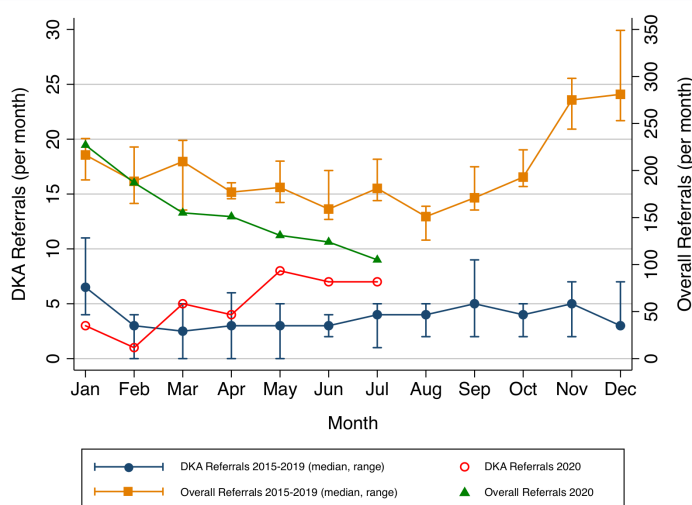


Paediatric critical care referrals of children with diabetic ketoacidosis during the COVID-19 pandemic

Child health practitioners in the UK and internationally have voiced concerns that restrictions and measures introduced to combat the COVID-19 pandemic may be causing unintended adverse consequences for the health and social well-being of children. Initial reports suggested a significant reduction in the utilisation of healthcare services by children during the pandemic, raising concerns about late presentation of children with serious illness.¹ In a national survey of UK paediatricians, 32% of clinicians reported having witnessed delayed presentations to emergency care over a 2-week period in April 2020.² The most frequently reported delayed presentation was new diagnosis of diabetes mellitus. Analysis of children newly diagnosed with type 1 diabetes in Germany identified that between March and April 2020, a significantly greater proportion of cases presented with diabetic ketoacidosis (DKA) (45%) when compared with corresponding periods over the previous 2 years (24%).³

Here, we report the frequency of referral of children with DKA to a regional paediatric critical care advice and transport service in the UK, before and during the COVID-19 pandemic. We also report overall referral activity to the service during these periods for comparison. We

Figure 1 DKA referrals and overall referrals by month, comparing 2020 with the preceding 5 years.



included all children up to 15 years of age with a confirmed diagnosis of DKA (based on national criteria).⁴ Two children referred from overseas for repatriation to the UK were excluded.

Thirty-one children were referred with DKA between March and July 2020, compared with a median of 12 (range 11–20) over corresponding months in the preceding 5 years (figure 1). In comparison, overall referrals to the service were lower during the pandemic period compared with previous years (figure 1).

We explored whether there was any difference in the severity of DKA cases referred before and during the pandemic

by comparing the clinical characteristics of 105 children referred between January 2018 and February 2020 with those of 31 children referred between March and July 2020. There were no significant differences between the groups in reported duration of symptoms prior to hospital attendance, blood gas analysis parameters at presentation, intensive care unit admission rates or intubation rates (table 1). Findings were similar when the prepandemic comparison group was limited to the months of March–July (to exclude seasonal variation).

In summary, we observed an increase in referral of children with DKA during

Table 1 Comparison of demographic and clinical characteristics of children referred with DKA during, and prior to, the COVID-19 pandemic

Patient characteristics	Pandemic period: March–July 2020 (n=31)	Prepandemic comparison periods		P value	P value
		January 2018–February 2020 (n=105)	March–July in 2018 and 2019 (n=31)		
Age (years), median (IQR)	10.1 (5.1–13.5)	8.8 (4.6–12.0)	9.1 (4.3–13.5)	0.274*	0.304*
Sex, n (%)				0.307†	0.075†
Male	13 (42)	55 (52)	20 (65)		
Female	18 (58)	50 (48)	11 (35)		
First presentation of DM, n (%)				0.111†	0.130†
Yes	29 (94)	85 (82)	25 (81)		
No	2 (6)	19 (18)	6 (19)		
Duration of symptoms (days), median (IQR)	7 (3–14)	7 (3–14)	5 (2–21)	0.816*	0.745*
pH, mean (SD)‡	6.94 (0.12)	6.95 (0.12)	6.96 (0.11)	0.821§	0.445§
PCO ₂ , mean (SD)‡	2.94 (0.98)	3.06 (0.99)	2.99 (0.82)	0.538§	0.588§
Bicarbonate, median (IQR)‡	5.5 (3.9–7.1)	6.0 (4.9–7.5)	6.15 (5.0–6.8)	0.176*	0.243*
Base excess, median (IQR)‡	–27.4 (–29.2 to –24.1)	–26.2 (–28.5 to –23.0)	–25.1 (–28.0 to –22.9)	0.452*	0.211*
Lactate, median (IQR)‡	3.2 (2.4–4.3)	3.0 (2.1–4.0)	3.2 (2.4–5.4)	0.466*	0.620*
Admitted to PICU, n (%)	11 (35)	26 (25)	13 (42)	0.239†	0.602†
Intubated, n (%)	1 (3.2)	4 (3.8)	3 (9.7)	0.879†	0.301†

*Wilcoxon rank-sum (Mann-Whitney) test.

† χ^2 test.

‡Blood gas analysis parameters are taken from the first test performed following presentation to hospital.

§t-Test.

DKA, diabetic ketoacidosis; DM, diabetes mellitus; PCO₂, partial pressure of carbon dioxide; PICU, paediatric intensive care unit.

the COVID-19 pandemic compared with previous years, at a time when overall referral activity to the service was lower than usual. There are various possible explanations for this observation. Reduced access to primary care services and/or parental anxiety about presenting to healthcare providers during the pandemic period may have contributed to later diagnosis of new cases of type 1 diabetes (with a higher likelihood of DKA at the time of diagnosis). Changes in the organisation of regional paediatric services during the pandemic, with closure of children's inpatient units at a number of district general hospitals to accommodate a predicted surge in acutely unwell adults, may have influenced the threshold for requests to our service for transport of cases (although clinical severity among referred cases was unchanged). There has also been speculation that COVID-19 infection may itself trigger the development of ketoacidosis via direct damage to pancreatic beta cells, based on observations that other coronaviruses bind to ACE2 receptors expressed by these cells.⁵

This study is limited by its small size, and the increase in cases observed during the pandemic period may have occurred by chance alone. Furthermore, the study cohort is limited to children referred for critical care advice. Interrogation of larger, nationally representative datasets that capture the overall occurrence of DKA in children would be beneficial to

further investigate whether there has been a true increase in incidence during the pandemic period.

Emre Basatemur , ¹ **Andrew Jones**,¹
Mark Peters,² **Padmanabhan Ramnarayan**¹

¹Children's Acute Transport Service, Great Ormond Street Hospital for Children, London, UK

²Department of Paediatric Intensive Care, Great Ormond Street Hospital for Children, London, UK

Correspondence to Dr Emre Basatemur, Children's Acute Transport Service, Great Ormond Street Hospital for Children, London WC1N 3JZ, UK; emre.basatemur@ucl.ac.uk

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ORCID iD

Emre Basatemur <http://orcid.org/0000-0003-1904-3898>

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