

## Irish Paediatric Critical Care Audit National Report 2021-2022 including key trends from 2018 to 2022

### AUTHOR(S)

Martina Healy, Aisling Walsh, Marie Lawlor, Mong Hoi Tan, Fiona Fallon, Karina Hamilton, Fionnola Kelly, Aisling Connolly

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# IRISH PAEDIATRIC CRITICAL CARE AUDIT

# NATIONAL REPORT 2021-2022

*including key trends from 2018 to 2022*



## REPORT WRITING GROUP:

### Associate Professor Martina Healy

*Clinical Lead for Irish Paediatric Critical Care Audit*  
*Consultant in Paediatric Critical Care*  
Children's Health Ireland at Crumlin

### Dr Aisling Walsh

*Consultant in Paediatric Critical Care*  
Children's Health Ireland at Temple Street

### Marie Lawlor

*Paediatric Critical Care Unit Clinical Nurse Audit*  
*and Research Coordinator*  
Children's Health Ireland at Temple Street

### Mong Hoi Tan

*Paediatric Critical Care Unit Clinical Nurse Audit*  
*and Research Coordinator*  
Children's Health Ireland at Crumlin

### Fiona Fallon

*Patient and Public Interest Representative*  
Irish National Intensive Care Unit Audit (Paediatrics)  
Governance Committee  
Member of Heart Children Ireland

### Karina Hamilton

*Irish Paediatric Critical Care Audit Manager*  
National Office of Clinical Audit

### Dr Fionnola Kelly PhD

*Head of Data Analytics and Research*  
National Office of Clinical Audit

### Aisling Connolly

*Communications and Events Manager*  
National Office of Clinical Audit

## NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

The National Office of Clinical Audit (NOCA) was established in 2012 to create sustainable clinical audit programmes at national level. NOCA is funded by the Health Service Executive Office of the Chief Clinical Officer and operationally supported by the Royal College of Surgeons in Ireland.

National Clinical Audit is defined as "a clinically-led quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and acting to improve care when standards are not met. The process involves the selection of aspects of the structure, processes and outcomes of care which are then systematically evaluated against explicit criteria. If required, improvements should be implemented at an individual, team or organisation level and then re-evaluated to confirm improvements." (HSE NCCA, 2022). NOCA supports hospitals to learn from their audit cycles.

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We would like to especially acknowledge the CHI Arts in Health Programme for curating a collection of artwork for use in this report. We are very grateful for the drawings made by patients in CHI and art donated to CHI Connolly by 3rd class groups in Scoil Thomais's in Castleknock.

We would also like to thank Professor Liz Draper, Co-Principal Investigator, Hannah Lever, Senior Project Manager, and Christopher Leahy, Senior Research Statistician, from the Paediatric Intensive Care Audit Network (PICANet). NOCA works with PICANet in the United Kingdom for data validation, data analysis and the generation of reports on activity in paediatric intensive care units.



### For more information about this report, contact

National Office of Clinical Audit, 2nd Floor, Ardilaun House,  
Block B, 111 St Stephen's Green, Dublin 2, D02 VN51

**Tel:** +353 (1) 402 8577  
**Email:** [icu@nocai.ie](mailto:icu@nocai.ie)

DESIGNED BY  
**SWERVE**

# **Irish Paediatric Critical Care Audit**

## National Report 2021-2022

**Associate Professor Martina Healy**

Clinical Lead  
Irish Paediatric Critical Care Audit  
National Office of Clinical Audit  
2nd Floor, Ardilaun House  
111 St. Stephen's Green, Dublin 2

25 April 2024

Dear Assoc. Prof. Healy,

Following an assurance review of this report to the NOCA National Reporting Standards, I am delighted, on behalf of the NOCA Governance Board, to endorse *Irish Paediatric Critical Care Audit National Report 2021-2022*.

I wish to congratulate you, Audit Manager Karina Hamilton, and your governance committee on the development of this report which is a valuable quality improvement initiative.

Please accept this as formal endorsement from the NOCA Governance Board of the *Irish Paediatric Critical Care Audit National Report 2021-2022* and we wish you every success in your ongoing commitment to improving the care of paediatric critical care patients.

Yours sincerely,



**Dr Brian Creedon**  
**Clinical Director**  
**National Office of Clinical Audit**

National Office of Clinical Audit  
2nd Floor  
Ardilaun House, Block B  
111 St Stephen's Green  
Dublin 2, D02 VN51  
Tel: + (353) 1 402 8577  
Email: [auditinfo@noca.ie](mailto:auditinfo@noca.ie)

# PREFACE

This publication is the third Paediatric Critical Care Unit (PCCU) National Report produced under the governance of the National Office of Clinical Audit (NOCA). It has come about as a result of a collaborative effort across both sites providing paediatric critical care: Children's Health Ireland (CHI) at Crumlin and CHI at Temple Street. It entails the collection of detailed Paediatric Intensive Care Audit Network (PICANet) datasets by skilled dedicated audit nurses and data managers. By collecting this audit data, we can ensure that continual improvement is part of the culture within the PCCUs in Ireland, and that we deliver the best care possible with the resources available for critically ill children and their families.



This report provides data on 7,575 infants and children admitted to the two PCCUs in Ireland during 2018–2022. Detailed information is supplied on bed days, length of stay (LOS), age breakdown, diagnosis and mortality trends over 5 years. These data can be used to inform choices and enable the Health Service Executive (HSE), Department of Health and government to make decisions regarding funding. PCCU beds are expensive; therefore, they must be used efficiently. We can, because of being part of an international dataset, allow ourselves to be benchmarked against 30 other PCCUs on LOS, mortality and key performance indicators. This allows us to consider all aspects of paediatric critical care, including work environment, staffing levels, the cost of the service and the changing epidemiology of patients over time.

The main recommendations included in this report are focused on workforce and audit, with an emphasis on recruitment and retention. We currently run 32 PCCU beds and, as per our data, provide 10,700 bed days per annum, with over one-half of our patient population transferred from other hospitals. Thus, we provide a national service for critically ill children. The required increase in the paediatric critical care workforce to enable the opening of the National Children's Hospital (NCH) Critical Care Unit with 42 PCCU beds needs a detailed multi-disciplinary workforce plan. This requires a national collaborative approach; as the NCH is projected to open during 2025 resourcing and planning for the projected increase in beds needs to be prioritised.

A handwritten signature in dark ink, appearing to read 'Martina Healy'.

**Associate Professor Martina Healy**

*Clinical Lead Irish Paediatric Critical Care Audit, NOCA*

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# GLOSSARY OF TERMS AND ABBREVIATIONS

NAME	DEFINITION
<b>bed days</b>	Calculated as the sum of children receiving intensive care in a Paediatric Critical Care Unit (PCCU) each day and counted if a child is in a bed for any part of the day
<b>bed occupancy</b>	Expressed as the percentage of bed days used out of total bed days available each year
<b>CHI</b>	Children's Health Ireland
<b>ECLS</b>	extracorporeal life support
<b>ECMO</b>	extracorporeal membrane oxygenation
<b>ELSO</b>	Extracorporeal Life Support Organization
<b>ETT</b>	endotracheal tube
<b>HIQA</b>	Health Information and Quality Authority
<b>HRG</b>	Healthcare Resource Group
<b>HSE</b>	Health Service Executive
<b>ICU</b>	Intensive Care Unit
<b>ICNARC</b>	Intensive Care National Audit and Research Centre
<b>INICUA</b>	Irish National Intensive Care Unit Audit
<b>IPATS</b>	Irish Paediatric Acute Transport Service
<b>IPCCA</b>	Irish Paediatric Critical Care Audit
<b>IQR</b>	interquartile range
<b>LOS</b>	length of stay
<b>NCH</b>	National Children's Hospital
<b>NHS</b>	National Health Service
<b>NIAC</b>	National Immunisation Advisory Committee
<b>NOCA</b>	National Office of Clinical Audit
<b>PCCS</b>	Paediatric Critical Care Society
<b>PCCU</b>	Paediatric Critical Care Unit
<b>PDA</b>	Potential Donor Audit
<b>PICU</b>	Paediatric Intensive Care Unit
<b>PHDU</b>	Paediatric High Dependency Unit

NAME	DEFINITION
<b>PPI</b>	Public and Patient Interest
<b>PICANet</b>	Paediatric Intensive Care Audit Network
<b>PIM</b>	Paediatric Index of Mortality
<b>ROI</b>	Republic of Ireland
<b>RSV</b>	Respiratory syncytial virus
<b>run</b>	Placing a patient on extracorporeal membrane oxygenation for one continuous period of time
<b>SMR</b>	standardised mortality ratio
<b>UK</b>	United Kingdom
<b>WTE</b>	whole-time equivalent

# EXECUTIVE SUMMARY

This is the third National Report from the Irish Paediatric Critical Care Audit (IPCCA) reporting on the 3,329 admissions to the two Paediatric Critical Care Units (PCCUs) in Ireland during 2021 and 2022, with key trends over the 5-year period 2018–2022 included.

There was a 14% increase in the number of children admitted to PCCUs in 2021 and 2022 compared to 2018. Both PCCUs showed high occupancy in 2021–2022 (above 85%), particularly in the winter months. A detailed analysis of these admissions shows that an increasing majority were secondary to seasonal viruses and respiratory syncytial virus (RSV) pathogen. The development of new vaccines for RSV could radically alter the annual surge of admissions to both children's hospitals and PCCUs and in doing so influence its effect on bed occupancy and elective surgical deferrals.

Quality indicators of Unit strain, such as bed occupancy and out-of-hours discharges, showed an increase in 2021 and 2022. Children's Health Ireland (CHI) at Crumlin had occupancy consistently over 95%; the recommended national standard is 85%. The number of qualified nurses per bed remains below the recommended standard in CHI at Temple Street for each of the 5 years examined. Admissions to CHI at Temple Street PCCU in 2022 (n=542) increased by 34% compared to 2018 (n=406). With the new National Children's Hospital due to open in 2025 with an additional 10 PCCU beds, there is a need to plan for adequate resourcing to maintain an average bed occupancy of 85% and allow for acute surges in demand, staff sick leave and maternity leave.

The average annual number of bed days delivered by the two PCCUs within the 5-year period was 10,232; however, the number decreased significantly in 2020 (by almost 1,000 bed days). More than three-quarters (76%) of the bed days per annum were provided in the Unit in CHI at Crumlin. In 2021 and 2022, children aged under 1 month accounted for the highest proportion of bed days in both Units, in keeping with previous years.

Most PCCU admissions in 2021 and 2022 were unplanned. The proportion of unplanned admissions transferred to CHI at Crumlin increased from 32% (n=132) in 2020 to 45% (n=267) in 2021 and 43% (n=281) in 2022. There was less variation in CHI at Temple Street, where most admissions are transferred in. Developing regional Paediatric High Dependency Unit (PHDU) capacity would ease the strain on PCCUs. The plan to expand paediatric regional surgical units to Model 4 hospitals means that children can be treated at a local level for non-specialist surgical procedures. However, this needs to be backed up by the provision of PHDU to allow for enhanced postoperative care in a PHDU if required.

With the extension of the Irish Paediatric Acute Transport Service's (IPATS) operational hours, there have been improvements in transport metrics, and the introduction of a new IPATS nurse-led repatriation service to bring children back to their local hospital will help patient flow.

Unplanned extubations have been included as a key metric for the first time. These are relatively rare events. CHI at Temple Street was an outlier for this metric in 2021 but initiated a quality improvement project, resulting in improved rates in 2022.

The crude mortality rates remain very low (4%) each year. Detailed analysis shows that most of the deaths occurred in the neonatal age group. The main causes of death for children in CHI at Crumlin were cardiovascular diagnoses, whereas in CHI at Temple Street the majority of deaths were due to external causes of accident or injury. The risk-adjusted standardised mortality ratio (SMR), which is an important high-level quality indicator, after allowing for the level of sickness at time of admission, showed that neither PCCU in the Republic of Ireland (ROI) had a mortality rate higher than expected.

For the first time, data are included on organ and tissue donation as this was added to the audit dataset in 2021. A small number of organ and tissue donations occur each year, but the data collected are limited. The appointment of dedicated hospital organ donation personnel has the potential to increase the number of organ donations.

There are ongoing challenges with audit data collection. Auditing PCCU activity is essential to identify shortfalls in quality of care, to drive improvements in care and to document activity to guide resource allocation.

# KEY QUALITY INDICATORS 2018–2022

Metric	Standard	2018	2019	2020	2021	2022
THINGS THAT IMPROVED						
Irish Paediatric Acute Transport Service retrieval mobilisation time	Within 1 hour	68%	72%	72%	77%	77%
Transport team time to bedside	Within 3 hours	57%	68%	55%	57%	67%
THINGS THAT STAYED THE SAME						
Emergency readmissions within 48 hours of discharge	Low	1.3%	1.7%	1.7%	1.9%	1.5%
Paediatric Critical Care Unit bed occupancy	Limit of 85%	95%	94%	85%	87%	92%
Mortality in Paediatric Critical Care Units	Low	4%	4%	4%	4%	4%
THINGS THAT DISIMPROVED						
Audit data submission within 3 months of patient discharge	100%	97%	72%	59%	34%	35%
Number of qualified nurses per critical care bed	5.5 WTE	5.37	5.61	5.64	5.20	5.22
Unplanned extubation rate per 1,000 intubated days	Fewer than 5.0	4.0	4.2	2.4	6.2	6.5
Out-of-hours discharge between 8.00pm and 7.59am	Less than 10%	10%	10%	10%	12%	13%

## KEY FINDINGS 2021-2022



The number of admissions to Paediatric Critical Care Units (PCCUs) in Ireland 2021 and 2022 has increased to **14%** higher than pre-pandemic levels (from 1,429 in 2018 to 1,634 in 2022).



Unplanned (i.e. emergency) admissions accounted for the majority of admissions in 2021 (n=1055, **65%**) and 2022 (n=1128, **69%**).



Neonates accounted for almost 30% (**28%**, n=606) of overall admissions to CHI at Crumlin, 15% (n=327) were preterm, and 5% (n=115) were aged under 32 weeks gestation. In CHI at Temple Street, one-quarter (**25%**, n=250) of total admissions were neonates, 16% (n=158) were preterm, and 8% (n=77) were aged under 32 weeks gestation.



Neonatal admissions with cardiac/cardiothoracic issues decreased from **37%** in 2018–2020 to 33% in 2021 and **30%** in 2022.



Patients admitted with a respiratory primary diagnosis increased in 2021 and 2022, comprising **30%** (n=323) of all admissions in 2022 to CHI at Crumlin, compared to 18% (n=178) in 2020, and **39%** (n=210) of all admissions to CHI at Temple Street in 2022, compared to 24% (n=100) in 2020. This is a predicted annual increase from October to January each year and is associated with annual respiratory syncytial virus (RSV) outbreaks. It also correlates with a greater than 100% occupancy in both Units over the same period.



The number of admissions of children to adult Intensive Care Units decreased in 2021 (n=53) and 2022 (n=65) compared to pre-pandemic figures (2019, n=111).



The total number of bed days delivered by PCCUs in Ireland in 2021 (n=**10387**) and 2022 (n=**10795**) has increased to above pre-pandemic levels (2018, n=10176).



Infants aged under 3 months occupied the highest proportion of bed days delivered in both Units.



In both PCCUs, the median length of stay (LOS) was highest for infants aged under 1 year, with infants aged under 3 months having the longest LOS in both Units.



Almost 60% (58%) of patients admitted to CHI at Crumlin and almost one-half (48%) of patients admitted to CHI at Temple Street received intensive care at Level 1 or above. More advanced levels of care require complex interventions and/or organ support for patients and higher nurse-patient ratios of between 2:1 and 3:1, which has major implications for nurse staffing and the ability of the Units to keep all other beds open.



CHI at Crumlin provided cardiac extracorporeal membrane oxygenation (ECMO) for 22 patients in 2021–2022. There were six patients requiring respiratory ECMO, some of whom were transferred abroad for treatment. ECMO is a life-saving treatment for children with heart or lung failure.



In 2021–2022 there were 87 deaths in CHI at Crumlin, three-quarters (75%, n=65) of which occurred in infants aged under 1 year, with the majority (50%, n=43) in the neonatal age group. There were 34 deaths in CHI at Temple Street, 61% (n=21) of which occurred in children aged 1–16 years. The largest group (43%, n=37) of children that died in CHI at Crumlin PCCU were patients admitted with cardiovascular diagnoses, while in CHI at Temple Street the majority (38%, n=13) of deaths were due to external causes of accident or injury. After allowing for the level of sickness at time of admission, no PCCU in the ROI had a mortality rate higher than expected.



Over one-half of patients (57%, n=69) in 2021–2022 died following the withdrawal of ongoing organ support, while brain stem death was the mode of death for 10% (n=12) of patients. In the two-year period 2021–2022, 11 infants and children ranging in age from 2 days to 15 years donated solid organs, tissues or both.

# KEY FINDINGS

## Irish Paediatric Critical Care Audit 2021-2022

**3329**  
2021 & 2022

3329 admissions in 2021 and 2022 – an increase of 14% when compared to 2018. This rise shows that more children have required critical care in recent years compared to the time before the pandemic.

**1098** | **1092**  
2021 | 2022

CHI at Crumlin had the third highest number of PCCU admissions of all units in the UK and Ireland in 2021, with 1098 admissions and 2022, with 1092 admissions.

**65%** | **69%**  
2021 | 2022

Emergency admissions accounted for the majority of admissions to PCCUs – 65% in 2021 and 69% in 2022



A significant number of admissions to PCCUs were very young babies, known as neonates. Neonates are babies that are defined as corrected age at admission of less than 29 days old. Corrected age takes a baby's actual due date and the gestational week in which they were born into account.

**CHI AT CRUMLIN**

**28% NEONATES**

**CHI AT TEMPLE STREET**

**25% NEONATES**



**33%** | **30%**  
2021 | 2022

Neonatal admissions with cardiac issues decreased from 37% in 2018–2020 to 33% in 2021 and 30% in 2022.



There has been a noticeable increase in children admitted with breathing issues, known as respiratory diagnoses, accounting for 30% of all the children admitted to PCCU at CHI at Crumlin in 2022, an increase from 18% in 2020. 39% of all admissions to PCCU in CHI at Temple Street in 2022 were for respiratory issues, up from 24% in 2020.



**CHI AT CRUMLIN**

**30% RESPIRATORY**

**CHI AT TEMPLE STREET**

**39% RESPIRATORY**

*These increases in admissions are expected every year from October to January due to the yearly outbreak of a common lung infection in children called respiratory syncytial virus (RSV). During these months, the hospitals were very full, with occupancy rates over 100%, meaning they were taking care of more children than they usually have beds available for.*



**53 65**  
**2021 2022**

Less children were admitted to adult ICUs. 53 children in 2021 and 65 children in 2022 aged under 16 years were admitted to adult ICUs in Ireland, a decrease from 111 in 2019.



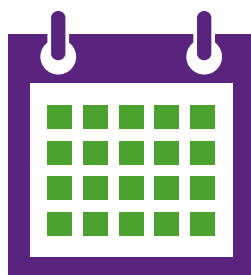
**22**  
**2021 & 2022**

22 babies and children in CHI at Crumlin received life support to help their heart called extracorporeal membrane oxygenation (ECMO) in 2021 and 2022. There were six children requiring ECMO for their lungs, some of whom were transferred abroad for treatment.



**11**  
**2021 & 2022**

In 2021-2022, 11 infants and children from 2 days old to 15 years of age donated organs and/or tissue (such as skin or bone).



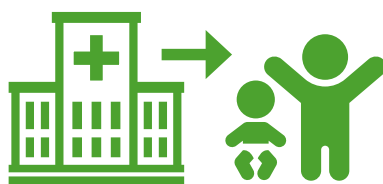
The median\* length of stay was highest for infants aged under 1 year. Infants aged under 3 months had the longest LOS in both Units – 5.14 days CHI at Crumlin and 3.57 days CHI at Temple Street.

**CHI AT CRUMLIN**

**5.14 DAYS**

**CHI AT TEMPLE STREET**

**3.57 DAYS**



**96%**  
**2021-2022**

In 2021-2022, 96% of patients admitted to PCCU's were discharged alive. There were 87 deaths in CHI at Crumlin, of these, 75% were in infants aged under 1 year. Cardiovascular diagnoses accounted for 43% of deaths.



There were 34 deaths in CHI at Temple Street, with 61% of these in children aged 1-16 years. Accident or injury accounted for 38% of deaths.



**CHI AT CRUMLIN**

**58% PCCU**

**CHI AT TEMPLE STREET**

**48% PCCU**

58% of children admitted to CHI at Crumlin and 48% percent admitted to CHI at Temple Street required complex treatment and support in PCCU.



The more complex treatment is required, such as invasive ventilation (where oxygen is given through a tube placed in a patient's throat connected to a machine called a ventilator), the greater the number of specialist nurses required to treat these patients.



\* The median is the middle number in a sorted list of numbers.

# KEY RECOMMENDATIONS

## RECOMMENDATION 1

Paediatric critical care should be resourced with a workforce which allows the Units to deal with acute surges in demand and maintain an average occupancy of 85%, as per national standards. To facilitate the opening and running of the Paediatric Critical Care Unit (PCCU) in the National Children's Hospital with an increase in beds from 32 to 42, a detailed multidisciplinary workforce plan is required. CHI should submit to the National Service Planning process for the additional resources required from the HSE.



## RECOMMENDATION 2

The Health Information and Quality Authority (HIQA) rapid health technology assessment (HTA) of immunisation against respiratory syncytial virus (RSV) in infants is underway. The Department of Health should prioritise findings from the HTA, when available, to inform their decision on immunisation of infants against RSV and, if approved progress implementation without delay.



## RECOMMENDATION 3

Paediatric critical care audit should be mandatory and adequately resourced to enable timely, complete and accurate information to be submitted.



## RECOMMENDATION 4

The Health Service Executive should consider the development of regional paediatric high dependency care capacity in regional centres.



## RECOMMENDATION 5

Dedicated hospital organ donation personnel should be appointed to increase awareness of organ donation and provide education and training locally to ensure all opportunities for organ and tissue donation in PCCUs are realised where appropriate.



## CAPTURING THE PATIENT VOICE

### SOPHIE'S STORY

We are parents to Charlie (9), Ollie (7) and Sophie (5). On 11 December 2022, our lives were turned upside down when, in the space of 24 hours, our youngest child Sophie went from being a very happy, healthy little girl to an extremely sick girl fighting for her life. Sophie woke up on the Sunday morning complaining of being cold and subsequently presented with a temperature. As the morning went on, the high temperature persisted, and she was vomiting. By early afternoon our gut instinct led us to make an appointment with our local out-of-hours doctor. Come time to leave for the appointment, Sophie was starting to appear quite limp and lethargic.

On presenting to our out-of-hours doctor with Sophie appearing drowsy and lethargic, they immediately examined her and made the decision to call an ambulance for her to be brought to CHI at Tallaght. On arrival to Tallaght, Sophie had somewhat perked up after taking on fluids and pain relief to manage her temperature. However, gradually she was unable to sit upright and was quite ragdoll-like. After failed attempts to get a urine sample, doctors agreed to take bloods and from there realised her infection markers were high and started her on a basic antibiotic. Sophie's vital signs were beginning to be a cause for concern, and it was then we heard the word 'sepsis' and were told she needed to go to CHI at Temple Street ICU to be placed on a ventilator.

Sophie made it safely to Temple Street ICU on Monday morning, despite grave concerns for potential intervention during the ambulance journey. On arrival



to Temple Street ICU, she was the entertainment, singing 'Jingle Bells', and was able to confirm her name and her age. This was the last time we saw her before she was placed on the ventilator, less than 24 hours after waking up on the Sunday morning with a temperature.

Throughout the Monday she stabilised on the ventilator and on a dialysis machine to help remove the toxins from her body. We understood that she was critically sick and were taking it hour by hour. In the early hours of Tuesday morning, Sophie began to deteriorate further while on maximum support; she was in multi-organ failure due to septic shock. The ICU team were doing everything they possibly could, with the support and advice of CHI at Crumlin. We were told what no parent ever wants to hear: "There is no more we can do for Sophie." She was already struggling on an oscillator, the strongest form of ventilator available. This was when the PICU consultant looking after Sophie mentioned to us about Sophie potentially going to Sweden for specialised treatment – extracorporeal membrane oxygenation (ECMO) – if she made it to Tuesday evening. This was Sophie's only option. We heartbreakingly brought her two brothers up to say goodbye to her; we didn't know if it would be the last time they saw her. Sophie was fighting one of her hardest battles, and she held her fight until the Swedish medical team arrived at about 7.00pm on the Tuesday evening. They explained what the ECMO treatment was and the risks associated with it. We knew it was Sophie's only chance of survival and were in agreement to proceed. Their plan was to place Sophie onto the transportable ECMO machine in Temple Street ICU and then fly her by Air Ambulance to the Karolinska hospital in Stockholm, where she would continue her treatment. After a long 4-5 hours we received the news that she had transferred over onto the ECMO machine and was

still stable. At 3.00am on Wednesday morning we said our goodbyes to Sophie at the doors of the ambulance that was taking her to the airport for her journey to Stockholm. We then proceeded to book our flights to Stockholm to follow her over. We got home to say a quick goodbye to our boys, and with the overwhelming support of both of our families and friends we were able to drop everything to follow Sophie to Stockholm.

Sophie arrived in Stockholm on the Wednesday morning, and we arrived on the Wednesday evening. Sophie settled on the treatment really well. Over the next few days, the Swedish ECMO team were busy draining fluid from Sophie to treat her low blood pressure. On Friday 16 December, while in Sweden we received word from the HSE that Sophie was confirmed positive for the invasive Group A streptococcal infection, which was what had led to the septic shock. While everyone was enjoying the run-in to Christmas and the joyous occasions that come with it, we were in a different country away from our families, our two boys at home trying to lead as normal as life as possible but without Mammy and Daddy. Sophie spent a week on ECMO, all of the time showing positive signs, even asking to lip sing 'Twinkle Twinkle, Little Star'. On Tuesday 20 December there was talk of us potentially going home, but Sophie was a little sleeper and still on the ventilator. The team got called away to another child, so going home to Ireland was paused. The Swedish team carried out some scans on Sophie due to the regression in her alertness and physical state; the scans showed some bleeding on the brain, one of the risks of the treatment. On Thursday 22 December, Sophie was successfully taken off the ventilator and there was further talk of us getting home to Ireland. The team redid the scans and were happy that Sophie was fit to transfer home. We got word on the Friday morning that we were flying back to Ireland for Sophie to continue her recovery in Temple Street ICU. We got to fly with Sophie in the Air Ambulance this time as they only needed a team of two to transfer with her. We landed back in Dublin on the evening of 23 December, just in time for Christmas. It was a very emotional reunion with our boys and families. Sophie transferred back to Temple Street ICU, where she had fought a tough battle before having to go to Sweden to get the life-saving treatment that wasn't available to her in Dublin. Sophie was extremely agitated, one of the disadvantages of being on sedative medication, so they started her on a weaning plan. She had scans done to determine the impact of the bleeding on the brain during her treatment; they confirmed she'd had two bleeds, one from the treatment and one from the sepsis. We didn't know what lay ahead

for her, but we were behind her every step of the way. Sophie turned four on 25 December while still in the ICU, and it's definitely a birthday we will never forget.



Sophie spent 8 days in the ICU before moving to a ward on 31 December. Here she started her rehab journey to rebuild her little life from scratch. Sophie's brave determination and courage knew no bounds, and the fantastic team behind her meant we were able to bring her home at the end of February. She still had a long way to go, but we were discharged to our local children's disability network team, and she has since had a stay in the National Rehabilitation Hospital in Dun Laoghaire.

We hope by sharing Sophie's story that it highlights the need for a fully operational ECMO service in Ireland. We are very grateful for the option of getting Sophie to Sweden for the ECMO treatment. However, we are fully aware that further lives could be saved by having this facility in Ireland. In Sweden we saw how vulnerable the system is, in that you are waiting on the stars to align so that the team and their logistics can come at the right time to treat those in need of ECMO. Our stars certainly aligned that Tuesday; we will never forget the sight of the various nurses and doctors bagging to keep our little star alive until the ECMO team arrived.

Also, through telling our story we hope that all those wonderful people who worked tirelessly to keep Sophie alive will now know how much we appreciate what they did for us and for that we will be forever grateful

**Ciara Swan**





# CHAPTER 1 **INTRODUCTION**

# CHAPTER 1: INTRODUCTION

## PAEDIATRIC CRITICAL CARE IN IRELAND

A Paediatric Critical Care Unit (PCCU) is a specialised facility within a children's hospital that is charged with the care of infants and children, staffed by a specialist team and designated to provide an increased level of detailed clinical observation, invasive monitoring, focused interventions and technical support to facilitate the care of critically ill paediatric patients over an indefinite period of time. A PCCU will care for patients diagnosed with life-threatening but potentially recoverable conditions, postoperative patients who may benefit from close nursing care, and children with chronic, complex medical comorbidities that exceed the care capabilities of other clinical care areas within the hospital.

In the Republic of Ireland (ROI), there are currently two dedicated PCCUs, located in Dublin at Children's Health Ireland (CHI) at Crumlin (23 beds) and CHI at Temple Street (9 beds), giving a combined capacity of 32 beds. CHI at Crumlin is the national centre for paediatric cardiology and cardiothoracic Surgery, the National Paediatric Haematology and Oncology Centre, and the National Paediatric Burns Unit. Major specialties at CHI at Temple Street include the national centre for paediatric neurosurgical cases and renal transplants as well as the National Paediatric Craniofacial Centre and the National Centre for Inherited Metabolic Disorders. The new National Children's Hospital – which will be located on a shared campus with St James's Hospital in Dublin – will house one large state-of-the-art PCCU incorporating a general and cardiac care unit with a planned capacity of 42 beds, and a separate Neonatal Intensive Care Unit (NICU) with a planned capacity of 18 beds, making it one of the largest PCCUs in Europe.

## THE IRISH PAEDIATRIC CRITICAL CARE AUDIT

This is the third report published by the Irish Paediatric Critical Care Audit (IPCCA), presenting data on patients admitted to a PCCU in the ROI during 2021 and 2022, with key trends included for the years 2018–2022. The overall purpose of the IPCCA is to improve critical care services provided to paediatric patients by measuring the quality of care and outcomes against predetermined standards, using data from across the United Kingdom and ROI as a benchmark.

The National Office of Clinical Audit (NOCA) works with the Paediatric Intensive Care Audit Network (PICANet) in the UK. PICANet was established to develop and maintain a secure and confidential high-quality clinical database of paediatric critical care activity in PCCUs and specialist paediatric critical care transport services across the UK and ROI. There are 32 PCCUs and 13 specialist transport services currently submitting data to PICANet, which is now part of the National Clinical Audit and Patient Outcomes Programme in the UK and is recognised as the definitive source for paediatric critical care data in the UK and the ROI (Healthcare Quality Improvement Partnership, n.d.).

The Irish National ICU Audit Governance Committee ([Appendix 1](#)) oversees the audit and developed the aim and objectives of the audit ([Appendix 2](#)). Members of the committee include clinical experts, Public and Patient Interest (PPI) representatives, a senior accountable healthcare manager, the Clinical Leads, ICU audit managers, and representatives from the ICU audit coordinators. The Clinical Lead, supported by the NOCA Executive Team, has operational responsibility for implementation of the IPCCA.

## CHAPTER 2

# METHODOLOGY



## CHAPTER 2: METHODOLOGY

This report uses three different datasets to audit the care given to children admitted to a PCCU or adult ICU in the ROI:

1.	The PICANet dataset is used to audit data on children transported and admitted to PCCUs.
2.	The Irish National Intensive Care Unit Audit (INICUA) dataset is used to audit data on all children admitted to an adult ICU in the participating hospitals ( <a href="#">see Appendix 3</a> ).
3.	The Extracorporeal Life Support Organization (ELSO) Registry is used to provide additional detail of patients requiring extracorporeal membrane oxygenation (ECMO) treatment (Table 6.2).

### DATASET 1: PICANET

The data are collected in the PCCUs by audit nurses, audit coordinators and a data manager, who are responsible for the local data entry and upload to PICANet. The data collected include the following:

- **Admission data:** These consist of each child's demographic details, including their date of birth, ethnicity and sex. The PICANet database also collects details about where children are admitted from, their date of admission, their clinical diagnoses and some physiological parameters on admission to PCCU, including arterial blood gas results, blood pressure, medical history and ventilation status. Data on outcome and discharge details are also included. The medical interventions that each child receives each day are also recorded as part of the audit.
- **Referral data:** These include details of the referring hospital, demographic details about the child, the grade of the referring doctor or nurse, the transport team involved and the destination PCCU.
- **Transport data:** These include details about the transport team, journey times, any interventions carried out and critical incidents.

PICANet provides documentation on data definitions and standardised data collection forms for the users.

### Data entry and submission

The IPCCA uses PICANet's information technology infrastructure in order to collect audit data. All data submitted is stored in the Leeds Analytic Secure Environment for Research (LASER) system. All data at rest in the LASER system are encrypted using Advanced Encryption Standard (AES) 256-bit encryption. The database enables the recording of admission, transport and referral event data, allowing for real-time data validation and reporting. Hospital access to the database is restricted to each hospital's own data. Permission to access the PICANet Web record for a named hospital or organisation (including retrieval teams) must be granted by the lead clinician. Detailed methodology is available on the [PICANet website](#).

### Data quality, validation and case ascertainment

Data validation is carried out at the point of data entry on the PICANet Web system and centrally on the database. Validation checks for logical inconsistencies, out-of-range values, and missing and incorrect data are reported back to the individual participating organisations on demand via the web interface. PICANet Web also allows PCCU staff to obtain reports on their own data to aid quality assurance, data validation checks and case ascertainment checks.

## **DATASET 2: IRISH NATIONAL ICU AUDIT**

Children who present to hospitals outside Dublin and who require specialist ICU care are cared for in adult ICUs. The numbers of children admitted to adult ICUs are small and will be presented separately from children admitted to PCCUs in this report (see Chapter 4). INICUA, in partnership with the UK's Intensive Care National Audit and Research Centre (ICNARC), reports on benchmarked quality indicators of outcomes and activity for INICUA to facilitate quality improvement. The INICUA dataset covers the patient journey throughout the entire acute hospital stay and is outlined in [Appendix 4](#).

## **DATASET 3: EXTRACORPOREAL LIFE SUPPORT ORGANIZATION (ELSO) REGISTRY**

ELSO collects data from more than 50 countries worldwide and has over 180,000 cases submitted. Since joining in 2005, CHI at Crumlin has submitted data on all ECMO cases to ELSO. Data entry is via a portal on the ELSO website, where data definitions, forms and instructions are available. This comprehensive registry is the world's leading data source on patients receiving ECMO.

## **ANALYTICAL TECHNIQUES**

### **Data analysis**

NOCA received the finalised data from PICANet as encrypted Excel files. Statistical analysis of these data included simple cross-tabulations and the calculation of crude and risk-adjusted standardised mortality ratios (SMRs) and 95% confidence intervals. The ICNARC dataset was used to describe the children in adult ICUs, and the ELSO dataset was used to describe patients receiving ECMO. Basic descriptive statistics were used to describe the relevant populations.

### **Data included**

Demographic, process and outcome measures are presented in this report for the participating Units in the ROI. PICANet audits and reports on the clinical care of children admitted to PCCUs in both the UK and the ROI. This report presents overall performance on five key quality metrics relevant to paediatric intensive care services (case ascertainment, including timeliness of data submission, retrieval mobilisation times, emergency readmissions within 48 hours of discharge, unplanned extubation in PCCU and mortality in PCCU) for the ROI and benchmarks that performance against other participating PCCUs in England, Wales, Scotland and Northern Ireland. Specifically, it includes data from CHI at Crumlin, CHI at Temple Street and the Irish Paediatric Acute Transport Service (IPATS). The data are presented for 2018–2022. This report should be read in conjunction with the [Paediatric Intensive Care Audit Network State of the Nation Report 2023](#) (Universities of Leeds and Leicester, 2023). Figures and tables have been sourced from the PICANet annual report, and NOCA has reproduced some data from that report.

### WHO WE WORK WITH

#### CHI at Crumlin PCCU

**Clinical Lead PICANet:** Associate Professor Martina Healy

**PCCU Data Manager:** Erika Brereton

**PCCU Clinical Nurse Audit and Research Coordinator:** Mong Hoi Tan

**PCCU Clinical Audit Nurses:** Andrea Joan Sequeira, Luiza Dsouza, Malena McLoone

**ECLS Coordinator:** Sunimol Joseph

**PCCU Clinical Nurse Manager 3:** Lorraine O'Reilly



#### CHI at Temple Street PCCU

**PCCU Clinical Lead:** Professor Kevin Carson

**PCCU Consultant in Paediatric Critical Care:** Dr Aisling Walsh

**PCCU Clinical Nurse Audit and Research Coordinator:** Marie Lawlor

**PCCU Clinical Nurse Manager 3:** Susan Kearns



# CHAPTER 3

## **DATA QUALITY**



**Coverage of  
Data Release**



**Completeness of  
Data Release**



**Accuracy of  
Data Release**

## CHAPTER 3: DATA QUALITY




### DATA QUALITY STATEMENT OF IPCCA NATIONAL REPORT 2020

Tables 3.1, 3.2 and 3.3 provide an assessment of the quality of the IPCCA data in this report using internationally agreed dimensions of data quality, as laid out in *Guidance on a Data Quality Framework for Health and Social Care* (Health Information and Quality Authority, 2018).

**TABLE 3.1:** CONTEXT OF DATA QUALITY STATEMENT

<b>Scope</b>	<p>This data quality statement provides an assessment of the data released for this report. This statement solely focuses on the data quality dimension of accuracy and reliability, specifically on the characteristics of</p> <ul style="list-style-type: none"> <li>• coverage of data release</li> <li>• completeness of data release</li> <li>• accuracy of data release.</li> </ul>
<b>Purpose</b>	<p>This information will help the reader decide whether the data are fit for the user's specific purpose.</p>
<b>Data source</b>	<p>Sources of data for this report are <b>PICANet</b>, <b>INICUA</b> and <b>ELSO</b>. While the overall numbers of patients who received ECMO are extracted from <b>PICANet</b>, Table 6.1 of this report includes additional data on ECMO from data submitted by CHI at Crumlin to the <b>ELSO</b> Registry.</p>
<b>Timeframe of data release</b>	<p>For each of the three datasets <b>PICANet</b>, <b>INICUA</b> and <b>ELSO</b>, the data published in this report are based on data collected within the period 1 January 2018 to 31 December 2022.</p>
<b>Type of data</b>	<p>The report uses data which have been validated by <b>PICANet</b>, ICNARC and <b>ELSO</b>.</p>

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY

<p><b>Coverage of data release</b></p> 	<p><b>PICANet</b> collects data from all 32 PCCUs in the UK and the ROI, giving 100% coverage. Case ascertainment within each PCCU is measured as the proportion of total number of admissions reported to PICANet and is usually assessed by validation visits from the PICANet team. At least 97% of admissions were captured in each Unit in 2018, and 95% in 2019. In 2020–2021, due to the COVID-19 pandemic, these routine visits did not take place. In 2022, there were 11 virtual validation visits to enable assessment of data accuracy in each Unit. Twice per year, reports are sent to participating Units checking case ascertainment – a cross-check of admission records with those recorded on PICANet Web database. In the reporting period, 99.9% of admissions were captured in each Unit.</p> <p><b>INICUA</b> collects data from 26 Intensive Care Units in 22 hospitals in the ROI, which represents 96% of all critical care in HSE-funded hospitals (<a href="#">see Appendix 3</a> for data coverage in each participating hospital).</p> <p><b>ELSO</b> collects data from more than 50 countries worldwide and has a total of 180,900 cases submitted. CHI at Crumlin submits data on all ECMO cases to ELSO. All cases were submitted for this reporting period.</p>
<p><b>Completeness of data release</b></p> 	<p><b>PICANet:</b> CHI at Crumlin and CHI at Temple Street did not achieve 100% completeness within 3 months of discharge during the reporting period (see Figure 7.1). However, 100% completeness was achieved prior to the final data lock for the reporting period, which occurs on 31 March each year. Data completeness reports by data item for each dataset are available in the <a href="#">PICANet Data Quality Report 2023</a></p> <p><b>INICUA:</b> Missing fields are identified as such and are thus corrected by each participating Unit or deemed unavailable before data are reported on.</p> <p><b>ELSO:</b> Data validation reports identifying missing fields are available to participating Units. CHI at Crumlin had 100% completeness for the reporting period.</p>
<p><b>Accuracy of data release</b></p> 	<p><b>PICANet:</b> PCCUs collect data on all patients admitted. Data validation is carried out at the point of data entry on the PICANet Web system and centrally on the database. Validation checks for logical inconsistencies, out-of-range values, missing and incorrect data are reported back to the individual participating organisations on demand via the web interface.</p> <p><b>INICUA:</b> Critical care Units collect data on all patients admitted to their Unit. Data are run against over 600 validation checks that identify potential errors as well as missing and unusual data. The Units use these checks to update their data before returning them for further validation checks. The data are ready for analysis after they have passed all validation checks.</p> <p><b>ELSO:</b> Data validation reports identifying missing fields are available to participating Units.</p>

**TABLE 3.3:** ASSESSMENT OF DATA QUALITY

<b>Strengths of data in this report</b>	<b>PICANet:</b> Even though there is no exact estimate of case ascertainment available for 2020, PICANet has consistently had high case ascertainment each year (2015–2019, 97% or higher); therefore, we can be confident about these data.
	<b>INICUA:</b> This is a robust dataset that includes case mix, activity and outcome data, which are routinely validated and risk adjusted for reporting purposes.
	<b>ELSO:</b> This is a comprehensive registry and the world's leading data source on patients receiving ECMO.
<b>Limitations of data in this report</b>	Data analysis should be carried out on all admissions to be confident that findings are interpreted appropriately. Due to the COVID-19 pandemic and the HSE cyberattack, this report is publishing data that are not as timely as they should be.



CHAPTER 4  
**ADMISSIONS AND  
PATIENT PROFILE  
IN PAEDIATRIC  
CRITICAL CARE UNITS**

## CHAPTER 4: ADMISSIONS AND PATIENT PROFILE IN PAEDIATRIC CRITICAL CARE UNITS

### ADMISSIONS TO PCCU

In the ROI, there were 1,659 admissions of patients to PCCU in 2021 and 1,670 in 2022. These numbers include 42 admissions of patients aged 16 years or over during 2021, and 36 in 2022. The figures do not include paediatric patients treated in adult ICUs; there were 53 admissions of children aged under 16 years to adult ICUs in 2021 and 65 in 2022, and these are detailed in Table 4.3.

Between 2018 and 2022, there were 94,188 admissions to all PCCUs across the UK and the ROI (CHI at Crumlin and CHI at Temple Street) (see Table 4.1). The ROI Units accounted for 8% (N=7571) of all admissions. All areas experienced a decrease in admissions in 2020, ranging from a 9% decrease in the ROI to a 31% decrease in Scotland, most likely attributable to the COVID-19 pandemic. Admissions to PCCUs increased in 2021 and 2022 compared to 2020. The rise in admissions in the ROI was higher than all UK nations, where overall admission numbers in 2021 and 2022 remained lower than those recorded in 2019 before the COVID-19 pandemic.

**TABLE 4.1:** NUMBER OF ADMISSIONS AGED UNDER 16 YEARS, BY COUNTRY AND YEAR, 2018–2022

Country	2018	2019	2020	2021	2022	2018-2022
ENGLAND	16 389	16 208	13 256	14 500	14 810	75 163
SCOTLAND	1351	1697	1178	1375	1509	7110
NORTHERN IRELAND	501	492	353	443	425	2214
WALES	510	489	363	372	396	2130
REPUBLIC OF IRELAND	1429	1514	1377	1617	1634	7571
<b>TOTAL</b>	<b>20 180</b>	<b>20 400</b>	<b>16 527</b>	<b>18 307</b>	<b>18 774</b>	<b>94 188</b>

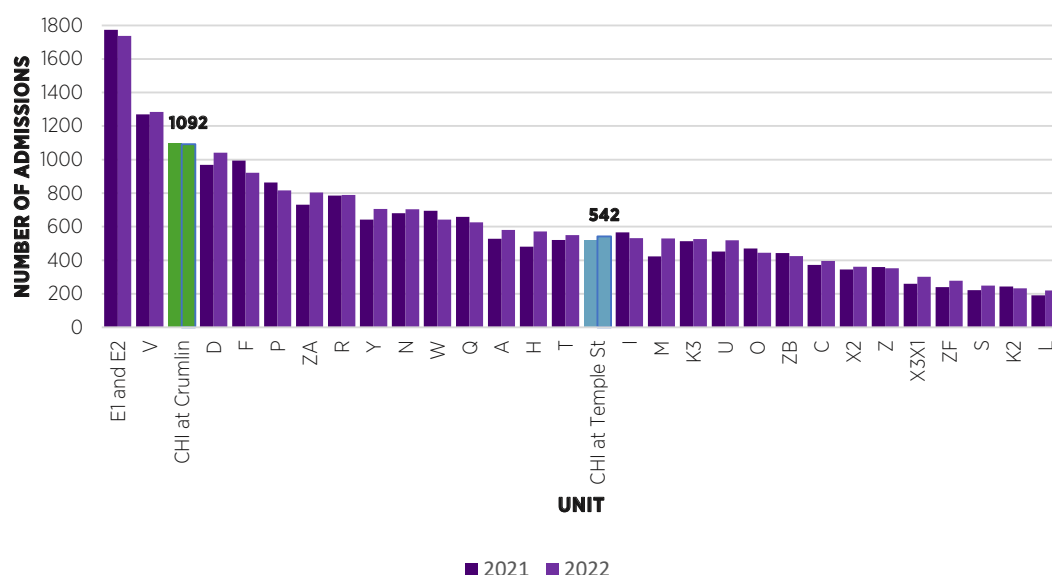
## PREVALENCE OF ADMISSION

The rate of PCCU admissions recorded in the ROI in 2021 was 143.9 per 100,000 childhood population; in 2022 it was 123.7 per 100,000 childhood population. The highest rate was recorded in Scotland in 2022, with Units collectively reaching 176.5 admissions for every 100,000 children. Scotland has a childhood population size close to the ROI and has 32 PCCU beds and 9 HDU beds across two Units. The admission rates in all areas decreased significantly between 2019 and 2020 (see Table 4.2).

**TABLE 4.2: RATES OF ADMISSION AGED UNDER 16 YEARS, BY COUNTRY AND YEAR, 2018–2022**

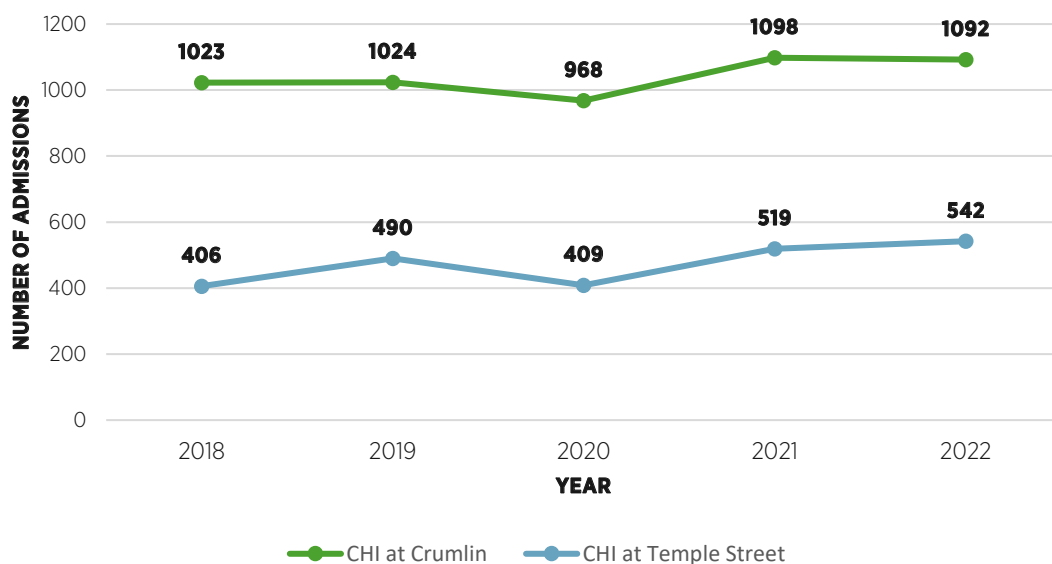
Country	Population	2018	2019	2020	2021	2022
ENGLAND	10 467 948	141.1	141.1	120.0	132.5	134.0
SCOTLAND	911 522	154.3	191.8	139.2	159.0	176.5
NORTHERN IRELAND	388 176	166.6	159.3	128.2	145.8	117.4
WALES	546 939	139.6	140.2	118.8	115.4	116.3
REPUBLIC OF IRELAND	1 068 195	127.8	133.4	119.7	143.9	123.7
<b>TOTAL</b>	<b>13 382 780</b>	<b>141.6</b>	<b>144.3</b>	<b>121.4</b>	<b>134.9</b>	<b>134.7</b>

The total number of admissions per Unit for 2021 and 2022 is illustrated in Figure 4.1 (see [Appendix 5](#) for the PICANet organisation key). CHI at Crumlin had the third-highest number of PCCU admissions of all PICANet participating Units, at 1,092 in 2022 and 1,098 in 2021, after Great Ormond Street Hospital (E1 and E2) and Birmingham Children's Hospital (V). CHI at Crumlin and CHI at Temple Street combined had total admissions of 1,634 in 2022 across 32 beds. When the new National Children's Hospital (NCH) opens with an additional 10 PCCU beds, it will have admissions numbers close to that of Great Ormond Street Hospital, which has 47 beds.



**FIGURE 4.1: TOTAL NUMBER OF ADMISSIONS TO PAEDIATRIC INTENSIVE CARE AUDIT NETWORK PARTICIPATING UNITS, BY UNIT, 2021 (N=18307) AND 2022 (N=18774)**

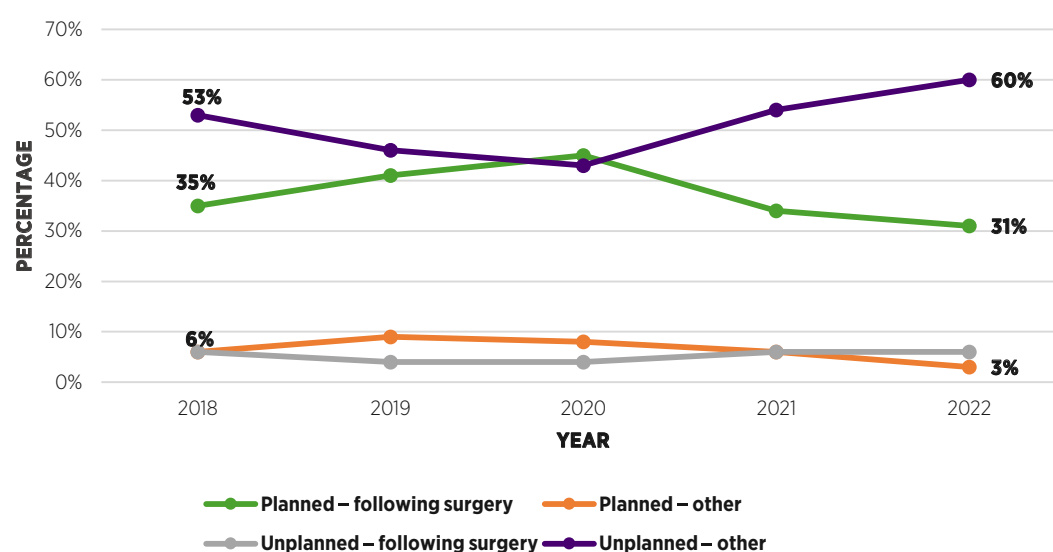
There was a slight increase (7%) in the number of admissions to CHI at Crumlin in 2021 and 2022 compared to 2018 (n=1023), while admissions to CHI at Temple Street PCCU in 2022 (n=542) increased by 34% compared to 2018 (n=406) (see Figure 4.2).



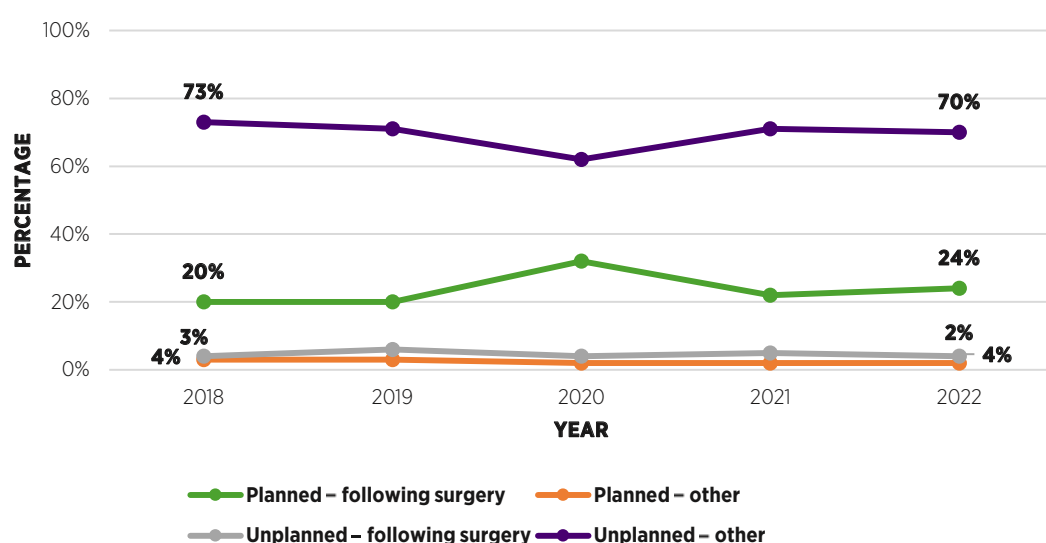
**FIGURE 4.2:** ADMISSIONS BY PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, 2018–2022 (N=7571)

## ADMISSIONS BY TYPE AND SOURCE

Over the 5-year period 2018–2022, the greatest proportion of admissions (62%, n=4717) to both PCCUs were unplanned (i.e. emergencies), with differences between the two Units. Over one-half of admissions to CHI at Crumlin PCCU in 2021 (60%, n=661) and 2022 (67%, n= 730) were unplanned (see Figure 4.3a), while in CHI at Temple Street unplanned admissions accounted for almost three-quarters of admissions in 2021 (76%, n=394) and 2022 (73%, n=398) (see Figure 4.3b). The proportion of unplanned admissions in both Units decreased in 2020 due to the COVID-19 pandemic, while the proportion of planned admissions following surgery increased in 2020 in both Units compared to other years. This can be accounted for by lower occupancy rates, which allowed more planned surgeries to take place.



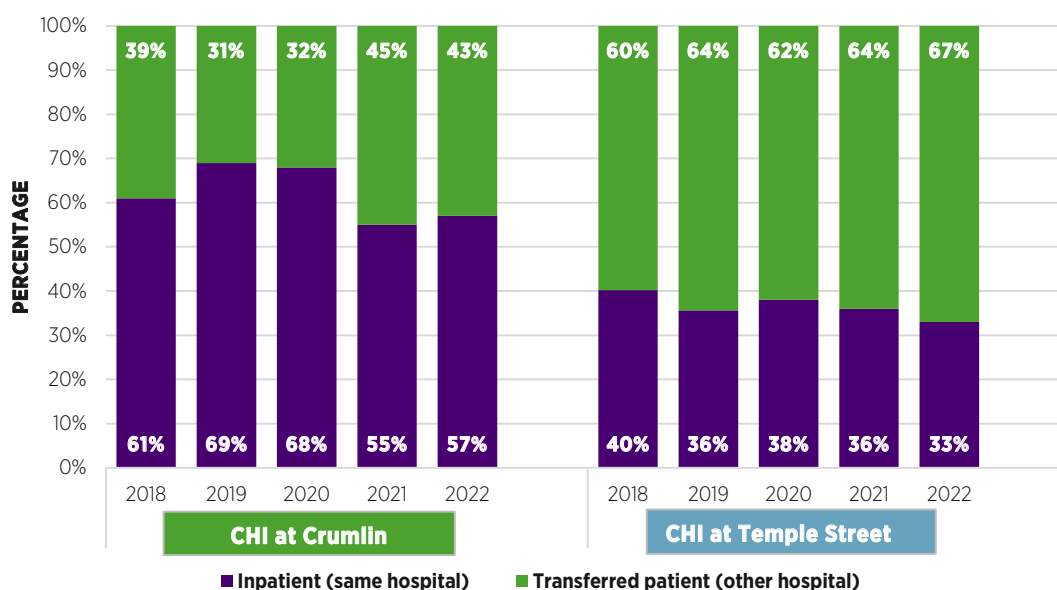
**FIGURE 4.3A:** TYPES OF PAEDIATRIC CRITICAL CARE UNIT ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=5205), 2018–2022



**FIGURE 4.3B:** TYPES OF PAEDIATRIC CRITICAL CARE UNIT ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=2366), 2018–2022

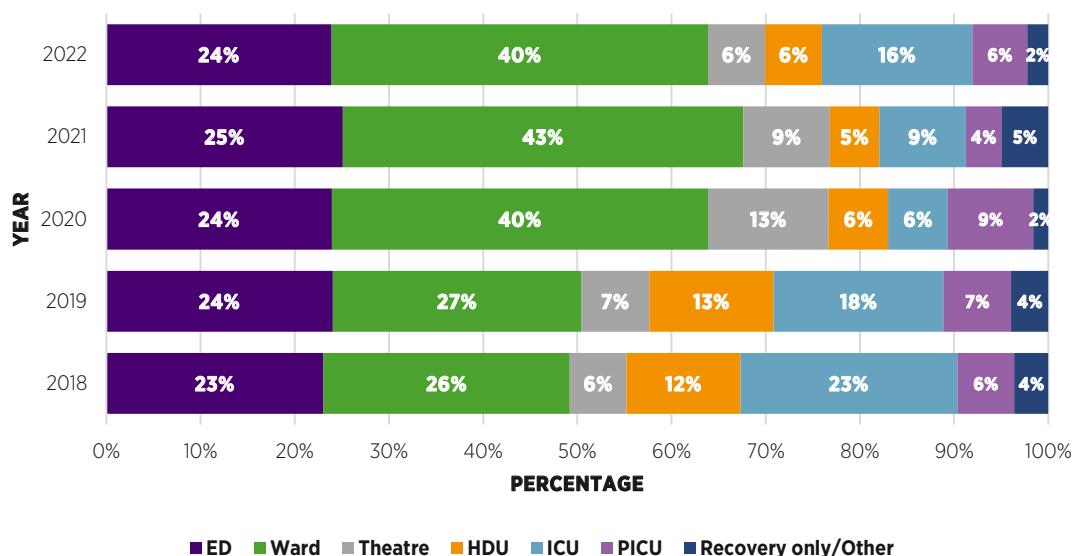
## SOURCE OF ADMISSION

The source of unplanned admissions varied between CHI at Crumlin and CHI at Temple Street. In CHI at Crumlin, a higher proportion of unplanned admissions to PCCU were inpatients of the same hospital, whereas in CHI at Temple Street, a greater proportion of unplanned admissions to PCCU were transfers from another hospital (see Figure 4.4). This can be accounted for by the higher number of in-house emergency admissions to PCCU in CHI at Crumlin. The proportion of unplanned admissions from outside the hospital to the CHI at Crumlin PCCU increased from 32% (n=132) in 2020 to 45% (n=267) in 2021 and 43% (n=281) in 2022. There was less variation in the ratio of transferred inpatient admissions in CHI at Temple Street (see Figure 4.4).



**FIGURE 4.4:** SOURCE OF 'UNPLANNED - OTHER' PAEDIATRIC CRITICAL CARE UNIT ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=2675) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=1642), 2018-2022

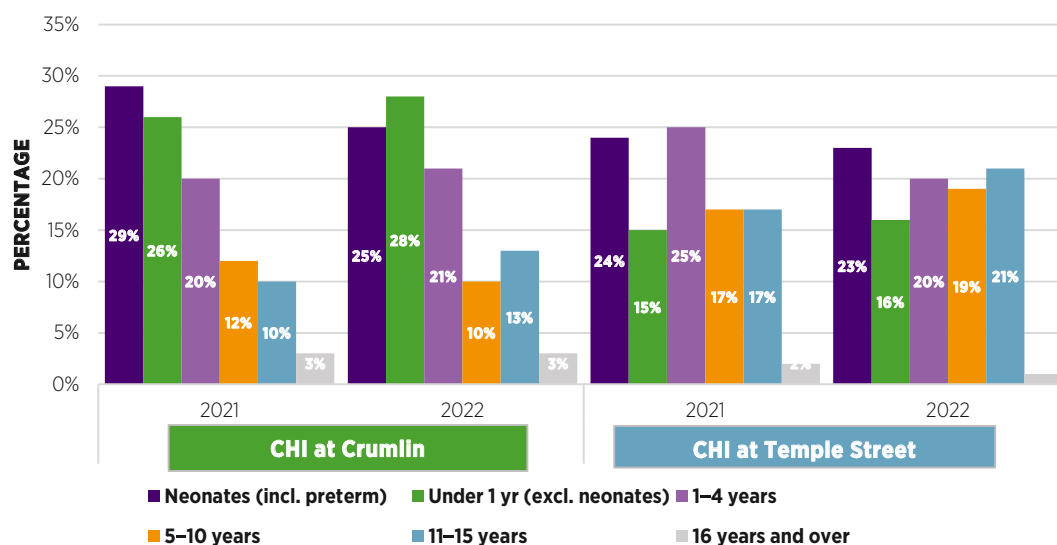
Unplanned admissions transferred from another hospital to a PCCU were collected by IPATS during its hours of operation. Figure 4.5 shows the care area of the other hospital from which the patient was collected for the period 2018–2022. Over 40% of patients in 2021 (n=56) and 2022 (n=55) were collected from a ward. There was a decrease in the proportion of patients collected from an ICU area in 2020 (6%). Each year, IPATS transfers a small number of patients between the two PCCUs, usually for specialist care (i.e. Cardiac in CHI at Crumlin and Neurosurgery in CHI at Temple Street).



**FIGURE 4.5:** COLLECTION AREA OF UNPLANNED ADMISSIONS TRANSPORTED BY IRISH PAEDIATRIC ACUTE TRANSPORT SERVICE TO PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, 2018–2022 (N=498)

## AGE PROFILE OF CHILDREN ADMITTED TO PCCUs

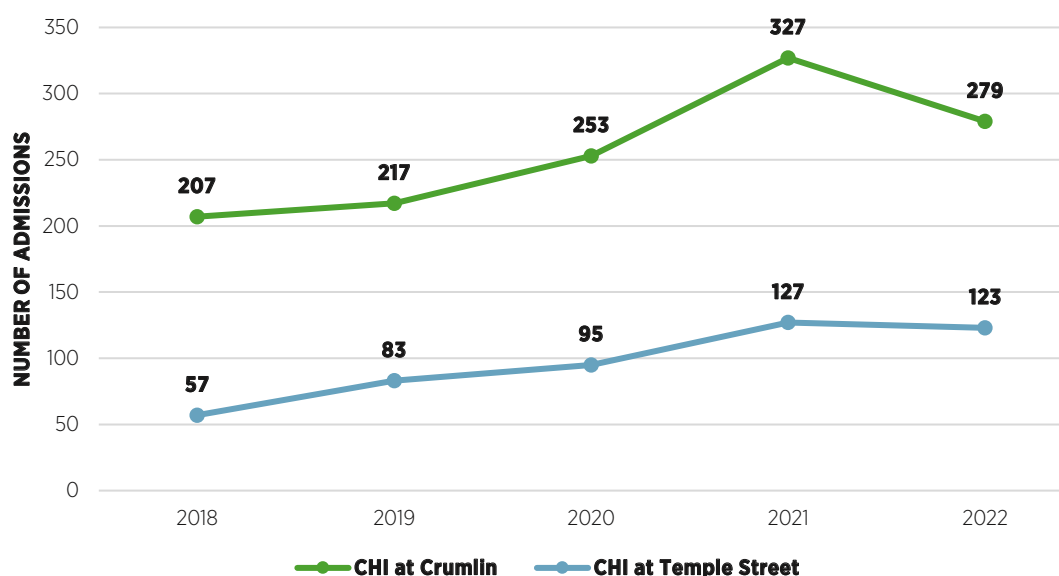
The age distribution of children admitted to individual PCCUs in the ROI in 2021 and 2022 is presented in Figure 4.6. Neonates and infants aged under 1 year account for over one-half of all admissions to CHI at Crumlin in 2021 (55%, n=617) and 2022 (53%, n=593) and 39% (2021 n=205, 2022 n=209) of admissions to CHI at Temple Street. Overall, patients admitted to PCCU in CHI at Temple Street were older than those admitted to CHI at Crumlin.



**FIGURE 4.6:** AGE PROFILE OF CHILDREN IN PAEDIATRIC CRITICAL CARE UNITS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=2252) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=1077), 2021-2022

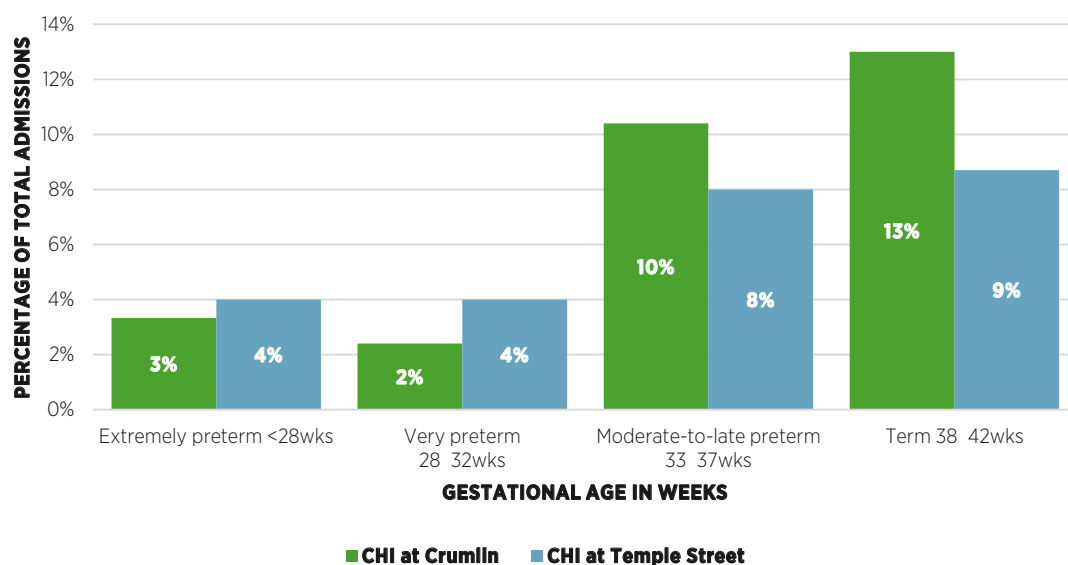
## NEONATAL ADMISSIONS

CHI at Crumlin provides both general and cardiac surgical neonatal services, while CHI at Temple Street provides neurological, neurosurgical and metabolic expertise at tertiary care level. Newborns ranging in age from 23 weeks to 1 month corrected gestational age are admitted from maternity hospitals to PCCU or may be referred for multidisciplinary team input subspecialist care (e.g. ear, nose and throat (ENT); nephrology; gastroenterology). Neonates may also be admitted with acute respiratory distress (e.g. respiratory syncytial virus (RSV) infection, sepsis or neurological issues). Figure 4.7 presents the number of neonatal admissions for both Units over the 5 years 2018–2022.



**FIGURE 4.7:** NEONATAL ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=1283) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=485), 2018–2022

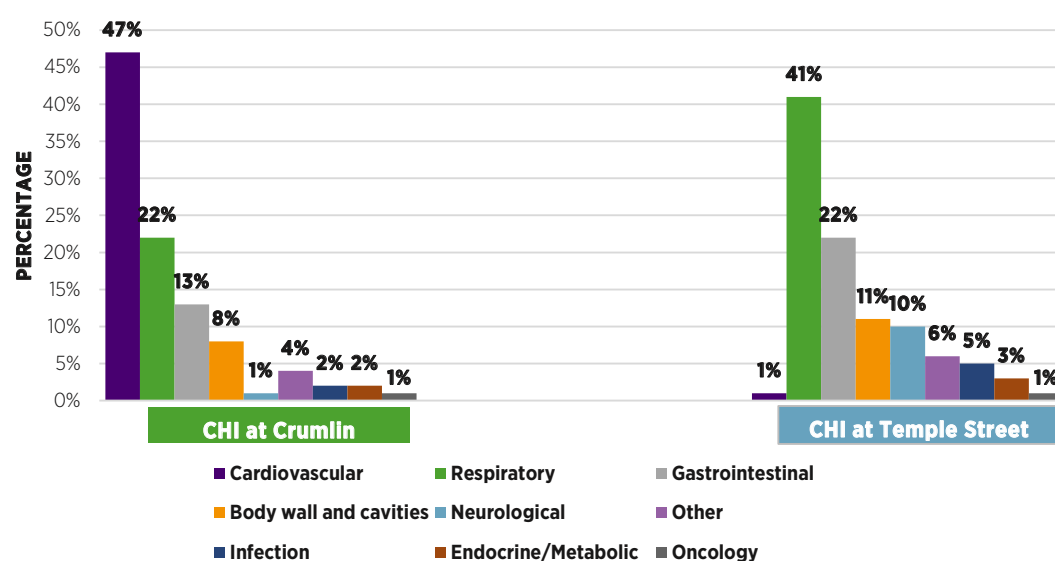
The ROI Units are among the few PCCUs participating in PICANet to have up to 30% of all admissions in the neonatal age category, with a considerable proportion aged under 38 weeks. Neonates cared for in a children's hospital setting are among the most complicated and highest-risk patients nationally. Figure 4.8 presents the proportion of overall admissions for neonates by their gestational age at delivery in weeks to CHI at Crumlin and CHI at Temple Street PCCUs for the years 2021–2022 combined. Neonate admissions are defined as corrected age at admission to PCCU under 29 days, where corrected age is calculated to the nearest full week. Almost 30% (28%, n=606) of overall admissions to CHI at Crumlin were neonates, 15% (n=327) were preterm, and 5% (n=115) were aged under 32 weeks gestation. One-quarter (n=250) of admissions to CHI at Temple Street were neonates, 16% (n=158) were preterm, and 8% (n=77) were aged under 32 weeks gestation.



**FIGURE 4.8: NEONATAL PAEDIATRIC CRITICAL CARE UNIT ADMISSIONS AS A PERCENTAGE OF TOTAL ADMISSIONS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=606) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=250), BY GESTATIONAL AGE, 2021–2022**

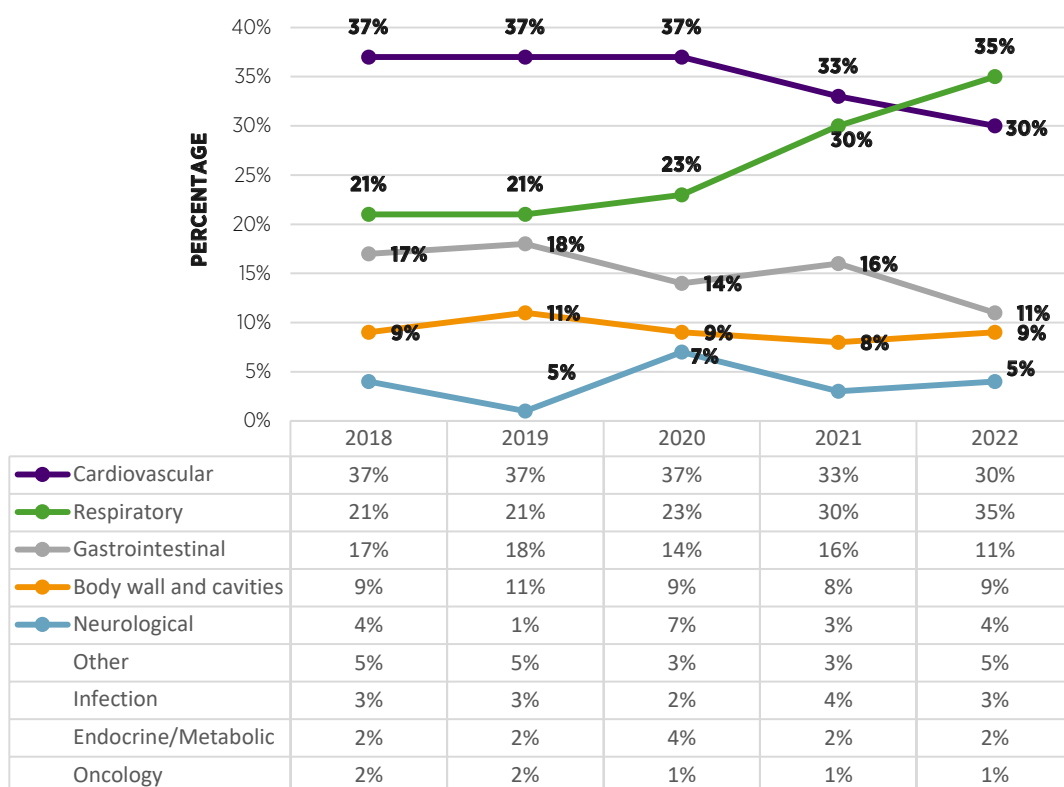
Figure 4.9 presents the breakdown of neonatal admissions to each individual PCCU during 2018–2022. In CHI at Crumlin, almost one-half (47%, n=596) of neonates were admitted due to cardiovascular problems, with the next largest group (22%, n=278) admitted due to respiratory problems. By contrast, in CHI at Temple Street, respiratory problems (41%, n=197) and gastrointestinal problems (22%, n=104) were the main reasons for admission.

Coding of admissions in PICANet provides a non-specific picture of complex surgical and medical patients. For example, the body wall and cavities diagnosis category may refer to general surgery, laparotomy, congenital diaphragmatic hernia (CDH) or trachea-oesophageal fistula, as can gastrointestinal diagnosis categories. To provide a more complete picture of the ROI PCCU population, data need to be subcategorised into general surgery, cardiac surgery, neurology or neurosurgery, with audit data provided on complexity and outcomes in these specific patient subgroups.



**FIGURE 4.9:** NEONATAL PAEDIATRIC CRITICAL CARE UNIT ADMISSIONS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=1278) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=482) BY PRIMARY DIAGNOSIS, 2018–2022

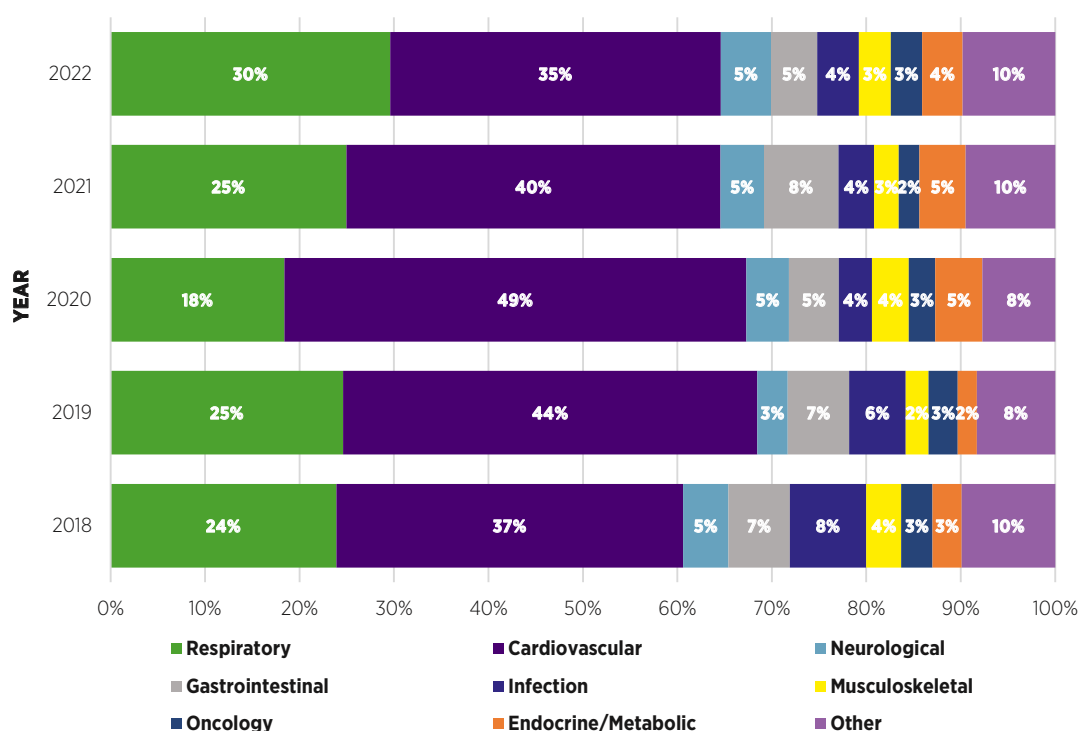
Figure 4.10 presents the breakdown of primary diagnosis of neonatal admissions to both PCCUs combined for each year over the 5-year period 2018–2022. Cardiovascular problems accounted for the largest proportion of admissions, followed by respiratory problems. However, in 2022 the proportion of respiratory admissions (35%, n=142) overtook the proportion of cardiovascular admissions (30%, n=120). Cardiovascular admissions decreased slightly from 37% in 2018–2020 to 33% in 2021 and 30% in 2022.



**FIGURE 4.10: NEONATAL ADMISSIONS TO PAEDIATRIC CRITICAL CARE UNITS, BY PRIMARY DIAGNOSIS, 2018–2022 (N=1763)**

## ADMISSIONS BY PRIMARY DIAGNOSIS GROUP

Admission by primary diagnosis group varied by Unit. The number of admissions to each Unit in 2018–2022 grouped by primary diagnosis is outlined in Figure 4.11a and 4.11b. In CHI at Crumlin, the largest proportion of patients admitted to PCCU each year were those with cardiovascular diagnoses. This finding is not surprising as CHI at Crumlin is the tertiary referral centre for paediatric cardiothoracic surgery and cardiology. Respiratory diagnoses accounted for between 18% (n=178) and 30% (n=323) of admissions in this Unit.



**FIGURE 4.11A:** ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT CRUMLIN PAEDIATRIC CRITICAL CARE UNIT, BY PRIMARY DIAGNOSIS AND YEAR, 2018–2022 (N=5205)

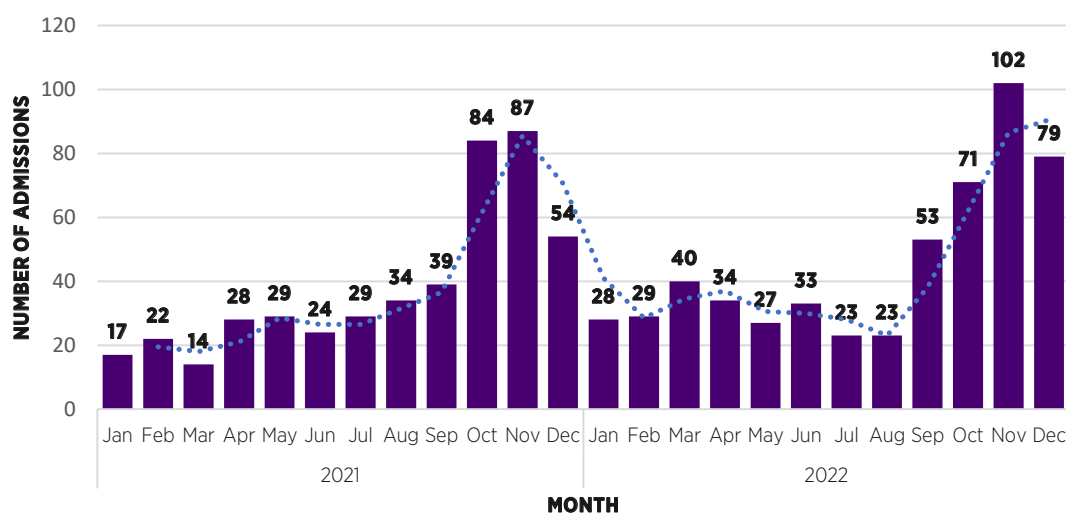
The pattern of admission over the 5-year reporting period differed for CHI at Temple Street, where the largest proportion of patients were admitted for respiratory diagnoses, accounting for between 24% (n=100) and 39% (n=210) of admissions in this Unit, followed by neurological diagnoses, including all neurosurgical cases requiring PCCU care.



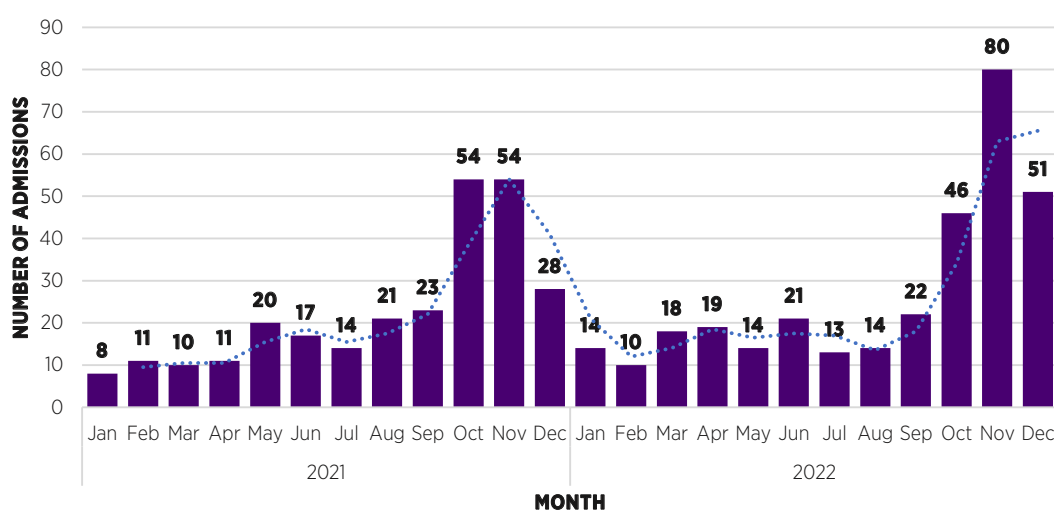
**FIGURE 4.11B:** ADMISSIONS TO CHILDREN'S HEALTH IRELAND AT TEMPLE STREET PAEDIATRIC CRITICAL CARE UNIT BY PRIMARY DIAGNOSIS AND YEAR, 2018-2022 (N=2366)

## RESPIRATORY DIAGNOSES

Respiratory primary diagnoses increased in 2021 and 2022, comprising 30% of all admissions in 2022 to CHI at Crumlin and 39% of all admissions to CHI at Temple Street, representing a return to pre-2020 levels. Figures 4.12a and 4.12b show that these admissions spiked from October to December, and that children aged under 1 year accounted for most of these admissions. Respiratory diagnoses include bronchiolitis, bronchitis, pneumonia – infections of the upper or lower respiratory tract which may be caused by RSV.



**FIGURE 4.12A:** RESPIRATORY ADMISSIONS TO PAEDIATRIC CRITICAL CARE UNITS, BY MONTH AND YEAR, 2021-2022 (N=1003)



**FIGURE 4.12B:** RESPIRATORY ADMISSIONS TO PAEDIATRIC CRITICAL CARE UNITS FOR CHILDREN AGED UNDER 1 YEAR, BY MONTH AND YEAR, 2021-2022 (N=593)

## ADMISSIONS OF CHILDREN TO ADULT INTENSIVE CARE UNITS

There were 53 admissions of children aged under 16 years to adult ICUs in 2021, and 65 in 2022. This is a decrease from pre-pandemic numbers and may reflect more frequent referral to PCCU or be related to the impact of the COVID-19 pandemic on adult ICUs. Notably, in 2021 and 2022 the numbers of admissions after surgery were lower than in previous years (see Table 4.3).

**TABLE 4.3:** CHILDREN AGED UNDER 16 YEARS ADMITTED TO ADULT INTENSIVE CARE UNITS, BY AGE, CASE MIX, VENTILATION, LENGTH OF STAY AND SURVIVAL TO HOSPITAL DISCHARGE, 2018–2022 (N=400)

Parameter	2018	2019	2020	2021	2022
Patients <16 years old	103	111	68	53	65
Age, mean (median; interquartile range (IQR))	8.7 (11; 3–14)	7.5 (8; 2–13)	9 (12; 5–14)	8 (7; 1–14)	8 (11; 2–14)
Age <1 year	11	18	5	7	11
Age 1–5 years	35	44	16	16	15
Age 6–15 years	57	49	47	30	39
Admissions after surgery	26	34	7	8	8
Admissions with sepsis	16	22	11	9	17
Invasive ventilation	30 (28%)	20 (18%)	21 (31%)	20 (38%)	21 (32%)
Unit length of stay (LOS); mean (median; IQR) (hours)	51 (22; 15–48)	27 (18; 12–24)	38.5 (16; 10–32)	24 (15.7; 6.3–35.3)	68 (15.4; 7.9–21.4)
Predicted mortality, mean (median; IQR)	3.2 (1.1; 0.4–2.3)	3.9 (1.1; 0.4–4.3)	4.7 (1.0; 0.3–2.4)	7.3 (1.9; 0.5–5.2)	8.2 (2.5; 0.7–7.9)
Unit survival (n)	98 (96%)	110 (100%)	67 (99%)	50 (96%)	63 (97%)
Hospital survival (n)	98 (96%)	107 (97%)	65 (96%)	47 (90%)	61 (94%)

## KEY FINDINGS FROM CHAPTER 4

- The numbers of admissions to PCCU in 2021 and 2022 in the ROI have increased and are higher than pre-pandemic levels (increasing from 1,429 in 2018 to 1,634 in 2022).
- Unplanned admissions accounted for the majority of admissions in 2021 (65%, n=1055) and 2022 (69%, n=1128).
- Neonatal admissions with cardiovascular problems decreased from 37% in 2018–2020 to 33% in 2021 and 30% in 2022.
- Primary diagnoses of respiratory problems increased in 2021 and 2022, comprising 30% (n=323) of all admissions in 2022 to CHI at Crumlin, compared to 18% (n=178) in 2020, and 39% (n=210) of all admissions to CHI at Temple Street in 2022, compared to 24% (n=100) in 2020.
- Admissions of children to adult ICUs decreased in 2021 (n=53) and 2022 (n=65) compared to pre-pandemic levels (2019, n=111).



## CHAPTER 5

# **BED ACTIVITY AND OCCUPANCY IN PAEDIATRIC CRITICAL CARE UNITS**

## CHAPTER 5: BED ACTIVITY AND OCCUPANCY IN PAEDIATRIC CRITICAL CARE UNITS

### NUMBER OF BED DAYS DELIVERED

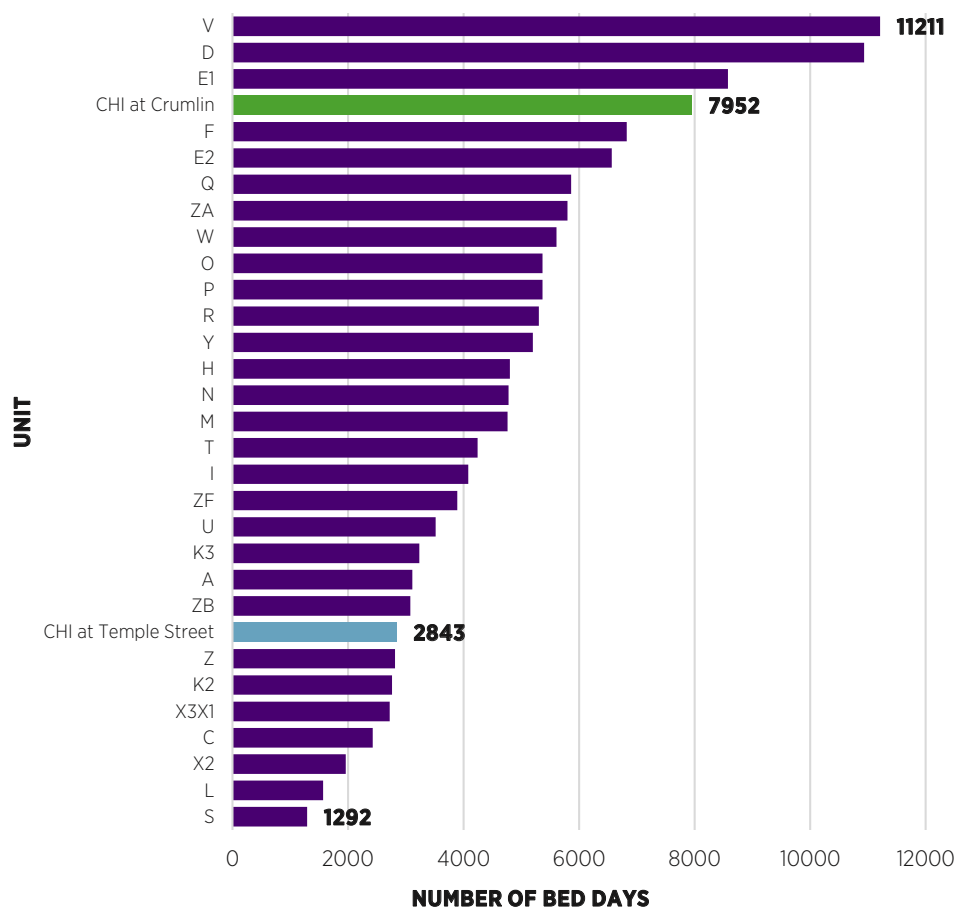
The total number of bed days delivered is calculated as the sum of children receiving critical care in a PCCU each day. A bed day is counted if a child is in a PCCU bed for part of any day during the reporting period. National figures of bed days delivered for individual countries are presented in Table 5.1, while total figures for individual Units during 2022 are illustrated in Figure 5.1.

The average annual number of bed days delivered by the two PCCUs in the ROI within this 5-year period was 10,232; however, the number decreased significantly in 2020 (by almost 1,000 bed days). More than three-quarters (76%) of the bed days per annum were provided in the Unit in CHI at Crumlin.

**TABLE 5.1:** NUMBER OF BED DAYS DELIVERED, BY COUNTRY OF ADMISSION AND YEAR, 2018–2022

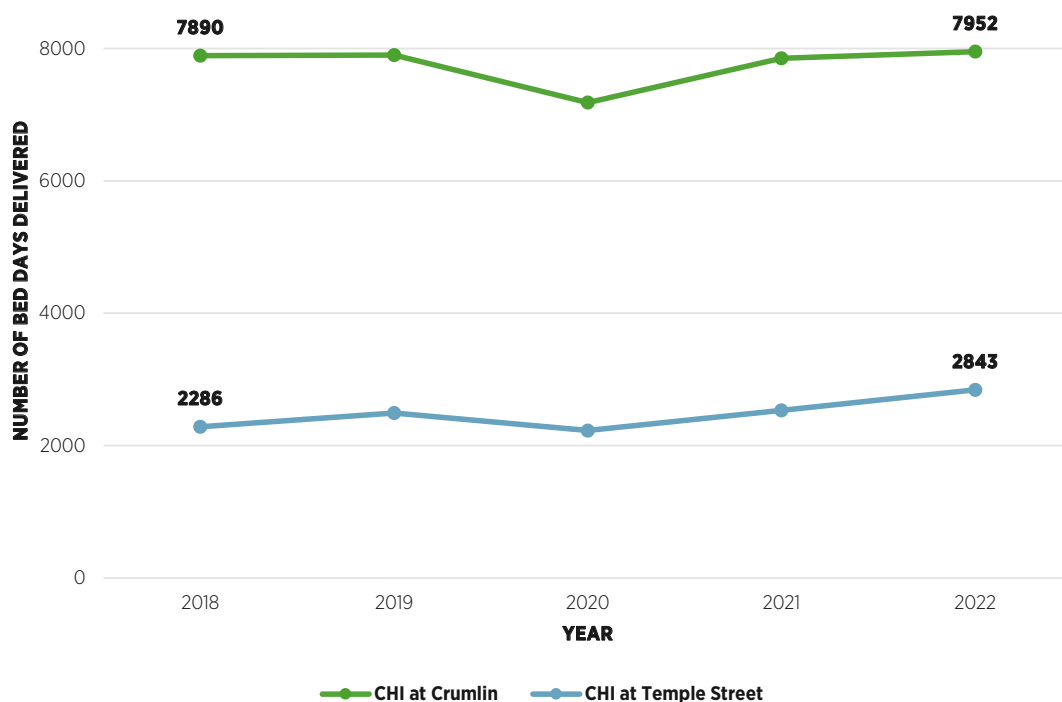
Country	2018	2019	2020	2021	2022	2018–2022
ENGLAND	117 424	115 088	98 298	111 012	121 180	563 003
SCOTLAND	10 319	12 055	8924	10 768	10 999	53 065
NORTHERN IRELAND	3275	3422	2806	3159	3079	15 741
WALES	2509	2626	2131	2150	2428	11 844
REPUBLIC OF IRELAND	10 176	10 393	9411	10 387	10 795	51 162
<b>TOTAL</b>	<b>143 703</b>	<b>143 584</b>	<b>121 570</b>	<b>137 476</b>	<b>148 481</b>	<b>694 814</b>

The total bed days delivered for each Unit during 2022 is illustrated in Figure 5.1. In 2022, CHI at Crumlin had the fourth-highest number of bed days (n=7,952) of all PCCUs in the UK and the ROI, after Birmingham Children's Hospital, Royal Manchester Children's Hospital and Great Ormond Street Hospital.



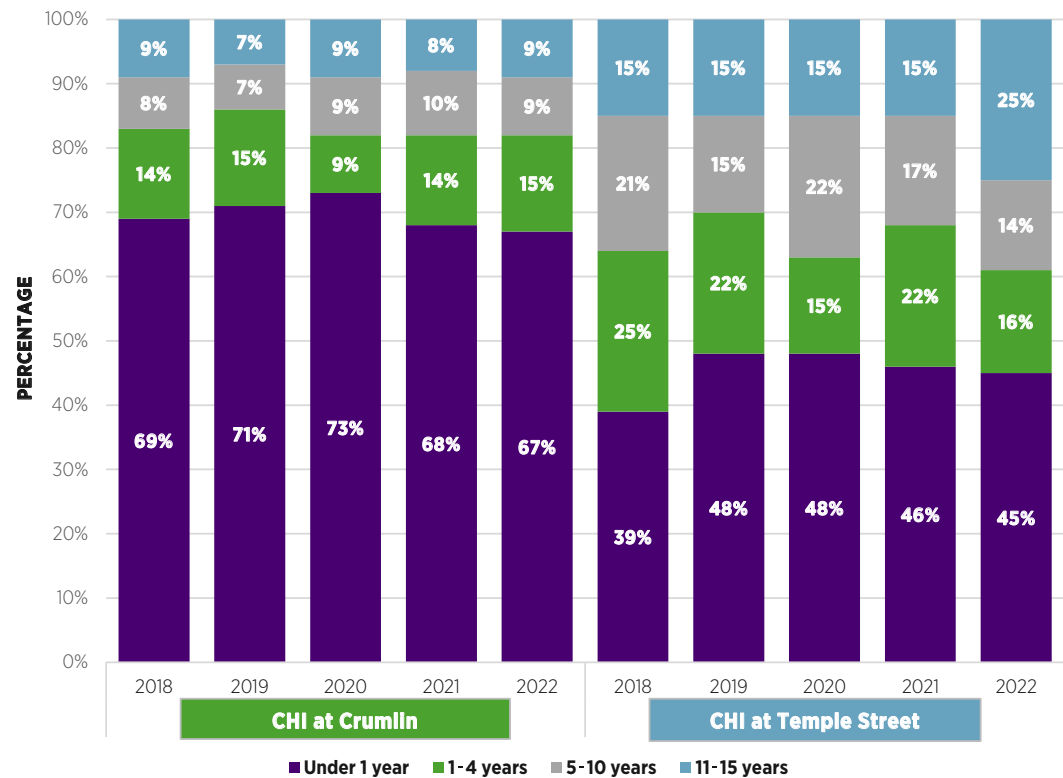
**FIGURE 5.1:** NUMBER OF BED DAYS DELIVERED BY EACH UNIT PARTICIPATING IN THE PAEDIATRIC CRITICAL CARE AUDIT NETWORK, BY UNIT, 2022 (N=148481)

Data for each PCCU in the ROI by year are provided in Figure 5.2. After a decline in 2020, the number of bed days delivered increased in 2021 and 2022 for both CHI at Crumlin and CHI at Temple Street. Bed days delivered has increased by over 500 days in CHI at Temple Street from 2,286 in 2018 to 2,843 in 2022.

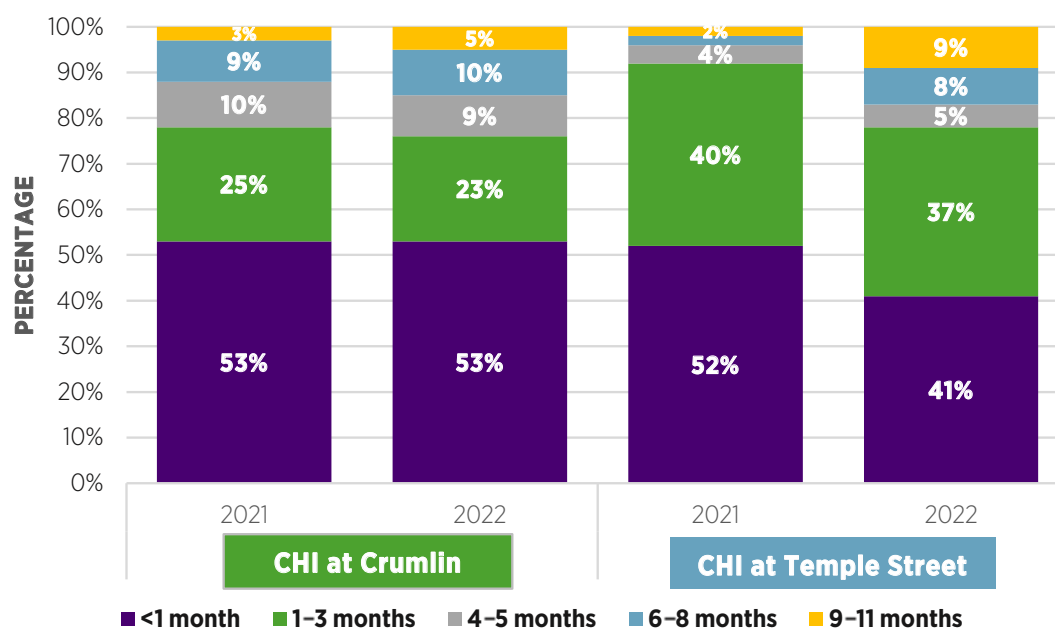


**FIGURE 5.2:** NUMBER OF BED DAYS DELIVERED IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=38779) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=12383), BY YEAR, 2018–2022

The majority of bed days were occupied by the youngest children (aged under 1 year) (see Figure 5.3a). The proportion decreased in CHI at Crumlin from 69% (n=5456) in 2018 to 67% (n=5252) in 2022. In CHI at Temple Street the proportion of children aged 11-15 years increased to 25% in 2022 compared to 15% for each of the years 2018–2021. In 2021 and 2022, children aged under 1 month accounted for the highest proportion of bed days in both Units (see Figure 5.3b).



**FIGURE 5.3A:** PERCENTAGE OF BED DAYS DELIVERED IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=38779) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=12383), BY AGE, 2018–2022



**FIGURE 5.3B:** PERCENTAGE OF BED DAYS DELIVERED IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=9304) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=1980), FOR CHILDREN AGED UNDER 1 YEAR, BY INFANT AGE IN MONTHS, 2021-2022

## BED ACTIVITY

Table 5.2 shows the bed activity in both Units for each year from 2018 to 2022. CHI at Crumlin has 23 bed spaces available, and CHI at Temple Street has 9 bed spaces available. CHI at Crumlin had a median of 22 beds open each year, apart from 2020 when beds were closed due to COVID-19 pandemic requirements for social distancing. CHI at Temple Street had a median of 6 beds open in 2018 and 2020, 7 beds open in 2019 and 2021 and 8 beds open in 2022.

**TABLE 5.2:** BED ACTIVITY, ALL ADMISSIONS TO PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, BY YEAR, 2018-2022

Unit	2018		2019		2020		2021		2022	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR
CHI at Crumlin	22	20-24	22	20-24	20	18-22	22	20-24	22	20-24
CHI at Temple Street	6	5-8	7	5-8	6	5-7	7	5-8	8	6-9

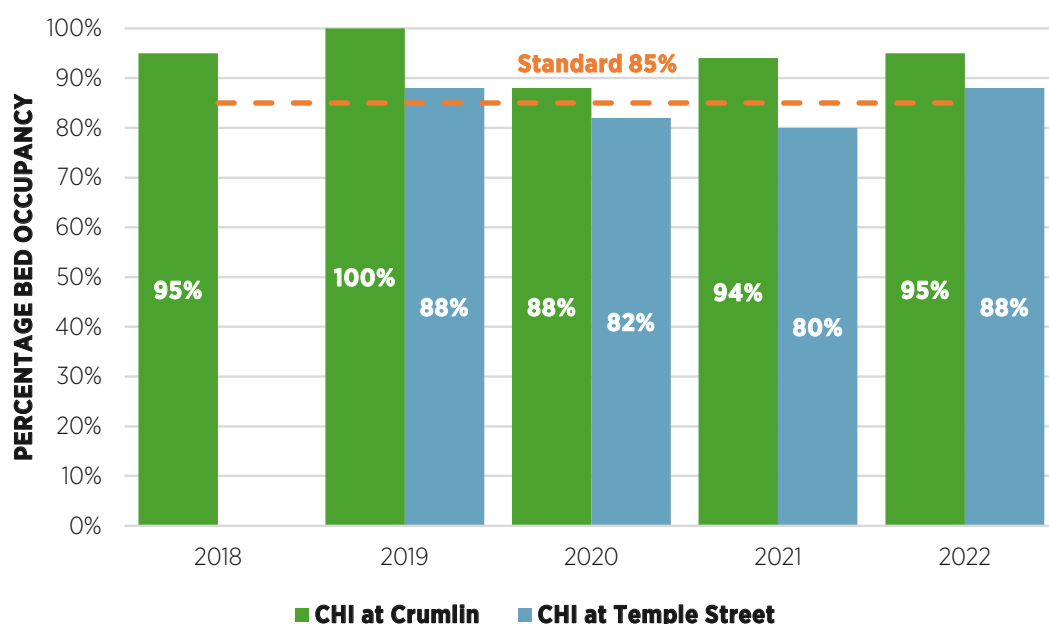
## BED OCCUPANCY IN PCCU

The *National Standards for Paediatric Critical Care Services Version 2.0* (Joint Faculty of Intensive Care Medicine of Ireland, 2018) recommends a bed occupancy limit of 85%. The UK Paediatric Critical Care Society recommends that average PCCU bed occupancy exceeding 85% for more than 2 successive months should be escalated to hospital management and specifically reviewed.

Bed occupancy figures for CHI at Crumlin exceeded the recommended limit of 85% each year, while CHI at Temple Street exceeded the recommended limit in 2019 and again in 2022. Detailed local data for daily bed availability in CHI at Temple Street were unavailable for 2018 (Figure 5.4).

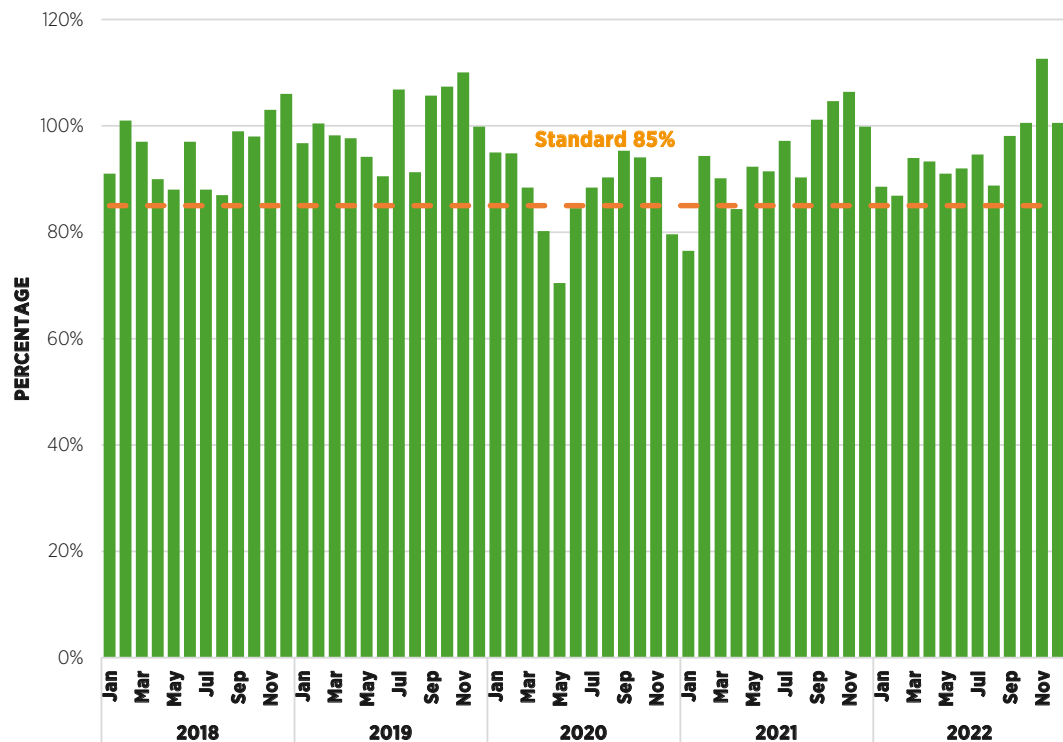
High occupancy levels may result in sudden, unexpected cancellations of semi-elective congenital, cancer or scoliosis surgeries, with unexpected deferrals resulting in anxiety and upset for families.

Accurate daily bed data are required for the planning and delivery of PCCU services. These data should be collected twice daily to reflect changes in staffing during the nursing shift system. The physical number of beds does not reflect bed availability, occupancy or staffing issues. An actual PCCU bed should reflect national PCCU standards for medical and nursing staff cover. These data do not reflect acuity, where one bed could require a nurse–patient ratio of 3:1; for example, if the patient is on extracorporeal life support (ECLS) or continuous venovenous haemodialysis (CVVH).

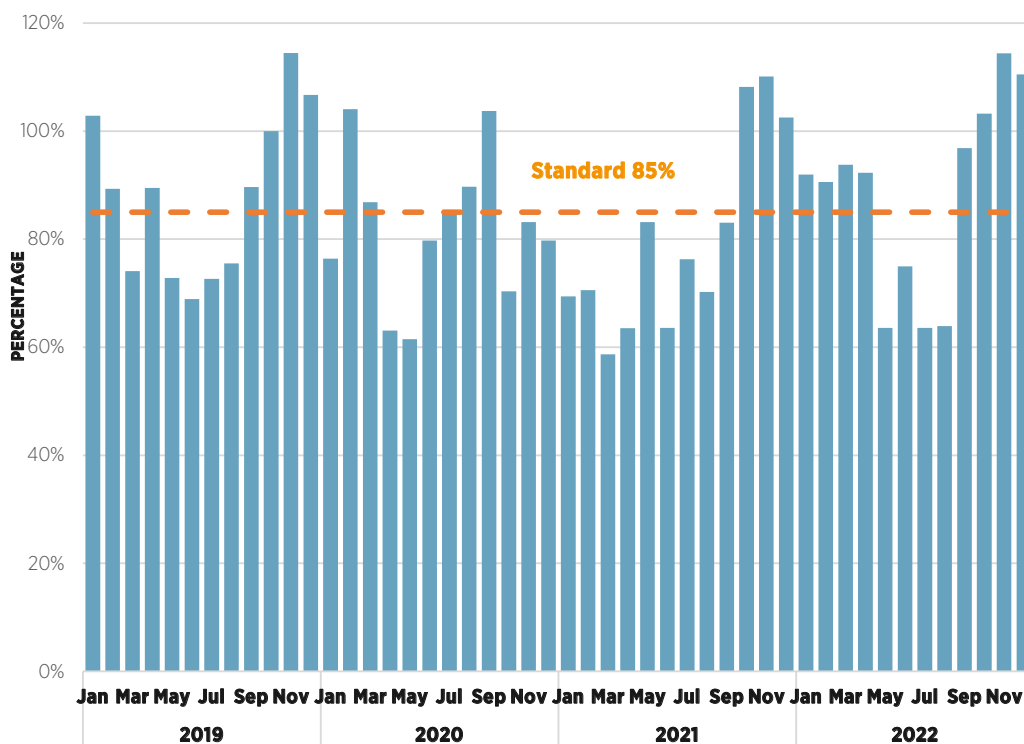


**FIGURE 5.4:** BED OCCUPANCY IN PAEDIATRIC CRITICAL CARE UNITS, BY YEAR, 2018–2022

Figure 5.5a presents the bed occupancy for CHI at Crumlin by month for the years 2018–2022. The only time that bed occupancy in this Unit fell below 85% was during the COVID-19 pandemic in April–May 2020, December 2020 and January 2021. Figure 5.5b presents the bed occupancy for CHI at Temple Street by month for the years 2019–2022. Detailed local data for daily bed availability in CHI at Temple Street were unavailable for 2018. During November and December each winter, both Units often reach bed occupancy above 100%.



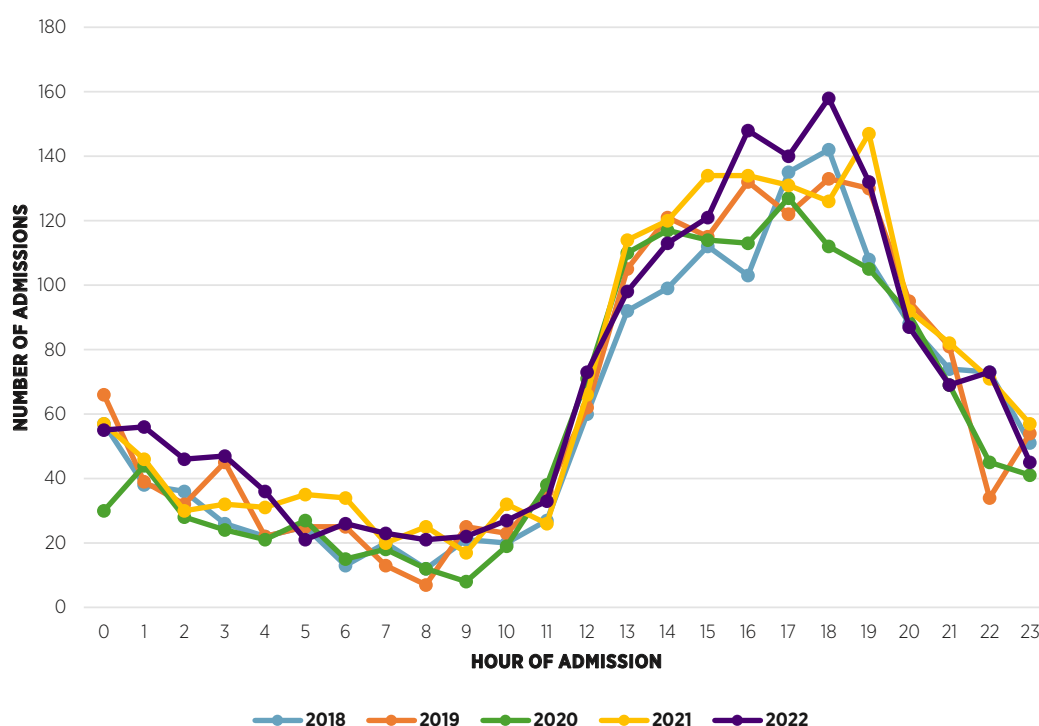
**FIGURE 5.5A:** BED OCCUPANCY IN CHILDREN'S HEALTH IRELAND AT CRUMLIN, BY MONTH, 2018–2022



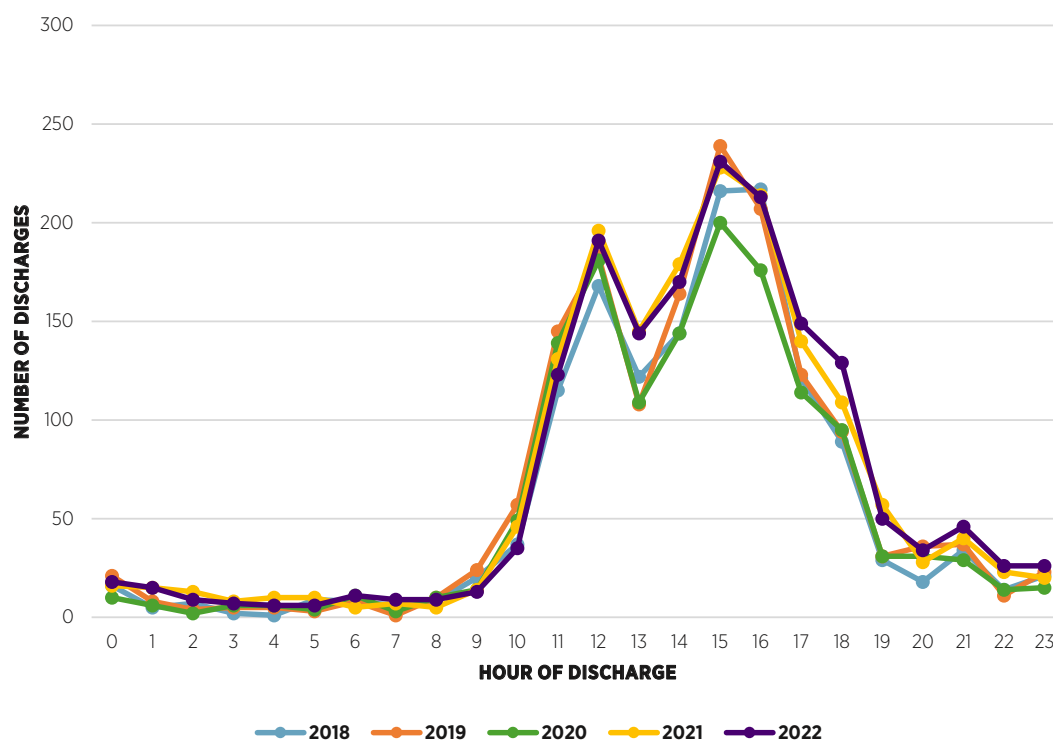
**FIGURE 5.5B:** BED OCCUPANCY IN CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, BY MONTH, 2019–2022

## TIME OF ADMISSION AND DISCHARGE

Over the 5-year period 2018–2022, the majority of patients were admitted and discharged in the afternoon (see Figures 5.6 and 5.7). Over one-third (35%, n=2678) of all admissions to PCCUs in the ROI were admitted out of hours, between 8.00pm and 7.59am (see Figure 5.6), while 11% (n=848) of patients were discharged during this time (see Figure 5.7). An out-of-hours patient discharge is suboptimal and should be avoided where possible. Out-of-hours discharges are influenced by hospital bed availability and lack of hospital beds may impact these figures, which without context may fail to identify the significant issues associated with late discharges from PCCU. For this reason, the cause of late discharge should be recorded.



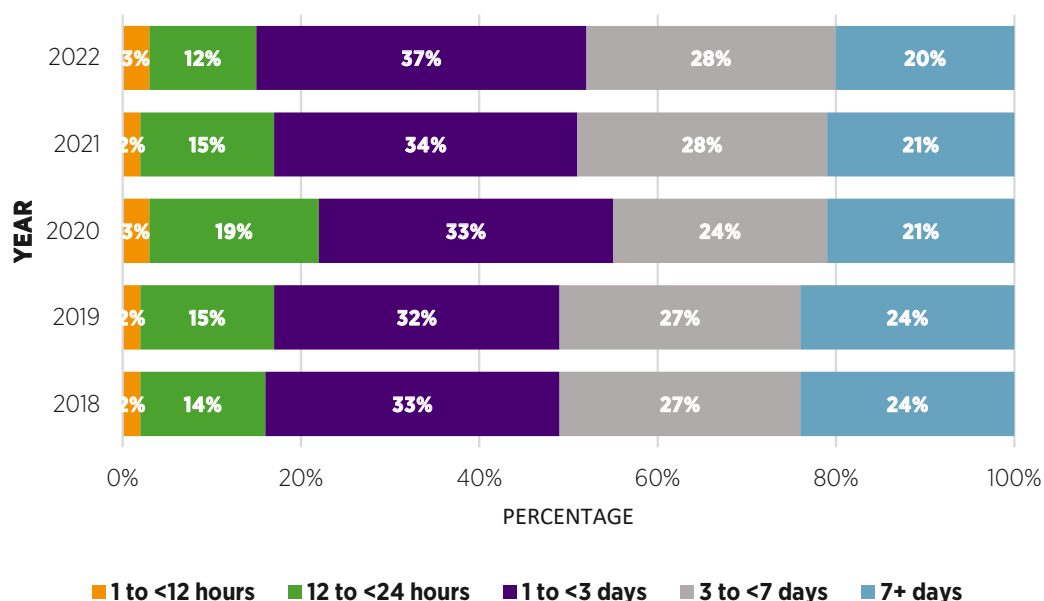
**FIGURE 5.6:** NUMBER OF PATIENTS ADMITTED TO PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, BY HOUR, 2018–2022 (N=7724)



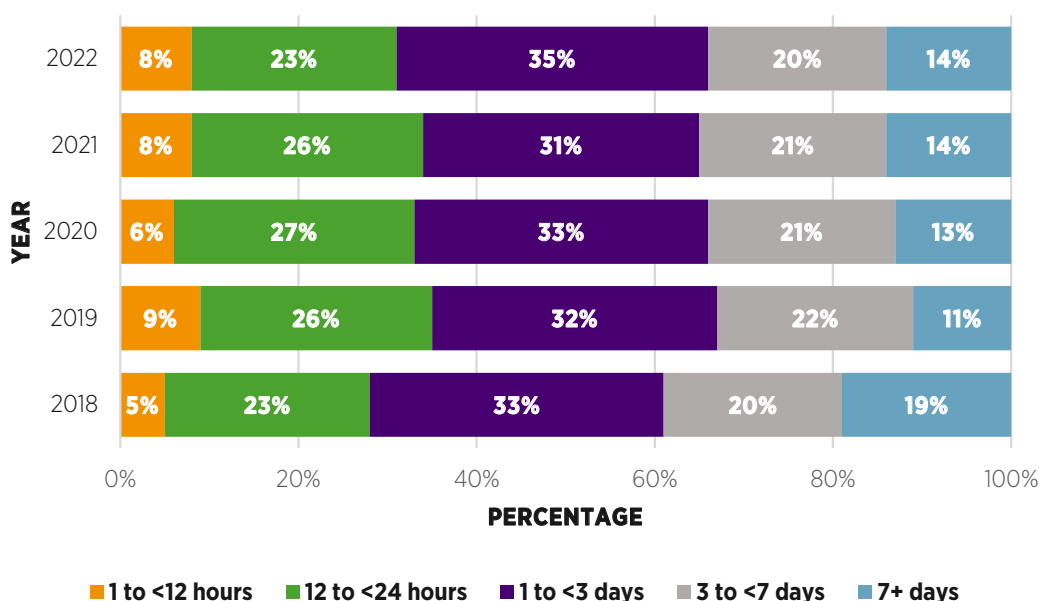
**FIGURE 5.7:** NUMBER OF PATIENTS DISCHARGED FROM PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, BY HOUR, 2018-2022 (N=7702)

## LENGTH OF STAY

The actual length of stay (LOS) for patients admitted to CHI at Crumlin is presented in Figure 5.8a, and for CHI at Temple Street in Figure 5.8b. The majority of patients stayed for between 1 and 3 days in both Units. The proportion of patients staying for longer than 7 days in CHI at Crumlin decreased slightly from 24% in 2018 (n=249) and 2019 (n=250) to 20% in 2022 (n=229). A smaller proportion of patients stayed for 7 days or longer in CHI at Temple Street compared to CHI at Crumlin.



**FIGURE 5.8A:** ADMISSIONS BY ACTUAL LENGTH OF STAY TO CHILDREN'S HEALTH IRELAND AT CRUMLIN, 2018–2022 (N=5273)



**FIGURE 5.8B:** ADMISSIONS BY ACTUAL LENGTH OF STAY TO CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, 2018–2022 (N=2360)

Median length of stay (LOS) for each Unit is presented in Table 5.3 as the median number of days, along with the interquartile range (IQR), by age group and year. In 2021 and 2022, the median LOS in CHI at Crumlin was 2.9 days; in CHI at Temple Street it was 1.67 and 1.91 days, respectively. LOS was higher for patients in CHI at Crumlin than for CHI at Temple Street for each age group and year examined. In both PCCUs, the median LOS was highest for infants aged under 1 year. Table 5.4 shows the median LOS for children aged under 1 year in both Units for 2021 and 2022. Infants aged under 3 months had the longest LOS in both Units.

**TABLE 5.3: LENGTH OF STAY, IN DAYS, BY AGE GROUP, 2018–2022 (MEDIAN, INTERQUARTILE RANGE)**

	2018		2019		2020		2021		2022	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR
	CHI at Crumlin									
<1 YEAR	4.24	(2.0–8.7)	4.03	(1.9–8.6)	3.96	1.8–7.6	3.83	1.9–7.9	3.92	2.0–7.9
1–4 YEARS	2.17	(1.0–4.6)	1.96	(1.0–4.5)	1.69	0.9–2.9	2.00	1.0–4.8	2.04	1.0–4.0
5–10 YEARS	2.04	(1.0–4.8)	1.73	(0.9–3.9)	1.78	0.9–4.2	1.96	1.0–4.6	2.01	1.3–4.9
11–15 YEARS	2.04	(1.0–4.5)	2.38	(1.0–4.1)	1.62	0.9–4.0	2.17	1.0–4.1	1.92	1.0–3.5
ALL AGES	3.08	(1.6–6.8)	3.08	(1.3–6.9)	2.75	1.1–6.5	2.95	1.4–6.2	2.92	1.7–5.9
	CHI at Temple Street									
<1 YEAR	2.60	(1.3–5.6)	2.08	(0.9–4.8)	2.99	1.2–5.3	2.44	1.0–5.4	3.08	1.6–5.8
1–4 YEARS	1.71	(0.8–5.1)	1.42	(0.8–3.5)	1.26	0.8–2.7	1.28	0.8–3.2	1.42	0.8–2.9
5–10 YEARS	1.55	(0.8–3.9)	1.05	(0.7–3.2)	1.49	0.8–3.8	1.14	0.8–3.5	1.23	0.9–2.1
11–15 YEARS	1.78	(1.0–6.8)	1.65	(0.7–4.3)	1.00	0.8–1.8	1.11	0.8–2.9	1.13	0.8–2.8
ALL AGES	1.92	(0.9–5.6)	1.70	(0.8–4.1)	1.74	0.9–4.1	1.67	0.8–4.1	1.91	0.9–4.0

**TABLE 5.4:** LENGTH OF STAY, IN DAYS, FOR CHILDREN AGED UNDER 1 YEAR BY INFANT AGE IN MONTHS, 2021-2022 (MEDIAN, INTERQUARTILE RANGE)

	CHI at Crumlin				CHI at Temple Street			
	2021		2022		2021		2022	
Age	Median	IQR	Median	IQR	Median	IQR	Median	IQR
<1 month	4.53	2.06-10.03	5.14	2.71-10.95	3.27	1.27-6.13	3.22	1.29-5.77
1 month	4.25	2.76-6.92	3.98	2.03-7.08	2.18	0.88-6.06	3.57	1.95-5.54
2 months	4.66	2.08-9.35	3.63	2.08-5.90	2.83	1.23-4.01	3.42	2.21-5.73
3 months	2.94	1.82-5.01	3.09	2.07-4.85	1.88	0.81-3.25	2.97	2.25-5.57
4 months	2.91	1.87-6.31	3.96	1.94-7.37	1.46	0.98-2.27	0.96	0.46-5.84
5 months	3.51	1.91-6.52	2.13	1.35-4.35	1.67	0.68-2.65	3.94	3.13-6.11
6 months	2.15	1.91-8.15	3.79	1.88-5.06	0.21	0.16-0.47	8.54	2.01-15.67
7 months	2.15	1.83-4.73	2.84	1.89-5.88	0.83	0.79-5.26	2.57	2.1-4.99
8 months	3.77	2.59-8.33	6.11	2.64-11.96	2.75	2.75-2.75	1.74	1.23-2.95
9 months	2.74	1.83-9.24	3.13	2.05-6.73	1.9	1.9-1.9	2.84	1.04-8.05
10 months	1.92	1.46-2.66	3.25	1.91-5.94	1.48	1.2-1.76	3.31	2.26-4.24
11 months	3.12	1.15-6.97	2.75	0.91-7.95	1.28	0.75-2.13	3.11	1.79-4.14

The LOS in days (median, IQR) for patients by the six most common diagnosis groups and hospitals is presented in Table 5.5. The highest median LOS in CHI at Crumlin was for patients in the respiratory diagnosis group (3.6 days), while in CHI at Temple Street it was for patients in the gastrointestinal diagnosis group (3.0 days). The lowest median LOS in both Units was for patients in the musculoskeletal diagnosis group (1.1 days and 1.0 days, respectively).

**TABLE 5.5:** MEDIAN LENGTH OF STAY (INTERQUARTILE RANGE) IN PAEDIATRIC CRITICAL CARE UNITS BY PRIMARY DIAGNOSIS AND UNIT, 2020-2022

	CHI at Crumlin			CHI at Temple Street		
	2020-2022			2020-2022		
Diagnosis	N	Median	IQR	N	Median	IQR
Cardiac	1291	3.0	1.8-6.0	32	1.8	0.5-3.0
Gastrointestinal	192	2.9	1.3-5.6	93	3.0	1.0-6.1
Infection	124	3.1	1.5-6.3	66	2.1	1.0-4.8
Musculoskeletal	103	1.1	0.9-2.0	105	1.0	0.8-1.1
Neurological	152	1.9	0.9-3.9	271	1.6	0.8-3.8
Respiratory	775	3.6	1.5-6.8	490	2.8	1.3-5.3

## KEY FINDINGS FROM CHAPTER 5

- The total number of bed days delivered by PCCUs in the ROI in 2021 (N=10387) and 2022 (N=10795) has increased and is higher than pre-pandemic levels (2018, N=10176).
- The highest proportion of bed days delivered in both Units are occupied by infants aged under 3 months.
- Bed occupancy figures for CHI at Crumlin exceeded the recommended limit of 85% each year, while CHI at Temple Street exceeded the recommended limit in 2019 and again in 2022. During October to January each year, both Units often reach bed occupancy above 100%.
- In both PCCUs, the median LOS was highest for infants aged under 1 year, with infants aged under 3 months having the longest LOS in both Units.
- The highest median length of stay in CHI at Crumlin was for patients in the respiratory diagnosis group (3.6 days), while in CHI at Temple Street it was for patients in the gastrointestinal diagnosis group (3.0 days).



### OPPORTUNITY FOR IMPROVEMENT

Out-of-hours discharges are influenced by hospital bed availability; lack of hospital beds may impact these figures, which without context may fail to identify the significant issues associated with late discharges from PCCU. For this reason, the cause of late discharge should be recorded. A QI project could improve understanding, provide measurement and identify interventions which have the potential to minimise late discharges.



## CHAPTER 6

# **INTERVENTIONS AND OUTCOMES IN PAEDIATRIC CRITICAL CARE UNITS**

# CHAPTER 6: INTERVENTIONS AND OUTCOMES IN PAEDIATRIC CRITICAL CARE UNITS

## DAILY ACTIVITY DATA: PAEDIATRIC CRITICAL CARE MINIMUM DATA SET

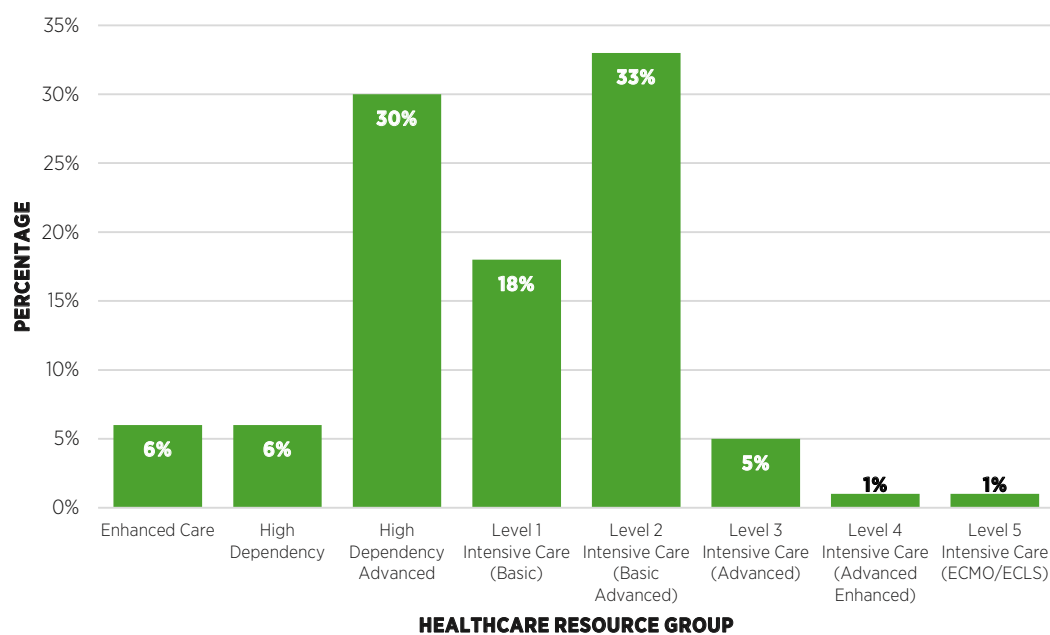
The purpose of the Paediatric Critical Care Minimum Data Set (PCCMDS) is to provide the basis for payment by results through the establishment of UK Healthcare Resource Groups (HRGs). HRGs (NHS UK National Casemix Office, 2022) were specified to take into account differing levels of activity in PCCUs. HRG definitions highlight differences in the intensity and complexity of support provided in PCCUs. HRG definitions and descriptions of the levels of paediatric critical care in the ROI are detailed in Table 6.1 and [Appendix 6](#). PICANet receives daily activity data from 32 participating organisations each year ([see Appendix 7](#)). These data are important in terms of bed days used, staffing and bed availability.

**TABLE 6.1:** DESCRIPTION OF THE HEALTHCARE RESOURCE GROUP DEFINITIONS

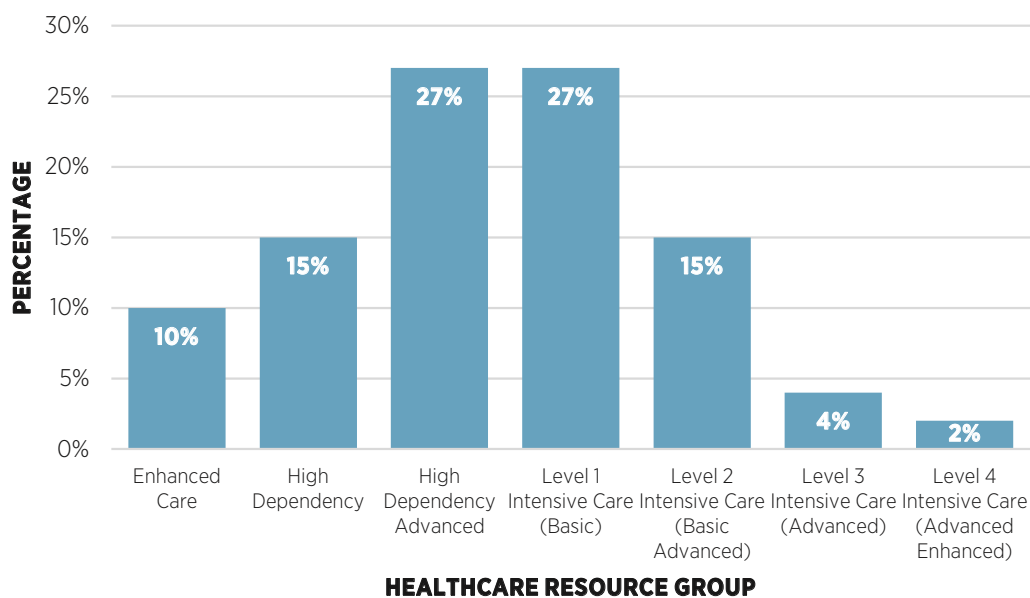
Level	HRG definitions	Description
<b>Level 0</b>	<b>Enhanced care</b>	Ward-level care
<b>Level 1</b>	<b>PCC High Dependency</b>	Monitoring and interventions, high flow oxygen therapy
<b>Level 2</b>	<b>PCC High Dependency Advanced</b>	Non-invasive mechanical ventilation, inotropic support
<b>Level 3</b>	<b>PCC Intensive Care Basic</b>	Invasive ventilatory support and/or support for two or more organ systems
	<b>PCC Intensive Care Basic Advanced</b>	Mechanical ventilation <b>and</b> inotropic support
	<b>PCC Intensive Care Advanced</b>	Mechanical ventilation <b>and</b> renal replacement therapy
	<b>PCC Intensive Care Advanced Enhanced</b>	Complex interventions/organ support
	<b>PCC Intensive Care ECMO/ECLS</b>	ECMO

The proportion of days of care delivered over the reporting period of 2020–2022 at each HRG group level in CHI at Crumlin and CHI at Temple Street PCCUs is illustrated in Figures 6.1a and 6.1b. Almost 60% (58%) of patients admitted to CHI at Crumlin received intensive care at Level 1 or above, 33% received Level 2, while the more complex care Levels 3, 4 and 5 accounted for 7%. Almost one-half (48%) of patients admitted to CHI at Temple Street received intensive care at Level 1 or above. The most frequent level of care delivered to patients in CHI at Temple Street was Level 1 (27%), followed by Level 2 (15%), with more complex care Levels 3 and 4 at 6%. CHI at Temple Street do not deliver Level 5 care (ECMO/ECLS).

The more advanced levels of care require complex interventions and/or organ support for patients as well as higher nurse–patient ratios of 2:1 and 3:1. There are major implications for nurse staffing and the ability to keep all other beds open when 2:1 and 3:1 staffing is required.



**FIGURE 6.1A:** PROPORTION OF DAYS OF CARE DELIVERED AT EACH HEALTHCARE RESOURCE GROUP LEVEL IN CHILDREN'S HEALTH IRELAND AT CRUMLIN, 2020-2022



**FIGURE 6.1B:** PROPORTION OF DAYS OF CARE DELIVERED AT EACH HEALTHCARE RESOURCE GROUP LEVEL IN CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, 2020-2022

## INTERVENTIONS IN PAEDIATRIC CRITICAL CARE UNITS IN IRELAND

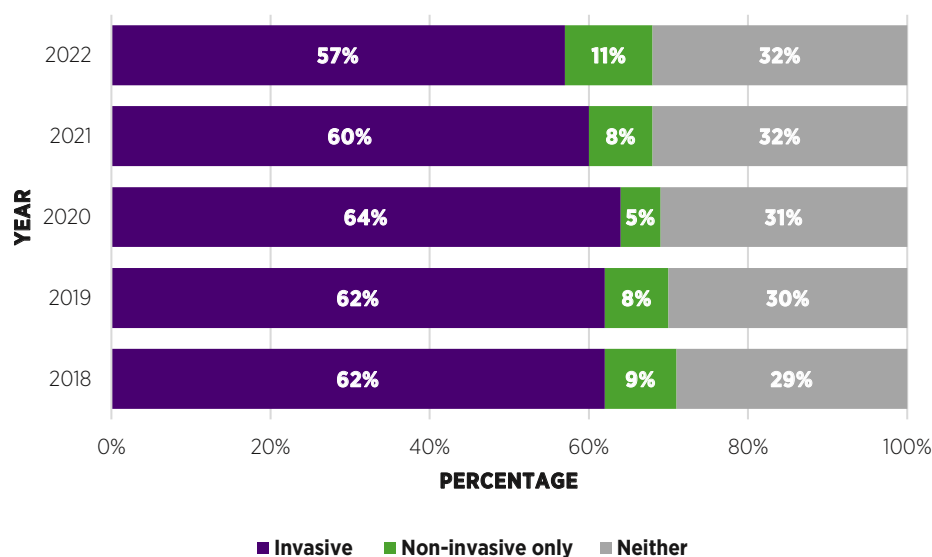
Table 6.2 shows the patient interventions carried out in the PCCUs in CHI at Crumlin and CHI at Temple Street for the period 2018–2022. The most frequently used intervention for patients in both PCCUs during the reporting period was invasive ventilation to deliver oxygen and air into the lungs (e.g. an endotracheal tube). There was a much greater use of vasoactive medication to support the patient's cardiovascular system in CHI at Crumlin (41%–55%) compared to CHI at Temple Street (12%–16%), which is reflected in the enhanced activity data in Figure 6.1. During the reporting period, up to 11% of patients in CHI at Temple Street had an intracranial pressure (ICP) device placed, a figure that reflects the proportion of neurosurgery patients in that PCCU. The percentage of patients requiring renal support was broadly similar in both Units (2%–3%), and 1%–2% of patients received ECMO in CHI at Crumlin each year.

**TABLE 6.2:** DAILY INTERVENTIONS WHILE IN CHILDREN'S HEALTH IRELAND AT CRUMLIN AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, 2018–2022

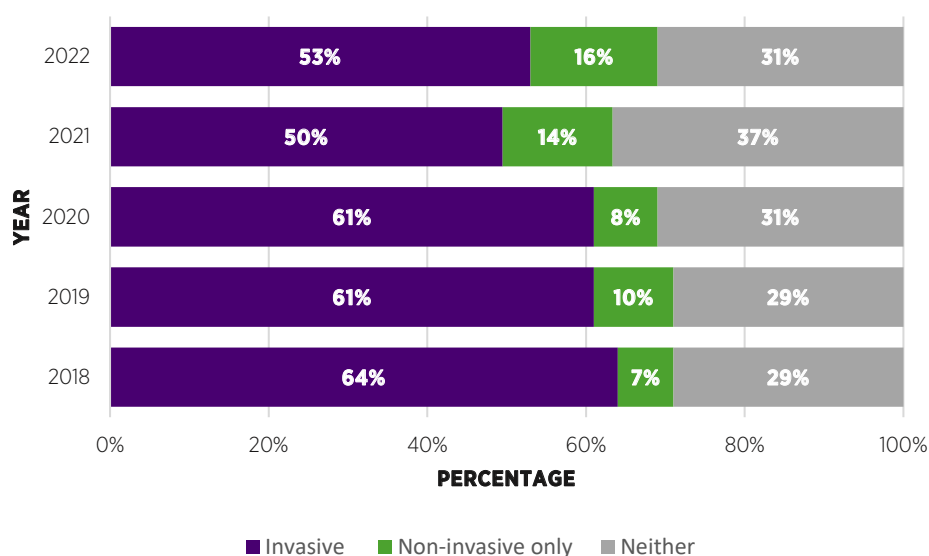
Year	CHI at Crumlin											
	Invasive Ventilation		Non-Invasive Ventilation		High Flow Nasal Cannula Therapy		IV Vasoactive Drugs		ECMO		Renal Support	
	N	%	N	%	N	%	N	%	N	%	N	%
2018	635	62%	278	27%	353	35%	464	45%	15	2%	31	3%
2019	630	62%	218	21%	410	40%	520	51%	21	2%	37	4%
2020	627	64%	196	20%	320	33%	541	55%	23	2%	28	3%
2021	673	60%	235	21%	426	38%	537	48%	14	1%	18	2%
2022	639	57%	300	27%	457	41%	466	41%	8	1%	25	2%
Year	CHI at Temple Street											
	Invasive Ventilation		Non-Invasive Ventilation		High Flow Nasal Cannula Therapy		IV Vasoactive Drugs		ICP Device		Renal Support	
	N	%	N	%	N	%	N	%	N	%	N	%
2018	261	64%	94	23%	182	45%	60	15%	23	6%	14	3%
2019	300	61%	96	20%	204	42%	58	12%	34	7%	13	3%
2020	254	61%	81	20%	121	29%	65	16%	45	11%	12	3%
2021	264	50%	133	25%	194	37%	80	15%	42	8%	12	2%
2022	287	53%	165	30%	236	43%	69	13%	40	7%	8	2%

## TYPE OF VENTILATION

Figure 6.2a and b shows the proportions of children admitted to each PCCU in the ROI that underwent invasive and non-invasive ventilation each year. In CHI at Crumlin the proportion of patients receiving invasive ventilation decreased from 62% in 2018 to 57% in 2022, and there was an increase in the proportion of patients receiving only non-invasive ventilation from 9% in 2018 to 11% in 2022. There was a decrease in the proportion of children receiving invasive ventilation in CHI at Temple Street from 64% in 2018 to 53% in 2022, while the proportion receiving only non-invasive ventilation increased from 7% in 2018 to 16% in 2022.



**FIGURE 6.2A:** TYPE OF VENTILATION IN CHILDREN'S HEALTH IRELAND AT CRUMLIN, BY YEAR, 2018–2022 (N=5283)



**FIGURE 6.2B:** TYPE OF VENTILATION IN CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, BY YEAR, 2018–2022 (N=2388)

## EXTRACORPOREAL LIFE SUPPORT

The ECLS cardiac programme in CHI at Crumlin began in 2005 and is recognised as a centre of excellence by ELSO. The CHI at Crumlin PCCU had a total of 95 ECLS runs for the period 2018–2022 (see Table 6.3). Many of these (n=75) were cardiac surgical patients. However, 20 ECLS runs were required for respiratory patients in CHI at Crumlin and CHI at Temple Street; a number of these patients were transferred abroad for treatment as there is not a formally funded and resourced paediatric respiratory ECMO programme in the ROI. Respiratory ECMO provides life-saving treatment for infants and children with very severe lung failure.

Several of these patients had an LOS greater than 70 days in another European country, which has both financial and social implications for the HSE and for the families of these patients. Although survival rates were favourable, a small number of patients died while undergoing treatment abroad.

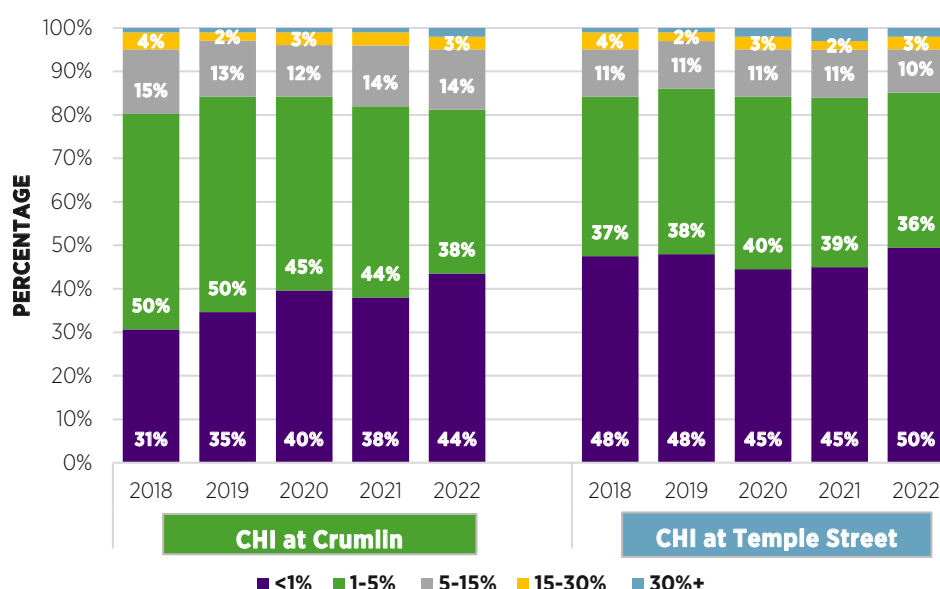
**TABLE 6.3: TOTAL EXTRACORPOREAL MEMBRANE OXYGENATION RUNS IN CHILDREN'S HEALTH IRELAND, 2018–2022**

ECMO	2018	2019	2020	2021	2022	2018–2022
Cardiac ECMO	<b>13</b>	<b>19</b>	<b>21</b>	<b>14</b>	<b>8</b>	<b>75</b>
	<ul style="list-style-type: none"> <li>extracorporeal cardiopulmonary resuscitation (ECPR)</li> <li>cardiac surgery</li> </ul>	<ul style="list-style-type: none"> <li>ECPR</li> <li>cardiology</li> <li>cardiac surgery</li> </ul>	<ul style="list-style-type: none"> <li>ECPR</li> <li>cardiology</li> <li>cardiac surgery</li> </ul>	<ul style="list-style-type: none"> <li>ECPR</li> <li>cardiology</li> <li>cardiac surgery</li> </ul>	<ul style="list-style-type: none"> <li>ECPR</li> <li>cardiology</li> <li>cardiac surgery</li> </ul>	
Respiratory ECMO	<b>7</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>20</b>
	<ul style="list-style-type: none"> <li>airway repair</li> <li>congenital diaphragmatic hernia (CDH) and persistent pulmonary hypertension of the newborn (PPHN) transferred to Sweden</li> </ul>	<ul style="list-style-type: none"> <li>CDH transferred to Sweden</li> <li>CDH + Tetralogy of Fallot – ECMO in CHI at Crumlin</li> </ul>	<ul style="list-style-type: none"> <li>PPHN + meconium aspirate transferred abroad</li> <li>CDH - ECMO in CHI at Crumlin</li> </ul>	<ul style="list-style-type: none"> <li>PPHN - ECMO at CHI at Crumlin</li> <li>Pneumococcal sepsis transferred to sweden</li> </ul>	<ul style="list-style-type: none"> <li>2 Airway Repairs on ECMO</li> <li>2 patients transferred to Sweden (Strep A and RSV)</li> </ul>	
Total ECMO: Cardiac and respiratory	<b>20</b>	<b>22</b>	<b>25</b>	<b>16</b>	<b>12</b>	<b>95</b>
Total ECMO days in CHI at Crumlin	92	118	148	60	79	497
Total ECMO days abroad	40	37	13	5	15	110
Total bed stay abroad (days)	89	43	17	10	22	181
Survival to decannulation	90%	91%	92%	56%	83%	
Survival to discharge	80%	82%	68%	50%	83%	

## PAEDIATRIC INDEX OF MORTALITY

The Paediatric Index of Mortality (PIM) is a severity scoring system for predicting the risk of mortality of patients admitted to PCCU, based on data collected within the first hour following admission. The PIM was updated (PIM3) in 2013 to provide better estimates of mortality risk among children admitted to critical care in the UK, Ireland, Australia and New Zealand. When estimating risk, the model adjusts for case mix, including factors such as diagnosis, recovery post-procedure, type of admission and mechanical ventilation, as well as physiological variables such as systolic blood pressure and pupillary reaction (Straney *et al.*, 2013).

The PIM3 risk grouping of children admitted to PCCU in both CHI at Crumlin and CHI at Temple Street in 2018–2022 is presented in Figure 6.3. The largest proportion of children (44%–50%) admitted to CHI at Crumlin for each year from 2018 to 2021 was in the 1–5% PIM3 risk group. However, in 2022 the largest proportion (44%, n=479) was in the lower <1% PIM3 risk group. In CHI at Temple Street the largest proportion of admissions each year (45%–50%) was in the lower <1% PIM3 risk group. In both Units, less than 5% of patients each year are in the higher PIM3 risk groups of 15–30% and 30%+. Table 6.4 shows the survival status of patients based on the PIM3 risk groups.



**FIGURE 6.3:** ADMISSIONS BY PAEDIATRIC INDEX OF MORTALITY IN PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, BY YEAR, 2018–2022 (N=7571)

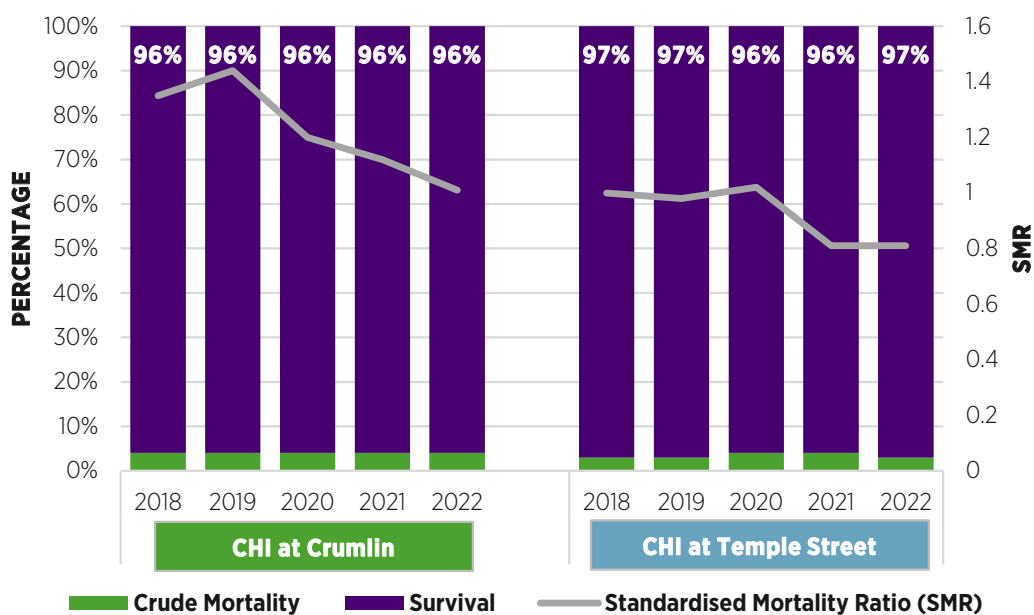
**TABLE 6.4:** PAEDIATRIC CRITICAL CARE UNIT SURVIVAL STATUS BY PAEDIATRIC INDEX OF MORTALITY 3 RISK CATEGORY, 2021–2022

PIM3 group	CHI at Crumlin			CHI at Temple Street		
	Survivors	Deaths	Total	Survivors	Deaths	Total
<1%	*	~	895	501	0	501
1-5%	886	17	903	389	8	397
5-15%	261	38	299	105	7	112
15-30%	48	16	64	21	6	27
30%+	*	*	29	11	13	24
<b>Total</b>	<b>2103</b>	<b>87</b>	<b>2190</b>	<b>1027</b>	<b>34</b>	<b>1061</b>

- Denotes five cases or fewer. \* Further suppression required in order to prevent disclosure of five cases or fewer.

## DEATHS IN PCCU

The proportion of deaths that occur after admission but prior to discharge for CHI at Crumlin and CHI at Temple Street for the years 2018–2022 are shown in Figure 6.4. CHI at Crumlin had a crude mortality rate of 4% each year, while CHI at Temple Street had a crude mortality rate of 3% in 2022 and 2018–2019 and 4% in 2020–2021.



**FIGURE 6.4:** PROPORTION OF DEATHS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=5205) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=2366) PAEDIATRIC CRITICAL CARE UNITS, BY UNIT, 2018–2022

PCCU deaths in the ROI account for 4% of admissions to PCCU each year for 2018–2022 (see Table 6.5). This shows that risk of death in PCCU is extremely low, with 96% of patients discharged alive. The risk-adjusted SMR in Chapter 7 of this report shows no PCCU in the ROI had a mortality rate higher than expected.

**TABLE 6.5: DEATHS IN PAEDIATRIC CRITICAL CARE UNIT BY COUNTRY OF ADMISSION, 2018–2022**

Country of admission	2018		2019		2020		2021		2022	
	Deaths		Deaths		Deaths		Deaths		Deaths	
	N	%	N	%	N	%	N	%	N	%
ENGLAND	562	4%	576	4%	491	4%	494	4%	607	4%
WALES	22	5%	10	2%	12	3%	15	4%	14	4%
SCOTLAND	33	3%	33	2%	27	2%	23	2%	32	2%
NORTHERN IRELAND	12	2%	11	2%	7	2%	11	3%	17	4%
REPUBLIC OF IRELAND	59	4%	60	4%	54	4%	65	4%	56	4%
<b>TOTAL</b>	<b>688</b>	<b>4%</b>	<b>690</b>	<b>4%</b>	<b>591</b>	<b>4%</b>	<b>608</b>	<b>3%</b>	<b>726</b>	<b>4%</b>

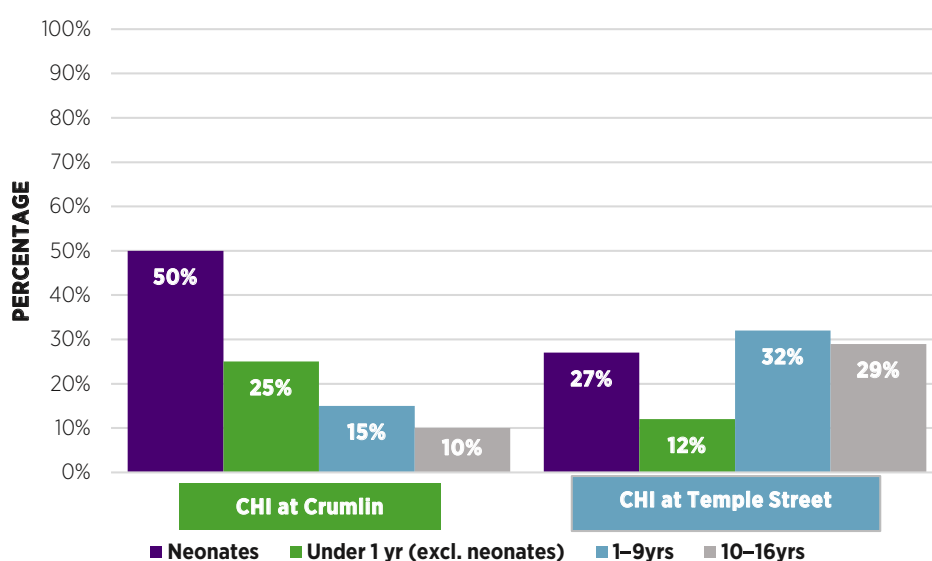
Of all childhood deaths that occurred in Ireland during 2018–2022, between 19.3% and 23.9% died in PCCU, (see Table 6.6). Deaths in PCCU account for one in five deaths in the paediatric population in the ROI in any given year. The proportion of childhood deaths occurring in PCCU in the UK is consistently lower than in the ROI. There are growing numbers of specialist palliative care services and 50 children's hospices in the UK, while in ROI there is only one children's hospice.

**TABLE 6.6: PROPORTION OF DEATHS IN PAEDIATRIC CRITICAL CARE UNIT OF ALL CHILD DEATHS IN THE POPULATION BY COUNTRY OF ADMISSION, 2018–2022**

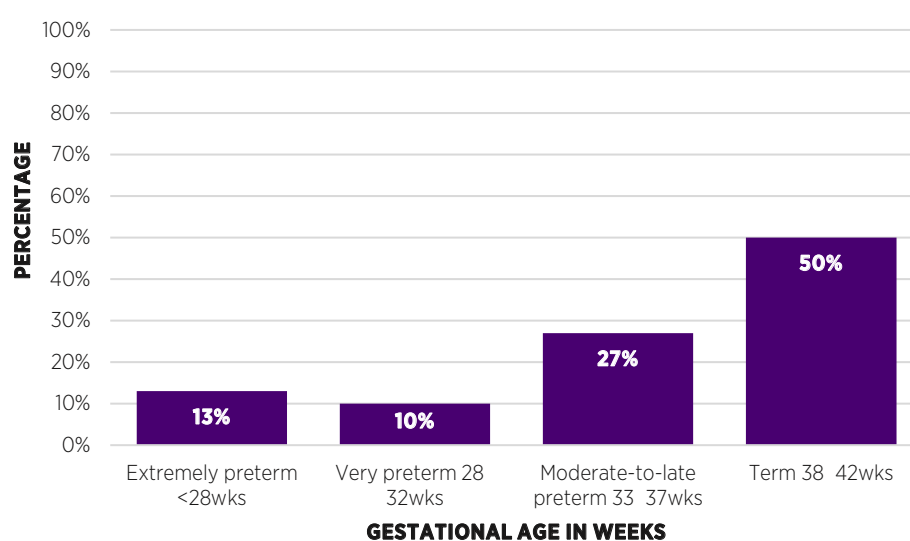
Year	ROI			UK		
	Deaths in Population	Deaths in PCCU	%	Deaths in Population	Deaths in PCCU	%
2018	246	59	23.9%	4028	629	15.6%
2019	311	60	19.3%	3962	629	15.9%
2020	268	54	20.1%	3653	537	14.7%
2021	314	65	20.7%	3822	544	14.2%
2022	261	56	21.5%	3737	671	17.9%

## AGE AT DEATH

There were 87 deaths in CHI at Crumlin and 34 deaths in CHI at Temple Street during 2021–2022. Figure 6.5 provides a detailed analysis and breakdown of the age at which patients died in PCCU in those years. Three-quarters (75%, n= 65) of the deaths in CHI at Crumlin occurred in infants aged under 1 year, with the majority of these (50%, n=43) in the neonatal age group. Almost one-third (32%, n=11) of the deaths in CHI at Temple Street occurred in children aged 1–9 years, and 29% (n=10) occurred in older children aged 10–16 years. Figure 6.6 provides a breakdown of the neonatal deaths by gestational age. One-half of the neonatal deaths (50%, n=26) occurred in preterm infants, with 23% (n=12) in infants aged under 32 weeks.



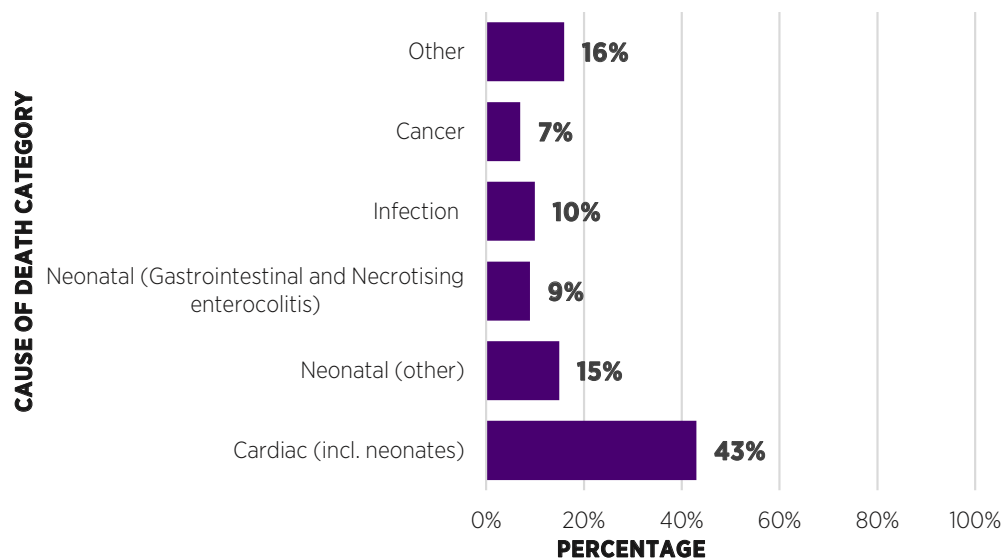
**FIGURE 6.5: AGE PROFILE OF DEATHS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=87) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=34), 2021–2022**



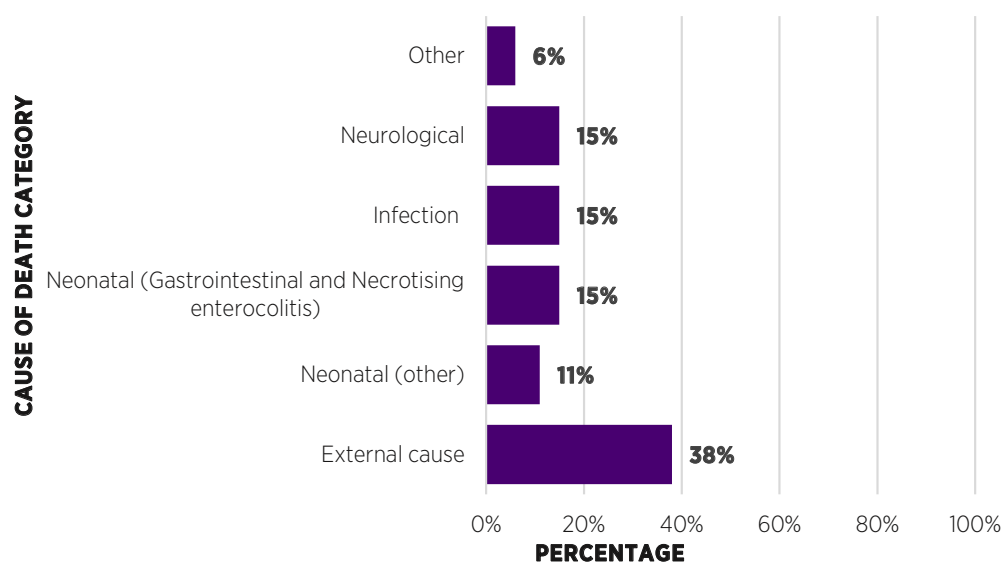
**FIGURE 6.6: AGE DISTRIBUTION OF NEONATAL DEATHS IN PAEDIATRIC CRITICAL CARE UNITS, BY GESTATIONAL AGE IN WEEKS, 2021–2022 (n=52)**

## CAUSE OF DEATH

The largest group (43%, n=37) of deaths in CHI at Crumlin PCCU were due to cardiovascular problems (Figure 6.7a). The largest group (38%, n=13) of deaths in CHI at Temple Street PCCU were due to external causes such as drownings or injuries sustained in accidents (Figure 6.7b). Necrotising enterocolitis (NEC) is a serious illness in newborns, especially those born premature, and was the cause of death for 5% of deaths in CHI at Crumlin and 15% of deaths in CHI at Temple Street.



**FIGURE 6.7A:** DEATHS IN CHILDREN'S HEALTH IRELAND AT CRUMLIN BY DIAGNOSTIC CATEGORY, 2021-2022 (N=87)



**FIGURE 6.7B:** DEATHS IN CHILDREN'S HEALTH IRELAND AT TEMPLE STREET BY DIAGNOSTIC CATEGORY, 2021-2022 (N=34)

## MODE OF DEATH AND ORGAN DONATION

As shown by Figure 6.4, a minority of patients admitted to PCCU die each year. Of the 3–4% who die, some may have the potential to help patients suffering from failure of a vital organ or tissue. Organ donation may be considered in children who die in PCCUs if certain criteria are met and if their families wish for organ donation. Both PCCUs have full-time intensive care consultants and nurses who are trained in the management of potential organ donors and their families. The collection of mode of death (see Table 6.7 for definitions) and transplant donor details were introduced to the PICANet dataset on 1 January 2021, allowing us to report on this for the first time (see Table 6.8).

**TABLE 6.7: PAEDIATRIC INTENSIVE CARE AUDIT NETWORK MODE OF DEATH DEFINITIONS**

Mode of death	Description
Treatment withdrawn	Death follows the withdrawal of ongoing organ support.
Treatment limitation	Death follows a decision to limit ongoing organ support and may include a limitation of ongoing organ support and/or a decision that the patient is not for active resuscitation.
Brain stem death	Death is confirmed using brain stem death criteria/testing.
Failed cardiopulmonary resuscitation	Death immediately follows an unsuccessful attempt at cardiopulmonary resuscitation.

Death can be defined according to either circulatory criteria or neurological criteria. Most deaths are defined by loss of circulation function (circulatory death). A smaller number of deaths are defined by neurological criteria, where patients have adequate circulatory function but no brainstem function (brain death). Patients who have been diagnosed as ‘dead by neurological criteria’ or ‘brain dead’ are the most important group of potential organ donors. Brain death is rare and is becoming even rarer with improvements in road safety and in the management of brain injury. Maximising the number of eligible donors who become organ donors is key to maximising the number of patients who receive life-saving organ transplantation. The benefits of organ and tissue donation for the donor’s family cannot be overemphasised, and the option of organ and tissue donation should always be considered and offered, where appropriate, as an integral part of end-of-life care. International experience demonstrates that an audit of organ donation activity and outcomes does not provide all the necessary information to drive improvement in organ donation. Evidence from other countries suggests that a Potential Donor Audit, conducted and used by specialist organ donation personnel, is a key driver of improvement in organ donation rates (NOCA, 2022).

Brain stem death was the mode of death for 12 patients in 2021–2022, representing 10% of PCCU deaths in the 2-year period. Over one-half of patients (57%, n=69) died following the withdrawal of ongoing organ support. In the 2-year period 2021–2022, 11 infants and children ranging in age from 2 days to 15 years donated solid organs, tissues or both (Table 6.8). Six of these patients died following the withdrawal of treatment and 5 following brain stem death. Some of the tissue donations were heart valves from infants; the human heart has four valves and each can be transplanted to help up to four patients. Unlike solid organ donation, the mode of death is not as relevant for tissue donation. Heart valve donations are used to repair congenital heart defects in babies and to replace diseased heart valves in adults. Heart valves do not need to be used immediately and may be stored for up to 5 years in the Irish heart valve bank.

**TABLE 6.8:** MODE OF DEATH AND TRANSPLANT DONORS IN PAEDIATRIC CRITICAL CARE UNITS, 2021–2022

Mode of death	N	%
Treatment withdrawn	69	57%
Treatment limitation	28	23%
Brain stem death	12	10%
Failed cardiopulmonary resuscitation	12	10%
<b>Total</b>	<b>121</b>	<b>100%</b>
Transplant donor	N	%
No	110	91.0%
Yes – Solid organs only	3	2.5%
Yes – Tissues only	5	4.0%
Yes – Both solid organs and tissues	3	2.5%
<b>Total</b>	<b>121</b>	<b>100%</b>
Mode of death for transplant donors	N	%
Treatment withdrawn	6	55%
Brain stem death	5	45%
<b>Total</b>	<b>11</b>	<b>100%</b>

## KEY FINDINGS FROM CHAPTER 6

- Almost 60% (58%) of patients admitted to CHI at Crumlin and almost one-half (48%) of patients admitted to CHI at Temple Street received intensive care at Level 1 or above.
- There was a decrease in the proportion of children receiving invasive ventilation in 2021 and 2022 compared to 2018.
- CHI at Crumlin provided cardiac ECMO for 22 patients in 2021 and 2022. Six patients required respiratory ECMO, some of whom were transferred abroad for treatment and survived.
- PCCU deaths in the ROI account for 4% of admissions to PCCU each year for 2018–2022. This shows that the risk of death in PCCU is extremely low, with 96% of patients discharged alive.
- There were 87 deaths in CHI at Crumlin and 34 deaths in CHI at Temple Street in 2021 and 2022. Three-quarters (75%, n=65) of the deaths in CHI at Crumlin occurred in infants aged under 1 year, with the majority of these (50%, n=43) in the neonatal age group. In CHI at Temple Street, 61% (n=21) of the deaths occurred in children aged 1–16 years. The largest group (43%, n=37) of deaths in CHI at Crumlin PCCU were due to cardiovascular problems. In CHI at Temple Street the majority (38%, n=13) of deaths were due to external causes.
- Over one-half of patients (57%, n=69) in 2021–2022 died following the withdrawal of ongoing organ support, while brain stem death was the mode of death for 10% (n=12) of patients. In the 2-year period 2021–2022, 11 infants and children ranging in age from 2 days to 15 years donated solid organs, tissues or both.

# CHAPTER 7

# **QUALITY**

# **ASSURANCE**



## CHAPTER 7: QUALITY ASSURANCE

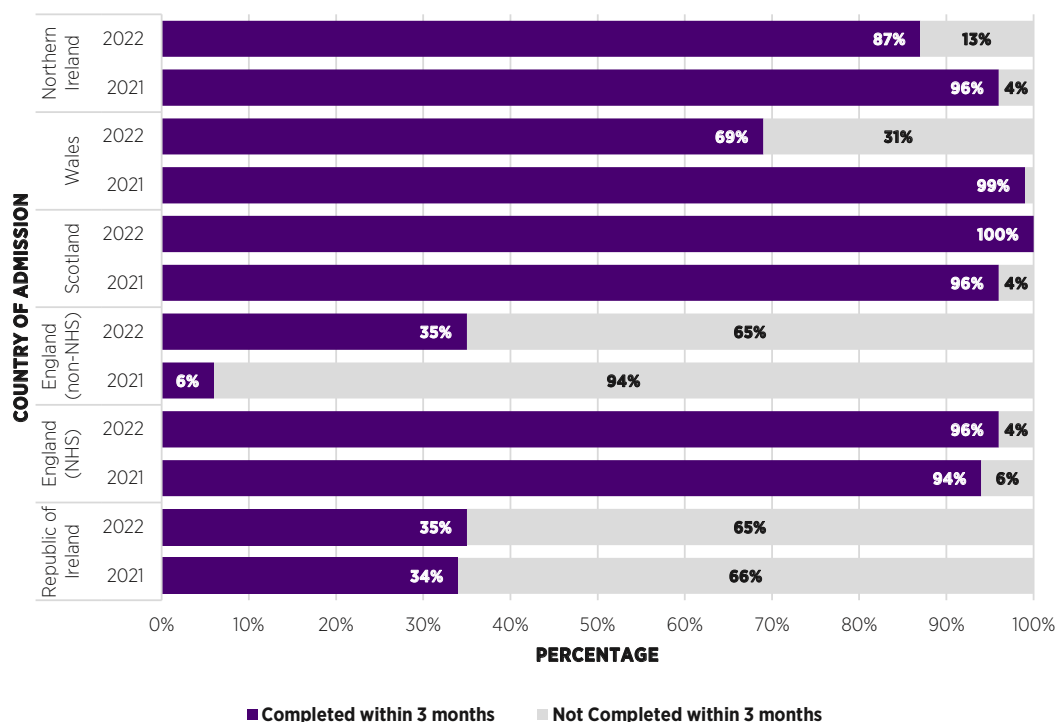
PICANet makes comparisons between PCCUs in the UK and the ROI, assessing each Unit against established clinical standards and guidelines. PICANet reports on five key performance metrics related to paediatric critical care services. This chapter presents these metrics as well as key Irish quality standards.

### PICANet METRIC 1: CASE ASCERTAINMENT AND TIMELINESS OF DATA SUBMISSION

**The completeness of patients' admission data within 3 months of their discharge from the Unit for the ROI was 34% in 2021 and 35% in 2022, which is well below the 100% target.**

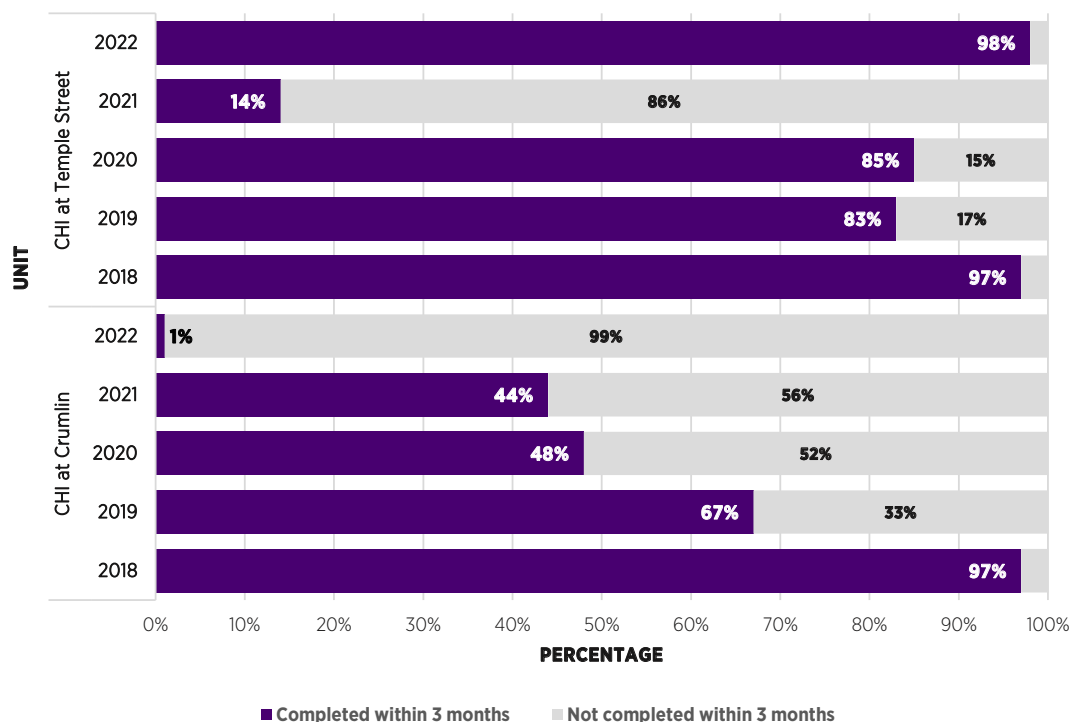
The timeliness of data submission is measured using the number of admission events that are completed on the PICANet database within 3 months of discharge – a requirement of the *Quality Standards for the Care of Critically Ill Children* (PCCS, 2021). From 1 January 2022, PICANet moved to a 2-month submission guideline per L3-702 of the *Quality Standards for the Care of Critically Ill or Injured Children* (PCCS, 2021) and PIC10a of the *Paediatric Intensive Care Unit (PICU) Quality Dashboard 2021/2022* (NHS England, 2021). An admission record is defined as complete when all validation checks have been fulfilled.

A PICANet database outage took place between March and June 2022, which resulted in data uploading delays. Therefore, the 2022 figures presented in Figure 7.1 are restricted to the period following the outage, from July to December.



**FIGURE 7.1: PROPORTION OF ADMISSION RECORDS COMPLETED WITHIN 3 MONTHS OF DISCHARGE, BY COUNTRY OF ADMISSION, 2021-2022 (N=27789)**

Figure 7.1a provides a breakdown by Unit of the completeness of patients' admission data within 3 months of their discharge for the years 2018–2022. CHI at Temple Street achieved 98% completeness in 2022; however, CHI at Crumlin only achieved 1% completeness in 2022, which was the lowest of all participating PCCUs. The HSE cyberattack in the ROI affected data submission timelines for 2021 data in both Units. The poor performance in CHI at Crumlin is attributable to the PICANet database outage in 2022 and a reduction in audit team resources (audit workload/sick leave/deployment). CHI at Crumlin is working with hospital management to improve the timeliness of data submission.

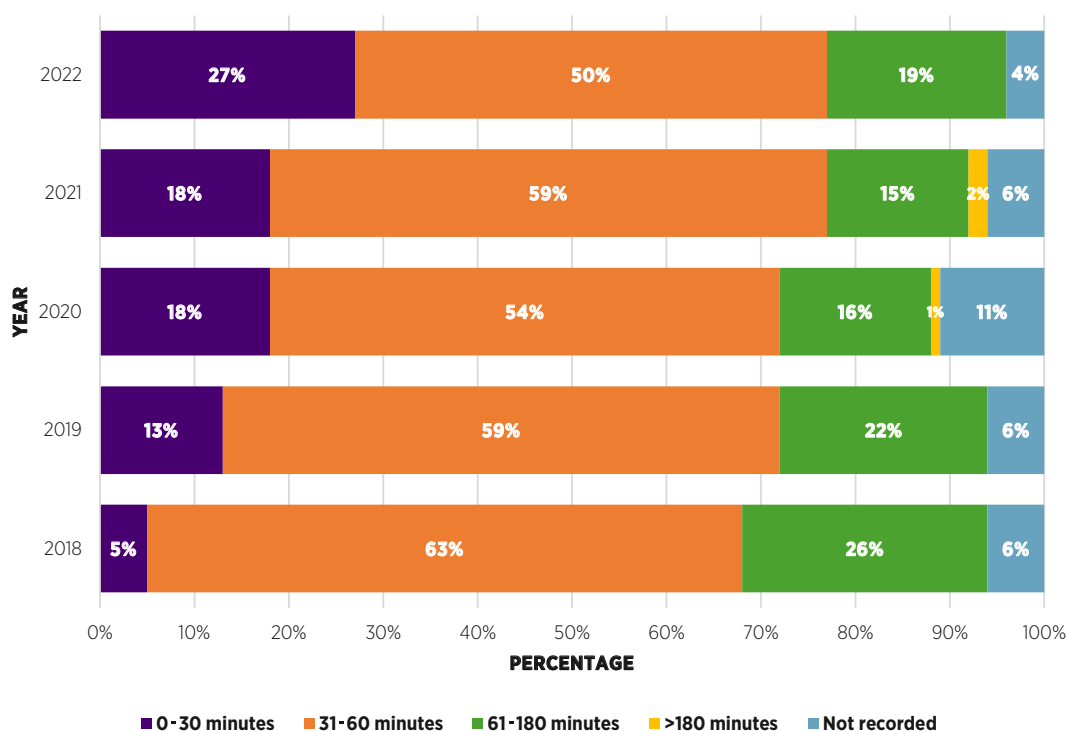


**FIGURE 7.1A:** PROPORTION OF ADMISSION RECORDS COMPLETED WITHIN 3 MONTHS OF DISCHARGE BY CHILDREN'S HEALTH IRELAND AT CRUMLIN (N=4733) AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET (N=2145), 2018–2022

## PICANet METRIC 2: RETRIEVAL MOBILISATION TIMES

Retrieval mobilisation times within 1 hour were achieved for 77% of IPATS journeys in 2021 (n=101) and 2022 (n=107). This is an increase of nine percentage points compared to 2018, when 68% (n=56) of journeys were within this timeframe.

Figure 7.2 shows the time taken to mobilise a team following a clinical decision that urgent (non-elective) patient transport is needed in the ROI (i.e. IPATS) for the years 2018–2022. The UK Care Quality Commission recommends that journeys be started within 1 hour (Universities of Leeds and Leicester, 2023). NHS England Quality Dashboard recommends that the team departs the transport base within 30 minutes from the time the referral is accepted for retrieval. This metric is considered as a measure of system capacity rather than quality of care; starting the journey is only one part of the timely access.

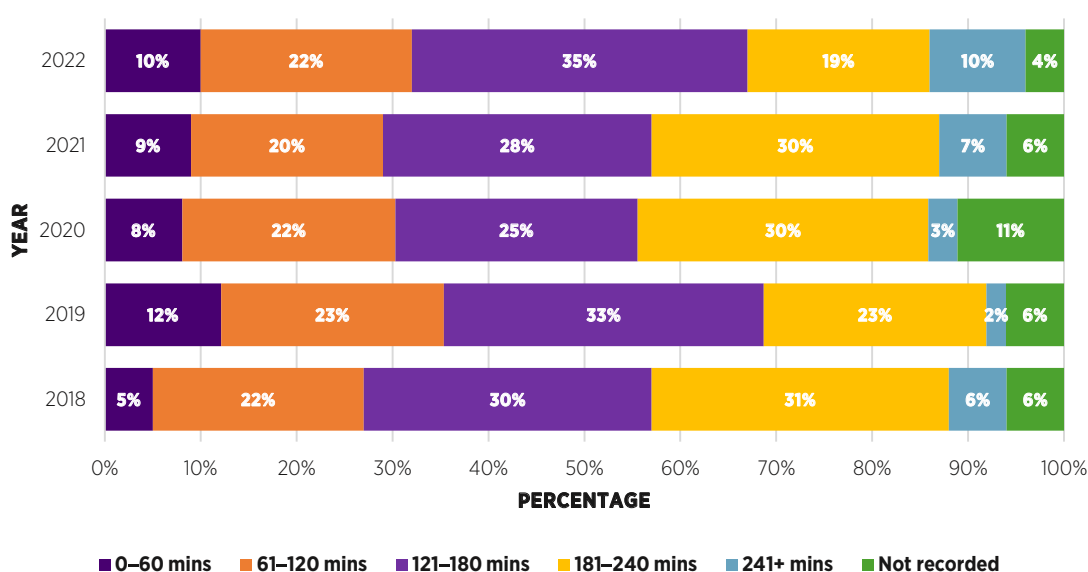


**FIGURE 7.2: NON-ELECTIVE TRANSPORTS BY MOBILISATION TIMES (IN MINUTES), IN REPUBLIC OF IRELAND, 2018–2022 (N=498)**

## NON-ELECTIVE TRANSPORTS – TIME TO BEDSIDE

In 2022, IPATS achieved the 3-hour target for time to bedside for 67% (n=93) of transports, an increase of ten percentage points compared to the 2018 figures of 57% (n=47).

*Quality Standards for the Care of Critically Ill Children* (PCCS, 2021) recommend a target for arrival at the referring Unit within 3 hours of the decision to transfer the child, except in remote areas, where the team should arrive within 4 hours. Due to the low volume of calls to IPATS, both the IPATS registrar and nurse provide support to the PCCU during their shifts. Following activation, the IPATS team must assemble with the IPATS consultant and the ambulance (or helicopter/aeroplane), which are often not co-located. Retrieval from remote geographical areas may require both road and air travel.



**FIGURE 7.3:** NON-ELECTIVE TRANSPORTS, BY TIME (IN MINUTES) TO BEDSIDE, IN REPUBLIC OF IRELAND, 2018-2022 (N=498)

### PICANet METRIC 3: EMERGENCY READMISSIONS WITHIN 48 HOURS

For the years 2018–2022, the proportion of patients readmitted within 48 hours of discharge is low and ranges from 1.3% (n=18) in 2018 to 1.9% (n=30) in 2021.

Emergency readmissions to the same PCCU within 48 hours of discharge from the PCCU may mean that a child was discharged too early or into the wrong care environment, or that the need for future critical care was not predicted. There is no standard acceptable rate of emergency readmissions within 48 hours to PCCU, but they are considered a rare event. Low readmission rates are accepted as an indicator of good-quality care.

Table 7.1 displays the number and percentage of admissions where the child was readmitted to PCCU within 48 hours of discharge by country for each year of the reporting period.

**TABLE 7.1: EMERGENCY READMISSIONS WITHIN 48 HOURS, 2018–2022**

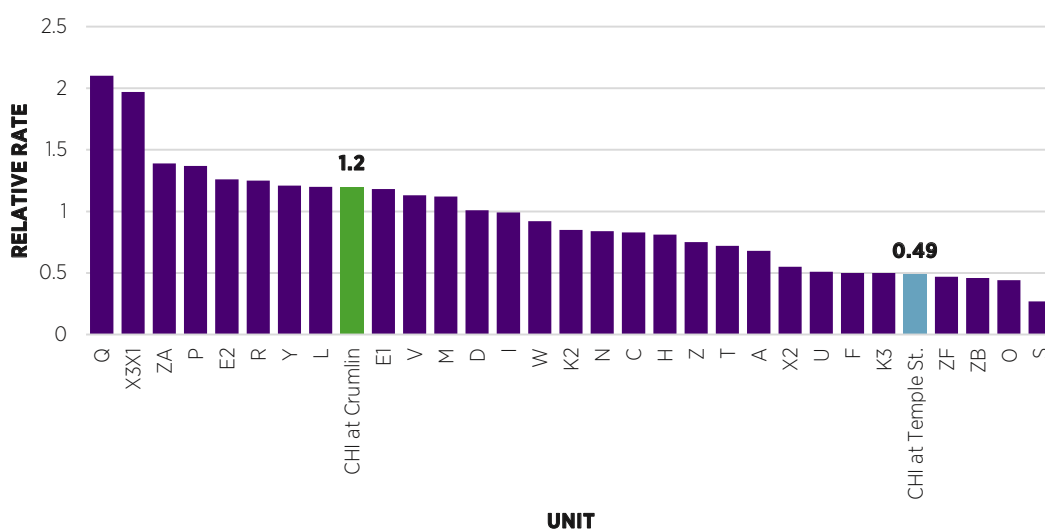
Country	2018		2019		2020		2021		2022	
	N	%	N	%	N	%	N	%	N	%
ENGLAND	268	1.6%	244	1.5%	216	1.6%	229	1.6%	219	1.5%
WALES	15	2.9%	8	1.6%	4	1.1%	4	1.1%	5	1.3%
SCOTLAND	26	1.9%	31	1.8%	25	2.1%	33	2.4%	30	2.0%
NORTHERN IRELAND	14	2.8%	8	1.6%	4	1.1%	6	1.4%	3	0.7%
REPUBLIC OF IRELAND	18	1.3%	26	1.7%	24	1.7%	30	1.9%	24	1.5%
<b>TOTAL</b>	<b>341</b>	<b>1.7%</b>	<b>317</b>	<b>1.6%</b>	<b>273</b>	<b>1.7%</b>	<b>302</b>	<b>1.7%</b>	<b>281</b>	<b>1.5%</b>

**In 2022, CHI at Temple Street was below the relative rate of emergency readmission within 48 hours (1.0) at 0.49, while CHI at Crumlin was slightly above the relative rate at 1.20.**

Figure 7.4 shows the relative emergency readmission rate for each individual Unit for 2022. The relative rate is calculated using the overall readmission rate for each specific year based on all participating PCCUs. Relative readmission rates higher than 1.0 show that a PCCU has a higher rate of emergency readmissions within 48 hours than the overall rate for the UK and ROI combined. In 2021 and 2022, CHI at Temple Street was below the relative rate of emergency readmission within 48 hours (1.0) at 0.58 and 0.49, respectively, while CHI at Crumlin was slightly above the relative rate at 1.37 and 1.20, respectively.

**TABLE 7.2: RELATIVE RATE OF EMERGENCY READMISSIONS WITHIN 48 HOURS AT CHILDREN'S HEALTH IRELAND AT CRUMLIN AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, 2018-2022**

Unit	2018	2019	2020	2021	2022
CHI at Crumlin	0.93	1.32	1.11	1.37	1.20
CHI at Temple Street	0.29	0.66	0.87	0.58	0.49



**FIGURE 7.4: RELATIVE RATE OF EMERGENCY READMISSION WITHIN 48 HOURS OF DISCHARGE, BY PARTICIPATING PAEDIATRIC CRITICAL CARE UNITS IN THE UNITED KINGDOM AND REPUBLIC OF IRELAND, 2022<sup>1</sup>**

<sup>1</sup> See [Appendix 5](#) for the PICANet Organisation Key

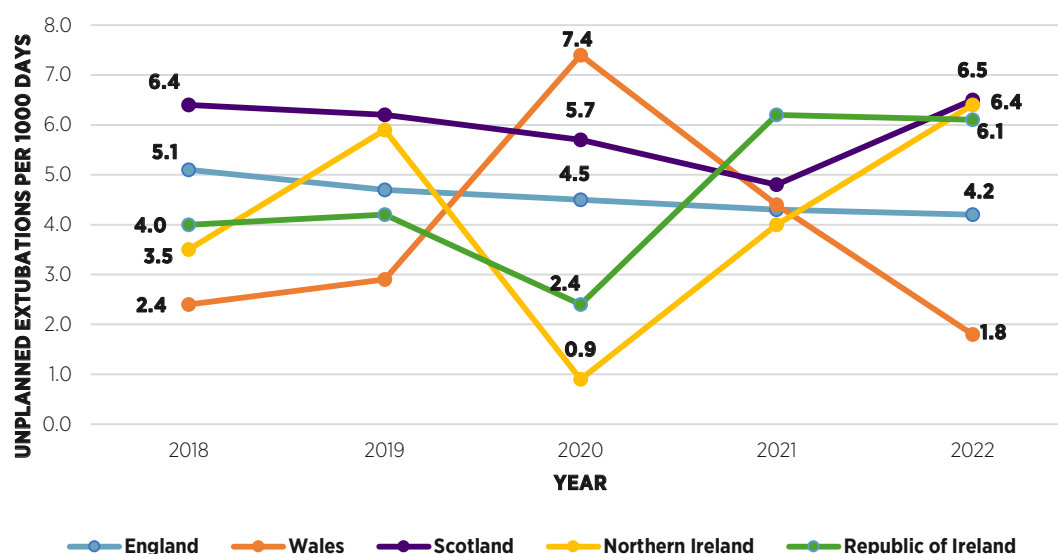
## PICANet METRIC 4: UNPLANNED EXTUBATIONS IN PCCU

The unplanned extubation rate in the ROI was fewer than 5.0 per 1,000 intubated days for 2018–2020, but this rose to 6.2 and 6.1 in 2021 and 2022, respectively, which is above the recommended threshold of fewer than 5.0 per 1,000 invasive ventilation days.

Rates of unplanned extubation should be carefully monitored, and PICANet has now included this as a key metric. The *Paediatric Intensive Care Unit (PICU) Quality Dashboard 2021/2022* (NHS England, 2021) aims for a threshold of fewer than 5 unplanned extubations per 1,000 invasive ventilation days.

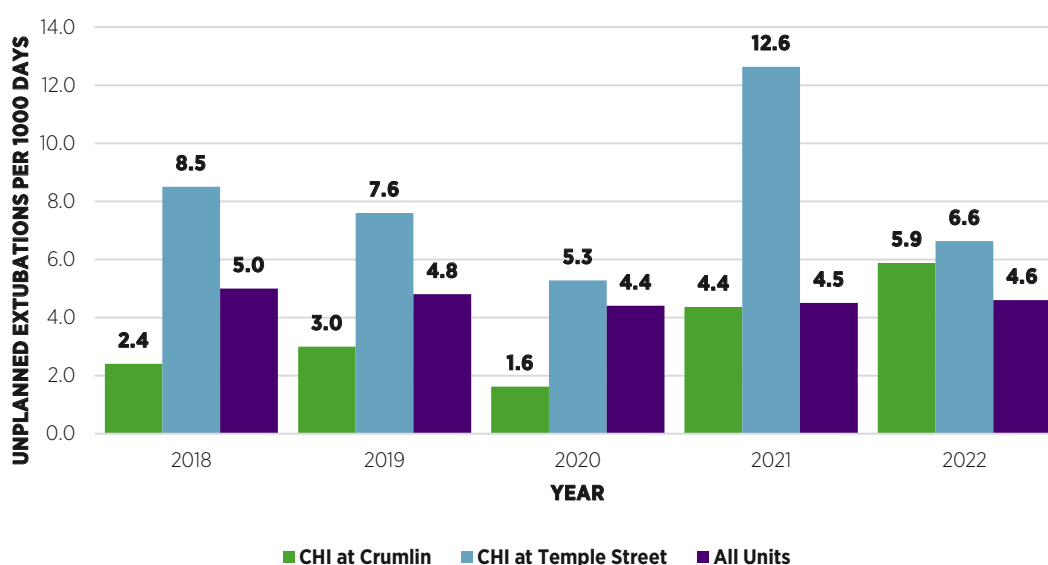
Invasive ventilation involves placing a flexible plastic tube in the patient's throat and connecting it to a machine that helps them to breathe. If the tube is accidentally dislodged or removed by the patient, this is referred to as unplanned extubation. Unplanned extubation is still a relatively rare event in PCCUs. It is the most common adverse event to airway management in critical care and can result in clinical complications such as hypoxaemia (very low blood oxygen), hypercarbia (high blood carbon dioxide) or, very rarely, death (Kanthimathinathan *et al.*, 2015). A single-cohort study using routine clinical data from 12,533 admissions to a single PCCU between 2010 and 2013 found an acceptable notional threshold rate of unplanned extubations of fewer than 10 per 1,000 invasive ventilation days (Kanthimathinathan *et al.*, 2015).

Rates of unplanned extubation per 1,000 intubated days by country of admission for 2018–2022 are shown in Figure 7.5. All countries reported unplanned extubation rates at or below 7.4 per 1,000 intubated days.



**FIGURE 7.5:** RATE OF UNPLANNED EXTUBATION PER 1,000 DAYS OF INVASIVE VENTILATION, BY COUNTRY OF ADMISSION, 2018–2022 (N=1429)

Figure 7.6 illustrates rates of unplanned extubation across all participating PCCUs (UK and ROI) in the 2018–2022 period. There was a decrease in unplanned extubation in both Units in the ROI in 2020. Rates at CHI at Crumlin were below the acceptable threshold of 5.0 per 1,000 invasive ventilation days for each year from 2018 to 2021, but this figure rose slightly to 5.9 per 1,000 in 2022. Although the rates of unplanned extubations in CHI at Temple Street were above the threshold rate, it should be noted that the actual number of unplanned extubations is small (n=14 in 2021, n=7 in 2022). CHI at Temple Street has reviewed its unplanned extubations and has initiated quality improvements to address the Unit's rates of unplanned extubations (see Chapter 8).



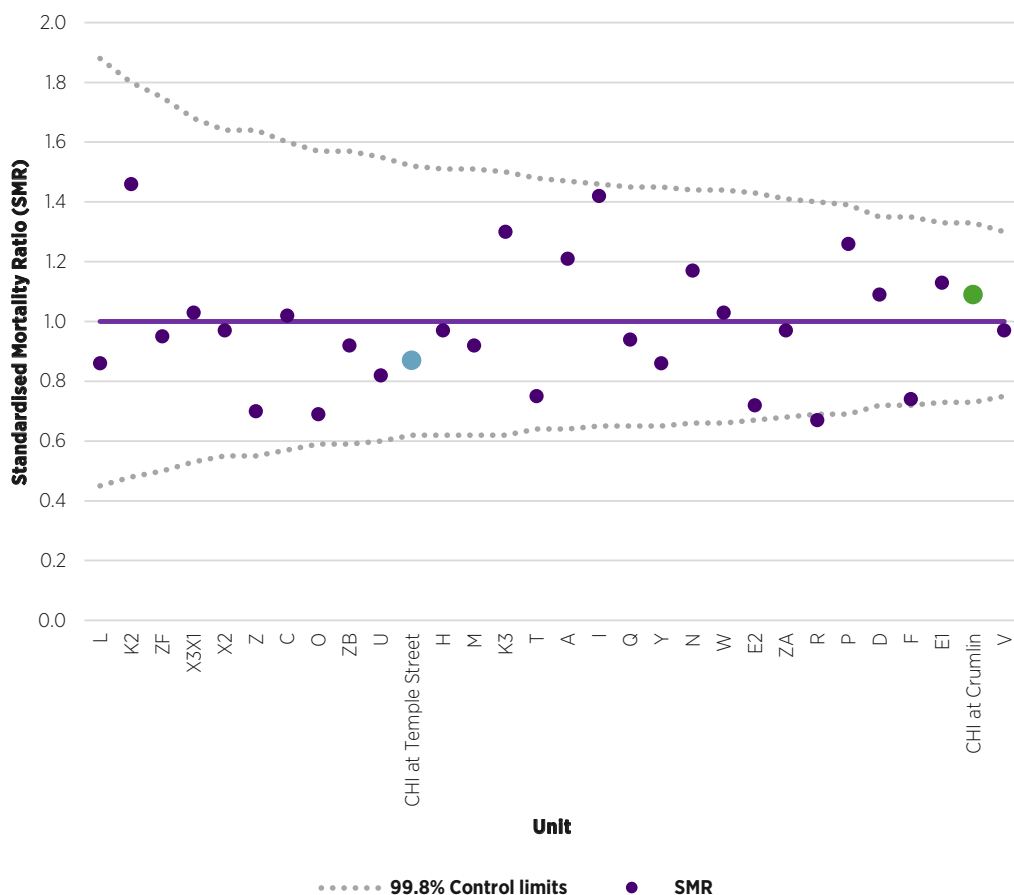
**FIGURE 7.6:** RATES OF UNPLANNED EXTUBATIONS AT PAEDIATRIC CRITICAL CARE UNITS, BY YEAR, 2018–2022 (N=118)

## PICANet METRIC 5: MORTALITY IN PCCU

In this reporting period, after allowing for the level of sickness at time of admission, no PCCU in the ROI had a mortality rate higher than expected. Risk-adjusted mortality is an important high-level quality indicator.

Mortality rates are assessed for each PCCU based on a statistical approach that accounts for the severity of the child's illness at the time of admission. The risk-adjustment method used is PIM3. The number of children predicted to die is calculated and compared to the actual number of deaths to derive the risk-adjusted SMR (Universities of Leeds and Leicester, 2023).

The risk-adjusted SMR for each PCCU in the UK and the ROI is displayed in a funnel plot (plotted against the number of admissions) for 2020–2022. Transparent presentation of this information is important to assure the public, parents and health service at large that hospitals are continuously monitoring important outcomes and that there are systems in place to review any areas of concern.



**FIGURE 7.7: RISK-ADJUSTED STANDARDISED MORTALITY RATIO, BY PARTICIPATING PAEDIATRIC CRITICAL CARE UNITS, 2020–2022<sup>2</sup>**

<sup>2</sup> See [Appendix 5](#) for the PICANet Organisation Key

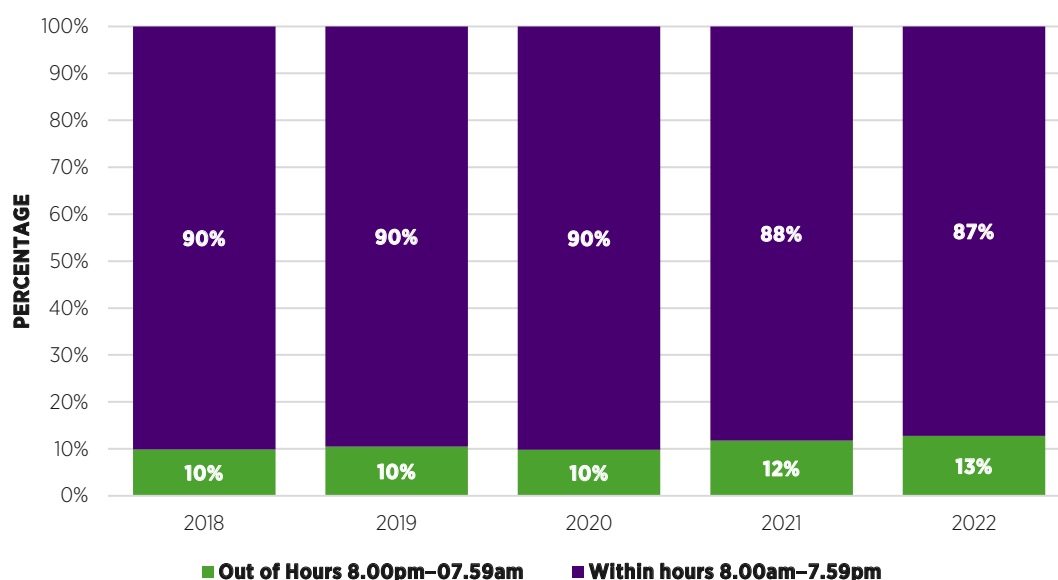
## OUT OF HOURS DISCHARGE

**There was an increase in the proportion of patients discharged out of hours (between 8.00pm and 7.59am) from 10% in 2018–2020 to 12% (n=195) in 2021 and 13% (n=213) in 2022, which is above the target of less than 10% of discharges.**

The PCCS *Quality Standards* (PCCS, 2021) state that PCCU operational policy should be that “discharges do not normally occur between 20:00 and 07:59” and that “arrangements for discharge [be] within four hours of the decision to discharge”. The *Paediatric Critical Care Getting It Right First Time Programme National Specialty Report 2022* (NHS England and NHS Improvement, 2022) states that the out-of-hours discharge target is less than 10% and that delays in discharge of more than 24 hours should be monitored, with a target of less than 5%.

Over the 5-year period, most patients were discharged from PCCU between 8.00am and 7.59pm (Figure 7.8).

An out-of-hours discharge of a patient is suboptimal and should be avoided where possible. It is important to record the reason for late discharges. For example, there may be no bed available on the ward, and a direct swap may take place to facilitate the admission of a critically ill patient. Annual audits should record the reasons for out-of-hours discharges and clearly show if ward capacity is the issue, communicating this to hospital management. During the evening and night-time medical and nursing staff availability on the wards is reduced and senior staff are less likely to be available to review a patient. It is also less likely that a parent/guardian will be present to accompany the child if the discharge occurs during the night.



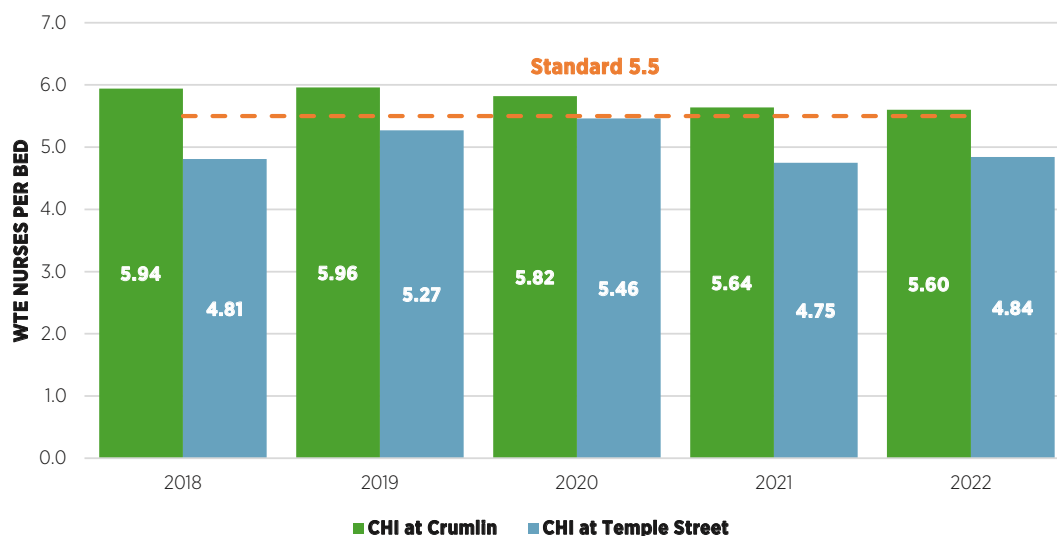
**FIGURE 7.8: OUT-OF-HOURS DISCHARGES FROM PAEDIATRIC CRITICAL CARE UNITS IN THE REPUBLIC OF IRELAND, 2018–2022 (N=7702)**

## NUMBER OF QUALIFIED NURSES PER BED

**CHI at Crumlin met the required nursing standard of 5.5 WTE per critical care bed for each year in 2018–2022, but CHI at Temple Street remained below the standard for each year reported.**

The *National Standards for Paediatric Critical Care Services* (Joint Faculty of Intensive Care Medicine of Ireland, 2018) in Ireland recommend that each critical care bed should be supported by a minimum of 5.5 whole-time equivalent (WTE) staff nurses. The ROI standard of 5.5 WTE nurses per critical care bed pertains to the number of nurses required in direct patient care, which includes the numbers required for one-to-one direct patient care only. However, the 5.5 WTE nursing standard needs to be amended to 5.8 WTE in line with changes to nurses' working hours under national pay agreements.

CHI at Crumlin met the required nursing standards each year for 2018–2022, but CHI at Temple Street remained below the standard for each year reported. Retention of nursing staff is particularly problematic in PCCUs for several reasons, including the higher nurse–patient ratios and specialised training required to enable working in a high-stress environment. Staffing shortages in CHI at Temple Street were due to multiple reasons, including retention of staff, ability to recruit suitable qualified staff, and maternity and sick leave. Staffing requirements may vary intermittently and are impacted by multiple factors, including case mix, outbreaks and season.



**FIGURE 7.9: NUMBER OF NURSES PER CRITICAL CARE BED FOR CHILDREN'S HEALTH IRELAND AT CRUMLIN AND CHILDREN'S HEALTH IRELAND AT TEMPLE STREET, 2018–2022**

## KEY FINDINGS FROM CHAPTER 7

- The completeness of patients' admission data within 3 months of their discharge from the Unit for the ROI was 34% in 2021 and 35% in 2022, which is well below the 100% target.
- Seventy-seven percent of IPATS journeys in 2021 (n=101) and 2022 (n=107) were started within the recommended 1-hour timeframe, an increase of nine percentage points compared to 2018, when the figure was 68% (n=56).
- *Quality Standards for the Care of Critically Ill Children* (PCCS, 2021) recommend a target for arrival at the referring Unit within 3 hours of the decision to transfer the child. In 2022, IPATS achieved the 3-hour target for 67% (n=93) of transports. This is an increase of 10 percentage points compared to 2018, when 57% (n=47) of transports met this target.
- Low readmission rates are accepted as an indicator of good-quality care. For the years 2018–2022, the proportion of patients readmitted within 48 hours of discharge is low and ranges from 1.3% (n=18) in 2018 to 1.9% (n=30) in 2021.
- The *Paediatric Intensive Care Unit (PICU) Quality Dashboard 2021/2022* (NHS England, 2021) aims for a threshold of fewer than 5.0 unplanned extubations per 1,000 invasive ventilation days. The Republic of Ireland had a rate of fewer than 5.0 per 1,000 intubated days for 2018–2020, but this figure rose to 6.2 and 6.1 in 2021 and 2022, respectively.
- Risk-adjusted mortality is an important high-level quality indicator. The risk-adjusted SMR for each PCCU for this reporting period, after allowing for the level of sickness at time of admission, showed no PCCU in the ROI had a mortality rate higher than expected.
- There was an increase in the proportion of patients discharged out of hours (between 8.00pm and 7.59am), from 10% in 2018–2020 to 12% (n=195) in 2021 and 13% (n=213) in 2022. The out-of-hours discharge target is less than 10%.
- CHI at Crumlin met the recommended standard each year for nursing WTE per bed, while CHI at Temple Street fell below the recommended standard each year.



## CHAPTER 8

# QUALITY IMPROVEMENT



## CHAPTER 8: QUALITY IMPROVEMENT

## PATIENT SAFETY

**Problem – unplanned extubations**

CHI at Temple Street had an increase in the number and rate of unplanned extubations in 2021 (12.6 per 1,000 intubated days) to above the acceptable threshold. The *Paediatric Intensive Care Unit (PICU) Quality Dashboard 2021/2022* (NHS England, 2021) aims for a threshold of fewer than 5 unplanned extubations per 1,000 invasive ventilation days. Unplanned extubation is the most common adverse event to airway management in critical care and can result in clinical complications such as hypoxaemia (very low blood oxygen), hypercarbia (high blood carbon dioxide) or, very rarely, death (Kanthimathinathan *et al.*, 2015).

**Findings**

A review of the audit data revealed that the highest rate of unplanned extubations occurred when PCCU bed occupancy was over capacity (greater than 100%) in October to December 2021. It was noted that several patients' endotracheal tubes (ETTs) were either positioned high or had not had their position imaged on admission to PCCU.

Unfortunately, the Unit at CHI at Temple Street remains over capacity in the winter months. Also, the number of qualified nurses per bed is increasing annually but remains below the recommended standard of 5.5 WTE nurses per critical care bed.

**Quality improvement methods**

Several improvement measures have been introduced:

- An airway check was added to the medical admission and ward round notes to ensure that the ETT position was checked and adjusted if high.
- The majority of ETTs involved in unplanned extubations were oral ETTs. The ward round safety checklist was revised to review each patient's suitability for conversion to a nasal ETT with the aim of converting all ETTs to nasal if deemed suitable.
- A number of risk factors for having an unplanned extubation were identified, including:
  - being a neonate
  - having loose tapes
  - being handled for a procedure.
- The PCCU team at CHI at Temple Street increased awareness of these risk factors among its staff, while continuing to assess ETT security on its ward round safety checklist and developed a new ETT retaping guide, which is included in its induction booklet for new doctors.

**Result**

The improvement measures introduced resulted in a decrease in the number of unplanned extubations in 2022 to 6.6 per 1,000 intubated days.

**Reflection of learning**

The PCCU team at CHI at Temple Street are working closely with its colleagues in CHI at Crumlin and has standardised the way we tape ETTs cross-site as well as developing a new unplanned extubation audit form, which was rolled out at both sites in January 2024.

## PATIENT EXPERIENCE

### CHI at Temple Street – PICU patient diary

The importance of patient outcomes and experience as key quality metrics has been well established in the literature. As part of the Parental Involvement and Engagement Project, a Paediatric Intensive Care Unit (PICU) diary initiative was launched at CHI at Temple Street in 2023. The use of patient diaries is an evolving intervention in paediatric intensive care settings in the UK and ROI (Lynch *et al.*, 2020). PICU patient diaries are a way of helping families understand what has happened to their critically ill child during a PICU admission (Aitken *et al.*, 2013). The diaries are kept, in part, to decrease symptoms of anxiety, depression and post-traumatic stress that may develop after PICU admission in both patients and family members. Moreover, patient diaries can help fill in memory gaps that often exist after patients are discharged from the PICU (Mikkelsen, 2018).

The diary is a record written by the patient's family in everyday language to help the patient understand what has happened during their stay and to help the family cope with the situation during this difficult period. A stay in the PICU can weaken the patient's perception and memory, with some having absent or delusional memories of the experience. Therefore, it is important to keep a record of the patient's condition.

The patient and family write the PICU diary. The PICU team (physicians, nurses, therapists and social workers) may also make entries. The diary can detail the reason and the events leading up to the PICU admission. This can include the daily status of the patient, medical measures, daily procedures or treatments, visitors and recovery milestones, such as first opening the eyes, standing or sitting in a chair, or coming off the ventilator. Anything that may interest the patient (e.g. visitors, activities) and notes on discharge or transfer from the PICU are recorded.

The PICU diary and photographs are a permanent record to help the patient have a true memory of their stay in the PICU, as well as helping the patient's family address how they feel during that time. The diary is not part of any research or clinical audit, but feedback may be obtained from the Parental Satisfaction Survey.

## PATIENT EXPERIENCE

### CHI at Temple Street – PICU Parental Satisfaction Survey

As part of the Parental Involvement and Engagement Project, a Parental Satisfaction Survey was developed and has been circulated in the PICU since 2019. Unfortunately, due to the COVID-19 pandemic, it was not advisable or prudent to continue collecting paper copies of this survey. Therefore, a fully digital Parental Satisfaction Survey was developed and issued to all parents. The survey data are collected and owned by the PICU at CHI at Temple Street but they are only shared with CHI, if requested.

All parents/carers who had children that were discharged from CHI at Temple Street PICU are invited to take part in the survey. Parents are sent a text, from the Defero system, containing a link to EUSurvey, an online survey and data collection platform, as recommended by the Data Protection Officer (DPO). Parents will be able to respond to the survey using either a personal computer or smartphone.

This is an anonymised survey to get parental feedback on experiences in the PICU to identify any issues which may have impacted on the child either positively or negatively with a view to improving patient and family care, including:

- communication
- environment and facilities
- positive or negative aspects of the child's stay.

The results of the survey are reviewed monthly, with feedback provided to the medical and nursing teams at departmental meetings. If a survey positively mentions an individual on the team, they receive a Learning from Excellence recognition form. Results for 2023 show 94% overall parental satisfaction.

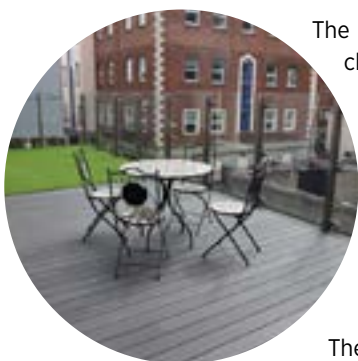
Since the introduction of the digital version of the survey, in January 2023, there has been a three-fold increase in responses to the survey. The digital version of the survey has made data collection and storage more efficient and regulated. This has helped the Unit to monitor progress and drive improvements at a local level. The Parental satisfaction survey also provides evidence to state bodies such as the Health Information and Quality Authority (HIQA) that their aims are being delivered.

## PALLIATIVE CARE AND END-OF-LIFE CARE

### CHI at Temple Street – The Butterfly Suite

In Ireland, most in-hospital paediatric deaths occur in the PCCU setting. Severely ill children are admitted to PCCUs to receive potentially curative therapies. However, for some children, these therapies are ineffective in achieving the desired outcome of survival with an acceptable quality of life. This often initiates a transition from invasive interventions to comfort care and the pursuit of allowing a dignified death. The Butterfly Suite offers a space within the hospital for redirection of care in these circumstances. It is a private space where children can live with their family members and spend their last few precious moments in peace and comfort.

The PCCU team in CHI at Temple Street aims to offer every family whose child is dependent on ICU-level therapies and where a decision has been made to redirect care towards comfort measures the option of withdrawal of life-sustaining therapies in an environment that is comfortable and less clinical than the PCCU.



The PCCU team facilitate the additional nursing resources required to open the suite and the clinical staff to support both the removal of invasive supports and the provision of symptom control. This approach is important for symptom control beyond the symptom management plan, particularly out of hours.

The Butterfly Suite in CHI at Temple Street was opened in August 2021. It is a private space with two rooms and is connected to a general paediatric ward. The child and family enter the suite via this ward but also have a separate access point during day shift hours. Staff access the patient's room through a connecting link to the ward's nursing area, affording the child, parents and family less disruption relating to clinical care and activity.

The family/parents' room offers a sitting room, with overnight facilities, an en-suite bathroom and a kitchenette with breakfast area. Curtains, carpets and other fabrics, not normally used in a hospital setting, are fitted throughout the suite. There is a fireplace, a TV and recliner couches to promote a home-away-from-home environment alongside clinical facilities that might be needed. The décor is neutral such that it can be personalised by the child and their family.

The space is also home to a private balcony garden with decking, grass and planting so that each child and their family can spend time outdoors if they wish. This affords an additional space for children or their siblings to play and have time outdoors, and it has been particularly valued by parents whose babies have come straight to Temple Street from a maternity hospital where they never had an opportunity to carry their baby outside into the fresh air.

The suite is not exclusively utilised by children being treated in the PCCU, and each child's care while in the suite is individualised to best meet their needs and the needs of their family. Since the suite opened, eight patients have been moved there from the PCCU.



## PATIENT FLOW

### National Ambulance Service Critical Care and Retrieval Service: IPATS nurse-led repatriation service

The HSE's National Ambulance Service (NAS) established a nurse-led repatriation service in January 2024 to safely bring children and young people back to their local hospital once they no longer need specialist care in a CHI hospital. This service is delivered by the Irish Paediatric Acute Transport Service (IPATS), which is part of NASCCRS (National Ambulance Service Critical Care and Retrieval Service).



Before transfer, a care plan for any child being transferred is made between the child's consultant in CHI and their consultant in the local hospital. Once both teams are happy with this plan, they contact the IPATS repatriation service and request the transfer to take place. This usually takes place within 24 hours. The IPATS repatriation service is integral to the development of a high-quality national paediatric network. It also ensures a flow of children into and out of the specialist hospitals so that every child can get the most appropriate care when they need it most.

When a child is transferred to Dublin, it is often part of a 'sharing of care' model between CHI and a regional hospital that aims to deliver the right care to the child, in the right place, at the right time. When a child no longer needs specialist services in a CHI hospital, they can be safely moved back to their local hospital and medical team, close to their home and family. The repatriation service completed 25 patient transfers in its first 30 days of operation.

A photograph of medical equipment in a hospital room, featuring three infusion pumps hanging from a stand. The pumps have small screens and buttons. The background is blurred, showing other medical equipment and a patient lying in a bed.

## CHAPTER 9

# AUDIT UPDATE

## CHAPTER 9: AUDIT UPDATE

UPDATE ON AUDIT RECOMMENDATIONS FROM *IRISH PAEDIATRIC CRITICAL CARE AUDIT NATIONAL REPORT 2020*

Recommendation	Update
<b>A comprehensive dataset should be developed locally, in addition to PICANet data, to accurately reflect the complexity and acuity of the ROI PCCU patient population and the scope of practice, to enable accurate audit and reporting.</b>	Diagnostic coding developed by the Australia New Zealand Intensive Care Society paediatric study group will be added to the PCCU database. These codes have four levels of classification: non-operative and post-procedural admission, diagnostic group, specific condition and, for injury and infection, aetiological factor. Specific procedures, listed by organ system, are used for patients admitted for recovery after a procedure. The CHI information system will be reconfigured to allow patient classification using this coding system. Data validation checks will be developed, and the system will be tested once it is set up. Data collected from 2024 will be coded and reported using new classifications. Data management support will be required at both Units to successfully implement this change, which will add to the audit workload.
<b>Adult Intensive Care Units caring for children should ensure the recommendations outlined in the <i>Model of Care for Paediatric Critical Care</i> are adhered to. Any child requiring treatment in an adult critical care unit should be discussed with the National Paediatric Critical Care Network to decide if stabilisation and transfer to a PCCU is required or that the child can be safely cared for locally.</b>	<p>Data in this report for the years 2021 and 2022 show that there has been a decrease in the number of children being admitted to adult ICUs and an increase in the number of children being transferred to PCCUs.</p> <p>Response from University Hospital Galway: "It is unlikely that we will be able to implement a regional PHDU with the current infrastructure and resources. It would split the limited experience across ICU and a separate PHDU. The vast majority of the paediatric admissions to ICU do not progress to transfer and are managed locally with good outcomes and the system has worked well and it would not be feasible to stretch a service over 2 locations."</p>

<p><b>Paediatric Critical Care Units should improve timeliness of audit data submission to meet the quality standard.</b></p>	<p>PICANet was consulted for shared learning based on best practice regarding submitting data for the audit: Best practice is dedicated protected time of a core team for data entry with internal validation built in regularly with consultant(s), with a particular focus on the primary diagnosis. Consultants should be involved for medical expertise and not on a rotation and include the data manager for oversight. A new feature in PICANet Web allows for identification of overdue, missing or incomplete records.</p> <p>Following changes to the timeliness of submission target from 3 months after discharge from PCCU to 2 months after discharge from PCCU, there was an increase in the WTE for audit nurses from 1.0 WTE to 1.46 WTE. However, CHI at Crumlin continues to encounter challenges and resulting delays in meeting the quality standard.</p> <p>A recommendation has been made in this report to address audit resourcing.</p>
<p><b>Paediatric Critical Care Units should monitor and review out-of-hours and delayed discharges.</b></p>	<p>The data in this report show that over the 5-year period 2018–2022, most patients were discharged from PCCU within hours, while there was an increase in the proportion of patients discharged out of hours between 8.00pm and 7.59am from 10% in 2018–2020 to 12% in 2021 and 13% in 2022. PCCUs should continue to monitor and review out-of-hours and delayed discharges. These are a sign of Unit strain.</p>
<p><b>A National Respiratory Paediatric Extracorporeal Life Support (ECLS) Programme should be progressed in Children's Health Ireland.</b></p>	<p>The data in this report show that there were six ECMO runs for respiratory patients in 2021 and 2022. One-half of these received ECMO treatment in CHI at Crumlin and one-half were sent abroad for ECMO treatment.</p>

## AUDIT ACTIVITY

- The audit manager attended the PICANet steering group meetings on 22 September 2022, 17 April 2023 and 18 October 2023.
- The audit manager attended the PICANet virtual validation visits in CHI at Crumlin and CHI at Temple Street in February 2023.
- A PPI engagement with the CHI Youth Advisory Council (YAC) was held in the Royal College of Surgeons in Ireland (RCSI) in November 2022: YAC comprises a group of young people currently aged between 14 years and 20 years who have all accessed CHI services as patients. YAC members share their experiences as service users to help develop better systems, improve services and care for all children and adolescents who access CHI. The conversations and discussions were broad ranging and included clinical audit, NOCA and its approach to audit promotion, the paediatric programme of clinical audit and the Irish Paediatric Critical Care Audit (IPCCA).
- The audit manager engaged with the CHI Arts in Health Programme to seek contributions for IPCCA publications.

## AUDIT DEVELOPMENT

### PICANet dataset changes

- The COVID-19 Customised Data Collection ended on 31 January 2024.
- From January 2024 additional data will be collected by the audit for delirium screening (assessed using the Cornell Assessment of Paediatric Delirium tool) and two healthcare-associated infections to capture healthcare-associated infection (HCAI):
  - Central line-associated bloodstream infection (CLABSI) will be reported as number of episodes per 100 line days.
  - Catheter-associated urinary tract infection (CAUTI) will be reported using number of episodes per 100 catheter days.

### IPCCA review

An interim report was published in September 2023 providing an outline of work to date towards completion of a review of the IPCCA. This follows a recommendation made in the *IPCCA National Report 2020* (NOCA, 2023) to develop a comprehensive dataset for the audit in addition to the PICANet data currently collected.

Consultation with stakeholders identified the following important themes which were relevant to users of PCCU audit information:

- equity stratifiers to evaluate health inequalities (e.g., ethnicity, place of residence)
- dataset on admissions of neonatal patients to PCCU and classification of medical and surgical cases
- database for classification of cardiac data to identify case mix of patients admitted to the PCCU
- patient flow metrics in the PCCU
- audit of healthcare-associated infections (HCAIs) in PCCU
- datasets on in-hospital cardiac arrest and organ donation
- patient-reported experience measures and patient-reported outcome measures
- workforce staffing census within PCCU
- care and outcomes at PRDHU.

These additional information requirements build on the current IPCCA to consolidate the place of patients, their safety and the quality of care they receive at the centre of the audit. From this there are some important recommendations, as well as work already in progress (i.e., inclusion of equity stratifiers, neonatal data reporting, classification of data, audit of out-of-hours discharge, audit of HCAI). A review of governance and executive audit management was completed, firmly establishing IPCCA within the Irish National Intensive Care Unit Audit (INICUA) governance structures.

### Key Recommendations

Recommendations approved by the INICUA governance committee are:

- Participate in national clinical audits on in-hospital cardiac arrest and potential organ donation, should they be implemented.
- Include analysis of data on cancellation of elective/planned surgery due to unavailability of a paediatric critical care bed in future IPCCA national reports.
- Develop a research proposal to explore the feasibility of patient-reported outcome measures (PROMS) and patient-reported experience measures (PREMS).
- Conduct healthcare worker staffing census of PCCUs to include nurse and medical staffing as well as health and social care professionals.
- Develop an audit process for regional PHDUs.

A newborn baby is lying in a hospital bed, covered with a white blanket. The baby's head is in the background, resting on a pillow, with a medical device (possibly a pulse oximeter) visible on its forehead. The baby's foot is in the foreground, resting on a white surface. The text "CHAPTER 10" is written in green, and "RECOMMENDATIONS" is written in bold green letters.

## CHAPTER 10 **RECOMMENDATIONS**

## CHAPTER 10: RECOMMENDATIONS

### RECOMMENDATION 1

**Paediatric critical care should be resourced with a workforce which allows the Units to deal with acute surges in demand and maintain an average occupancy of 85%, as per national standards. To facilitate the opening and running of the Paediatric Critical Care Unit (PCCU) in the National Children's Hospital with an increase in beds from 32 to 42, a detailed multidisciplinary workforce plan is required. CHI should submit to the National Service Planning process for the additional resources required from the HSE.**

#### Rationale

- Bed occupancy frequently exceeds the recommended limit (see Figures 5.4 and 5.5).
- Admissions show a predictable pattern of surge in winter months (see Figure 4.12).
- The adverse consequences of Unit strain are late cancellations of planned surgery and out-of-hours discharges (see Figure 7.8).
- The new National Children's Hospital (NCH) will increase the number of PCCU beds from 32 to 42.
- The new NCH PCCU will be close to the size of Great Ormond Street, which has 47 beds (see Figure 4.1).
- The number of qualified nurses per critical care bed is below the recommended 5.5 WTE standard (see Figure 7.9).

#### What action should be taken?

**CHI management should use the data in this report to ensure the business case for the planned workforce for the new NCH includes the resourcing required to open 42 PCCU beds with occupancy maintained at 85%. CHI should submit to the National Service Planning process for the additional resources required from the HSE.**

- Units should be staffed to allow for the maximum number of beds open over 365 days per annum. This requires emphasis on retention initiatives of PCCU nurses to ensure that all PCCUs have appropriate staffing levels.
- Occupancy should be maintained at 85% to allow for clinical surges, staff sick leave and maternity leave.
- CHI management should engage with the Clinical Lead of the HSE National Critical Care Programme to establish a workforce planning group to plan for the appropriate resourcing of paediatric critical care medicine consultant, trainee and nursing staff in line with national standards for the expansion from the current 32 beds to 42 beds in the new NCH.
- The 5.5 WTE nursing standard needs to be amended by the Joint Faculty of Intensive Care Medicine to 5.8 WTE in line with changes to nurses' working hours as per national pay agreements, and Units should be resourced to this standard.

#### Who will benefit from this action/recommendation?

- PCCU staff in terms of reduced burnout and stress.
- Management dealing with staff retention and recruitment as consistent occupancy figures of less than 85% have positive implications in this area.
- Children requiring critical care and their families.
- Children awaiting surgery after cancellations.

#### Who is responsible for implementing this action/recommendation?

CHI hospital management.

**When should this be implemented?**

As soon as possible.

**Evidence base for recommendation**

- The *Critical Care Capacity, Workforce and Activity Census Report 2023* (National Clinical Programme for Critical Care, 2024) highlights the need to prioritise increasing the paediatric critical care medicine consultant, trainee and nursing workforce to meet the requirements of opening the new NCH PCCU with 42 beds.
- There is increasing evidence that appropriately staffed and skilled PCCUs will deliver better outcomes for their patients. This is clearly outlined in the *Model of Care for Paediatric Critical Care* (HSE National Clinical Programme for Critical Care and National Clinical Programme for Paediatrics, 2019), the *PCCU Quality Standards* (Paediatric Critical Care Society, 2021) and the healthcare literature (Gupta *et al.*, 2016; Rae *et al.*, 2021).
- Research has described burnout and the psychological impact of COVID-19 on staff working in paediatric critical care (Ffrench-O'Carroll *et al.*, 2021).
- The Paediatric Critical Care *Getting It Right First Time* (NHS England and NHS Improvement, 2022) report provides an overview of the many factors that will affect the balance between demand and capacity and the resulting strain on staff.

An example of initiatives used at Oxford Children's Hospital and Evelina London Children's Hospital:

- Nursing staff have the option of working annualised hours and taking more annual leave over the summer months compared to winter.
- A flex system allows staff to flex off shifts when staffing exceeds patient demand and repay these shifts at other times, principally in winter. This can be done at short notice and is closely monitored to ensure equal opportunities for all staff and to avoid excessive extra hours being owed.
- Nurse training and education, study time and staff appraisals are all undertaken avoiding the peak winter months.
- Short-term contracts for external staff are offered through NHS professionals over the winter months.
- Elective surgical scheduling is reduced over winter.

## RECOMMENDATION 2

**The Health Information and Quality Authority (HIQA) rapid health technology assessment (HTA) of immunisation against respiratory syncytial virus (RSV) in infants is underway. The Department of Health should prioritise findings from the HTA, when available, to inform their decision on immunisation of infants against RSV and, if approved progress implementation without delay.**

### Rationale

- The data in this report show a consistent and predictable surge in admissions to PCCU from October to January each year, the majority of patients being infants admitted with RSV (see Figure 4.12).
- Infant RSV infection poses a significant burden on paediatric services in Ireland.

### What action should be taken?

Health Information and Quality Authority (HIQA) should use the data in this report to progress the health technology assessment (HTA) of immunisation against RSV in infants as soon as possible in advance of the next winter surge.

The Department of Health should prioritise using the findings from the HTA, when available, to inform their decision on immunisation of infants against RSV and if approved progress implementation without delay.

### Who will benefit from this action/recommendation?

- Infants, children and their families.
- The healthcare system.

### Who is responsible for implementing this action/recommendation?

HIQA is responsible for undertaking the HTA, while the Department of Health is responsible for the national immunisation programme.

### When should this be implemented?

As soon as is feasible, prioritising infants.

### Evidence base for recommendation

- The Royal College of Physicians of Ireland National Immunisation Advisory Committee (NIAC) has reviewed the evidence about the RSV vaccine and has recommended the passive immunisation of all infants against RSV during their first RSV season (NIAC, 2023).
- A new maternal vaccine and a monoclonal antibody for infants is available, and both products have acceptable safety and efficacy profiles. The provision of these would alter the predictable surge each year.
- Preliminary data from a clinical trial conducted in Europe during winter 2022–2023 involving over 8,000 infants reported an 83% reduction in RSV-related hospitalisations in infants who had received the antibody (NIAC, 2023).

## RECOMMENDATION 3

**Paediatric Critical Care Audit should be mandatory and adequately resourced to enable timely, complete and accurate information to be submitted.**

### Rationale

- Auditing PCCU activity is essential to identify shortfalls in quality of care, to guide improvements in care and to document activity in PCCU in order to guide resource allocation.
- The IPCCCA dataset is extensive, and new data variables have been added to the data collection to enhance the audit (see Chapter 9).
- PCCU data should be up to date and timely (see Figure 7.1).
- High PCCU bed occupancy adds to the audit workload (see Figures 5.4 and 5.5). During periods of sustained high occupancy, audit nurses are frequently deployed to provide clinical cover on the Unit, which results in a backlog of work and not meeting data submission timeline standards.

### What action should be taken?

**CHI management should use the data in this report to ensure that the provision for critical care audit is enabled by WTE posts in audit:**

- The vacant data manager post 1.0 WTE covering both Units needs to be filled as a matter of urgency.

The data manager role held in CHI at Crumlin PCCU was seconded to join the CHI electronic healthcare record team (Project Ogham) in June 2023. Recruitment for a suitable replacement has not been sanctioned, so no data manager is currently in post. Neither Unit with an electronic healthcare record covering 32 beds has access to a data manager. This has resulted in the Units being unable to retrieve data, enable research or produce reports on infection rates. It has also caused delays to the upload of data for 2023 to PICANet.

- Additional audit nursing staff of 1.0 WTE in CHI at Crumlin and 0.4 WTE in CHI at Temple Street need to be provided.

CHI at Temple Street and CHI at Crumlin both require additional audit nurse WTE to achieve the 2-month timeline for submission of audit data according to the PCCS quality standard. Both Units have been below the standard since it was reduced from 3 months to 2 in 2022. From January 2024 additional data collection will be required for Unit-acquired infection and delirium screening, which have been added to the dataset. The current audit nurse in CHI at Temple Street will be retiring and succession planning needs to be put in place.

### Who will benefit from this action/recommendation?

- Children requiring critical care and their families
- The health service.
  - The use of electronic data allows data extraction to provide quality reports, which should be used to drive quality improvement in services caring for critically ill children.
  - Accurate and timely comprehensive data support the appropriate and reliable interpretation of care provided in PCCUs in the ROI.

### Who is responsible for implementing this action/recommendation?

CHI Hospital management.

## When should this be implemented?

As soon as possible.

## Evidence base for recommendation

- CHI Units have not been meeting the PCCS standard that “data for submission to PICANet should be collected and submitted as soon as possible and no later than 2 months after discharge from the PCC unit” (see Figure 7.1).
- The *Quality Standards for the Care of Critically Ill or Injured Children* (PCCS, 2021) and the *PICU Quality Dashboard 2021/2022* (NHS England, 2021) include timely data submission as a key performance indicator. PICANet data submissions should be made as soon as possible and no later than 2 months after discharge from PCCU (*PICU Quality Dashboard PIC10a Domain 4: Ensuring that people have a positive experience of care*).
- The *HIQA Guidance on a Data Quality Framework for Health and Social Care* (Health Information and Quality Authority, 2018) states the importance of accurate and timely data.
- PICANet does not have a defined WTE per bed for audit nurses. In adult critical care Units the INICUA-recommended standard for audit nursing WTE per bed is 1.0 WTE per 10 critical care beds, based on the *Critical Care Nursing Workforce Report 2021* (HSE Office of Nursing and Midwifery Services Director, 2021).
- The work involved in repurposing healthcare data for national clinical audit requires skill and judgement (McVey *et al.*, 2021).

## RECOMMENDATION 4

**The HSE should consider the development of paediatric regional high-dependency care capacity in regional centres.**

### Rationale

- Data provided by INICUA show that children are still being admitted to adult ICUs (see Table 4.3). The provision of regional PHDU would allow these admissions to be reduced in line with recommendations for children in the *Model of Care for Paediatric Critical Care* (HSE National Clinical Programme for Critical Care and National Clinical Programme for Paediatrics, 2019).
- The data in this report show that the proportion of unplanned admissions from outside the hospital to the CHI at Crumlin PCCU increased from 32% (n=132) in 2020 to 45% (n=267) in 2021 and 43% (n=281) in 2022. Of patients in CHI at Temple Street each year, 60%–67% are transferred in (see Figure 4.4).
- The only designated regional PHDU is in University Hospital Limerick (UHL), which produces satisfactory patient outcomes and low levels of patient transfer to PCCU.
- The plan to expand paediatric regional surgical Units to Model 4 hospitals means that children can be treated at local level for non-specialist surgical procedures. However, this needs to be backed up by the provision of PHDUs to allow for enhanced postoperative care if required (e.g. provision of non-invasive ventilation for postoperative tonsillectomy in children with obstructive sleep apnoea).
- Provision of more PHDU beds would improve efficiency and improve value for money in line with the Sláintecare vision of providing the right care, in the right place, at the right time (Department of Health, 2019).

### What action should be taken?

- The HSE Regional Executive Officers should use the data from this report to consider the strategic development of regional PHDU capacity in Model 4 regional hospitals.
- The recommended staffing and equipment requirements for a Level 1 regional PHDU in a Model 4 regional hospital are outlined in the *Model of Care for Paediatric Critical Care*.
- Currently, there is no ring-fenced additional funding for PHDU activity delivered outside PCCU/tertiary services. Extra funding would be required for model 4 regional hospitals to train nurses and allied healthcare workers to effectively manage PHDU patients.
- With the resources and equipment for the provision of HDU and the concentration of these sites to a limited number of designated Model 4 regional hospitals (e.g., Cork and Galway), regional delivery of PHDU could be achieved.

### Who will benefit from this action/recommendation?

- Sick children, who will be able to receive care as close to the family home as possible.
- PCCUs – the development of regional PHDU capacity would ease the strain on the Units, which are already burdened with high occupancy rates, particularly in the winter months.

### Who is responsible for implementing this action/recommendation?

HSE Regional Executive Officer West and North West and Regional Executive Officer South West. Regional PHDUs are part of both the Paediatric and Neonatal model of care (NCAGL Children and Young People) and the MOC for Critical Care (NCAGL for Acute Hospitals). However, while NCAGL support the pathways and the model, the REOs would have to submit for funding for beds, equipment and staffing.

## When should this be implemented?

In conjunction with the expansion of regional surgical Units.

## Evidence base for recommendation

- The *Model of Care for Paediatric Critical Care*, chapter 6 (National Clinical Programme for Critical Care and National Clinical Programme for Paediatrics, 2019).
- *Improving Services for General Paediatric Surgery* (National Clinical Programme for Paediatrics and Neonatology, 2016).
- Recommendations for the safe and effective care of children in local, regional, and super-regional hospital models were agreed in conjunction with stakeholders in paediatric medicine, adult critical care and anaesthesia. These recommendations are outlined in the *National Standards for Paediatric Critical Care Services* (Joint Faculty of Intensive Care Medicine of Ireland, 2018).
- The Paediatric Critical Care *Getting It Right First Time* report (NHS England and NHS Improvement, 2022) recommends that a minimum of one Level 2 bed (HDU) should be in place for every two Level 3 beds (PCCU).
- Observations from UHL highlight the PHDU demand, appropriate equipping and multidisciplinary staff training and competence to safely cater for the critically ill infants and children at regional centres, thus supporting their safe care closer to home, with obvious health, economic and societal benefits. Since the opening of the PHDU in Limerick, tertiary care transfers to Dublin have decreased by 54% and admissions to adult ICU by 78% (Philip *et al.*, 2019).
- Black *et al.* (2022) provide positive evidence for the value of a regional PHDU. In 2019, the regional PHDU in UHL was operational for a total of 265 bed days, at an equivalent estimated total cost to the hospital of €375,296.

## RECOMMENDATION 5

**Dedicated hospital organ donation personnel should be appointed to increase awareness of organ donation and provide education and training locally to ensure all opportunities for organ and tissue donation in PCCUs are realised where appropriate.**

### Rationale

- Organ donation activity takes place in CHI with a range of 1–5 organ donors reported from 2018 to 2022 (Organ Donation and Transplant Ireland, 2022).
- Audit data is available for the first time on organ and tissue donation in paediatric critical care. The data in this report show that in 2021–2022 there were 11 patients who donated solid organs, tissues or both organs and tissues. However, the data collected are limited and offer little contextual insight regarding the true potential for organ donation or potential missed opportunities.
- CHI is the only hospital group in Ireland with no specifically appointed hospital organ donation personnel.
- Organ donation saves lives and improves the quality of life for patients with end-stage organ failure, including children and young people. Where appropriate, every person who is approaching the end of life in an ICU or emergency department should be offered the possibility of becoming an organ donor.
- Implementation of the Human Tissue (Transplantation, Post-Mortem, Anatomical Examination and Public Display) Act 2024, will establish an organ donation register in Ireland. Dedicated hospital organ donation personnel will contribute to the implementation of this important legislation and support clinical personnel in critical care areas in their practice.
- Critical care staff play a crucial role in the management of organ donors and their families. Support and recognition of this role also has the potential to improve organ donation uptake and outcomes.
- Public awareness and support of the need for organ donation in children is essential for the continued growth of a paediatric organ donation programme.
- Children with end-stage organ failure may only accept suitable and compatible organs from donors of comparable size, so paediatric donors are important for this population.

### What action should be taken?

- Funding should be secured to recruit hospital organ donation personnel in PCCUs.
- Appropriate governance arrangements should be put in place to support the new roles.
- Organ Donation and Transplant Ireland should engage with CHI to operationalise these new roles.

### Who will benefit from this action/recommendation?

- Patients with end-stage organ failure, including children and young people awaiting transplant.
- The families of organ donors.
- Healthcare staff.
- Critical care personnel, who will be better supported through complex organ donation processes.
- Members of the public, who will be assured of the appropriate application of new organ donation legislation.

### Who is responsible for implementing this action/recommendation?

Organ Donation and Transplant Ireland and CHI Hospital management.

## When should this be implemented?

Within six months or as soon as possible.

## Evidence base for recommendation

- The *Model of Care for Paediatric Critical Care* (National Clinical Programme for Critical Care and National Clinical Programme for Paediatrics, 2019) acknowledges that organ and tissue donation is a crucial element of paediatric intensive care medicine and should be supported with clinical pathways, guidelines, audit and staff training. It recommends a Clinical Lead for organ donation among PCCU consultant staffing to provide leadership to the PCCU Multi Disciplinary Team.
- There is evidence that having a specialist nurse in organ donation doubles the consent rate for organ donation (NHS Blood and Transport, 2022).
- There is robust evidence that a Potential Donor Audit (PDA) is a key pillar to enhancing organ donation at national level (NOCA, 2022). Specialised organ donation personnel have the necessary expertise to collect the data required for the PDA and to use this information to drive improvement in organ donation (NHS Blood and Transport, 2022).
- There is a clear recommendation from NOCA that a PDA should be implemented in both adult and paediatric hospitals (NOCA, 2022). NOCA identified strong clinical support for a PDA in CHI, with representation on the steering committee for the PDA Development from PCCU Consultant Dr Suzanne Crowe.
- An audit of paediatric organ and tissue donation in Ireland (Marshall *et al.*, 2018) from 2007 to 2018 demonstrated that while the numbers of paediatric organ donations are small, they have increased over the last 10 years. Donor families have highlighted the importance of the presence of specialised organ donation personnel in family conversations about organ donation (NOCA, 2022). The presence of hospital group organ donation personnel is a metric in the PDA soon to be rolled out nationally.

## CHAPTER 11

# CONCLUSION



## CHAPTER 11: CONCLUSION

The Irish Paediatric Critical Care Audit continues to monitor the quality of care provided to patients in the two PCCUs in Ireland, benchmarked against 30 other Units across the UK.

Presenting the data over the 5 years 2018–2022 revealed the effect the COVID-19 pandemic had on the number of admissions, in particular the decrease in patients presenting with respiratory diagnoses and the increased number of planned surgeries that were performed because capacity was available in the Units.

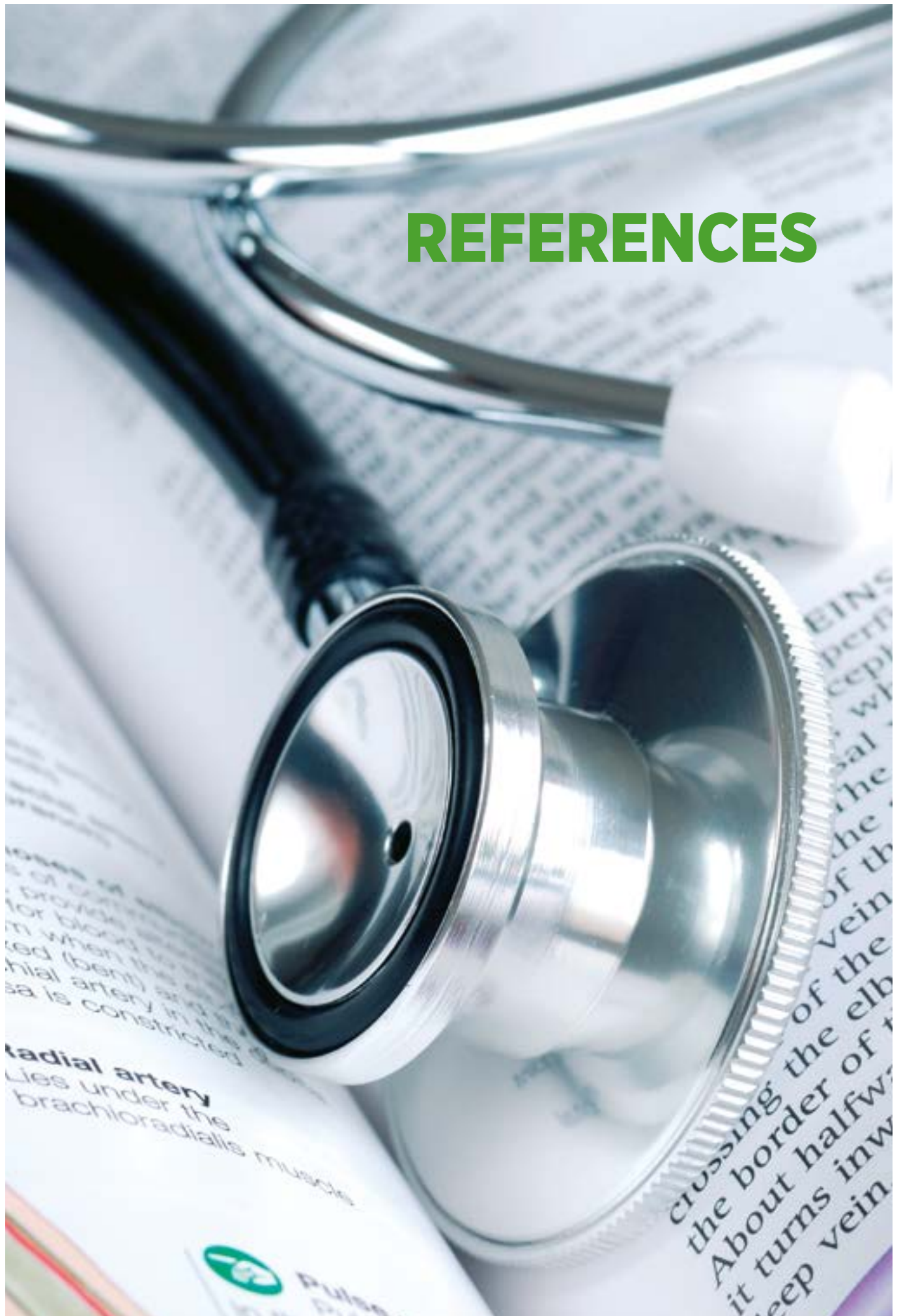
However, the reduction seen in 2020 was completely reversed in 2021–2022. Following a 9% (n=137) decrease in admissions of patients to PCCU in 2020 attributable to the COVID-19 pandemic, there was an increase of 14% in the number of admissions in 2021 and 2022 compared to 2018, while admissions to both PCCUs showed high occupancy in 2021–2022, particularly in the winter months. A detailed analysis of these admissions shows that an increasing majority were secondary to seasonal viruses and the RSV pathogen. The development of new vaccines for RSV could radically alter the annual surge of admissions to both children's hospitals and PCCUs and thereby influence its effect on occupancy and elective surgical deferrals. CHI at Crumlin had occupancy consistently over 95%, when 85% is the recommended national standard. Overall, the demand for PCCU care is increasing.

The new National Children's Hospital, including a 42-bed PCCU, due to open in 2025 requires a detailed workforce plan for all staffing, particularly due to its single-cubicle design, and this will have to be addressed as soon as possible for it to be realised.

For the first time, this report includes data on organ and tissue donation in paediatric critical care. However, the data collected offer little contextual insight into the true potential for organ donation or potential missed opportunities. The appointment of hospital organ donation personnel would help increase awareness and provide education and training locally to increase the number of donations.

Despite the high demands on the PCCUs, there is evidence of excellent quality of care and outcomes comparable with other PCCUs across the UK. Mortality remains at 4%, with a detailed breakdown showing that most deaths are in the neonatal group.

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# **ACCESSING REPORT APPENDICES**



# ACCESSING REPORT APPENDICES

National Office of Clinical Audit (2024)

*Irish Paediatric Critical Care Audit National Report 2021-2022*

*including key trends from 2018-2022.*

Dublin: National Office of Clinical Audit.

Available at: <https://www.noca.ie/publications/publications-listings/?category=national-reports>

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ICU AUDIT GOVERNANCE COMMITTEE 2022

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IPCCA AIM AND OBJECTIVES

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INICUA DATASET

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PICANET ORGANISATION KEY

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HEALTHCARE RESOURCE GROUP  
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**APPENDIX 8:**  
FREQUENCY TABLES

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Phone: +353 1 4028577

Email: [icu@noca.ie](mailto:icu@noca.ie)

Twitter: [@noca\\_irl](https://twitter.com/noca_irl)

**[www.noca.ie](http://www.noca.ie)**