

## Acute Paediatric Transfers from Regional Centre to Tertiary Centres

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### Abstract

#### *Aims*

To establish the volume and nature of transfers from Cork University Hospital (CUH) to tertiary centres over a 24month period to highlight need for resources and establish seasonal changes.

#### *Methods*

All paediatric transfers were recorded from July 2021 – July 2023 including age, reason for transfer, accepting hospital, transport team, and ventilation status. Recorded data was anonymised and analysed using excel.

#### *Results*

238 transfers from CUH to tertiary paediatric centres including 89 (37%) to PICU and 2(<1%) to NICU. Regional paediatric registrars accompanied 105 (44%). Regional anaesthetic registrars accompanied the paediatric registrar on 35 (15%). Nursing staff alone accounted for 58 (24%) and parents 20 (8%). Regarding PICU transfers; IPATS: n=30 (34%), regional paediatrics plus anaesthetics: n=33(37%), NNTP: n=14 (16%), Paediatric registrar alone: n=8(9%), MICAS: n=3 (3%). 30/33(90%) of transfers by the regional anaesthetics team were ventilated for transport, compared to 16/30 (53%) of IPATs transfers and 4/14 (28%) with NNTP. Documentation during transfers was highlighted as a key area for improvement.

#### *Discussion*

44 (49%) of transfers to from CUH to PICUs were performed by specialist paediatric retrieval services. Early referral and discussion with IPATS is an essential component of regional transfers. The regional anaesthetic team plays a vital role in the stabilisation and transfer of critically ill children.

### Introduction

Children's Health Ireland (CHI) has two Paediatric Intensive Care Unit (PICU) sites located in Our Lady's Children's Hospital Crumlin (OLCHC) and Temple Street Children's University Hospital (TSCUH)<sup>1</sup>.

The HSE model of care highlights the importance of a paediatric retrieval service. The Irish Paediatric Acute Transport Service (IPATS) “serves approximately 1.1 million children within the Republic of Ireland by providing support to hospital sites that provide acute care to infants, children and adolescents”<sup>1</sup>.

Many children who require PICU level care present to regional and peripheral centres and require stabilisation and transfer. IPATs and the National Neonatal Transport Programme (NNTP) are national retrieval services, however, these services have limited resources. While NNTP has a 24/7-365 service, IPATS does not (yet). Regional and peripheral centres are therefore sometimes required to complete their own critical transfers. In addition, there are time critical transfers who cannot wait for the national service to deploy from a central hub. There is currently no service providing transport of neonates or children who do not fulfill the critical care/HDU criteria, and so the responsibility for transport falls on the referring centre.

The IPATs website provides resources for regional hospitals and states that “staff most familiar with inter-hospital transfer and competent in airway management should perform the transfer. This will usually be a member of the anaesthetic team from the referring hospital”<sup>1</sup>.

The burden of transfers on regional centres is high. In Cork, there is a 24hour, 7 days per week paediatric transport roster staffed by paediatric registrars working between Cork University Hospital (CUH) and the Mercy University Hospital.

CUH is a large regional centre with many tertiary services, but currently without a paediatric High Dependency Unit or PICU. While no neonatal unit within the hospital, Cork University Maternity Hospital, and a tertiary NICU, is within the same campus. CUH provides a service for the largest paediatric population outside of Dublin.

This retrospective cohort study sought to establish the volume and nature of transfers from CUH to CHI, and in particular to PICUs at CHI, over a 24-month period, describing whether these transfers were performed by a national retrieval service or the referring team, and if the referring team, whether this included paediatric and/or anaesthetic staff, as well as the respiratory support requirements. This study is the first of its kind looking at paediatric transfers from CUH to CHI since the IPATs service was established.

In addition, this retrospective cohort study aims to establish whether any transport aids are in use, for example the IPATS “Transport considerations for the transfer of the critically ill child by the Referring Hospital Team” and whether the “Paediatric Critical Care Transport Record” is being completed.

## Methods

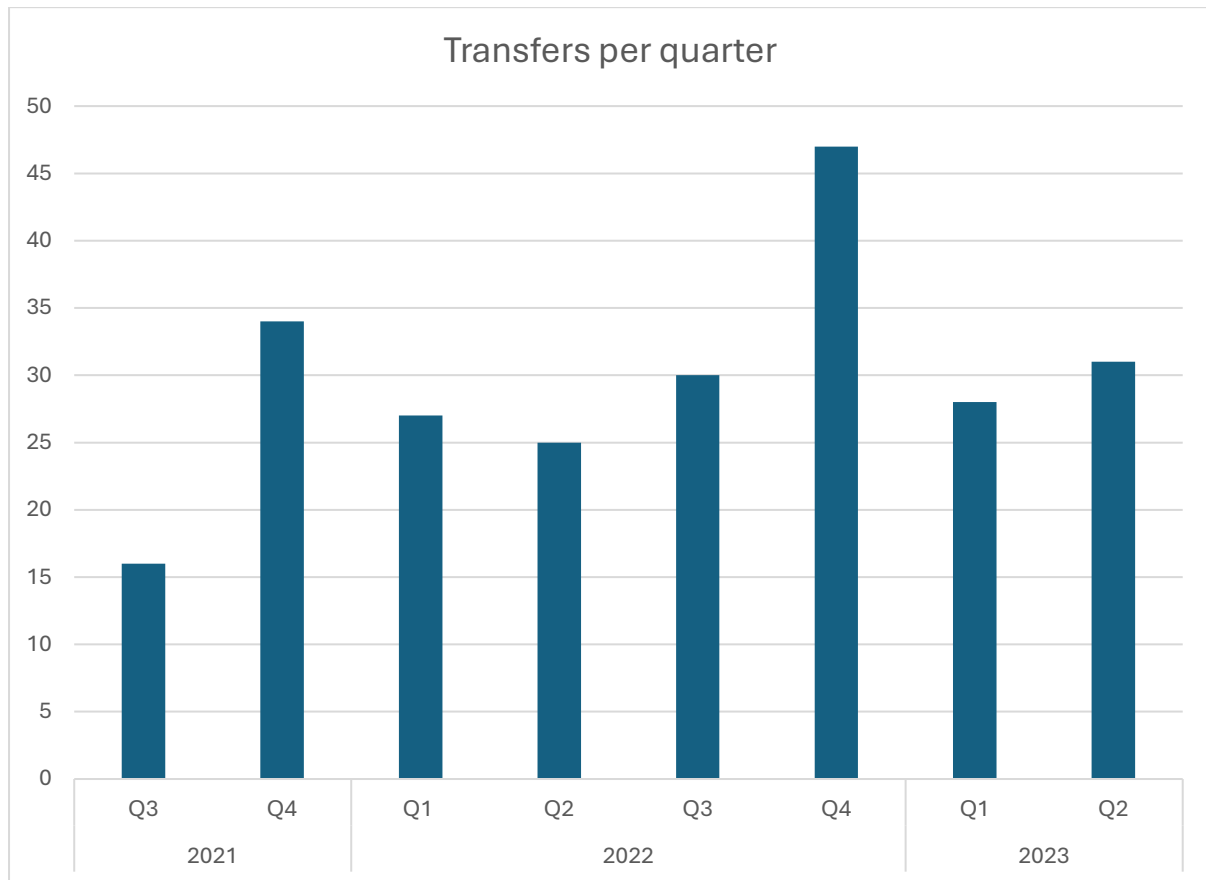
A retrospective cohort study was undertaken of patients transferred for tertiary care from CUH to CHI from July 2021 – July 2023. Paediatric transfer data is recorded at the time of transfer in a transport document under the headings: Name, MRN, age, referring consultant, reason for transfer, accepting hospital, ward, specialty, accompanied by and ventilation status. This log is kept within the paediatric department. This recorded data was anonymised and entered in excel, which was used for data analysis. Ongoing data collection continues to facilitate repeat analysis. Ethical approval was granted in advance by the Clinical Research Ethics Committee, Cork.

## Results

In a 24-month period from July 2021- July 2023 there was a total of 238 transfers from CUH to CHI. Of these, 89(37%) were to PICU. All patients arrived at the receiving hospital without critical incident.

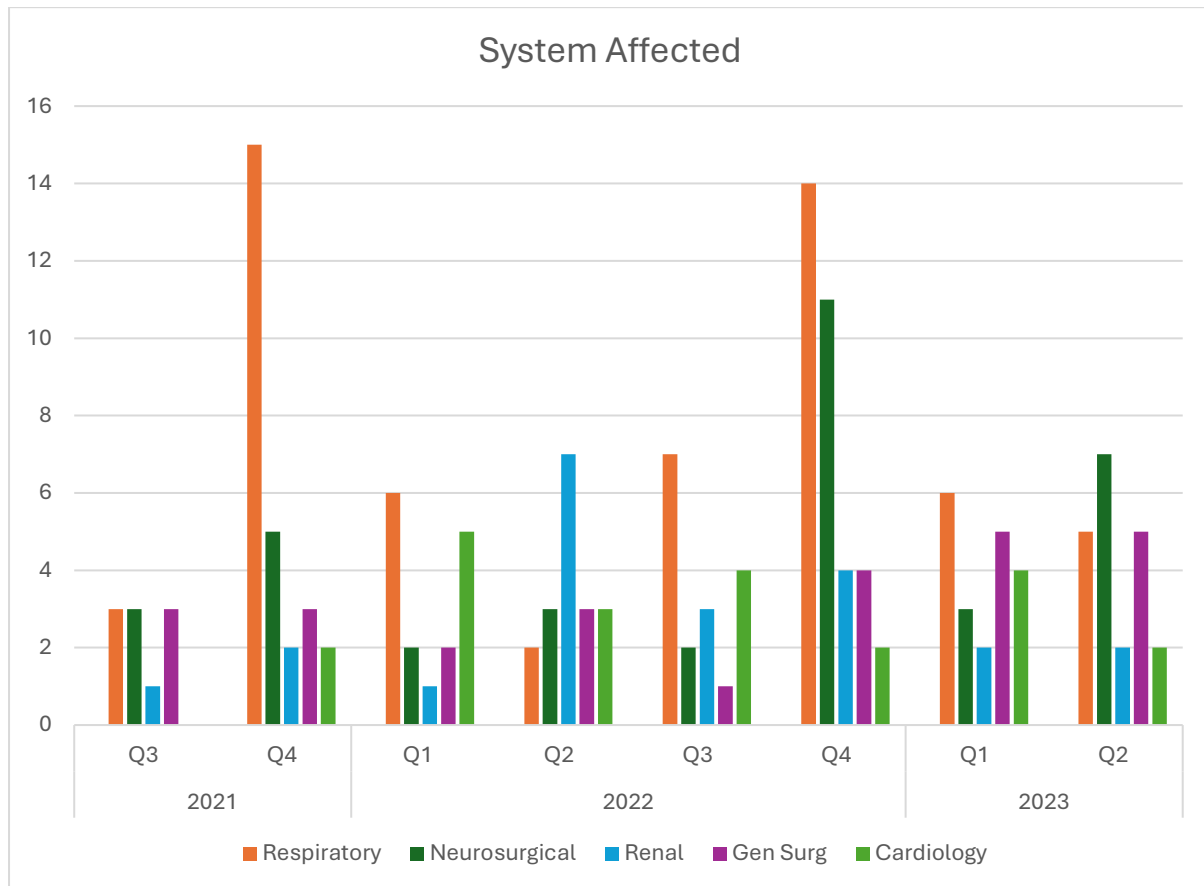
Q4 each year accounted for the highest number of transfers, 34 patients in 2021 and 47 patients in 2022. (*Figure 1*)

*Figure 1: Number of transfers per quarter*



The most common reasons for transfer were respiratory, neurosurgical, renal, general surgery, and cardiology. Respiratory causes peaked in Q4 each year; other causes were less likely to be affected by quarterly changes. *Figure 2* highlights the most common systems affected. Other common reasons for transfer were gastrointestinal, infection/sepsis, haematology/oncology, and ear-nose-throat.

*Figure 2: Reasons for transfer per quarter*

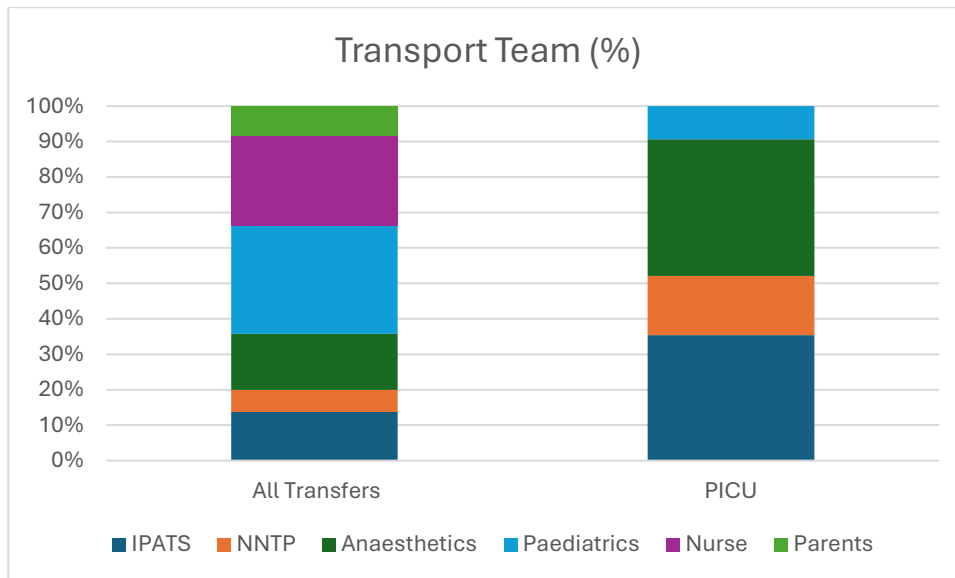


Regional paediatric registrars provided 44% (n=105) of all transfers over this time-period, including 15% (n=35) with the referring anaesthetic team. Nursing staff alone provided 24% (n= 58), with parents accounting for 8% (n=20). National retrieval services (IPATS, NNTP, MICAS) account for 20% (N= 47).

All the nursing staff and parent transfers, and the majority of the paediatric registrar transfers, were to ward level care. Anaesthetics (n=2), IPATS (n=1) and NNPT (n=1) transferred small numbers to non-ICU level care.

Regarding PICU transfers, a team of regional anaesthetics plus paediatrics doctors accompanied the most patients (37%, n=33), followed by IPATs (34%, n=30), and NNTP (16%, n=14). Another 3 patients (3%) were transferred by the adult MICAS service Paediatric staff alone accompanied 9% (n=8) of PICU transfers, the reasons for transfer of these patients include: Diabetic Ketoacidosis, Haemolytic Uraemic Syndrome, subdural haematoma, ascending cholangitis, line sepsis and pleural effusion requiring drainage. (Figure 3).

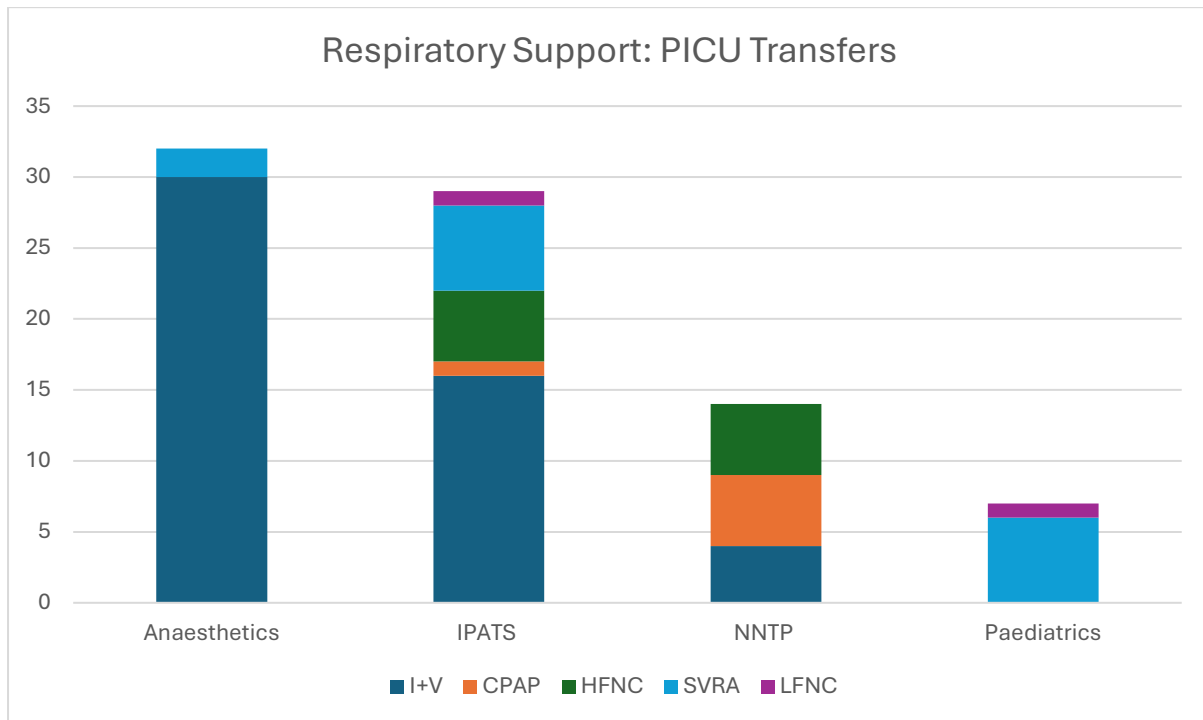
Figure 3: Transport Team



Patients under 3-months-of-age represent a disproportionately large number of cases, accounting for one quarter of all transfers, both to ICU and to ward level care. Overall, there are similar percentages of age ranges for both ward and PICU transfers.

The respiratory support requirements of PICU transfers appeared to be influenced by the transport/retrieval team. 90% (30/33) of PICU transfers completed by the regional anaesthetic team were ventilated for transport, compared to 53% (16/30) of those completed by IPATs, and 28% (4/14) by NNPT. NNTP were most likely to utilise non-invasive ventilation. 2 of the 8 patients (25%) transferred by the paediatrics team alone were on low flow oxygen, the rest were self-ventilating in room air. (Figure 4).

Figure 4: Respiratory Support Requirement for PICU Transfers



Formal transport documentation for transfers completed by the regional centre was not in use.

### Discussion

In the UK the majority of paediatric transfers to PICUs are undertaken by specialist teams, with only 7% conducted by an ad hoc non-specialist team. There is evidence of fewer critical incidents and improved outcomes after specialist transfer, supporting this balance of provision<sup>3,4</sup>.

A UK study in 2010 assessed the effect of transfer to PICUs in England and Wales by a specialist retrieval team compared to transfer by the referring centre<sup>5</sup>. In this study, children transferred by a specialist retrieval team were older, more acutely unwell on arrival and had longer PICU admissions than those transferred by the referring centre. Crude mortality rate was similar in the two groups however specialist retrieval teams were associated with lower risk-adjusted mortality. The median distance travelled in this study was 31km (varying greatly with the distance travelled in this study of 250km between Cork and Dublin) and the distance travelled did not affect outcome.

This study highlights the important service provided by the national retrieval services. Out of 89 PICU transfers, 44 (42%) were performed by IPATS/NNTP, with another 3 patients (3%) transferred by the adult MICAS service. Despite this, there is significant ongoing need for the referring team to provide transports. Factors such as retrieval team resource limitations and

working hours, time consuming journeys across the country as well as time critical transfers unsuitable to wait for the retrieval service to depart from a central hub, all contribute to the ongoing need for regional and peripheral centres to transport many of their patients to tertiary centres.

There is currently no formal transport arrangement between the Paediatric and Anaesthetics Departments in CUH. The transfer service is provided when required. Transfers significantly impact the staffing levels of both the paediatric and anaesthetics departments, as the most senior registrars are often responsible for the transfer and therefore transfers represent a significant hospital resource consumption with operational and organisational challenges in terms of staff allocation and resource planning. By nature, these are unplanned and often out of hours. Time-critical transfers are emergencies that are of a 'life-or-limb saving', or where urgent, definitive care is not available in the referring centre. Examples include: neurosurgical emergencies, suspected duct-dependent cardiac lesions, acute abdomen requiring urgent surgical review, ischaemic limbs<sup>4</sup>. Time-critical transfers, if not planned effectively, can pose a significant risk to patient safety<sup>6</sup>, and these are often the transports performed by referring centres, to avoid delays associated with waiting for a retrieval service. Early referral to PICU, with discussion and provision of clinical advice, is essential. This is facilitated by a single point of contact to a transport consultant and call conferencing facilities in order to discuss patients, refer to PICU and arrange retrieval if appropriate.

An interesting observation in this study is that the disposition of transfers by the referring anaesthetics team (94%), IPATs (97%) and NNTP (92%) are all almost exclusively to PICU, however differences lie in the mode of ventilation utilised for transfer. PICU transfers provided by the regional anaesthetics team were more likely to be intubated and ventilated than those transferred by IPATs or NNTP. This difference may be explained in part by limited availability of transport CPAP/High Flow devices. Additionally, the referring team, providing care when required and without paediatric intensive care expertise may be more inclined to transfer with a "secure" airway to minimise the risk of needing an emergency airway in transit. IPATS and NNTP were more likely to use non-invasive ventilation modalities, therefore the use of a specialised retrieval service may reduce invasive ventilation for transfer.

Notably, 8 patients were transferred from CUH to PICUs accompanied by paediatrics without anaesthetic support. Decisions regarding the transport of patients accepted to PICU should be made by senior paediatric and anaesthetics doctors in conjunction with IPATS. Transport considerations include level of dependency and the risks associated with transport. Teams must consider the likelihood of deterioration during transfer and if so, what additional interventions may be required. Having a standardised model ensures the right patient is taken at the right time, by the right people, to the right place by the right form of transport and



receives the right care throughout. There is good evidence that critically unwell patients can be transferred safely by an appropriately trained team<sup>7,8</sup>, however where transport teams are performing on an ad hoc basis, serious complications can occur<sup>9,10</sup> and so the recommendation is that the transfer of critically unwell children should be undertaken by appropriately prepared and trained teams<sup>3</sup>.

There continues to be an increase in the demand for paediatric critical care beds and a corresponding rise in demand for paediatric retrieval services 6. It is therefore likely that referring teams will need to continue to provide a significant number of critical transfers going forward, and so a process to improve quality is necessary.

Results of this study were presented to stakeholders (from Emergency, Anaesthetics and Paediatric Departments) and recommendations were made including; Formal teaching sessions for paediatric staff; Generation of a STOPP (Safe Transfer of Paediatric Patients) Tool; Standardisation of transport bags; IPATS Documents 1 “Pre-transfer considerations” and “intra-hospital transfer documentation” to be completed at time of departure and during transfer; Next audit cycle to include: time of decision to transfer, time of departure

In addition, the results of this study will be used to inform stakeholders of the burden of transfers to facilitate preparation and planning for staffing and other resources.

Inter-hospital transport services will play a vital and ever-increasing role in a centralised model of care for paediatric intensive care services. The referring team is likely to continue to transport many children for tertiary care, often including time critical transfers to PICUs and so continually improving quality is necessary. Q4 each year represents the highest burden on services.

**Declarations of Conflicts of Interest:**

None declared.

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