Irish National ICU Audit Annual Report 2018

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CITATION

Dwyer, Rory; Baggot, Mary; Brych, Olga; Cronin, Marina; Fleming, Andrew; Gaffney, Alan; et al. (2021): Irish National ICU Audit Annual Report 2018. Royal College of Surgeons in Ireland. Report. https://doi.org/10.25419/rcsi.16964794.v1

DOI

10.25419/rcsi.16964794.v1

National Office of Clinical Audit

Irish National ICU Audit

IRISH NATIONAL ICU AUDIT
ANNUAL REPORT 2018

REPORT PREPARED BY THE FOLLOWING WITH ASSISTANCE FROM MEMBERS OF THE ICU AUDIT GOVERNANCE COMMITTEE

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NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

NOCA was established in 2012 to create sustainable clinical audit programmes at national level. NOCA is funded by the Health Service Executive Quality Improvement Team and operationally supported by the Royal College of Surgeons in Ireland.

The National Clinical Effectiveness Committee (NCEC, 2015, p.2) defines national clinical audit as "a cyclical process that aims to improve patient care and outcomes by systematic, structured review and evaluation of clinical care against explicit clinical standards on a national basis". NOCA supports hospitals to learn from their audit cycles.

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Citation for this report:
National Office of Clinical Audit, (2020)
Irish National ICU Audit Annual Report 2018.
Dublin: National Office of Clinical Audit.

ISSN 2565-6295 (Print)
ISSN 2565-6309 (Electronic)

This report was published on 12 February 2020.

ACKNOWLEDGMENTS

This work uses data provided by patients and collected by their healthcare providers as part of their care. NOCA would like to thank all participating hospitals for their valuable contribution, and the ICU Audit Coordinators and Clinical Leads. Without their continued support and input, this audit could not continue to produce meaningful analysis of critical care in Ireland. NOCA greatly appreciates the ongoing commitment and support received from the HSE QIT and its Director, Dr Philip Crowley, which has led to major growth and development in clinical audit in Ireland. NOCA would also like to thank DMF Systems and Chameleon Information Management Services Ltd (CIMS), software providers for the Irish National ICU Audit.

NOCA works with the Intensive Care National Audit and Research Centre (ICNARC) in the UK for data validation, data analysis, and the generation of reports on activity in ICUs. ICNARC has been in operation in the UK since the 1990s and has been at the forefront of quality and research initiatives in critical care.

The Quality Improvement Team (QIT) was established to support the development of a culture that ensures improvement of quality of care is at the heart of all services that the HSE delivers. The HSE QIT works in partnership with patients, families and all who work in the health system to innovate and improve the quality and safety of its care.

ACKNOWLEDGING SIGNIFICANT CONTRIBUTIONS FROM THE FOLLOWING:

NOCA would like to thank Beaumont Hospital and St James's Hospital for supplying imagery used throughout this report.

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National Office of Clinical Audit

Irish National ICU Audit

IRISH NATIONAL ICU AUDIT

ANNUAL REPORT 2018

NOCA National Office of Clinical Audit

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17th January 2020

Dear Dr Dwyer,

I wish to acknowledge receipt of the Irish National ICU Audit Annual Report 2018. Following your presentation to the NOCA Governance Board on the 16th January 2020 and feedback from our membership, we are delighted to endorse this report.

On behalf of the NOCA Governance Board, I wish to congratulate you and your committee on an excellent report which gives assurance to the most ill patients in our healthcare system that their care is being carefully monitored in Irish hospitals.

Please accept this as formal endorsement from the NOCA Governance Board.

Yours sincerely,

Dr Brian Creedon
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INICUA ADULT REPORT FOREWORD

The Health Service Executive's (HSE's) values are care, compassion, trust and learning. 'Values in action' is about having a culture to support the implementation of these values in everyday care and being able to demonstrate that this is being done. This audit of Intensive Care Unit (ICU) activity and outcomes is the product of the HSE Critical Care Programme supported by the National Office of Clinical Audit (NOCA), and it is a service that is dedicated to providing quality-assured care and is not wary of standing up and being counted.

The Irish National ICU Audit authors and auditors are to be commended not only for bringing this audit to publication but also for the feedback to individual Units that directly supports quality improvement and for their thorough and structured approach to outlier intervention and corrective action.

The amount of work involved in generating this type of audit is not always obvious and its importance should not be underestimated. This audit assures our population that they will receive quality care irrespective of which of these ICUs they are admitted to, and that their families and friends can be reassured that they are being given the best opportunity to survive their critical illness through national and international benchmarking. This supports trust in our system and demonstrates that it is a continually learning and improving environment.

I am grateful to the hospitals for their support of this audit process and ask that they continue to ensure that data collection is sustained and delivered by appropriately qualified individuals, in order to maintain the very high standard achieved to date. In a high-pressure, complex and busy environment with a high basal mortality rate and very sick patients, it can be difficult to identify avoidable harm without a formal audit process. Indeed, this report demonstrates the impact of excessive occupancy and busyness on patient outcomes and how this can be reversed with additional resourcing.

I would like to thank all of the clinicians and support staff who provide care and compassion for patients and their families, and I would like to celebrate with them this documentation of the excellent work that they deliver, often in very challenging and emotional circumstances. I would also like to thank the families of those patients who generously supported the donation of their loved one's organs so that others might benefit.

Go raibh míle maith agat,

Dr Vida Hamilton
National Clinical Advisor and Group Lead – Acute Hospitals

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GLOSSARY OF TERMS AND DEFINITIONS

NAME	DEFINITION
ABF	activity-based funding
AKI	acute kidney injury
APACHE II	Acute Physiology and Chronic Health Evaluation; this is designed to measure the severity of disease for adult patients admitted to Intensive Care Units.
ARS	advanced respiratory support; this is a measure to support lungs that have failed to function correctly at an advanced level.
BIS	bed information system
Calendar days	A calendar day is defined as any complete calendar day (00:00–23:59) or part thereof, e.g. a patient admitted on 1 January 2012 at 23:45 and discharged on 3 January 2012 at 00:10 would be recorded as having received three calendar days of care
CCP	HSE Critical Care Programme
CEO	chief executive officer
CMP	Case Mix Programme; this is the data collection undertaken by the Intensive Care National Audit and Research Centre (ICNARC) within the UK.
CNM	clinical nurse manager
CPR	cardiopulmonary resuscitation; this is resuscitation of the heart and lungs in an emergency situation.
CRBSI	catheter-related bloodstream infection; the presence of bacteraemia originating from an intravenous catheter
CRRT	continuous renal replacement therapy
CT ICU	Cardiothoracic Intensive Care Unit
CVC	central venous catheter
CVS	cardiovascular system
DCD	donation after circulatory death
Dialysis	removal of waste products from the body when the kidneys are not functioning
DPIP	National Deteriorating Patient Improvement Programme
DVR	data validation report
ED	Emergency Department; also known as Accident and Emergency
ESICM	European Society of Intensive Care Medicine
EWS	Early Warning Score
FROMs	Family Reported Outcome Measures
GDPR	General Data Protection Regulation
GICU	General Intensive Care Unit
HCAI	healthcare-associated infection; infection contracted in hospital
HD	haemodialysis
HDU	High Dependency Unit

NAME	DEFINITION
HIPE	Hospital In-Patient Enquiry
HIQA	Health Information and Quality Authority
HPO	Healthcare Pricing Office
HSE	Health Service Executive
IACCN	Irish Association of Critical Care Nurses
ICNARC	Intensive Care National Audit and Research Centre
ICSI	Intensive Care Society of Ireland
ICU	Intensive Care Unit
InfoFlex	ICU Audit software
INICUA	Irish National Intensive Care Unit Audit; the name of this audit and the term used for data collection supported by ICNARC within Ireland
INICUA web portal	A secure portal where INICUA anonymised data are loaded for transfer to ICNARC and data validation and Quarterly Quality Reports are retrieved by Units
Invasive monitoring	Using direct measurement from within the body of a patient. This type of monitoring is common in the ICU and involves inserting a cannula in a suitable artery or vein.
IQR	interquartile range
IT	information technology
JFICMI	Joint Faculty of Intensive Care Medicine of Ireland
KDIGO	Kidney Disease: Improving Global Outcomes; this is a definition and staging of acute kidney injury.
KPI	key performance indicator
Levels of care	Specifies level of care received on each day of Unit stay. Levels of care are from 0 to 3 and allocated based on the monitoring and support of organ failure: Level 3 – Monitoring and support for two or more organs Level 2 – Monitoring and support for one or more organs Level 1 – Admissions receiving a greater degree of observation, monitoring, intervention(s), clinical input or advice than Level 0 care Level 0 – Admissions receiving normal ward care
Level of care days	Specifies the total number of calendar days during which the admission received a particular level of care
LOS	length of stay; the number of days that a patient spends in ICU and/or hospital
MDT	multidisciplinary team
Mean	The mean is the average of the numbers.
Mechanical ventilation	Use of a machine as life support for breathing
Median	The median is the middle value in the list of numbers.
NEWS	National Early Warning Score
NICU	Neurosurgical Intensive Care Unit

NAME	DEFINITION
NOCA	National Office of Clinical Audit
ODTI	Organ Donation and Transplant Ireland
ODP	organ donation personnel
Organ failure	When one or more organs of the body to fail to function correctly
PICANet	Paediatric Intensive Care Audit Network
PPI	public/patient interest
PROMs	Patient reported outcome measures
QI	quality indicator
QQR	Quarterly Quality Report
ROI	Republic of Ireland
SD	standard deviation; this is a statistical measure.
Sepsis	Sepsis is a potentially life-threatening complication of an infection. It occurs when chemicals released into the bloodstream to fight the infection trigger inflammatory responses throughout the body.
SMR	standardised mortality ratio; this is a statistical measure. The rate of patient deaths (mortality) in a hospital is shown as a mortality ratio that compares patients' actual mortality to their expected mortality. The 'observed-to-expected mortality' is a risk-adjusted measure that compares the actual number of deaths in a hospital with the average.
TBI	traumatic brain injury
UABSI	unit-acquired bloodstream infection
UK	United Kingdom
UK Units	Intensive Care Units in the United Kingdom; they are reported on by ICNARC and used as comparators within this report.

EXECUTIVE SUMMARY

This report is based on data from 18 Units in 15 hospitals which undertook 70% of all critical care activity in Health Service Executive (HSE)-funded hospitals during 2018. Units varied widely in numbers of beds, numbers of admissions, and in case mix on admission to the Unit. Some Units were High Dependency Units (HDUs), some were Intensive Care Units (ICUs), some were mixed ICU/HDU, and some were specialist Units (e.g. neurosurgical, cardiothoracic). Our data provide a detailed insight into the characteristics of each Unit and allow Units to benchmark themselves against comparable Units. In addition, the data allow comparisons between Units in Ireland and those in the United Kingdom (UK).

Bed occupancy was very high in Irish Units; 88% overall and up to 96% in some Units. The European Society of Intensive Care Medicine recommends an occupancy rate of 75%, if bed occupancy is calculated using the fraction of a day a patient occupies a bed, as our audit did. The high bed occupancy rate is not surprising, as the provision of critical care beds in Ireland (including beds in private hospitals) is only 6.0 beds per 100,000 population compared with the European average of 11.5 per 100,000.

RECOMMENDATIONS FROM 2017 REPORT - UPDATE ON ACTIONS

RECOMMENDATIONS FOR THE HSE	UPDATE
Increase ICU/HDU bed capacity in Ireland.	Critical Care beds increased by 4% between 2017 and 2018 in audited Units. Total national Critical Care beds increased by 6% between 2018 and 2019.
Identify the Units operating at or above capacity.	In 2018, all Units were still above recommended bed occupancy levels, some with > 90% bed occupancy.
Set up ICU Bed Information System (BIS) to optimise use of ICU beds.	BIS will be implemented in 2020.
Ensure specialist retrieval service for critically ill patients is available 24 hours per day, 365 days per year.	Significant developments took place in the Critical Care Retrieval Service in 2019 – NOCA will support this in 2020 by providing data on critical care transfers.
RECOMMENDATIONS FOR MANAGERS, CLINICIANS AND AUDIT COORDINATORS	**UPDATE**
Prioritise discharges from ICU.	The 2018 Report continues to document delayed discharges and delayed admissions.
Hospitals should minimise ICU discharges at night.	Fewer Units were outliers for this Quality Indicator in 2018.
Hospital management should ensure adequate resources for audit data collection.	Audit coordinators are now in place in all but two Units.
Local clinicians should use their data to promote improvements in practice.	NOCA escalation process has ensured active responses to outlier data for Quality Indicators.
Ensure time of decision to admit to ICU is documented to allow reporting of delay in ICU admission.	Reports on delay in ICU access are now being provided to hospital CEOs and HSE BIU.
RECOMMENDATIONS FOR NOCA	**UPDATE**
More information on unmet should be collected.	New metrics developed in 2018 and reported in annual Report.
Additional information on patients who die after ICU discharge should be collected.	Not implemented to date.
Consider introducing patient-reported outcome measures.	Not implemented to date.
National database for INICUA established.	Verbal confirmation of funding for establishment of a national database in 2020.
Promote audit of catheter-related bloodstream infection in ICUs.	Preliminary report produced from 5 Units for 2018.
Target education on ICNARC definitions for ICU Audit Coordinators in training workshops.	Being implemented on a regular basis by NOCA Audit Managers.

KEY FINDINGS

KEY FINDINGS

Nationally, 42% of admissions to ICU/HDU were direct from the operating theatre after surgery and 9% followed trauma (3% after head injury).

Over one-quarter (27%) of patients had sepsis on admission.

Six per cent had received cardiopulmonary resuscitation within 24 hours before admission.

Over half (51%) had acute kidney injury within 24 hours of admission and 11% required dialysis.

Just over 1% (1.2%) of admissions were children aged <16 years old.

Severity of illness on admission to ICU was similar in Ireland and the UK, but the predicted mortality rate was somewhat higher for Irish patients (7% versus 5%), indicating that Irish patients had more risk factors than patients in the UK.

Some 46% of Unit admissions required ventilation via an endotracheal tube or tracheostomy.

Twenty-two per cent required advanced cardiovascular support with two or more vasoactive drugs.

Unit-acquired bloodstream infection (UABSI) was formally audited in five Units. Of patients who spent more than 48 hours in the Units, 2.3% of patients developed UABSI and 0.6% had UABSI secondary to infection of a central venous catheter.

The numbers of bed days occupied stayed relatively constant in most Units between 2017 and 2018. Units that received resources to open extra beds in 2018 had bed occupancy levels which decreased towards recommended levels. The overall national bed occupancy rate of 88% was an improvement compared with the rate of 91% in 2017. A lower bed occupancy rate is well established to improve patient outcomes and hospital efficiency.

Unit length of stay (LOS) averaged 5.0 days. A common feature was delayed discharge from ICU of patients after being cleared for discharge. This is due to shortage of ward beds, but it leads to inappropriate utilisation of scarce ICU beds, leading to delays when a critically ill patient needs urgent admission from the ward or Emergency Department.

National Early Warning Scores (NEWS) before discharge from ICU were surprisingly high with a median value in some Units of 4 and an upper quartile value of 6, meaning that 25% of patients were being discharged with a NEWS of 6 or greater. These values were seen in the Units with the highest rates of bed occupancy. Discharges from ICU with these levels of NEWS may be appropriate if patients are being discharged to a step-down Unit such as a HDU. However, in hospitals without a HDU, discharges to a ward with a high Early Warning Score (EWS) are undesirable. This generally occurs because of a need to make a bed available for a new admission.

Hospital LOS after ICU discharge for hospital survivors was 22 days in Ireland versus 14 days in the UK.

Delay in admission to ICU for critically ill patients worsens outcomes. Only one Unit (Regional Hospital Mullingar) achieved the HSE target of 50% of patients admitted within one hour. Five out of 18 Units achieved the HSE target of 80% of patients admitted within four hours of a decision to admit, but there were problems with delayed admission in the larger Units in Dublin and Galway.

If a patient develops organ failure in four or more organ systems within 24 hours of admission to ICU, it is suggestive of delayed admission to ICU. The national rate was 11.5%, which was somewhat greater than the UK rate of 9.3%. However, St James's Hospital General Intensive Care Unit (GICU) had a rate of 16.7%, which was outside the expected range, and was thereby deemed an outlier for this outcome measure.

The national rate of unplanned discharges at night was 4.6% (4.6% versus 2.2% UK). The rate for University Hospital Galway was 5.3%, which was an outlier. Discharges from ICU at night of patients not cleared for discharge the previous evening suggests that the patients may not be fully ready for ward care. In addition, the admission of a sick patient to a ward at night is less than ideal, as staffing levels are lower, and the patient is not known to staff.

The national rate of unplanned readmission to ICU within 48 hours of discharge was 1.2% (1.2% versus 1.2% UK). Unplanned readmission to ICU suggests unanticipated deterioration after discharge or premature discharge due to pressure on ICU beds. Beaumont Hospital GICU had a rate of 3.1%, which was an outlier for this outcome measure.

Nationally, there was a mortality rate of 14% in patients in critical care and a further 7% died after leaving ICU before leaving acute hospital. Thus, 79% of the critically ill patients admitted to ICU or HDU survived to leave hospital. Mortality rates in individual Units must be adjusted to take account of patient case mix before using mortality as an outcome measure. Risk-adjusted mortality is the ratio of actual deaths to the number of deaths predicted using complex risk prediction models (standardised mortality ratio; SMR). Nationally, the overall value for SMR was 1.06 (compared with the expected value of 1.0). Risk-adjusted mortality rates were within the acceptable range for all Units.

Death diagnosed by the criteria for brain death made up 6.7% of all deaths. Some 59% of brain dead patients became organ donors. The commonest reason why patients did not become organ donors was that families refused assent to organ donation. Surprisingly, the highest refusal rate was in the larger Units with the largest numbers of brain dead patients. The reason for this is unknown. These data suggest there is potential to increase the number of organ donors from the larger Units.

Only four patients from one hospital became organ donors after circulatory death. This suggests that there is potential to increase donation after circulatory death also.

KEY FINDINGS


FR 13Hz
Vel 223 cm/s
PG 20 mmHg
CW
Patient Directory
Send to...
To Media as JPG/AVI
Display Exam Tree
Unselect All
Close

SUMMARY AND COMPARISON TO 2017 DATA

The demographics, patient characteristics and case mix of patients admitted to Irish Critical Care Units (ICU/HDU) in 2018 were similar to 2017. Bed occupancy levels improved in some Units which had opened extra beds in 2018, but bed occupancy was still excessive in all Units by international standards, particularly in the larger Units in the major referral hospitals.

Risk-adjusted mortality was within acceptable limits in all Units. Other measures of outcome and quality of care were generally within acceptable limits, although in some of the larger Units there were sporadic quality indicators (QIs), which were outliers by a small amount. These outlier data seemed to be linked to shortage of beds in these Units. There were no extreme outliers for any quality indicators.

In summary, the Irish National ICU Audit data indicate that the quality of care in ICU/HDU in Ireland is good, despite the shortage of ICU beds.

RECOMMENDATIONS

RECOMMENDATION 1
Increase bed capacity in adult Critical Care Units (ICU and HDU) towards the 430 beds recommended in the Department of Health's *Health Service Capacity Review 2018*.

RECOMMENDATION 2
Review the appropriateness of providing care for critically ill patients in Units with small numbers of patients with multiorgan failure, in line with the recommendations of the HSE Critical Care Programme Model of Care, the Joint Faculty of Intensive Care Medicine of Ireland, and the European Society of Intensive Care Medicine.

RECOMMENDATION 3
Prioritise the discharge of patients from ICU to the ward once they have been declared fit for discharge.

RECOMMENDATION 4
Explore best practice in providing optimal care for high-risk patients outside critical care, including the potential benefits of critical care outreach teams.

RECOMMENDATION 5
Improve the rates of organ donation after brain death in the larger Units.

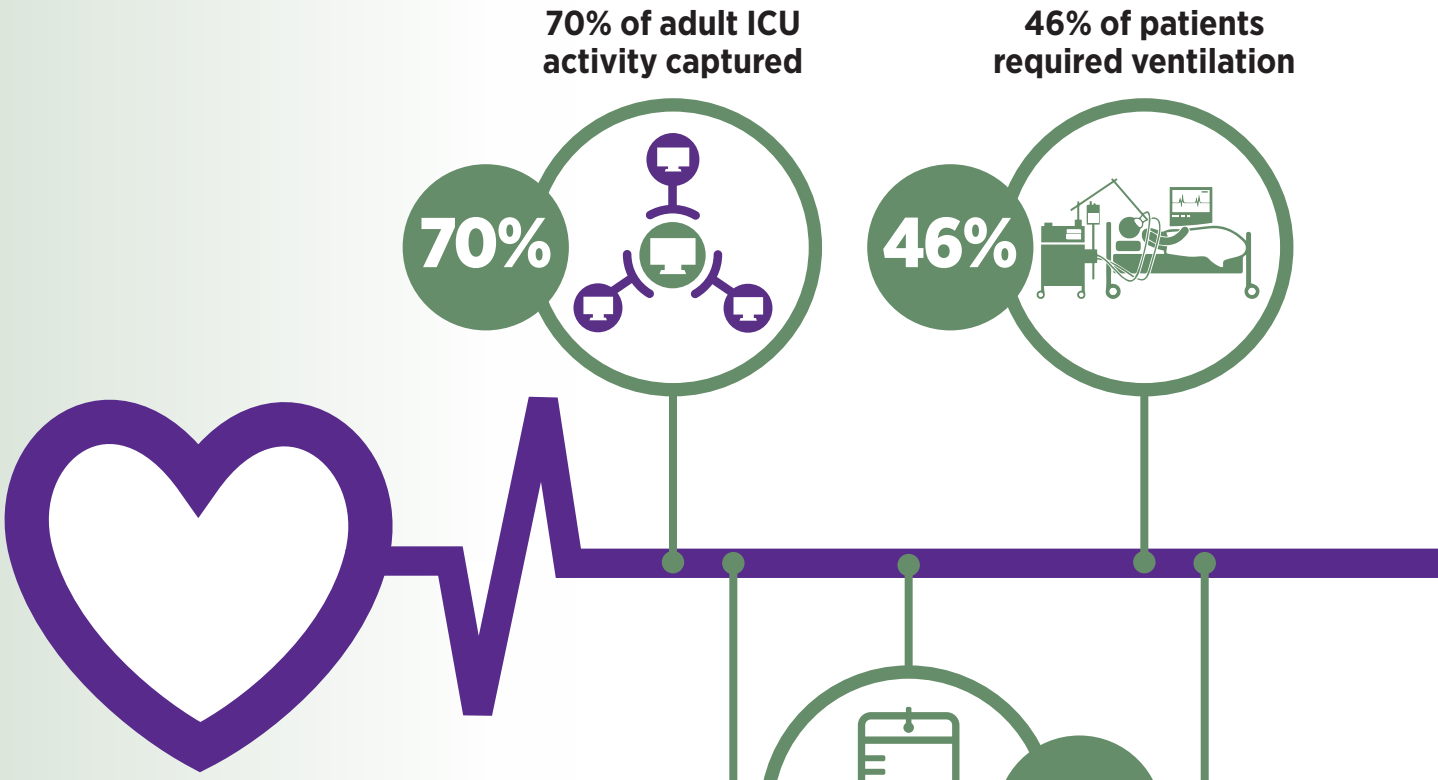
RECOMMENDATION 6
Improve the rates of organ donation after circulatory death (DCD).

RECOMMENDATION 7
Improve psychological care for relatives whose family member is in critical care.

RECOMMENDATION 8
Expand the range of reports produced by the NOCA ICU Audit on data already collected for ICU Audit.

RECOMMENDATION 9
Regrade ICU Audit Coordinator posts to clinical nurse manager (CNM) level.

KEY HIGHLIGHTS 2018



70% of adult ICU activity captured

46% of patients required ventilation

27% of patients were admitted with sepsis

42% of patients were admitted after surgery

51% of patients had acute kidney injury soon after admission

11% required dialysis

88% overall bed occupancy in adult ICU's (recommended level is 75%)

79% of patients survived to leave hospital. Survival rates in all Units were within the expected range

Unplanned discharges at night — 4.6% Ireland versus 2.2% UK

Unit mean length of stay (LOS) was five days, the same as in the UK.

59% of brain dead patients became organ donors

PATIENT PERSPECTIVE – SHAUN'S STORY: **'ICU BUT NOT AS WE KNOW IT!'**

Shaun at 19 years of age was involved in a road traffic accident in 2013. Following a long stay in ICU, he is now living at home and completing a full-time university course. This is his story, as told by himself and his mum, Gretta.

Shaun was driving home from work on a Saturday evening when the road traffic accident happened. He sustained a spinal cord injury and was admitted to his local hospital. Shaun's care involved extensive stays across three hospitals, in acute care, specialist care, and rehabilitation in a UK hospital. Finally, Shaun was discharged home from his local hospital with support for activities of daily living as part of a home care package.

During Shaun's hospital stay there were some good times that brought joy and hope as well as not so good times that brought despair and hopelessness. One example of a good time came as an unexpected consequence. The cuff on Shaun's trachea leaked air and in tolerating this he was able to talk. When his voice was heard and his safety assured, Gretta says "that was a huge step forward for us, I cried with joy after that. I thought there's no stopping us now".

As with any illness, there were not so good times also. Shaun's pain medication was incorrectly charted on transfer from one area of care to another. This caused fear, despair and hopelessness. Gretta remembers: "He was asking us to turn off the ventilation because he couldn't stand the pain anymore." Once this was resolved, things settled down again. The transfers between units and hospitals was traumatic for everyone, but they built a trusting relationship with new staff each time. According to Gretta, "you build a relationship on a ward with those staff, then you're going on to a strange ward with new people. That's kind of tough".

Shaun and Gretta describe the changes to themselves and family. They describe changes in the structure of the family unit, finding strength and "getting tough fast" in order to deal with their situation. Gretta says "you take on a whole new persona, you are a different person".

From left to right: Gretta Fogarty, Shaun Fogarty and Dr Michael Power, Clinical Lead for the HSE Critical Care Programme

A home care plan and package was made for Shaun, so that he could live at home. He now lives in his ICU at home.

Many themes exist within this story. Three main themes are highlighted here as relevant to ICU care and to this report. These are access to care, patient-centred care, and psychological care for the family during the ICU stay.

> ***"you build a relationship on a ward with those staff, then you're going on to a strange ward with new people. That's kind of tough."***

ACCESS TO CARE FOR SHAUN

Following admission to the local hospital, three days passed before Shaun was transferred for surgery. According to Shaun, the tertiary centre "wasn't convinced they could take me, but they eventually took me in the end and two doctors accepted responsibility to do the surgery". While three days does not appear a protracted length of time, this was life on hold for Shaun's family. Shaun describes the experience as "a huge battle" from the start of the journey, getting to surgery and later to rehabilitation to optimise living with a life-changing injury. Gaining access to rehabilitation for Shaun meant spending a year in hospital before transferring to a UK hospital for a nine-month stay. Gretta campaigned for this access for Shaun, knowing it was important to his longer-term holistic living. This was complicated by multiple administrative challenges.

> ***wasn't convinced they could take me, but they eventually took me in the end and two doctors accepted responsibility to do the surgery.***

In order to return home Shaun required a home care package. The renovated family home was ready. However, further delays were encountered. Plans were made on a care pathway for potential emergency readmission to his local hospital. A home care package had to be agreed and granted. Frustrations were many during the 300 days, requiring patience and the onerous task of filling out lots of forms.

Shaun's experience is borne out again and again. Delays in ICU admission and discharge are discussed within this report in Chapter 6. Research by Smith and Synnott (2017) illustrates that valuable healthcare is wasted when patients with traumatic spinal cord injury cannot move seamlessly from one area of care to another and can impact negatively on the quality of care for patients. This is eloquently described by Shaun and Gretta in their story.

PATIENT-CENTRED CARE FOR SHAUN

There were many difficulties faced in accessing and delivering the care that Shaun required. Gretta expressed the need for Shaun's rehabilitation to be part of his holistic care, which was "important for his mind", and the advantage of seeing other people living with paralysis 'living a very good life'.

In preparation for the return to his local hospital, an assessment of Shaun's care needs was made. Relevant staff were trained to facilitate Shaun's return, firstly to his local hospital and ultimately home. Gretta greatly appreciated the local staff travelling "to be trained up specifically in Shaun's care". A home care agency was engaged to look after Shaun at home. The local ICU staff trained the home care agency nurses regarding Shaun's care needs.

Maintaining Shaun at home is supported by the peace of mind of knowing that he has an immediate care pathway to the Acute Medical Unit in his local hospital and onwards to ICU there, when required.

Core tenets of patient-centred care are access to care as required, individual assessment of care needs, and delivery of that care (Phelan *et al.*, 2017). Shaun's story as outlined illustrates delays in access to care required. This is counterbalanced later in Shaun's story with the establishment of a care pathway allowing him immediate access to the local hospital from home. Staff were trained to meet Shaun's care needs, and home care packages were delivered. Care was built around Shaun, enabling him to live at home with his family and attend university. While Shaun truly experienced a patient-centred approach to care, it was also fragmented.

Patient-centred care as a priority in the health system is underpinned by the principles of dignity, compassion and respect (Phelan *et al.,* 2017). The honesty and caring nature of the staff in the ICUs was appreciated by Shaun and his family.

> ***"There were many difficulties faced in accessing and delivering the care that Shaun required"***

PSYCHOLOGICAL SUPPORT FOR SHAUN'S FAMILY

Shaun's story illustrates the high emotional needs of family members due to their heightened levels of distress. They describe the feelings of uncertainty in not knowing the surgery outcome. In addition, they describe feeling nervous, not being heard, and also the honesty, the compassion, and reassurance from the hospital staff at the various points of care; in particular, the nervousness during the surgery and the honesty afterwards. Gretta talks about the importance of being heard, for healthcare staff to listen "to the patient and family perspective" and to create an opportunity to ensure the best outcome for patients like Shaun.

Shaun and his family recognised a gap in support for families of critically ill patients. They describe the fear, uncertainty, and powerlessness of those days in the ICU waiting rooms. They recommend early support for families, in the form of advocacy groups stepping in where healthcare is lacking, and the ICU waiting rooms displaying information on services available. Gretta now works with an advocacy group to support families in the same situation, reassuring them that "their thoughts and feelings are perfectly normal".

Lower satisfaction for emotional support replicates what is in the literature. Care and caring in the ICU is described as satisfactory by the family members regarding the patient's care, but lower satisfaction is expressed in the emotional support for families (Carlson *et al.,* 2015).

Clearly, this story illustrates a gap in psychological care for the families during the ICU stay of patients with life-changing injuries. Truly, this is an issue that needs to be addressed. Who will take on the responsibility of providing this essential support? Will it come from advocacy groups or the care provider?

> ***Care was built around Shaun, enabling him to live at home with his family and attend university.***

CHAPTER 1
INTRODUCTION

CHAPTER 1: **INTRODUCTION**

INTRODUCTION

The importance of audit in Intensive Care Units (ICUs) was highlighted in *Towards Excellence in Critical Care: Review of Adult Critical Care Services in the Republic of Ireland* (Prospectus, 2009). The two key recommendations regarding audit in ICUs were as follows:

- R37: The collection of a national, standard clinical dataset on the case mix, outcome and activity of adult critical care on all admissions to all adult Critical Care Units should be developed and implemented.
- R38: A national audit system to foster improvements in the organisation and practice of critical care, through national benchmarking, reviewing trends and continuous comparative audit, should be implemented (Prospectus, 2009, p. 19).

In fulfilment of key objectives of the Health Service Executive (HSE) Critical Care Programme (CCP) and the Joint Faculty of Intensive Care Medicine of Ireland (JFICMI), the National Office of Clinical Audit (NOCA) has established the Irish National Intensive Care Unit Audit (INICUA). NOCA is implementing the INICUA in 22 acute hospitals with adult ICUs in Ireland (this deployment will continue into 2020). At the time of writing this report (November 2019), 20 hospitals are participating, with 23 Units collecting live data. This report focuses on 18 adult Units across 15 hospitals that were participating in INICUA in 2018.

NATIONAL OFFICE OF CLINICAL AUDIT

NOCA is fully committed to promoting an open culture of shared learning from national clinical audits in order to ensure patient safety and improve clinical outcomes. NOCA is committed to meeting best practice standards in how clinical audit is governed.

NOCA works with the Intensive Care National Audit and Research Centre (ICNARC) in the United Kingdom (UK) for data validation, data analysis, and the generation of reports for adult ICUs. These Units report on activity using quality indicators that are benchmarked against other participating Units. The NOCA ICU Audit Governance Committee governs the output from INICUA.

PURPOSE OF THIS REPORT

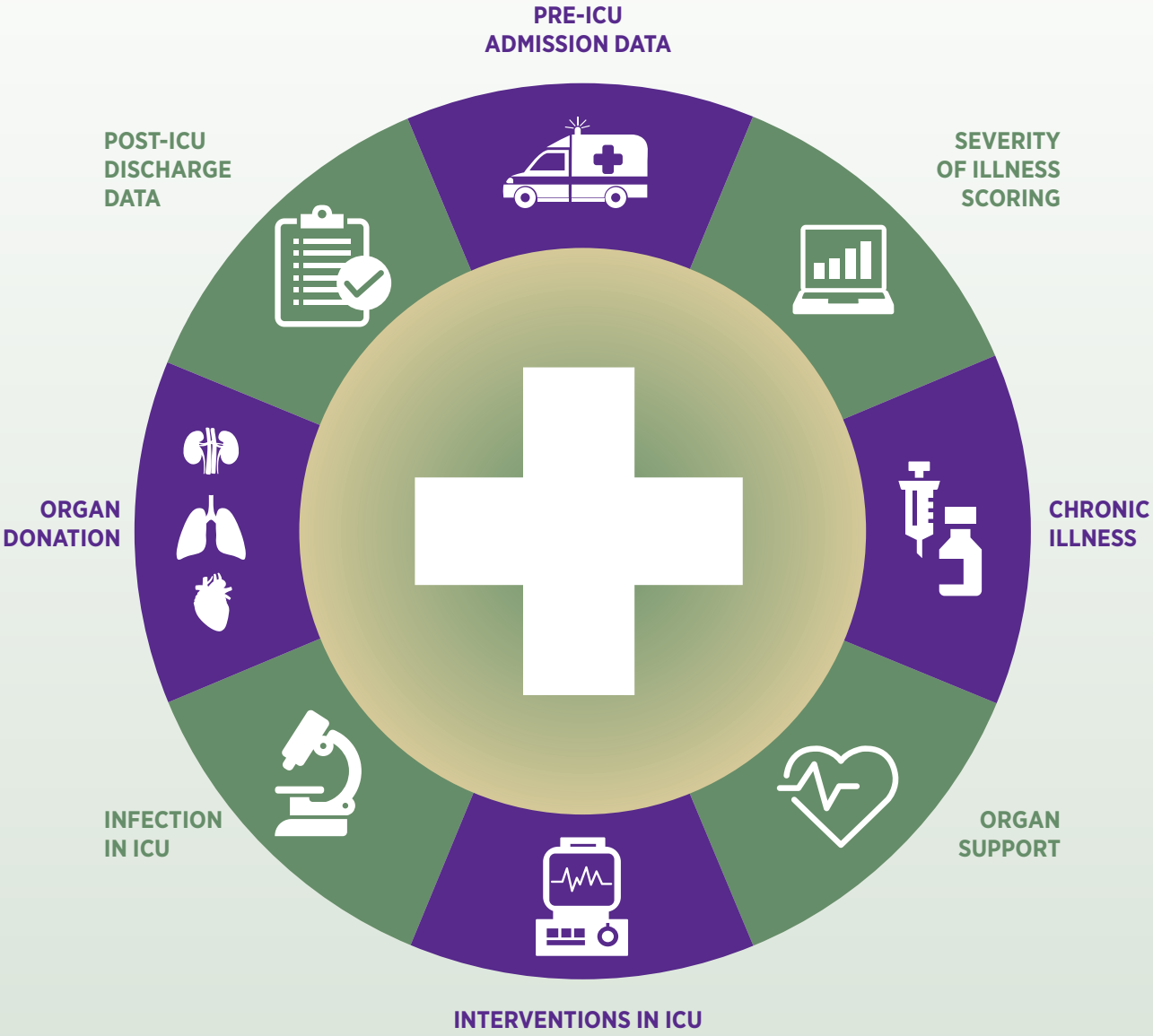
This national report by the NOCA ICU Audit Governance Committee presents comprehensive data on ICU admissions during 2018 to INICUA-participating Units.

At the heart of this audit report are the patients who have been cared for in ICU and their families. This report includes the viewpoint of Shaun, a patient who received care in a number of adult Units, and his mum Gretta, who has supported him throughout his journey. Their story is called Shaun's Story, 'ICU But Not as We Know It!', which begins on page 20 of this report.

By sharing their experience, Shaun and Gretta are providing us with a deep and detailed perception of ICU patient and family experiences. The inclusion of this personal account seeks to ground this NOCA report in the lived patient and family experience and the impact on patients' lives.

This report is aimed at the multidisciplinary teams (MDTs) caring for patients in ICUs, at the hospital managers who support them, at the national structures for administration of the health service, and at the users of the intensive care services in the Republic of Ireland (ROI). It is accompanied by a summary report which is aimed at patients, patient organisations, and the public.

CHAPTER 2
METHODOLOGY



CHAPTER 2: **METHODOLOGY**

INICUA AIM

The overall purpose of INICUA is to benchmark quality of care across ICUs in Ireland and to drive improvements in quality of care.

INICUA OBJECTIVES

The objectives of INICUA include the following:

1. Benchmark outcomes between Irish and UK Critical Care Units to assess quality of care.
2. Use audit data to drive improvements in quality of care.
3. Measure activity to guide the configuration of critical care nationally.
4. Audit healthcare-associated infection (HCAI).
5. Audit organ donation and potential organ donors.
6. Develop an ICU bed information system (BIS).
7. Develop a National Database for ICU Audit data.
8. Provide comprehensive national audit coverage of critical care activity.

GOVERNANCE AND MANAGEMENT STRUCTURE

The NOCA Governance Board was convened to oversee and guide NOCA's strategic direction. The Governance Board has the authority to issue directions to NOCA management with regard to the various clinical audit streams.

INICUA is governed by a Governance Committee, which makes strategic decisions in relation to the audit and oversees operational plans. The Governance Committee comprises relevant clinical and management stakeholders and two patient representatives.

The operation of the Irish National ICU Audit is managed by the clinical audit team of audit managers and the NOCA Clinical Lead for ICU Audit, who are responsible for the development, implementation, and reporting from the audit. This team is supported by the NOCA executive team, which provides expertise in statistical analysis, data quality and security, information technology (IT), communications and quality standards.

NOCA ICU AUDIT GOVERNANCE COMMITTEE

The primary role of the Governance Committee is to monitor the ICNARC reports of the quality of care provided in each Critical Care Unit. The Governance Committee supports and advises the National Clinical Lead on the operation of the audit and is the link to the NOCA Governance Board. In addition, the Governance Committee provides guidance on the strategic direction of the ICU Audit Programme. Membership includes professional organisations, two public/patient interest (PPI) representatives, and a senior accountable healthcare manager, National Clinical Lead the NOCA Executive Director and ICU audit managers. Membership is a three-year staggered term (see Appendix 1). A new Governance Committee chairperson was appointed in September 2019.

The Governance Committee meets quarterly, with additional meetings where necessary. A record of attendance is published within this report (see Appendix 1). The Committee requires 50% plus one member in attendance in order to establish a quorum. The National Clinical Lead and the National ICU Audit Manager attend and report at all Governance Committee meetings. Committee members are asked to declare any interest with regard to agenda items to the Chair.

The Governance Committee is accountable to the Governance Board. The NOCA executive team furnishes regular status reports on behalf of the Governance Committee to the Governance Board.

THE NOCA CLINICAL LEAD FOR ICU AUDIT

The National Clinical Lead provides clinical leadership for the successful implementation and management of the ICU Audit. The National Clinical Lead is accountable to the National Director of the HSE Quality Improvement Division and to the NOCA Governance Board.

This role requires a commitment of one day per week. The post is renewable every three years subject to agreement with the National Director of the HSE Quality Improvement Division, the NOCA Clinical Director, and the National Clinical Lead.

KEY RESPONSIBILITIES OF THE NATIONAL CLINICAL LEAD

The responsibilities of the National Clinical Lead include the following:

- Promote the value of the national clinical audit.
- Provide clinical leadership to the project team for audit development and implementation.
- Engage with the healthcare community to garner support for audit implementation.
- Provide ongoing leadership of the audit by establishing effective working relationships with key stakeholders, such as the HSE National Clinical Programmes, specialty bodies, the Department of Health, the Department of Children and Youth Affairs, and other key stakeholders in service delivery.

THE NATIONAL ICU AUDIT MANAGER

The National ICU Audit Manager, who works as part of the NOCA team, provides clinical support and expertise for the successful implementation and management of the ICU Audit. The Audit Manager is accountable to the National Clinical Lead, the NOCA Executive, the NOCA ICU Audit Governance Committee, and to the NOCA Governance Board.

KEY RESPONSIBILITIES OF THE NATIONAL ICU AUDIT MANAGER

The Irish National ICU Audit Manager has a pivotal role in the coordination and management of activities and resources to implement the ICU audit nationally. The ICU audit managers provide clinical expertise and deliver training throughout the implementation process. Following implementation, the Irish National ICU Audit Manager is the go-to person for ongoing support and training and facilitates communication across the healthcare teams. The Irish National ICU Audit Manager has a key role in the monitoring of INICUA output and participates in ongoing developments in ICU audit and clinical audit nationally, supporting the National Clinical Lead and the NOCA ICU Audit Governance Committee.

NATIONAL ICU AUDIT GEOGRAPHICAL SCOPE

The geographical scope is national, deploying a common IT system and business process for collection of audit data across all ICU Units. The scope of the project includes the following HSE and voluntary hospitals:

PHASE 1

- Mater Misericordiae University Hospital: **live in 2015**
- University Hospital Limerick: **live in 2015**
- Our Lady of Lourdes Hospital, Drogheda: **live in 2015**
- Beaumont Hospital: **live in 2016**
- Tallaght University Hospital: **live in 2016**
- University Hospital Galway: **live in 2017**
- St James's Hospital: **live in 2017**
- University Hospital Waterford: **live in 2017**
- St Vincent's University Hospital: **live in 2018**
- Cork University Hospital: **live in 2019**

PHASE 2

- Regional Hospital Mullingar: **live in 2018**
- Wexford General Hospital: **live in 2018**
- St Luke's General Hospital, Kilkenny: **live in 2018**
- Connolly Hospital Blanchardstown: **live in 2018**
- Naas General Hospital: **live in 2018**
- Midland Regional Hospital Tullamore: **live in 2018**
- South Tipperary General Hospital, Clonmel: **live in 2019**
- University Hospital Kerry: **live in 2019**
- Mercy University Hospital, Cork: **live in 2019**
- Letterkenny University Hospital: **live in 2019**
- Sligo University Hospital: **planned to be live by Q1 2020**
- Cavan General Hospital: **planned to be live by Q1 2020**

- SAOLTA UNIVERSITY HEALTH CARE GROUP
- RCSI HOSPITALS
- DUBLIN MIDLANDS HOSPITAL GROUP
- IRELAND EAST HOSPITAL GROUP
- UL HOSPITAL GROUP
- SOUTH/SOUTH WEST HOSPITAL GROUP

UNIVERSITY HOSPITAL GALWAY

CLINICAL LEAD: Dr John Bates
AUDIT COORDINATOR: Ms Anita McGlynn
AUDIT COORDINATOR: Ms Maura Lyons

UNIVERSITY HOSPITAL LIMERICK

CLINICAL LEAD: Dr John O'Dea
AUDIT COORDINATOR: Ms Amy Walsh

UNIVERSITY HOSPITAL WATERFORD

CLINICAL LEAD: Dr Wahid Altaf
CLINICAL LEAD: Dr Vida Hamilton
AUDIT COORDINATOR: Mr Chris Gallagher

ST JAMES'S HOSPITAL KEITH SHAW UNIT (CT ICU)

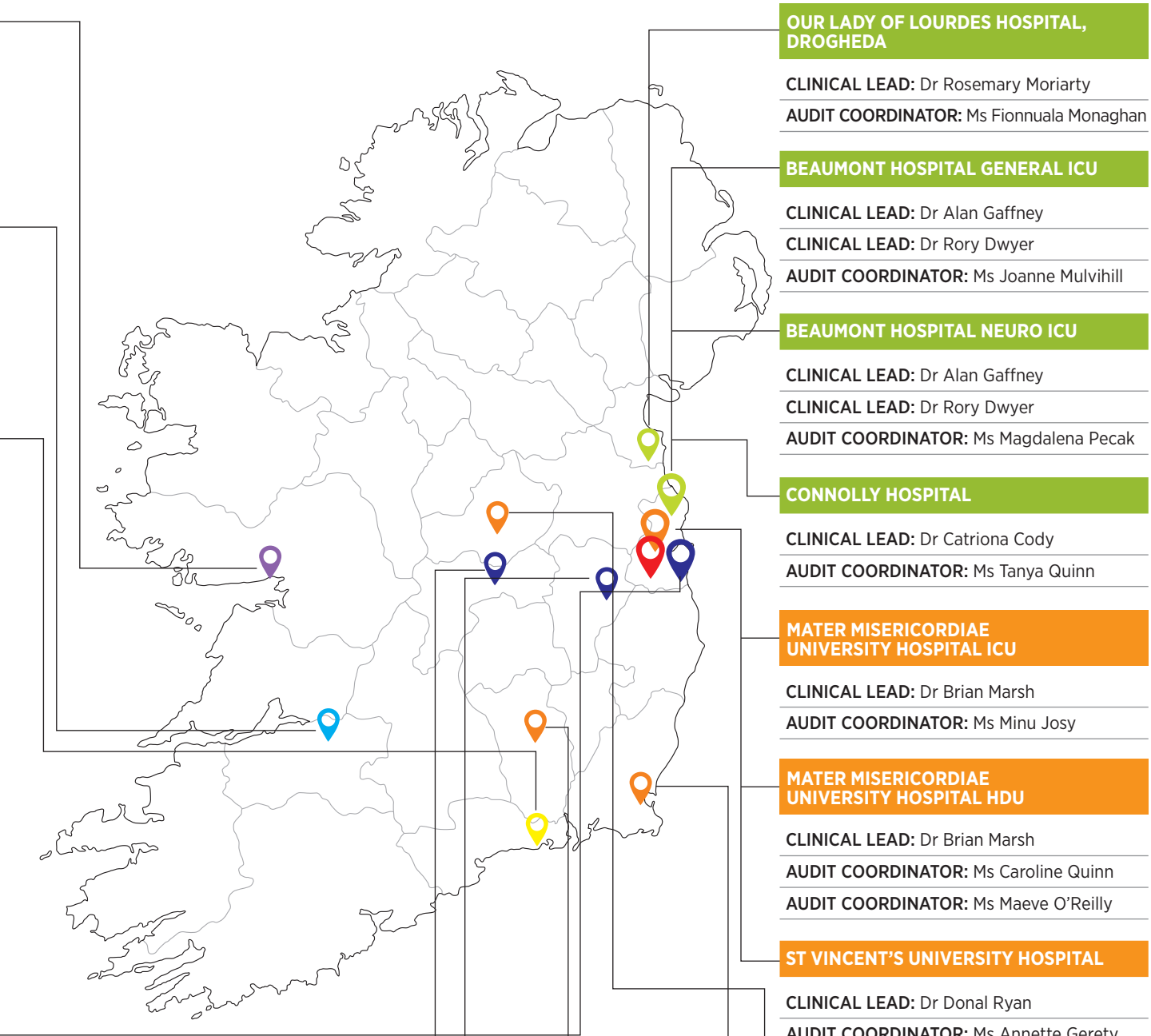
CLINICAL LEAD: Dr Enda O'Connor
CLINICAL LEAD: Dr Tom Ryan
AUDIT COORDINATOR: Ms Michelle Pacturanan

ST JAMES'S HOSPITAL GICU

CLINICAL LEAD: Dr Enda O'Connor
CLINICAL LEAD: Dr Tom Ryan
AUDIT COORDINATOR: Ms Zieta O'Hagan

TALLAGHT UNIVERSITY HOSPITAL

CLINICAL LEAD: Dr Maria Donnelly
CLINICAL LEAD: Dr Gerard Fitzpatrick
AUDIT COORDINATOR: Ms Lilly Mathew



OUR LADY OF LOURDES HOSPITAL, DROGHEDA

CLINICAL LEAD: Dr Rosemary Moriarty

AUDIT COORDINATOR: Ms Fionnuala Monaghan

BEAUMONT HOSPITAL GENERAL ICU

CLINICAL LEAD: Dr Alan Gaffney

CLINICAL LEAD: Dr Rory Dwyer

AUDIT COORDINATOR: Ms Joanne Mulvihill

BEAUMONT HOSPITAL NEURO ICU

CLINICAL LEAD: Dr Alan Gaffney

CLINICAL LEAD: Dr Rory Dwyer

AUDIT COORDINATOR: Ms Magdalena Pecak

CONNOLLY HOSPITAL

CLINICAL LEAD: Dr Catriona Cody

AUDIT COORDINATOR: Ms Tanya Quinn

MATER MISERICORDIAE UNIVERSITY HOSPITAL ICU

CLINICAL LEAD: Dr Brian Marsh

AUDIT COORDINATOR: Ms Minu Josy

MATER MISERICORDIAE UNIVERSITY HOSPITAL HDU

CLINICAL LEAD: Dr Brian Marsh

AUDIT COORDINATOR: Ms Caroline Quinn

AUDIT COORDINATOR: Ms Maeve O'Reilly

ST VINCENT'S UNIVERSITY HOSPITAL

CLINICAL LEAD: Dr Donal Ryan

AUDIT COORDINATOR: Ms Annette Gerety

AUDIT COORDINATOR: Ms Anne Feehan

REGIONAL HOSPITAL MULLINGAR

CLINICAL LEAD: Dr Mohammad Faheem

AUDIT COORDINATOR: Roseanne Smith

WEXFORD GENERAL HOSPITAL

CLINICAL LEAD: Dr David Honan

AUDIT COORDINATOR: Ms Roisin O'Neill

NAAS GENERAL HOSPITAL

CLINICAL LEAD: Dr Nader Almane

AUDIT COORDINATOR: Ms Jennifer Keogh

MIDLAND REGIONAL HOSPITAL TULLAMORE

CLINICAL LEAD: Dr Rajesh Kumar Jain

AUDIT COORDINATOR: Ms Mary Kelly

ST LUKE'S GENERAL HOSPITAL KILKENNY

CLINICAL LEAD: Dr Niall Kavanagh

AUDIT COORDINATOR: Ms Teresa Garrahy

THE NATIONAL ICU AUDIT DATASET (ADULT UNITS)

The National ICU Audit Dataset covers the patient journey throughout the entire acute hospital stay. This is outlined in Table 2.1. Of this dataset, 45% comprises the ICNARC dataset for Ireland and 55% the local dataset.

TABLE 2.1: INICUA DATASET

Dataset	Examples
Pre-ICU admission data	Demographic data, hospital transfer details, length of stay (LOS) in hospital prior to ICU admission
Severity of illness scoring systems	Acute Physiology and Chronic Health Evaluation (APACHE II), ICNARC, Sequential Organ Failure Assessment (SOFA) score
Chronic illness	Metastatic, cardiovascular, other chronic disease
Interventions in ICU	Ventilation, invasive monitoring, dialysis, nutrition, intracranial pressure monitoring, transfers to theatre.
Organ support	Respiratory, cardiovascular, renal, neurological, liver, dermatological, and gastrointestinal support
Data to support Hospital In-Patient Enquiry (HIPE) coding	Diagnosis (current) during ICU stay, hours of ventilation
Infection in ICU	Unit-acquired and hospital-acquired infection
Organ donation	Potential and actual organ donation
Post-ICU discharge data	Outcome and LOS in unit, ward and hospital; patient journey details

THE IT INFRASTRUCTURE FOR INICUA

NOCA is working as a partner with the HSE, which procured and funded a system for ICU Audit suitable for the Irish healthcare system. This system can be interfaced with existing hospital systems and data can be extracted for analysis by ICNARC. The system will support the establishment of a National Database for ICU Audit.

INFOFLEX (THE IRISH NATIONAL ICU AUDIT SOFTWARE) AND HOW IT IS USED

- National ICU Audit data are stored within InfoFlex.
- Patient-identifiable information is held on the hospital database and stored on a HSE server.
- Access by hospital is restricted to data from that hospital only.
- Access is restricted by user, and all users of the system must adhere to their local hospital's data protection policy.
- The software has IT security safeguards in place to protect the data.
- The software interfaces with existing hospital IT systems.
- The software exports anonymised data to ICNARC every quarter (no patient-identifiable information is sent).
- The software generates a suite of local reports.
- The software can be manipulated to answer local queries.
- The software provides a platform for a future National Database for further national reports on critical care activity.

DATA PROTECTION AND INFORMATION MANAGEMENT

NOCA and the ICU Audit Governance Committee recognise the importance of maintaining privacy and confidentiality at all times, and are committed to the highest standards of data management.

- Patient-identifiable information is stored on a HSE server but is only accessible to staff from the relevant hospital. IT security safeguards have been put in place in order to protect the data. No patient-identifiable information is shared with ICNARC, NOCA or anyone else outside the relevant hospital.
- Users must keep data secure and confidential in accordance with the General Data Protection Regulation (GDPR) that came into effect in 2018; *the Guide to Professional Conduct and Ethics for Registered Medical Practitioners: 8th Edition 2016 (Medical Council, 2016), and the Code of Professional Conduct and Ethics for Registered Nurses and Registered Midwives* (NMBI, 2014), as well as with national standards and guidance (HIQA, 2018; HIQA, 2017). Users must also comply with their local hospital's data protection policy.
- At hospital level, the ICU Audit Local Clinical Lead takes overall responsibility for ICU Audit data management.
- Access to the ICU database is restricted to the Audit Nurse and the Local Clinical Lead in order to ensure compliance with the GDPR.

REPORTING ON BENCHMARKED OUTCOMES (ADULT UNITS)

The Irish National ICU Audit, in partnership with ICNARC, provides reporting on benchmarked quality indicators on outcomes and activity for the Irish National ICU Audit, to facilitate quality improvement. These quality indicators are listed in Table 2.2.

TABLE 2.2: QUALITY INDICATORS

No.	Quality indicator
1	High-risk admissions from the ward
2	High-risk sepsis admissions from the ward
3	Out-of-hours discharge to the ward not delayed
4	Bed days of care post eight-hour delay
5	Bed days of care post 24-hour delay
6	Discharges direct to home
7	Non-clinical transfers to another unit
8	Unplanned readmissions within 48 hours
9	Risk-adjusted acute hospital mortality
10	Risk-adjusted acute hospital mortality for predicted risk <20%

Quarterly Quality Reports (QQRs) are provided to the Units and the output displayed in a dashboard format for ease of viewing (Figure 2.1). These data are reported within this report.

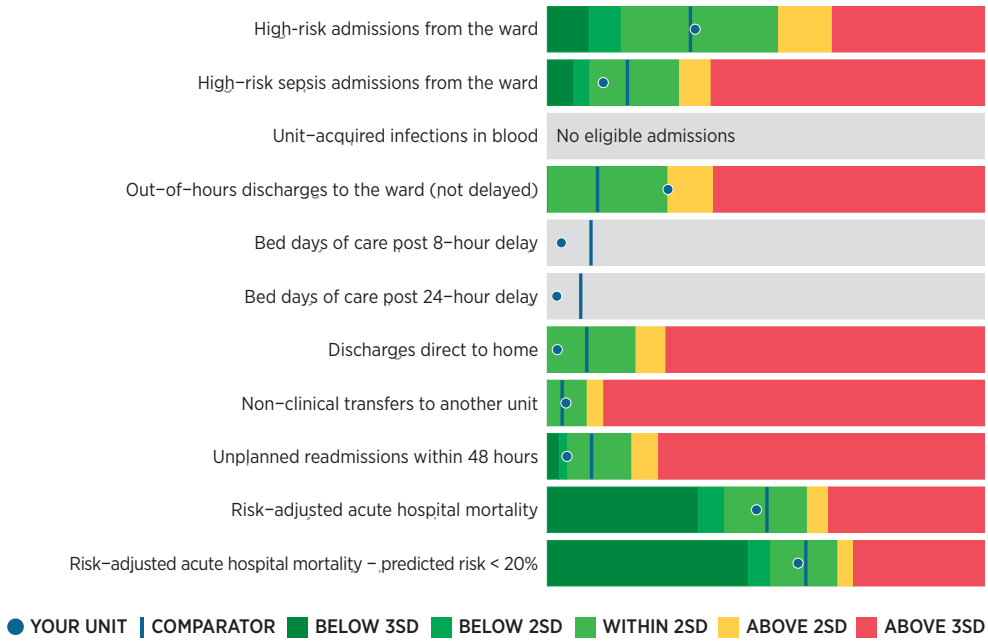


FIGURE 2.1: QUARTERLY QUALITY REPORTS FROM ICNARC

NATIONAL ICU AUDIT IN THE HOSPITALS

The National ICU Audit is supported in each hospital by the Local Clinical Lead for the ICU Audit and by the ICU Audit Coordinator.

Local Clinical Lead for the ICU Audit

The Local Clinical Lead is usually either the ICU Director or their nominee from the ICU consultant group. They play a fundamental role in managing the ICU Audit by ensuring that adequate resources are provided locally, by supporting the ICU Audit Coordinators regarding logistics and data quality issues, and by reviewing and responding to audit findings. They are fundamental in maintaining close relationships with hospital governance bodies and are central figures in linking with NOCA. They take ultimate responsibility for issues relating to data quality and for responding to outlier findings for quality indicators.

ICU Audit Coordinator

The role of the ICU Audit Coordinator at hospital level is directed by the National and Local Clinical Leads and supported by the NOCA ICU Audit Manager. The key responsibilities of this role involve supporting the implementation of the National ICU Audit in their Unit and the ongoing collection and input of validated ICU Audit data. The Audit Coordinator is responsible for the security of all patient data and must be aware of, and comply with, data protection legislation.

The Audit Coordinator works closely with the Local Clinical Lead on the operation of the audit and management of the audit output. They have an in-depth understanding of their specific audit, attend training programmes given by NOCA, and deliver audit-specific training within their local hospital where required. They are responsible for ensuring data quality and for monitoring and communicating the audit output with the support of the Local Clinical Lead and NOCA. The Audit Coordinator attends local hospital governance committee meetings and supports local quality initiatives associated with the ICU Audit.

Local hospital governance committee meetings

The local hospital governance structure for the ICU Audit is normally led by the Local Clinical Lead. The Local Clinical Lead is usually either the ICU Director or their nominee and is supported by the ICU Audit Coordinator.

The local hospital governance committee is responsible for:
- maintaining data quality
- developing procedures for data protection
- ensuring that deadlines for data submission are met
- reviewing quarterly ICNARC reports, supported by the clinicians involved in the Unit both nursing and medical
- circulating the outcome of local ICU MDT meetings to local hospital governance structures. That is, Quality Assurance Committees, the hospital lead clinician, the chief executive officer (CEO), etc.

Further information on local hospital governance committee is available in Appendix 2.

Review of ICU Audit QQRs based on the ICNARC quality indicators

Each QQR is reviewed locally and by NOCA.

LOCAL HOSPITAL REVIEW
- Unit and Directorate level
- local hospital governance committee meetings

NOCA REVIEW
- The National Clinical Lead and ICU Audit Manager review all QQRs.
- The ICU Audit Governance Committee overviews the outcomes and decisions regarding actions.
- The NOCA Governance Board oversees the full process of review.

Where a statistical outlier is identified within the review of ICU Audit QQRs, data quality is the first checkpoint. The NOCA Audit Manager and the National Clinical Lead work with the hospital audit team to resolve data quality issues. If issues do not relate to data quality, a more detailed review of the statistical outlier is undertaken.

The National Clinical Lead notifies the hospital CEO and key stakeholders of the occurrence of a statistical outlier. The hospital CEO appoints a senior accountable person to lead a review and develop an action plan to address the outlier. The output of this process is included in national reports, sharing learning more broadly in the healthcare system. Outliers for INICUA (adult Units) for the 2018 reporting year are included in this report.

Outlier definition

Statistical outliers for INICUA (adult Units) are defined as results that are:
- >2 standard deviations (SDs) outside the expected value for two consecutive quarters

OR
- >2 SDs outside the expected value for the full year

OR
- >3 SDs outside the expected value for one quarter.

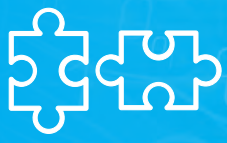
The *NOCA Monitoring and Escalation Policy* for statistical outliers is available on the NOCA website (NOCA, 2017).

CHAPTER 3
DATA QUALITY

Relevance

Accuracy and reliability

Timeliness and punctuality



Coherence and comparability

Accessibility and clarity

CHAPTER 3: **DATA QUALITY**

The overall objectives of INICUA are to benchmark quality of care and outcomes across ICUs in Ireland and to drive improvements in quality of care. This data quality assessment (Table 3.1) supports the interpretation and judgement of the information contained in this reporting time period from 1 January to 31 December 2018 (HIQA, 2018).

The INICUA dataset is collected by ICU Audit Coordinators on each participating Unit, examples of which are found in Table 2.1. Once collected, a robust process of data validation ensures data quality. QQRs are issued to hospital Units once data are clean and include information on data completeness. Participating Units receive reports called QQRs that include activity in Units and clinical information on ICU quality indicators, as listed in Table 2.2.

Implementation of INICUA in the remaining adult ICUs in Ireland will provide complete coverage and comparative data for all Units in HSE-funded hospitals. See the National ICU Audit Geographical Scope on page 28 in Chapter 2.

TABLE 3.1: DATA QUALITY ASSESSMENT, 2018

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Relevance 	**Relevant data meet the current and potential future needs of users.**	Relevance of the National ICU Audit data for 2018 is assessed by the following characteristics: release and use of the data; value of the data; and adaptability of the data source. The Audit Manager and National Clinical Lead work in collaboration with data users to determine relevance. Data users include the local hospital, Hospital Groups, HIPE coding locally, HSE Business Intelligence Unit, Organ Donation and Transplant Ireland (ODTI), and NOCA for national reporting. An example of this is meeting with the Healthcare Pricing Office (HPO) to update data fields to optimise their use by HIPE coders locally. Changes were made to the dataset in October 2018 to support this. Ten scheduled audio meetings in 2018 with ICU Audit Coordinators were used to review release, value and adaptability of the database. The ICU Audit database has a suite of preformatted reports that report on all data fields. These data can be exported into Microsoft Excel locally for further analysis. The data requests of individual Units are managed and stored locally. Participating Units receive a QQR and a Microsoft Excel data appendix of ICNARC reported data fields. In 2018, NOCA and ICNARC biannual workshops were facilitated to educate ICU Audit on using these reports. ICU Audit supports the objectives of ODTI. The ICU Audit software contains a specific predefined report in line with ODTI requirement. This report was updated in line with requirements and is in use since 1 October 2018. NOCA collaborated with the HSE Business Intelligence Unit to develop a national key performance indicator (KPI), tracking timeliness of admissions to ICU within participating Units. The ICU Audit dataset was updated and a predefined report developed in October 2018 to meet this need. This report is sent from hospitals to the HSE Business Intelligence Unit for national reporting. Where required, a plan is put in place to align the ICU Audit with changes in new clinical practice and use of terminology to ensure relevance (e.g. changes in medical terminology: Cardiovascular accident (CVA) to Stroke, as updated in the ICU Audit Database 1 October 2018).

TABLE 3.1: DATA QUALITY ASSESSMENT, 2018

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Accuracy and reliability 	The accuracy of data refers to how closely the data correctly describe what they were designed to measure. Reliability refers to whether, over time, those data consistently measure the reality that they were designed to represent.	**The accuracy and reliability of the National ICU Audit data for 2018 is assessed by the following characteristics:** • coverage • data capture and collection • data processing, and • data completeness and validity. **COVERAGE** The reference population for the National ICU Audit are all live patients admitted to participating Units. Reporting is based on dates and times of Unit admission. Full coverage in each Unit is when all the admissions are entered onto the system. In the year subsequent to ICU Audit implementation, the expectation is that four quarters data are collected. The ***Irish National ICU Audit Annual Report 2018*** has coverage of 18 participating Units across 15 hospitals (Table 3.3.1). These Units have 100% of live admissions in the quarters reported. • 12 Units have provided one complete year of data. • Six Units have provided six months of data. This deployment of the ICU Audit will continue into 2020 until all 22 hospitals initially identified for inclusion are collecting data for analysis and reporting. The phased roll-out of the National ICU Audit is described in Chapter 2 on page 28.

TABLE 3.1.1: DATA COVERAGE IN PARTICIPATING ICUs, 2018

Key	Hospital	Critical Care Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
A	Beaumont Hospital	General ICU (GICU)				
B	Beaumont Hospital	Neurosurgical ICU (Neuro ICU)				
C	Mater Misericordiae University Hospital	High Dependency Unit (HDU)				
D	Mater Misericordiae University Hospital	ICU				
E	Our Lady of Lourdes Hospital, Drogheda	ICU				
F	St James's Hospital	Keith Shaw Unit Cardiothoracic ICU (CT ICU)				
G	St James's Hospital	ICU				
H	Tallaght University Hospital	ICU				
I	University Hospital Galway	ICU				
J	University Hospital Limerick	ICU				
K	University Hospital Waterford	ICU				
L	Regional Hospital Mullingar	ICU				
M	Wexford General Hospital	ICU				
N	Connolly Hospital Blanchardstown	ICU				
O	Midlands Regional Hospital Tullamore	ICU				
P	Naas General Hospital	ICU				
Q	St Luke's General Hospital	ICU				
R	St Vincent's University Hospital	ICU				

Data available Data not available Unit not participating

TABLE 3.1: DATA QUALITY ASSESSMENT, 2018 *(CONTINUED)*

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Accuracy and reliability ***(Continued)*** 	The accuracy of data refers to how closely the data correctly describe what they were designed to measure. Reliability refers to whether, over time, those data consistently measure the reality that they were designed to represent.	**DATA CAPTURE AND COLLECTION** Validation is inbuilt to INICUA InfoFlex database. At data entry, validation minimises errors and duplicate admissions are easily identified. Users are trained on deletion of duplicate admissions and supported by NOCA and the InfoFlex support company if issues arise. Data collection manuals are available to all ICU Audit Coordinators. Induction training was carried out in four newly participating Units and biannual workshops keep nurses updated. ICU Audit Coordinator Workshops were held in March and November 2018 at NOCA, with 100% attendance. **DATA PROCESSING** The ICU Audit dataset (Table 2.1) comprises 45% of the ICNARC dataset for Ireland and 55% of the local dataset. The ICNARC dataset is extracted to, and validated by, ICNARC. Any errors are presented to the user and updated before an extract is made. Following receipt of extracted data, ICNARC sends a series of Data Validation Reports (DVRs) to Units. This validation process includes completeness, reliability, and accuracy of the submitted data. A DVR is sent back to the Unit identifying data validation questions. The number of DVRs per Unit ranges from one to five per quarter (see Table 3.1.2). This process continues until ICNARC is satisfied with the data quality. The process was successfully achieved in 2018. When data are clean, a QQR is issued to the Unit. Data quality issues where there is a reported outlier are addressed as per the NOCA Monitoring and Evaluation Policy (NOCA, 2017). The local dataset currently not extracted will be validated in a similar manner by NOCA. The NOCA validation process will begin when a National Database of all ICU Audit data are in place, which is planned for 2020. **DATA COMPLETENESS AND VALIDITY** DVRs clearly document invalid and missing fields. These are corrected or deemed unavailable before data are reported. Gaps of certain parameters in reported data are detailed within the QQR. For example, an expected gap would be on blood gas analysis where a patient is without an arterial line within the first 24 hours. Four Units began participating in INICUA in 2018. These Units require time for 'bedding in' of data quality. NOCA provided on-site support to newly participating sites during this time. Data quality is always the first point of analysis and review in the occurrence of a potential statistical outlier. **REVISION OF DATA** ICNARC reports on clean data only. These are the data that will be included in the INICUA Adult Report 2018. Occasionally, data are revised during the time of national reporting or just before the period. All ICNARC reports are dated. There were three revisions of 2018 data necessitating reruns of reports. These revised versions are issued with a different date. These do not affect the amalgamation of data used as the basis for this report.

TABLE 3.1.2: NUMBER OF DVRs PER QUARTER IN PARTICIPATING ICUs, 2018

Key	Hospital	Critical Care Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
A	Beaumont Hospital	GICU	2	2	2	2
B	Beaumont Hospital	Neuro ICU	1	2	1	1
C	Mater Misericordiae University Hospital	HDU	3	2	3	2
D	Mater Misericordiae University Hospital	ICU	2	2	5	1
E	Our Lady of Lourdes Hospital, Drogheda	ICU	3	3	2	2
F	St James's Hospital	Keith Shaw (CT ICU)	3	2	2	2
G	St James's Hospital	ICU	2	3	3	2
H	Tallaght University Hospital	ICU	2	2		
I	University Hospital Galway	ICU	2	2	3	3
J	University Hospital Limerick	ICU	4	4	3	2
K	University Hospital Waterford	ICU	3	3	3	3
L	Regional Hospital Mullingar	ICU	2	1	1	1
M	Wexford General Hospital	ICU	2	1	1	1
N	Connolly Hospital Blanchardstown	ICU			2	1
O	Midlands Regional Hospital Tullamore	ICU			1	2
P	Naas General Hospital	ICU			2	1
Q	St Luke's General Hospital	ICU		3	2	
R	St Vincent's University Hospital	ICU			3	2

Data not available due to no Unit Coordinator **Unit not participating**

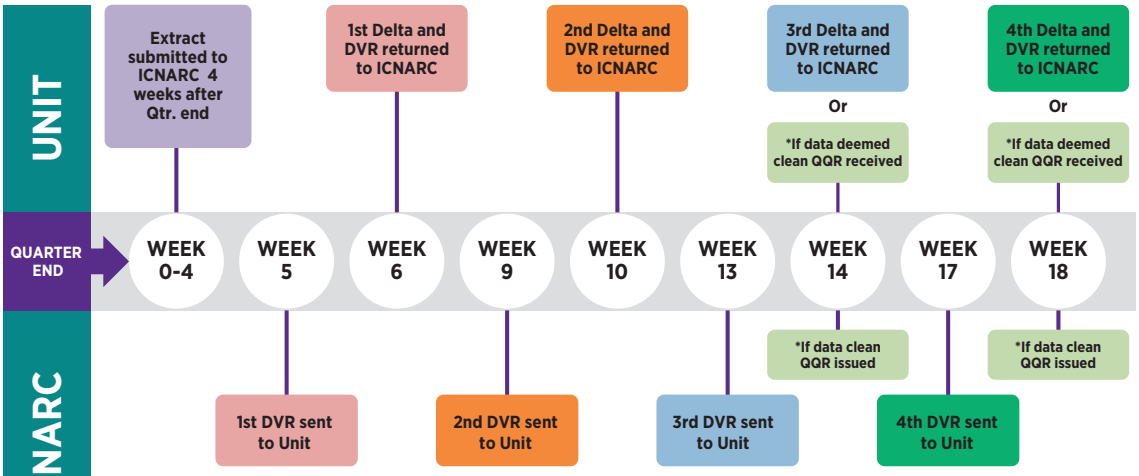
TABLE 3.1: DATA QUALITY ASSESSMENT, 2018 *(CONTINUED)*

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Coherence and comparability 	**Coherent and comparable data are consistent over time and across providers and can be easily combined with other sources.**	The coherence and comparability of the National ICU Audit data for 2018 is assessed on the following characteristics: standardisation, coherence and comparability. **STANDARDISATION** The ICNARC dataset for Ireland (INICUA), standards, and classifications are linked to the Case Mix Programme (CMP) dataset. The remainder of the INICUA dataset is local to Ireland and aspects of these data are aligned with international standards, for example, unit-acquired bloodstream infection (UABSI) is defined in line with European protocols (UABSI surveillance protocol for Ireland, 2013). HIPE data items were updated in 2018, defined by HIPE, and linked to individual admission's diagnosis (current) during ICU stay. A data definition manual for INICUA is available to the ICU Audit Coordinators on the NOCA website (NOCA, 2017). ICU Audit Coordinators are trained using the same data dictionary, so that the definitions and coding are consistent. **COHERENCE** Sources of data for the ICU Audit dataset include the patient chart and both the patient administration system and the clinical information system, where one exists on a Unit. The definitions of the INICUA dataset in the ***NOCA National ICU Audit Data Definition Manual*** (NOCA, 2017) are used to enable coherence of this data source to another. A review between the Paediatric Intensive Care Audit Network (PICANet) paediatric data and the ICNARC adult dataset showed differences in the dataset as expected between adult and paediatric admissions. This supported the request for a separate analysis of paediatric admissions to adult Units included in this reported on 2018 data. There is potential to compare INICUA data with the Major Trauma Audit (MTA), the National Perinatal Epidemiology Centre (NPEC) maternal morbidity audit, PICANet, and sepsis, which could be explored when the National Database is in place (planned for 2020). **COMPARABILITY** The INICUA dataset is consistent with the ICNARC CMP dataset and enables comparison of activity and outcome measures for all participating Units from Ireland and across the UK. ICNARC coding of diagnosis is a structured system for uniform numeric coding of the reason(s) for admission to critical care. ICNARC reviews and updates this coding method periodically, ensuring that the terminology is consistent. The limitations in comparison are those data not reported on by ICNARC. This is a recognised gap for Irish ICU Audit. The planned National Database is intended to bridge that gap. Areas that may provide comparison within the National Database include organ donation, unit-acquired bloodstream infection (UABSI), and obstetric and paediatric admissions to adult ICUs.

TABLE 3.1: DATA QUALITY ASSESSMENT, 2018 *(CONTINUED)*

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Timeliness and punctuality	**Timely data are collected within a reasonable, agreed time period after the activity that they measure. Punctuality refers to whether data are delivered on the dates promised, advertised, or announced.**	NOCA and ICNARC issue data collection targets for each Unit based on quarterly submissions, in order to ensure timeliness and punctuality. The targeted timeliness of submissions per quarter for 2018 is displayed in Table 3.1.3. These data are processed and reported to Units within 17 weeks of receipt of the data, early in the third month of the subsequent quarter. Reporting is with the proviso that QQRs are run when at least 50% of participating Units (CMP and INICUA) have fully validated, clean data. This allows for sufficient data for comparative benchmarking. When there is a delay in the target submission date, there is a delay in the release date of the QQR. In 2018, two Units had gaps in data collection due to the loss of each Unit's coordinator and the inability of the hospital to fill these posts. These data gaps were escalated to the appropriate Hospital Groups. One hospital recruited a replacement coordinator following an upgrade of the role. The other is without a solution at time of report writing (November 2019). NOCA monitors and documents the timeliness of data submission from Units. These target submissions dates were delayed in some instances due to holiday times, Easter and Christmas, and planned and unplanned leave in 2018. These timelines are continually monitored. National reports may be impacted if Q4 data are delayed in reporting. INICUA Network Quality Report 2019 data expected by the end of July 2019 were released on 12 August 2019. The national report timeline was successfully updated to accommodate this delay.

TABLE 3.1.3: TARGETED TIMELINESS OF SUBMISSIONS PER QUARTER FOR PARTICIPATING ICUs, 2018



*As QQRs are comparable reports, run from a combined data pool of UK Case Mix Programme (CMP) and INICUA units, at least 50% of units are required to have data for a quarter clean before the quarterly reports are run. The first QQRs for a quarter are therefore generally run early in the third month of the subsequent quarter. If a unit are very fast/ efficient in validating their data quickly, they may wait longer than one week for their QQR to ensure there is enough comparable data to produce the report.

TABLE 3.1: DATA QUALITY ASSESSMENT, 2018 *(CONTINUED)*

Dimensions of data quality in 2018	Definition (HIQA, 2018)	Assessment of dimension
Accessibility and clarity 	**Data are easily obtainable and clearly presented in a way that can be understood.**	The accessibility and clarity of the National ICU Audit data for 2018 is assessed based on the following characteristics: accessibility and interpretability. **ACCESSIBILITY** Local data users – Audit Coordinators and Clinical Leads – receive and can run reports to monitor trends and changes in their Units. Access from outside the participating Units is governed and managed by use of a request form (see Appendix 3). This enables the local Units to monitor the use of ICU Audit information. **INTERPRETABILITY** NOCA has developed a data definition manual (NOCA, 2017) and the ***Irish National ICU Audit Dataset Frequently Asked Questions*** (NOCA, 2017). Each QQR has a page at the beginning titled 'Understanding the report' to support report readers. Continual education, telephone, and email support on data collection, validation, interpretation of data definitions, and audit output are available from ICNARC and NOCA.

CHAPTER 4

DESCRIPTION OF PARTICIPATING UNITS

CHAPTER 4: **DESCRIPTION OF PARTICIPATING UNITS**

The Units participating in the Irish National ICU Audit differ considerably from each other in size (Table 4.1) and case mix.

Beds provided for critically ill patients are classified as ICU beds (Level 3, more complex care provided) or HDU beds (Level 2, less complex care provided). The Units participating in ICU Audit vary in their bed designation, containing (i) all ICU beds, (ii) a mixture of ICU and HDU beds, or (iii) all HDU beds. Furthermore, some Units have patients predominantly from a particular specialty, for example, cardiac surgery, neurosurgery, etc. These differences explain some of the variations reported in the metrics in this report. A brief summary of the characteristics of participating Units is provided in Table 4.1.

TABLE 4.1: CHARACTERISTICS OF THE UNITS PARTICIPATING IN INICUA

Key	Unit	Description	Staffed beds
A	**Beaumont Hospital General ICU**	General ICU for medical and surgical patients with a significant number of neurosurgical patients as overflow from the hospital neurosurgical ICU	9
B	**Beaumont Hospital Neurosurgical ICU**	Specialist Unit for neurosurgical/ neuromedical patients with a significant number of general medical/surgical patients as overflow from the hospital General ICU	8
C	**Mater Misericordiae University Hospital HDU**	High Dependency Unit for general medical and general surgical patients	14
D	**Mater Misericordiae University Hospital ICU**	General ICU for medical and surgical patients. Significant influences on case mix include cardiothoracic surgery, heart and lung transplantation, extracorporeal life support	18
E	**Our Lady of Lourdes Hospital, Drogheda ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	8
F	**St James's Hospital Cardiothoracic ICU**	Specialist ICU for patients after cardiothoracic surgery	6
G	**St James's Hospital General ICU**	General ICU for medical and surgical patients with 19 beds. The Audit Report also includes data from two Burns Unit beds, totalling 21 critical care beds.	21
H	**Tallaght University Hospital ICU**	General ICU for medical and surgical patients, with nine beds. The Audit Report also includes data from three beds in the Post Anaesthesia Care Unit, totalling 12 critical care beds.	12
I	**University Hospital Galway ICU**	General ICU for medical, surgical, obstetric and paediatric patients, with 10 beds. The Audit Report includes data from a six-bed HDU, totalling 16 critical care beds.	16

TABLE 4.1: CHARACTERISTICS OF THE UNITS PARTICIPATING IN INICUA

Key	Unit	Description	Staffed beds
J	University Hospital Limerick ICU	General ICU for medical and surgical patients. The hospital also has an eight-bed HDU, which is not included in this report.	9
K	University Hospital Waterford ICU	General ICU for medical and surgical patients. The hospital also has a four-bed HDU, which is not included in this report.	5
L	Regional Hospital Mullingar ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	6
M	Wexford General Hospital ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	5
N	Connolly Hospital Blanchardstown ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	4
O	Midland Regional Hospital Tullamore ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	6
P	Naas General Hospital ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	4
Q	St Luke's General Hospital, Kilkenny ICU	General Unit (mixed ICU/HDU) for medical and surgical patients	4
R	St Vincent's University Hospital ICU	General ICU for medical and surgical patients, with a significant number of patients with liver-related illness	16

ACTIVITY IN CRITICAL CARE

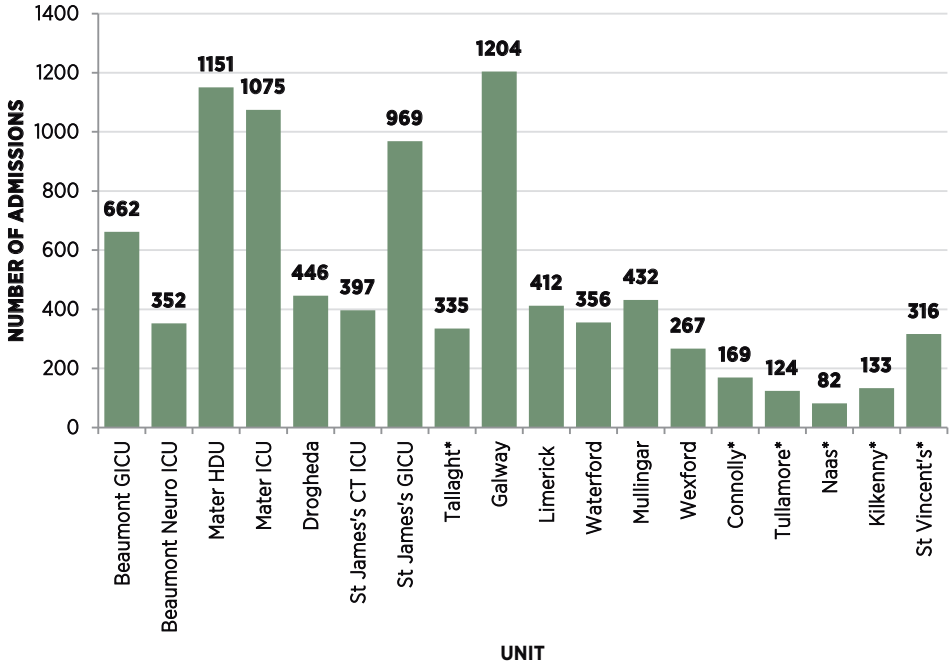
COVERAGE

The Units included in the Irish National ICU Audit in 2018 provided 70.4% of all ICU care in HSE-funded hospitals (CCP, 2018).

VOLUME

Participating Units differed widely in numbers of admissions (Figure 4.1). This was related to their numbers of beds and to their LOS – Units with a shorter LOS could accept larger numbers of admissions for a given number of beds.

A number of the Units participated for only six months in 2018 (Tallaght, Connolly, Tullamore, Naas, Kilkenny and St Vincent's) with a corresponding effect on the numbers of admissions noted in Figure 4.1.



*Tallaght, Connolly, Tullamore, Naas, Kilkenny and St Vincent's had data for six months of 2018.

FIGURE 4.1: NUMBER OF ADMISSIONS TO EACH UNIT IN 2018 (n=8882)*

* Full hospital names are available within the frequency tables.

AGE PROFILE

The mean age of patients was similar across different Units in the ROI (Figure 4.2). An exception was Beaumont Hospital Richmond ICU (Neuro), reflecting its case mix, which includes younger patients with traumatic brain injury.

The mean age of patients across all Units in the ROI was 61 years, the same as for UK Units (England, Wales, and Northern Ireland).

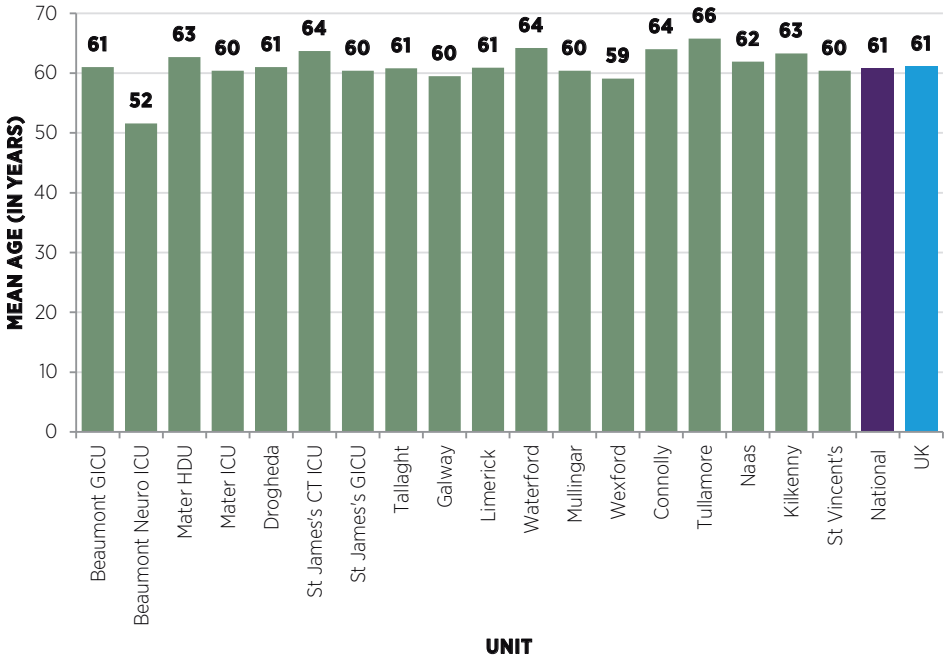


FIGURE 4.2: MEAN AGE OF PATIENTS (IN YEARS) ON ADMISSION TO EACH UNIT*

* Full hospital names are available within the frequency tables.

GENDER

Gender distribution showed a predominance of male patients, in line with international experience (Figure 4.3). Seventy-seven per cent of admissions to St James's Hospital Keith Shaw Unit (CT ICU) were male, reflecting a characteristic of patients undergoing cardiac surgery.

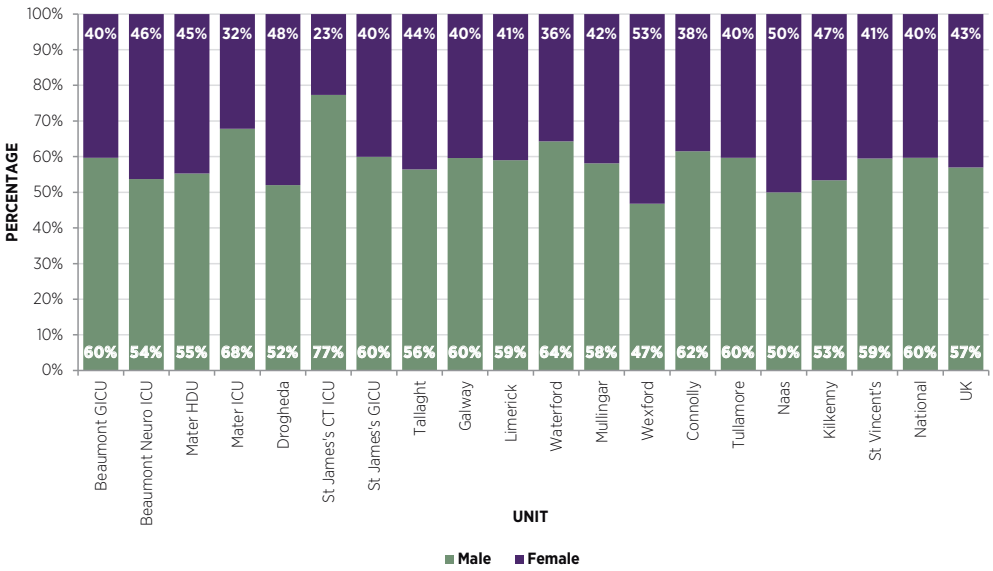
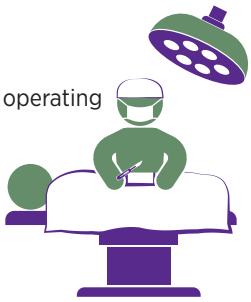


FIGURE 4.3: GENDER DISTRIBUTION IN EACH UNIT*

* Full hospital names are available within the frequency tables.

ICU ADMISSIONS AFTER SURGERY



The percentage of patients who came to the Unit directly from the operating theatre varied between Units (Figure 4.4).

The percentage of admissions after emergency surgery varied from 42% in Beaumont Hospital Richmond ICU (Neuro) to 6% in both of the St James's Hospital Units, reflecting variation between neurosurgery and cardiac surgery. ICU admission after emergency surgery is a risk factor for mortality in ICU (Thompson and Stonebridge, 2005).

Patients admitted to ICU not included in the coloured bars in Figure 4.4 came to the Unit because of a non-surgical condition (e.g. sepsis, cardiac arrest, liver disease, haemorrhage, etc.) or may have been postoperative but did not come to ICU directly from the operating theatre. The proportion of admissions from locations other than the operating theatre varied considerably between Units. These groups of patients are usually admitted to ICU as an emergency, that is, in an unpredictable manner.

The numbers of ICU admissions after elective surgery tend to be consistent and predictable, and therefore requirements for ICU beds are predictable. The caseload of admissions after emergency surgery and for non-surgical conditions fluctuates and is unpredictable, leading to considerable variability in requirements for ICU beds. Provision of ICU bed capacity should take the proportion of these emergency admissions into account, as capacity needs to be able to cope with peaks in demand rather than average demand.

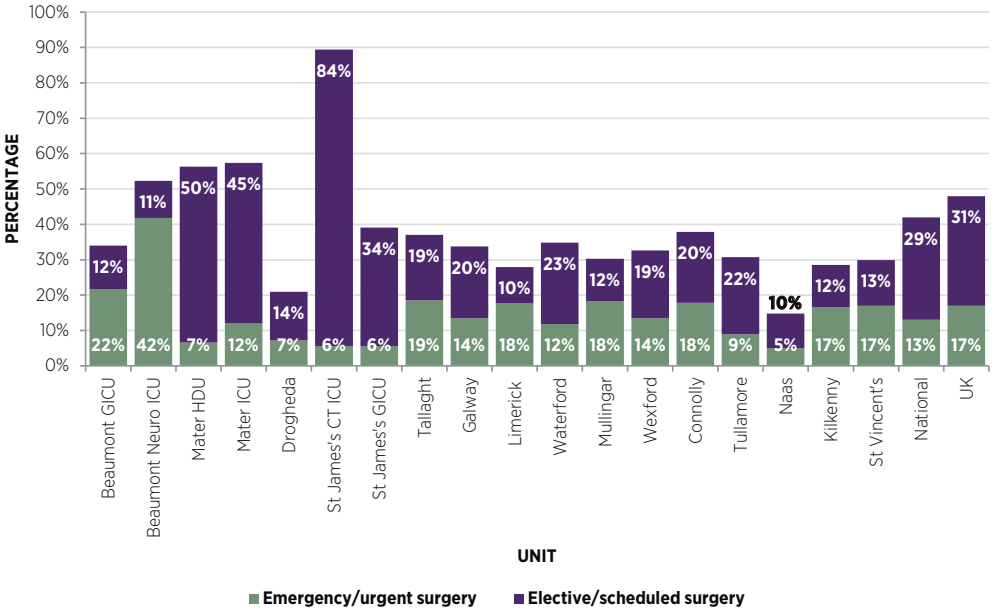


FIGURE 4.4: ADMISSIONS FROM THE OPERATING THEATRE TO THE UNIT AFTER EMERGENCY SURGERY AND AFTER ELECTIVE SURGERY (AS A PERCENTAGE OF ALL ADMISSIONS)*

> ***Gretta: Dr X came in to us and she was super. She is absolutely brilliant and she kind of sat there and sighed with relief and said "he's out, he's stable. You know, we'll just have to wait and see now". So you know, we went from there and spent every day in the ICU and his dad was up every single day, and his brother and sister.***

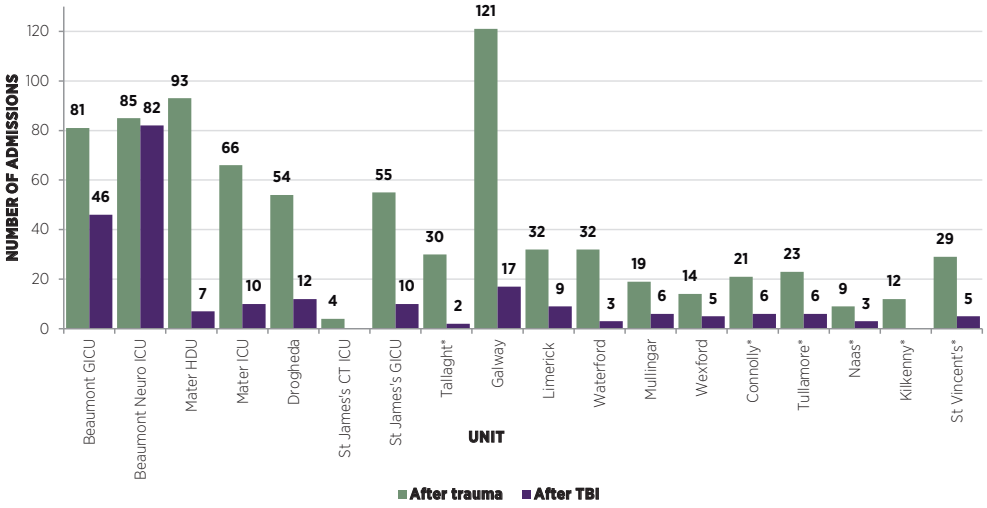
* Full hospital names are available within the frequency tables.

ICU ADMISSIONS AFTER TRAUMA

Figure 4.5a and Figure 4.5b display the numbers of patients and percentages of ICU admission after trauma and, as a subset of these, after traumatic brain injury (TBI).

University Hospital Galway had the largest number of trauma admissions (n=121) (Figure 4.5a), which represented 10% of its total number of admissions (Figure 4.5b). Beaumont Hospital Neurosurgical ICU had the largest number of TBI admissions (n=82), which represented 23% of its total number of admissions. In the General ICUs, the proportion of admissions after trauma and TBI was consistently around the national averages of 9% and 3%, respectively.

Our data show trauma admissions were widely distributed among all participating hospitals. It is likely that the development of trauma centres will lead to greater centralisation of these patients in the future. Our data on ICU admissions should be useful in planning the future requirements for ICU beds in trauma centres; further audit data are available also on LOS, organ support, outcomes, etc. for patients admitted to ICU after trauma.



*Tallaght, Connolly, Tullamore, Naas, Kilkenny and St Vincent's had data for only six months of 2018.

FIGURE 4.5A: NUMBER OF ADMISSIONS DIRECT TO EACH UNIT (I) AFTER ALL TRAUMA AND (II) AFTER TRAUMATIC BRAIN INJURY*

* Full hospital names are available within the frequency tables.

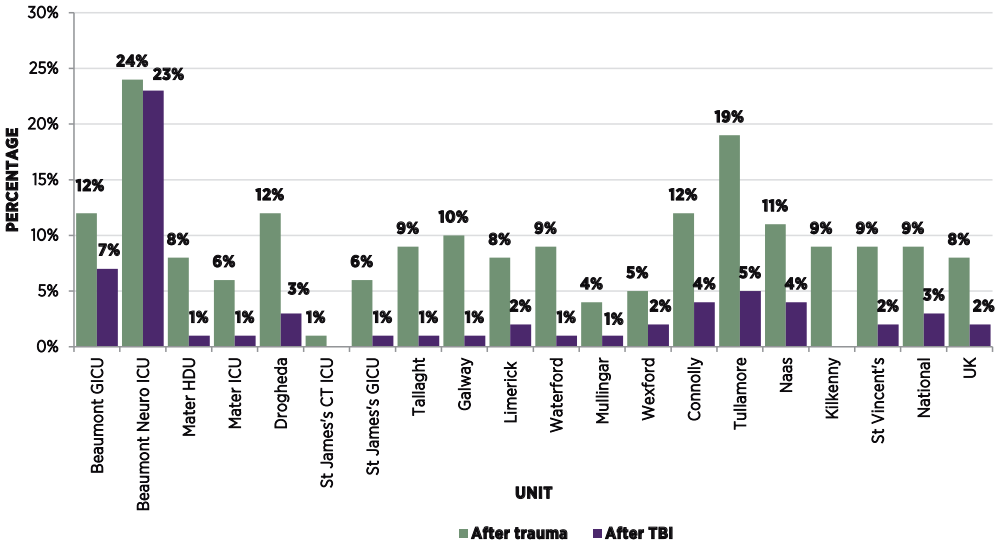
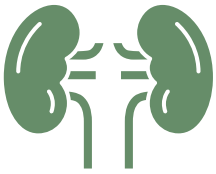


FIGURE 4.5B: ADMISSIONS TO EACH UNIT (I) AFTER ALL TRAUMA AND (II) AFTER TRAUMATIC BRAIN INJURY (AS A PERCENTAGE OF ALL ADMISSIONS)*

> *Gretta: He had the accident on Saturday evening and on the Monday night, Monday evening, they transferred him to ICU in Hospital B.*

* Full hospital names are available within the frequency tables.

ICU ADMISSIONS WITH ACUTE KIDNEY INJURY



Acute kidney injury (AKI) is associated with increased mortality and morbidity, both in the short term and long term. The Kidney Disease: Improving Global Outcomes (KDIGO) classification system is used to define and grade AKI as KDIGO Stages 1–3.

KDIGO Stage 1 is defined as an increase in serum creatinine more than 1.5 times above the baseline value or oliguria (urine output <0.5 ml/kg/hr for <6 hours). The proportion of patients with AKI (KDIGO Stages 1–3) in the first 24 hours after admissions was 51% nationally, with most General ICUs having a rate around this figure (Figure 4.6). AKI within 24 hours of admission usually reflects kidney injury which occurred in the period before admission to ICU.

KDIGO Stage 3 is defined as an increase in serum creatinine to more than three times the baseline value or more prolonged oliguria (see reference for full definitions). KDIGO Stage 3 indicates a greater severity of AKI with a greater requirement for organ support (including dialysis) and increased mortality.

The proportion of patients with KDIGO Stage 3 in General ICUs within 24 hours of admission ranged from 7% (Naas) to 25% (Waterford). The percentage of patients with KDIGO Stage 3 AKI for all Irish Units was 13%, similar to that in the UK (12%).

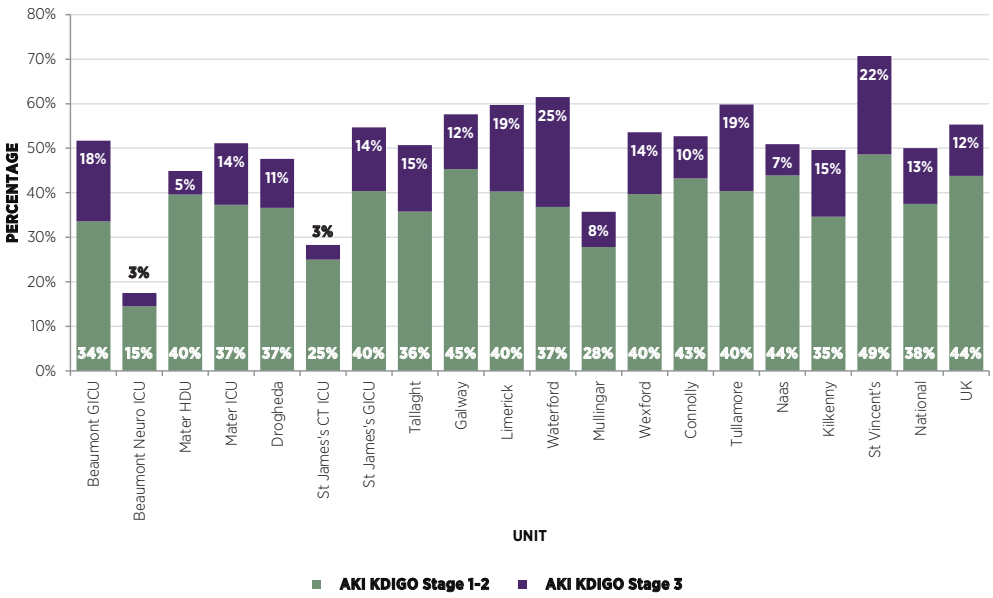


FIGURE 4.6: PATIENTS WITH ACUTE KIDNEY INJURY DURING THE FIRST 24 HOURS AFTER ADMISSION (KDIGO STAGES 1–3) (AS A PERCENTAGE OF ALL ICU ADMISSIONS)*

* Full hospital names are available within the frequency tables.

ICU ADMISSIONS WITH SEPSIS (SEPSIS-2)

Sepsis is a leading reason for admission to ICU, reflected in the consistently high percentage of admissions with sepsis (Figure 4.7). The incidence was lower in specialist Units (cardiothoracic and neurosurgical), where admissions are commonly directly postoperative (Figure 4.4). The national percentage of admissions with sepsis was similar to that in the UK (27%).

Sepsis with dysfunction in four or more organ systems is associated with a high mortality rate and a requirement for support of multiple organ systems. This severity of illness usually reflects the course of the illness in the period before admission to ICU and possibly indicates delayed admission to ICU. The proportion of cases with sepsis and dysfunction in four or more organ systems ranged from 1% to 8% in participating Units.

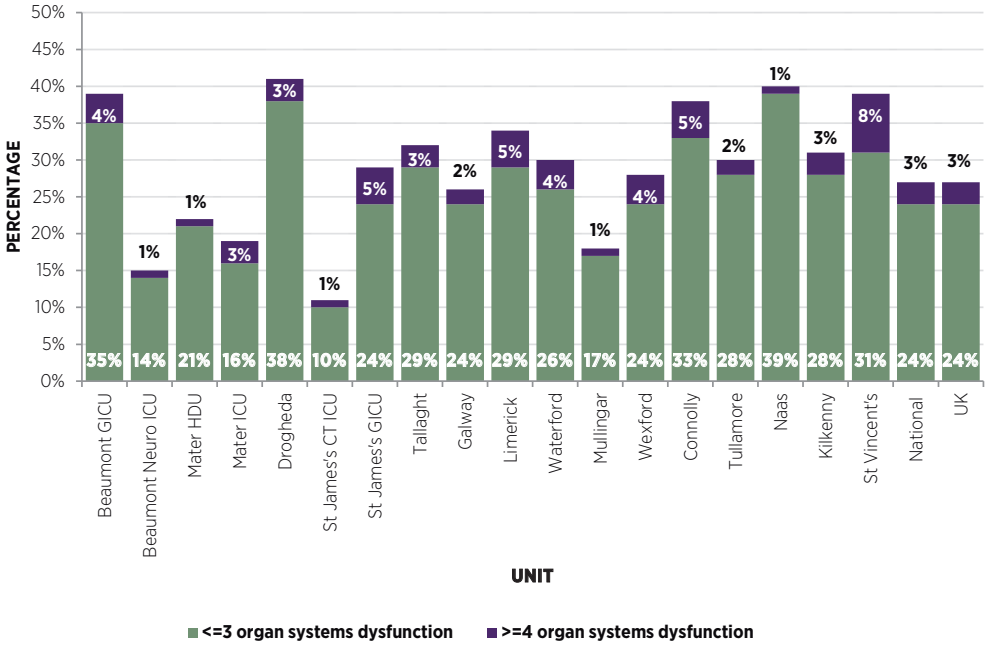


FIGURE 4.7: ADMISSIONS TO THE UNIT WITH A DIAGNOSIS OF SEPSIS (SEPSIS-2) WITH (I) THREE OR FEWER ORGAN SYSTEMS DYSFUNCTION AND (II) FOUR OR MORE ORGAN SYSTEMS DYSFUNCTION, WITHIN 24 HOURS OF ADMISSION (AS PERCENTAGES OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

ADMISSIONS FOLLOWING CARDIOPULMONARY RESUSCITATION (CPR) IN THE COMMUNITY OR CPR IN HOSPITAL

The proportion of patients who were admitted to General ICUs following CPR varied considerably – from 5% to 15%. These patients have a worse prognosis than other ICU admissions. Ireland had a similar proportion of ICU admissions after CPR to the UK (6.3% versus 5.4%).

The proportion of admissions to General ICUs after in-hospital CPR ranged from 2.1% to 9.8%. Numbers of hospital inpatients who require ICU admission after CPR can be an indication of the quality of care outside ICU. There are too many variables involved for direct comparisons between Units to be valid. However, hospitals could track their own numbers over time or admissions after inpatient CPR, as percentages of all acute hospital admissions could be compared between hospitals as a measure of quality of care.

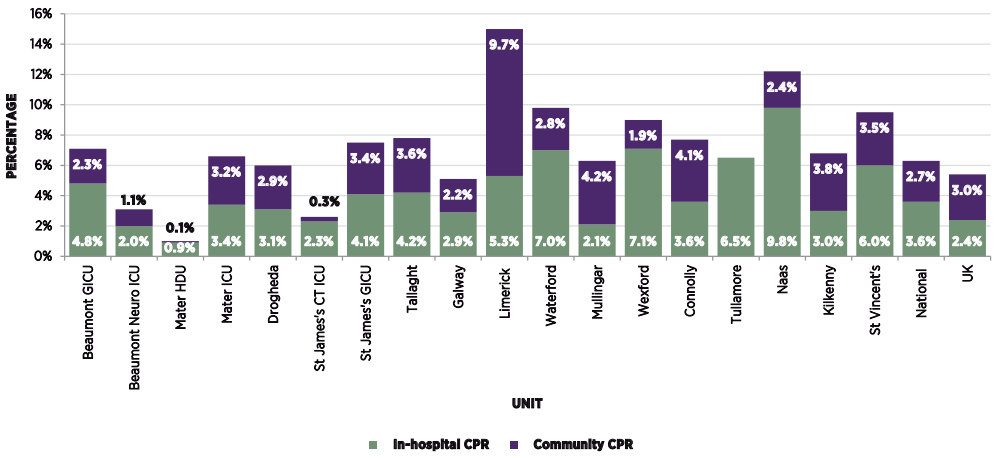


FIGURE 4.8: ADMISSIONS FOLLOWING CPR IN THE COMMUNITY OR IN HOSPITAL (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

ADMISSIONS AS A RESULT OF SERIOUS ILLNESSES (SEVERE LIVER DISEASE, HAEMATOLOGICAL MALIGNANCY, METASTATIC DISEASE)

These three subgroups of patients are important, even though they make up a small proportion of ICU admissions. These patients tend to be sicker, have very high mortality rates, and use more ICU resources than other ICU admissions. For these reasons, there may often be considerable discussion about the appropriateness of admitting these patients to ICU.

The proportion of patients who were admitted to participating ICUs with severe liver disease ranged from 0% to 9% (St Vincent's, which is the national specialist liver centre) (Figure 4.9a and Figure 4.9b).

The proportion of patients who were admitted to participating ICUs with haematological malignancy ranged from 0% to 5% (Figure 4.10a and Figure 4.10b).

The proportion of patients who were admitted to participating ICUs with metastatic disease ranged from 0% to 18% (Figure 4.11a and Figure 4.11b).

The proportion of ICU admissions with each of these three diagnoses was similar in Ireland and in the UK.

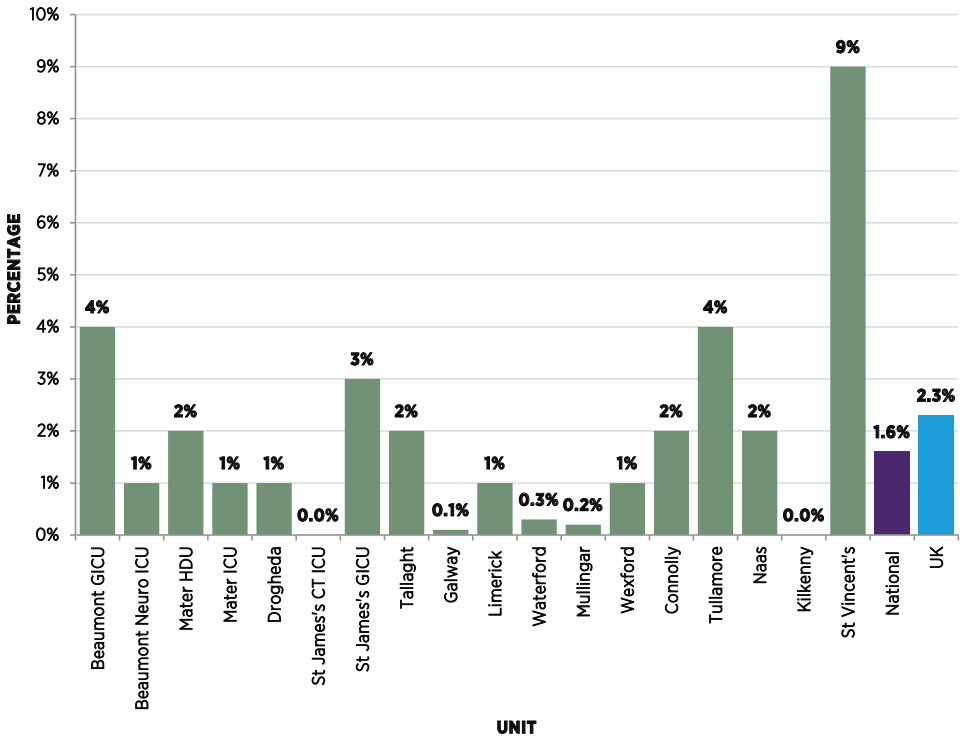


FIGURE 4.9A: ADMISSIONS WITH SEVERE LIVER DISEASE (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

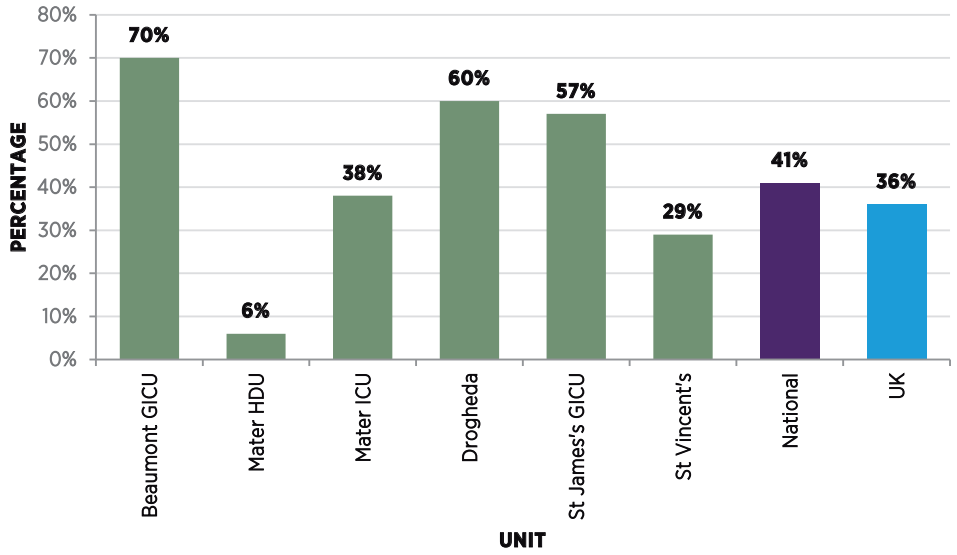


FIGURE 4.9B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH SEVERE LIVER DISEASE*

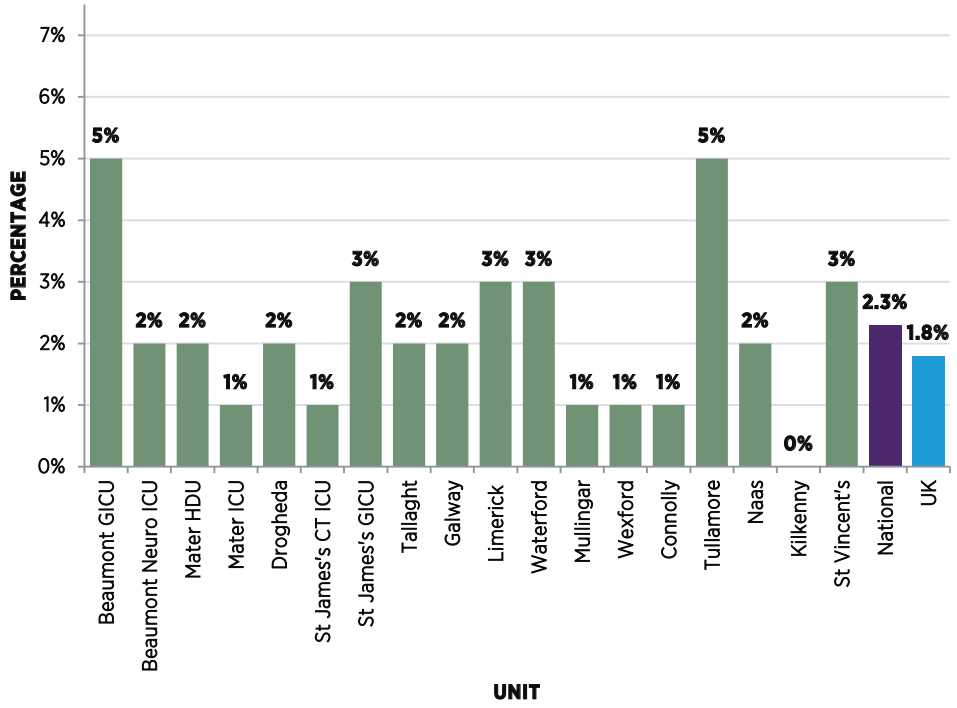


FIGURE 4.10A: ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

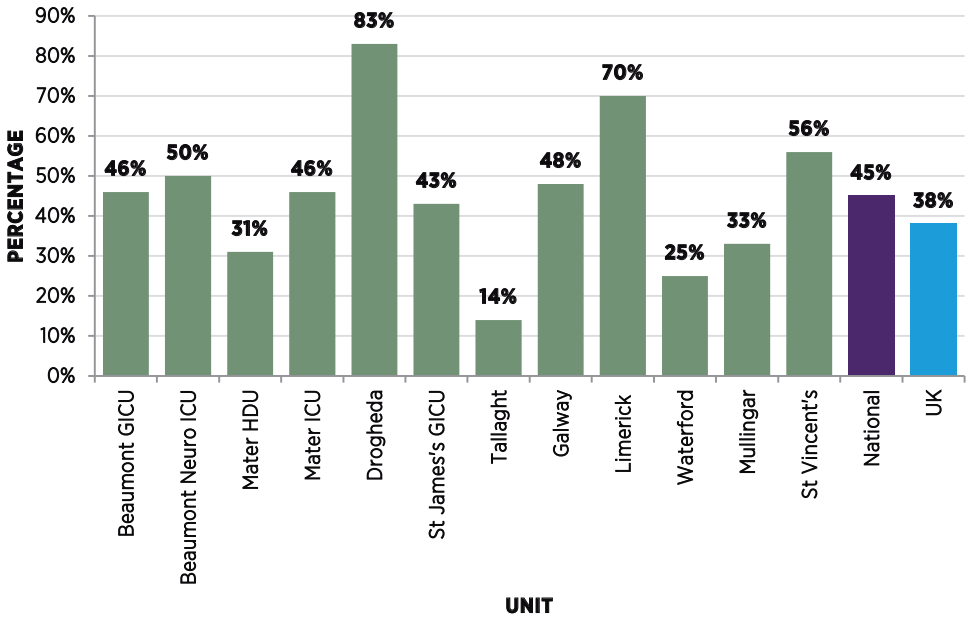


FIGURE 4.10B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY*

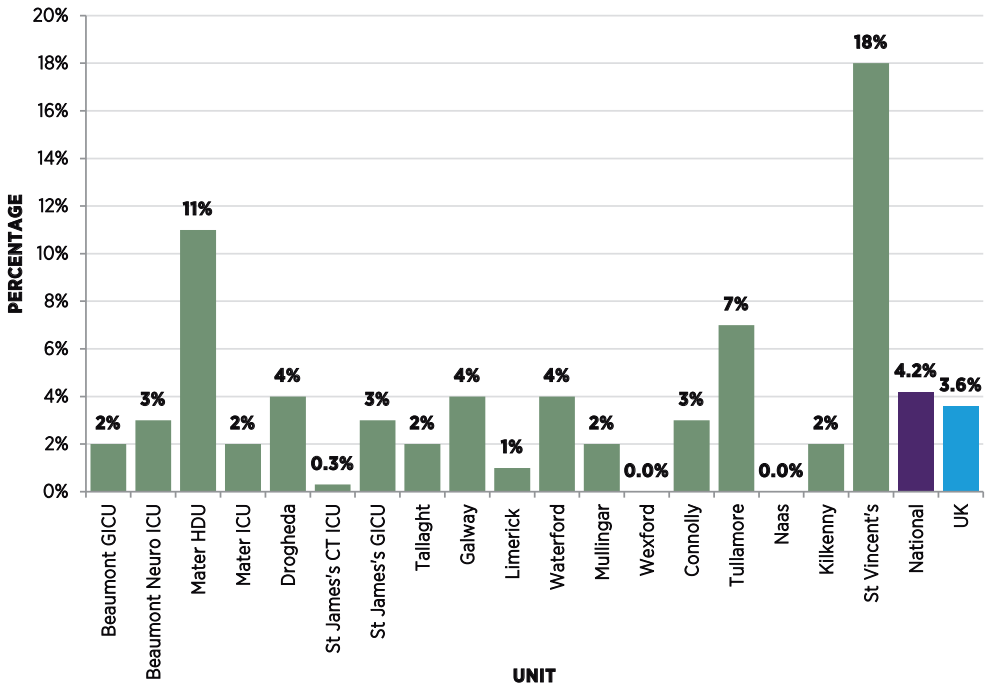


FIGURE 4.11A: UNIT ADMISSIONS WITH METASTATIC DISEASE (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

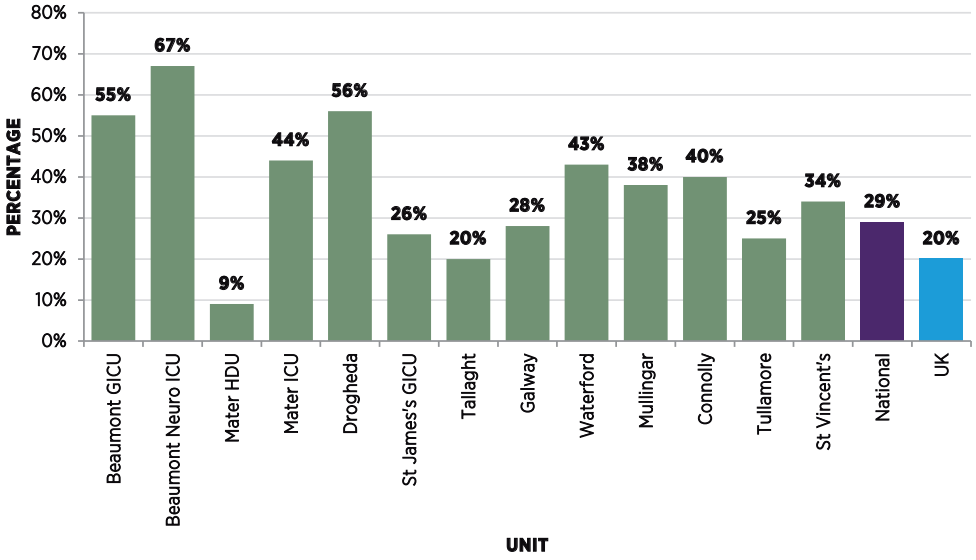


FIGURE 4.11B: HOSPITAL MORTALITY IN UNIT ADMISSIONS WITH METASTATIC DISEASE*

* Full hospital names are available within the frequency tables.

CHILDREN IN ADULT ICUs

Ideally, all patients under 16 years of age should be admitted to a paediatric hospital and to a specialist paediatric ICU if they required admission to an ICU. In 2018, 103 children under 16 years of age were admitted to the adult ICUs included in this report (1.2% of all Unit admissions). Details are provided in Table 4.2.

TABLE 4.2: CHILDREN <16 YEARS ADMITTED TO ICU: AGE, ADMISSIONS AFTER SURGERY AND WITH SEPSIS, UNIT LENGTH OF STAY, AND SURVIVAL TO HOSPITAL DISCHARGE

Parameter	n
Patients <16 years old	103
Age, mean (median; interquartile range (IQR)	8.7 (11; 3, 14) years
Age <1 year	11
Age <6 years	35
Admissions after surgery	26
Admissions with sepsis	16
Invasive ventilation	30 (28%)
Unit LOS; mean (median; IQR) (hours)	51 (22; 15–48)
Unit survival (n)	98 (96%)
Hospital survival (n)	98 (96%)

The numbers of children admitted to individual Units was very small, with the exceptions of Beaumont Neurosurgical ICU and Galway ICU (Table 4.3). This presumably reflects a requirement for specialist care (e.g. neurosurgery in Beaumont) or geographical distance (e.g. Galway). LOS was very short in Galway and in other Units where geographical distance was a factor, indicating rapid transfer to a Paediatric Unit if ICU care was going to be prolonged. LOS was somewhat longer in the specialist Units, reflecting the lack of options for transferring out. Only Galway admitted children less than six years old.

TABLE 4.3: NUMBERS OF PATIENTS AGED <16 YEARS, PATIENTS AGED <6 YEARS, LENGTH OF STAY, NUMBERS VENTILATED

Unit	Beaumont GIGU	Beaumont NICU	Mater HDU	Mater GIGU	Tallaght ICU	Galway ICU	Limerick ICU	Wexford ICU
Patients <1 year	0	0	0	0	0	11	0	0
Patients <6 years	0	0	0	0	0	24	0	0
Patients 6-16 years	1	22	1	3	2	41	3	1
Mean LOS (days)	0.5	4.2	8.1	5.1	3.9	1.1	0.6	1.6
Ventilated (n)	1	13	3	0	1	8	2	0

KEY FINDINGS FROM CHAPTER 4

- The Units participating in the Irish National ICU Audit in 2018 provided 70.4% of all ICU care in HSE-funded hospitals.
- The data presented in this chapter provide an overview of the demographics and case mix of the patients admitted to ICU.
- Units varied widely in bed numbers, numbers of admissions and case mix. These differences must be considered in all comparisons between Units.
- The mean age for patients in the ROI in 2018 was 61 years.
- Gender distribution showed 60% of patients were male, which is in line with international experience.
- Admissions after trauma were widely distributed throughout all hospitals, with the largest number (n=121) admitted to University Hospital Galway and the largest number after TBI admitted to Beaumont Hospital Neuro ICU (n=82).
- Fifty-one per cent of admissions had AKI within 24 hours of admission, with 13% having severe AKI (KDIGO Stage 3).
- Twenty-seven per cent of admissions fulfilled criteria for sepsis. The proportion of these patients with dysfunction in four or more organ systems ranged from 1% to 8% in different Units.
- The proportion of admissions to General ICUs which followed in-hospital CPR ranged from 2.1% to 9.8%.
- A small proportion of admissions had severe liver disease (2%), haematological malignancy (2%) or metastatic disease (4%). Patients from these groups had a high mortality rate.
- Comparisons of data for age, gender and case mix between Irish Units and UK Units showed no major differences.
- Numbers of children (<16 years) admitted to adult ICUs were very small, with the exceptions of Beaumont Neurosurgical Unit and Galway ICU. Mean LOS was very short, except in the specialist Units. Survival to discharge from acute hospital was 96%.

CHAPTER 5

ORGAN SUPPORT IN ICU

CHAPTER 5: **ORGAN SUPPORT IN ICU**

ILLNESS SEVERITY SCORES ON ADMISSION TO ICU

ICU patients vary widely in the severity of their illness and a number of scoring systems are used to assess this. The Acute Physiology and Chronic Health Evaluation (APACHE II) system is the most widely used and best-known measure of illness severity in the critically ill. APACHE II scores are based on patient age, pre-existing health conditions, and acute physiological derangement.

Mean APACHE II scores ranged from 13 to 19 across different Units, reflecting differences in case mix between Units (Figure 5.1). The mean APACHE II score for all admissions in participating Irish Units was 16 (versus 15 in the UK).

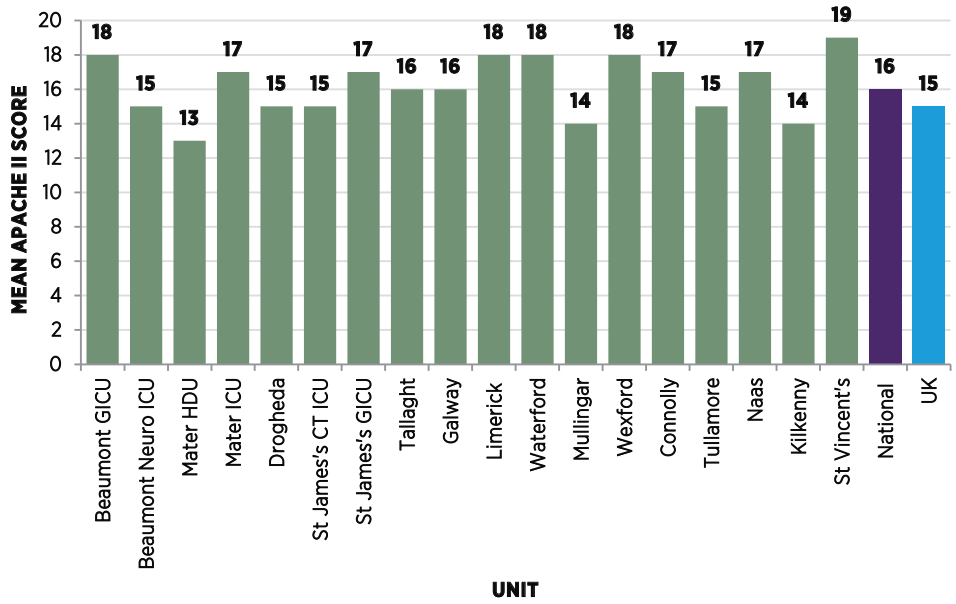


FIGURE 5.1: MEAN APACHE II SCORES FOR EACH UNIT*

> ***Gretta: In the ICU, everything was so focused on him medically, and all I wanted to know was that he was going to get up out of that bed and walk into my arms again like he used to when he was younger.***

* Full hospital names are available within the frequency tables.

PREDICTED RISK OF DEATH ON ADMISSION TO ICU

Mortality is predicted by the ICNARC$_{H\text{-}2015}$ model, which has been refined over the past 25 years, is frequently updated, and has excellent predictive value. The model is based on multiple variables, including age, pre-existing conditions, dependency before admission, CPR before admission, admission diagnosis, source of admission, acute physiological status, and requirement for ventilation in the first 24 hours after admission.

Predicted mortality shows considerably more variability between Units than APACHE II scores (Figure 5.2), reflecting important differences in case mix between participating Units. The highest predicted mortality rate was for St Vincent's University Hospital (24%). This is partly explained by the high percentage of patients admitted with liver disease (9%; Figure 4.9a) and metastatic disease (18%; Figure 4.11a). Naas General Hospital had a predicted mortality of 18%, which is partly explained by 12.2% of patients undergoing CPR in the 24 hours before admission (Figure 4.8).

The median predicted mortality rate was 7% for Irish patients versus 5% for UK patients. While a statistical comparison has not been undertaken (as NOCA does not have access to individual patient data), this suggests that ICU patients are sicker on admission in Ireland than in the UK. This may reflect either delayed access to ICU in Ireland, limited bed capacity, or both. Data from the new KPI for ICU access may help to inform this issue (Figure 7.1).

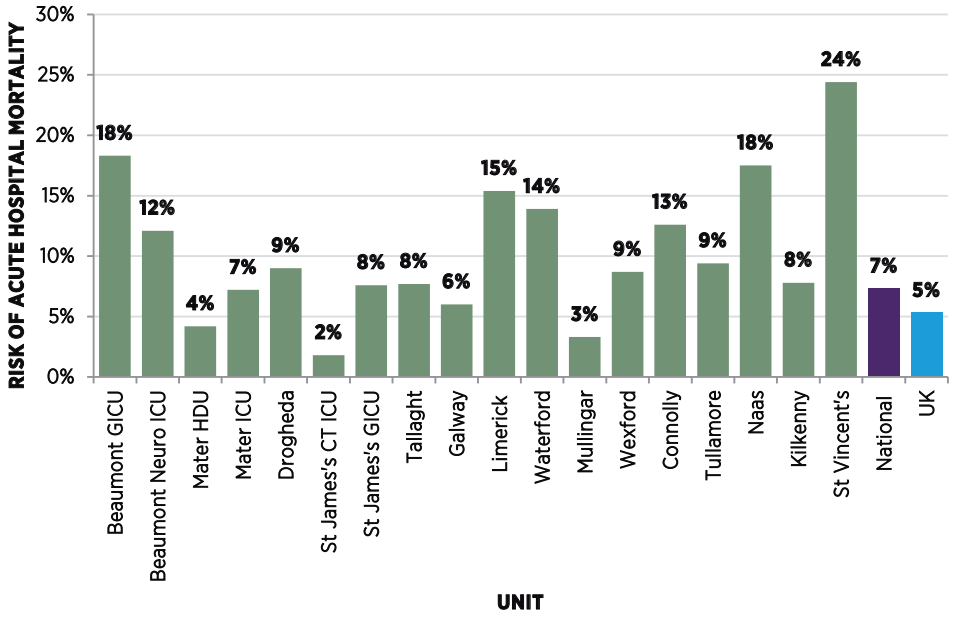


FIGURE 5.2: PREDICTED RISK OF ACUTE HOSPITAL MORTALITY (ICNARC$_{H\text{-}2015}$ MODEL) (MEDIANS)*

> ***Gretta: It was explained to us very very clearly that the chance of him surviving the surgery was very slim, and so we sat in the hospital until maybe five o'clock that evening waiting for word.***

* Full hospital names are available within the frequency tables.

ADVANCED RESPIRATORY SUPPORT AFTER ADMISSION TO ICU

Advanced respiratory support (ARS) is defined as mechanical ventilation via an invasive airway (endotracheal tube or tracheostomy).

There was wide variability in the percentage of patients receiving ARS (Figure 5.3), as might be expected with Units ranging from a pure HDU to mixed ICU/HDUs to a specialist cardiothoracic ICU. Some 51% of patients in Ireland received ARS versus 41% in the UK.

The percentage of Unit patient days when ARS was provided followed a similar pattern to the percentage of patients who received ARS (Figure 5.4). The percentage of patient days when ARS was provided was 46% in Irish Units versus 38% in UK Units. This is consistent with other indicators of greater illness severity in patients on admission to ICU in Ireland, for example, APACHE II scores and predicted mortality.

These data provide useful insights into the relative requirements for ICU beds versus HDU beds. Although a patient may need to be in ICU, even if not receiving ARS, they cannot be safely managed outside ICU if they are receiving ARS (although patients who are ventilated long term via a tracheostomy may be managed in less acute environments).

Even if a patient is not receiving ARS, they may need to be in ICU for other reasons, for example, advanced cardiovascular support, renal support, invasive monitoring (intra-arterial, intracranial), for close observation, in the periods before and after the provision of ARS, or for general complexity of care. While the numbers requiring ARS underestimates the total requirement for ICU beds, it is the best single indicator of the numbers of patients who require care at this level.

The European Society of Intensive Care Medicine (ESICM, 2011) defines those requiring Level 3 care as patients with 'two or more acute vital organ failure of an immediate life-threatening character' (Valentin *et al.* 2011). The Joint Faculty of Intensive Care Medicine of Ireland (JFICMI,2019) recommends that Units providing Level 3 care should treat a minimum of 200 patients per annum who require Level 3 care, in order to maintain skills and expertise.

Level 3 care for critically ill patients is currently provided in 26 hospitals in Ireland, many with relatively low numbers of Level 3 patients. If reconfiguration of services for critically ill patients is going to take place in the future, the numbers of patients requiring ARS should be one of the factors to be taken into account in deciding the configuration of ICU beds. However, for many of these hospitals, having an on-site ICU is essential in order to support the range of services they provide, despite the fact that their volumes of ICU Level 3 patients are low. It is reassuring that outcomes in all these smaller Units were within acceptable limits, despite small numbers of Level 3 patients (see Chapter 7).

> ***Gretta: It was very organised. I guess because of his ventilation and, you know, while he was still quite stable, still quite up and down.***

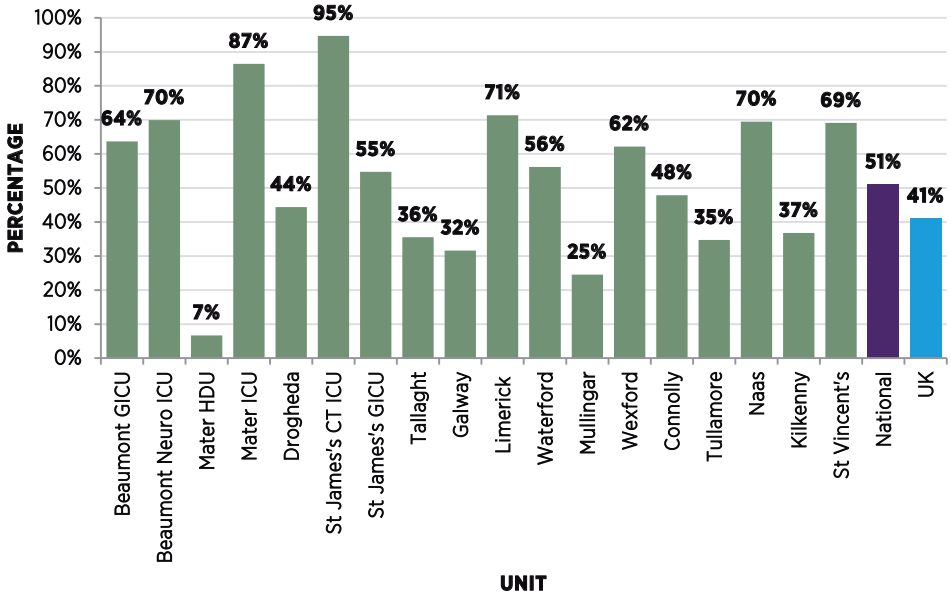


FIGURE 5.3: ADMISSIONS WHO RECEIVED ADVANCED RESPIRATORY SUPPORT (AS A PERCENTAGE OF ALL ADMISSIONS)*

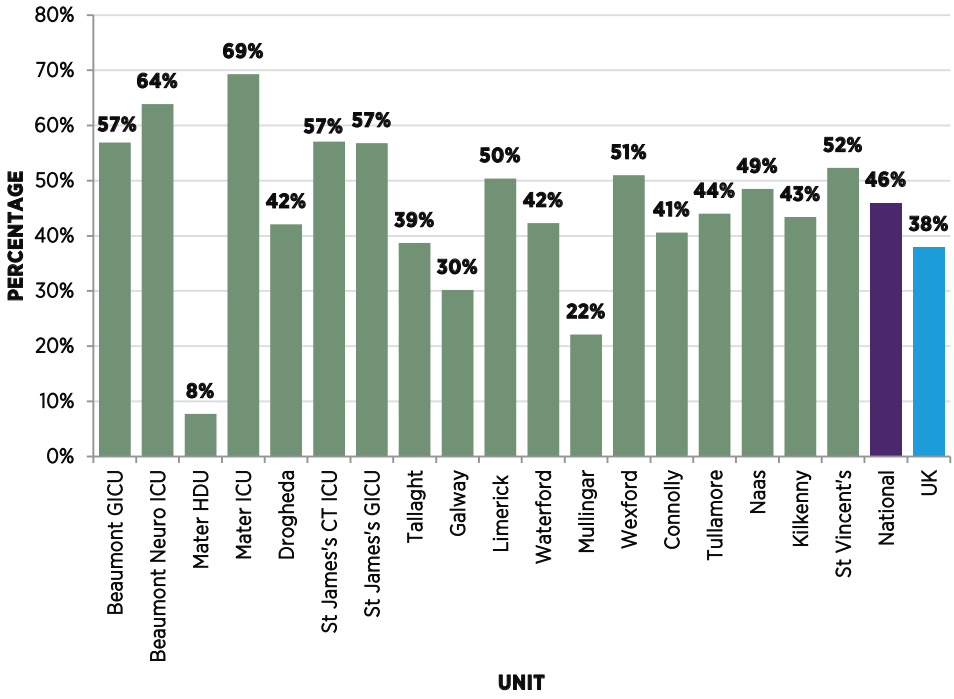


FIGURE 5.4: PATIENT DAYS WHEN ADVANCED RESPIRATORY SUPPORT WAS PROVIDED (AS A PERCENTAGE OF ALL PATIENT DAYS)*

* Full hospital names are available within the frequency tables.

ADVANCED CARDIOVASCULAR SUPPORT AFTER ADMISSION TO ICU

Advanced cardiovascular support means complex care for the cardiovascular system (CVS), that is, a vasopressor plus another intravenous infusion acting on the CVS, or an intra-aortic balloon pump, or a temporary pacemaker or continuous cardiac output measurement. Patients requiring advanced CVS support normally require care in ICU. Commonly, patients who require advanced CVS support will also require ARS, as well as support for other organ systems.

Not surprisingly, this correlates with other measures of complexity, such as APACHE II scores. Advanced CVS support was most frequent in Units that admit a high proportion of patients after cardiac surgery (Figure 5.5). The proportion of bed days receiving advanced CVS support was also greatest in Units which admit patients postoperatively after cardiac surgery (Figure 5.6).

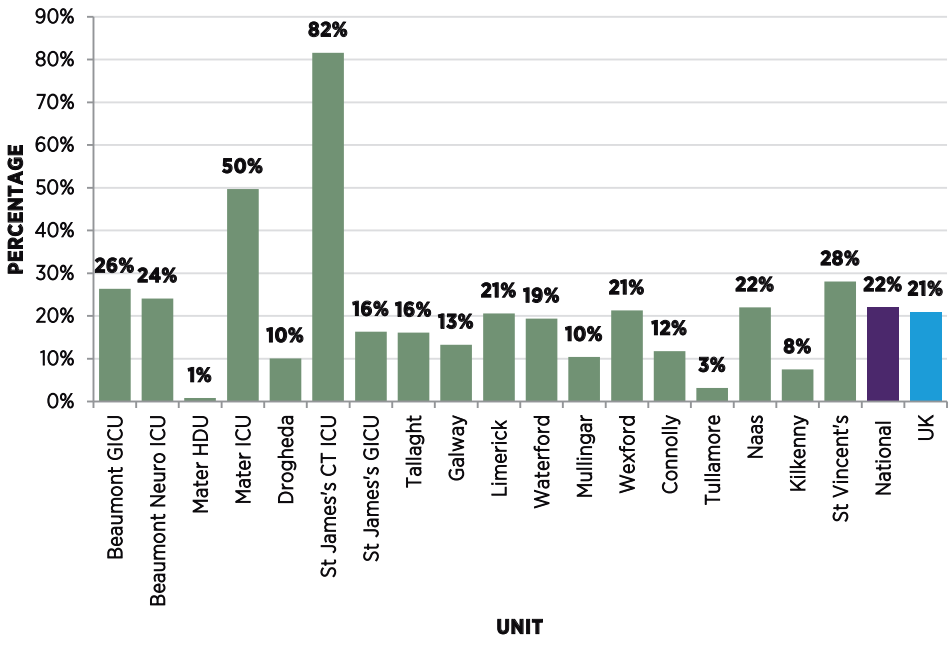


FIGURE 5.5: ADMISSIONS WHO RECEIVED ADVANCED CARDIOVASCULAR SUPPORT (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

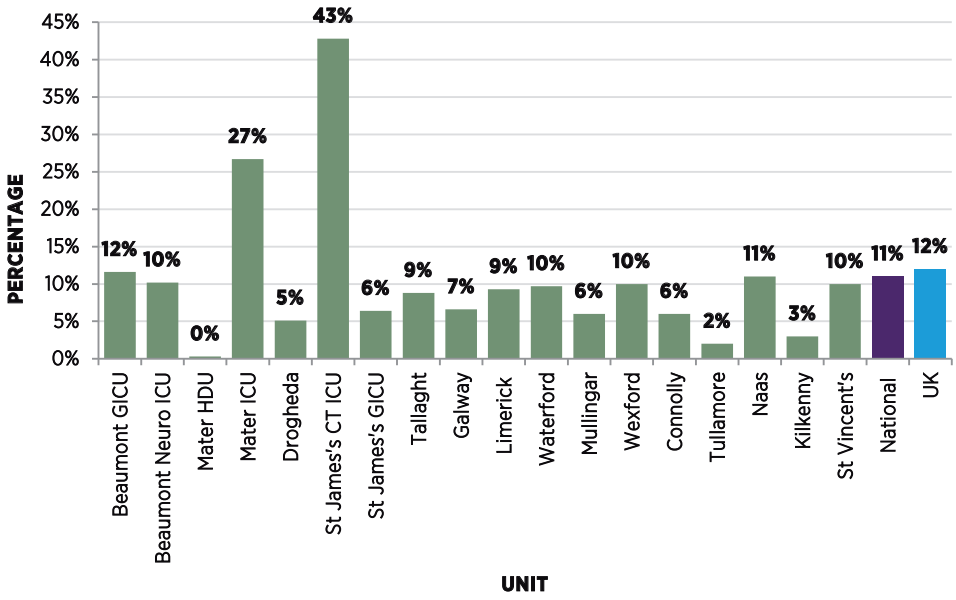


FIGURE 5.6: BED DAYS PROVIDED FOR ADVANCED CARDIOVASCULAR SUPPORT (AS A PERCENTAGE OF ALL PATIENT DAYS)*

* Full hospital names are available within the frequency tables.

RENAL SUPPORT AFTER ADMISSION TO ICU

Renal support is defined as dialysis either for acute renal failure or for patients on long-term dialysis who are also receiving other acute organ support.

Dialysis may be provided as intermittent haemodialysis (HD) or continuous renal replacement therapy (CRRT). Long-term HD for chronic renal failure is normally provided in a Dialysis Unit, but if patients are too sick to be managed off-Unit, HD may be provided in ICU with vasopressor support. However, the majority of dialysis in ICU is provided as CRRT. The data below do not distinguish between CRRT and HD (Figure 5.7).

There was considerable variability between Units in the percentage of patients requiring renal support and the percentage of patient days when renal support was provided (Figures 5.7 and 5.8). Some Units (Naas, Kilkenny) do not undertake renal support, and patients who require this must be transferred to a larger Unit.

Patients who require dialysis in ICU tend to be very ill with multiorgan failure. These patients are commonly ventilated, on vasopressors, receiving enteral or parenteral feeding and have an impaired level of consciousness. Care of these patients is complex, requiring skilled nursing care. Units with a high proportion of patient days providing renal support require high nurse–patient staffing ratios and highly skilled nurses.

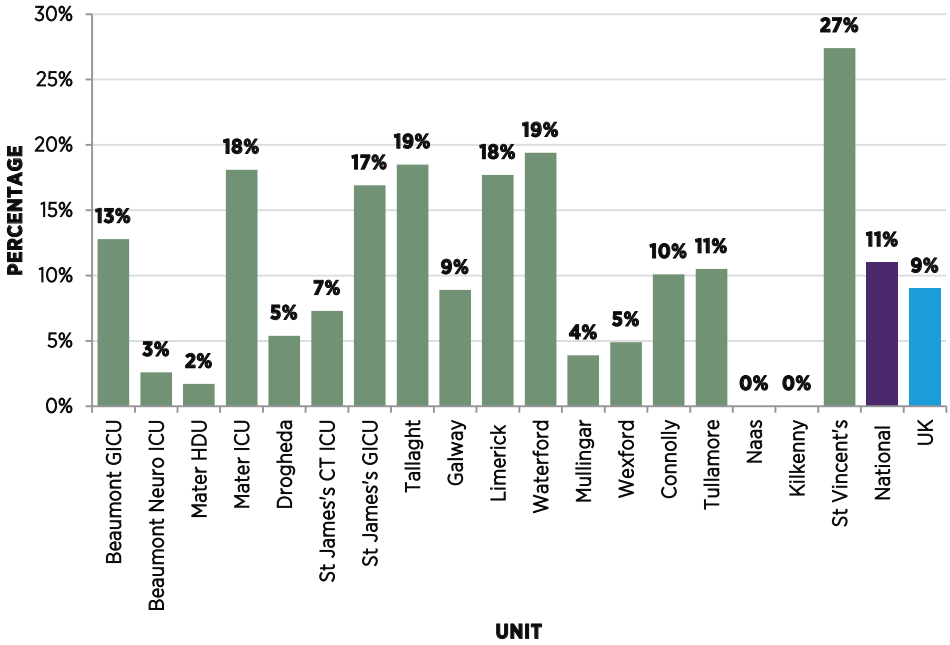


FIGURE 5.7: PATIENTS WHO UNDERWENT DIALYSIS (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

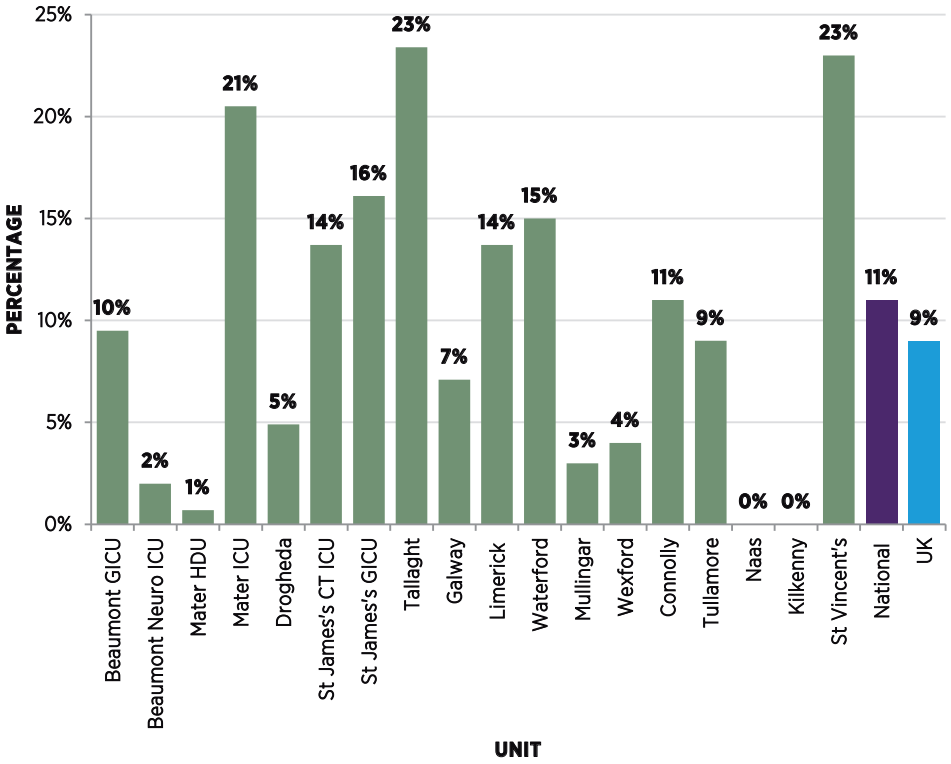


FIGURE 5.8: BED DAYS WHILE PROVIDING DIALYSIS (AS A PERCENTAGE OF ALL PATIENT DAYS)*

* Full hospital names are available within the frequency tables.

GASTROINTESTINAL SUPPORT AFTER ADMISSION TO ICU

Enteral nutrition is provided via a tube into the stomach or small bowel. Parenteral nutrition is provided by infusion into a large vein. These methods of nutrition are required in patients who are unable to eat due to coma, impaired swallowing, or if the gut is not working properly. Enteral or parenteral nutrition is not needed if the patient is able to eat or if the period without nutrition is short, for example, after surgery. If the duration without nutrition is prolonged, it is good practice to initiate artificial nutrition.

Figure 5.9 shows the proportion of patients who received enteral or parenteral nutrition at some point during their stay in the Unit. Figure 5.10 shows the proportion of patient days when enteral or parenteral nutrition was provided. While higher values indicate good practice, some of the lower values are explained by patients having a short stay in the Unit or being able to eat normally while still in the Unit, for example, after recovery from cardiothoracic surgery.

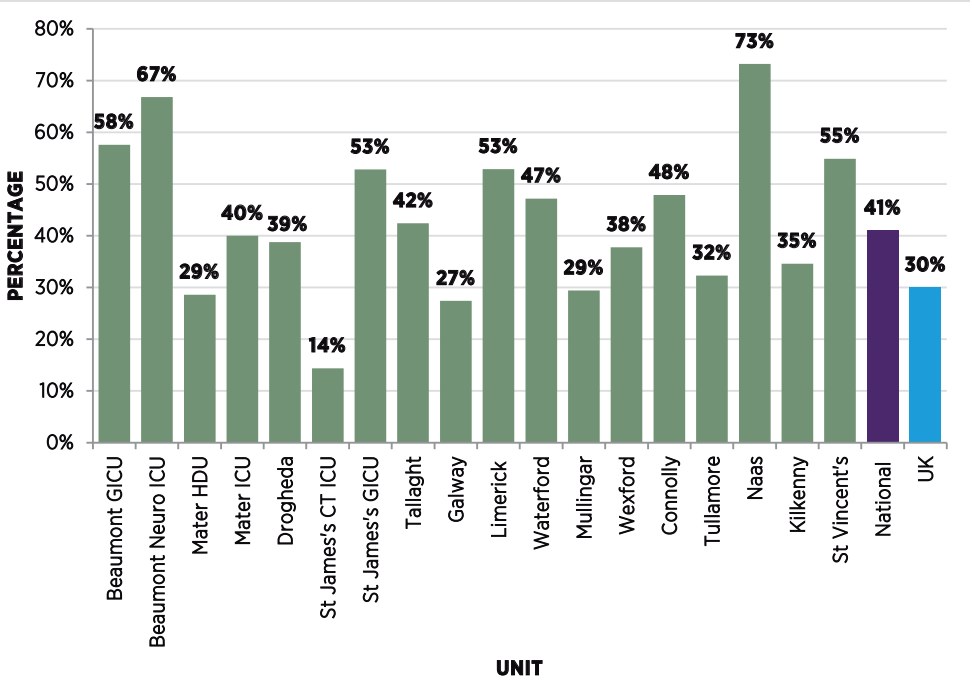


FIGURE 5.9: ADMISSIONS WHO RECEIVED ENTERAL OR PARENTERAL NUTRITION (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

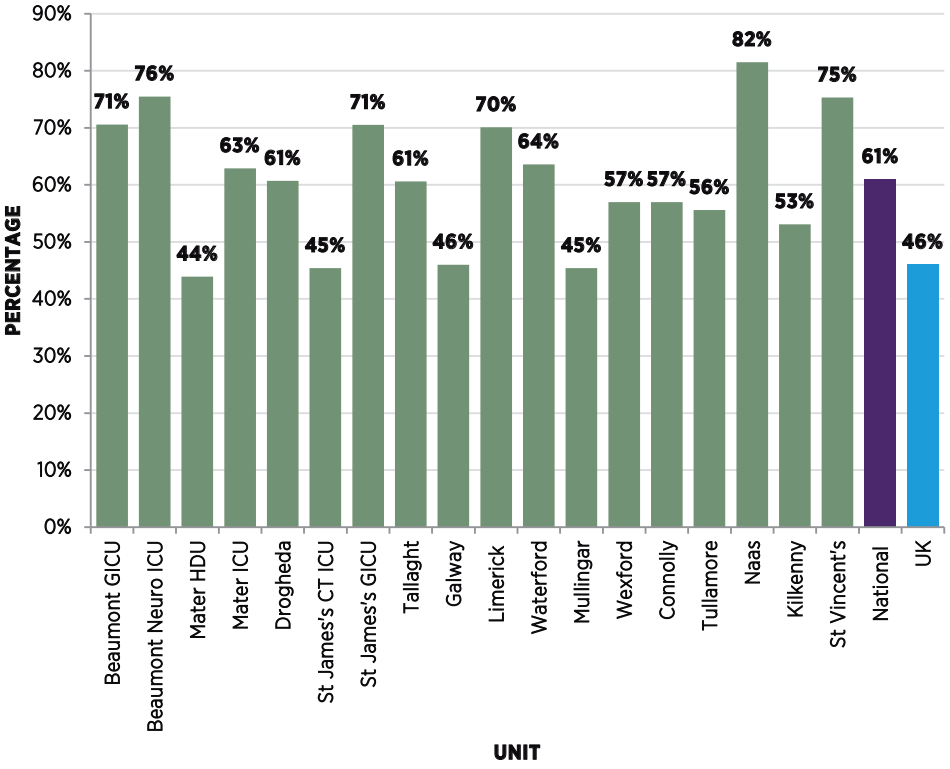


FIGURE 5.10: BED DAYS WHEN ENTERAL OR PARENTERAL NUTRITION WAS PROVIDED (AS A PERCENTAGE OF ALL PATIENT DAYS)*

* Full hospital names are available within the frequency tables.

NUMBER OF ORGAN SYSTEMS SUPPORTED IN ICU

ICNARC reports the number of organ systems supported and the number of patient days this support is provided. Figures 5.11 and 5.12 show the percentage of patients who had three or more organ systems supported and the proportion of all bed days when this support was provided. This gives an indication of the severity of illness treated in a Unit and the resources utilised. These data are consistent with other indicators of illness severity, such as APACHE II score, the provision of ARS and advanced CVS support, renal support (dialysis), etc.

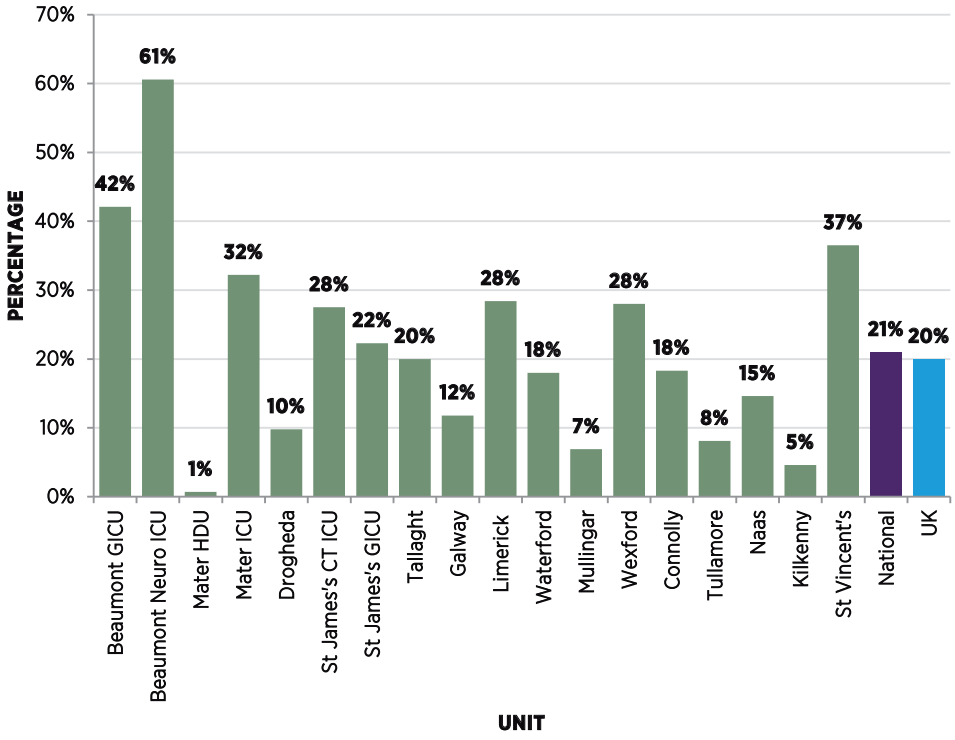


FIGURE 5.11: PATIENTS WHO RECEIVED SUPPORT FOR THREE OR MORE ORGAN SYSTEMS (AS A PERCENTAGE OF ALL ADMISSIONS)*

* Full hospital names are available within the frequency tables.

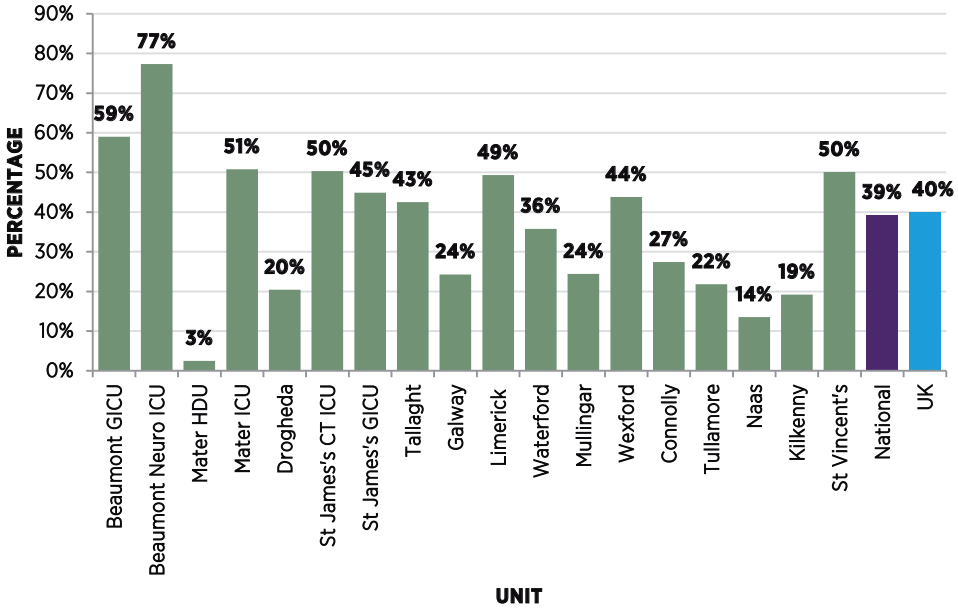


FIGURE 5.12: PATIENT DAYS WITH THREE OR MORE ORGAN SYSTEMS SUPPORTED (AS A PERCENTAGE OF ALL PATIENT DAYS)*

* Full hospital names are available within the frequency tables.

UNIT-ACQUIRED BLOODSTREAM INFECTION

Infection is an important condition in critically ill patients. Many patients are admitted to ICU because of infection or because of another condition but with co-existing infection.

Many patients also develop infection while in ICU. Patients with organ failure have impaired mechanisms for defence against infection. Many patients are admitted after surgery or trauma, both of which lead to a breach in barriers against infection and reduced resistance to infection.

Infection is particularly serious if it enters the bloodstream; bloodstream infection acquired in the Unit is termed UABSI. UABSI is important to audit because (i) it is a serious condition which increases the risk of death and (ii) its incidence can be reduced by good clinical practice in the Unit. Aspects of patient management may reduce resistance to infection, and poor infection prevention precautions by staff may increase the risks of infection; for example, not washing hands.

All Units routinely monitor patients closely for infection but the methodology for measuring rates of infection often differs between Units. The NOCA ICU Audit is trying to standardise the approach to measuring rates of infection in ICU in association with the Health Protection Surveillance Centre, but there is some distance to go in achieving this aim.

The presence or absence of UABSI and the source of UABSI may not be clear-cut and different staff may have different opinions on these issues. For this reason, NOCA requires that these issues have been agreed by an MDT before entering data on UABSI in the ICU Audit database. To date, only five of the participating Units have this mechanism in place. Data are presented from these Units in Table 5.1.

Some 2.3% of patients who stayed more than 48 hours in ICU developed UABSI. The commonest source was pulmonary (32% of cases), followed by central venous catheter (27%) and digestive tract (17%) (Table 5.1). UK data were not available.

TABLE 5.1: INCIDENCE AND SOURCE OF UABSI IN UNITS WITH MDT IN PLACE TO DIAGNOSE UABSI

Incidence	**n**	**%**
Admissions	2947	100%
Admissions who stayed >48 hours	1788	61%
MDT – confirmed UABSI (inpatients >48 hours in Unit)	41	2.3%
Source of UABSI	**n**	**%**
CVC	11	27%
Peripheral venous catheter	0	0%
Pulmonary	13	32%
Urinary tract	3	7%
Digestive tract	7	17%
Surgical site	2	4.9%
Skin and soft tissue	1	2.4%
Other identifiable origin	1	2.4%
Origin unidentifiable	3	3.7%

The incidence of UABSI in individual Units is listed in Table 5.2, along with the source of UABSI. The rate of UABSI ranged from 0.3% to 5.0% in patients who spent more than 48 hours in the Unit.

A key quality indicator is the rate of UABSI from central venous catheter (CVC) infection per 1,000 line days. We do not have these denominator data for the participating Units, but hope to develop the capacity to collect this in the future.

TABLE 5.2: INCIDENCE AND SOURCE OF UABSI IN INDIVIDUAL UNITS WITH MDT IN PLACE TO DIAGNOSE UABSI

Unit	Beaumont GICU	Beaumont Neuro ICU	Galway	Limerick	St Vincent's
Admissions (n)	662	352	1204	412	317
Stayed >48 hours (n)	391	258	640	280	219
Stayed >48 hours + UABSI, n (%)	13 (3.3)	13 (5.0)	2 (0.3)	6 (2.1)	7 (3.2)
Source of UABSI	**Beaumont GICU**	**Beaumont Neuro ICU**	**Galway**	**Limerick**	**St Vincent's**
CVC (%)	1 (0.3)	3 (1.2)	2 (0.3)	0 (0)	5 (2.3)
Peripheral venous catheter	0	0	0	0	0
Pulmonary	3	6	0	3	1
Urinary tract	2	1	0	0	0
Digestive tract	4	0	0	3	0
Surgical site	0	1	0	0	1
Skin and soft tissue	0	1	0	0	0
Other identifiable source	0	1	0	0	0
Origin unidentifiable	3	0	0	0	0

KEY FINDINGS FROM CHAPTER 5

- There was considerable variability between Units in measures of illness severity and in the levels of organ support provided. This is to be expected in view of the heterogeneity of the Units participating.

- Patients in the larger Units in major referral centres tended to require higher levels of organ support, as would be expected.

- The Mean APACHE II score was 16 for all admissions in participating Irish Units versus 15 in the UK.

- The median predicted mortality rate was 7% for Irish patients versus 5% for UK patients, suggesting that patients are sicker on admission to ICU in Ireland than in the UK. This is also suggested by the higher requirements for invasive ventilation in Ireland (51% versus 41%), although requirements for complex cardiovascular support and for dialysis were similar in Ireland and in the UK.

- These data provide insight into variations between Units in the complexity of illness and requirements for resources.

- The numbers of patients requiring invasive ventilation varied widely between Units, some of which had relatively low patient numbers. Similarly, some Units had small numbers of patients requiring support of multiple organ systems, which means that those Units have less experience in managing these patients. These data should be taken into account in any future planning for reconfiguration of critical care services.

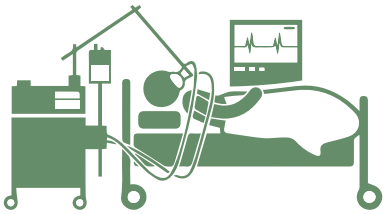
- UABSI was formally audited in five Units. Some 2.3% of all admissions developed UABSI. Some 0.6% of all admissions developed UABSI, with a CVC as the source.

CHAPTER 6

BED UTILISATION

CHAPTER 6: **BED UTILISATION**

BED OCCUPANCY



Ireland had 249 ICU/HDU beds in publicly funded hospitals in 2018 (240 in 2017). Together with 43 critical care beds in private hospitals, this gives Ireland a figure of 6.0 ICU/HDU beds per 100,000 population, which is well below the European average of 11.5 beds per 100,000 population (Rhodes, 2012). This underprovision of beds led to high levels of bed occupancy, as critically ill patients usually needed an ICU bed urgently and had to be admitted, even if it led to the Unit operating overcapacity. High levels of ICU bed occupancy are recognised as leading to delay in ICU admission, early discharge, cancellation of elective surgery, and increased incidence of hospital-acquired infection.

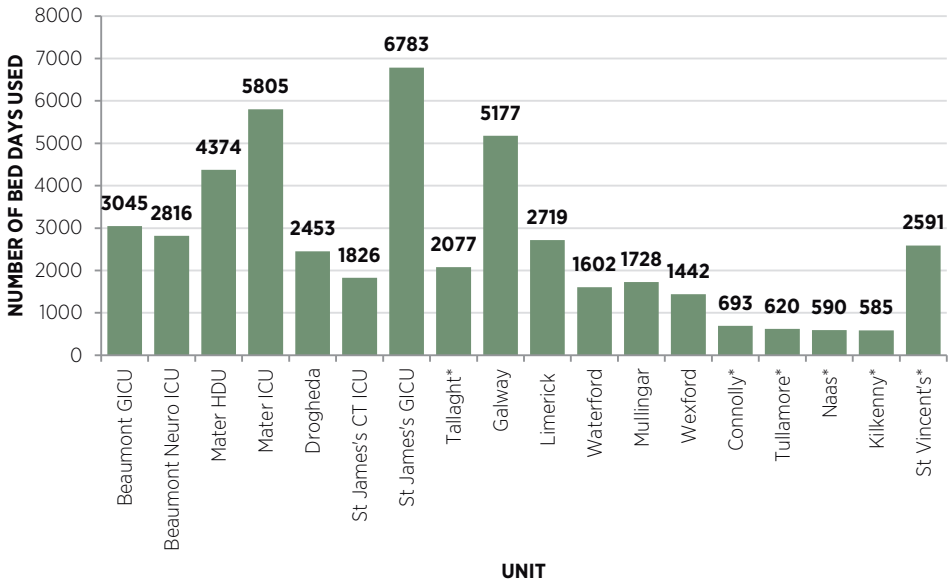
Recommendations for appropriate levels of ICU bed occupancy differ between different authorities, generally due to differences in the method of calculating bed occupancy. The most accurate method of calculating ICU bed occupancy is by measurement on an hourly basis, and the ICNARC team has used this method.

ICNARC calculates LOS in ICU from the date and time of admission to the Unit until the date and time the patient leaves the Unit. Multiplying the mean LOS by the number of admissions to the Unit gave the total number of days the ICU beds were occupied.

The number of ICU bed days available was calculated by multiplying the number of staffed beds open in the Unit by 365. Local Clinical Leads for each Unit provided the most representative value for the number of staffed beds open during 2018. Bed occupancy was the percentage of these available bed days for which the bed was occupied.

If this method of calculating bed occupancy is used, the recommended level of bed occupancy is 75% (ESICM, 2011).

There was wide variability between Units in numbers of bed days provided, in keeping with the different bed numbers in each Unit (Figure 6.1a). In addition, data for some of the Units were for only six months (Tallaght, Connolly, Tullamore, Naas, Kilkenny, and St Vincent's).

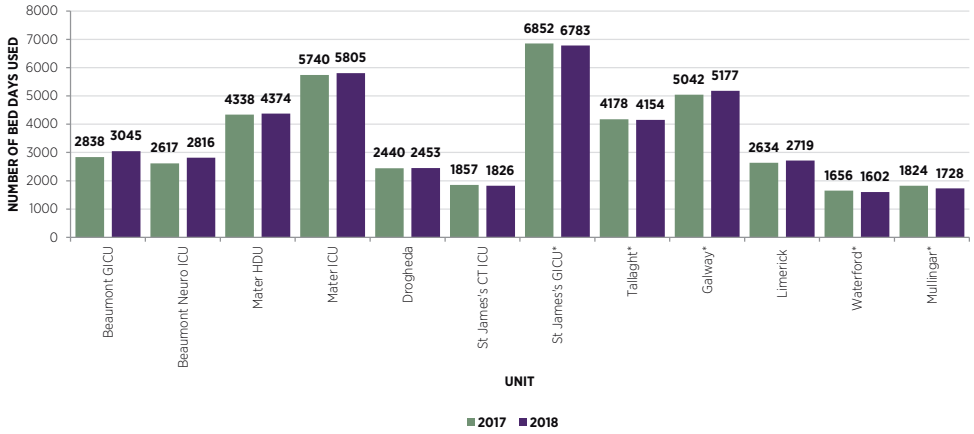


*Tallaght, Connolly, Tullamore, Naas, Kilkenny and St Vincent's had data for only six months of 2018.

FIGURE 6.1A: NUMBER OF BED DAYS OCCUPIED IN 2018*

* Full hospital names are available within the frequency tables.

The numbers of bed days occupied in each Unit were remarkably consistent between 2017 and 2018 (Figure 6.1b). Exceptions were Beaumont GICU and Beaumont Neuro ICU, where the number of bed days occupied increased by 7.2% and 7.6%, respectively.



* Waterford, Mullingar, St James's GICU and Galway did not have data for the full 12-month period for 2017. Available data have been extrapolated in order to provide an estimated value for the full year. Tallaght had data for only six months for both 2017 and 2018. These values have been doubled in order to provide estimated values for each year.

FIGURE 6.1B: NUMBER OF BED DAYS OCCUPIED IN 2017 AND 2018[1]*

Mean bed occupancy levels ranged from 79% to 96% (Figure 6.1c). All Units had bed occupancy levels greater than the value of 75% recommended by the ESICM – some by a wide margin.

The national bed occupancy level for all the Units audited was 88%. ICNARC reports do not supply the relevant data to allow estimation of bed occupancy in UK Units.

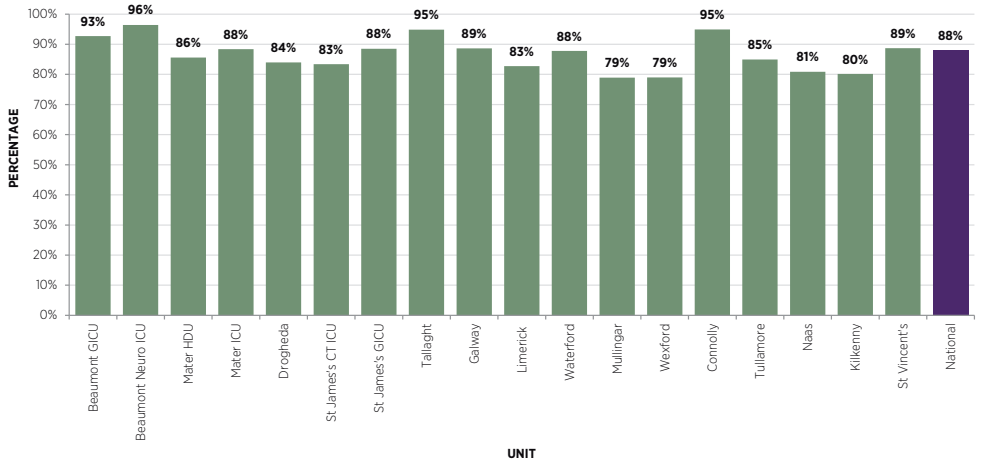


FIGURE 6.1C: BED OCCUPANCY IN 2018 (BED DAYS OCCUPIED AS A PERCENTAGE OF BED DAYS AVAILABLE)*

[1] Only hospitals with data for both 2017 and 2018 are included in Figure 6.1b.
* Full hospital names are available within the frequency tables.

There has been an improvement in bed occupancy levels in some Units since 2017, and the national level of bed occupancy has improved from 91% to 88% (Figure 6.1d). This reflects the opening of additional beds in some of the busier Units (Mater, St James's ICU, Limerick, and Drogheda). Conversely, there was a substantial worsening of bed occupancy levels in Beaumont GICU and Beaumont Neuro ICU, which were busier in 2018 but with unchanged bed numbers, and in Galway, where an ICU bed was closed because of nursing shortages.

The reasons that the recommended bed occupancy level is 75% are: (i) time is required between patients for cleaning the environment; (ii) times of admission are unpredictable, and so the bed may be vacant even if booked for a patient; (iii) levels of demand are unpredictable, with wide fluctuations in numbers of admissions on different days resulting in a need to have adequate capacity for peak demand rather than average demand; and (iv) the need to have a bed immediately available for critically ill patients. If levels of bed occupancy are above 75%, Units commonly have to manage this by opening an additional, non-resourced bed. This means nursing and medical staff have to manage an additional patient, leading to risk of compromise in the care of all patients in the Unit. In addition, ICU admissions may be delayed and patients may need to be discharged early or outside normal working hours.

Occupancy levels below 75% indicate underuse of expensive critical care beds and inappropriate use of resources. This was not an issue in Ireland, as occupancy exceeded 75% in all Units.

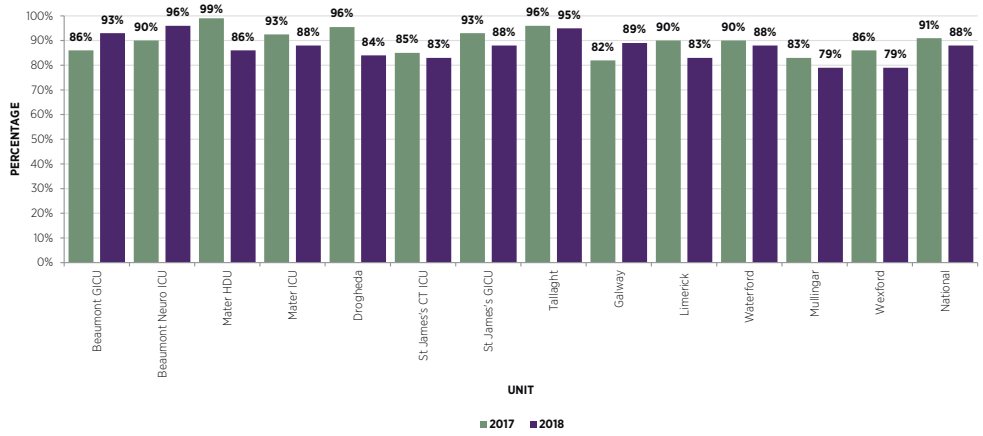


FIGURE 6.1D: BED OCCUPANCY IN 2017 AND 2018 (BED DAYS OCCUPIED AS A PERCENTAGE OF BED DAYS AVAILABLE)[2]*

[2] Only hospitals with data for both 2017 and 2018 are included in Figure 6.1b.
* Full hospital names are available within the frequency tables.

LENGTH OF STAY IN ICU FOR ICU SURVIVORS

LOS for ICU survivors varied between Units (Figure 6.2). LOS tended to be longer in Units with greater illness severity scores (Figure 5.1), and shorter in Units classified as 'mixed ICU/HDU' and in Units which accept patients after cardiothoracic surgery (Table 4.1). The longest LOS was in Beaumont Neurological ICU, which is explained by the case mix of mostly brain-injured patients. Mean LOS was 5.0 days both in Ireland and in the UK.

Mean LOS was greater than median LOS for all Units, and by a large margin for some. This is because mean LOS is influenced by a small number of patients who stay for a long time.

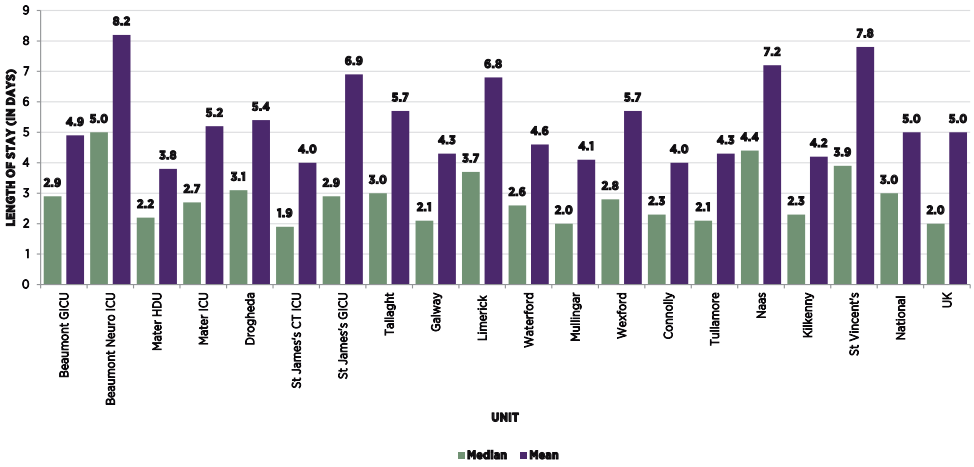


FIGURE 6.2: UNIT SURVIVORS; MEAN AND MEDIAN LOS IN THE UNIT (DAYS)*

* Full hospital names are available within the frequency tables.

LOS: UNIT SURVIVORS VERSUS NON-SURVIVORS

Survivors in some Units had a longer mean LOS than non-survivors, while in other Units the picture was the opposite (Figure 6.3). It is possible that this finding is random, that it reflects the case mix in certain Units, or that it reflects earlier decision-making regarding withdrawal of life-sustaining therapies in some Units.

Nationally, mean LOS was five days for survivors versus six days for non-survivors. These data are comparable with the UK, which had a mean LOS of five days for both survivors and non-survivors. Mean LOS in non-survivors was considerably longer in St James's CT ICU at 19.6 days; this value may have been influenced by a small number of patients who had a prolonged illness before they died.

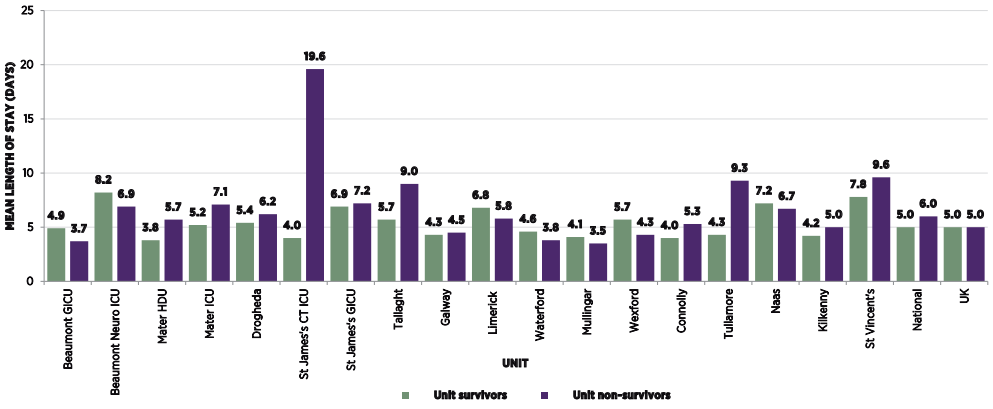


FIGURE 6.3: UNIT LOS FOR UNIT SURVIVORS VERSUS NON-SURVIVORS (MEAN, DAYS)*

* Full hospital names are available within the frequency tables.

DELAYED DISCHARGE FROM ICU >24 HOURS

There is a shortage of hospital beds in Ireland, leading to well-publicised delays in the transfer of patients from the Emergency Department (ED). This issue also increases the time between when the patients are cleared for discharge from ICU and actual discharge to the ward.

There were large differences between Units in the proportion of patients whose discharges were delayed for more than 24 hours (Figure 6.4). The reasons for this can only be explained locally, although some of the variation may be related to difficulty in capturing these data. The overall Irish figure was comparable to the UK (21% versus 18%).

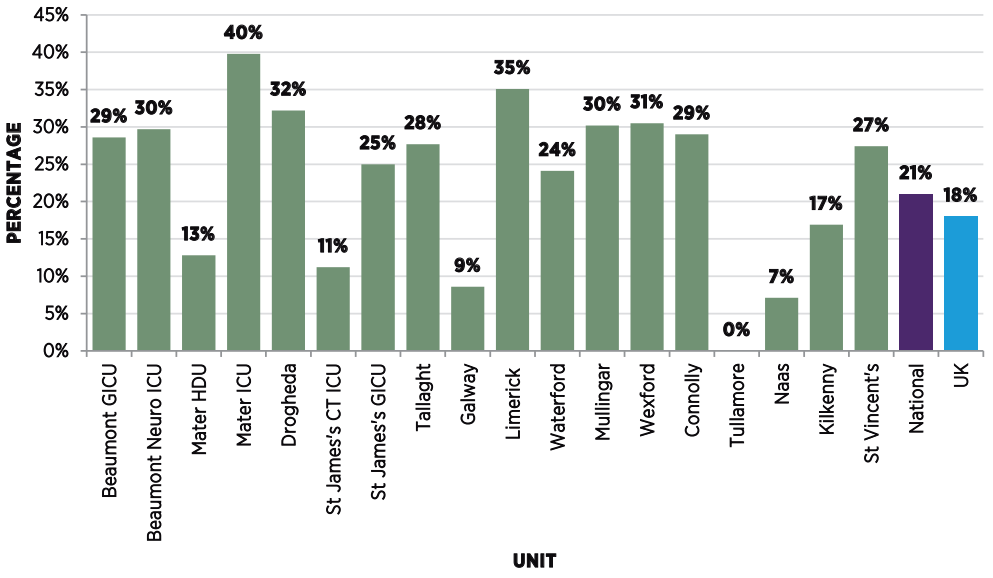


FIGURE 6.4: DISCHARGES TO THE WARD DELAYED >24 HOURS (AS A PERCENTAGE OF ALL DISCHARGES TO THE WARD)*

* Full hospital names are available within the frequency tables.

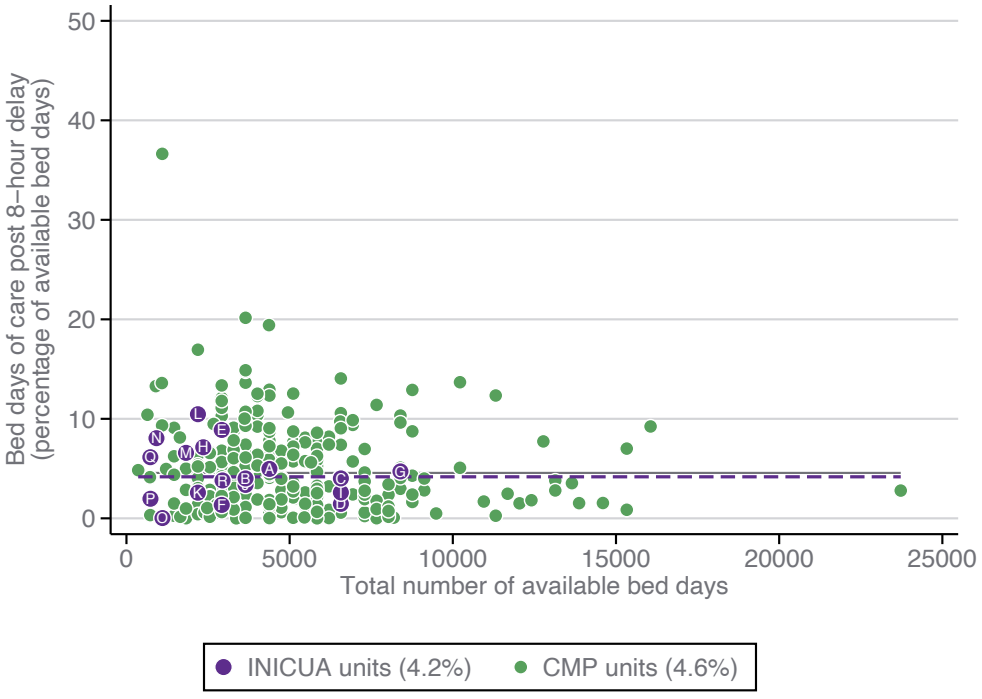
DELAYED DISCHARGE: NUMBER OF DAYS OF DELAY

Patients commonly stay in ICU for a period after they have been declared clinically ready for ward care (Figures 6.5 and 6.6). There were considerable variations between Units that are likely to be explained by local factors in requirements for ICU beds and in bed management policies. Irish Units had similar values as UK Units (4.2% of available bed days versus 4.6% for delays >8 hours; 2.5% versus 2.8% for delays >24 hours).

Delay in ICU discharge reflects the widespread shortage of ward beds; until the ICU bed is needed for a new ICU admission, patients are left in ICU in order to allow admissions to the ward from ED. This seems like a potential waste of expensive ICU resources, which ideally would be used only for critically ill patients. However, it is difficult to achieve full efficiency with ICU beds when demand is variable and unpredictable. Nevertheless, expediting ICU discharges would make ICU beds more available for the rapid admission of critically ill patients rather than the prolonged delays in admission which occur at the moment.

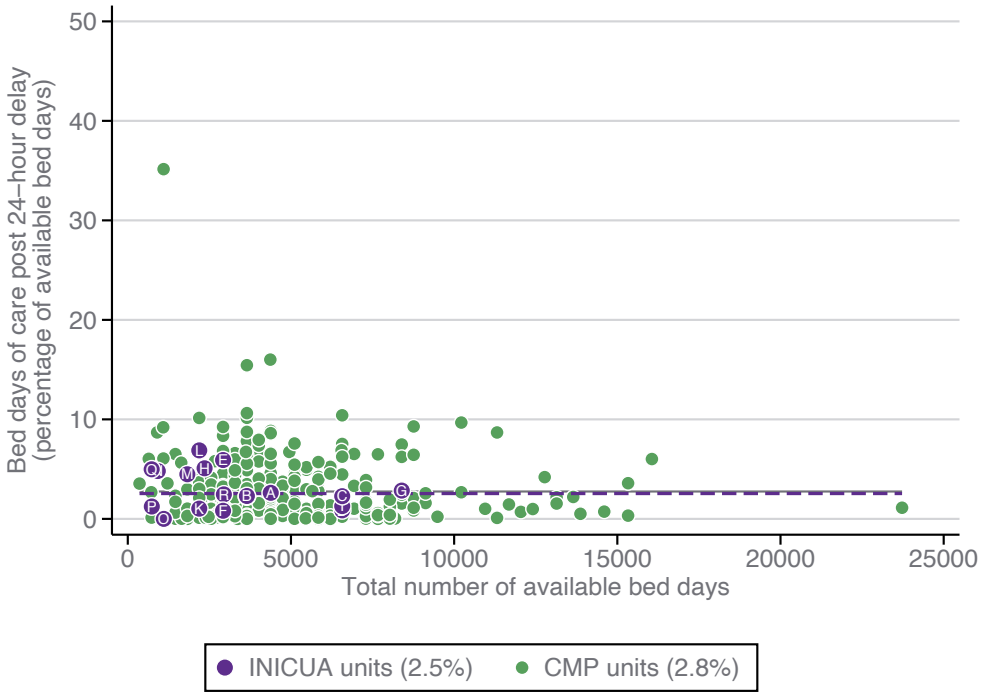
These data are useful in guiding decisions about the optimal use of bed capacity in the Unit and the wards. They also highlight the potential for transfer of patients from a hospital whose ICU is full to a Unit which has beds occupied by patients who could be discharged to a ward.

A factor to be taken into account in interpreting these data is that ICNARC calculates the bed days available (the denominator for this metric) using the number of bed spaces in the Unit rather than the number of staffed beds. In some Units, these are the same, but in others there may be bed spaces but the beds are not staffed.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

FIGURE 6.5: BED DAYS SPENT IN UNIT MORE THAN EIGHT HOURS AFTER BEING DECLARED READY FOR DISCHARGE (AS A PERCENTAGE OF AVAILABLE BED DAYS)*



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

FIGURE 6.6: BED DAYS SPENT IN UNIT MORE THAN 24 HOURS AFTER BEING DECLARED READY FOR DISCHARGE (AS A PERCENTAGE OF AVAILABLE BED DAYS)*

NATIONAL EARLY WARNING SCORES ON DISCHARGE FROM THE UNIT

The National Early Warning Score (NEWS) is a risk prediction score for patients on the ward to target intervention to prevent further clinical deterioration. It is a composite score based on respiratory and cardiovascular observations, temperature, and level of consciousness. The normal value is 0. Increased NEWS values indicate a degree of physiological disturbance.

NEWS scores were calculated before patients were discharged from ICU. Data collection was incomplete in a number of Units and data are displayed only for Units with NEWS scores for more than 50% of patients.

Median NEWS scores at ICU discharge were surprisingly high for a number of Units (Figure 6.7). The upper quartile was 6 for a number of Units, meaning 25% of patients had a NEWS of 6 or greater at the time of discharge to the ward. This indicates that a significant number of patients were discharged to the ward while still unwell. This is likely to indicate pressure on ICU beds, meaning that the patient was discharged to make a bed available for another patient who was sicker.

Collection of this data item was inconsistent, and in a number of Units insufficient data were collected to be meaningful. This was also true of NEWS scores before ICU admission; there were so many gaps in data that comparisons between Units would not be meaningful.

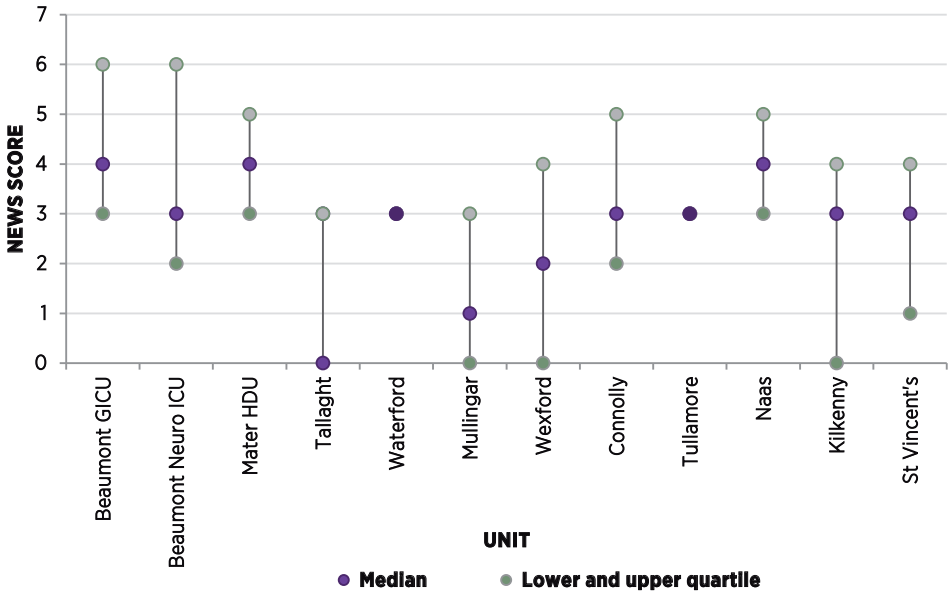


FIGURE 6.7: NEWS SCORES AT THE TIME OF DISCHARGE FROM THE UNIT (MEDIANS, QUARTILES)[3*]

[3] Data are only presented only for Units with documentation of NEWS for >50% of patients
* Full hospital names are available within the frequency tables.

LOS AFTER ICU DISCHARGE

Hospital LOS after Unit discharge varied between hospitals (Figure 6.8). This may reflect differences in case mix or differences in local community or convalescent facilities. The mean LOS was greater than the median LOS in hospital after ICU discharge in all hospitals because a small number of patients who stayed for a long time increased the mean LOS.

The mean LOS in hospital after Unit discharge in Ireland was 22 days for hospital survivors versus 31 days for non-survivors (Figure 6.9). In the UK, the mean LOS after ICU discharge was 14 days for hospital survivors versus 18 days for non-survivors.

The shorter LOS for hospital survivors in the UK may be explained by better community facilities to facilitate hospital discharge. However, better community facilities would not explain the shorter LOS for hospital non-survivors in the UK compared with that in Ireland, and the reason for this difference is unknown.

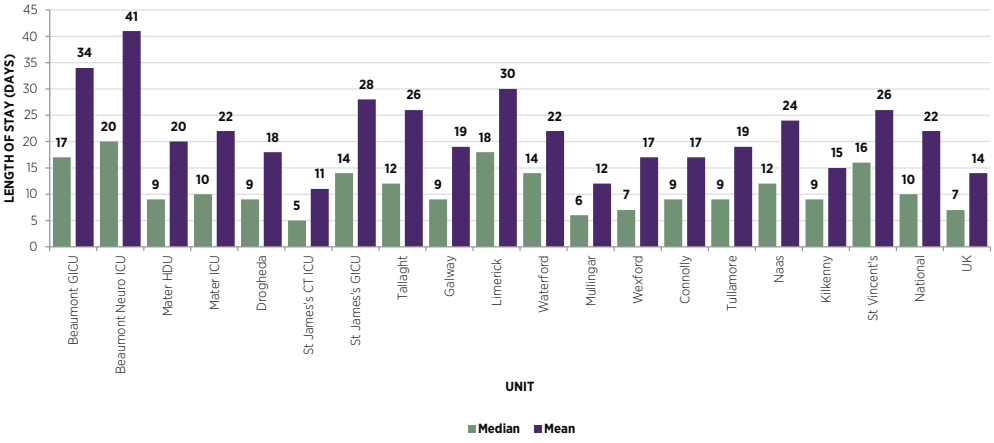


FIGURE 6.8: HOSPITAL SURVIVORS; MEAN AND MEDIAN LOS IN ACUTE HOSPITAL AFTER UNIT DISCHARGE (DAYS)*

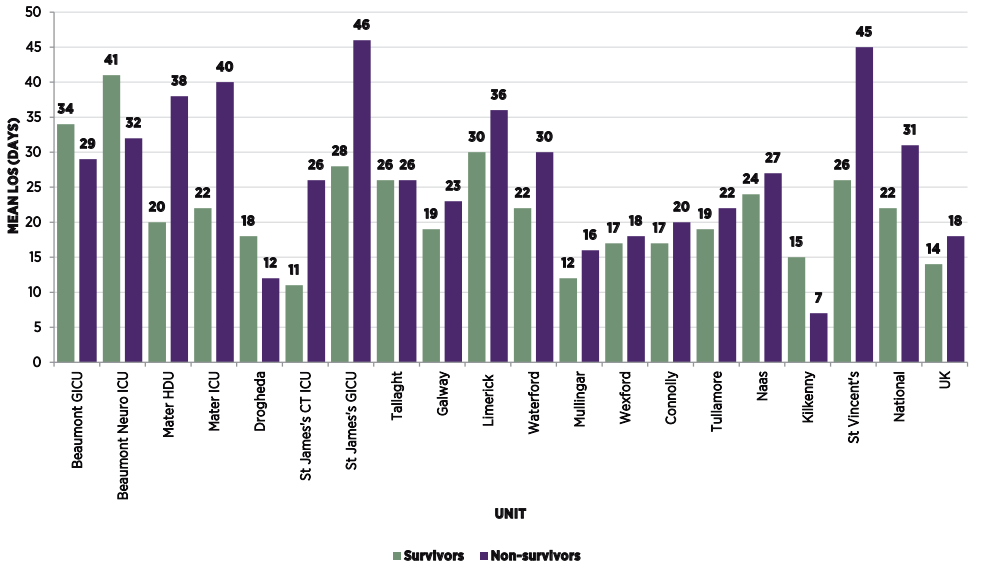


FIGURE 6.9: ACUTE HOSPITAL MEAN LOS AFTER UNIT DISCHARGE FOR HOSPITAL SURVIVORS VERSUS NON-SURVIVORS (DAYS)*

* Full hospital names are available within the frequency tables.

KEY FINDINGS FROM CHAPTER 6

- The numbers of bed days provided in each ICU was remarkably similar between 2018 and 2017. Exceptions were Beaumont GICU and Beaumont Neuro ICU, where numbers of ICU bed days provided increased by more than 7% in both Units.

- Bed occupancy across the Units audited ranged from 79% (Mullingar, Wexford) to 96% (Beaumont Neuro ICU). Occupancy was greater than the recommended level of 75% in all the Units audited.

- Nationally, ICU bed occupancy was 88%, an improvement from 91% in 2017. This was due to additional ICU beds in certain Units. Bed occupancy increased to 89% in Galway from 81% in 2017 because a bed was closed due to nursing shortages.

- LOS varied considerably between Units, usually in keeping with differences in their case mix. Mean LOS for Unit survivors across all Irish Units was 5.0 days versus 6.0 days for Unit non-survivors.

- LOS was similar in Irish and UK Units for both ICU survivors and non-survivors.

- Delayed discharges from ICU were common across most Units. This led to utilisation of ICU beds by patients who could have been cared for in the ward. This inappropriate utilisation of ICU beds varied considerably between individual Units. Nationally, 4.2% of all potential ICU bed days were utilised by patients who had been cleared for discharge to the ward for more than eight hours (compared with 4.6% of bed days for UK Units).

- NEWS scores at discharge from ICU were relatively high in a number of Units, with median NEWS scores up to 4 and upper quartile NEWS scores up to 6. This indicates that patients were discharged from ICU while still relatively unwell. If discharge of patients with a high NEWS was to a ward rather than a step-down Unit (HDU), it suggests that discharge was because of a shortage of ICU beds.

- LOS in the acute hospital after an ICU stay for hospital survivors was in keeping with the varying case mix of the individual Units. Mean hospital LOS was 22 days in Ireland versus 14 days in the UK.

- Hospital LOS after ICU was longer for non-survivors than survivors in most Units, but not all. Nationally, the mean hospital LOS was 31 days for non-survivors versus 22 days for survivors. Corresponding figures for the UK were 18 days versus 14 days.

CHAPTER 7

OUTCOME MEASURES AND QUALITY INDICATORS

CHAPTER 7: **OUTCOME MEASURES AND QUALITY INDICATORS**

If patients are acutely ill and require admission to ICU, the more quickly they are admitted, the better the patient outcome (Harris *et al.,* 2018). Delays in admission to ICU are inevitable with the high levels of ICU bed occupancy in Irish Units (Figure 6.1c). Most ICU beds are occupied by patients who are critically ill and cannot be discharged to the ward. However, some beds may be occupied by patients who have been cleared for discharge to the ward but remain in ICU because of a shortage of ward beds. There is evidence that this occurs commonly in Irish ICUs (Figures 6.4, 6.5, and 6.6).

If ICU is full and a new patient needs an ICU bed, a ward bed will be sought for any ICU patient cleared for discharge in order to create space in ICU. This can be a lengthy process, including the time to clean the vacated bed space and prepare equipment. This means that the patient to be admitted to ICU is likely to be deteriorating, increasing the risk of morbidity and mortality. In order to enable rapid admission to ICU for critically ill patients, ideally there should be a vacant ICU bed available routinely.

In Q4 2018, the HSE Business Intelligence Unit introduced a new KPI for hospitals to measure time taken to access ICU. The metric was defined as the time elapsed from the decision to admit the patient to ICU by the key decision-maker until the time of arrival in the Unit. This metric is only applied to patients coming to ICU from a hospital ward or ED, as there are many other variables involved in admission to ICU from the operating theatre or from another hospital. The targets for this KPI were defined as 50% of ICU admissions reaching ICU within one hour of the decision to admit and 80% of ICU admissions reaching ICU within four hours of the decision to admit. The aim of this KPI was to promote rapid admission to ICU for critically ill patients because of the proven benefits for patient outcomes (by prioritising discharges from ICU to the ward). This KPI should also highlight Units with particular problems with delayed admissions, either because of ICU bed shortages because of administrative issues.

Data for this metric were collected for the first time in Q4 2018 by ICU Audit Coordinators and the HSE Business Intelligence Unit (Figure 7.1). There were gaps in the data (Figure 7.2), which is unsurprising, as the time of decision to admit is often difficult to ascertain. We expect that the level of unknown data will decrease with experience and with education of staff to document the time of decision to admit to ICU.

In interpreting the data in Figure 7.1, it is important to note that if the time of decision to admit was unknown, the patients were defined as not meeting the target time for admission. Thus, in Units with a high proportion of patients for whom time of decision to admit was unkown, the values for admission within one hour and within four hours were likely to be an underestimate. The data are presented as a composite for each hospital; that is, in hospitals with two Units, the data are combined for both Units to give only one value.

There was wide variability between Units in the proportions of patients achieving the target times to admission (Figure 7.1). Some of this variability may be due to time of decision to admit being unknown in a high proportion of patients (Figure 7.2). Only one Unit (Mullingar) achieved the target of 50% of ICU patients being admitted within one hour of the decision to admit.

A number of Units achieved the target of 80% of patients being admitted within four hours of the decision to admit, which is a positive finding (Figure 7.1). The Units with rates below 80% tended to be the larger Units, especially in Dublin, with very high occupancy levels (between 86% and 96%; Figure 6.1c).

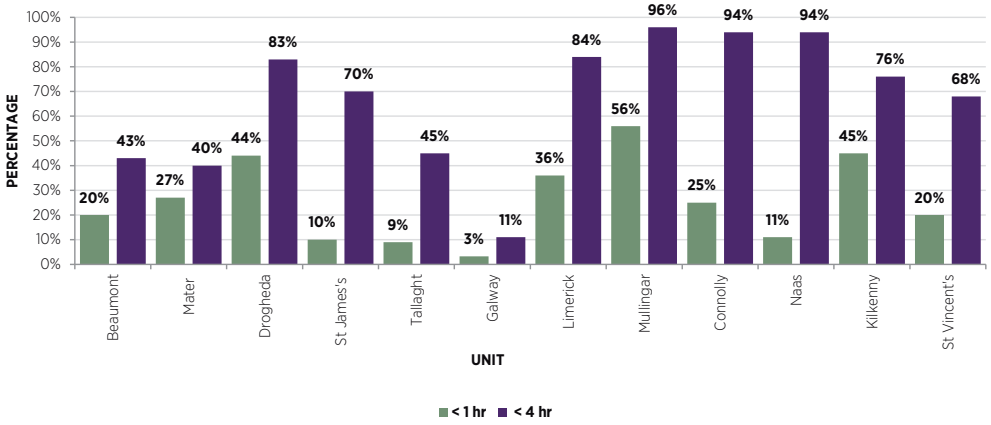


FIGURE 7.1: PERCENTAGE ADMITTED TO ICU (I) <1 HOUR FROM DECISION TO ADMIT AND (II) <4 HOURS FROM DECISION TO ADMIT (Q4 2018)*

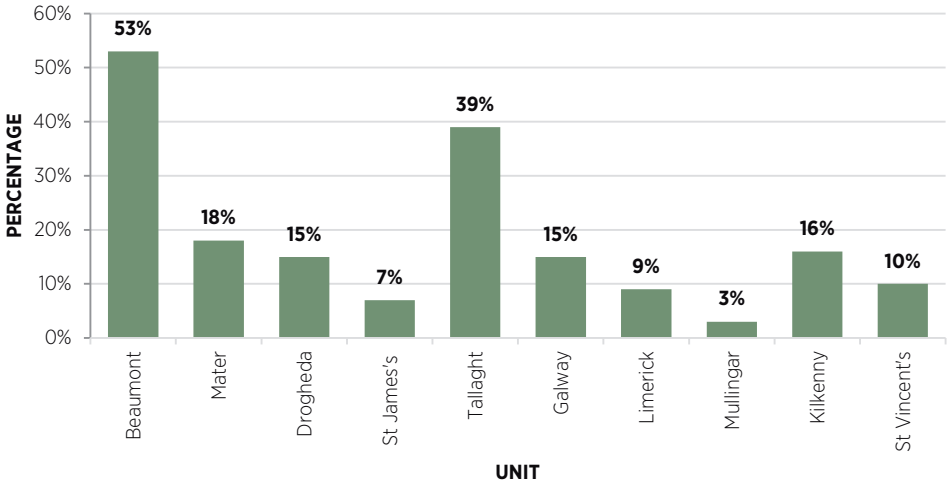


FIGURE 7.2: TIME OF DECISION TO ADMIT TO ICU NOT KNOWN (Q4 2018)*

* Full hospital names are available within the frequency tables.

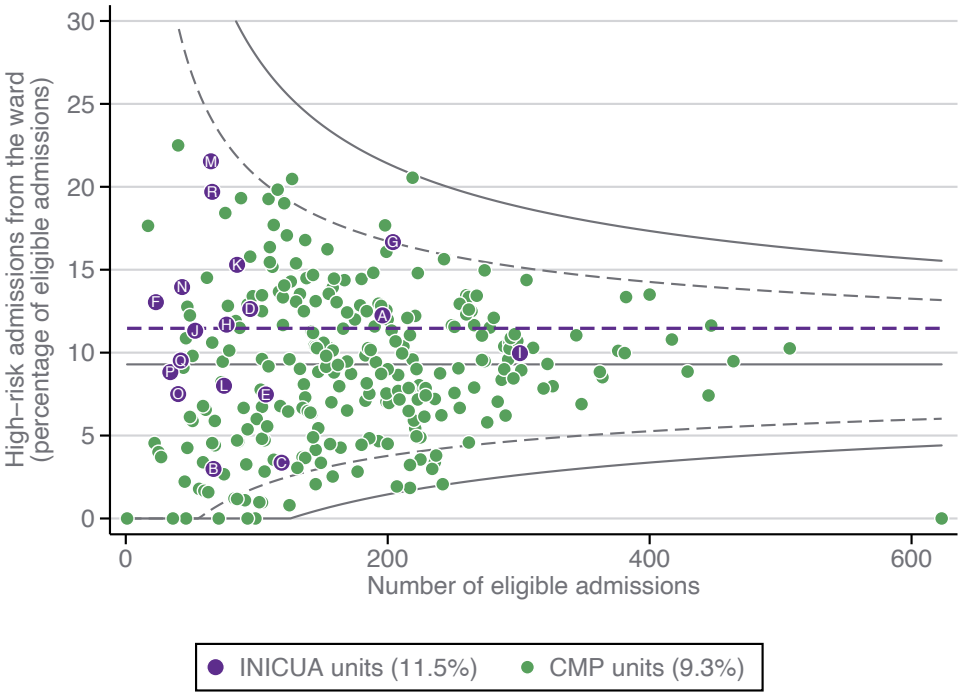
DELAYED ADMISSION TO ICU

This quality indicator (QI) measures the proportion of patients who are very ill (as defined by dysfunction in four or more organ systems) within the first 24 hours after admission to ICU from a ward in the same hospital.

Some patients may be admitted to ICU with failure of one or two organ systems and then deteriorate quickly to multiorgan failure, despite the support they receive in ICU. However, if excess numbers of patients have multiorgan failure within 24 hours of admission, it is likely that some of these patients deteriorated on the ward after the time they should have been admitted to ICU. This indicates that admission to ICU was delayed.

The reasons why very sick patients were not admitted to ICU in a timely fashion could be that (i) staff did not recognise the severity of their illness or (ii) the severity of illness was recognised but no ICU bed was available.

St James's Hospital GICU was an outlier for this QI in 2018; all other Units were within acceptable limits (Figure 7.3). Data to date in 2019 for St James's Hospital GICU have been within acceptable limits for this Quality Indicator.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

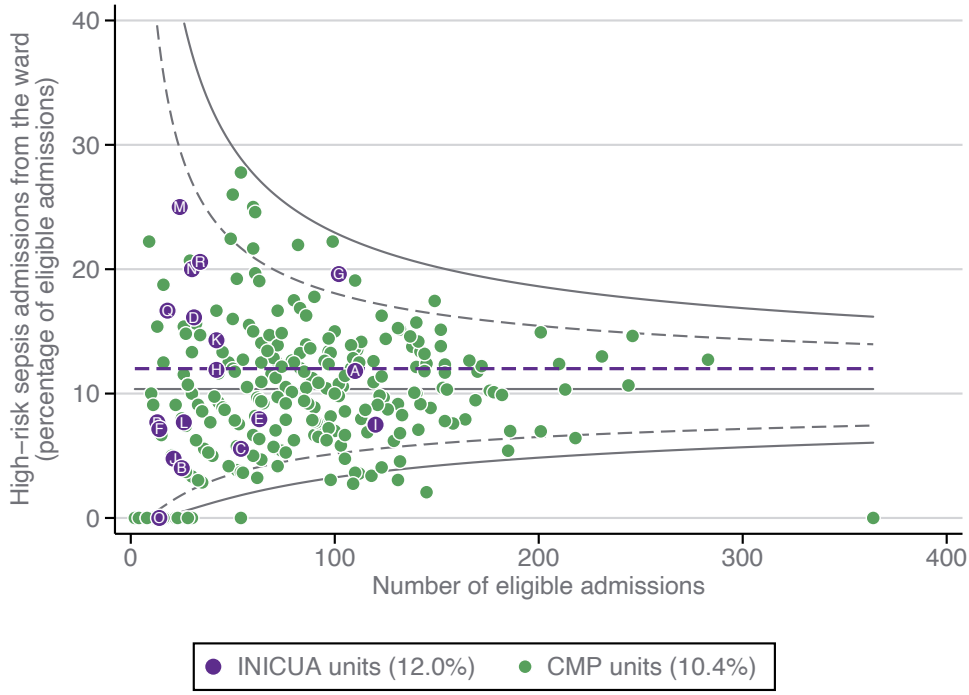
FIGURE 7.3: UNIT ADMISSIONS FROM A WARD WITH ORGAN FAILURE IN FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL ADMISSIONS FROM WARDS IN THE SAME HOSPITAL)*

* Full hospital names are available within the frequency tables.

DELAYED ADMISSION TO ICU WITH SEPSIS

A subgroup of the patients documented in Figure 7.3 are patients with a diagnosis of sepsis who suffered from failure of four or more organ systems within 24 hours of ICU admission. Sepsis is a highly important condition in critically ill patients and is notoriously difficult to diagnose in the early stages. Considerable resources have been committed to early diagnosis and rapid treatment of sepsis, as this improves outcomes in this common and potentially serious condition. There is evidence that these resources have improved outcomes in Irish hospitals (HSE, 2019).

As with the previous quality indicator (Figure 7.3), St James's Hospital GICU was the only outlier for this QI in 2018 (Figure 7.4a). A submission from the hospital in relation to these outliers is summarised on page 94.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

FIGURE 7.4A: ADMISSIONS FROM THE WARD WITH A DIAGNOSIS OF SEPSIS (SEPSIS-2) AND DYSFUNCTION OF FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF ADMISSION (AS A PERCENTAGE OF ALL ADMISSIONS FROM A WARD IN THE SAME HOSPITAL)*

* Full hospital names are available within the frequency tables.

Response from St James's Hospital regarding outlier data for high-risk admissions to ICU and high-risk admissions to ICU with sepsis

It is apparent that the number of both high-risk patients and high-risk sepsis patients admitted from the ward are at least 2 standard deviations (SDs) above the mean. Furthermore, and likely as a direct consequence, the moving average for risk-adjusted acute hospital mortality had risen to between 2 and 3 SDs above the expected range by the end of 2018 (Figure 7.4B). All of these findings are of concern and deserve scrutiny.

These problems most likely reflect a lack of bed capacity. Data to support this conclusion indicate a bed occupancy of 94% for GICU/HDU. As a consequence, patients deemed to need ICU admission frequently experience considerable delays in admission. Only 14% of patients were admitted within one hour of a decision to admit (target >50%), and 74% were admitted within four hours (target >80%). Delayed ICU admission can be expected to increase mortality rate.

ACTIONS

St James's will continue to monitor outcomes in NOCA reports and canvass for hospital, Hospital Group and Department of Health support for appropriate expansion of its ICU in order to meet the rising demand for its services.

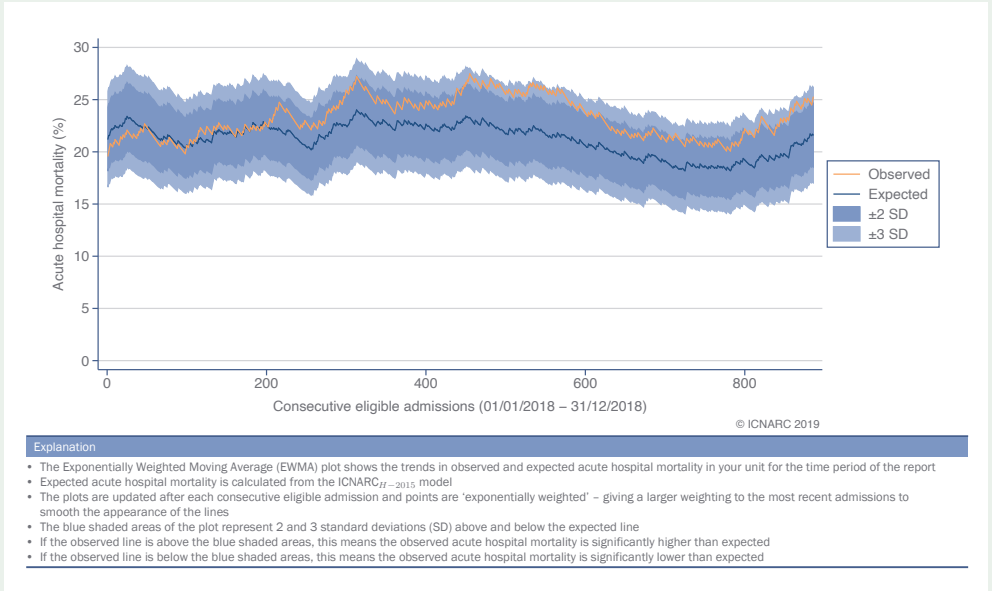
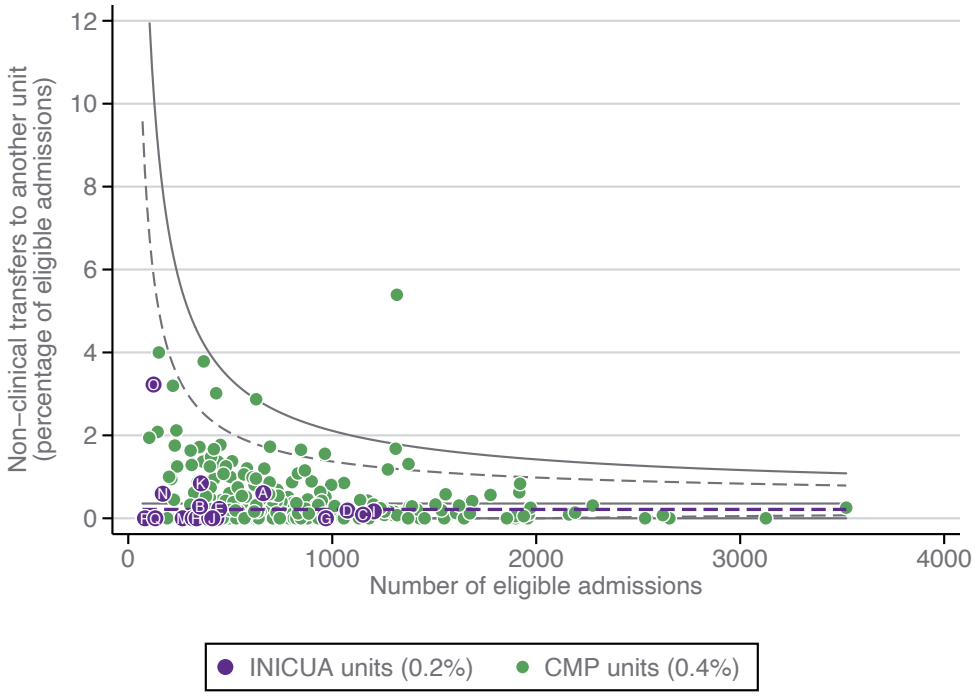


FIGURE 7.4B: MOVING AVERAGE FOR RISK-ADJUSTED MORTALITY, ST JAMES'S GICU, 2018

NON-CLINICAL TRANSFERS

Non-clinical transfers occur when a patient is transferred out of the Unit for reasons other than for specialist care (e.g. neurosurgery, cardiothoracic surgery, liver failure, etc.). The most common reason for non-clinical transfers is shortage of bed capacity.

Non-clinical transfers are unusual in Ireland (Figure 7.5) because it is not normally in the interests of patients to transfer them out to a new Unit where the staff do not know them, and which is possibly more geographically distant from their families. Transfers take place when there is inadequate capacity in a Unit, but normally the new patient is transferred out of the hospital from ED or the ward. These transfers out from the ward or ED are not currently documented by the National ICU Audit.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

FIGURE 7.5: NON-CLINICAL TRANSFERS TO ANOTHER UNIT*

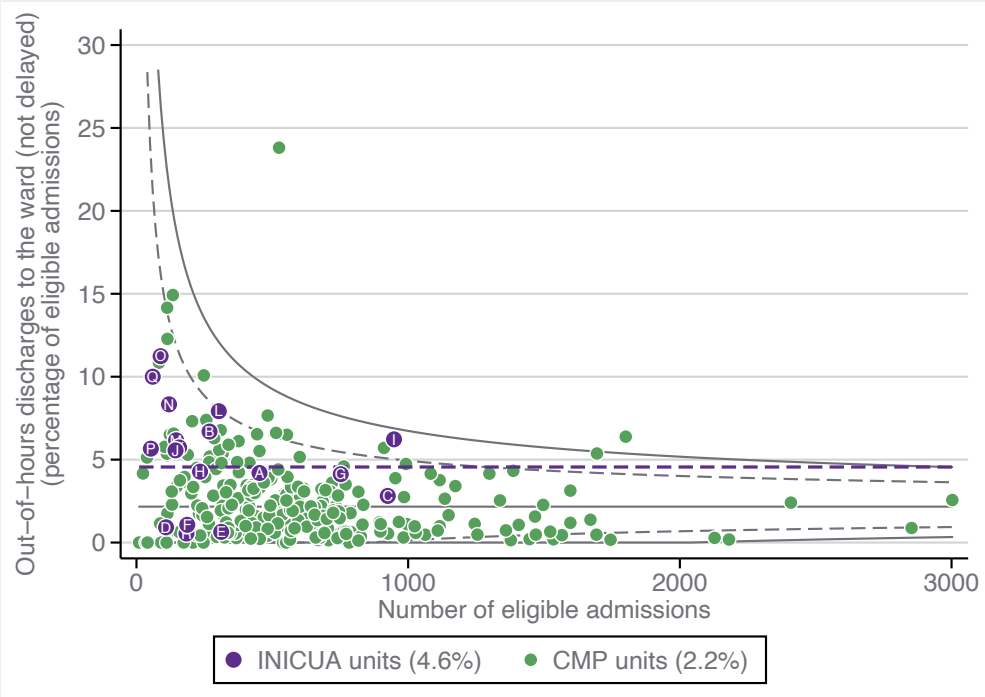
UNPLANNED DISCHARGES FROM ICU AT NIGHT

Ideally, discharges to the ward from ICU should take place during normal working hours and only after patients have been declared fit for discharge by the ICU consultant. ICU patients discharged outside of normal working hours have worsened outcomes (Azevedo *et al.,* 2015). This may be related to factors in the wards such as reduced staffing levels, less experienced staff, or lack of knowledge of the patient's history. An additional factor may be that patients are discharged without being fully ready because of the need for an ICU bed for an urgent ICU admission.

The proportion of patients discharged out-of-hours is a useful quality indicator which can reflect good practice in documenting decisions as to which patients are fit for discharge and having adequate ICU beds to avoid having to discharge patients outside normal working hours. University Hospital Galway was an outlier for this QI in 2018 (Figure 7.6).

Response from University Hospital Galway in relation to outlier data for unplanned out-of-hours discharges from ICU.

Distinguishing which discharges were planned versus unplanned was difficult. Patient flow problems have led to discharges from the Unit occurring late in the day. The outlier data result only from Q1 of 2018, and for the remainder of the year, out-of-hours discharges were at acceptable levels.



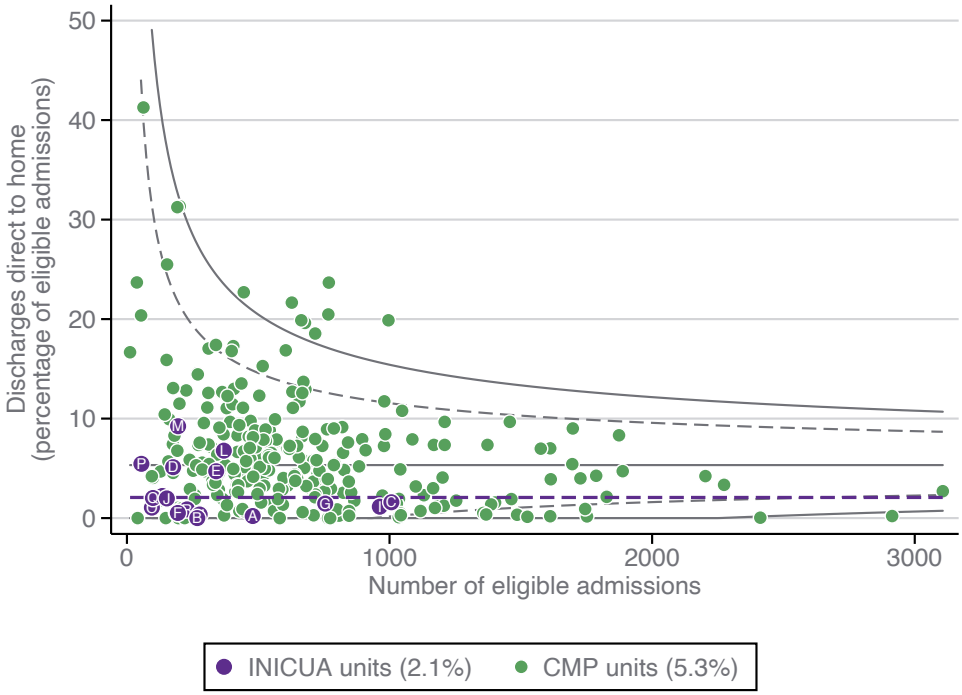
* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

FIGURE 7.6: DISCHARGES TO THE WARD AT NIGHT (22:00–07:00) THAT WERE NOT CLEARED FOR DISCHARGE BY 18:00 THAT EVENING (AS A PERCENTAGE OF ALL UNIT SURVIVORS) *

DISCHARGE DIRECTLY FROM ICU TO HOME

Discharge directly from ICU to home is unusual because if patients are sick enough to be in ICU, they normally need a period of step-down care and observation before discharge. Discharge directly from ICU to home normally means that discharge to a ward was delayed because of ward bed shortages.

No Irish Units were outliers for this QI in 2018 (Figure 7.7). Of all discharges from ICU/HDU in Ireland, 2.1% were direct to home (compared with 5.3% in the UK).



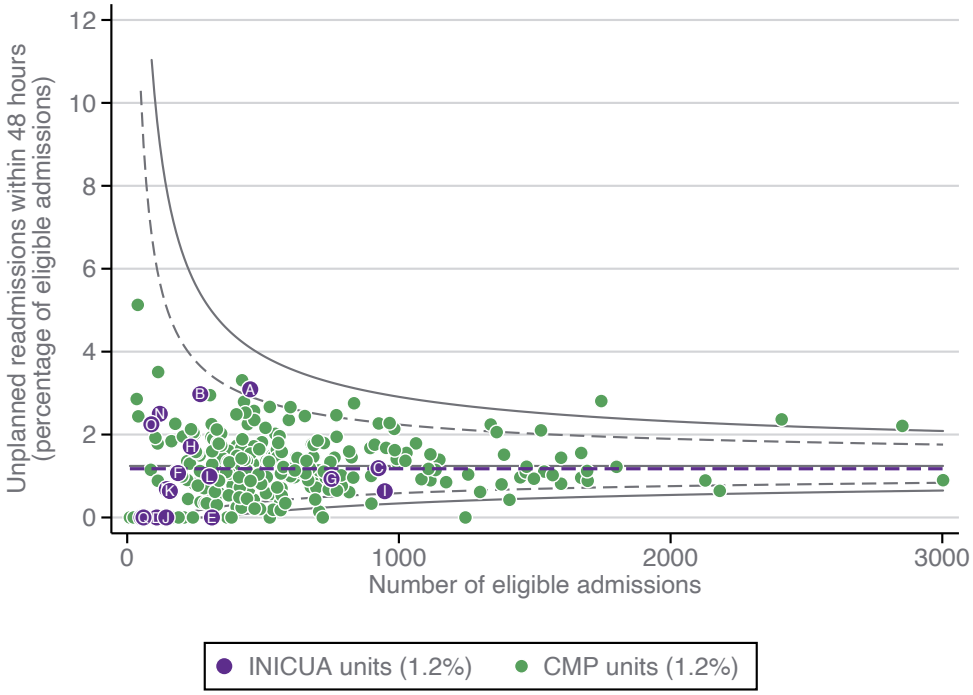
* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1 CMP refers to Case Mix Programme, the term ICNARC useu to describe data from UK Units.

FIGURE 7.7: DISCHARGES DIRECTLY FROM THE UNIT TO HOME*

UNPLANNED READMISSION TO ICU

Unplanned readmission to the Unit within 48 hours is an important QI in ICU audit. This can happen in individual cases due to an unpredictable event after Unit discharge, or due to an error in clinical judgement in assessing a patient as ready for ward care. However, the commonest reason for increased numbers of unanticipated readmissions is that patients were discharged too early because of the need to make an ICU bed available for a patient who was sicker.

The overall rate of unplanned readmission to ICU in 2018 was 1.2% for both Ireland and the UK. Beaumont Hospital GICU was an outlier for this QI in 2018, with an overall unplanned readmission rate of 3.1% (Figure 7.8). Data from Beaumont Hospital GICU for this Quality Indicator to date in 2019 have been within acceptable limits.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units

FIGURE 7.8: UNPLANNED READMISSIONS TO THE UNIT WITHIN 48 HOURS OF DISCHARGE FROM THE UNIT (AS A PERCENTAGE OF ALL ADMISSIONS) *

Response from Beaumont Hospital regarding outlier data for unanticipated readmission to ICU within 48 hours

In response to a query from NOCA, Beaumont Hospital reviewed the factors related to unanticipated readmission to GICU within 48 hours of discharge. Patients who required readmission were sicker at initial admission to ICU and had a higher predicted mortality, but had a shorter LOS in ICU than those who did not require readmission (Table 7.1). The readmission group also had higher Early Warning Scores (EWS) at the time of discharge from ICU (median EWS was 6). However, EWS did not predict readmission to ICU, as 34% of those who did not require readmission also had an EWS >6. EWS on discharge were surprisingly high; 18% of patients had EWS >7 on discharge. Clearly, patients were discharged to the ward while still very ill, presumably because of pressure on ICU beds (bed occupancy was 93% for 2018).

Despite frequent discharges of relatively sick patients, overall hospital mortality in patients admitted to GICU in 2018 was within acceptable limits (SMR = 1.05).

ACTIONS

Since 2018, Beaumont has opened an eight-bed HDU and instituted a pilot ICU Outreach Team to improve patient care after ICU discharge. The hospital continues to monitor quality indicators, all of which have been within acceptable limits to date in 2019.

TABLE 7.1: AGE, APACHE II SCORES, AND PREDICTED MORTALITY (ICNARC$_{H\text{-}2015}$ MODEL) AT ICU ADMISSION, EWS AT ICU DISCHARGE AND ICU LOS IN PATIENTS WHO DID AND DID NOT REQUIRE READMISSION TO ICU WITHIN 48 HOURS OF DISCHARGE

	ICU discharges readmitted <48 hours	ICU discharges not readmitted <48 hours	*p* value
n	14	439	
Age; years (mean)	68	60	0.09
Admission APACHE II score; mean (median)	22 (19)	16 (15)	<0.05
Predicted mortality; mean (median)	35% (33%)	18% (10%)	<0.05
EWS on ICU discharge; mean (median)	5.6 (6.0)	4.1 (4.0)	<0.05
ICU LOS (days); mean (median)	4.4 (2.0)	4.8 (2.8)	0.08

MORTALITY AFTER ADMISSION TO CRITICAL CARE

Patients admitted to ICU or HDU are the sickest patients in the hospital, often have significant co-existing illnesses, and are elderly, putting them at high risk of death. Figure 7.9 presents the actual (crude) mortality rate for all patients included in the ICU Audit, showing both deaths in the Unit and subsequent deaths in the ward before discharge from the acute hospital.

Eighty-six per cent of patients survived to leave critical care and 79% survived to leave acute hospital (Figure 7.9). This mortality rate is similar to international experience and reflects (i) the severity of the underlying condition (e.g. brain injury), (ii) serious pre-existing conditions (e.g. cardiac disease, metastatic cancer) and (iii) patient age.

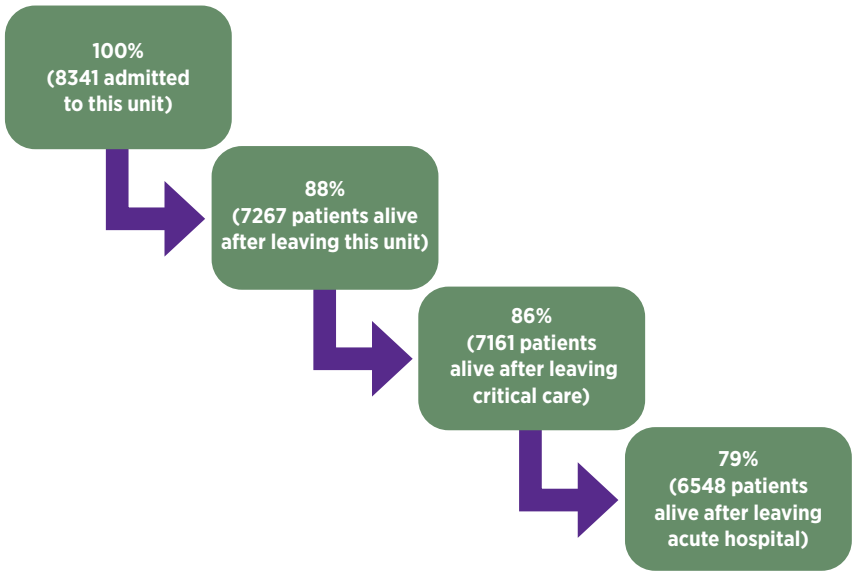


FIGURE 7.9: PATIENT SURVIVAL LEAVING ORIGINAL UNIT ADMITTED TO, LEAVING ALL CRITICAL CARE, AND LEAVING HOSPITAL (n=8341)

STANDARDISED MORTALITY RATIOS

Crude mortality is not useful in assessing the quality of care in a Unit because outcomes depend predominantly on the case mix of patients admitted to the Unit. Units with a large proportion of high-risk patients will have a high mortality rate, independent of the quality of care.

Consideration of mortality must take into account the severity of illness on admission as well as other risk factors such as age, pre-existing conditions, and underlying diagnoses. In order to take these factors into account, we have compared risk-adjusted mortality rates between Units rather than crude mortality rates (Figure 7.10).

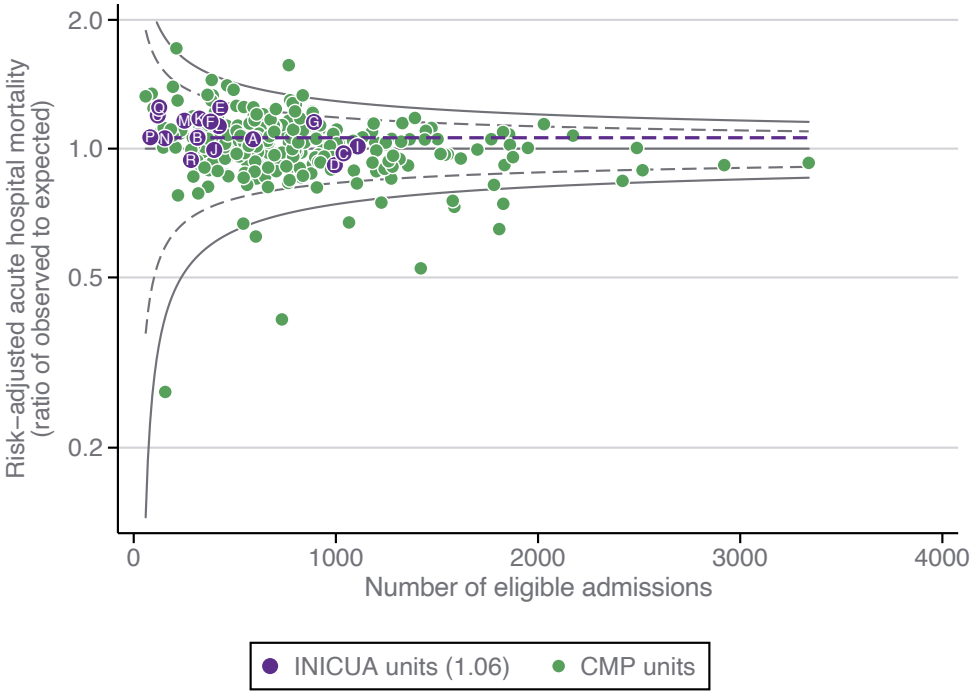
ICNARC uses a mathematical model to predict the risk of death of individual patients. This incorporates data on age, pre-existing conditions, source of referral, admission diagnosis and illness severity, as assessed by physiological and laboratory data. Patients who are readmissions to the Unit are excluded from analysis, so they are not included in the mortality figures more than once. The analysis is based on outcomes from ICNARC's large database of ICU patients collected over the past 25 years. The model is updated and recalibrated regularly in order to account for changes in ICU practice and demographics, as well as for the generally improving outcomes in ICU observed in recent years with improved practice.

For each Unit, ICNARC will calculate an expected number of deaths based on this mathematical model. The ratio of the observed number of deaths to the expected number provides the SMR. If the SMR is 1.0, it means the Unit had exactly the expected number of deaths.

There are flaws with using SMR as a measure of quality of care in ICU. ICU patients and Units are very heterogeneous, and no single mathematical model is perfect for every patient and every Unit. Despite these reservations, SMR is generally accepted as an important signal of possible issues relating to quality of care, as it directly links to the most important outcome in ICU: survival.

With variability in case mix and unavoidable flaws in the mortality prediction model, some variability in SMRs is expected. To allow for this, a range for Unit SMRs, which is ±2 SDs around the value of 1.0, is expected. SMR values within this range are considered acceptable. Statistically, these limits should encompass 95% of all Units. Units outside of these limits are considered to be outliers for this QI. This is a signal that there may be concerns about quality of care which is affecting clinical outcomes.

SMR data for Irish Units are shown in Figure 7.10. There were no outlier Units with an SMR outside the acceptable range. The SMR for all 8,223 eligible Irish admissions in 2018 was 1.06 – that is close to the expected value of 1.0.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units. The overall value for risk-adjsuted mortality for CMP Units is not available.

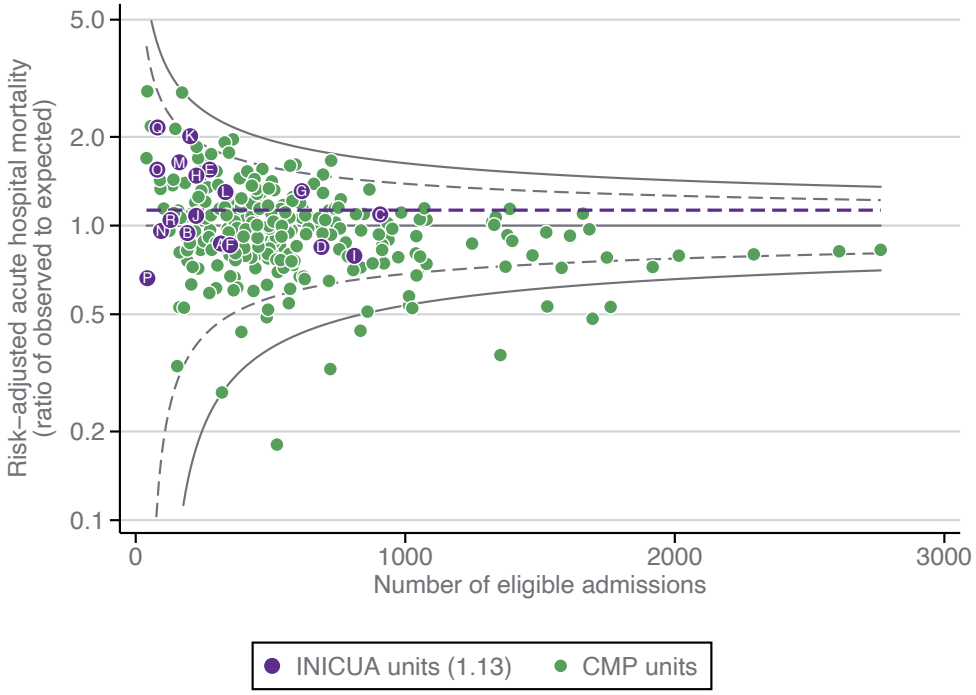
FIGURE 7.10: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (SMR) (ICNARC$_{H\text{-}2015}$ MODEL)*

MORTALITY IN LOW-RISK PATIENTS

Figure 7.11 shows the SMR for patients who were judged to have a relatively low risk of death (<20%) when admitted to ICU. These patients are a subset of the patients shown in Figure 7.10. While some deaths are expected in this group, an excess number of deaths would suggest an issue with the quality of care.

This metric is useful as a QI in its own right and is also very useful in order to gain further insight into Units that have outlier data for overall mortality.

There were no outlier Units for this QI in 2018. The overall SMR for low-risk admissions in Ireland was 1.13.



* Each purple circle marks an Irish Unit; the letter in the circle is linked to the relevant Unit in the list of Units in Table 3.1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units. The overall value for risk-adjsuted mortality for CMP Units is not available.

FIGURE 7.11: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY RATIO OF OBSERVED TO EXPECTED (SMR) FOR PATIENTS WHOSE PREDICTED RISK WAS <20% (ICNARC$_{H\text{-}2015}$ MODEL) *

KEY FINDINGS FROM CHAPTER 7

- There were delays from the time of the formal decision to admit a patient to ICU until the time of admission in some Units, especially in the larger Units in Dublin.

- The number of patients who developed organ failure in four or more organ systems within 24 hours of admission to ICU was outside the expected value in St James's Hospital. This was most likely due to a shortage of ICU beds. Other hospitals were within expected limits for this quality indicator.

- The number of unplanned discharges from ICU at night was outside the expected limits in University Hospital Galway. Other hospitals were within expected limits for this quality indicator.

- The proportion of patients discharged from ICU who subsequently required unplanned readmission to ICU was outside the expected value in Beaumont Hospital GICU. This was likely due to premature discharge because of pressure on ICU beds. Other hospitals were within expected limits for this quality indicator.

- Mortality in ICU nationally was 14%, and a further 7% of patients died before leaving the acute hospital. Seventy-nine per cent of patients admitted to the Units participating in the ICU Audit survived to leave hospital.

- Mortality adjusted for illness severity, pre-existing conditions, and admission diagnoses showed that outcomes in Irish Units were similar to those in UK Units.

- No Irish Units were outside the acceptable limits for mortality rates (adjusted for risk factors).

CHAPTER 8

ORGAN DONATION

CHAPTER 8: **ORGAN DONATION**

Data on organ donation were obtained directly from the Units participating in the NOCA National ICU Audit during 2018 rather than from ICNARC (which currently does not provide a full report on organ donation). UK data presented here for comparison come from the ICNARC Network Quality Report for 2018.

Reports were received from 16 Units in 13 hospitals, representing 69% of activity in HSE hospitals nationally. Some Units had data for only part of the year, in line with the duration of their participation in the ICU Audit (Table 3.1.1). This shorter duration of participation must be borne in mind where absolute values rather than percentages are presented.

While Tallaght and Kilkenny participated in the National ICU Audit in 2018, the data on organ donation could not be retrieved from the database because the Audit Coordinator posts were vacant in June 2019 when these reports were requested.

If data are presented as 'National', this refers only to the 13 hospitals that provided data in 2018 and is an under-representation of the full national picture of organ donation, which currently occurs in 26 adult hospitals.

BRAIN DEATH

Deaths diagnosed using the criteria for brain death made up 6.7% of all deaths nationally (Table 8.1) compared with 6.3% in the UK. Brain deaths as a proportion of all deaths ranged from zero (n=0) in some Units to 31% of deaths in Beaumont Neurosurgical ICU (n=15). Variability in rates of diagnosis of brain death may reflect case mix (e.g. brain death is rare in a CT ICU) or rates of transfer out to a neurosurgical centre. The numbers of brain dead patients were very small in most Units, making it difficult to draw conclusions regarding variability in the rates of diagnosis of brain death. A clearer picture of the rates of diagnosis of brain death in different Units may be obtained when data are available for multiple years.

TABLE 8.1: NUMBER AND PERCENTAGE OF BRAIN DEATHS AS A PROPORTION OF ALL DEATHS IN THE UNIT

Unit	Number of brain deaths	Percentage of all deaths
Beaumont Neuro ICU	15	31%
St James's GICU	12	8%
Mater ICU	9	6%
Limerick ICU	8	10%
Beaumont GICU	8	6%
Galway ICU	6	5%
Connolly ICU	3	12%
Wexford ICU	3	5%
Mullingar ICU	2	6%
Drogheda ICU	2	3%
Waterford ICU	2	3%
Tullamore ICU	1	5%
Mater HDU	0	0%
St James's CT ICU	0	0%
Naas ICU	0	0%
St Vincent's ICU	2	4%
National	**73**	**6.7%**

ORGAN DONATION

Most organs donated in Ireland in 2018 came from patients who had been diagnosed as brain dead. Only 59% of brain dead patients became organ donors (Figure 8.1) (compared with 55% in the UK). Potential organ donors were lost at three points: (i) families were not approached for assent to organ donation, (ii) families refused assent, and (iii) families assented, but donation did not proceed for a variety of reasons.

Eighty-nine per cent of families were approached for organ donation. Of families who were approached, 75% assented to organ donation. Of families who assented, 88% of their relatives proceeded to become organ donors. Thus, there is fall-off at each step in the 'cascade' shown in Figure 8.1.

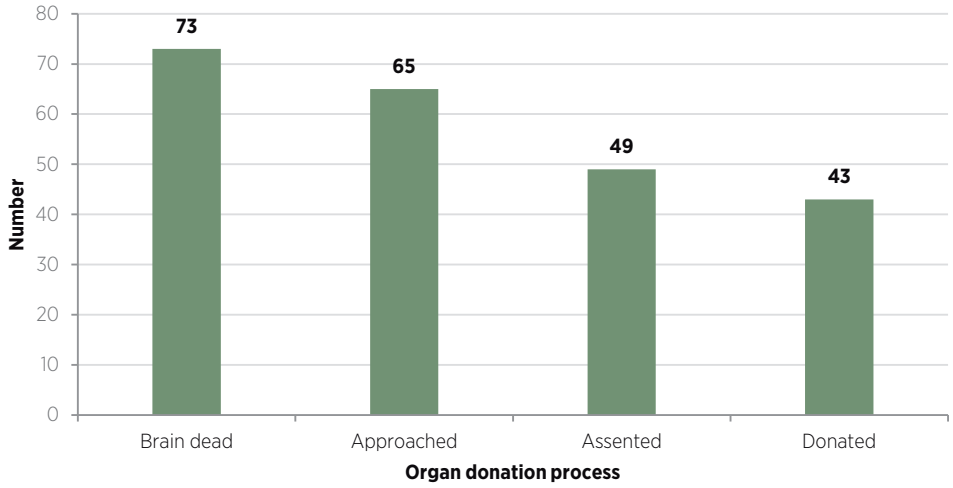


FIGURE 8.1: PROCESS FROM BRAIN DEATH TO ORGAN DONATION (NUMBERS OF PATIENTS, DIAGNOSED AS BRAIN DEAD)

BRAIN DEATH AND ORGAN DONATION IN INDIVIDUAL UNITS

Organ donation data for individual Units are shown in Figure 8.2. The proportion of patients whose families were not approached to request organ donation was relatively constant across Units – this was usually due to patient factors which were perceived to make organ donation inappropriate (Figure 8.3). We have not examined how many cases were referred to ODTI before Units made a decision not to approach families regarding organ donation.

The rate of assent when families were approached regarding organ donation varied between Units. Surprisingly, rates of family assent to organ donation tended to be lower in the Units with the largest numbers of brain dead patients (assent rates: Mater, 43%; Beaumont Neuro ICU 55%; St James's GICU, 60%; Beaumont GICU, 66%). Limerick varied from this trend with an assent rate of 86% from eight brain dead patients. Assent rates were 100% in smaller Units with 1–3 brain dead patients.

Numbers were too small to draw firm conclusions on the rates of assent to organ donation, but data over a number of years would be more informative. The low rates of 'conversion' of brain dead patients to organ donors in the larger Units suggests that there could be considerable potential to increase organ donation by improving assent rates in these Units. It would be useful for these Units to locally explore the reasons for low rates of assent.

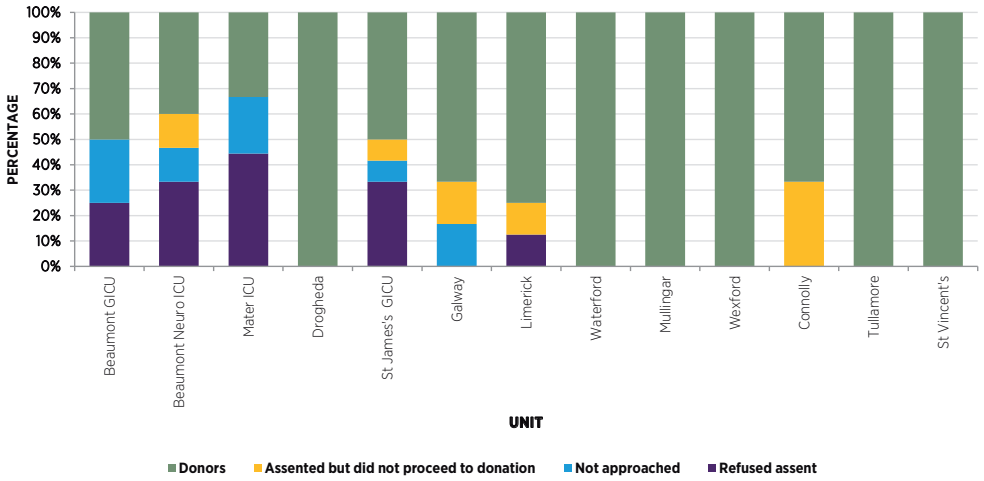


FIGURE 8.2: BRAIN DEATH AND ORGAN DONATION IN EACH UNIT (PERCENTAGES OF BRAIN DEAD PATIENTS)*

* Full hospital names are available within the frequency tables.

REASONS FOR NOT BECOMING AN ORGAN DONOR

The reasons why families were not approached about organ donation, why patients for whom assent had been obtained did not progress to organ donation, and the numbers of families who refused assent are shown in Figure 8.3. Data were pooled for all Units.

By far the commonest reason that patients did not become donors was because families withheld assent. We have no data on the reasons for this; often there are multiple reasons, or the reasons are unclear. It could be intrusive to probe for these reasons in many cases.

The predominant reason why families were not approached to request organ donation was a perceived contraindication to organ donation.

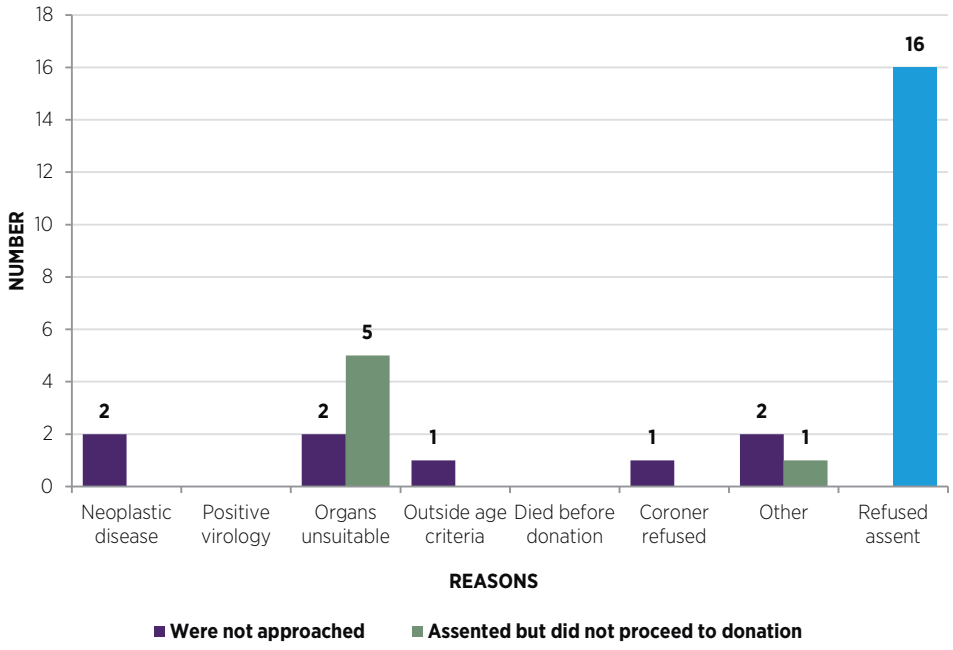


FIGURE 8.3: REASONS WHY BRAIN DEAD PATIENTS DID NOT BECOME DONORS: (I) WHY FAMILIES WERE NOT APPROACHED, (II) FAMILIES ASSENTED BUT PATIENTS DID NOT BECOME DONORS, AND (III) REFUSED ASSENT

RATES OF ORGAN DONATION IN BRAIN DEAD PATIENTS

Refusal of assent to organ donation by families was the leading reason why brain dead patients did not become organ donors (Figure 8.3). Thus, the Units with the lowest rates of assent to organ donation (Figure 8.2) also had the lowest rates of organ donation by brain dead patients (Figure 8.4). The proportion of brain dead patients becoming organ donors ranged from 33% in the Mater Misericordiae University Hospital to 100% in smaller Units with only 1–3 brain dead patients.

Nationally, 59% of brain dead patients became organ donors in 2018 (compared with 63% in 2017). These numbers are similar to international comparators – in the UK, 55% of patients diagnosed as brain dead in 2018 became organ donors.

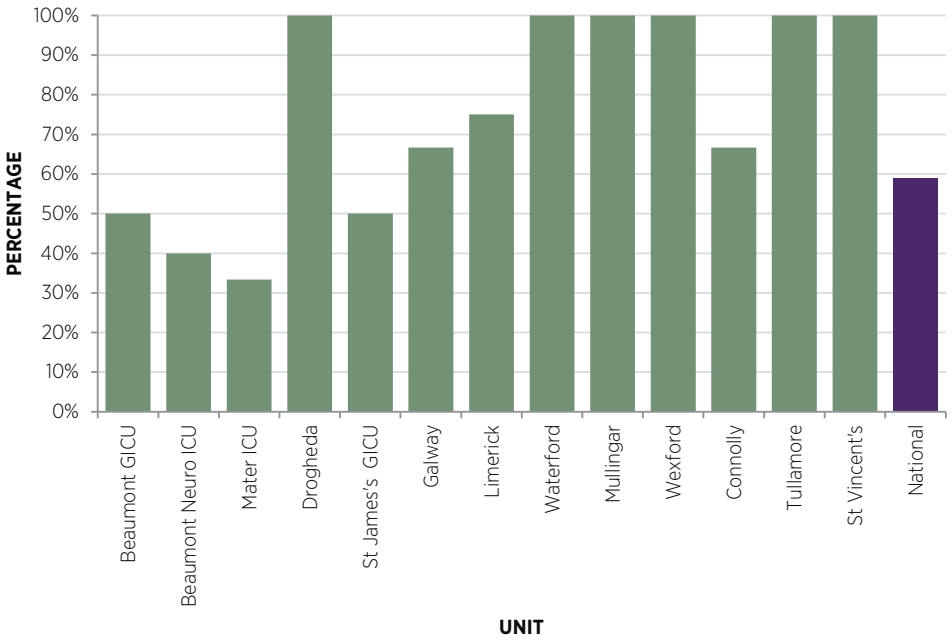


FIGURE 8.4: DONORS AFTER BRAIN DEATH AS A PROPORTION OF ALL BRAIN DEATHS*

* Full hospital names are available within the frequency tables.

REFERRAL TO ORGAN DONATION PERSONNEL

Referral of brain dead patients to organ donation personnel (ODP) is a key step in progressing the process of organ donation. ODP were defined as ODTI staff or the Hospital Group Organ Donation Nurse or ICU consultant. The commonest reason why patients are not referred to ODP is likely because families have already refused assent after being approached by local clinical staff regarding organ donation. Sometimes patients are not referred to ODP because clinical staff feel the patient will not be suitable to donate organs; however, this may not be the case and all brain dead patients should be referred, in case some organs may be utilised. Even if families have refused assent, communication with ODP facilitates collection of complete data in this important area.

Interestingly, the lowest rates of referral to ODP were in the larger Units with the largest numbers of brain dead patients (Beaumont, Mater) (Figure 8.5). These Units had the highest rates of refusal of assent (Figure 8.2). If families had already refused assent, this could explain why patients were not referred. Conversely, it could be that the lack of involvement of ODP may have contributed to the low rates of assent.

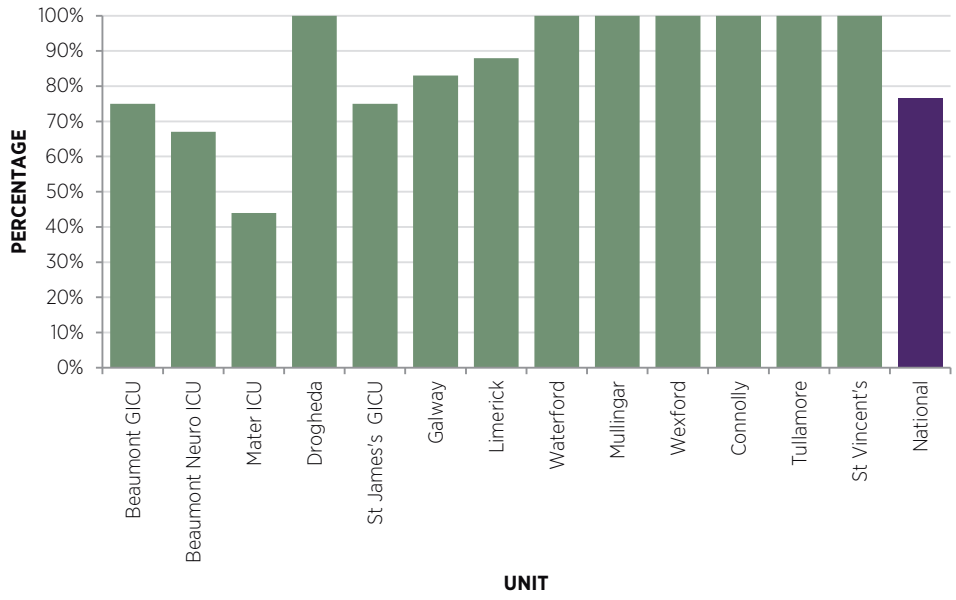


FIGURE 8.5: PERCENTAGE OF BRAIN DEAD PATIENTS REFERRED TO ORGAN DONATION PERSONNEL*

* Full hospital names are available within the frequency tables.

CIRCULATORY DEATHS

Ninety-seven per cent of deaths in ICU were 'circulatory deaths'; death was defined by cessation of circulation (Figure 8.6). A very small proportion of these patients may be suitable as organ donors, but in many countries this group makes a valuable contribution to organ donation. The National ICU Audit aimed to identify the potential for this in Irish ICUs.

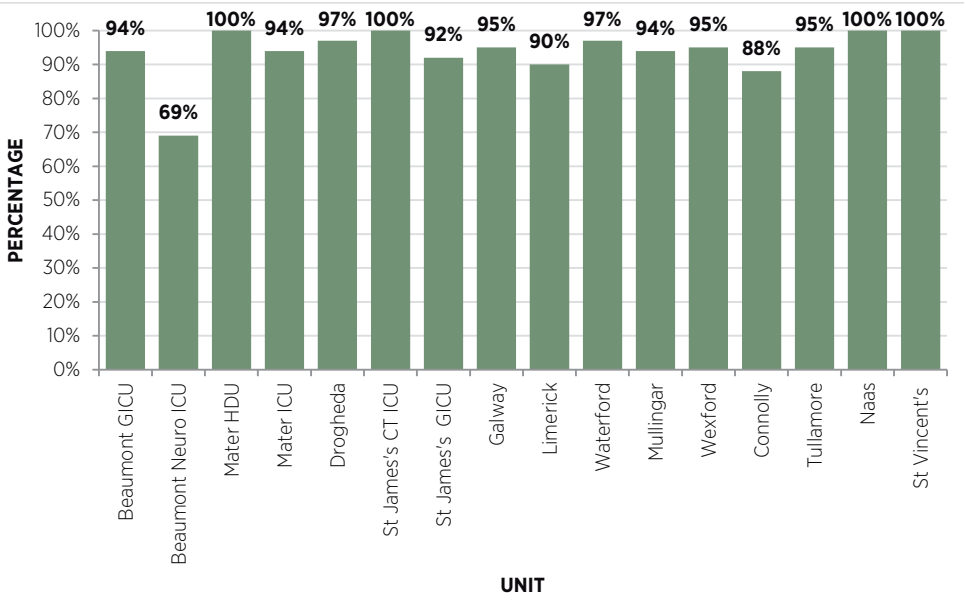


FIGURE 8.6: CIRCULATORY DEATHS AS A PERCENTAGE OF ALL DEATHS*

* Full hospital names are available within the frequency tables.

REFERRAL TO ORGAN DONATION PERSONNEL (ODP)

The potential for organ donation after circulatory death typically occurs in patients who have suffered a severe brain injury with no hope of a meaningful recovery but who do not fulfil the criteria for brain death. These patients present in all ICUs but are more frequent in a Neurosurgical Unit. While the bulk of donation after circulatory death (DCD) referrals came from Beaumont Hospital, a number of other Units also referred potential donors to ODP (Figure 8.7).

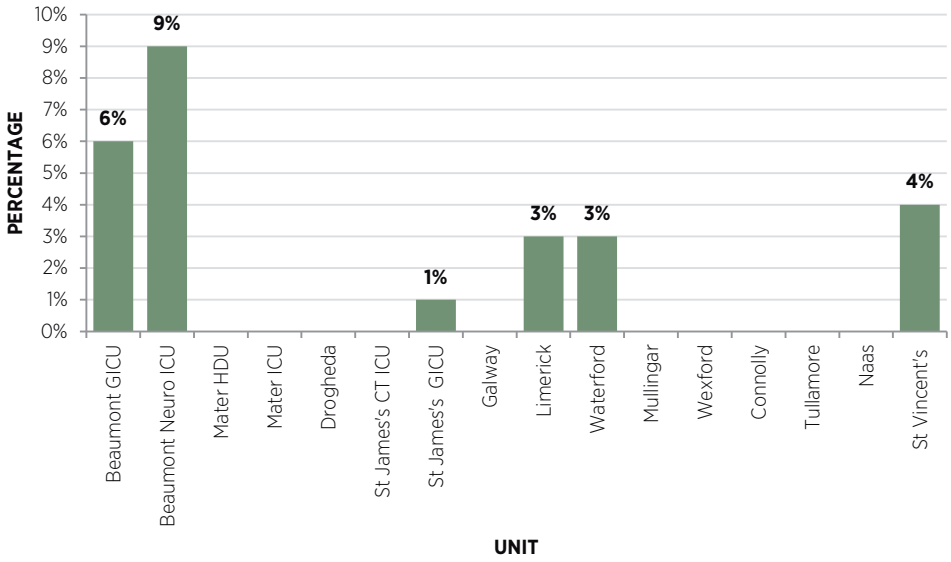


FIGURE 8.7: PERCENTAGE OF CIRCULATORY DEATHS REFERRED TO ORGAN DONATION PERSONNEL*

* Full hospital names are available within the frequency tables.

DONATION AFTER CIRCULATORY DEATH

In the vast majority of cases, DCD was not feasible for clinical reasons and the prospect of organ donation was not raised with the families of patients who were dying. A number of Units approached some families to request assent to DCD for their family member (Figure 8.8). There was a high refusal rate to DCD (13 of 21 requests; 62%).

In patients with assent to DCD, four out of eight did not proceed to organ donation because the organs were deemed unsuitable, death occurred before DCD took place, or the time to reach asystole after withdrawal of life-sustaining therapies was too prolonged. Four patients in total donated organs after circulatory death: three in Beaumont GICU and one in Beaumont Neurosurgical ICU. Reasons why only Beaumont provided DCD donors could be related to it having a larger population of potential organ donors as a neurosurgical centre, having the renal transplant team based in the hospital (which reduces the logistical challenges of DCD), and the experience and expertise which has been built up by Beaumont Hospital staff having regularly undertaken DCD.

Some 0.4% of all circulatory deaths resulted in organ donation in Ireland, compared with 2.1% in the UK.

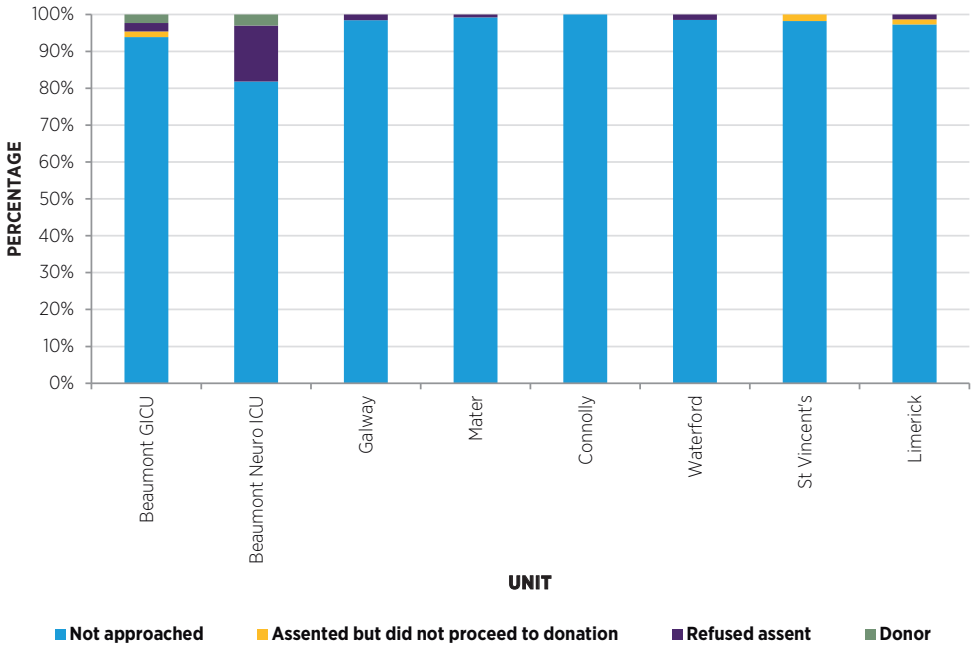


FIGURE 8.8: DONATION AFTER CIRCULATORY DEATH: DONORS, ASSENTED BUT DID NOT PROCEED TO DONATION, REFUSED ASSENT, FAMILIES NOT APPROACHED (PERCENTAGES)*

* Full hospital names are available within the frequency tables.

REASONS WHY FAMILIES WERE NOT APPROACHED FOR ORGAN DONATION

If the cause of death is not related to a neurological condition, DCD is generally not feasible. Thus, the commonest reason for not approaching families regarding DCD was because the cause of death was not neurological (Figure 8.9). Other reasons are documented below.

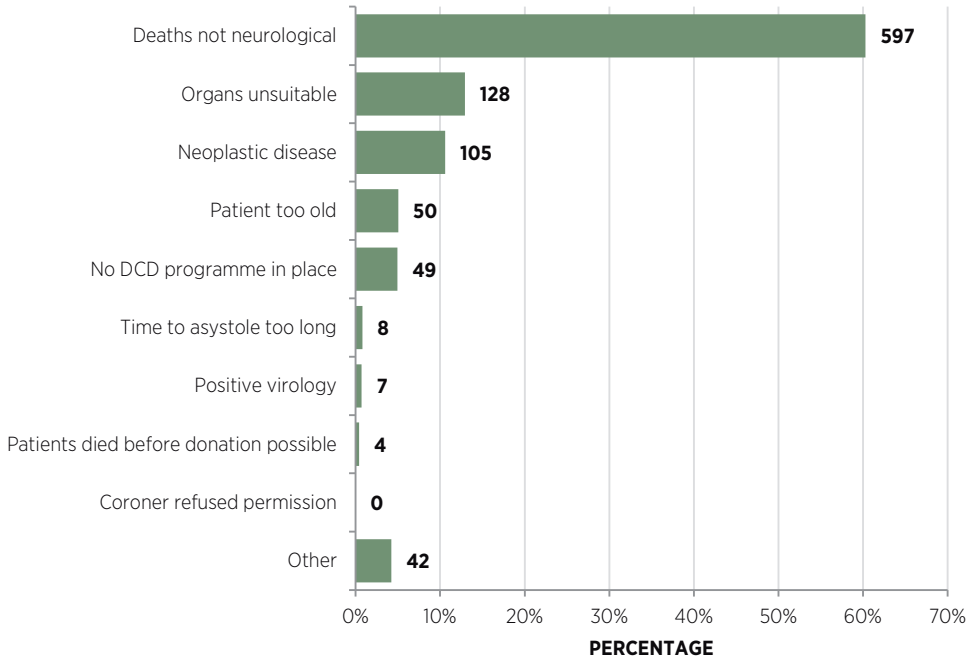


FIGURE 8.9: REASONS FOR NOT APPROACHING FAMILIES OF PATIENTS REGARDING ORGAN DONATION AFTER CARDIAC DEATH (NUMBER AND PERCENTAGE OF ALL DEATHS DIAGNOSED BY CIRCULATORY CRITERIA)

KEY FINDINGS FROM CHAPTER 8

- Deaths defined by the criteria for brain death made up 6.7% of all deaths with a range from 0% of deaths in a Cardiothoracic Unit to 31% in a Neurosurgical Unit.

- Fifty-nine per cent of patients who were brain dead became organ donors. The commonest reason for patients not becoming organ donors was families withholding assent. Nevertheless, 75% of families who were approached gave assent to organ donation.

- Surprisingly, the rates of assent by families to organ donation were lowest in the larger Units with greater numbers of brain dead patients. The reasons for this are unclear. It offers the potential for a significant increase in organ donor numbers by focusing on improving assent rates in the larger Units.

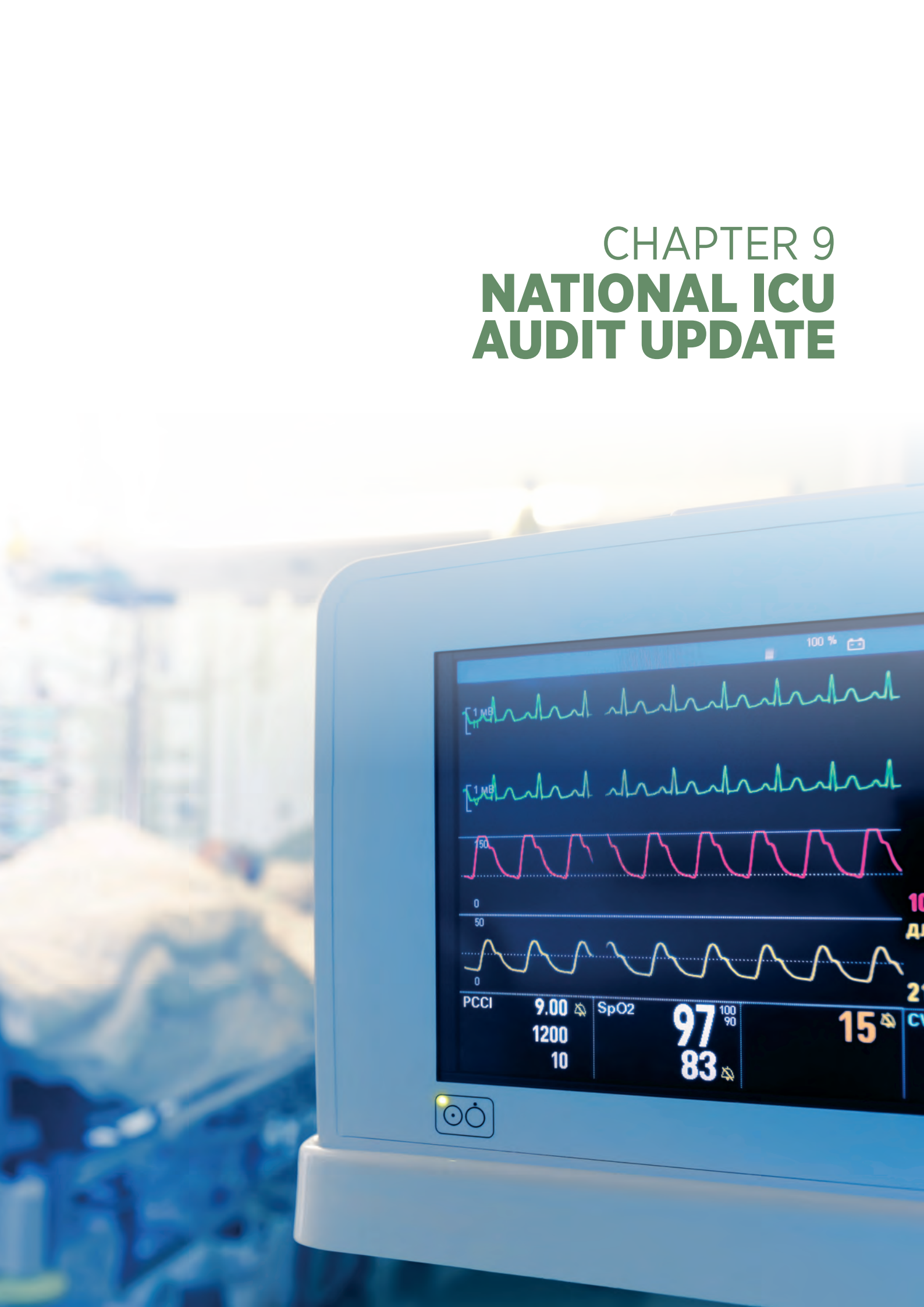
- Twelve per cent of patients whose families assented to organ donation (six patients) did not progress to organ donation. The commonest reason was that transplant surgeons did not consider the organs suitable for transplantation.

- Only four patients whose deaths were defined by circulatory criteria became organ donors, all in Beaumont Hospital. The majority of patients were not suitable to be considered for organ donation due to clinical reasons.

- The refusal rate to requests for organ donation was considerably higher in potential DCD donors than with potential donors after brain death (13 of 21 requests). The reasons for this are unknown. Only 0.4% of circulatory deaths resulted in organ donation in Ireland, compared with 2.1% in the UK, suggesting significant potential to recruit more DCD donors.

CHAPTER 9

NATIONAL ICU AUDIT UPDATE



CHAPTER 9: **NATIONAL ICU AUDIT UPDATE**

USE OF NATIONAL ICU AUDIT INFORMATION

NOCA launched and presented the first Irish National ICU Audit Report in February 2019 at the NOCA Conference. The NOCA Clinical Lead for ICU Audit was invited to present this report at the National Clinical Programme for Critical Care Conference and at the ICNARC conference in London in May 2019. The ICU audit managers presented on the report at the Irish Association of Critical Care Nurses Conference in April and submitted a poster at the CCP Conference in May entitled 'Irish National ICU Audit (INICUA) – a lot done more to do'.

In November 2019, the NOCA Clinical Lead presented a summary of the National ICU Audit structure and dataset to a delegation from the French Ministry of Health, which is interested in setting up a similar national project.

Development of an ICU Audit National Database was recommended in the first National Report. Data from this report have supported a submission for funding to the HSE for this project, which is expected in 2020.

There are four hospitals with ICUs which are not participating in the ICU Audit at the moment. To have comprehensive national coverage, a funding submission has been made to incorporate these Units.

The National CCP uses the data collated from the ICU Audit to further align capacity planning for critical care expansion with the Models of Care for Critical Care. In November 2019, the NOCA Clinical Lead presented draft data from the 2018 Report to senior managers from the HSE to highlight deficiencies in critical care capacity and to support the expansion of critical care beds. Specific service planning and initiatives are also supported by the CCP in response to findings within the ICU Audit. Reconfiguration of critical care services was recommended in the 2017 report and again in this report.

The CCP has been a strong advocate for the development of additional audit nurse posts since the launch of the first report in critical care to further expand data collection nationally, confirming the importance of this work.

Timely access to ICU was a recommendation in the 2017 report and again in this report. Since October 2018, Units have contributed data for a HSE KPI for the proportion of patients admitted to ICU within one hour and four hours of the decision to admit to ICU. The targets for this KPI are 50% of ICU admissions reaching ICU within one hour and 80% of ICU admissions reaching ICU within four hours of the decision to admit. The aim of this KPI is to promote rapid admission to ICU for critically ill patients and highlight Units with particular problems with delayed admissions, either because of ICU bed shortages or administrative issues. These reports are returned to the HSE Business Intelligence Unit quarterly and then forwarded to HSE Acute Operations, hospital CEOs and Hospital Group CEOs as part of the HSE quarterly reporting cycle.

A funding model for activity-based funding (ABF) is being developed by the Healthcare Pricing Office (HPO) to link ICU Audit data with the costs incurred in care of patients in ICU/HDU. The aim is to support accurate costing of future developments in critical care capacity and to reimburse hospitals appropriately for care of the critically ill, as there is a recognition that existing systems have deficiencies. This would support the future development of models of 'ABF'.

ICU Audit data support HIPE coding in each hospital. Data are made available to HIPE coders by means of a shared folder on the local hospital drive. Full data protection, governed locally, is part of this process. This was described within a poster presentation from Tullamore ICU, at the CCP Conference in May entitled 'Irish National ICU Audit (INICUA) – supporting HIPE coding locally'.

Training

Training for Audit Coordinators was provided at two workshops in 2018. These were very popular, with full attendance by Audit Coordinators at both. Feedback from the March workshop and issues with data quality which emerged while writing the 2017 National Report were used to inform the November workshop. These workshops promote interaction between colleagues from different hospitals and development of uniformity in the interpretation of data definitions. Throughout the year, there were monthly teleconferences for ICU audit managers and coordinators. In addition, the audit managers regularly attended local hospital meetings to support interpretation of ICNARC reports received by the hospitals.

Audit developments

The National ICU Audit IT system has been used to support a national BIS for ICU beds. This is a web-based view of ICU bed availability in individual Units to facilitate the transfer of critically ill patients between hospitals. The ICU-BIS can also be used to improve Units' ability to manage critically ill patients both in the Unit and outside the Unit while awaiting a bed.

Funding is being sought to have a National ICU Audit Database at NOCA. Reports are planned on organ donation, obstetric, and paediatric activity in adult ICUs, transfers from other Units and hospitals, and HCAI. Reports generated from a National Database could have a role in supporting research projects in the future.

NOCA has developed an activity dashboard for Ireland East Hospital Group to provide regular updates on hospital activity and performance. This model could be expanded to provide a similar dashboard for reports for other Hospital Groups. A National Database could allow automatic population of activity dashboards for Hospital Groups and others.

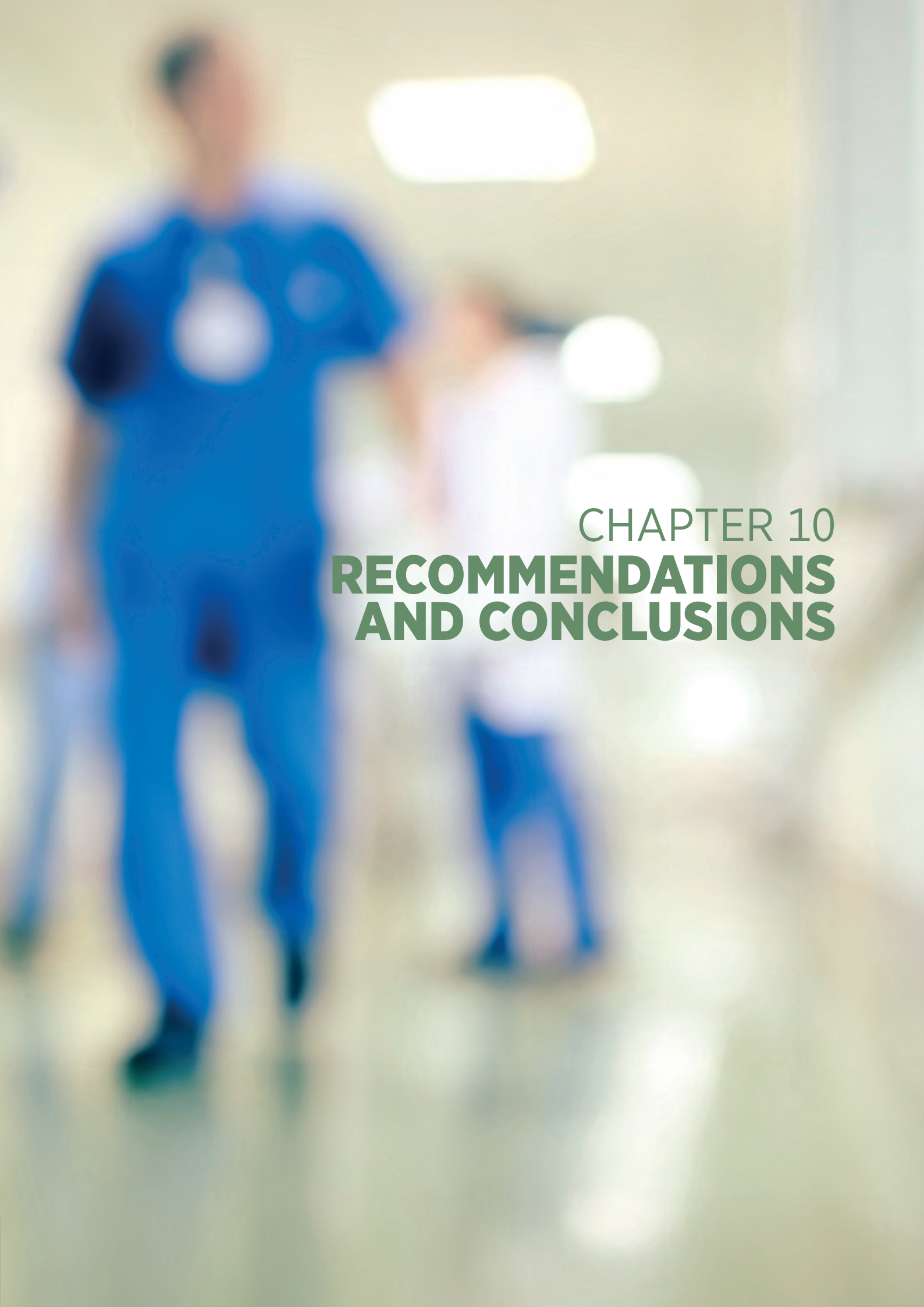
STRENGTHS AND LIMITATIONS OF THE 2018 REPORT

Strengths

1. The report provides a good cross-sectional view of critical care facilities nationally; contributing Units include major tertiary referral centres, smaller regional hospitals, specialty Units, a HDU, and combined ICU/HDUs.
2. The report covered an estimated 70% of national critical care activity in HSE-funded hospitals.
3. The quality of data was good. ICU audit nurses have been trained by ICNARC and NOCA; there is good ongoing support from the audit managers at NOCA in order to ensure national consistency in interpretation of ICNARC definitions for data entry; the numbers of ICU audit nurses are generally adequate; and ICNARC provides invaluable support in validating the quality of data it receives and in liaising with individual Units about any data quality issues that ICNARC identifies.
4. Data analysis has been provided by ICNARC in the UK, allowing NOCA to benefit from its experience, expertise, and the credibility provided by its international reputation.
5. The report provides benchmarking of Irish activity and outcomes against the UK.
6. The report provides benchmarking between Irish Units, which is a powerful driver of quality improvement.
7. There has been complete buy-in to the ICU Audit project by clinicians (both medical and nursing), hospital management, and national structures (the HSE, the Department of Health and Hospital Groups). This has facilitated the implementation of the ICU Audit and should also support actions to improve patient care based on the findings of the report.

Limitations

1. Some large ICUs were not included as ICU Audit had not yet been implemented there. Thus, the case mix and outcomes do not fully represent the national picture.
2. No private hospitals were included in the report.
3. Some Units had only six months of data reported.
4. While there is clear evidence of pressure on ICU bed capacity, there are no data on unmet need, that is, patients not admitted to ICU or delayed admission to ICU or patients discharged early.
5. There was insufficient coverage by the adult ICU Audit to calculate population metrics, such as the number of admissions to ICU per 100,000 population. This and other metrics would allow comparisons of ICU provision between countries.



CHAPTER 10
RECOMMENDATIONS AND CONCLUSIONS

CHAPTER 10: **RECOMMENDATIONS AND CONCLUSIONS**

RECOMMENDATION 1

Increase bed capacity in adult Critical Care Units (ICU and HDU) towards the 430 beds recommended in the Department of Health's *Health Service Capacity Review 2018.*

Rationale

1. Bed occupancy levels were significantly greater than recommended, especially in the larger Units.
2. Patients had greater levels of multisystem organ dysfunction, higher illness severity scores, and higher values for predicted mortality on admission to ICU compared with the UK. This suggests delayed admission to ICU or that patients who would be admitted to ICU in the UK are remaining in the ward in Ireland.
3. Rates of unplanned ICU readmission were excessive in one large Unit.
4. Rates of admission with multiorgan dysfunction were excessive in another large Unit, suggesting delayed ICU admission.
5. The Department of Health identified a major shortfall in critical care bed capacity in the *Health Service Capacity Review 2018.*

What action should be taken?

1. Identify the Units which have the greatest need for additional critical care bed capacity, using the data in this report on bed occupancy, delay in admission to ICU, the complexity of care provided, outlier data for quality indicators linked to inadequate bed capacity, and efficiency in using existing bed capacity.
2. Identify additional resources to increase critical care beds in these Units.

Who will benefit from this action/recommendation?

1. Critically ill patients will receive appropriate treatment earlier, leading to reduced morbidity and mortality.
2. Patients can stay in ICU or HDU for longer, thus reducing out-of-hours discharges, discharges with a high NEWS, and unanticipated readmissions.
3. Units will not operate overcapacity, which impacts on the care received by all patients in the Unit.
4. Staff will experience lower levels of stress and burnout, which will assist staff recruitment and retention and improve morale and patient outcomes in ICU.
5. Earlier intervention in critical illness will lead to a shorter stay in ICU, ultimately reducing costs.

Who is responsible for implementing this action/recommendation?

1. The CCP and Hospital Groups to prioritise hospitals and Units which are most in need of additional critical care beds.
2. HSE Acute Operations to allocate lead in identifying resources to increase critical care capacity in consultation with the Department of Health.
3. Hospital and Hospital Group CEOs to implement expansion of critical care beds where appropriate.

When will this be implemented?

Implementation is likely to be gradual due to funding limitations and also due to the existing difficulty in recruitment of specialist staff for critical care.

However, commitment to a programme of continual expansion of critical care beds is essential to correct the existing deficit and to meet future increased needs.

RECOMMENDATION 2

Review the appropriateness of providing care for critically ill patients in Units with small numbers of patients with multiorgan failure, in line with the recommendations of the HSE Critical Care Programme Model of Care, the Joint Faculty of Intensive Care Medicine of Ireland, and the European Society of Intensive Care Medicine.

Rationale

Some Units had low numbers of patients undergoing invasive ventilation, cardiovascular support, and dialysis (see Chapter 5). Professional bodies have highlighted the importance of Units having adequate volumes of critically ill patients to maintain expertise and skills (JFICMI, 2019; ESICM, 2011).

Conversely, many smaller hospitals require on-site ICU to support the range of services they currently provide, i.e. ED, obstetrics. Reassuringly, the ICU Audit shows that ICU outcomes are good in the smaller hospitals reported to date.

What action should be taken?

1. Review critical care services in hospitals with lower volumes of patients requiring support of multiple organ systems, within the context of the other services which must continue to be provided in the hospital.
2. Develop protocols for the early transfer of critically ill patients from smaller hospitals to a 'hub' ICU (as per the HSE Critical Care Programme Model of Care (HSE, 2014)).
3. Increase the numbers of ICU beds in 'hub' ICUs to accommodate the patients who are currently managed in smaller Units before any decisions are made about discontinuing critical care services in hospitals with small volumes of patients.

Who will benefit from this action/recommendation?

1. Patients have been shown internationally to have better outcomes in Units with larger volumes of patients.
2. Larger Units have more potential for training, which will aid staff recruitment.
3. Concentrating critically ill patients in a larger Unit is cost-effective.

Who is responsible for implementing this action/recommendation?

1. Hospital Groups in collaboration with the HSE Critical Care Programme and the support of HSE Acute Operations.

When will this be implemented?

This requires an ongoing process of education, data collection, and engagement with health professionals, the HSE, politicians and local communities.

RECOMMENDATION 3

Prioritise the discharge of patients from ICU to the ward once they have been declared fit for discharge.

Rationale

1. Earlier discharge of patients who are fit for discharge would make ICU beds available immediately for the rapid admission of critically ill patients, and thus avoid these patients having to endure a prolonged wait while existing ICU patients are being discharged.
2. Discharging patients from ICU when they no longer require this level of care would reduce overcrowding in ICU, which impacts on patient care.
3. Discharging patients when cleared for discharge would reduce discharges from ICU at night, which increases risk for patients.

What action should be taken?

1. Patient flow managers should prioritise discharges from ICU when patients are cleared for discharge in order to have at least one 'emergency bed' free in ICU whenever possible.
2. The HSE and Hospital Groups should ensure that there is adequate hospital bed capacity to accommodate patients discharged from ICU/HDU.

Who will benefit from this action/recommendation?

1. Patients who require urgent admission to ICU
2. Patients in ICU
3. Staff in ICU who currently spend a lot of time arranging ICU discharges and trying to ensure that patients awaiting admission to ICU receive adequate care outside the Unit.

Who is responsible for implementing this action/recommendation?

1. Hospital CEOs
2. Hospital patient flow managers
3. The CCP
4. HSE Acute Operations.

When will this be implemented?

This recommendation should be implemented immediately.

RECOMMENDATION 4

Explore best practice in providing optimal care for high-risk patients outside critical care, including the potential benefits of critical care outreach teams.

Rationale

1. Critically ill patients may remain on a ward for a lengthy period while awaiting admission to ICU.
2. The incidence of in-hospital CPR before ICU admission was high in certain hospitals; this may have been prevented by better detection and treatment of deteriorating patients in the wards and earlier admission to ICU.
3. High rates of (i) patients with multiorgan failure within 24 hours of ICU admission, (ii) ICU discharges out-of-hours and (iii) high NEWS on ICU discharge suggest a need for better support for ward staff in caring for sick patients.
4. An outreach service would improve the documentation of 'unmet need' in the care of critically ill patients in the ward.

What action should be taken?

1. Explore which options will work best to improve the care of critically ill patients in Irish hospital wards.
2. Review the potential role of critical care outreach teams.
3. Improve the documentation of unmet need in the care of critically ill patients.
4. Set up and resource critical care outreach teams if pilot schemes in Irish hospitals show benefit.

Who will benefit from this action/recommendation?

1. Patients who become critically ill in hospital wards
2. Ward staff, who will benefit from more skilled support and extra manpower in caring for critically ill patients outside ICU
3. Critical care staff, who are currently drawn away from the Unit to care for ward patients.

Who is responsible for implementing this action/recommendation?

1. All acute hospitals
2. The CCP
3. The HSE National Deteriorating Patient Improvement Programme (DPIP).

When will this be implemented?

This recommendation should be implemented immediately.

RECOMMENDATION 5

Improve the rates of organ donation after brain death in the larger Units.

Rationale

In 2018, the largest Units had the lowest rates of organ donation from brain dead patients. Focusing efforts on these Units offers the best potential for improvement in numbers of organ donors.

What action should be taken?

Units with lower rates of organ donation after brain death should explore the reasons for this and focus on efforts to address this issue.

Who will benefit from this action/recommendation?

Patients on transplant waiting lists.

Who is responsible for implementing this action/recommendation?

1. ODTI
2. ODP funded by ODTI in high-volume Units and across Hospital Groups
3. All staff in ICU and HDU.

When will this be implemented?

This recommendation should be implemented immediately.

RECOMMENDATION 6

Improve the rates of organ donation after circulatory death (DCD).

Rationale

Rates of organ donation after circulatory death (DCD) and rates of referral to ODP were low compared with potential rates and compared with the UK.

What action should be taken?

1. Improve awareness and training of staff in relation to DCD.
2. Increase staffing of transplant teams to support increased retrieval of organs after circulatory death.
3. Put programmes in place in all Units for protocols, education, and training in relation to DCD.
4. Assess resources needed to support an increase in DCD by increasing organ donation personnel for all hospitals.

Who will benefit from this action/recommendation?

Patients on the waiting list for organ transplantation.

Who is responsible for implementing this action/recommendation?

1. ODP in Hospital Groups
2. All staff in ICU and HDU
3. ODTI to assess resources needed to increase organ donation and transplant team staff.

When will this be implemented?

Implementation of programmes for DCD should start immediately.

RECOMMENDATION 7

Improve psychological care for relatives whose family member is in critical care.

Rationale

The stress and trauma experienced by families of critically ill patients is highlighted in the Patient Story section in this report (page 20). Support for families is an integral part of the role of critical care staff and there is potential for significant improvements in this area, in order to ensure the consistency and appropriateness of support.

What action should be taken?

1. Improve awareness among staff of this issue by education.
2. Ensure adequate staffing of ICUs/HDUs to ensure that staff have enough time to undertake this important part of their job.
3. Develop Family-Reported Outcome Measures (FROMs) to monitor how well Units are performing in this area.

Who will benefit from this action/recommendation?

Relatives, patients and ICU staff.

Who is responsible for implementing this action/recommendation?

1. The CCP, professional bodies (Intensive Care Society of Ireland (ICSI), Irish Association of Critical Care Nurses (IACCN), JFICMI) and patient groups (ICUsteps) should develop programmes to promote awareness and education in this area.

2. NOCA should develop metrics and targets for FROMs and incorporate them into the ICU Audit Programme.
3. Local hospitals should run pilot projects in this area and report the results.

When will this be implemented?

This recommendation should be implemented immediately.

RECOMMENDATION 8

Expand the range of reports produced by the NOCA ICU Audit on data already collected for ICU Audit.

Rationale

1. There is a lack of information in some areas, including obstetric patients in ICU, infection in ICU, transfers of patients between hospitals, levels of care provided, Patient-Reported Outcome Measures (PROMs), and FROMs. Data on transfers of critically ill patients between hospitals are required for planning the National Ambulance Service Critical Care Retrieval Service, but such data are currently not available.
2. Information on the needs of different groups of critically ill patients is essential in order to identify risks which should be managed and also in order to ensure the proper structuring of services, including, for example, addressing the issue of the numbers of obstetric patients who develop critical illness and require ICU admission.
3. Collecting data on outcomes (e.g. central venous catheter-related bloodstream infection (CRBSI)) drives quality improvement measures to improve these outcomes.

What action should be taken?

1. Develop other reports from ICNARC to maximise the information available from the existing ICNARC dataset.
2. Develop a National Database to facilitate reports on issues which arise from the large database now recording ICU activity in Ireland (as recommended in the *Irish National ICU Audit Annual Report 2017*).

Who will benefit from this action/recommendation?

1. Patients will benefit from optimal organisation of critical care services and from the recognition and prevention of organisational risks to their recovery.
2. Healthcare clinicians, managers and planners.
3. The National Ambulance Service, which needs data on transfers of critically ill patients.

Who is responsible for implementing this action/recommendation?

NOCA.

When will this be implemented?

Funding has been sought to develop the National ICU Audit Database.

RECOMMENDATION 9

Regrade ICU Audit Coordinator posts to clinical nurse manager (CNM) level.

Rationale

The ICU Audit Coordinator is a senior role requiring an ability to accurately interpret complex ICU data for ICU Audit. NOCA recommends clinical nurse manager (CNM) level for this role. However, national funding for the role in most hospitals is at a staff nurse level, although some hospitals have recognised the role at CNM level. Failure to recognise the role at CNM level has resulted in Audit Coordinators leaving their posts and hospitals being unable to fill vacancies due to the lower grade offered. This has significantly impacted on data collection for these sites and has led to gaps in the continuity of ICU Audit in a number of hospitals.

What action should be taken?

Recognise and fund the ICU Audit Coordinator post at CNM grade.

Who will benefit from this action/recommendation?

ICU Audit and, indirectly, patients who require critical care.

Who is responsible for this action/recommendation?

The CCP and the Office of Nursing and Midwifery Services Director to develop a business case to submit for funding.

When will this be implemented?

As soon as possible.

CONCLUSION

This report provides a large volume of data on activity and on outcomes in Irish Critical Care Units (ICUs and HDUs). The accuracy of the data within this report is supported by (i) the experienced and committed Audit Coordinators who collect the data; (ii) the data quality assessment in Chapter 3 of this report; (iii) support from NOCA experts for the data collection process; (iv) quality control and analysis of the data by the UK Audit organisation ICNARC; (v) the fact that unexpected or outlier findings in the data have generally been confirmed as valid when investigated; and (vi) the consistency in data findings in individual Units between 2017 and 2018.

Accurate data and agreement by the ICU Audit Governance Committee on interpretation of these data provide the basis for the recommendations above. The Governance Committee advocates that these recommendations are acted upon for the benefit of critically ill patients in our hospitals.

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APPENDICES

APPENDIX 1: GOVERNANCE OF INICUA, 2018

NATIONAL ICU AUDIT GOVERNANCE COMMITTEE ATTENDANCE AT MEETINGS, 2018

Organisation	Name	14.3.18	27.6.18	3.10.18	22.11.18	12.12.18
NOCA Clinical Lead ICU Audit	Dr Rory Dwyer	✓	✓	✓	✓	✓
Joint Faculty of Intensive Care Medicine of Ireland	Dr Brian Marsh	N/A	N/A	✓	✓	✓
Joint Faculty of Intensive Care Medicine of Ireland	Dr Jeanne Moriarty	✓	✓	N/A	N/A	N/A
National Lead for Paediatric ICU Audit	Dr Martina Healy	✗	✗	✓	✓	✗
Intensive Care Society of Ireland	Dr Catherine Motherway	✗	✓	✓	✓	✓
College of Anaesthesiologists of Ireland	Dr Kevin Carson	✗	✗	N/A	N/A	N/A
College of Anaesthesiologists of Ireland	Dr Brian Kinirons	N/A	N/A	✗	N/A	N/A
College of Anaesthesiologists of Ireland	Professor Gerry Fitzpatrick	N/A	N/A	N/A	✗	✗
Royal College of Surgeons in Ireland	Dr Chris Collins	✓	✗	N/A	N/A	N/A
Royal College of Surgeons in Ireland	Professor David Healy	N/A	N/A	N/A	✓	✗
ICU Audit Coordinator Representative	Ms Magdalena Pecak	✓	✓	✗	✓	✗
Office of the Nursing and Midwifery Services Director, HSE	Mr Derek Cribbin	✓	✓	✓	✓	✓
Royal College of Physicians of Ireland	Prof Tim Mc Donnell	N/A	✓	✓	✗	✗
Public/Patient Interest Representative	Ms Barbara Egan	✓	✓	✓	✓	✓
Public/Patient Interest Representative	Mr Damian Nee	N/A	N/A	N/A	✓	✓
Irish Association of Directors of Nursing and Midwifery	Ms Eileen Whelan	✓	✓	✓	✗	✓
HSE Critical Care Programme	Dr Michael Power	✗	✗	✗	✓	✓
NOCA ICU Audit Manager	Ms Mary Baggot	✓	✓	✓	✓	✓
NOCA Executive Director	Ms Collette Tully	✓	✓	✓	✓	✓
NOCA ICU Audit Manager	Ms Fionnuala Treanor	✓	✓	✓	✓	✓

APPENDIX 2: LOCAL HOSPITAL GOVERNANCE COMMITTEE

This guidance can be applied to any Hospital Clinical Audit Committee that is involved in overseeing the local operation of a national audit under the auspices of NOCA. In some hospitals, it may be appropriate that a single Clinical Audit Committee provides oversight for a number of clinical audits.

ROLE AND REMIT OF THE CLINICAL AUDIT COMMITTEE

The Clinical Audit Committee should provide governance for the clinical audit. It should provide both clinical and professional expertise, when required, and work closely with the hospital's Clinical Lead for each audit.

This committee is responsible for:

- monitoring and supporting hospital participation in the clinical audit
- identifying clinical expertise for case review
- reviewing reports from the clinical audit and making recommendations regarding unexpected outcomes
- reporting to the hospital's Quality and Safety Executive Committee on results from the clinical audit
- providing assurance to the relevant NOCA Governance Committee regarding local governance of the clinical audit.

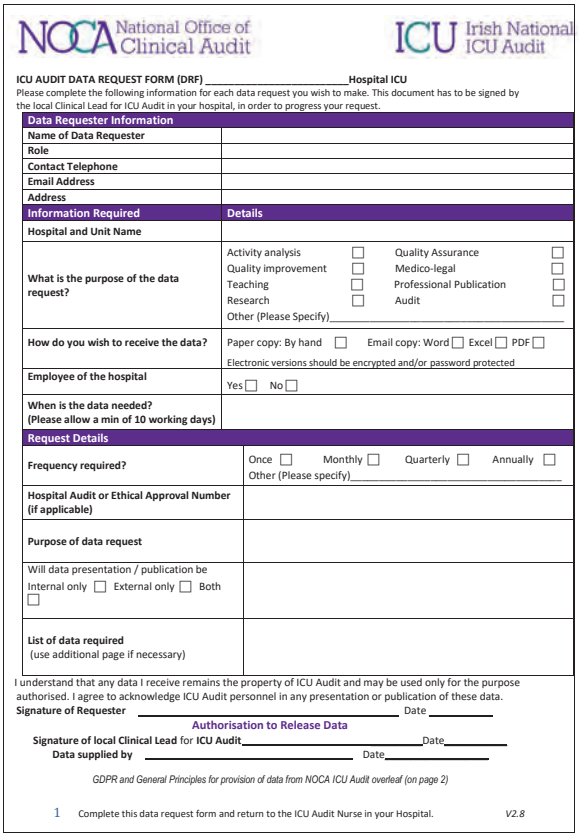
MEMBERSHIP OF THE CLINICAL AUDIT COMMITTEE

Membership should reflect the stakeholders in patient safety in each hospital and provide an appropriate mix of relevant expertise to support clinical audit governance.

ACCOUNTABILITY AND REPORTING RELATIONSHIPS

The Clinical Audit Committee is accountable to the Hospital Quality and Safety Executive Committee Chair.

APPENDIX 3: ICU AUDIT DATA REQUEST FORM (NOCA, 2017)



NOCA National Office of Clinical Audit — ICU Irish National ICU Audit

ICU AUDIT DATA REQUEST FORM (DRF) _____Hospital ICU

Please complete the following information for each data request you wish to make. This document has to be signed by the local Clinical Lead for ICU Audit in your hospital, in order to progress your request.

Data Requester Information	
Name of Data Requester	
Role	
Contact Telephone	
Email Address	
Address	
Information Required	**Details**
Hospital and Unit Name	
What is the purpose of the data request?	Activity analysis ☐ Quality Assurance ☐ Quality improvement ☐ Medico-legal ☐ Teaching ☐ Professional Publication ☐ Research ☐ Audit ☐ Other (Please Specify)_____
How do you wish to receive the data?	Paper copy: By hand ☐ Email copy: Word ☐ Excel ☐ PDF ☐ Electronic versions should be encrypted and/or password protected
Employee of the hospital	Yes ☐ No ☐
When is the data needed? (Please allow a min of 10 working days)	
Request Details	
Frequency required?	Once ☐ Monthly ☐ Quarterly ☐ Annually ☐ Other (Please specify)_____
Hospital Audit or Ethical Approval Number (if applicable)	
Purpose of data request	
Will data presentation / publication be Internal only ☐ External only ☐ Both ☐	
List of data required (use additional page if necessary)	

I understand that any data I receive remains the property of ICU Audit and may be used only for the purpose authorised. I agree to acknowledge ICU Audit personnel in any presentation or publication of these data.

Signature of Requester _____ Date _____

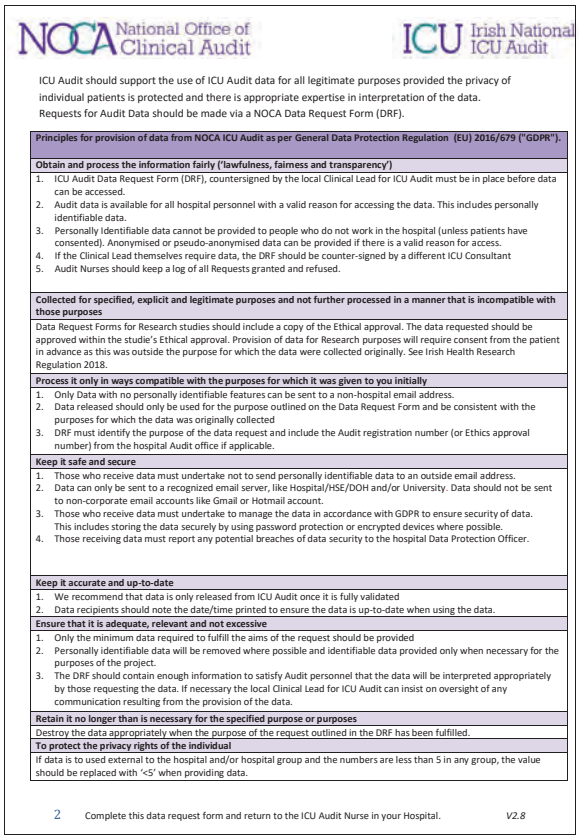
Authorisation to Release Data

Signature of local Clinical Lead for **ICU Audit**_____Date_____

Data supplied by _____ Date_____

GDPR and General Principles for provision of data from NOCA ICU Audit overleaf (on page 2)

1 Complete this data request form and return to the ICU Audit Nurse in your Hospital. *V2.8*



NOCA National Office of Clinical Audit — ICU Irish National ICU Audit

ICU Audit should support the use of ICU Audit data for all legitimate purposes provided the privacy of individual patients is protected and there is appropriate expertise in interpretation of the data. Requests for Audit Data should be made via a NOCA Data Request Form (DRF).

Principles for provision of data from NOCA ICU Audit as per General Data Protection Regulation (EU) 2016/679 ("GDPR").

Obtain and process the information fairly ('lawfulness, fairness and transparency')

1. ICU Audit Data Request Form (DRF), countersigned by the local Clinical Lead for ICU Audit must be in place before data can be accessed.
2. Audit data is available for all hospital personnel with a valid reason for accessing the data. This includes personally identifiable data.
3. Personally Identifiable data cannot be provided to people who do not work in the hospital (unless patients have consented). Anonymised or pseudo-anonymised data can be provided if there is a valid reason for access.
4. If the Clinical Lead themselves require data, the DRF should be counter-signed by a different ICU Consultant
5. Audit Nurses should keep a log of all Requests granted and refused.

Collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes

Data Request Forms for Research studies should include a copy of the Ethical approval. The data requested should be approved within the studie's Ethical approval. Provision of data for Research purposes will require consent from the patient in advance as this was outside the purpose for which the data were collected originally. See Irish Health Research Regulation 2018.

Process it only in ways compatible with the purposes for which it was given to you initially

1. Only Data with no personally identifiable features can be sent to a non-hospital email address.
2. Data released should only be used for the purpose outlined on the Data Request Form and be consistent with the purposes for which the data was originally collected
3. DRF must identify the purpose of the data request and include the Audit registration number (or Ethics approval number) from the hospital Audit office if applicable.

Keep it safe and secure

1. Those who receive data must undertake not to send personally identifiable data to an outside email address.
2. Data can only be sent to a recognized email server, like Hospital/HSE/DOH and/or University. Data should not be sent to non-corporate email accounts like Gmail or Hotmail account.
3. Those who receive data must undertake to manage the data in accordance with GDPR to ensure security of data. This includes storing the data securely by using password protection or encrypted devices where possible.
4. Those receiving data must report any potential breaches of data security to the hospital Data Protection Officer.

Keep it accurate and up-to-date

1. We recommend that data is only released from ICU Audit once it is fully validated
2. Data recipients should note the date/time printed to ensure the data is up-to-date when using the data.

Ensure that it is adequate, relevant and not excessive

1. Only the minimum data required to fulfill the aims of the request should be provided
2. Personally identifiable data will be removed where possible and identifiable data provided only when necessary for the purposes of the project.
3. The DRF should contain enough information to satisfy Audit personnel that the data will be interpreted appropriately by those requesting the data. If necessary the local Clinical Lead for ICU Audit can insist on oversight of any communication resulting from the provision of the data.

Retain it no longer than is necessary for the specified purpose or purposes

Destroy the data appropriately when the purpose of the request outlined in the DRF has been fulfilled.

To protect the privacy rights of the individual

If data is to used external to the hospital and/or hospital group and the numbers are less than 5 in any group, the value should be replaced with '<5' when providing data.

2 Complete this data request form and return to the ICU Audit Nurse in your Hospital. *V2.8*

APPENDIX 4: FREQUENCY TABLES

Figure 4.3 Gender distribution in each Unit

Unit	Male		Female		Total
	n	%	n	%	N
Beaumont Hospital GICU	395	60%	267	40%	662
Beaumont Hospital Richmond ICU Neuro	189	54%	163	46%	352
Mater Misericordiae University Hospital HDU	636	55%	515	45%	1151
Mater Misericordiae University Hospital ICU	729	68%	346	32%	1075
Our Lady of Lourdes Hospital, Drogheda	232	52%	214	48%	446
St James's Hospital Keith Shaw Unit CT ICU	307	77%	90	23%	397
St James's Hospital GICU	581	60%	388	40%	969
Tallaght University Hospital	189	56%	146	44%	335
University Hospital Galway	718	60%	486	40%	1204
University Hospital Limerick	243	59%	169	41%	412
University Hospital Waterford	229	64%	127	36%	356
Regional Hospital Mullingar	251	58%	181	42%	432
Wexford General Hospital	125	47%	142	53%	267
Connolly Hospital Blanchardstown	104	62%	65	38%	169
Midlands Regional Hospital Tullamore	74	60%	50	40%	124
Naas General Hospital	41	50%	41	50%	82
St Luke's General Hospital	71	53%	62	47%	133
St Vincent's University Hospital	188	59%	128	41%	316
National	**5302**	**60%**	**3580**	**40%**	**8882**

Figure 4.4 Admissions from the operating theatre to the Unit after emergency surgery and after elective surgery (as a percentage of all admissions)

Unit	Elective surgery		Emergency surgery		Total admissions
	n	%	n	%	N
Beaumont Hospital GICU	82	12%	143	22%	662
Beaumont Hospital Richmond ICU Neuro	37	11%	147	42%	352
Mater Misericordiae University Hospital HDU	572	50%	76	7%	1151
Mater Misericordiae University Hospital ICU	488	45%	129	12%	1075
Our Lady of Lourdes Hospital, Drogheda	61	14%	32	7%	446
St James's Hospital Keith Shaw Unit CT ICU	333	84%	22	6%	397
St James's Hospital GICU	326	34%	53	6%	969
Tallaght University Hospital	62	19%	62	19%	335
University Hospital Galway	245	20%	163	14%	1204
University Hospital Limerick	42	10%	73	18%	412
University Hospital Waterford	82	23%	42	12%	356
Regional Hospital Mullingar	52	12%	79	18%	432
Wexford General Hospital	51	19%	36	14%	267
Connolly Hospital Blanchardstown	34	20%	30	18%	169
Midlands Regional Hospital Tullamore	27	22%	11	9%	124
Naas General Hospital	8	10%	4	5%	82
St Luke's General Hospital	16	12%	22	17%	133
St Vincent's University Hospital	41	13%	54	17%	316
National	**2559**	**29%**	**1178**	**13%**	**8882**

APPENDIX 4: FREQUENCY TABLES

Figure 4.5A and 4.5B Number of admissions direct to each Unit (i) after all trauma and (ii) after traumatic brain injury

Unit	Trauma admissions		TBI admissions		Total admissions
	n	%	n	%	N
Beaumont Hospital GICU	81	12%	46	7%	662
Beaumont Hospital Richmond ICU Neuro	85	24%	82	23%	352
Mater Misericordiae University Hospital HDU	93	8%	7	1%	1151
Mater Misericordiae University Hospital ICU	66	6%	10	1%	1075
Our Lady of Lourdes Hospital, Drogheda	54	12%	12	3%	446
St James's Hospital Keith Shaw Unit CT ICU	4	1%	0	0%	397
St James's Hospital GICU	55	6%	10	1%	969
Tallaght University Hospital	30	9%	2	1%	335
University Hospital Galway	121	10%	17	1%	1204
University Hospital Limerick	32	8%	9	2%	412
University Hospital Waterford	32	9%	3	1%	356
Regional Hospital Mullingar	19	4%	6	1%	432
Wexford General Hospital	14	5%	5	2%	267
Connolly Hospital Blanchardstown	21	12%	6	4%	169
Midlands Regional Hospital Tullamore	23	19%	6	5%	124
Naas General Hospital	9	11%	3	4%	82
St Luke's General Hospital	12	9%	0	0%	133
St Vincent's University Hospital	29	9%	5	2%	316
National	**780**	**9%**	**229**	**2%**	**8882**

Figure 4.6 Patients with acute kidney injury during the first 24 hours after admission (KDIGO Stages 1–3) (as a percentage of all ICU admissions)

Unit	Acute kidney injury (KDIGO Stage 1)		Acute kidney injury (KDIGO Stage 2)		Acute kidney injury (KDIGO Stage 3)		All admissions
	n	%	n	%	n	%	N
Beaumont Hospital GICU	85	13%	138	21%	120	18%	662
Beaumont Hospital Richmond ICU Neuro	27	8%	24	7%	9	3%	352
Mater Misericordiae University Hospital HDU	216	19%	239	21%	61	5%	1151
Mater Misericordiae University Hospital ICU	170	16%	231	22%	148	14%	1075
Our Lady of Lourdes Hospital, Drogheda	90	20%	73	16%	49	11%	446
St James's Hospital Keith Shaw Unit CT ICU	61	15%	38	10%	13	3%	397
St James's Hospital GICU	159	16%	233	24%	139	14%	969
Tallaght University Hospital	55	16%	65	19%	50	15%	335
University Hospital Galway	224	19%	322	27%	148	12%	1204
University Hospital Limerick	59	14%	107	26%	80	19%	412
University Hospital Waterford	61	17%	70	20%	88	25%	356
Regional Hospital Mullingar	72	17%	48	11%	34	8%	432
Wexford General Hospital	45	17%	61	23%	37	14%	267
Connolly Hospital Blanchardstown	32	19%	41	24%	16	10%	169
Midlands Regional Hospital Tullamore	24	19%	26	21%	24	19%	124
Naas General Hospital	19	23%	17	21%	6	7%	82
St Luke's General Hospital	19	14%	27	20%	20	15%	133
St Vincent's University Hospital	60	19%	94	30%	70	22%	316
National	**1478**	**17%**	**1854**	**21%**	**1112**	**13%**	**8882**

APPENDIX 4: FREQUENCY TABLES

Figure 4.7 Admissions to the Unit with a diagnosis of sepsis (Sepsis-2) with (i) three or fewer organ systems dysfunction and (ii) four or more organ systems dysfunction, within 24 hours of admission (as percentages of all admissions)

Unit	≤3 organ systems dysfunction		≥4 organ systems dysfunction		All admissions
	n	%	n	%	N
Beaumont Hospital GICU	234	35%	29	4%	662
Beaumont Hospital Richmond ICU Neuro	48	14%	3	1%	352
Mater Misericordiae University Hospital HDU	246	21%	7	1%	1151
Mater Misericordiae University Hospital ICU	175	16%	37	3%	1075
Our Lady of Lourdes Hospital, Drogheda	171	38%	13	3%	446
St James's Hospital Keith Shaw Unit CT ICU	39	10%	3	1%	397
St James's Hospital GICU	231	24%	49	5%	969
Tallaght University Hospital	97	29%	10	3%	335
University Hospital Galway	289	24%	21	2%	1204
University Hospital Limerick	121	29%	19	5%	412
University Hospital Waterford	92	26%	13	4%	356
Regional Hospital Mullingar	73	17%	5	1%	432
Wexford General Hospital	65	24%	11	4%	267
Connolly Hospital Blanchardstown	56	33%	9	5%	169
Midlands Regional Hospital Tullamore	35	28%	3	2%	124
Naas General Hospital	32	39%	1	1%	82
St Luke's General Hospital	37	28%	4	3%	133
St Vincent's University Hospital	99	31%	26	8%	316
National	**2140**	**24%**	**263**	**3%**	**8882**

Figure 4.8 Admissions following CPR in the community or in hospital (as a percentage of all admissions)

Unit	Community CPR		In-hospital CPR		All admissions
	n	%	n	%	N
Beaumont Hospital GICU	15	2%	32	5%	662
Beaumont Hospital Richmond ICU Neuro	4	1%	7	2%	352
Mater Misericordiae University Hospital HDU	1	0%	10	1%	1151
Mater Misericordiae University Hospital ICU	34	3%	37	3%	1075
Our Lady of Lourdes Hospital, Drogheda	13	3%	14	3%	446
St James's Hospital Keith Shaw Unit CT ICU	1	0%	9	2%	397
St James's Hospital GICU	33	3%	40	4%	969
Tallaght University Hospital	12	4%	14	4%	335
University Hospital Galway	27	2%	35	3%	1204
University Hospital Limerick	40	10%	22	5%	412
University Hospital Waterford	10	3%	25	7%	356
Regional Hospital Mullingar	18	4%	9	2%	432
Wexford General Hospital	5	2%	19	7%	267
Connolly Hospital Blanchardstown	7	4%	6	4%	169
Midlands Regional Hospital Tullamore	0	0%	8	7%	124
Naas General Hospital	2	2%	8	10%	82
St Luke's General Hospital	5	4%	4	3%	133
St Vincent's University Hospital	11	4%	19	6%	316
National	**238**	**3%**	**318**	**4%**	**8882**

APPENDIX 4: FREQUENCY TABLES

Figure 4.9A Admissions with severe liver disease (as a percentage of all admissions)

Unit	Severe liver disease		All admissions
	n	%	N
Beaumont Hospital GICU	24	4%	662
Beaumont Hospital Richmond ICU Neuro	2	1%	352
Mater Misericordiae University Hospital HDU	19	2%	1151
Mater Misericordiae University Hospital ICU	8	1%	1075
Our Lady of Lourdes Hospital, Drogheda	5	1%	446
St James's Hospital Keith Shaw Unit CT ICU	0	0%	397
St James's Hospital GICU	32	3%	969
Tallaght University Hospital	5	2%	335
University Hospital Galway	1	0%	1204
University Hospital Limerick	4	1%	412
University Hospital Waterford	1	0%	356
Regional Hospital Mullingar	1	0%	432
Wexford General Hospital	3	1%	267
Connolly Hospital Blanchardstown	3	2%	169
Midlands Regional Hospital Tullamore	5	4%	124
Naas General Hospital	2	2%	82
St Luke's General Hospital	0	0%	133
St Vincent's University Hospital	29	9%	316
National	**144**	**2%**	**8882**

Figure 4.9B Hospital mortality rate in Unit admissions with severe liver disease

Unit	Severe liver disease		
	n	%	Number of patients
Beaumont Hospital GICU	14	70%	20
Mater Misericordiae University Hospital HDU	1	6%	18
Mater Misericordiae University Hospital ICU	3	38%	8
Our Lady of Lourdes Hospital, Drogheda	3	60%	5
St James's Hospital GICU	16	57%	28
St Vincent's University Hospital	7	29%	24

APPENDIX 4: FREQUENCY TABLES

Figure 4.10A Admissions with haematological malignancy (as a percentage of all admissions)

Unit	Haematological malignancy		All admissions
	n	%	N
Beaumont Hospital GICU	30	5%	662
Beaumont Hospital Richmond ICU Neuro	8	2%	352
Mater Misericordiae University Hospital HDU	28	2%	1151
Mater Misericordiae University Hospital ICU	15	1%	1075
Our Lady of Lourdes Hospital, Drogheda	7	2%	446
St James's Hospital Keith Shaw Unit CT ICU	2	1%	397
St James's Hospital GICU	29	3%	969
Tallaght University Hospital	7	2%	335
University Hospital Galway	28	2%	1204
University Hospital Limerick	11	3%	412
University Hospital Waterford	9	3%	356
Regional Hospital Mullingar	6	1%	432
Wexford General Hospital	2	1%	267
Connolly Hospital Blanchardstown	1	1%	169
Midlands Regional Hospital Tullamore	6	5%	124
Naas General Hospital	2	2%	82
St Luke's General Hospital	0	0%	133
St Vincent's University Hospital	9	3%	316
National	**200**	**2%**	**8882**

Figure 4.10B Hospital mortality rate in Unit admissions with haematological malignancy

Unit	Haematological malignancy		
	n	%	Number of patients
Beaumont Hospital GICU	12	46%	26
Beaumont Hospital Richmond ICU Neuro	4	50%	8
Mater Misericordiae University Hospital HDU	5	31%	16
Mater Misericordiae University Hospital ICU	6	46%	13
Our Lady of Lourdes Hospital, Drogheda	5	83%	6
St James's Hospital GICU	12	43%	28
Tallaght University Hospital	1	14%	7
University Hospital Galway	13	48%	27
University Hospital Limerick	7	70%	10
University Hospital Waterford	2	25%	8
Regional Hospital Mullingar	2	33%	6
St Vincent's University Hospital	5	56%	9
National	**74**	**45%**	**164**

APPENDIX 4: FREQUENCY TABLES

Figure 4.11A Unit admissions with metastatic disease (as a percentage of all admissions)

Unit	Metastatic disease		All admissions
	n	%	N
Beaumont Hospital GICU	12	2%	662
Beaumont Hospital Richmond ICU Neuro	9	3%	352
Mater Misericordiae University Hospital HDU	129	11%	1151
Mater Misericordiae University Hospital ICU	26	2%	1075
Our Lady of Lourdes Hospital, Drogheda	19	4%	446
St James's Hospital Keith Shaw Unit CT ICU	1	0%	397
St James's Hospital GICU	32	3%	969
Tallaght University Hospital	5	2%	335
University Hospital Galway	42	3%	1204
University Hospital Limerick	4	1%	412
University Hospital Waterford	14	4%	356
Regional Hospital Mullingar	10	2%	432
Wexford General Hospital	0	0%	267
Connolly Hospital Blanchardstown	5	3%	169
Midlands Regional Hospital Tullamore	8	6%	124
Naas General Hospital	0	0%	82
St Luke's General Hospital	3	2%	133
St Vincent's University Hospital	56	18%	316
National	**375**	**4%**	**8882**

Figure 4.11B Hospital mortality in Unit admissions with metastatic disease

Unit	Metastatic disease		
	n	%	Number of patients
Beaumont Hospital GICU	6	55%	11
Beaumont Hospital Richmond ICU Neuro	6	67%	9
Mater Misericordiae University Hospital HDU	11	9%	117
Mater Misericordiae University Hospital ICU	10	44%	23
Our Lady of Lourdes Hospital, Drogheda	10	56%	18
St James's Hospital GICU	8	26%	31
Tallaght University Hospital	1	20%	5
University Hospital Galway	11	28%	40
University Hospital Waterford	6	43%	14
Regional Hospital Mullingar	3	38%	8
Connolly Hospital Blanchardstown	2	40%	5
Midlands Regional Hospital Tullamore	2	25%	8
St Vincent's University Hospital	16	34%	47

APPENDIX 4: FREQUENCY TABLES

Figure 5.3 Admissions who received advanced respiratory support (as a percentage of all admissions)

Unit	Admissions		
	n	%	N
Beaumont Hospital GICU	422	64%	662
Beaumont Hospital Richmond ICU Neuro	246	70%	352
Mater Misericordiae University Hospital HDU	77	7%	1151
Mater Misericordiae University Hospital ICU	930	87%	1075
Our Lady of Lourdes Hospital, Drogheda	198	44%	446
St James's Hospital Keith Shaw Unit CT ICU	376	95%	397
St James's Hospital GICU	530	55%	969
Tallaght University Hospital	119	36%	335
University Hospital Galway	380	32%	1204
University Hospital Limerick	294	71%	412
University Hospital Waterford	200	56%	356
Regional Hospital Mullingar	106	25%	432
Wexford General Hospital	166	62%	267
Connolly Hospital Blanchardstown	81	48%	169
Midlands Regional Hospital Tullamore	43	35%	124
Naas General Hospital	57	70%	82
St Luke's General Hospital	49	37%	133
St Vincent's University Hospital	219	69%	316
National	**4493**	**51%**	**8882**

Figure 5.4 Patient days when advanced respiratory support was provided (as a percentage of all patient days)

Unit	Patient days	
	n	%
Beaumont Hospital GICU	2089	57%
Beaumont Hospital Richmond ICU Neuro	2021	64%
Mater Misericordiae University Hospital HDU	427	8%
Mater Misericordiae University Hospital ICU	4774	69%
Our Lady of Lourdes Hospital, Drogheda	1210	42%
St James's Hospital Keith Shaw Unit CT ICU	1297	57%
St James's Hospital GICU	4382	57%
Tallaght University Hospital	923	39%
University Hospital Galway	1912	30%
University Hospital Limerick	1562	50%
University Hospital Waterford	812	42%
Regional Hospital Mullingar	477	22%
Wexford General Hospital	860	51%
Connolly Hospital Blanchardstown	349	41%
Midlands Regional Hospital Tullamore	330	44%
Naas General Hospital	323	49%
St Luke's General Hospital	305	43%
St Vincent's University Hospital	1621	52%
National	**25 674**	**46%**

APPENDIX 4: FREQUENCY TABLES

Figure 5.5 Admissions who received advanced cardiovascular support (as a percentage of all admissions)

Unit	Admissions		
	n	%	N
Beaumont Hospital GICU	175	26%	662
Beaumont Hospital Richmond ICU Neuro	85	24%	352
Mater Misericordiae University Hospital HDU	9	1%	1151
Mater Misericordiae University Hospital ICU	534	50%	1075
Our Lady of Lourdes Hospital, Drogheda	45	10%	446
St James's Hospital Keith Shaw Unit CT ICU	324	82%	397
St James's Hospital GICU	158	16%	969
Tallaght University Hospital	54	16%	335
University Hospital Galway	160	13%	1204
University Hospital Limerick	85	21%	412
University Hospital Waterford	69	19%	356
Regional Hospital Mullingar	45	10%	432
Wexford General Hospital	57	21%	267
Connolly Hospital Blanchardstown	20	12%	169
Midlands Regional Hospital Tullamore	4	3%	124
Naas General Hospital	18	22%	82
St Luke's General Hospital	10	8%	133
St Vincent's University Hospital	89	28%	316
National	**1941**	**22%**	**8882**

Figure 5.6 Bed days provided for advanced cardiovascular support (as a percentage of all patient days)

Unit	Patient days	
	n	%
Beaumont Hospital GICU	424	12%
Beaumont Hospital Richmond ICU Neuro	322	10%
Mater Misericordiae University Hospital HDU	14	0%
Mater Misericordiae University Hospital ICU	1835	27%
Our Lady of Lourdes Hospital, Drogheda	146	5%
St James's Hospital Keith Shaw Unit CT ICU	972	43%
St James's Hospital GICU	490	6%
Tallaght University Hospital	209	9%
University Hospital Galway	416	7%
University Hospital Limerick	290	9%
University Hospital Waterford	187	10%
Regional Hospital Mullingar	129	6%
Wexford General Hospital	174	10%
Connolly Hospital Blanchardstown	48	6%
Midlands Regional Hospital Tullamore	13	2%
Naas General Hospital	71	11%
St Luke's General Hospital	20	3%
St Vincent's University Hospital	303	9%
National	**6063**	**11%**

APPENDIX 4: FREQUENCY TABLES

Figure 5.7 Patients who underwent dialysis (as a percentage of all admissions)

Unit	Admissions		
	n	%	N
Beaumont Hospital GICU	85	13%	662
Beaumont Hospital Richmond ICU Neuro	9	3%	352
Mater Misericordiae University Hospital HDU	19	2%	1151
Mater Misericordiae University Hospital ICU	195	18%	1075
Our Lady of Lourdes Hospital, Drogheda	24	5%	446
St James's Hospital Keith Shaw Unit CT ICU	29	7%	397
St James's Hospital GICU	164	17%	969
Tallaght University Hospital	62	19%	335
University Hospital Galway	107	9%	1204
University Hospital Limerick	73	18%	412
University Hospital Waterford	69	19%	356
Regional Hospital Mullingar	17	4%	432
Wexford General Hospital	13	5%	267
Connolly Hospital Blanchardstown	17	10%	169
Midlands Regional Hospital Tullamore	13	11%	124
Naas General Hospital	0	0%	82
St Luke's General Hospital	0	0%	133
St Vincent's University Hospital	87	27%	316
National	**983**	**11%**	**8882**

Figure 5.8 Bed days while providing dialysis (as a percentage of all patient days)

Unit	Patient days	
	n	%
Beaumont Hospital GICU	347	10%
Beaumont Hospital Richmond ICU Neuro	62	2%
Mater Misericordiae University Hospital HDU	41	1%
Mater Misericordiae University Hospital ICU	1409	21%
Our Lady of Lourdes Hospital, Drogheda	140	5%
St James's Hospital Keith Shaw Unit CT ICU	312	14%
St James's Hospital GICU	1240	16%
Tallaght University Hospital	558	23%
University Hospital Galway	447	7%
University Hospital Limerick	424	14%
University Hospital Waterford	287	15%
Regional Hospital Mullingar	62	3%
Wexford General Hospital	73	4%
Connolly Hospital Blanchardstown	96	11%
Midlands Regional Hospital Tullamore	67	9%
Naas General Hospital	0	0%
St Luke's General Hospital	0	0%
St Vincent's University Hospital	725	23%
National	**6290**	**11%**

APPENDIX 4: FREQUENCY TABLES

Figure 5.9 Admissions who received enteral or parenteral nutrition (as a percentage of all admissions)

Unit	Admissions		
	n	%	N
Beaumont Hospital GICU	381	58%	662
Beaumont Hospital Richmond ICU Neuro	235	67%	352
Mater Misericordiae University Hospital HDU	329	29%	1151
Mater Misericordiae University Hospital ICU	430	40%	1075
Our Lady of Lourdes Hospital, Drogheda	173	39%	446
St James's Hospital Keith Shaw Unit CT ICU	57	14%	397
St James's Hospital GICU	512	53%	969
Tallaght University Hospital	142	42%	335
University Hospital Galway	330	27%	1204
University Hospital Limerick	218	53%	412
University Hospital Waterford	168	47%	356
Regional Hospital Mullingar	127	29%	432
Wexford General Hospital	101	38%	267
Connolly Hospital Blanchardstown	81	48%	169
Midlands Regional Hospital Tullamore	40	32%	124
Naas General Hospital	60	73%	82
St Luke's General Hospital	46	35%	133
St Vincent's University Hospital	174	55%	316
National	**3604**	**41%**	**8882**

Figure 5.10 Bed days when enteral or parenteral nutrition was provided (as a percentage of all patient days)

Unit	Patient days	
	n	%
Beaumont Hospital GICU	2589	71%
Beaumont Hospital Richmond ICU Neuro	2387	76%
Mater Misericordiae University Hospital HDU	2432	44%
Mater Misericordiae University Hospital ICU	4328	63%
Our Lady of Lourdes Hospital, Drogheda	1742	61%
St James's Hospital Keith Shaw Unit CT ICU	1030	45%
St James's Hospital GICU	5437	71%
Tallaght University Hospital	1447	61%
University Hospital Galway	2908	46%
University Hospital Limerick	2176	70%
University Hospital Waterford	1221	64%
Regional Hospital Mullingar	978	45%
Wexford General Hospital	952	57%
Connolly Hospital Blanchardstown	494	57%
Midlands Regional Hospital Tullamore	417	56%
Naas General Hospital	543	82%
St Luke's General Hospital	373	53%
St Vincent's University Hospital	2333	75%
National	**33 787**	**61%**

APPENDIX 4: FREQUENCY TABLES

Figure 5.11 Patients who received support for three or more organ systems (as a percentage of all admissions)

Unit	Admissions		
	n	%	N
Beaumont Hospital GICU	278	42%	662
Beaumont Hospital Richmond ICU Neuro	213	61%	352
Mater Misericordiae University Hospital HDU	8	1%	1151
Mater Misericordiae University Hospital ICU	347	32%	1075
Our Lady of Lourdes Hospital, Drogheda	44	10%	446
St James's Hospital Keith Shaw Unit CT ICU	109	28%	397
St James's Hospital GICU	217	22%	969
Tallaght University Hospital	67	20%	335
University Hospital Galway	142	12%	1204
University Hospital Limerick	117	28%	412
University Hospital Waterford	64	18%	356
Regional Hospital Mullingar	30	7%	432
Wexford General Hospital	75	28%	267
Connolly Hospital Blanchardstown	31	18%	169
Midlands Regional Hospital Tullamore	10	8%	124
Naas General Hospital	12	15%	82
St Luke's General Hospital	6	5%	133
St Vincent's University Hospital	116	37%	316
National	**1886**	**21%**	**8882**

Figure 5.12 Patient days with three or more organ systems supported (as a percentage of all patient days)

Unit	Patient days	
	n	%
Beaumont Hospital GICU	2114	59%
Beaumont Hospital Richmond ICU Neuro	2419	77%
Mater Misericordiae University Hospital HDU	128	3%
Mater Misericordiae University Hospital ICU	3475	51%
Our Lady of Lourdes Hospital, Drogheda	587	20%
St James's Hospital Keith Shaw Unit CT ICU	1058	50%
St James's Hospital GICU	3254	45%
Tallaght University Hospital	1013	43%
University Hospital Galway	1320	24%
University Hospital Limerick	1453	49%
University Hospital Waterford	644	36%
Regional Hospital Mullingar	406	24%
Wexford General Hospital	665	44%
Connolly Hospital Blanchardstown	236	27%
Midlands Regional Hospital Tullamore	163	22%
Naas General Hospital	89	14%
St Luke's General Hospital	130	19%
St Vincent's University Hospital	1541	50%
National	**20 695**	**39%**

APPENDIX 4: FREQUENCY TABLES

Figure 6.4 Discharges to the ward delayed >24 hours (as a percentage of all discharges to the ward)

Unit	Discharges		
	n	%	N
Beaumont Hospital GICU	130	29%	455
Beaumont Hospital Richmond ICU Neuro	80	30%	269
Mater Misericordiae University Hospital HDU	120	13%	941
Mater Misericordiae University Hospital ICU	47	40%	118
Our Lady of Lourdes Hospital, Drogheda	106	32%	329
St James's Hospital Keith Shaw Unit CT ICU	21	11%	188
St James's Hospital GICU	192	25%	769
Tallaght University Hospital	65	28%	235
University Hospital Galway	83	9%	963
University Hospital Limerick	53	35%	151
University Hospital Waterford	38	24%	158
Regional Hospital Mullingar	100	30%	331
Wexford General Hospital	50	31%	164
Connolly Hospital Blanchardstown	36	29%	124
Midlands Regional Hospital Tullamore	0	0%	90
Naas General Hospital	4	7%	56
St Luke's General Hospital	11	17%	65
St Vincent's University Hospital	51	27%	186
National	**1187**	**21%**	**5592**

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