

Rationalizing the Pediatric Emergency Department Workload: An Epidemiological Profile of Presentations Before and During the COVID-19 Pandemic

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Abstract

Background: Infectious respiratory disease in children provides a significant seasonal workload burden to pediatric emergency departments. Studies from the southern hemisphere during the first wave of coronavirus (COVID-19) had shown a decrease in seasonal pediatric respiratory infections. During the COVID-19 pandemic, predicted drops in infectious diseases circulating in children led to redeployment of junior doctors in pediatric services to adult services. **Methods:** We extracted data on children presenting to a tertiary emergency department with a respiratory illness, comparing winter 2019-2020 (pre-COVID-19) to winter 2020-2021 (during-COVID-19). We compiled demographic and epidemiological data and compared the two groups with regards to number and type of infectious respiratory presentations, admissions, days spent in hospital, and whether intensive or high-dependency support was required. **Results:** We have found a reduction in respiratory disease presentations during-COVID-19 compared to pre-COVID-19. These patients were more likely to be admitted but their stay was reduced, and there was a trend towards a reduction in requirement for intensive or high-dependency support during their admission. **Conclusion:** This work supports the redeployment of junior doctors in pediatric departments to adult departments given increased demand in other areas of medical care at that time. In view of the changing landscape, we suggest the introduction of a flexible staffing format to ensure adequate support to areas with higher demand.

Key Words: COVID-19; Workforce; Workload; Communicable Diseases; Respiratory Tract Diseases (Source: MeSH-NLM).

Introduction

On Wednesday 11th March 2020, the World Health Organization declared a global pandemic of coronavirus (COVID-19),¹ resulting in large-scale changes in behavior in the United Kingdom and globally. Decrease in attendance at pediatric emergency departments (PED) occurring in line with social distancing and stay-at-home orders has been well documented,²⁻⁴ and is thought to be due to a reduction in other transmissible infections. Typically, winter is the busiest time of year for pediatric departments, with an increase in children and young people (CYP) presenting with communicable respiratory disease such as croup, bronchiolitis and viral-induced wheeze (VIW).⁵⁻⁷ However, the changes in behavior caused by stay-at-home restrictions were thought to have led to a reduction in the incidence of typical seasonal infections, which particularly affect CYP.

As such, prior to an anticipated increase in COVID-19 infections and hospital presentations in winter 2020-2021, experience of decreased pediatric presentations²⁻⁴ associated with peaks of COVID-19 infection meant that junior doctors (particularly

foundation and early specialty trainees) on pediatric rotations in the UK were amongst the lowest priority groups to remain on scheduled rotations, and amongst the first to be re-deployed to help with the anticipated increase in COVID-positive adult patients.⁸

In this study, we characterize the changes in population attending the PED of a tertiary-level pediatric hospital in the UK for respiratory complaints between the 2019-2020 and 2020-2021 winters, as well as an overview of the resultant clinical workload in terms of admissions and treatment escalation to the pediatric intensive care unit (PICU). We aim to provide information in order to further rationalize the redeployment of junior medical personnel in future pandemic situations whilst ensuring adequate staffing is maintained for the care of CYP.

Methods

We analyzed respiratory disease presenting to the PED of a tertiary hospital in November-February of 2019-2020 (henceforth referred to as winter pre-COVID-19) and November-February

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2020-2021 (henceforth referred to as winter during-COVID-19). We manually searched these records and included patients with clinical respiratory diagnoses on their discharge summaries of likely infectious etiology (bronchiolitis, croup, viral-induced wheeze, upper respiratory tract infection, lower respiratory tract infection and asthma exacerbation). We excluded patients with uncertain diagnoses, non-respiratory pathology and non-communicable causes of respiratory pathology (for example, foreign body inhalation and panic attacks). The STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) checklist⁹ was used to ensure study quality.

Analysis of respiratory presentations was conducted within Prism. Respiratory presentations were assessed as a proportion of total presentations to the PED and will be presented as % (n, males) unless specified otherwise. A Fisher's exact test was used to analyze whether there was a significant relationship between either presentations or admissions and the year. The effect of these relationships was estimated using an odds ratio. Results are presented with 95% confidence intervals (95% CI).

Analysis of demographic changes was conducted in Microsoft Excel using paired T-test analysis assuming unequal variance (age) and two sample Z test analysis (proportion of respiratory admissions where the patient had previously required high dependency unit (HDU)/ICU care).

Results

There was a 45.9% decrease in presentations to the PED, with the total number of presentations during winter pre-COVID-19 being 7,789 and 4,210 presentations during during-COVID-19 (**Table 1**). Of these presentations, 21.4% (n=1,666, m=1,003) were due to respiratory illness in winter pre-COVID-19 and 7.0% (n=296, m=196) were due to respiratory illness in winter during-COVID. Presentations are presented by discharge diagnosis in **Table 2**. Children presenting during-COVID-19 were significantly less

likely to have a respiratory illness than those pre-COVID-19 (95% CI 0.24-0.32, $p < 0.0001$). We analyzed the clinical need of respiratory presentations by looking at number of admissions, duration of stay, and requirement for escalation to pediatric intensive care unit (PICU). Pre-COVID-19, 34.1% of presentations of respiratory illness (n=568) led to admission with a mean duration of stay of 2.14 nights (**Table 1**). During-COVID-19, although the number of admissions decreased to 164, the proportion requiring admission increased to 55.4% (**Table 1**). This relationship was statistically significant with patients presenting during during-COVID-19 being 2.4 times more likely to be admitted (95% CI 1.87-3.08, $p < 0.0001$, **Table 3**).

During-COVID-19, the mean duration of stay decreased to 1.62 nights, and the proportion requiring escalation to intensive care unit (ICU) decreased from 5.1% of respiratory admissions pre-COVID-19 to 3.0% of respiratory admissions during-COVID-19.

We also analyzed patients attending the PED due to respiratory illness in terms of age and prior requirement for HDU/ICU care for a respiratory complaint. We found that there was no significant change ($p=0.178$) in terms of mean age at presentation (pre-COVID-19 = 2.56 years; during-COVID-19 = 2.82 years). In terms of prior HDU/ICU care for a respiratory complaint, 4.1% of patients pre-COVID-19 had received this care (n = 68), whilst during-COVID-19 5.4% of CYP attending for a respiratory illness had previously required HDU/ICU support (n = 16). This was not a statistically significant difference ($p=0.43$).

Discussion

Our data show a significant decrease in presentations at a PED during winter 2020-2021 compared to winter 2019-2020. There was a reduction in the number of children attending the PED, and a lower proportion attending with a respiratory illness. The winter of 2020-2021 occurred after the onset of the COVID-19 pandemic

Table 1. Respiratory Presentations to the Emergency Department (ED) Pre-COVID-19 and During-COVID-19.

Month	Year	All ED Presentations (n)	Infectious respiratory presentations (% of total presentations)	Respiratory presentations leading to admission (%)	Mean length of admission (days)
Total	2019	7789	1666 (21.4)	568 (34.1)	2.14
	2020	4210	296 (7)	164 (55.4)	1.62
November	2019	2140	456 (21.3)	128 (28.1)	1.90
	2020	1287	123 (9.6)	89 (72.4)	1.59
December	2019	2189	589 (26.9)	192 (32.6)	2.29
	2020	1103	86 (7.8)	50 (58.1)	1.62
January	2020	1772	343 (19.4)	136 (39.7)	2.17
	2021	886	36 (4.1)	13 (36.1)	1.85
February	2020	1688	278 (16.5)	112 (40.3)	2.14
	2021	934	51 (5.5)	12 (23.5)	1.50

Table 2. Demographics of Children and Young People Presenting to ED with Respiratory Illness.

Season	Diagnosis	Number of admissions (%)	Mean Age		Sex (n)	
			Months	Years	Male	Female
19/20	Total	1666	30.76	2.56	1003	663
	Asthma Exacerbations	51 (3.1)	117.04	9.75	30	21
	Bronchiolitis	416 (25.0)	5.62	0.47	259	157
	Croup	222 (13.3)	34.74	2.90	145	77
	Lower respiratory tract infection (LRTI)	211 (12.7)	45.03	3.75	112	99
	Upper respiratory tract infection (URTI)	436 (26.2)	34.35	2.86	249	187
	Viral induced wheeze (VIW)	300 (18.0)	32.40	2.70	188	112
	Other	30 (1.8)	48.60	4.05	9	2
20/21	Total	296	33.84	2.82	196	100
	Asthma Exacerbations	16 (5.4)	130.34	10.86	8	8
	Bronchiolitis	28 (9.5)	7.14	0.60	19	9
	Croup	23 (7.8)	23.15	1.93	16	7
	Lower respiratory tract infection (LRTI)	10 (3.4)	25.38	2.12	7	3
	Upper respiratory tract infection (URTI)	71 (24.0)	15.82	1.32	50	21
	Viral induced wheeze (VIW)	137 (46.3)	36.13	3.01	88	49
	Other	11 (3.7)	98.10	8.18	5	3

in March 2020, and during the second wave of COVID-19 infections and resulting hospitalizations in the UK adult population. This reduction in presentations reflects recent data from Brueggeman et al,¹⁰ demonstrating that in the adult population, non-COVID-19 transmissible bacterial disease dramatically decreased in the face of social distancing and increased hygiene measures. During this period, junior doctors were redeployed from pediatric to adult wards to assist with the care of COVID-positive patients.

One caveat to this support for reduction in pediatric staffing would be that a greater proportion of respiratory presentations at PEDs did require admission. Although there were a much smaller number of admissions compared to the previous (pre-COVID) winter, we suggest that this underlines the need to maintain senior staff support on pediatric wards to provide quality care for those CYP requiring admission. Flexible staff redeployment must also be a possibility given that the summer of 2021 has seen an increased demand for pediatric services and

EDs, with a significant burden of disease that is typically considered to be winter seasonal disease, for example viral-induced wheeze.^{11, 12}

A limitation of this study would be that it only reviews the patient profile at one tertiary-level ED; COVID-19 prevalence levels did vary between regions, leading to regional changes in social restrictions which could impact patient presentation at EDs. However, by the start of this study restrictions were in place on a national as opposed to local basis. Restrictions also varied by country, which emphasizes the need for research from multiple healthcare providers internationally to enable a comprehensive evaluation of changes in presentation behavior associated with COVID-19.

Another limitation of this study is that it does not completely provide an overview of why there was a reduction in presentations. Were the same number of children ill, but parents/caregivers were less likely to bring children to ED given

Table 3. Statistical Analysis Comparing Winter Pre-COVID-19 (November 2019 – February 2020) and During-COVID-19.

Period	Analysis of infectious respiratory presentations p-value (95% CI)	Analysis of respiratory presentations leading to admission p-value (95% CI)
Total	p < 0.0001 (0.24-0.32)	p < 0.0001 (1.87-3.08)
November	p < 0.0001 (0.32-0.48)	p < 0.0001 (4.32-10.42)
December	p < 0.0001 (0.18-0.29)	p < 0.0001 (1.81-4.56)
January	p < 0.0001 (0.12-0.24)	p = 0.72 (0.43-1.72)
February	p < 0.0001 (0.22-0.40)	p = 0.027 (0.24-0.88)

Legend: A Fisher’s exact test was used to analyse whether there was a significant relationship between either presentations or admissions and the year. The effect of these relationships was estimated using an odds ratio. Results are presented with 95% confidence interval.

concerns around COVID-19 transmission in a hospital setting? A piece of our data supporting this would be the increase in the proportion of children presenting who were then admitted, indicating that in the pre-COVID-19 winter there was perhaps a tendency to present to ED more readily, with children being less unwell at presentation. However, this is not then mirrored in the length of stay or an increased requirement for HDU/ICU support in children admitted during-COVID. It is worth considering that medical staff and parents/caregivers may also have been more supportive of earlier discharge given concerns about transmission of COVID in a hospital setting. This would require more qualitative research to elucidate, but we note that by the time of winter during-COVID-19, it was widely accepted that CYP rarely suffered significant consequences from a COVID-19 infection.

A more likely explanation could be that there was overall a reduction in respiratory illness in CYP in the during-COVID-19 due to increased hygiene measures and reduced social contact, with there being less illness overall. This is supported by the recent surge in childhood infectious respiratory illness, particularly respiratory syncytial virus (RSV), in the summer of 2021.^{11,12} Our analysis of PED attendances supports the

redistribution of junior medical staff when necessary and suggests that a significant factor underpinning the overall decrease in attendance at PED was the decrease in infectious respiratory disease presentations. We suggest a system of flexible staffing to manage the changing demographic of respiratory presentations during and after the COVID-19 pandemic. Pediatric doctors have been working intensively throughout the pandemic, and we highlight the need to be cautious in redeployment of pediatric junior doctors, so that children are not harmed and continue to receive excellent care.

An area for future research would be exploring the reasons behind a reduction in ED presentation, including comparison of community healthcare consultation frequencies with ED presentations to determine whether anxiety about hospital-related COVID-19 transmission had a role in the reduction in ED presentations seen in this study. In the long-term, research into this area may have the potential to inform care-seeking behavior modification strategies by further understanding drivers for presentation at community- or hospital-based healthcare settings.

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