This article has been accepted for publication in ARCHDISCHILD following peer review.
The definitive copyedited, typeset version is available online at
10.1136/archdischild-2024-327088

Transport of critically ill children to paediatric intensive care units in the United Kingdom and Republic of Ireland: 2013 to 2022

Padmanabhan Ramnarayan[1], Dora Wood[2], Elizabeth S Draper[3], Lyn Palmer[3], Richard G Feltbower[4], Hannah L Buckley[4], Michael J Griksaitis[5,6], Daniel Lutman[7], Constantinos Kanaris[8], Deirdre O'Shea[9], Sarah E Seaton*[3]

On behalf of the Paediatric Critical Care Society Acute Transport Group

1: Section of Anaesthetics, Pain Medicine and Intensive Care, Department of Surgery and Cancer, Faculty of Medicine, Imperial College London, London

2: Paediatric Intensive Care Unit, Bristol Royal Hospital for Children, Bristol

3: Department of Population Health Sciences, University of Leicester, University Road, Leicester

4: Leeds Institute for Data Analytics, School of Medicine, University of Leeds, Leeds.

5: Paediatric Intensive Care Unit, University Hospital Southampton NHS Foundation Trust, Southampton

6: Faculty of Medicine, University of Southampton, Southampton

7: Paediatric Intensive Care Unit, Great Ormond Street Hospital for Children, Great Ormond Street, London

8: Paediatric Intensive Care Unit, Cambridge University NHS Trust, Hills Road, Cambridge

9: Paediatric Intensive Care Unit, Oxford University NHS Trust, Headley Way, Oxford

*Corresponding author: Sarah E Seaton, Department of Population Health Sciences, University of Leicester, University Road, LE1 7RH. Email: sarah.seaton@leicester.ac.uk

Word count: 2247

ABSTRACT (250 words)

Objective: To explore the trends and changes in the transport of children to paediatric intensive care units (PICU) between 2013 and 2022.

Design: Retrospective analysis of routinely collected data

Patients: Children transported for care in a PICU in the United Kingdom and Republic of Ireland aged <16 years

Interventions: None

Measurements and main results: There were 43,058 transports to a PICU involving 36,438 children from 2013 to 2022, with the majority of children requiring only one transport. The number of transports increased from 4131 (2013) to 4792 (2022). Over the study period the percentage of children aged under one year who were transported decreased from 50.2% to 45.2% and similarly, the percentage who were invasively ventilated also decreased from 81.1% to 70.2%. Conversely, the use of non-invasive ventilation during transports increased slightly from 4.0% to 7.0%. The percentage of transports where a parent was able to accompany the child increased over time (2013: 66.2% to 2019: 74.9%), although there were reductions due to the COVID-19 pandemic and requirements for social distancing (2020: 52.4%).

Conclusions: We have demonstrated an increased use of specialist paediatric transport services and changes in the PICU population over time. Routine data collection from the transport services provide a means to measure improvements and changes over time in the service provided to critically-ill children and young people who need transport to PICU.

What is known

- Following centralisation, critically-ill children who require admission to PICU in another hospital will require a specialist transport service to facilitate their journey
- The majority of transports undertaken by specialist transport teams is to move a child to PICU

What this study adds

- There have been changes in the care needs of children who are transported to PICU over the last ten years with decreases in the use of invasive ventilation and increases in the use of non-invasive ventilation
- The percentage of parents able to accompany their child in the ambulance increased until the impact of social distancing during COVID-19, and this has shown an indication of a return to the higher levels previously seen again in 2022

How this study might affect research, practice or policy

- We have demonstrated that routine data collection of paediatric transports to PICU can be used to monitor changes in children and care needs
- This high-quality data is available for local audits and research projects and other countries should consider similar audits of transports to PICU where they do not already exist

BACKGROUND

Paediatric intensive care services have been centralised in many parts of the world based on evidence and expert consensus that concentration of specialist skills in fewer larger hospitals leads to improved patient outcomes. In the United Kingdom (UK), dedicated paediatric intensive care units (PICUs) were established following the publication of the Framework for the Future report from the Department of Health (1997).[1 2 3 4] This meant that acutely ill and injured children presenting to hospitals without a PICU required transport to a PICU. Although inter-hospital transfers of critically ill children were initially performed by non-specialist teams, evidence of greater safety and improved survival associated with the use of specialist staff has meant that most critical care transfers are currently undertaken by specialist teams.[5]

Over time, there has been a gradual evolution in specialist transport for critically-ill children, from individual PICU-based teams to Paediatric Critical Care Transport teams (PCCTs) that serve geographical regions. PCCTs now provide a single point of contact for referring hospitals for critical care advice, bed finding and transport to a PICU. National quality standards for PCCTs have been proposed by the Paediatric Critical Care Society (PCCS),[6] and quality metrics such as mobilisation time (time from acceptance of a referral to leaving the transport base) have been published on the NHS England Specialised Services Quality Dashboard. [7] In parallel, since 2013, the Paediatric Intensive Care Audit Network (PICANet) has collected a standardised dataset from all transport teams based in the United Kingdom (UK) and Republic of Ireland (RoI).[8] These data include information about each child's characteristics; interventions performed; team composition; transport timings and critical incidents. As such, the PICANet transport dataset represents a unique and comprehensive national dataset to systematically study trends in the structure, process measures and outcomes for transported critically-ill children over time.

Aim

Our aim was to analyse PICANet data to provide ongoing information for the future planning of services by describing national trends in transport characteristics over the past decade of children transported by specialist transport teams.

METHODS

Data sources

Information about all children who are transported to a PICU in the UK and RoI by a specialised transport team (PICU-based or PCCT) has been collected by PICANet since 2013. Timely data entry into PICANet of all transport events is recommended by the PCCS within three months of the event (more recently two months since 1 January 2022). PICANet uses a bespoke data collection system with in-built validation queries which is complemented by validation visits and annual data cleaning to ensure the accuracy of the data.

Information is collected about each transport including details about the child (e.g., age, sex, Paediatric Index of Mortality (PIM3) score); about the transport (e.g., where the child was collected from, transport timings) and the transport team (e.g., name of team, mode of transport). Full details about the data collection can be found at: https://www.picanet.org.uk/data-collection/

Inclusion/exclusion

We included all children aged under 16 years who were transported to a PICU in the UK and RoI from 1st January 2013 to 31st December 2022. We did not include transports performed by non-specialist teams or by neonatal transport teams. We made no exclusions although missing or inaccurate data may have reduced the sample size in parts of our analysis. There were changes over time in the composition of the transport teams from PICU-based teams to PCCTs but we have included all transports and refer to these as "specialist transport teams."

Statistical analysis

We described the children and transports by using summary statistics: median (inter-quartile range) for continuous variables and number (percentage) for categorical variables. We presented graphically the number of transports (by elective and non-elective status) and PICU admissions over time.

For all transports we considered whether the parent could accompany their child and if not whether this was because they declined or not permitted. When presenting key metrics of how long it took to reach the bedside of the child or mobilise, we excluded elective transports (as these are not required to meet these standards) and any missing data.

Ethical approval was not required for this work. PICANet is a nationwide audit and this work has been approved as part of the extended outputs process (reference: E002).

RESULTS

From the 1st January 2013 to 31st December 2022 there were 52,602 transfers of children aged <16 years initiated in the UK and RoI by a specialist transport team.

Of these, 51,165 transfers were completed (496 children died prior to transport completion and in 941 instances the transport was not completed for other reasons, e.g., because the child's condition improved). The majority were to a PICU (n=43,058, 84%) and we focus on these in this work. These transfers were from 36,438 children, with the majority of children having only one transport.

Whilst team structures have changed, there are currently 13 regional-based PCCTs, which are presented alongside the area they cover in Figure 1.

Overall transports and children

The number of transports to PICU has steadily increased over time (4131 to 4792, Table 1A), although a marked drop was observed in 2020 related to the COVID-19 pandemic. Most transports were non-elective (n=41,025, 95%, Figure 2), defined as a transport where the child could not wait more than six hours without a deterioration in their condition.

Whilst specialist transport teams can transfer children of any age, nearly half were under one year although this has declined slightly over time (from 50.2% in 2013 to 45.2% in 2023, Table 1A). The average PIM3 score has reduced over time indicating a potential change in the population of children or their level of sickness at the time of transport (Table 1A).

The care provided to children during transport has changed over time (Table 1A and Table 1B). The percentage of children invasively ventilated during the transport has declined over time (2013: 81.1% to 2022: 70.2%) while the percentage of those non-invasively ventilated has increased slightly (2015: 4.0% to 2022: 7.0%). Over time there was a marked decrease in the use of advanced vascular access during transport from 52.1% in 2013 to 34.7% in 2022. Conversely, the percentage of children transported on vasoactive medication has remained fairly constant at around 20% to 25% of transports. Over time, more transports are now led by Advanced Nurse Practitioners (11.1% to 18.9% Table 1B). The percentage of transports which experienced a critical incident (e.g., accidental extubation, full list in footnote for Table 1B) ranged by 2 to 5% across the years (Table 1B).

Quality standards for specialist transport team

Improvements have been noted over time with the percentage of transports mobilising in under 30 minutes increasing from 55.3% to 66.8% (Figure 3, Appendix Table 1), and the percentage of teams reaching the child's bedside in less than three hours increasing from 85.9% (2013) to 89.2% (2022).

The percentage of transports where the parent was able to accompany their child was increasing over time (66.2% to 74.9%) although this reduced markedly during the COVID-19 pandemic (2020: 52.4%) and has subsequently increased again (2022: 73.0%, Table 2).

DISCUSSION

We have provided findings from over 40,000 transports which chart the development of a comprehensive national system of specialist transport teams and show how the characteristics of children transported and processes changed in the UK and RoI over ten years. At the beginning of the time window, there were seven commissioned transport services and by the end there were 13 services (and an additional service, Heartlink, which specialises in ECMO transports which we have not highlighted here). The impact of the COVID-19 pandemic is evident in terms of numbers of transports undertaken, the interventions provided (e.g., increased use of vasoactive treatments through a peripheral route, possibly related to the transport of children with Paediatric Inflammatory Multisystem Syndrome, PIMS-TS) and the opportunity for parents to travel in the ambulance.

Development of the dataset over time

Transport data collection has been broadly consistent over time and data quality is ensured by transport teams being visited regularly by the PICANet team who validate their data against the original medical notes. There is an inevitable tension between precise information and what can be collected consistently across a national group. The main change has been in the information collected about critical incidents during a transport, which are an important measure of transport risk and quality both intrinsically and because they have been shown to be associated with poor outcome.[9] Here we focussed on the critical incidents that had been collected consistently throughout the decade. However, future work should establish a list of defined critical incidents and clear recommendations should be provided for what teams should do to locally investigate their root causes.

The use of clinical standards

Specialist transport teams report their performance against standards for both mobilisation time and time to the child's bedside. While mobilisation time has improved slightly over time there has not been as much of an improvement in the number of children reached within three hours. Other research has demonstrated no association between time to bedside and outcome.[10] Future work may focus on improved triaging of children to identify who may benefit from faster access to specialist teams.

Parents being able to travel with their child in the ambulance is a key factor associated with a positive experience.[11] Over the first seven years of the study, the percentage of parents not permitted to travel with their child fell from 10% to 4% but this rose to nearly 30% in 2020, probably

associated with national guidance to minimise interpersonal contact to reduce the spread of COVID-19.

We have not compared between teams in this work, as there is wide variation in the challenges faced by different teams due to the geographies they cover. For example, previous work has shown that some hospitals cannot be reach by their transport team in under three hours due to the distance and therefore the teams can never meet that target.[12] However, we plan to explore this further in future work.

Child demographics

Over time, the children transported have been increasingly likely to be aged over one year, less likely to be invasively ventilated and to have a lower PIM3 score. Despite this the number of children aged under one year has remained relatively stable in absolute terms. This is against the backdrop of a reducing birth rate, leading to a change in the breakdown of children by age group. However, this may also represent the changing demographic of the PICU population over time with a shift from management of acute illness in otherwise healthy children towards children living with more complex chronic conditions as documented in several studies.[13] The lower PIM3 scores, in combination with fewer children having arterial lines and more children managed on non-invasive ventilation, indicates that the threshold for PICU transport/admission may have changed in recent years, either related to increasing numbers of children with medical complexity or changes to the organisation of critical care services.[14] There was a peak in the use of vasoactive support in 2020 and 2021 corresponding with the peak prevalence of PIMS-TS (which was first described in 2020[15 16] and often requires vasoactive support for hypotension) in UK PICUs.[17] The decrease over time in both invasive ventilation and advanced vascular access may alternatively reflect increasing confidence and experience of PCCT teams in managing children more conservatively during transport. However, it may also represent that, as potentially seen in Victoria,[18] provision of a specialist transport service means local teams are less confident in managing children with complex needs. The group of children requiring PICU admission may continue to change in the future, for example as respiratory syncytial virus (RSV) vaccination is introduced more widely in the UK, and both admissions and transport should continue to be monitored. Indications from recent research in Catalonia has suggested that RSV vaccination has the potential to reduce emergency admissions to PICU and future work should monitor this in the UK and RoI.[19]

Strengths and Limitations

This large cohort means we can identify even relatively small trends with some confidence. However, there may be issues of data quality and interpretation of data definitions. Despite these limitations, our data collection of nationwide paediatric transport services is unique and we would recommend that other countries consider the collection of paediatric intensive care transport data on a national level to allow benchmarking and international comparison. We have only presented data related to transports to PICUs, although an increasing part of specialist transport team workload is children requiring admission to high dependency care (level two) and future work should capture these data and explore their needs further. PICANet is commissioned to capture data on the activity from designated level two critical care beds and this should be expanded to capture information about children transported to these locations. We were unable to link to outcomes such as survival following PICU admission. However, previous research has suggested there is limited association between transport team logistics and outcomes, with the exception of critical incidents which are associated with higher odds of mortality.[9]

Conclusions

We have demonstrated the feasibility and utility of using a national audit system to collect robust data about the children transported to PICUs in the UK and RoI over the last ten years. Our data collection processes and their evolution may be helpful to those setting up similar arrangements in other healthcare systems across the world, and the data itself provides information about the development of a national paediatric critical care transport network over time against the backdrop of a changing population of children requiring care.

Conflict of interest

The authors have none to declare.

References

1 Pearson G, Shann F, Barry P, et al. Should paediatric intensive care be centralised? Trent versus Victoria. *The Lancet* 1997;349:1213-7.

2 Department of Health. Paediatric intensive care: A framework for the future. Report from the National Coordinating Group on Paediatric Intensive Care to the Chief Executive of the NHS Executive. Wetherby: Department of Health 1997.

3 Gemke R. Centralisation of paediatric intensive care to improve outcome. *The Lancet* 1997;349:1187-8.

4 Pollack M, Alexander S, Clarker N, et al. Improved outcomes from tertiary center pediatric intensive care: A statewide comparison of tertiary and nontertiary care facilities. *Critical Care Medicine* 1991;19:150-9.

5 Ramnarayan P, Thiru K, Parslow RC, et al. Effect of specialist retrieval teams on outcomes in children admitted to paediatric intensive care units in England and Wales: a retrospective cohort study. *Lancet* 2010;376:698-704.

6 Quality standards for the care of critically ill or injured children (6th edition). Available at: https://pccsociety.uk/wp-content/uploads/2021/10/PCCS-Standards-2021.pdf.

7 NHS England. PICU Quality Dashboard. https://www.england.nhs.uk/wp-content/uploads/2018/03/picu-metric-definitions-2018-19.pdf [Last accessed: 3/9/19].

8 PICANet. PICANet Annual Report 2021. Online at: https://www.picanet.org.uk/annual-reporting-and-publications/ [Last accessed: 26/1/2023].

9 Seaton SE, Draper ES, Pagel C, et al. The effect of care provided by paediatric critical care transport teams on mortality of children transported to paediatric intensive care units in England and Wales: a retrospective cohort study. *BMC pediatrics* 2021;21:217 doi:10.1186/s12887-021-02689-x.

10 Seaton SE, Ramnarayan P, Davies P, et al. Does time taken by paediatric critical care transport teams to reach the bedside of critically ill children affect survival? A retrospective cohort study from England and Wales. *BMC pediatrics* 2020;20:1-11 doi:10.1186/s12887-020-02195-6.

11 Evans REC, Barber V, Seaton S, et al. Is Parental Presence in the Ambulance Associated With Parental Satisfaction During Emergency Pediatric Intensive Care Retrieval? A Cross-Sectional Questionnaire Study. *Pediatric critical care medicine* 2022;23:708-16 doi:10.1097/PCC.0000000000002995.

12 King M, Ramnarayan P, Seaton SE, et al. Modelling the allocation of paediatric intensive care retrieval teams in England and Wales. *Archives of Disease in Childhood* 2019;104:962-6 doi:10.1136/archdischild-2018-316056.

13 Fraser LK, Parslow R. Children with life-limiting conditions in paediatric intensive care units: a national cohort, data linkage study. *Archives of disease in childhood* 2018;103:540-7 doi:10.1136/archdischild-2017-312638.

14 . Paediatric Critical Care: GIRFT Programme Speciality Report. Online at: https://pccsociety.uk/wp-content/uploads/2022/04/Paed-Critical-Care-GIRFT-report_final_April2022.pdf [Last accessed: 31st May 2024[.

15 Davies P, Evans C, Kanthimathinathan HK, et al. Intensive care admissions of children with paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS) in the UK: a multicentre observational study. *The lancet child & adolescent health* 2020;4:669-77 doi:10.1016/S2352-4642(20)30215-7.

16 Harwood R, Allin B, Jones CE, et al. A national consensus management pathway for paediatric inflammatory multisystem syndrome temporally associated with COVID-19 (PIMS-TS): results of a national Delphi process. *The Lancet Child & Adolescent Health* 2021;5:133-41 doi:10.1016/S2352-4642(20)30304-7.

17 . PICANet report on SARS-CoV-2 related illness in children admitted to paediatric intensive care. Online at: https://www.picanet.org.uk/wp-content/uploads/sites/25/2023/01/PICANet-report-on-SARS-CoV-2-related-illness_v1.0-30Jan2023.pdf.

18 Duke T. Services for critical and emergency care of children in Victoria. *Critical care and resuscitation* 2024;26:54-7 doi:10.1016/j.ccrj.2023.11.008.

19 Coma E, Martinez-Marcos M, Hermosilla E, et al. Effectiveness of nirsevimab immunoprophylaxis against respiratory syncytial virus-related outcomes in hospital and primary care settings: a retrospective cohort study in infants in Catalonia (Spain). *Arch Dis Child* 2024:archdischild-327153 doi:10.1136/archdischild-2024-327153.

ACKNOWLEDGEMENTS

We would like to thank all members of the paediatric transport services who contribute high-quality data, with particular thanks to members of the PCCS Acute Transport Group who provide clinical expertise to support our work. We would like to credit Dr Barney Scholefield who produced the map used in Figure 1. Similarly, we would like to thank the PICANet team members, both past and present, for their contributions.

PICANet is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP). HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing, and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that clinical audit, outcome review programmes and registries have on healthcare quality in England and Wales. HQIP holds the contract to commission, manage, and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies www.hqip.org.uk/national-programmes.

Most importantly, we would like to thank the parents, families, children and young people who have supported our work.

ETHICS

Ethical approval was not required for this work. PICANet is a nationwide audit and this work has been approved as part of the extended outputs process.

FUNDING

PICANet is funded by NHS England, NHS Lothian and NHS Greater Glasgow and Clyde in Scotland, the Welsh Health Specialised Services Committee, the Royal Belfast Hospital for Sick Children, the National Office of Clinical Audit (NOCA) in the Republic of Ireland, and HCA Healthcare.

DATA AVAILABILITY

PICANet data for England may be requested from the data controller, the Healthcare Quality Improvement Partnership (HQIP). A Data Access Request Form can be obtained from https://www.hqip.org.uk/national-programmes/accessing-ncapop-data/

AUTHOR CONTRIBUTIONS

SES led the analysis and oversaw the writing of the paper. PR and DW led the writing of the paper. PR, DW, LP, MG, DL, CK, DOS provided clinical contributions. HB, ED, LP and RF provided insight on data collection and analysis. All authors contributed to the writing of the paper, revising it critically for content and helping interpret and contextualise findings. SES is responsible for overall content as the guarantor.

Figure 1: Map of the Paediatric Critical Care Transport teams in the United Kingdom and Republic of Ireland as of 2023

Figure 2: PICU admissions and transports by status in UK and Republic of Ireland over time

Figure 3: Process measures used to assess quality of transport team: mobilised in <30 minutes and reached child in under three hours*

*Only non-elective transports are eligible to meet these metrics so elective transports and those with missing data are excluded.

Table 1A: Characteristics of children transported by a specialist transport team to PICU from 2013 to 2022

Year	Total transports	Children aged under one year, n (%)	Male sex, n (%)	Invasively ventilated during transport, n (%)*[1]	Non-invasive ventilation during transport, n (%)	Advanced vascular support during transport, n (%)*[2]	Vasoactive support during transport, n (%)*[3]	PIM3 score, median (10th to 90th centile)
2013	4131	2073 (50.2)	2382 (57.7)	3349 (81.1)	Not collected	2150 (52.1)	787 (19.1)	0.040 (0.005 to 0.141)
2014	4236	2200 (51.9)	2464 (58.2)	3376 (79.7)	Not collected	2094 (49.4)	806 (19.0)	0.039 (0.005 to 0.125)
2015	4363	2196 (50.3)	2511 (57.6)	3452 (79.1)	173 (4.0)	2158 (49.5)	971 (22.3)	0.037 (0.005 to 0.117)
2016	4535	2329 (51.4)	2509 (55.3)	3651 (80.5)	236 (5.2)	2138 (47.1)	1018 (22.5)	0.036 (0.005 to 0.105)
2017	4403	2278 (51.7)	2421 (55.0)	3420 (77.7)	337 (7.7)	1944 (44.2)	1022 (23.2)	0.035 (0.005 to 0.108)
2018	4433	2278 (51.4)	2527 (57.0)	3472 (78.3)	296 (6.7)	1926 (43.5)	958 (21.6)	0.034 (0.005 to 0.100)
2019	4446	2152 (48.4)	2512 (56.5)	3506 (78.9)	301 (6.8)	1792 (40.3)	867 (19.5)	0.032 (0.004 to 0.102)
2020	3224	1495 (46.4)	1834 (56.9)	2187 (67.8)	213 (6.6)	1340 (41.6)	773 (24.0)	0.034 (0.005 to 0.114)
2021	4495	1962 (43.7)	2528 (56.2)	3008 (66.9)	283 (6.3)	1616 (36.0)	1057 (23.5)	0.025 (0.004 to 0.093)
2022	4792	2167 (45.2)	2744 (57.3)	3362 (70.2)	337 (7.0)	1662 (34.7)	946 (19.7)	0.019 (0.004 to 0.097)

*1 Intubated or reintubated by local team or transport team

*2 Primary/additional CVA; arterial access; primary/additional intraosseous

*3 Inotropes/vasopressor; prostaglandin

Table 1B: Characteristics of the transport undertaken by a specialist transport team to PICU from 2013 to 2022

Year	Total transports	Non-elective transport, n (%)	Transport undertaken by PCCT, n (%)	Transport led by a Consultant, n (%)	Transport led by Advanced Nurse Practitioner, n (%)	Child transported via air, n (%)	Critical incident* affecting the child during transport, n (%)
2013	4131	3993 (96.7)	3415 (82.7)	1491 (36.1)	457 (11.1)	66 (1.6)	83 (2.0)
2014	4236	4097 (96.7)	3504 (82.7)	1602 (37.8)	571 (13.5)	86 (2.0)	160 (3.8)
2015	4363	4198 (96.2)	3926 (90.0)	1730 (39.7)	568 (13.0)	92 (2.1)	216 (5.0)
2016	4535	4359 (96.1)	4419 (97.4)	1710 (37.7)	645 (14.2)	104 (2.3)	198 (4.4)
2017	4403	4199 (95.4)	4314 (98.0)	1773 (40.3)	681 (15.5)	111 (2.5)	178 (4.0)
2018	4433	4170 (94.1)	4417 (99.6)	1635 (36.9)	803 (18.1)	111 (2.5)	132 (3.0)
2019	4446	4239 (95.3)	4446 (100)	1547 (34.8)	782 (17.6)	123 (2.8)	119 (2.7)
2020	3224	3013 (93.5)	3224 (100)	1028 (31.9)	654 (20.3)	93 (2.9)	85 (2.6)
2021	4495	4274 (95.1)	4495 (100)	1481 (33.0)	888 (19.8)	99 (2.2)	87 (1.9)
2022	4792	4483 (93.6)	4791 (100)	1720 (35.9)	904 (18.9)	86 (1.8)	82 (1.7)

*Defined as: accidental extubation; required intubation during transports; ventilator failure; IV access lost; cardiac arrest en route; medication administration error; medical gas supply lost; equipment failure

Table 2: Number (%) of parents accompanying their child in the ambulance

Year	Yes	No declined	No not present	No not permitted	Missing
2013	2735 (66.2)	545 (13.2)	267 (6.5)	424 (10.3)	160 (3.9)
2014	2935 (69.3)	547 (12.9)	210 (5.0)	409 (9.7)	135 (3.2)
2015	3051 (69.9)	624 (14.3)	259 (5.9)	307 (7.0)	122 (2.8)
2016	3217 (70.9)	705 (15.6)	232 (5.1)	251 (5.5)	130 (2.9)
2017	3157 (71.7)	697 (15.8)	216 (4.9)	239 (5.4)	94 (2.1)
2018	3336 (75.3)	643 (14.5)	214 (4.8)	184 (4.2)	56 (1.3)
2019	3331 (74.9)	609 (13.7)	200 (4.5)	193 (4.3)	113 (2.5)
2020	1688 (52.4)	314 (9.7)	194 (6.0)	964 (29.9)	64 (2.0)
2021	2797 (62.2)	637 (14.2)	241 (5.4)	729 (16.2)	91 (2.0)
2022	3499 (73.0)	754 (15.7)	199 (4.2)	246 (5.1)	94 (2.0)

Table of co-authors ORCID and Twitter/X details

Name	**ORCID**	**Twitter/X**
Padmanabhan Ramnarayan	0000-0003-0784-8154	@pic_pram
Dora Wood	0000-0002-3687-6587	-
Elizabeth S Draper	0000-0001-9340-8176	@DraperES
Lyn Palmer	0000-0003-1737-0326	@DrLynPalmer
Richard G Feltbower	0000-0002-1728-9408	@rgfeltbower
Hannah L Buckley	-	@PICStato
Michael J Griksaitis	0000-0003-3858-9677	@MJGriksaitis
Daniel Lutman	-	-
Constantinos Kanaris	0000-0002-4017-4553	@DrKanaris
Deirdre O'Shea	-	@DrDeeOS
Sarah E Seaton	0000-0001-8711-4817	@SarahESeaton