{4, 13}, it may also indicate hospital avoidance due to concerns about contracting COVID-19, or a belief that health services were unavailable¹². Misunderstanding of governmental guidelines may have played a larger role in the pandemic with parents who were more concerned regarding Covid19 3.4 times more likely to misunderstand¹². The factors that might explain the changes in presentations are beyond the scope of this study.

The unwell child accounted for the vast majority of presentations every year on record. This was removed from graph 1 due to the overrepresentation of the unwell child in the years analysed. The unwell child presentation also followed the trend of a significant decrease in 2020 from 2019 (45.8%) with a rebound in 2021 of 34.4% and increasing further in 2022 of 35%. As these were classified on initial presentation, it is possible the unwell child encompassed many of the other conditions analysed.

Respiratory problems, especially in light of the pandemic, showed a significant decrease in lockdown year (2020) over the preceding year (2019). This can be attributed to the beginning of lockdowns and the decrease in interactions between the population. This is in line with a recent study of 27 centres across 14 European countries where several non-pharmaceutical interventions such as lockdowns, school closures and face masks were associated with decreased incidences of bronchiolitis from January 2018 to March 2021¹⁴. Between the same months of 2020 and 2021, these figures more than doubled highlighting the significant bounce back of respiratory presentations to the emergency department.

The decrease in 'abdominal pain' presentation by 40.3% in 2020 compared with 2019 is consistent with other studies that showed a decrease in ED gastrointestinal presentations during Covid-19¹⁵. Appendicitis is the most common abdominal surgical emergency and prehospital delay is a risk factor in increasing morbidity and mortality¹⁶. Delayed presentations to healthcare can have serious complications for conditions where a child may have a rapid and serious deterioration⁴. Studies have also described decreased rates of intussusception presentations which could be due to patient fear of contracting the virus in public places and due to mass media campaigns by the government to stay at home¹⁷. There have been contradictory conclusions regarding hospital presentations with one study

showing that although overall presentations decreased, presentations that required surgical intervention remained stable⁷. One study of 39 paediatric ED's across Europe highlighted no major service change across Europe with no relation between the peak incidence rates of Covid 19 and hospital change in departments¹⁸. A comment on surgical presentations to ED is beyond the scope of this study, as only medical triage cases are included.

Finally, despite overall data showing a significant decline during social restrictions in 2020, mental health presentations increased by 25.4% (from 94 to 126) after a decline in 2019 from 2018 and levelling off to a higher baseline. Irish data in this area has shown a rise in anxiety, depression and overall stress in children and adolescents with the largest increase in youth presentations for mental health in September to December and a return to pre Covid baseline in January 2021¹⁹. These presentations disproportionately affected females with the largest increases for anorexia nervosa, anxiety and other eating disorders¹⁹. Similarly, an Irish study focusing on paediatric mental health presentations in the greater Dublin area (paediatric population of 430,000) found that although overall ED attendances decreased, mental health presentations underwent a sustained increase after an initial reduction during the first lockdown²⁰.

The categories which were used for the presentations of children presenting to Paediatric ED were based on categories that are in ongoing use at ULHG. Analysis of discharge diagnosis from Paediatric ED or discharge destination were beyond the scope of this study. This study has similarities to the HRB CUPID study during the same time period which looked at measures that were introduced during COVID that may have had an impact on hospital avoidance for non-COVID related illnesses as has been evidenced in previous pandemics such as SARS and MERS²¹. However, while there are other similar studies from other institutions, this is the first study to examine trends in presentations to Paediatrics ED in Ireland before, during and after Covid-19.

A limitation of this study is that it was based on data collected from one hospital in Limerick and with medical paediatric emergency department presentations and not pertaining to all children attending the emergency service across the hospital, thereby leading to selection bias. A larger study involving a more representative cross section of hospitals would yield a greater contribution to understanding the reasons of the decrease in patient presentations to the ED during this time. Nonetheless this is the only Paediatric ED in the ULHLG and thus is representative of the pattern of presentations in the wider group.

Furthermore, categorisation in this study was not standardised but it is the categorisation that is used in triage on an ongoing basis. However, the large numbers of presentations mitigate this limitation.

A second limitation is that only data on the initial presentations are recorded rather than data on diagnosis at discharge. Due to this, it is possible that many respiratory presentations were assigned as 'unwell child'. However, the large numbers of presentations mitigates this limitation.

A third limitation is that the severity of illness or proportion of children requiring hospital admission is beyond the scope of this study, but would be worthy of further analyses in a future report.

A strength of this study is the very high number of presentations studied which is representative of the paediatric population during this time, and that these presentations represent medical paediatric ED presentations to this hospital group during this time frame.

As we enter into another stage of Covid, this analysis of the virus' effect on ED presentations is important in order to limit prehospital delay in emergency events, an important avenue for further research. Furthermore, analysis of how to conduct public health messages in the most appropriate manner should be studied. These data, while collated and analysed in a single hospital group, should be generalisable to paediatric ED presentations nationally.

Declaration of Conflicts of interest:

None declared.

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Appendices:

Appendix A

STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	
Introduction			
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses	
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)
Outcome data	15*	Report numbers of outcome events or summary measures over time
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

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