National Office of Clinical Audit

Irish National ICU Audit

IRISH NATIONAL ICU AUDIT
ANNUAL REPORT 2021

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

Mary O Dwyer Baggot
Irish National ICU Audit Manager
National Office of Clinical Audit (NOCA)

Anna Carrigan
Data Analyst
National Office of Clinical Audit (NOCA)

Professor Rory Dwyer
Irish National ICU Audit Clinical Lead
National Office of Clinical Audit (NOCA)

Andrew Fleming
National Clinical Audit Programme Manager
Intensive Care National Audit and Research Centre (ICNARC)

Dr Fionnola Kelly PhD
Head of Data Analytics & Research
National Office of Clinical Audit (NOCA)

Damien Keogh
Data Analyst
National Office of Clinical Audit (NOCA)

Dr Brian Marsh
Chair
National ICU Audit Governance Committee

Dr Catherine Motherway
Intensive Care Society of Ireland representative
National ICU Audit Governance Committee

Fionnuala Treanor
National ICU-BIS Audit Manager
National Office of Clinical Audit (NOCA)

Aisling Connolly
Communications & Events Lead
National Office of Clinical Audit (NOCA)

NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

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

The National Clinical Effectiveness Committee (NCEC) 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" (NCEC, 2015, p. 2). NOCA supports hospitals to learn from their audit cycles.

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NOCA would like to thank all participating hospitals and the Irish National Intensive Care Unit Audit (INICUA) Audit Coordinators and Clinical Leads for their valuable contributions. 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 Health Service Executive. We would especially like to thank Dr Colm Henry, Chief Clinical Officer, Dr Orla Healy, National Clinical Director, National Quality and Patient Safety Directorate, Ms Mary Day, HSE National Director for Acute Operations, and Dr. Ciaran Browne, National Lead Acute Hospital Services. Their commitment and support has led to major growth and development in ICU Audit in Ireland.

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For more information about this report, contact: National Office of Clinical Audit, 2nd Floor, Ardilaun House, 111 St Stephen's Green, Dublin 2, D02 VN51
Tel: + (353) 1 402 8577
Email: icu@noca.ie

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National Office of Clinical Audit

Irish National ICU Audit

IRISH NATIONAL ICU AUDIT

ANNUAL REPORT 2021

NOCA National Office of Clinical Audit

Prof Rory Dwyer
Clinical Lead
Irish National ICU Audit
National Office of Clinical Audit
2nd Floor, Ardilaun House
111 St. Stephen's Green
Dublin 2

19th July 2023

Dear Professor Dwyer,

I wish to acknowledge receipt of the Irish National ICU Audit Report 2021.

On behalf of the NOCA Governance Board, I wish to congratulate you; the Audit Manager, Mary Baggot; and your governance committee on an excellent report. This gives assurance to the most ill patients in our healthcare system that their care is being carefully monitored in Irish hospitals, and that opportunities for continuing improvement are being identified.

Please accept this as formal endorsement from the NOCA Governance Board of the Irish National ICU Audit Report 2021.

Yours sincerely,

Dr Brian Creedon
Clinical Director
National Office of Clinical Audit

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

PREFACE

As Clinical Lead for the Critical Care Programme (CCP), I very much welcome this INICUA Report on 2021 Adult ICU Audit data.

INICUA was initiated in 2015 with just four adult ICUs collecting data. As of 2021, due to the determination and hard work of the INICUA team, INICUA's capture of ICU activity has increased to almost 100%, which is a remarkable achievement.

Clinical audit is one of a range of quality improvement methodologies that can deliver improved processes and outcomes for patients (HQIP, 2020). Clinical audit can provide data to support quality improvement at all levels, from the local clinical team through to hospital management and national policymakers. Within this report is a quality improvement chapter, showing improvements at local and national levels, and identifying areas where further improvements can be made.

The Irish National ICU Audit Coordinators and local Clinical Leads are to be commended for their contribution to this national report, and for the quality improvement measures that have evolved from the findings.

The partnership of NOCA and ICNARC with this audit assures quality benchmarking of data and appropriate governance. This is an assurance for the Critical Care Programme. The INICUA reports compliment the work of the CCP and assure quality care for the sickest patients in the hospital.

The Department of Health and the Health Service Executive are to be commended for their commitment to increasing our critical-care capacity over the coming years. The need for such an increase has been made evident not only by the present report but also by those previously published. Equally, the implementation of structures (such as the Critical Care Outreach Services) required for pre-ICU care, and indeed ICU avoidance, is to be welcomed.

Dr Martina Healy, Clinical Lead
Critical Care Programme, Health Service Executive National Clinical Programmes

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GLOSSARY OF TERMS AND DEFINITIONS

TERM	MEANING
Bed days	Any calendar day (00.01 to 24.00) or part thereof where a patient occupies a Unit bed. (For example, a patient admitted on 1 January at 23.00 and discharged on 3 January at 01.00 would be recorded as having received 3 bed days of care.)
Calendar days	Any complete calendar day (00.01 to 24.00) or part thereof. (For example, a patient admitted on 1 January at 23.00 and discharged on 3 January at 01.00 would be recorded as having received 3 calendar days of care.)
Dialysis	Removal of waste products from the body when the kidneys are not functioning.
Invasive monitoring	Using direct measurement from within the body of a patient. This type of monitoring is common in the Intensive Care Unit (ICU) and involves inserting a cannula in a suitable artery or vein.
Levels of care	Specifies the level of care provided in ICU or in a High Dependency Unit (HDU). Levels of care range from 0 to 3 and are allocated based on the monitoring and support of organ failure: **Level 0** applies to admissions receiving normal ward care. **Level 1** involves a greater degree of observation, monitoring, intervention(s), clinical input, or advice than normal ward care would entail. **Level 2** involves monitoring and support for one organ system. **Level 3** involves monitoring and support for two or more organ systems.
Patient days	Any calendar day (00.01 to 24.00) or part thereof where a patient occupies a Unit bed. (For example, a patient admitted on 1 January at 23.00 and discharged on 3 January at 01.00 would be recorded as having received 3 Patient days of care.)
Mean	The average of a set of numbers.
Mechanical ventilation	Use of a machine to support breathing by application of variable positive pressure.
Median	The middle value in a set of numbers.
Organ failure	When organs of the body fail to function correctly.
Sepsis	When an infection leads to effects on the whole body and organ dysfunction. Sepsis occurs when chemicals that were released into the bloodstream to fight the infection trigger inflammatory responses throughout the body.
UK Units	Pooled data for ICUs in England, Wales and Northern Ireland; this is reported on by the Intensive Care National Audit and Research Centre (ICNARC) and used as a comparator within this report.

Acronyms and Initialisms

ACRONYM	MEANING
AKI	Acute kidney injury
ANP	Advanced Nurse Practitioner
APACHE II	Acute Physiology and Chronic Health Evaluation score, version 2: this measures the illness severity of adult patients admitted to Intensive Care Units (ICUs).
ACS	Acute Coronary Syndrome
ARS	Advanced Respiratory Support; mechanical ventilation of the lungs via a tube into the trachea, to support lungs that are failing in their function.
BIS	Bed Information System
BMI	Body mass index
CCOT	Critical Care Outreach Team

TERM	MEANING
CCRS	Critical Care Retrieval Service
CEO	Chief Executive Officer
CIMS	Chameleon Information Management System
CMP	Case Mix Programme: the data collected by the Intensive Care National Audit and Research Centre (ICNARC) from ICUs within the United Kingdom (UK).
CPR	Cardiopulmonary resuscitation: restoration of blood circulation by chest compressions with or without ventilation of the lungs.
CRRT	Continuous renal replacement therapy
CT ICU	Cardiothoracic Intensive Care Unit
CUH	Cork University Hospital
CVS	Cardiovascular system
DBD	Organ donation after brain death
DCD	Organ donation after circulatory death
DPIP	Deteriorating Patient Improvement Programme
ED	Emergency Department; also known as Accident and Emergency or Casualty.
EMT	Emergency Medical Technician
EMD	Emergency Medical Doctor
ESICM	European Society of Intensive Care Medicine
EWS	Early Warning Score
FiO2	Fraction of inspired oxygen: the concentration of oxygen in the gas mixture.
GICU	General Intensive Care Unit
HIQA	Health Information and Quality Authority
HD	Haemodialysis
HDU	High Dependency Unit
HIPE	Hospital In-Patient Enquiry: data-coding system in HSE hospitals
HPSC	Health Protection Surveillance Centre
HQIP	Healthcare Quality Improvement Partnership.
HSE	Health Service Executive
IARO	Irish Association of Resuscitation Officers
ICNARC	Intensive Care National Audit and Research Centre
ICSI	Intensive Care Society of Ireland
ICU	Intensive Care Unit
IEHG	Irish East Hospital Group
ICU-BIS	ICU Bed Information System; also known as BIS
INEWS	Irish National Early Warning System
INICUA	Irish National Intensive Care Unit Audit
IPATS	Irish Paediatric Acute Transport Service
IQR	Interquartile range

TERM	MEANING
JFICMI	Joint Faculty of Intensive Care Medicine of Ireland
KDIGO	Kidney Disease: Improving Global Outcomes; this is a system for definition and staging of acute kidney injury.
KPa	Kilopascal (measurement of pressure)
KPI	Key Performance Indicator
LOS	Length of stay: the number of days that a patient spends in ICU and/or hospital.
MDRO	Multidrug-resistant organism
MDT	Multidisciplinary Team
MICAS	Mobile Intensive Care Ambulance Service
MMUH	Mater Misericordiae University Hospital
NAS	National Ambulance Service
NCAA	National Cardiac Arrest Audit
NCCA	National Centre for Clinical Audit
NCEPOD	National Confidential Enquiry into Patient Outcome and Death
NNTP	National Neonatal Transport Programme
NOCA	National Office of Clinical Audit
NQPSD	National Quality and Patient Safety Directorate
ODTI	Organ Donation and Transplant Ireland
OECD	Organisation for Economic Co-operation and Development
PaO2	Partial pressure of oxygen in arterial blood.
PDA	Potential Donor Audit
QI	Quality indicator
QPS	Quality and Patient Safety
ROI	Republic of Ireland
SD	Standard deviation
SMR	Standardised mortality ratio: the ratio of the number of observed deaths to the number of deaths predicted by the ICNARC risk-prediction model.
SOFA score	Sequential Organ Failure Assessment score
SOP	Standard operational procedure
SJH	St. James Hospital
STEMI	ST-Elevation Myocardial Infarction
SVUH	St. Vincent's University Hospital
TBI	Traumatic brain injury
TOR	Terms of Reference
UABIs	Unit acquired bloodstream infections
UK	United Kingdom
UHL	University Hospital Limerick
WTE	Whole Time Equivalent

EXECUTIVE SUMMARY

INICUA captured activity in 22 adult public hospitals, which collectively provided 96% of Level 3 ICU care in adult HSE-funded hospitals in 2021. The ICU audit documented 12,151 admissions of 11,420 patients to 26 Units in 22 hospitals. The mean length of stay was 6.6 days.

Data in this report provides detailed insights into the complexity and volume of care provided in each Unit, with implications for resource requirements when planning ICU services. A key metric in defining the complexity of care provided is the number of bed days where the Patient is undergoing invasive ventilation. The Report provides data for each Unit on (i) the total number of bed days with invasive ventilation and (ii) bed days with invasive ventilation as a percentage of total bed days.

Hospitals with the largest numbers of bed days where the Patient is undergoing invasive ventilation were St James's Hospital, Beaumont Hospital, Mater Misericordiae Hospital, Cork University Hospital and St Vincent's Hospital.

On average, 303 ICU/HDU beds were open daily in publicly funded hospitals in 2021 (ICU-BIS data). This corresponded to 6.0 critical care beds per 100,000 population; the average for OECD countries was 14.1/100,000.[1]

The average bed-occupancy rate nationally was 88.5%. Recommendations for bed-occupancy rates range from 75% to 85%. Occupancy rates below this range indicate unnecessary allocation of expensive resources, while occupancy above this range suggests that the Unit will be unable to cope with surges in demand, and that admission of critically ill patients will frequently be delayed. A number of Units, including some of the larger Units, had bed-occupancy rates greater than 90% for 2021 (St Vincent's Hospital, Mater Hospital, Cork University Hospital, Beaumont Hospital and Mercy University Hospital).

In keeping with the high bed-occupancy levels, there was evidence that patients were being discharged before they were fully ready for ward care. INEWS scores at ICU discharge were relatively high in some Units, with median INEWS scores of 4 and upper quartile INEWS scores of 6.

Despite the high bed-occupancy levels, delays in discharges of patients judged ready for ward care were common; 3.3% of bed days were occupied by patients cleared for discharge for over 8 hours.

Mean length of stay (LOS) was 6.6 days in 2021 (compared with 5.8 days in 2020). The increased LOS is due to greater numbers of COVID-19 patients who had a longer LOS (see below). The median LOS was 3 days.

[1] The most recent data for ICU beds open (January–April 2023, ICU-BIS) showed an average of 299 ICU/HDU beds open daily, equivalent to 5.9 beds/100,000 population.

COVID-19 disease had a major impact on ICU activity in 2021. Our audit documented 1,671 patients admitted to ICU with a diagnosis of COVID, which represents 15% of all patients admitted to ICU in 2021. Length of stay was over twice as long for COVID-19 patients, and they accounted for 29% of all ICU beds occupied in 2021.

Other common reasons for ICU admission were surgery (35% of admissions), sepsis (37%) and trauma (7.6%). There were 284 admissions as a result of traumatic brain injury, 130 of these to Beaumont Hospital.

A requirement for in-hospital cardiopulmonary resuscitation (CPR) before admission to ICU is suggestive of unrecognised deterioration in the ward. The rates of requirement for CPR ranged from 0.4% to 11% between different Units, suggesting potential for intervention in hospitals with higher rates. The national rate of patients requiring CPR before ICU admission has remained unchanged over the 5 annual ICU Audit reports despite investments in outreach, in early warning scores and in education about the deteriorating patient.

Fifty-three children under 16 years were admitted to adult ICU in 2021, a decrease of more than 50% since 2019, reflecting a move towards admitting children to specialist paediatric Units.

One hundred and ninety-six patients who were pregnant or recently pregnant (within 6 weeks of Unit admission) were admitted, 31% more than in 2020. This increase was due to the admission of 73 pregnant or recently pregnant patients with COVID-19, all of whom survived.

Patients needed to be sicker to be admitted to ICU in Ireland, compared with the UK, as judged by mean APACHE II score and median predicted risk of acute hospital mortality ($ICNARC_{H\text{-}2018}$ model). This suggests a shortage of ICU beds compared to the UK.

Units varied considerably in their rates of provision of dialysis, especially if days receiving dialysis were expressed as a proportion of days receiving invasive ventilation. The data indicate variability in both case mix and clinical practice between hospitals.

A key role of audit is to define quality indicators (QI) and measure how Units meet the targets for these. Prompt access to ICU improves outcomes for critically ill patients. The HSE has defined targets for the time of the decision to admit to arrival in ICU. Of the 18 hospitals with adequate data for this analysis, one met the target of 50% of admissions within one hour of a decision to admit (Beaumont Hospital). Fifteen hospitals met the target of 80% of patients admitted within 4 hours of a decision to admit, leaving only 3 hospitals which did not meet this target.

Another measure of timely admission to ICU is the proportion of patients who develop organ failure in four or more organ systems within 24 hours of admission. Outliers for this QI were St Vincent's University Hospital, Connolly Hospital and Cork University Hospital. All of these hospitals have submitted action plans to achieve improved outcomes for this QI in the future.

Unplanned discharges at night suggest that patients not fully ready for ward care are being discharged to wards unfamiliar with the patients, and such unplanned discharges are therefore highly undesirable. University Hospital Galway and Cavan General Hospital were outliers for this QI in 2021. Both hospitals have submitted action plans to address this issue.

Unplanned readmission to ICU within 48 hours of discharge is a key QI which may reflect either pressure on Units to discharge prematurely or poor care in the ward to which the patient is discharged. There were no outlier Units for this QI in 2021.

The crude mortality rate in ICU was 18%. A further 6% of ICU admissions died after ICU discharge, before leaving hospital, giving a mortality rate of 24%. This represents a survival rate of 76%. These numbers are similar to data from comparable international Units.

A key QI of care in ICU is the acute hospital mortality rate adjusted for the relative risk of death by consideration of the factors known to affect mortality. Data from our audit are analysed by ICNARC, the organisation which runs ICU audit in the UK, and ICNARC analysis of our data makes it possible to directly compare outcomes in the Republic of Ireland with outcomes in the UK. The national risk-adjusted standardized mortality ratio (SMR) for ROI, calculated using the $ICNARC_{H\text{-}2018}$ model, was similar to the SMR for the UK.

The national value for SMR was 1.16 compared to the 2020 value of 1.05; this increase is a possible cause for concern. This finding may, however, reflect greater numbers of COVID-19 patients in 2021.[2]

No individual Units had risk-adjusted mortality rates outside the acceptable range for this QI. This indicates that quality of care in all these Units reached an acceptable standard.

A key finding of the audit was that risk-adjusted mortality outcomes were similar whether patients were initially admitted to a larger Unit (> 200 Level 3 patients annually) or to a smaller Unit (< 200 Level 3 patients annually). Similar outcomes for smaller and larger Units were found for the overall population of all patients admitted to ICU, for just high-risk patients (> 20% predicted risk of acute hospital mortality) and for COVID-19 patients. This finding differs from accepted wisdom regarding outcomes in smaller versus larger Unit. There are large numbers of inter-hospital transfers of patients within the Irish healthcare system, and we believe that this has achieved equality of risk-adjusted outcomes for critically ill patients across the system.

Six hundred and three COVID-19 patients died before discharge from acute hospital, giving a crude hospital mortality rate of 36%, compared to a 24% mortality rate for the overall ICU population.

Using the COVID-19 specific ICNARC model, the risk-adjusted 28-day in-hospital SMR for COVID-19 patients was 0.87, which was slightly better than the UK value of 1.0.

[2] Reassuringly, provisional data for Quarters 1–3 2022 show an SMR value of 1.07.

Data on multidrug-resistant organisms (MDROs) showed low rates of colonisation on admission to ICU with the exception of Vancomycin Resistant Enterococci (VRE) at 11%. Rates of Unit-acquired transmission were low.

Brain death was diagnosed in 103 patients in our audited Units in 2021. Fifty of these patients became organ donors, a conversion rate of 48.5%. The most common reasons for not progressing to organ donation were families not assenting (27 patients) and organs being judged unsuitable by transplant teams although families had assented (12 patients).

There was considerable variability between Units in the rates of diagnosis of brain death and in the rates of progression from brain death to organ donation, although the numbers of patients in many Units were too small to draw conclusions.

Donations after circulatory death (DCD) increased to 10 in 2021, compared with 6 in 2020. The rate of DCD remains low compared to the rate in the UK. Inter-hospital transfers were an integral part of care pathways in the ROI. The audit identified 913 inter-hospital transfers to ICU in 2021. Transfers commonly occurred outside normal working hours; 44% occurred between 20.00 and 08.00, and 26% took place at weekends.

The specialties receiving the most transfers were respiratory medicine (16%), neurosurgery (13%) and general medicine (11%). In 2021 it is likely that many of the transfers to respiratory medicine represented COVID-19 patients who required advanced critical care.

RECOMENDATIONS AND LEARNING POINT

RECOMMENDATION 1

Continue the ongoing HSE programme to expand ICU capacity in line with the Critical Care Strategic Plan.

RECOMMENDATION 2

Develop and implement a national policy that each Unit should keep one staffed ICU bed empty to be available for immediate admission of critically ill patients, if this can be achieved by discharge of a patient who has been declared clinically ready for discharge.

RECOMMENDATION 3

Develop the Critical Care Retrieval Service of the National Ambulance Service to provide a 24-hour, 7-day transport service for inter-hospital transfers of critically ill patients.

RECOMMENDATION 4

Adequately staff ICU audit by providing one whole-time equivalent (WTE) ICU audit coordinator for every 10 Unit beds audited.

RECOMMENDATION 5

Continue the development of the National ICU Audit database at NOCA to allow wider reporting of data nationally.

CONSIDERATIONS AND LEARNING POINT

NOCA is committed to including the patient voice at the centre of national clinical audit, thereby providing a broader picture of quality and safety and of the patient's experience of healthcare. From previous INICUA reports with patients' stories, a recognisable gap in psychological and practical support for patients, and for families of critically ill patients, was identified.

This is a learning point for NOCA. To explore services available nationally for patients and their families during and following ICU admission.

CONCLUSIONS

Critical care Units (ICU/HDUs) were under considerable pressure in 2021, with the added pressure of large numbers of patients seriously ill with COVID-19. Bed occupancy rates were above recommended levels, especially in some of the larger Units. Measures of illness severity indicated that patients needed to be sicker to get a bed in ICU in Ireland than in the UK. Quality indicator measures related to ICU bed availability were outside the acceptable range for a number of Units. These measures included timeliness of access to ICU beds, severity of illness on admission and the numbers of discharges from ICU at night.

Despite these pressures, outcomes as assessed by risk-adjusted mortality rates were within the acceptable range for all Units audited. An important finding was that outcomes were similar whether patients were initially admitted to larger or to smaller ICUs; a key factor in achieving this equality of outcomes was the large number of inter-hospital transfers to ICU.

This report highlights the pressure that ICUs are under, the lack of reserve capacity and the inability to admit all of the patients who would benefit from care. Data from 2023 show that the ratio of ICU beds open as a proportion of the population has fallen since 2021, despite the extra investment made by the Government. To reverse this, there are issues around staffing and infrastructure which need to be resolved.

KEY FINDINGS 2021

LENGTH OF STAY (LOS)

6.6 DAYS

The mean (average) length of stay in ICU was

6.6 DAYS

BED OCCUPANCY

88.5%

88.5% occupancy of available ICU bed days nationally

The recommended bed occupancy rate is 85%, but many of the larger Units had rates greater than 90%.

CPR WITHIN 24 HOURS BEFORE ADMISSION

3.3%

3.3% of patients required in-hospital cardio-pulmonary resuscitation (CPR) within 24 hours before ICU admission.

This is related to quality of care in the hospital and is an important predictor of patient outcomes.

PREGNANT PATIENTS IN ICU

196

196 patients admitted to ICU were pregnant or recently pregnant, 31% more than in 2020.

This increase was due to 73 patients requiring ICU care with COVID-19.
All of the 73 pregnant/recently pregnant patients admitted to ICU with COVID-19 survived.

CHILDREN IN ADULT ICUS

53

Fifty-three children under 16 years were admitted to adult ICUs in 2021, a decrease from 111 children in 2019.

COVID-19 PATIENTS IN ICU

Patients	As a percentage of all patients admitted to ICU	Percentage of total ICU bed days	Survived to leave hospital
1671	15%	29%	64%

Having ICU beds available for COVID-19 patients was a critical issue during the pandemic.

COVID-19 patients occupied almost one-third of all ICU bed-days during 2021.

TRANSFERS TO ICU BETWEEN HOSPITALS

- **913 patients were transferred from one hospital to an ICU bed in another hospital.**
- **44% of transfers took place at night (20.00 - 08.00).**
- **26% of transfers took place at weekends.**

DELAYED DISCHARGE

1,515 discharges of patients from ICU were delayed more than 24 hours.

(22% of all discharges nationally)

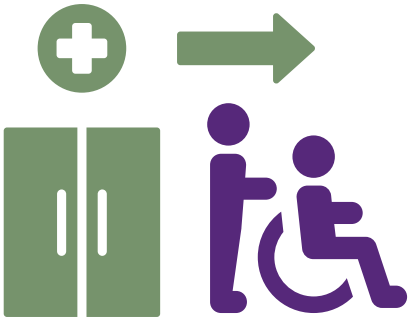
22%

1,966 ICU bed days were occupied by patients who had been cleared for discharge for more than 24 hours.

1,966 DAYS

MORTALITY

76% of patients admitted to ICU survived to leave acute hospital alive.



76%

An important measure of the quality of care is the mortality rate, which takes into account the severity of illness in each patient.

All Units had mortality rates within the expected range, indicating that quality of care in ICU in Ireland is good.

Mortality rates were similar whether patients were initially admitted to a larger Unit or a smaller Unit.

ORGAN DONATION

49% of patients whose death was diagnosed according to brain-death criteria became organ donors. This compares to 54% in 2019.

2019 54%

2020 50%

2021 49%

The proportion of all deceased patients who progressed to become organ donors has fallen since 2019.

2019 4.7%

2020 3.6%

2021 3.0%

NOCA & Organ Donation and Transplant Ireland set up the Potential Donor Audit for Irish hospitals in May 2022. The aim of this quality improvement project is to ensure that every person who is approaching the end of life in ICU is offered the possibility of becoming an organ donor, where this is appropriate.

A PATIENT PERSPECTIVE: **AISLING'S EXPERIENCE OF ICU**

INTRODUCTION

Aisling has a rare genetic condition, which in 2018 was made worse by a rare complication. As a result, Aisling required lifesaving neurosurgery. Following a long wait, the surgery was performed in August 2020. This is the story of Aisling's stay in ICU and its aftermath; the story is told from Aisling's perspective and focuses on the issues that were most important to her.

When Aisling received the specialised brain surgery that she urgently needed, she was twenty-one years old. Aisling was extremely vulnerable and a very high-risk patient for that surgery. Her situation was further complicated by the first wave of the COVID-19 pandemic and the risks and restrictions that it brought with it.

ACCESS TO CARE

The six months that Aisling spent waiting for her surgery were very difficult for her. During this time, she was bed-bound and completely reliant on her mother, who acted as her full-time carer. Aisling very vividly recalls the extreme difficulties she faced during these months: "I wasn't able to eat. I couldn't sit up. I was five foot five, forty kilos and very skinny". Aisling's prolonged wait was due to the specialised nature of the neurosurgery required, to the time it took for an appropriate theatre to become available, and to the associated requirement for an ICU bed to be available for post-operative care after surgery. Aisling's pain was managed by morphine but was nevertheless "unbearable, totally incessant, and [it] just would not stop". Delays and the unavailability of an ICU bed during the first phase of the pandemic were serious issues. As Aisling recalls, "We were told all the beds were taken, and we couldn't book a theatre, and we'd have to wait, and as a consequence I could have died".

Aisling movingly describes the fear that she felt during this waiting period: "I could have died at any point during those six months. I was bed-bound because of the nature of the complication I had. It was beyond frustrating and absolutely terrifying during the six-month wait". Naturally, the fear and anxiety that Aisling experienced also affected the rest of her family: "We knew that if I didn't have my surgery in time that I would die".

AISLING'S ICU STAY

When Aisling's surgery was finally performed, it proved to be even more complicated than had been anticipated: "I nearly died during the surgery itself as well, because it ended up being much more complicated and dangerous than we had originally thought'.

Postoperatively, Aisling was cared for in ICU. Her recovery was complicated by "immobility, blood pressure issues with pain medication, and then the issues of the actual surgery itself". Aisling had a "much steeper climb to recovery" than had been expected. Due to COVID restrictions in the hospital, she was on her own when she was admitted. The sense of isolation and powerlessness that Aisling felt as a result is still very much with her: "I had to say goodbye to my Mom and Dad at the front door of the hospital not knowing if we would see each other again. . . . I just felt especially alone and powerless".

As Aisling was coming around after surgery and lying down flat in her bed, she experienced tremendous pain and anxiety: "I had this big neck brace on to keep me immobile. I was in a lot of pain because of the surgery and totally alone trying to understand what was happening". Aisling gratefully remembers the kindness of one particular ICU nurse who looked after her with great care and consideration: "One nurse in particular who kind of minded me throughout my whole stay. I'll never, ever, ever forget her. . . She spoon fed me every meal, or a Fortisip [a nutritional supplement] if I couldn't eat". When Aisling heard a calm voice reassuring her and describing what was happening, she felt safe. She was also particularly comforted by physical contact, by having her hand held for even a couple of seconds: "That human touch does so much to calm you, especially if the patient is alone and they have no family with them".

After she left ICU, Aisling was cared for in the

ward. She vividly remembers how it felt to move from ICU into this different setting: "It was a daunting, next step and you feel, 'Oh God, now this is a totally new environment I have to get used to'". She found herself at ease in the ward, however, and was delighted to have a bed beside a window. More importantly, she says that she "was extremely lucky in that sense that it all went very well".

GOING HOME

Aisling was discharged from hospital in the middle of a pandemic. Because there had been a complete ban on hospital visitors, her family had not seen her for a very long time. In fact, the last time Aisling's parents had seen her was when they said goodbye to her at the door of the hospital on her admission. When they came to collect her, they were very surprised to see how fragile Aisling was after her surgery.

Aisling remained underweight for some time and had difficulty walking. She had to "relearn how to feed [herself], how to get up out of a chair". For eight months, Aisling was in a full neck brace at home. She felt that her experience of this prolonged recovery period was arduous and intense: "It turned out to be very, very difficult to keep me safe. . . . It was a tough, tough recovery". Aisling recalls the psychological effects of her long recovery and coming off pain meds: "I suffered from an awful lot of nightmares from the whole hospital experience, but especially from the ICU". Support from ICUsteps Dublin, a group set up to provide support to patients and relatives affected by critical illness, helped her tremendously: "I've met people through ICUsteps who have had similar experiences, which has really helped me understand it and feel less alone with the whole thing".

AISLING'S KEY MESSAGES

Following a prolonged period in hospital that includes complex surgery and an ICU stay, the preparation for discharge and the transition home can be really difficult. Aisling highlights the value of informing the patient and family about how difficult this can be. Aisling had great difficulty with nightmares. Aisling strongly advises patients and their families to listen closely to any advice that they receive on discharge from hospital, "because at that stage you're lucid enough to hear". Patients and family members need to be reminded that "there will be ups and downs" and that "it will get easier".

As part of the patient support organisation ICUsteps Dublin, Aisling now talks to nurses and passes on what she has learned from her own ICU experience. Her central messages to nurses are that "the best thing [they] can do is treat the patient like a person rather than a number" and that "the best thing [they] can do is be kind and reassuring". Aisling also highlights the value of having a patient diary in ICUs, wherever possible, which in her view is a great idea because "you can fill in the gaps of what you don't remember". She strongly emphasises the importance of memory and a sense of continuity for the patient: "The biggest thing . . . is trying to link that person who went through all that" to who she is now.

INNER STRENGTH AND COPING STRATEGY

Patients will draw on different strengths as they cope with difficult experiences. Aisling found some of the inner strength that she needed in her optimism and sense of humour: "I love using humor. It's my way of dealing with it, and I find it really helps". An ability to look on the bright side has been the biggest factor in Aisling's recovery. She also found it very helpful to write a personal letter to one of the ICU nurses, who cared for her during much of her stay in the Unit. Aisling's letter was warmly received: "I gave [the nurse] my number, and she rang me, and we've texted; she was delighted with the letter".

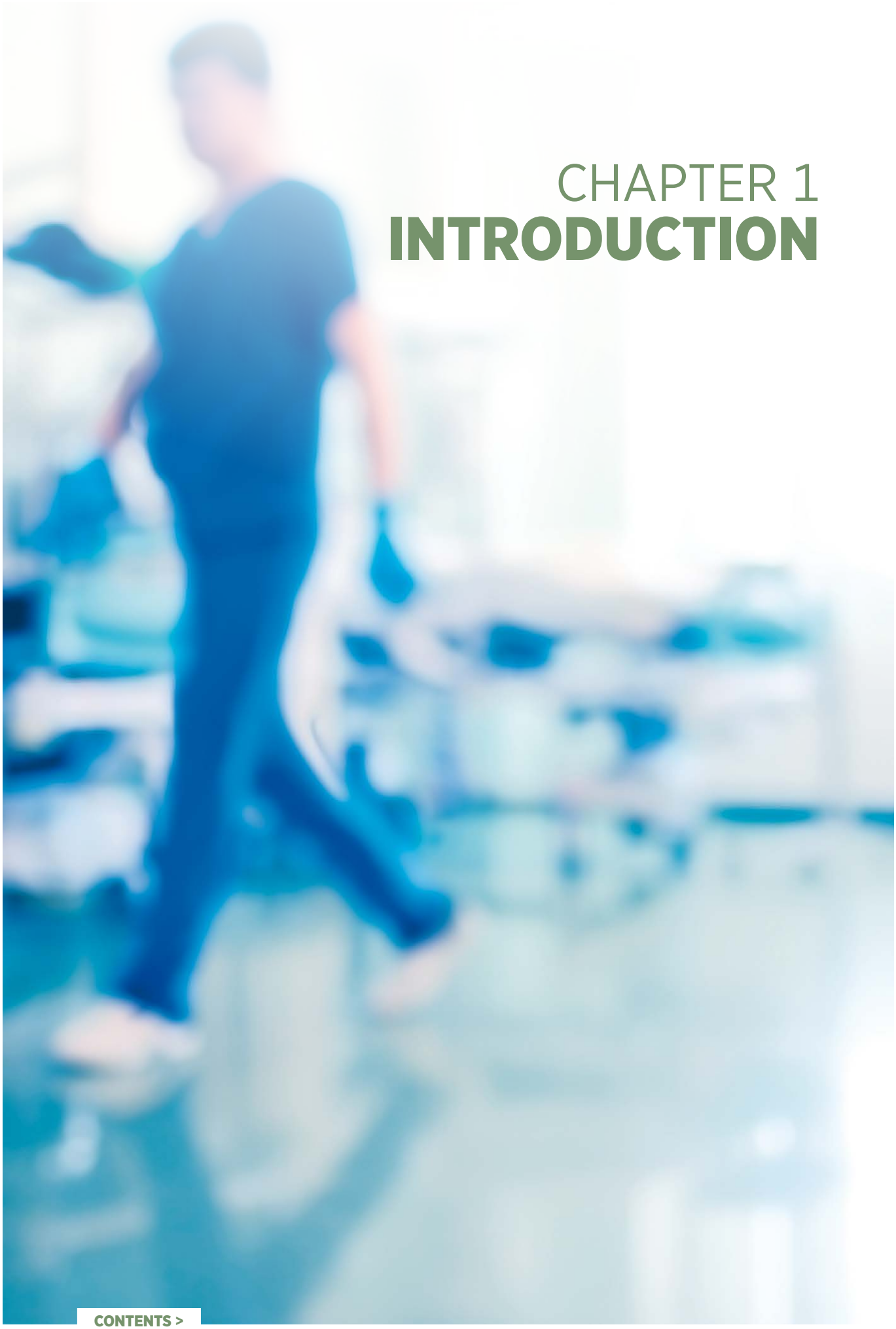
Aisling also credits ICUsteps Dublin with changing her life for the better. Their support allowed her to "go from feeling so isolated" to reach the point where she knows that "people understand me, and they felt the exact same thing". By

connecting with a group of people who had had similar experiences, Aisling learned that she was not alone and that she certainly hadn't gone mad. In September 2023, Aisling is due to start in college. She strongly connects her decision to pursue further education with the inspiration she received from those who cared for her during her hospital stay: "[The] impact that some of those doctors and nurses have had on me was so much that I want to be able to do that for someone else, and that hopefully this September, I'll be able to start off that journey".

> ***'The experience of critical illness is frequently overwhelming, confusing, frightening and deeply upsetting for our patients and their families. Leaving critical care is often only the beginning of a long, uncertain, and arduous journey, often made more difficult by the lack of appropriate and timely multidisciplinary support.'***
>
> **Dr Melanie Ryberg, Principal Specialist Clinical Psychologist, Critical Care, Tallaght University Hospital ICU '**

NOCA is committed to including the patient voice at the centre of national clinical audit, providing a broader picture of quality and safety, and of the patient's experience of healthcare. From previous INICUA reports with patients' stories, a recognisable gap in psychological and practical support for patients, and for families of critically ill patients, was identified.

This is a learning point for NOCA: to explore services available nationally for patients and their families during and following ICU admission.



CHAPTER 1
INTRODUCTION

CHAPTER 1: **INTRODUCTION**

INTRODUCTION

This is the Irish National Intensive Care Unit Audit (INICUA) national report on 2021 data. It is published by the National Office of Clinical Audit (NOCA) and the Irish National Intensive Care Unit Governance Committee. The 2021 INICUA report presents comprehensive data on Intensive Care Unit (ICU) admissions to Units participating in the Irish National Intensive Care Unit Audit (INICUA).

NATIONAL OFFICE OF CLINICAL AUDIT

NOCA is committed to promoting a culture of shared learning from national clinical audits in order to promote patient safety and improve clinical outcomes. NOCA is also 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), which provides validation and analysis of data and formal reports on activity in adult ICUs. ICNARC reports also provide data on indicators of quality of care in ICU that are benchmarked between participating Units in the Republic of Ireland (ROI) and those participating in the UK Case Mix Programme (CMP). The Irish National ICU Audit Governance Committee governs the output from INICUA.

WHO IS THIS REPORT AIMED AT?

The INICUA annual report is intended for the multidisciplinary teams (MDTs) caring for patients in ICU, for the hospital managers who support them, for the national structures for administration of the health service, and for the patients and their families requiring care in ICU.

The report has been designed in two parts:

1. The Irish National ICU Audit: National Report — a critical review of INICUA data for Ireland for 2021, which presents the key findings regarding case mix, severity of illness and organs supported, bed availability and utilisation, outcomes measures, organ donation and inter-hospital transfers.
2. The Irish National ICU Audit: Summary report — a summary of some of the detail within the National Report that will be of particular interest to patients, patient organisations, and the public.

This report describes the methodology and data quality in Chapters 2 and 3. Chapters 4, 5, 6, 7, 8, 9, and 10 present the findings from the analysis. Chapter 11 presents the value of the audit and the quality improvement initiatives that are being undertaken with the aim of improving the quality of care received by patients in ICU. Chapter 12 gives an Audit update and includes updates on 2020 Report recommendations. The final chapters present the recommendations and conclusions from the data within the report.

At the heart of this audit report are the patients and their families who have been cared for in Irish ICUs. This report includes the viewpoint of Aisling, a patient who received care in an ICU. By sharing her experience, Aisling is providing us with a deep and detailed perception of an ICU patient's experiences. The inclusion of this personal account seeks to ground this NOCA report in the lived patient experience and to highlight the real impact of ICU care on patients' lives.

Twenty-six Units in 22 hospitals participated in this ICU audit in 2021. These 26 Units had provided 96% of all Level 3 ICU care in adult hospitals funded by the Health Service Executive (HSE) in 2021. Data completeness in participating Units during 2021 is illustrated in table 1.1. No data were collected for 2 quarters in Tallaght University Hospital or for 3 quarters in University Hospital Kerry, leading to gaps in data completeness; this was due to the Audit Coordinator post being vacant for these periods. Data collection was complete for all other Units for the full year.[3]

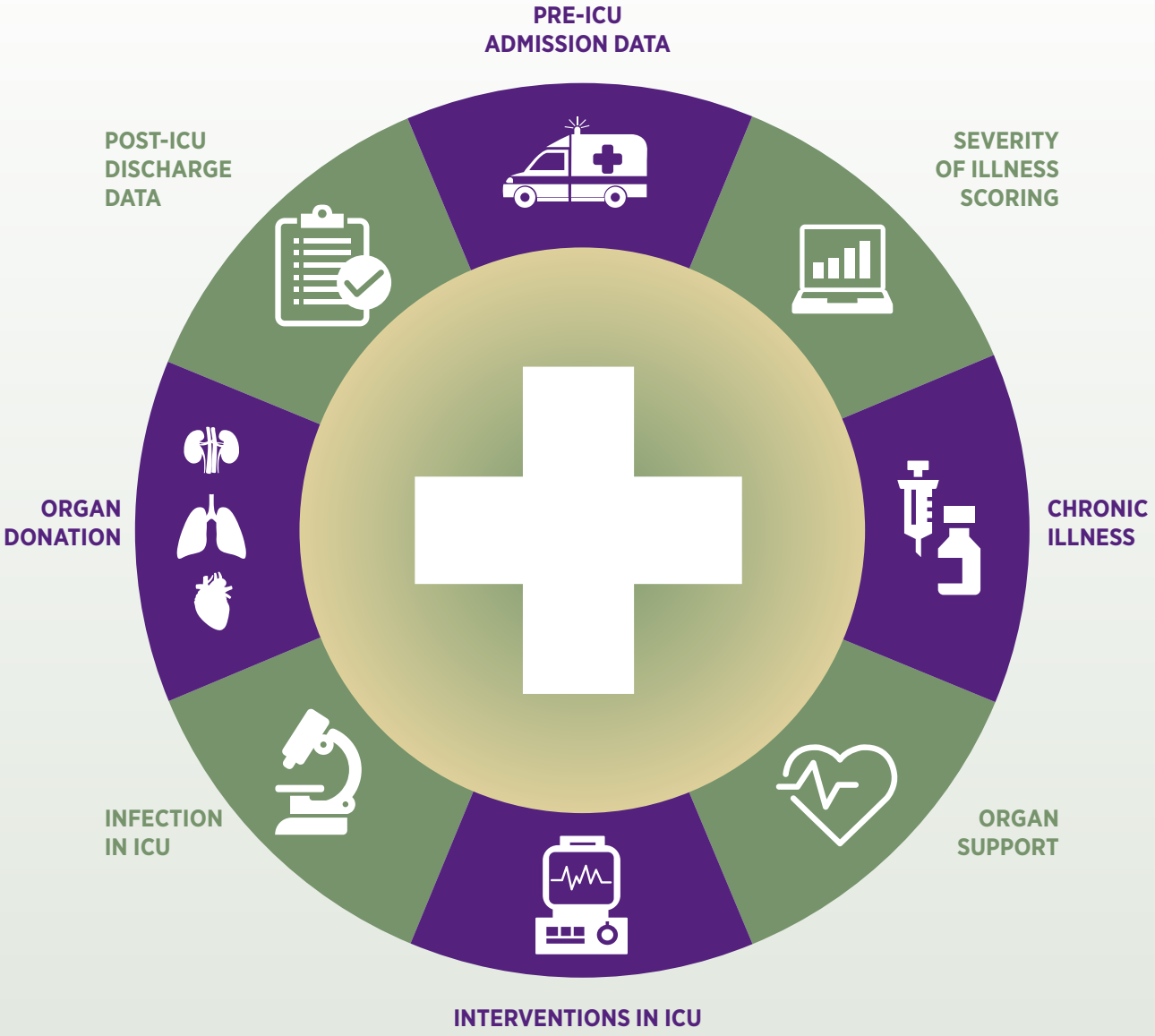
[3] It is worth noting in this Report that there were greater gaps in data completeness during 2022; data for a total of 18 quarters across 9 hospitals were not collected or entered. This is a worrying trend, which undermines the validity and usefulness of national ICU audit in documenting ICU activity and the quality of care across the national ICU network of care. The predominant reason for these gaps in 2022 was vacant Audit Coordinator posts or inadequate Audit Coordinator staffing levels for the workload being undertaken by the Unit. See Recommendation 4 (Chapter 13).

TABLE 1.1: DATA COVERAGE IN INTENSIVE CARE UNITS PARTICIPATING IN THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT, 2021

KEY	HOSPITAL NAME	UNIT NAME	Q1	Q2	Q3	Q4
A	Beaumont Hospital	Beaumont Hospital General ICU	Y	Y	Y	Y
B	Beaumont Hospital	Beaumont Hospital (Richmond) Neurosurgical ICU	Y	Y	Y	Y
C	Mater Misericordiae University Hospital	Mater Misericordiae University Hospital HDU	Y	Y	Y	Y
D	Mater Misericordiae University Hospital	Mater Misericordiae University Hospital ICU	Y	Y	Y	Y
E	Our Lady of Lourdes Hospital Drogheda	Our Lady of Lourdes Hospital Drogheda ICU	Y	Y	Y	Y
F	St James's Hospital	St James's Hospital Cardiothoracic ICU	Y	Y	Y	Y
G	St James's Hospital	St James's Hospital General ICU	Y	Y	Y	Y
H	Tallaght University Hospital	Tallaght University Hospital ICU	Y	Y	N	N
I	University Hospital Galway	University Hospital Galway ICU	Y	Y	Y	Y
J	University Hospital Limerick	University Hospital Limerick ICU	Y	Y	Y	Y
K	University Hospital Waterford	University Hospital Waterford ICU	Y	Y	Y	Y
L	Regional Hospital Mullingar	Regional Hospital Mullingar ICU	Y	Y	Y	Y
M	Wexford General Hospital	Wexford General Hospital ICU	Y	Y	Y	Y
N	Connolly Hospital	Connolly Hospital ICU	Y	Y	Y	Y
O	Midland Regional Hospital Tullamore	Midland Regional Hospital Tullamore ICU	Y	Y	Y	Y
P	Naas General Hospital	Naas General Hospital ICU	Y	Y	Y	Y
Q	St Luke's General Hospital, Carlow/Kilkenny	St Luke's General Hospital Carlow/Kilkenny ICU	Y	Y	Y	Y
R	St Vincent's University Hospital	St Vincent's University Hospital ICU	Y	Y	Y	Y
S	Cork University Hospital	Cork University Hospital Cardiothoracic ICU	Y	Y	Y	Y
T	Cork University Hospital	Cork University Hospital General ICU	Y	Y	Y	Y
U	Letterkenny University Hospital	Letterkenny University Hospital ICU	Y	Y	Y	Y
V	Tipperary University Hospital	Tipperary University Hospital ICU	Y	Y	Y	Y
W	University Hospital Kerry	University Hospital Kerry ICU	Y	N	N	N
X	Cavan General Hospital	Cavan General Hospital ICU	Y	Y	Y	Y
Y	Mercy University Hospital	Mercy University Hospital Cork ICU	Y	Y	Y	Y
Z	Sligo University Hospital	Sligo University Hospital ICU	Y	Y	Y	Y

Y	**DATA INCLUDED IN REPORT**
N	**NO DATA**

CHAPTER 2
METHODOLOGY



CHAPTER 2: **METHODOLOGY**

Reporting on 2021 data, this is the fifth Irish National Intensive Care Unit Audit (INICUA) report. INICUA provided most of the data for this report. This report also includes data collected by the National ICU Bed Information System (ICU-BIS). The methodologies from both systems are described below under the headings "Irish National ICU Audit" and "ICU Bed Information System".

IRISH NATIONAL ICU AUDIT

Background

INICUA was established by NOCA in 2013 and focuses on the care of patients in adult ICUs. INICUA is an audit of patient outcomes from adult Critical Care Units (ICUs, combined Intensive Care/High Dependency Units (HDUs) and one standalone HDU) in the ROI. Patients cared for in these Units are the sickest patients in the hospital. INICUA is a quality and patient safety initiative that measures the quality of care in each ICU, benchmarking this against international standards. Activity within the participating ICUs is also measured to help improve the standard of critical care within hospitals.

Data Collection, Validation and Analyses

INICUA works with ICNARC, an organisation in the UK, for data validation and benchmarking of quality indicators for all Units. Critical Care Units collect data on all patients admitted to their Unit. Data are securely submitted to ICNARC and run against more than 600 validation checks, which identify potential errors as well as missing or unusual data. The Units use these checks to update their data before returning them for further validation checks. Once the data have passed all validation checks, they are ready for analysis. Reports based on these data are then sent to the Units, identifying trends over time and detailed quality indicators.

Irish National ICU Audit Dataset

This dataset covers the patient journey before and after admission to ICU. The data recorded in the INICUA dataset are presented in Table 2.1.

TABLE 2.1: IRISH NATIONAL INTENSIVE CARE UNIT AUDIT DATASET

Dataset	Examples
Pre-ICU admission data	Demographics, 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 model risk-adjusted predicted acute hospital mortality and Sequential Organ Failure Assessment (SOFA) score
Chronic illness data	Metastatic, cardiovascular, respiratory and other chronic disease
Data on interventions in ICU	Ventilation, invasive monitoring, dialysis, nutrition, transfers to operating theatre
Data on organ support	Respiratory, cardiovascular, dermatological, neurological, liver, renal and gastrointestinal support
Data to support Hospital In-Patient Enquiry (HIPE) coding	Diagnosis during ICU stay, hours of ventilation
Data on Infection in ICU	Unit- and hospital-acquired infection
Data on Organ donation	Potential and actual organ donation
Post-ICU discharge data	Outcome and LOS in Unit, ward and hospital; patient journey details

The Irish National ICU Audit dataset on InfoFlex also contains dataset items specific to Ireland, defined in the NOCA National ICU Audit Data Definition Manual (NOCA 2017). Some examples to support service requirement in Ireland are:

- the dataset on infection acquired in the Unit, which supports the audit of Unit Acquired Bloodstream Infections (UABSI);
- the dataset on organ donation, which supports the Organ Donation and Transplant Ireland (ODTI) and Potential Donor Audit (PDA); and
- the dataset for the currently/recently pregnant patients.

Each Unit has access to their own data from the HSE database. Data retrieval from the database is possible on Units through ad hoc queries, and by running a preformatted National report.

NOCA's plans to develop a National Database for Critical Care audits is underway. This will mean that the full dataset will be available at NOCA.

Inclusion Criteria

The analysis in this report is based on records as captured on the INICUA data-collection tool. It includes patients who were admitted to a participating adult ICU or HDU between 1 January and 31 December 2021. Also included are all patients admitted to the additional 'surge' ICU beds that were opened in response to the corona virus disease 2019 (COVID-19) pandemic, provided that these were under the care of the ICU team.

Four small regional hospitals and the five private hospitals did not participate in INICUA in 2021, and there is incomplete data from two other hospitals. MICAS transfer data was used as a cross reference in chapter 10 to support the findings for inter-hospital transfers.

Exclusion Criterion

This report excludes patients who were admitted to a paediatric ICU or paediatric HDU. Coronary Care Units are not included in the INICUA.

ICU BED INFORMATION SYSTEM (ICU-BIS)

Background

On 26 March 2020, the ICU-BIS went live for the 26 adult public hospitals in the ROI that have an ICU. This coincided with marked increases in the number of COVID-19 patients in ICU at the time. On 2 April 2020, the five private hospitals in the ROI with ICU capacity were included in the system, and on 6 April 2020 the two paediatric hospitals that have an ICU were included. Since then, the ICU-BIS has provided a comprehensive national picture of bed capacity and patient numbers (both COVID-19 and non-COVID-19) in ICU. Data in this report relate only to the 26 adult public (HSE-funded) hospitals in the ROI.

Criteria for Inclusion of Units in ICU-BIS

Data are collected from all ICUs, which are defined as Units with the ability to provide invasive ventilation on an ongoing basis. Data are also collected from HDUs, which are defined as Units with the ability to provide organ support, such as vasopressors or renal replacement therapy (but short of invasive ventilation via endotracheal tube), and the ability to undertake invasive monitoring such as direct arterial pressure monitoring. Other criteria for a HDU were a nurse–patient ratio of 1:2 and clinical and administrative management of the Unit by the ICU medical team.

Exclusion Criterion

Coronary Care Units are not included in the ICU-BIS.

ICU-BIS Dataset

Data collected by the ICU-BIS fall into two categories: ICU occupancy data and COVID-19-specific patient data. Data collected and reported by the ICU-BIS include:

1. numbers of ICU beds open (with appropriate staffing), of beds occupied, of beds reserved for another patient, of patients cleared for discharge from ICU, and of beds available;
2. the total number of patients (COVID-19 and non-COVID-19) invasively ventilated;
3. the total number of patients (COVID-19 and non-COVID-19) undergoing renal replacement therapy (intermittent and continuous);
4. data on critically ill patients managed by the ICU team outside normal ICU locations;
5. data on COVID-19 patients, defined as those who have tested positive for COVID-19 during the current hospital admission, including: (i) numbers in each Unit, (ii) numbers invasively ventilated, (iii) the number of new admissions in the last 24 hours, (iv) the number of discharges in the last 24 hours, and (v) numbers of deaths in the last 24 hours; and
6. patient-level data on COVID-19 patients, including age, sex, comorbidities, vaccination status, whether they are currently or were recently pregnant (if female), primary reason for admission to ICU, and source of COVID-19 infection (if known).

CHAPTER 3
DATA QUALITY

Coverage of Data Release

Completeness of Data Release

Accuracy of Data Release

CHAPTER 3: **DATA QUALITY**

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

TABLE 3.1: CONTEXT OF DATA QUALITY STATEMENT

SCOPE	This data-quality statement provides an assessment of the data released for this report. This statement focuses solely on the data-quality dimension of accuracy and reliability, and specifically on the following characteristics: • coverage of data release • completeness of data release • accuracy of data release.
PURPOSE	This data-quality statement will help the reader decide whether the data are fit for the user's specific purpose.
DATA SOURCE	The sources of data for this report are INICUA and the ICU-BIS. Unless otherwise stated, the source of data for individual figures and tables is INICUA.
TIMEFRAME OF DATA RELEASE	The data published in this report are based on data collected during the period from 1 January to 31 December 2021.
TYPE OF DATA	Final

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY

Coverage of data release 	a. INICUA collects data from 26 Units in 22 hospitals in the ROI, which collectively represent 96% of Level 3 critical care in HSE-funded hospitals (See Chapter 1 for data coverage in each participating Unit for 2021). b. The ICU-BIS collects data for all ICUs in the ROI (both public and private hospitals). The data in this report refer to the proportion of patients admitted to public hospital ICUs or HDUs in ROI only. NOCA estimates that patient coverage for the ICU-BIS data presented in this report is 99–100%.
Completeness of data release 	INICUA missing fields are identified at point of entry by inbuilt validation prompts, by ICNARC through their validation process or by NOCA respectively. Data are then corrected by each Unit or are deemed unavailable before data are reported on. Missing/incomplete data are documented in this report. Two Units did not have data for 2 and 3 quarters respectively in 2021. The reason for the gap in data was a direct result of not having an ICU Audit Coordinator in post or the current ICU Audit Coordinators were unable to catch up on additional data entry post pandemic and cyber attack.[4] ICU-BIS is supported by NOCA seven days a week, to ensure the completeness and accuracy of data. This support involves phoning Units who have not entered data or where the data entered differs from expected. NOCA estimates that patient coverage for the ICU-BIS data presented in this report was 100%.
Accuracy of data release 	a. INICUA: Critical Care Units collect data on all patients admitted. Data are run against more than 600 validation checks, which identify potential errors as well as missing and unusual data. The Units use these checks to update their data before returning them for further validation checks. Once the data have passed all validation checks they are submitted for analysis. b. ICU-BIS: Data entry errors are identified at data entry point by inbuilt validation rules. NOCA also supports the system seven days a week to ensure data accuracy. Any anomalies, missing or unusual data are checked, and the Units are contacted, and data corrected by the Unit or NOCA before data is reported on. Further validation checks are carried out against the previous days extract to identify any further errors before the reports are run and distributed.

[4] Patient data integrity is important in providing timely and appropriate care. Data completeness is an internationally agreed dimension of data quality. To ensure we have data completeness by having no gaps in data reported, NOCA recommend staffing should be 1 WTE ICU Audit Coordinator for 10 beds audited.

TABLE 3.3: ASSESSMENT

Strengths of data in this report	a. INICUA dataset is a comprehensive dataset that includes case mix, activity, and outcome data, which are routinely validated for reporting. b. ICU-BIS dataset is concise, with clearly defined variables, and is routinely validated by NOCA staff. There is full coverage of all acute hospitals in the ROI throughout the reporting period.
Limitations of data in this report	a. INICUA: data collection and input for 2021 were delayed due to the COVID-19 pandemic and the HSE cyber attack. This report will be published on 8 November 2023.

CHAPTER 4

PARTICIPATING UNITS, ACTIVITY AND CASE MIX

CONTENTS >

CHAPTER 4: **PARTICIPATING UNITS, ACTIVITY AND CASE MIX**

The ICUs included in INICUA are all in adult public hospitals funded by the HSE. The Units differ considerably from each other in size (Table 4.1) and case mix.

Units providing care for critically ill patients are classified as ICUs (Level 3: multi-organ support provided) or HDUs (Level 2: single-organ support or invasive monitoring provided). The Units vary in their bed configuration, containing: (i) ICU (Level 3) beds only, (ii) a mixture of ICU and HDU beds, or (iii) HDU (Level 2) beds only. Some Units have patients receiving care predominantly from a particular specialty (e.g. cardiac surgery, neurosurgery). These differences explain some of the variability between Units 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 THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT*

Key	Unit	Description	Unit admissions in 2021 (n)	Open beds; mean during 2021, (source ICU-BIS)
A	**Beaumont Hospital General ICU**	General ICU (GICU) for medical and surgical patients, with a significant number of neurosurgical patients as overflow from the hospital's neurosurgical ICU.	854	18.8
B	**Beaumont Hospital (Richmond) Neurosurgical ICU**	Specialist Unit for neurosurgical patients, with a significant number of general medical/ surgical patients as overflow from the hospital's GICU.	340	8.9
C	**Mater Misericordiae University Hospital ICU**	HDU for general medical and surgical patients.	1341	16.0
D	**Mater Misericordiae University Hospital ICU**	GICU for medical and surgical patients. Significant influences on case mix include cardiothoracic surgery, heart and lung transplantation, and extracorporeal life support.	829	16.2
E	**Our Lady of Lourdes Hospital Drogheda ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	411	10.3
F	**St James's Hospital Cardiothoracic ICU**	Specialist Cardiothoracic ICU (CT ICU) for patients after cardiothoracic surgery.	238	7.8
G	**St James's Hospital General ICU**	GICU for medical and surgical patients. In addition, this report includes data from two Burns Unit beds.	996	26.3
H	**Tallaght University Hospital ICU**	GICU for medical and surgical patients. This report also includes data from the Post Anaesthesia Care Unit.	275 (6 months only)	14.1
I	**University Hospital Galway ICU**	The GICU and separate HDU are combined for INICUA purposes. Case mix includes medical, surgical, obstetric and paediatric patients.	1163	20.3 **
J	**University Hospital Limerick ICU**	GICU for medical and surgical patients. The hospital also has a HDU, which is not included in this report.	427	11.8

* Note: The order in which Units are listed reflects the order in which Units began participating in INICUA; this order is repeated in most of the figures throughout this report.
** This is an estimate as data were incomplete.

TABLE 4.1: CHARACTERISTICS OF THE UNITS PARTICIPATING IN THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT* *CONTINUED*

Key	Unit	Description	Unit admissions in 2021 (n)	Open beds; mean during 2021, (source ICU-BIS)
K	**University Hospital Waterford ICU**	GICU for medical and surgical patients. The hospital also has a HDU, which is not included in this report.	339	5.9
L	**Regional Hospital Mullingar ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	368	7.1
M	**Wexford General Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	301	5.9
N	**Connolly Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	344	6.6
O	**Midland Regional Hospital Tullamore ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	240	6.1
P	**Naas General Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	167	3.6
Q	**St Luke's General Hospital Carlow/ Kilkenny ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	217	4.8
R	**St Vincent's University Hospital ICU**	General ICU for medical and surgical patients, with a significant number of patients with liver-related illness.	671	18.1
S	**Cork University Hospital Cardiothoracic ICU**	Specialist CT ICU for patients after cardiothoracic surgery, with some GICU patients admitted also.	609	5.7
T	**Cork University Hospital General ICU**	GICU for medical, surgical, and neurosurgical patients.	618	16.5
U	**Letterkenny University Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	307	5.4
V	**Tipperary University Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	195	5.0
W	**University Hospital Kerry ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	68 (3 months only)	5.5
X	**Cavan General Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	228	4.0
Y	**Mercy University Hospital Cork ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients.	311	5.9
Z	**Sligo University Hospital**	General Unit (mixed ICU/HDU) for medical and surgical patients.	294	5.0

* Note: The order in which Units are listed reflects the order in which Units began participating in INICUA; this order is repeated in most of the figures throughout this report.

ACTIVITY IN CRITICAL CARE

Coverage and Number of Patients

Units participating in National ICU Audit provided an estimated 96% of all Level 3 ICU care in HSE-funded hospitals in 2021 (Source: NOCA ICU Bed Information System, using days receiving invasive ventilation as a method for estimating Level 3 care).

Participating Units differed widely in numbers of patients admitted (Figure 4.1). University Hospital Kerry ICU participated for only 3 months and Tallaght University Hospital ICU participated for only 6 months in 2021 (Figure 4.1). These partial data have been used throughout the Report with appropriate labelling to indicate where data are incomplete.

During 2021, INICUA documented 12,151 admissions of 11,420 patients to ICU in 22 participating hospitals (i.e. 731 readmissions). Bed days while undergoing invasive ventilation made up 53% of the total number of bed days. Eight thousand, six hundred and fifty-eight patients survived to leave acute hospital alive, which means that there is a crude mortality rate of 24%.

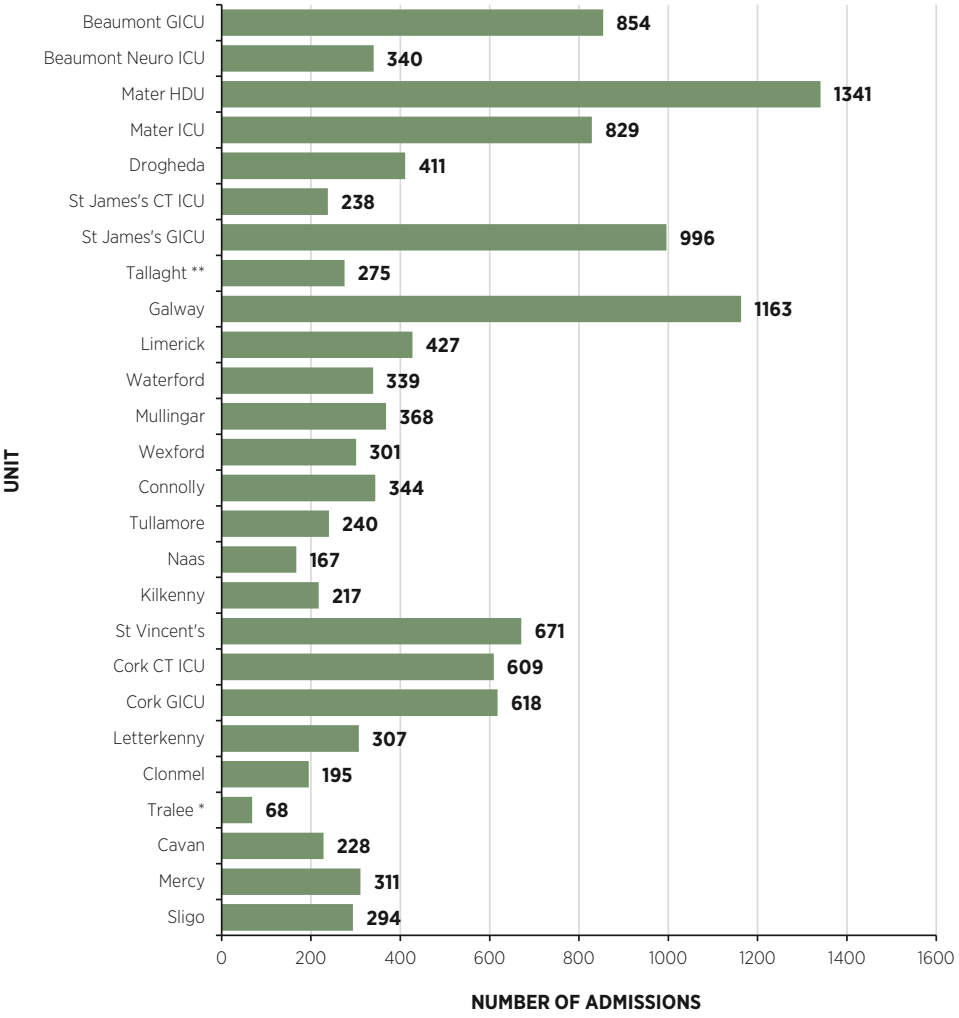


FIGURE 4.1: NUMBER OF PATIENTS ADMITTED TO EACH UNIT IN 2021

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

DEMOGRAPHICS

The mean age of patients admitted to ICU in 2021 was 61 years, and 60% were male (Appendix 2).

Source of Admissions: Non-Theatre and Theatre

Sixty-five per cent of patients came to ICU from a location other than the operating theatre. Patients admitted from a non-theatre location often suffer from a variety of serious conditions (e.g. sepsis, COVID-19, cardiac arrest, liver disease, haemorrhage, post-operative complications). These patients are usually admitted to ICU as an emergency, the admission is usually unpredictable, they tend to be sicker than patients admitted from the operating theatre, and they have a greater risk of death. Patients coming from a non-theatre location ranged from 15% of all admissions in Cork CT ICU to 91% of all admissions in Tralee.

Patients admitted directly from the Operating Theatre after emergency and elective surgery represented 13% and 22% respectively of all ICU admissions in 2021, compared with 13% and 29% in 2019 (i.e., before the COVID pandemic). Decreased proportions of ICU admissions after elective surgery may reflect reduced surgical activity in 2021 related to COVID-19.

Unit admissions after emergency surgery varied from 48% of all admissions in Beaumont Hospital (Richmond) Neurosurgical ICU to 4% in Mater Misericordiae University Hospital HDU (Figure 4.2). Patients admitted to ICU after emergency surgery are known to have a higher mortality rate in ICU than those admitted after elective surgery.

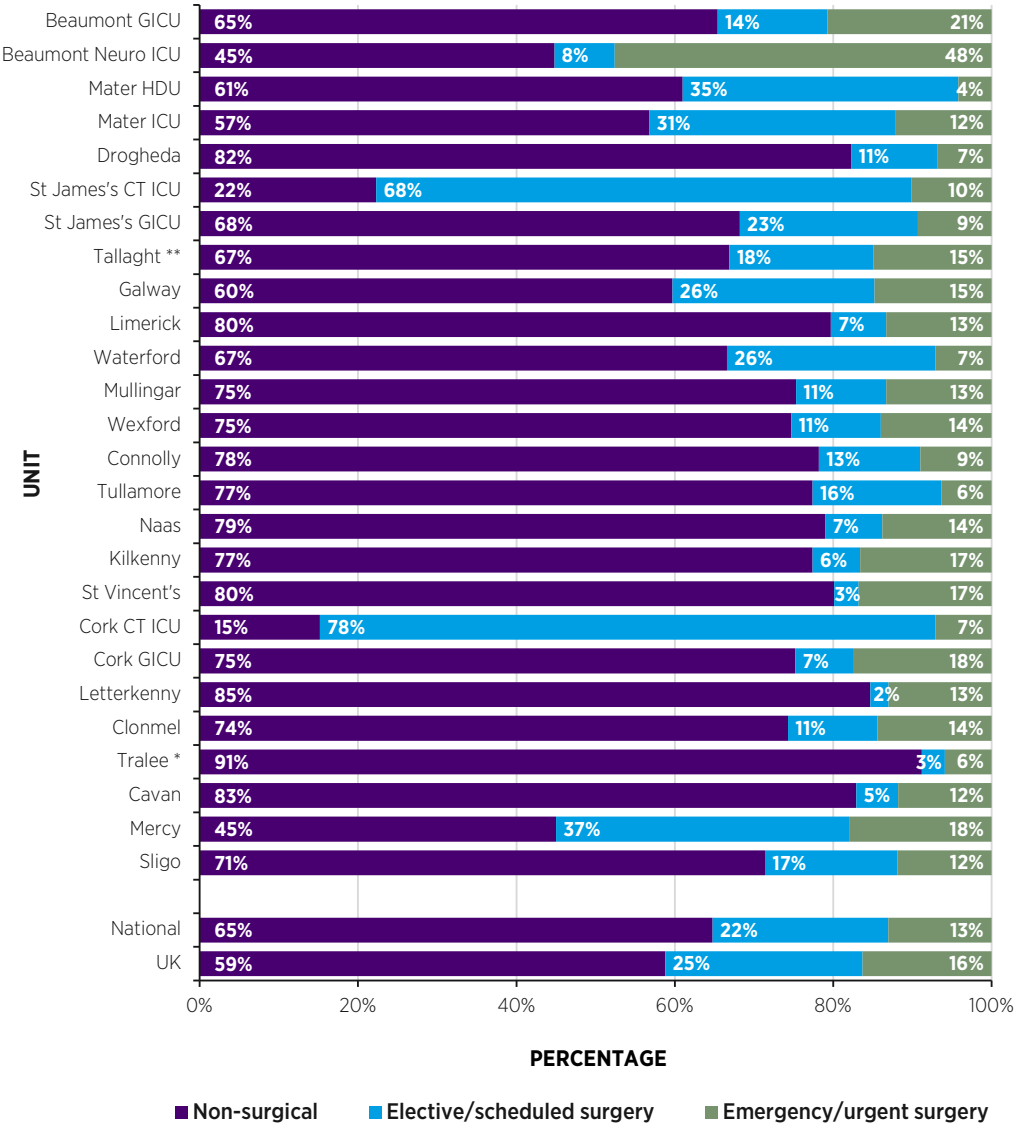


FIGURE 4.2: ADMISSIONS TO EACH UNIT DIRECTLY FROM THE OPERATING THEATRE AFTER EMERGENCY SURGERY AND AFTER ELECTIVE SURGERY AND NON-THEATRE (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)[5]

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

[5] Percentages may not add up to 100% due to rounding

ICU ADMISSIONS AFTER TRAUMA

The numbers of patients admitted to ICU after trauma and (as a subset of all trauma admissions) after traumatic brain injury (TBI) are shown in Figure 4.3. Almost 8% of all ICU admissions followed trauma. The largest numbers of trauma admissions were to Mater Misericordiae University Hospital (n=170) and to Beaumont Hospital (n=169).

There were 284 admissions of patients after TBI (130 of these to Beaumont Hospital), making up 2.3% of all ICU admissions in 2021.

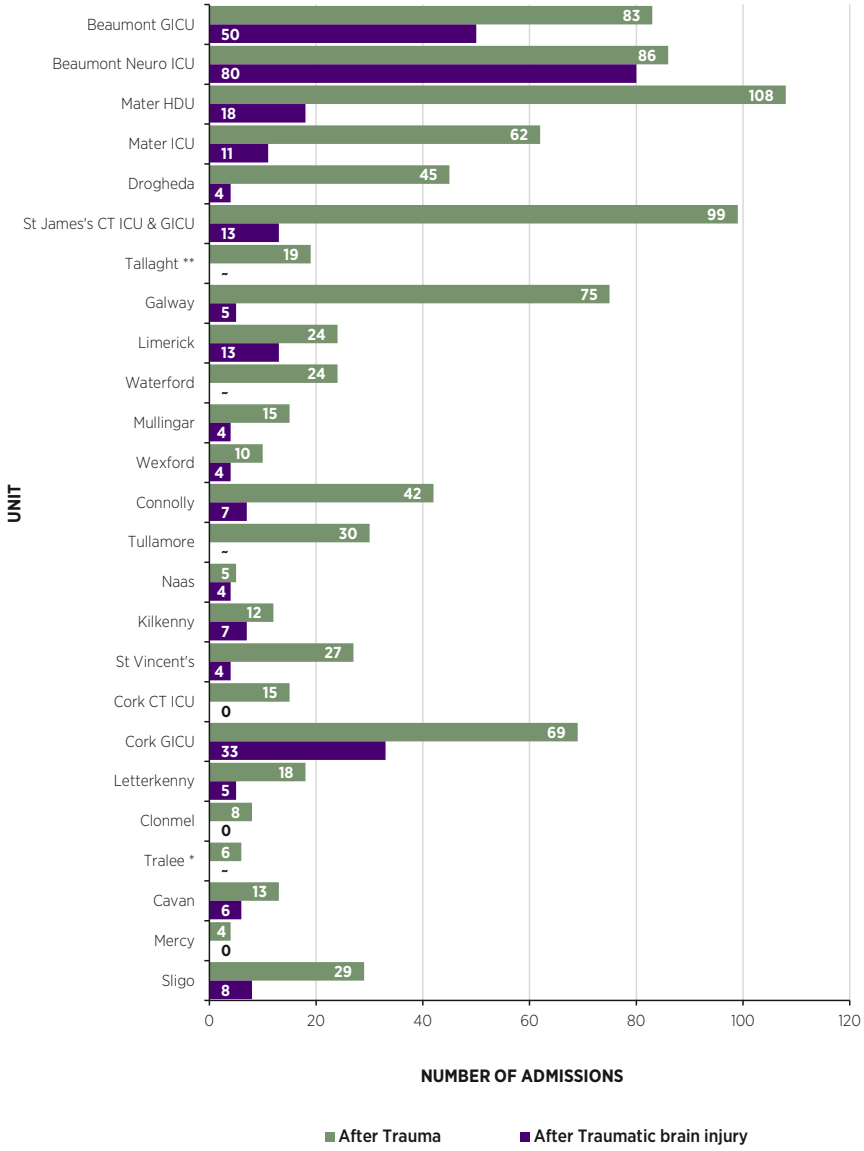
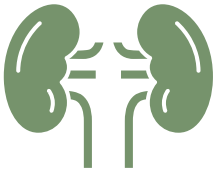


FIGURE 4.3: NUMBER OF ADMISSIONS TO EACH UNIT: (i) AFTER ANY TRAUMA, AND (ii) AFTER TRAUMATIC BRAIN INJURY (N.B. (ii) IS A SUBSET OF (i))

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.
~ Number suppressed where there were three admissions or fewer to the Unit.

ICU ADMISSIONS WITH ACUTE KIDNEY INJURY



Acute kidney injury (AKI) is associated with increased mortality and morbidity, both during the current hospital admission and in the longer term. The *Kidney Disease: Improving Global Outcomes (KDIGO)* classification system is used to define and grade AKI as KDIGO Stages 1–3 (*Kidney Disease: Improving Global Outcomes* (KDIGO), Acute Kidney Injury Work Group, 2012). 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). Nationally, 52% of patients had AKI (KDIGO Stages 1–3) in the first 24 hours after ICU admission (Figure 4.4). 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. KDIGO Stage 3 indicates a greater severity of AKI with a greater requirement for dialysis and increased mortality. The incidence of KDIGO Stage 3 (severe) AKI within 24 hours of admission to GICUs ranged from 2% (Beaumont Hospital (Richmond) Neurosurgical ICU) to 24% (St Vincent's University Hospital ICU). Nationally, 12% of patients had KDIGO Stage 3 (severe) AKI within 24 hours of ICU admission, similar to the UK (11%).

Of patients admitted to ICU nationally, the percentages with Stages 1–2 and with Stage 3 (severe) AKI were similar in 2021 as in 2020 (39% and 13%, respectively, in 2020 versus 39% and 12%, respectively, in 2021).

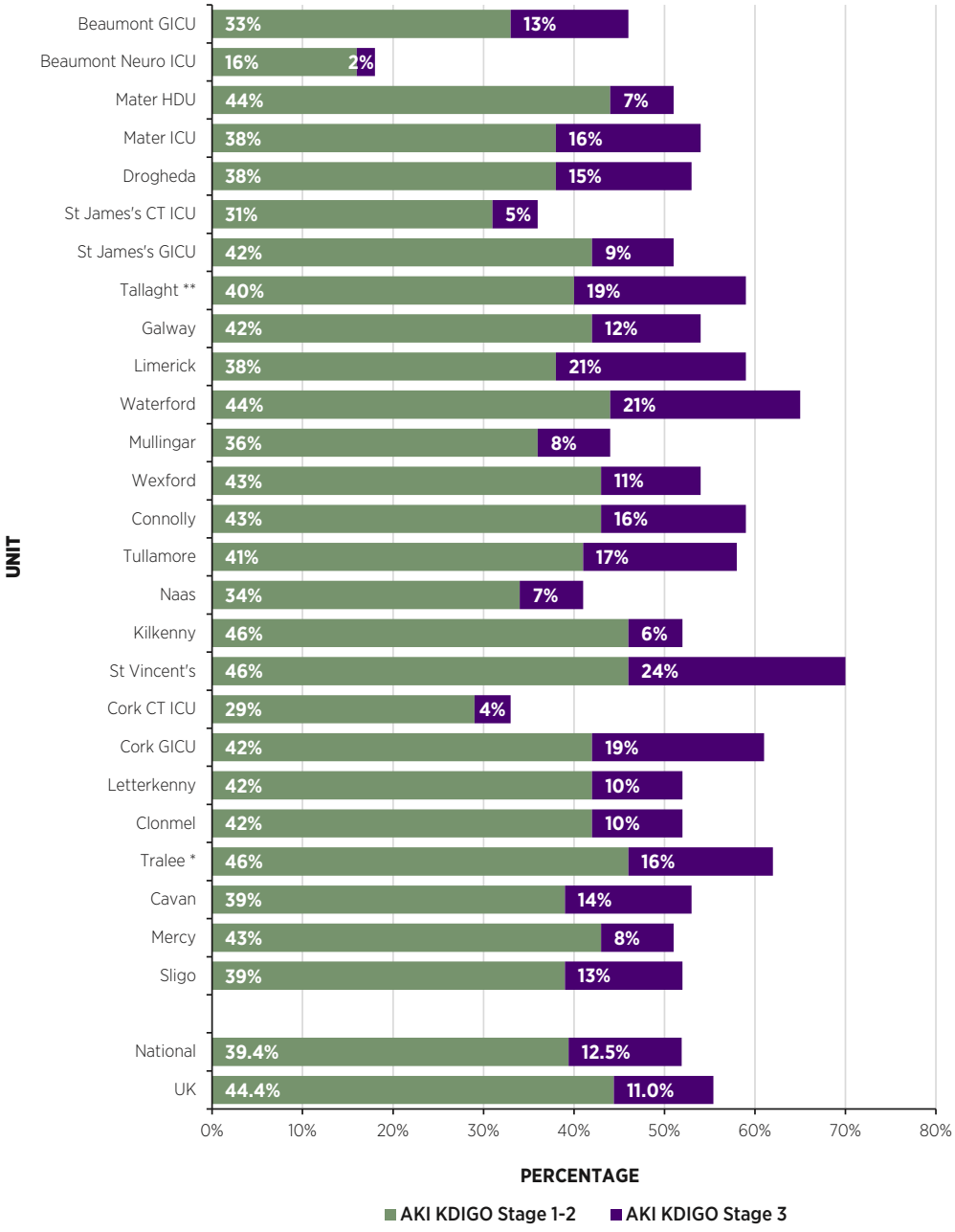


FIGURE 4.4: PATIENTS WITH ACUTE KIDNEY INJURY DURING THE FIRST 24 HOURS AFTER ADMISSION TO THE INTENSIVE CARE UNIT (KIDNEY DISEASE: IMPROVING GLOBAL OUTCOMES STAGES 1–3) (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

ICU ADMISSIONS WITH SEPSIS

Thirty-seven per cent of admissions to ICU had sepsis at the time of admission, as defined by the Sepsis-3 criteria (*Singer et al., 2016*) (Figure 4.5). Sepsis admissions tended to be more common in Units with a greater proportion of non-surgical admissions (Figure 4.2).

Sepsis associated with dysfunction in four or more organ systems indicates severe illness and has a high mortality rate. Developing this severity of illness within 24 hours of ICU admission commonly indicates delayed admission to ICU. The proportion of patients with sepsis and dysfunction in four or more organ systems ranged from 0% (Mater Misericordiae University Hospital HDU) to 7% (University Hospital Limerick ICU). Nationally, patients admitted with sepsis and dysfunction in four or more organ systems made up 3% of all admissions in both 2021 and in 2020.

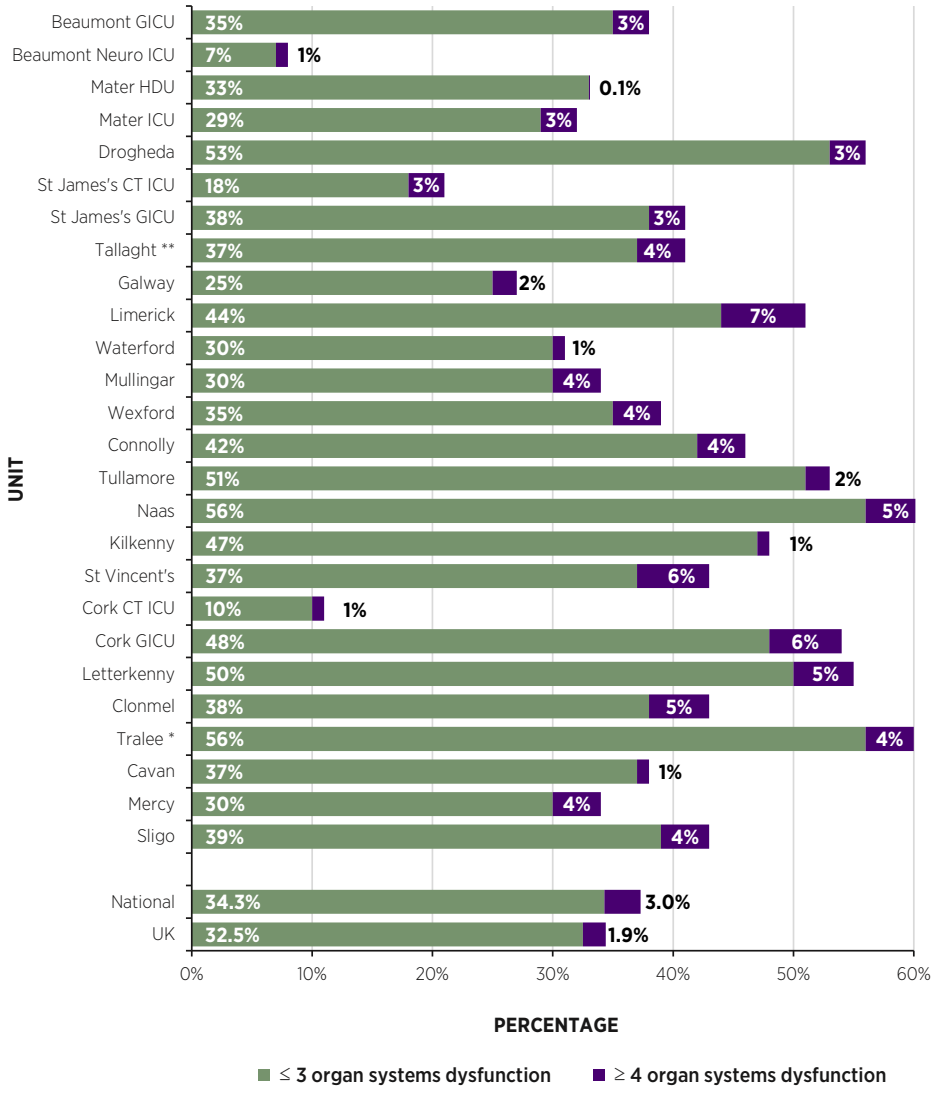


FIGURE 4.5: ADMISSIONS TO THE UNIT WITH A DIAGNOSIS OF SEPSIS (SEPSIS-3) WITH: (i) THREE OR FEWER OR (ii) FOUR OR MORE ORGAN SYSTEMS DYSFUNCTION WITHIN 24 HOURS OF ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

ADMISSIONS TO ICU AFTER CARDIOPULMONARY RESUSCITATION

A requirement for cardiopulmonary resuscitation (CPR) before ICU admission is a negative prognostic indicator. The proportion of patients admitted to ICUs following CPR ranged from 0.4% to 15% (Figure 4.6). The proportions of ICU admissions which followed CPR were similar in the ROI (6%) and the UK (5%) and were unchanged from 2020.

Admissions to ICU after in-hospital CPR ranged from 0.4% to 11% of all admissions among different hospitals. Reasons why some Units have higher rates of in-hospital CPR before ICU admission include a failure to recognise deterioration in patients in the ward or delay in ICU admission. NOCA suggests that hospitals should review the reasons for variation in their rates compared with other hospitals and compared to historical rates in their own hospital. Units should incorporate the measures outlined in the HSE document *Patient Safety Strategy 2019–2024*, including critical care outreach and improved access to ICU beds.

In November 2022, funding was approved for a National Cardiac Arrest Audit to be piloted in Ireland East Hospital Group (IEHG) hospitals. This quality improvement project seeks to establish an IEHG in-hospital cardiac arrest audit to augment existing governance structures for Quality and Patient Safety across the IEHG for the deteriorating patient. The INICUA report 2020 (NOCA 2022) also identified as a key recommendation the implementation of a national in-hospital cardiac arrest audit (Recommendation 5).

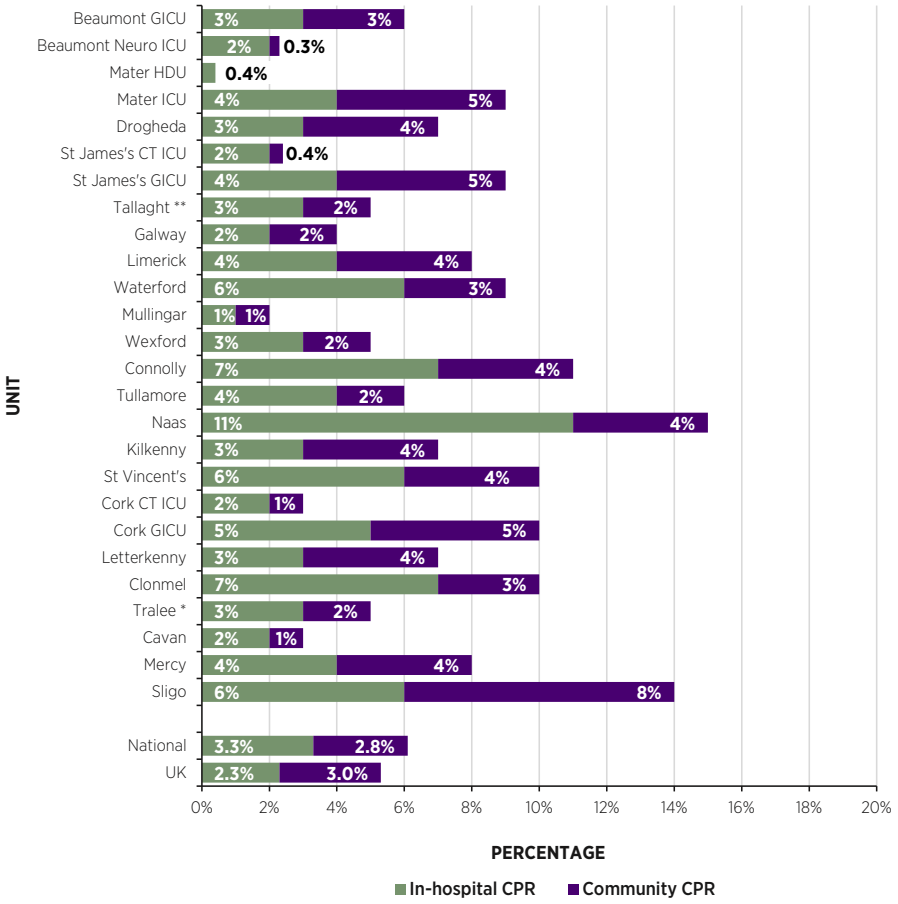


FIGURE 4.6: ADMISSIONS FOLLOWING CARDIOPULMONARY RESUSCITATION IN THE COMMUNITY OR IN HOSPITAL (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

SEVERE LIVER DISEASE, HAEMATOLOGICAL MALIGNANCY, AND METASTATIC CANCER

Certain subgroups of patients — patients with severe liver disease, patients with haematological malignancy, and patients with metastatic cancer — are important to document, even though they make up a small proportion of ICU admissions. These patients tend to be sicker, to have very high mortality rates and to use more ICU resources than other ICU admissions.

Admissions of patients with severe liver disease ranged from 0% of all admissions to 6% (Figure 4.7A). Admissions of patients with haematological malignancy ranged from 0% to 8% (Figure 4.8A), and admissions with metastatic disease ranged from 0% to 9% (Figure 4.9A). The percentages of admissions to ICU with each of these three diagnoses were similar in the ROI and in the UK, respectively. The respective percentages for admissions with the three diagnoses in 2021 were similar to those recorded for 2020.

For all three conditions, there were wide variations in mortality rates between Units (Figures 4.7B, 4.8B and 4.9B). This may be due to differing admission policies or to the small numbers of patients admitted with these three conditions.

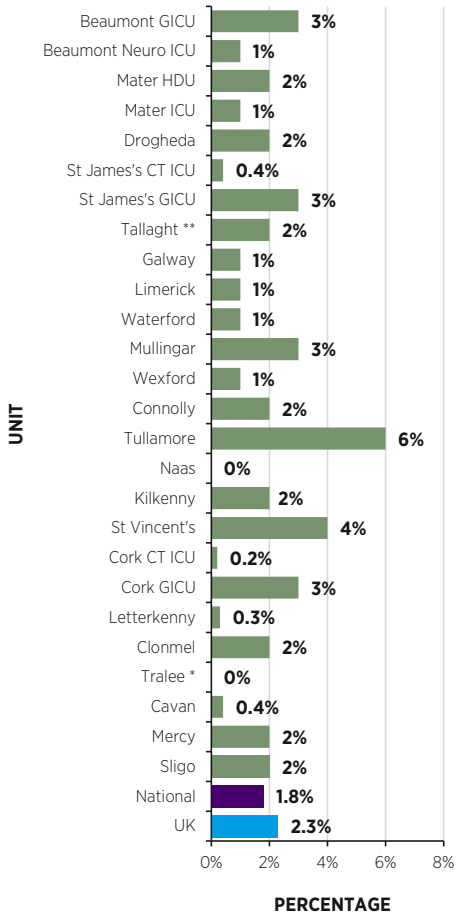


FIGURE 4.7A: ADMISSIONS WITH SEVERE LIVER DISEASE

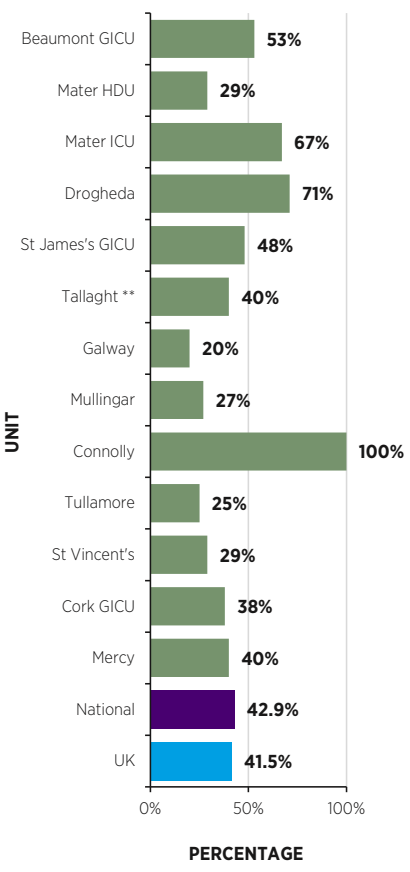


FIGURE 4.7B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH SEVERE LIVER DISEASE (UNITS WITH 5 OR MORE ADMISSIONS ONLY)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

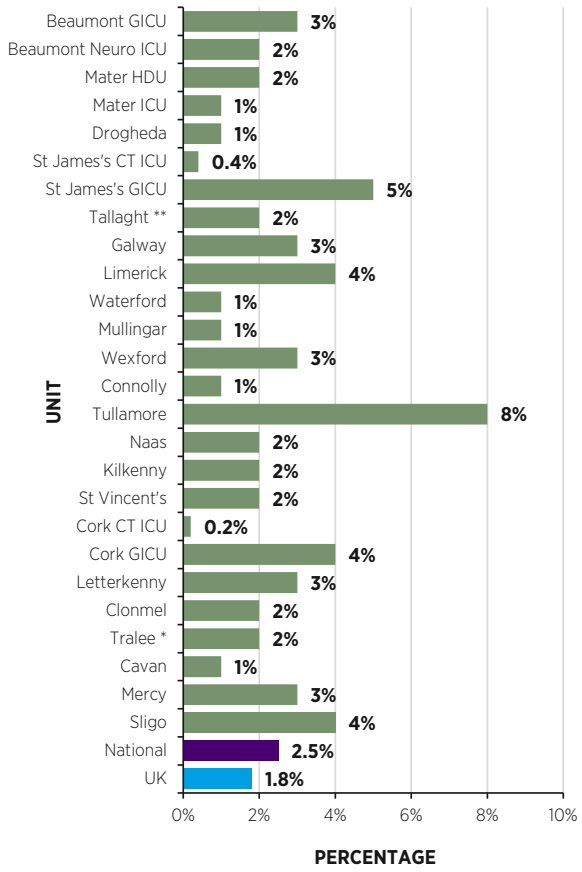


FIGURE 4.8A: ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY

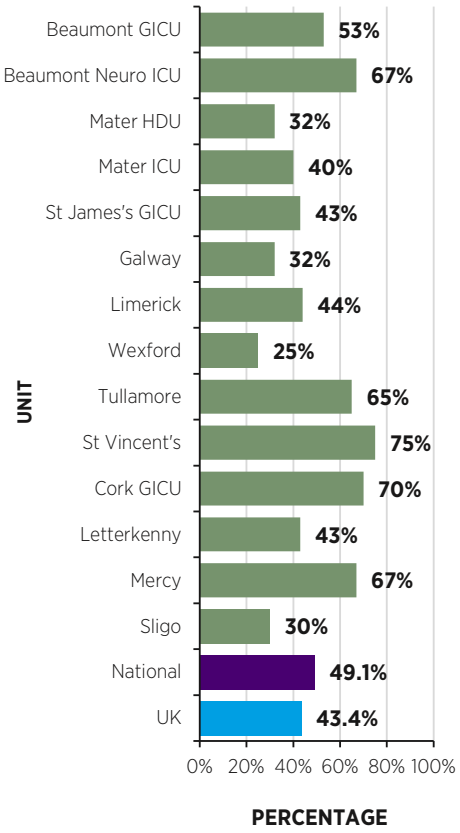


FIGURE 4.8B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY (UNITS WITH 5 OR MORE ADMISSIONS ONLY)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

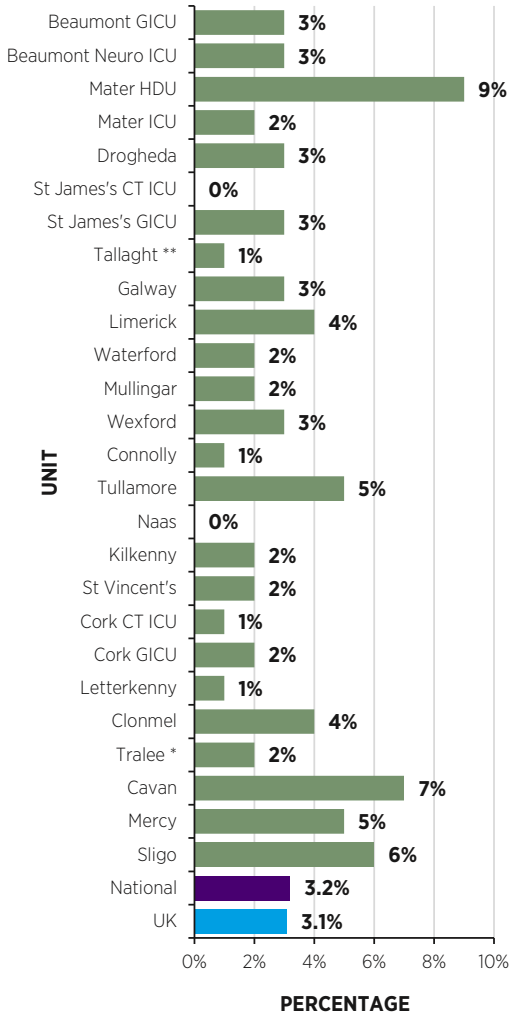


FIGURE 4.9A: ADMISSIONS WITH METASTATIC DISEASE

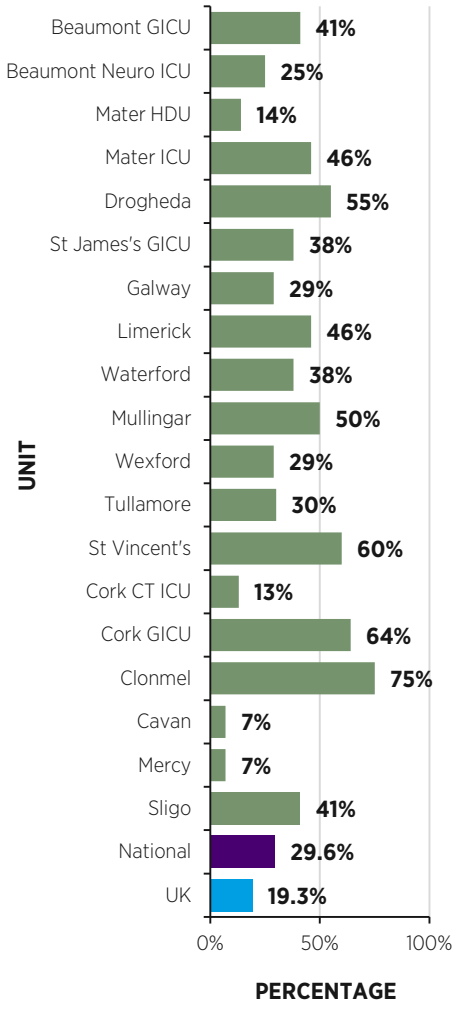


FIGURE 4.9B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH METASTATIC DISEASE (UNITS WITH 5 OR MORE ADMISSIONS ONLY)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

COVID-19 ACTIVITY IN IRELAND

INICUA data for 2021 documented 1,671 patients admitted to ICU with a diagnosis of COVID-19. This represented 14.6% of all patients admitted to ICU in 2021. COVID-19 patients accounted for 28.7% of all ICU beds occupied in 2021 (ICU-BIS data).

Six hundred and three patients died before discharge from acute hospital, giving a crude mortality rate of 36%. This compared to a 24% mortality rate for the overall ICU population.

CHILDREN IN ADULT ICUs

Ideally, all patients aged under 16 years should be admitted to a specialist paediatric ICU if they require ICU care. In 2021, 53 children aged under 16 years were admitted to the adult ICUs included in this report (0.4% of all Unit admissions) (Table 4.2).

TABLE 4.2: CHILDREN AGED UNDER 16 YEARS ADMITTED TO ADULT INTENSIVE CARE UNITS: AGE, CASE MIX, VENTILATION, LENGTH OF STAY, AND RATES OF SURVIVAL TO HOSPITAL DISCHARGE

Parameter	2019	2020	2021
Number of patients aged under 16 years	111	68	53
Mean age (median; interquartile range (IQR))	7.5 (8; 2–13)	9.0 (12; 5–14)	8 (7; 1–14)
Number of patients aged under 1 year	18	5	7
Number of patients aged 1–5 years	44	16	16
Number of admissions after surgery	34	7	8
Number of admissions with sepsis	22	11	9
Number of patients on invasive ventilation (percentage)	20 (18%)	21 (31%)	20 (38%)
Mean Unit LOS, in hours (median; IQR)	27.0 (18; 12–24)	38.5 (16; 10–32)	24 (16; 6–35)
Number of Unit survivors (percentage)	110 (99%)	67 (99%)	50/52 (96%)*
Number of hospital survivors (percentage)	107 (96%)	65 (96%)	47/52 (90%)*

* Status at discharge unavailable for one admission.

The numbers of children aged under 16 years who were admitted to individual Units were very small, except for in the case of University Hospital Galway ICU (Table 4.3). This presumably reflects the geographical distance of Galway from the specialist paediatric hospitals. LOS was very short in University Hospital Galway ICU 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.

Numbers of admissions of children decreased significantly in 2021 and have more than halved since 2019 (decreasing from 111 to 53 admissions). This may reflect more frequent referral to specialist paediatric hospitals, or it may be related to the impact of COVID-19 in 2020–21.

University Hospital Galway ICU was the only adult ICU which admitted children aged under 1 year (Table 4.3).

TABLE 4.3: NUMBERS OF PATIENTS AGED UNDER 16 YEARS, UNDER 6 YEARS, AND UNDER 1 YEAR: LENGTH OF STAY, NUMBERS VENTILATED

	Patients aged under 1 year (n)	Patients aged under 6 years (n)	Patients aged 6–15 years (n)	Mean LOS (hours)	Ventilated (n)
Mater Misericordiae University Hospital ICU	0	0	1	75	1
St James's Hospital General ICU	0	0	1	26	1
University Hospital Galway ICU	7	8	15	16	7
University Hospital Waterford ICU	0	1	0	18	0
St Luke's General Hospital Carlow/Kilkenny ICU	0	0	1	11	1
Cork University Hospital Cardiothoracic ICU	0	0	1	96	0
Cork University Hospital General ICU	0	1	4	12	4
Letterkenny University Hospital ICU	0	5	3	5	3
Cavan General Hospital ICU	0	0	1	3	1
Mercy University Hospital Cork ICU	0	0	1	53	1
Sligo University Hospital ICU	0	1	2	66	1

OBSTETRIC ADMISSIONS TO ICU IN 2021

During 2021, 196 patients who were pregnant or recently pregnant (delivered within the previous 6 weeks) were admitted to ICU (1.6% of all ICU admissions) (Table 4.4). This compares with 149 patients in 2020. These patients were younger than the average ICU admission and had lower illness-severity scores. Nevertheless, 30% of them required invasive ventilation, 3% required advanced cardiovascular support, and 4% required dialysis. Three post-partum patients required veno-venous extracorporeal membrane oxygenation (ECMO) in 2021; all three survived to leave hospital.

Patient demographics and clinical features were similar in 2020 and 2021. Median LOS in ICU for pregnant and recently pregnant patients was relatively short, at 43 hours. One patient who was recently pregnant died in ICU; the cause of death was a complication related to pregnancy.

Sixty-one of these patients (31%) were pregnant at the time of admission to ICU, with gestations ranging from 4 to 37 weeks (Table 4.5). We do not have complete data on fetal outcome for these patients, but we are aware of at least one fetal death that occurred while the mother was being treated in ICU for COVID-19 disease.

Most of the 'recently pregnant' patients came to ICU immediately after delivery (Table 4.6). Over two-thirds had just had a caesarean section, and fetal outcomes in this group were good: all fetuses from the 'recently pregnant' group survived.

The numbers of obstetric admissions (pregnant or recently pregnant) increased by 31% compared to 2020 (Table 4.4). The number of patients who were pregnant at the time of ICU admission increased by 110%: from 29 patients in 2020 to 61 in 2021. Increased admissions of pregnant and recently pregnant patients to ICU were related to low vaccination rates and to the severity of COVID disease in pregnant women. ICU audit documented 73 admissions of pregnant or recently pregnant patients with COVID during 2021. Many of these were extremely ill, requiring prolonged ventilatory support. There was a greater requirement for organ support in 2021; respiratory support increased from 24% of obstetric patients to 30%, and dialysis rates went from 1% to 4%. All of the pregnant or recently pregnant patients with COVID-19 disease survived.

TABLE 4.4: PREGNANT OR RECENTLY PREGNANT PATIENTS ADMITTED TO ICU OR HDU IN 2021: DEMOGRAPHICS, ILLNESS SEVERITY, SUPPORT PROVIDED AND OUTCOME

	2020	2021
Total admissions, N	**149**	**196**
Mean age in years (standard deviation (SD))	33 (6)	32 (6)
Median age in years (IQR)	33 (30, 37)	33 (29, 37)
Age range in years	18-50	17-46
Mean body mass index (BMI) (SD)	27 (5.4)	29 (7)
Median BMI (IQR)	25 (23, 29)	28 (24, 32)
BMI range	18-41	14-58
Median APACHE II score (IQR)	8 (6, 11)	9 (7, 13)
Median ICNARC physiology score (IQR)	8 (6, 12)	10 (7, 15)
Mean predicted percentage mortality risk (SD)	3% (10%)	3% (7%)
Patients who received advanced respiratory support N (%)	36 (24%)	59 (30%)
Patients who received advanced cardiovascular support N (%)	2 (1%)	5 (3%)
Number of patients who received renal support (%)	2 (1%)	7 (4%)
Median Unit LOS in hours (IQR)	40 (20, 71)	43 (19, 113)
Number of patients discharged alive from ICU (%)	148 (99%)	195 (99%)

TABLE 4.5: ADMISSIONS OF CURRENTLY PREGNANT PATIENTS TO INTENSIVE CARE UNITS IN 2021

	2020	2021
Currently pregnant admissions, N (% of all obstetric admissions)	29 (19%)	61 (31%)
Gestation of pregnancy on ICU admission in weeks; mean (SD)	24 (10)	25 (9)
Gestation of pregnancy on ICU admission in weeks; range	5-38	4-37

TABLE 4.6: RECENTLY PREGNANT ADMISSIONS TO INTENSIVE CARE UNITS IN 2021

	2020	2021
Recently pregnant admissions, N	120	135
Gestation at delivery of recent pregnancy in weeks; mean (SD; range)	34 (9; 5–41)	35 (8, 3-41)
Median number of days from delivery to ICU admission (IQR)	0 (0–1)	0 (0,3)
Patients with molar pregnancy associated with recent pregnancy N (%)	1 (1%)	0
Recent pregnancy outcomes N (%)		
Vaginal delivery	26 (22%)	28 (21%)
Caesarean section	80 (67%)	94 (70%)
Ectopic pregnancy	6 (5%)	4 (3%)
Termination of pregnancy	7 (6%)	9 (7%)
Hysterectomy since delivery	16 (13%)	5 (4%)
Data missing	1 (1%)	0
Previous live births and/or stillbirths from previous pregnancies	**N (%)**	**N (%)**
0	52 (43%)	54 (40%)
1	30 (25%)	36 (27%)
≥2	32 (27%)	40 (30%)
Previous caesarean sections	**N (%)**	**N (%)**
0	91 (76%)	105 (78%)
1	9 (8%)	14 (10%)
≥2	13 (11%)	7 (5%)
Number of patients who used assisted conception N (%)	5 (4%)	6 (4%)
Live births from recent pregnancies	**N (%)**	**N (%)**
0	13 (11%)	19 (14)
1	99 (83%)	105 (78%)
≥2	7 (6%)	11 (8%)

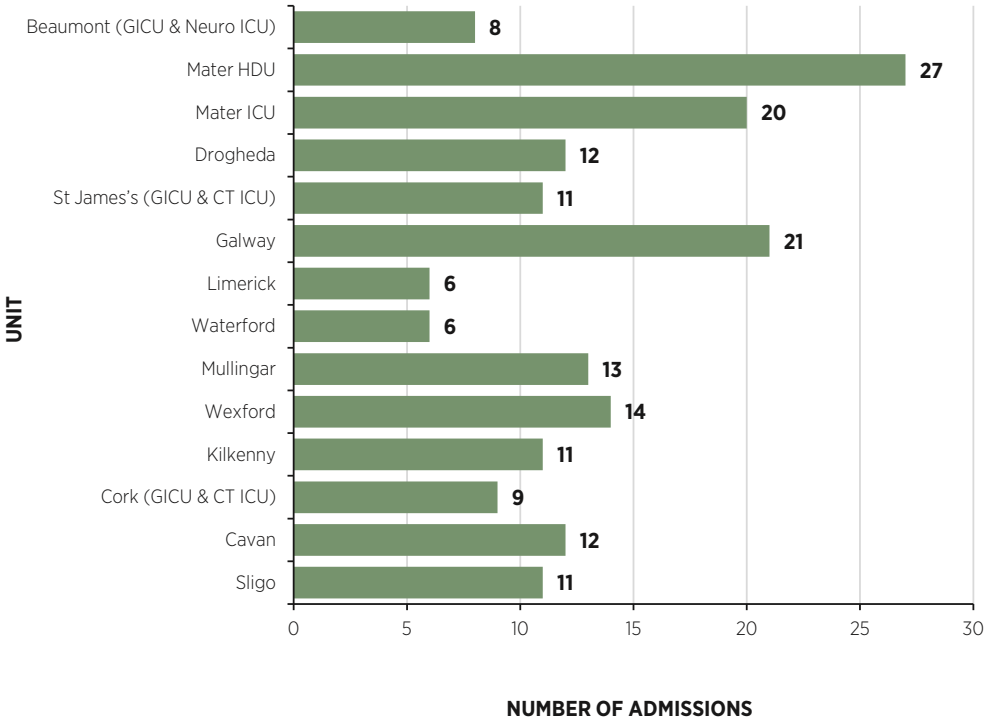


FIGURE 4.10: NUMBER OF PREGNANT OR RECENTLY PREGNANT PATIENTS ADMITTED TO CRITICAL CARE UNITS IN 2021

Units with five or fewer obstetric admissions have been excluded from Figure 4.10 (Tallaght University Hospital ICU **, Connolly Hospital ICU, Midland Regional Hospital Tullamore ICU, Naas General Hospital ICU, St Vincent's University Hospital ICU, Letterkenny University Hospital ICU, Tipperary University Hospital Clonmel ICU, University Hospital Kerry ICU *, and Mercy University Hospital Cork ICU).

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

KEY FINDINGS FROM CHAPTER 4

- INICUA captured activity in 22 adult public hospitals, which provided 96% of Level 3 ICU care in adult HSE-funded hospitals in 2021. The ICU audit documented 12,151 admissions of 11,420 patients to 26 Units in 22 hospitals. The mean length of stay was 6.6 days.
- The mean age of patients admitted to ICU was 61 years, and 60% of patients were male. Age, sex and case mix were similar in the ROI and the UK.
- The proportion of patients admitted directly to ICU after surgery decreased from 42% of ICU admissions in 2019 to 35% in 2021. This was due to a decrease in admissions after elective surgery from 29% of admissions to 22%. This may reflect the impact of COVID-19 on elective surgical activity in 2021, or it may indicate a greater need for ICU beds for sicker patients coming to ICU from non-theatre locations.
- The proportion of patients admitted after trauma was 7.6% in 2021, compared to 8.3% in 2019.
- Admissions after trauma were widely distributed across hospitals. The largest numbers of admissions after trauma were to the Mater ICU and HDU (170 admissions) and to Beaumont General and Neurosurgical ICUs (169 admissions).
- There were 284 admissions after traumatic brain injury, 130 of which were admissions to Beaumont Hospital.
- Fifty-two percent of admissions had AKI within 24 hours of admission, with 12% having severe AKI (KDIGO Stage 3).
- Thirty-seven percent of patients fulfilled the criteria for sepsis on admission. The proportion of these with dysfunction in four or more organ systems within the first 24 hours ranged from 0.1% (Mater HDU) to 7% (UH Limerick ICU).
- The proportion of admissions to general ICUs following in-hospital CPR ranged from 0.4% to 11% (in Naas Hospital).
- A small proportion of admissions had severe liver disease (2%), haematological malignancy (2.5%) or metastatic disease (3.2%). Patients in these groups had a high mortality rate; nevertheless 57%, 51% and 70%, respectively, of patients with these conditions survived to leave hospital.
- INICUA data for 2021 documented 1,671 patients admitted to ICU with a diagnosis of COVID. This represented 14.6% of all patients admitted to ICU in 2021. COVID-19 patients accounted for 28.7% of all ICU beds occupied in 2021 (ICU-BIS data).
- Six hundred and three COVID-19 patients died before discharge from acute hospital, giving a crude mortality rate of 36%. This compared to a 24% mortality rate for the overall ICU population.
- Fifty-three children aged under 16 years were admitted to adult ICUs in 2021, a significant decrease from 2019 (111 admissions). University Hospital Galway ICU admitted 30 children, but their mean LOS was very short (16 hours). Mean LOS for all children in adult ICUs was also short (24 hours). Survival to discharge from acute hospital was 90%.
- One hundred and ninety-six patients who were pregnant or recently pregnant were admitted to ICU; these patients represented 1.6% of all admissions to ICU in 2021. This was a 31% increase in numbers compared to 2020. Sixty-one of these patients were pregnant at the time of ICU admission, an increase of 110% compared to 2020. This increase was due to the admission of 73 patients with COVID-19 disease.
- ICU mortality was low in pregnant or recently pregnant patients, with only one maternal death while in ICU; this death was due to complications related to pregnancy. All of the pregnant or recently pregnant patients admitted with COVID-19 disease survived.

CHAPTER 5

SEVERITY OF ILLNESS AND PROVISION OF ORGAN SUPPORT IN ICU

CONTENTS >

CHAPTER 5: SEVERITY OF ILLNESS AND PROVISION OF ORGAN SUPPORT IN ICU

ILLNESS SEVERITY SCORES ON ADMISSION TO ICU

ICU patients vary widely in the severity of their illness, and data from two separate scoring systems are presented in this Report: (i) APACHE II scores and (ii) the risk of mortality as predicted by the ICNARC$_{H\text{-}2018}$ model.

The APACHE II scoring system is the most widely used measure of illness severity in critically ill patients. APACHE II scores are based on patient age, pre-existing health conditions and acute physiological derangement during the first 24 hours after ICU admission.

Mean APACHE II scores ranged from 13 to 20 across different Units, reflecting differences in case mix between Units (Figure 5.1). The mean APACHE II score for all admissions in participating Units in the ROI was 16 (versus 14 in the UK). Values for 2020 were 16 and 15 respectively.

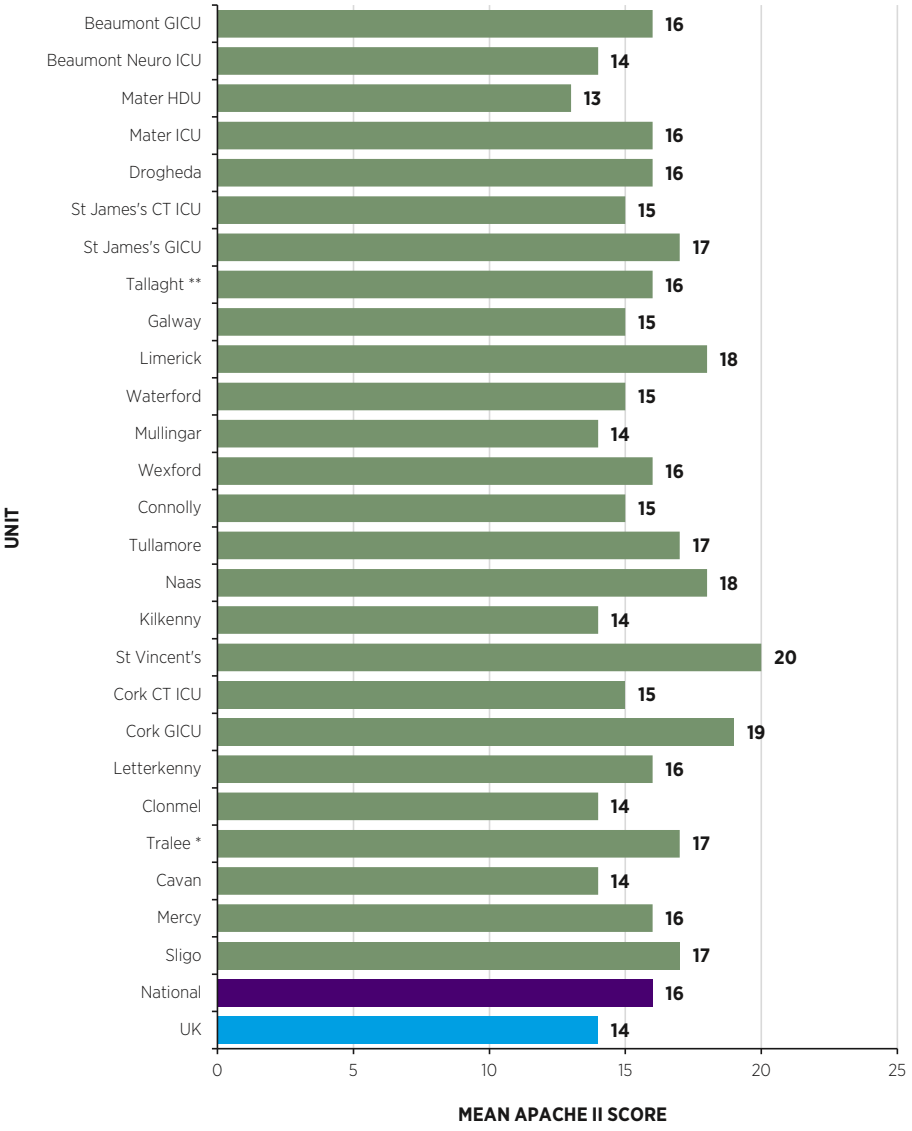


FIGURE 5.1: MEAN APACHE II SCORES FOR EACH UNIT

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

PREDICTED RISK OF DEATH ON ADMISSION TO ICU

The calculation of the predicted mortality risk for each patient is based on illness severity assessed by the ICNARC$_{H\text{-}2018}$ model. This predictive model has been validated by ICNARC as a reliable predictor of mortality for general ICU patients.

The ICNARC$_{H\text{-}2018}$ model is based on multiple variables, including age, pre-existing medical conditions, dependency before admission, CPR before admission, admission diagnosis, source of admission, physiological parameters, and requirement for ventilation in the first 24 hours after admission. Interactions between physiological parameters and other physiology, medical history, interventions and admission diagnosis, along with interactions between age and medical history, are also taken into account.

Predicted mortality shows 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 ICU (26.1%).

The median predicted mortality rate was 8.7% for patients in the ROI versus 6.3% for patients in the UK. The figures for 2020 were 7.3% and 6.2%, respectively.

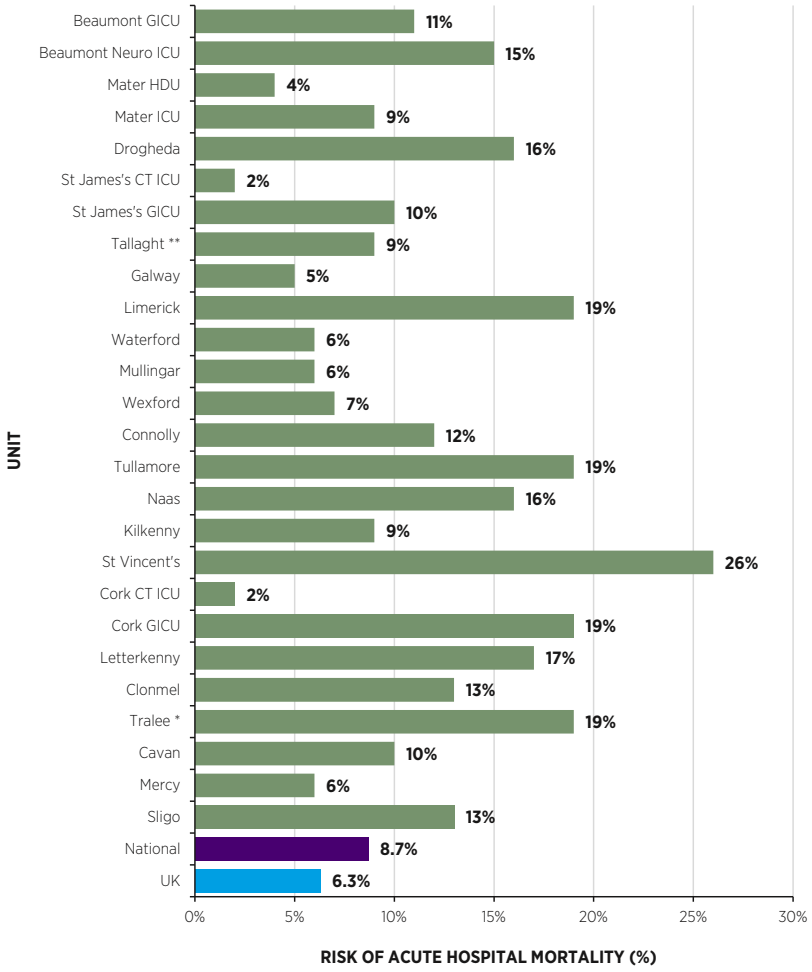


FIGURE 5.2: MEDIAN PREDICTED RISK OF ACUTE HOSPITAL MORTALITY (ICNARC$_{H\text{-}2018}$ MODEL)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

ADVANCED RESPIRATORY SUPPORT (ARS) AFTER ADMISSION TO ICU

Advanced respiratory support (ARS) is defined as mechanical ventilation via an invasive airway (endotracheal tube or tracheostomy). Patients receiving ARS cannot be safely managed outside ICU (with the exception of patients who are ventilated long-term via a tracheostomy, who may be managed in a HDU or even on the ward). Data on the provision of ARS are useful therefore for comparisons of illness severity between Units and as an indicator of the requirements for ICU bed capacity in different Units.

There was wide variability in the percentage of patients receiving ARS in individual Units (Figure 5.3), which included a pure HDU, mixed ICUs/HDUs and a specialist cardiothoracic ICU. Fifty-three percent of patients in the ROI received ARS (versus 47% in the UK). The figures for 2020 were 50% and 46%, respectively.

The duration of organ support provided indicates the severity of illness treated in each Unit and the resources required to provide care. The numbers of days with organ support provided are calculated by counting each day or part of a day as a day of organ support. For example, 36 hours receiving ARS counts as 2 days of ARS.

The percentage of patient days when ARS was provided followed a similar pattern to the percentage of patients who received ARS (Figure 5.4). ARS was provided on 53% of patient days in Units in the ROI versus 50% in UK Units. The respective figures for 2020 were 49% and 48%.

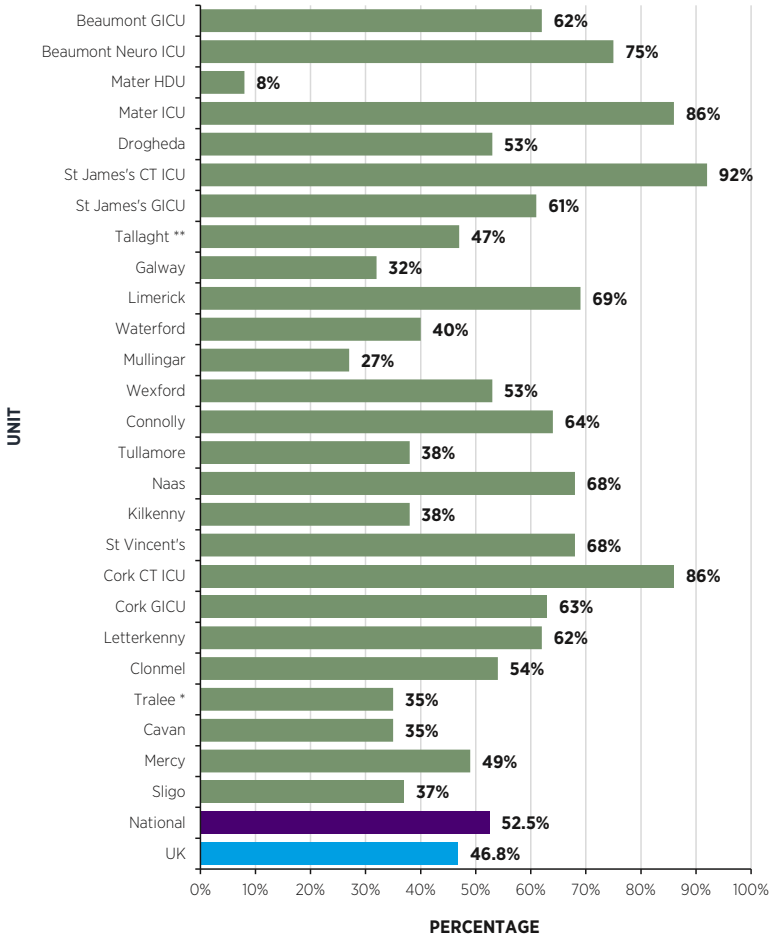


FIGURE 5.3: PATIENTS WHO UNDERWENT INVASIVE VENTILATION (ADVANCED RESPIRATORY SUPPORT-ARS) AS A PERCENTAGE OF ALL UNIT ADMISSIONS

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

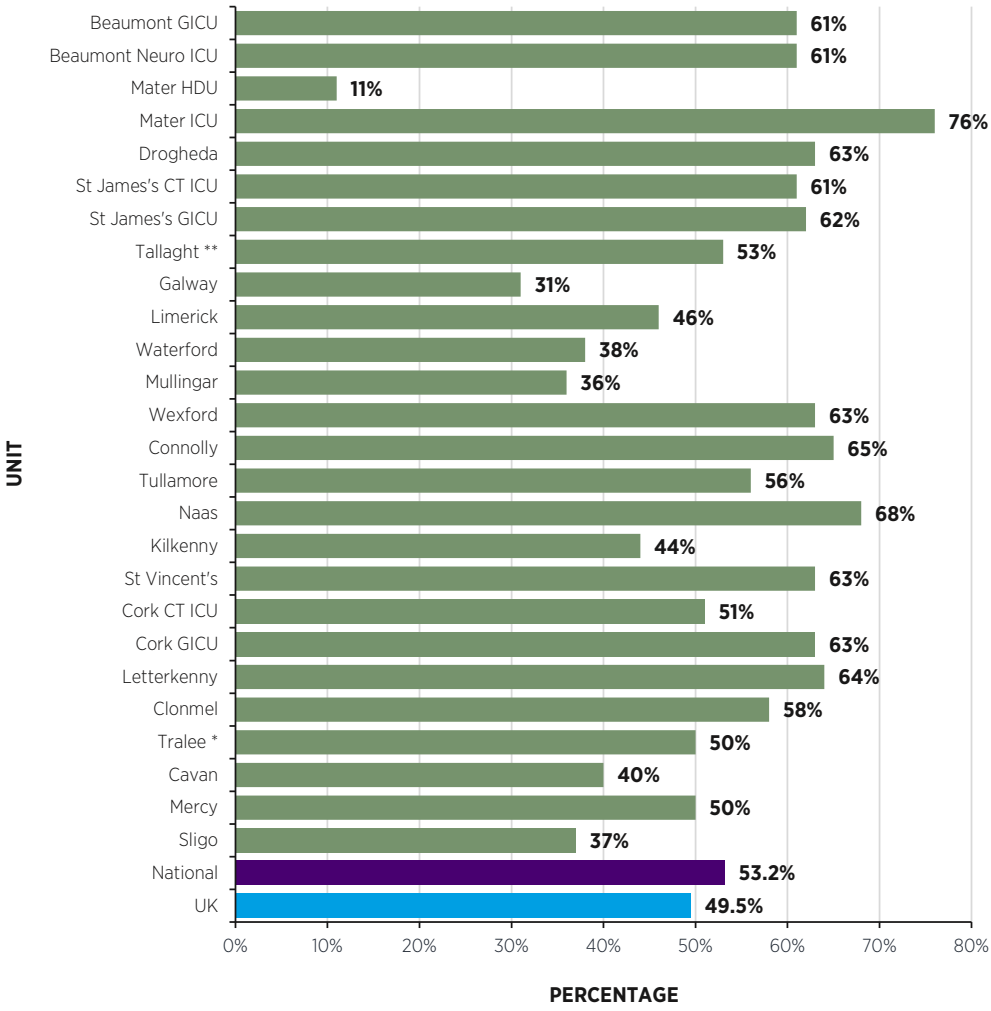


FIGURE 5.4: PATIENT DAYS WITH INVASIVE VENTILATION (ADVANCED RESPIRATORY SUPPORT-ARS) PROVIDED AS A PERCENTAGE OF ALL PATIENT DAYS IN UNIT

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

PATIENTS RECEIVING LEVEL 3 CARE

Advanced respiratory support is not the only determinant of a requirement for ICU care, and many patients need to be in ICU without requiring ARS, e.g. patients who require vasopressors, dialysis or invasive monitoring (inter-arterial, intracranial); or high-risk patients who require close observation. A standard way of defining the type of patients being cared for in a Unit is to classify them according to the level of support they require, ranging from Level 0 (no support) to Level 3 (a high level of support that requires one-to-one nursing care).

The European Society of Intensive Care Medicine (ESICM) defines those requiring ICU (Level 3) care as patients with "multiple (two or more) acute vital organ failure of an immediate life-threatening character" (*Valentin et al., 2011*). The Guidelines of the Joint Faculty of Intensive Care Medicine of Ireland and the Intensive Care Society of Ireland (2019) recommend that Units providing Level 3 care should treat a minimum of 200 patients per annum who require Level 3 care in order to maintain an appropriate level of skills and expertise. Units with low numbers of patients requiring ARS may not be reaching these numbers.

Figure 5.5 shows the numbers of patients admitted to each Unit who received Level 3 care at any stage during their ICU admission. Level 3 care is defined by ICNARC as organ support for two or more organ systems, excluding gastrointestinal support. Patients receiving basic respiratory and basic cardiovascular support only are classified as Level 2.

In 2021, 13 Units admitted more than 200 Level 3 patients (assuming Tallaght achieved this figure over the entire 12-month period), and 13 admitted fewer than 200 Level 3 patients.

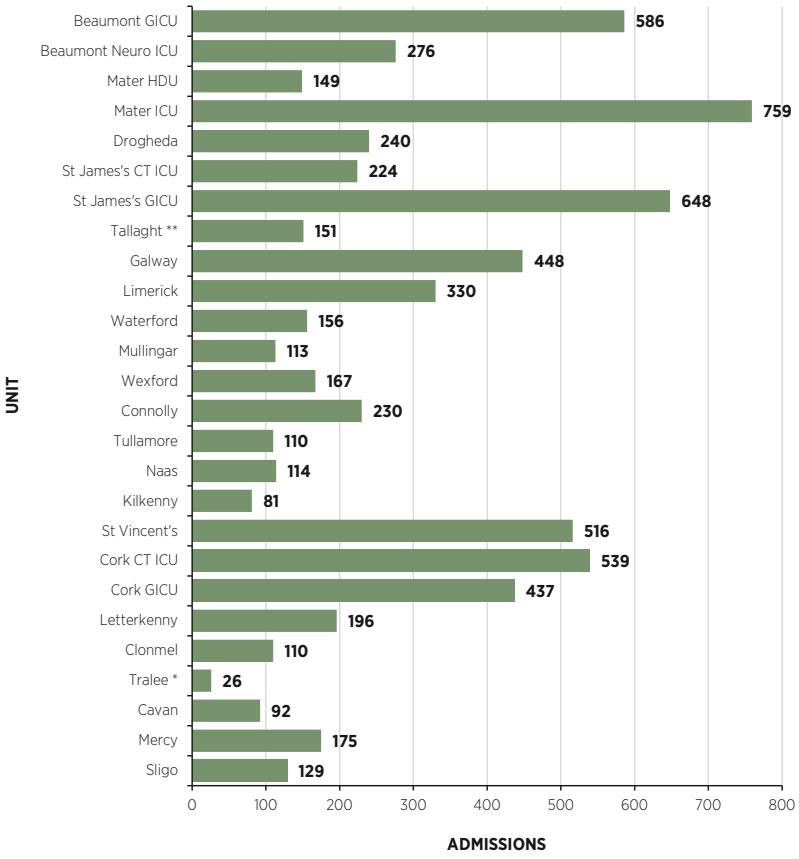


FIGURE 5.5: NUMBERS OF PATIENTS ADMITTED TO EACH UNIT WHO RECEIVED LEVEL 3 CARE DURING INTENSIVE CARE UNIT ADMISSION

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

ADVANCED CARDIOVASCULAR SUPPORT AFTER ADMISSION TO ICU

Advanced cardiovascular support means complex care for the cardiovascular system (CVS), e.g. care involving a vasopressor plus another intravenous infusion acting on the CVS; 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, the provision of advanced CVS support 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 5.6). The proportion of bed days with advanced CVS support provided was also greatest in Units that admit a high proportion of patients postoperatively after cardiac surgery (Figure 5.7). Data for numbers of patients and numbers of total bed days receiving ACS in 2021 were similar to 2020.

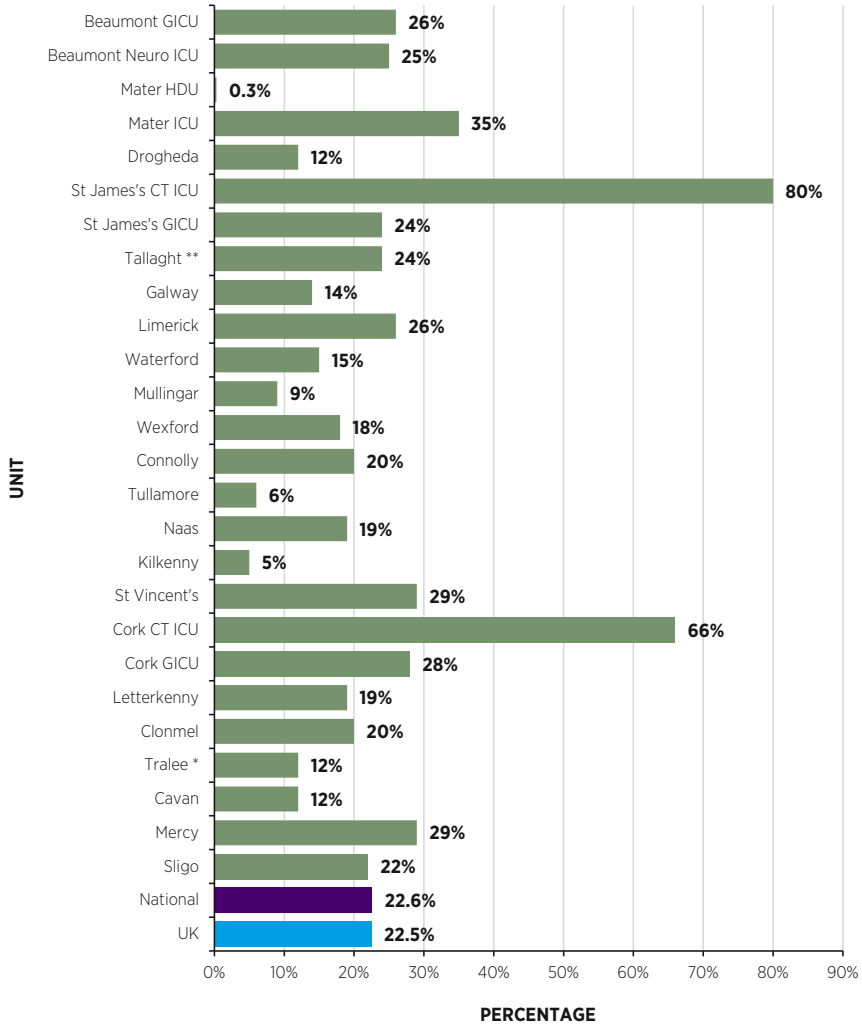


FIGURE 5.6: PATIENTS WHO RECEIVED ADVANCED CARDIOVASCULAR SUPPORT (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

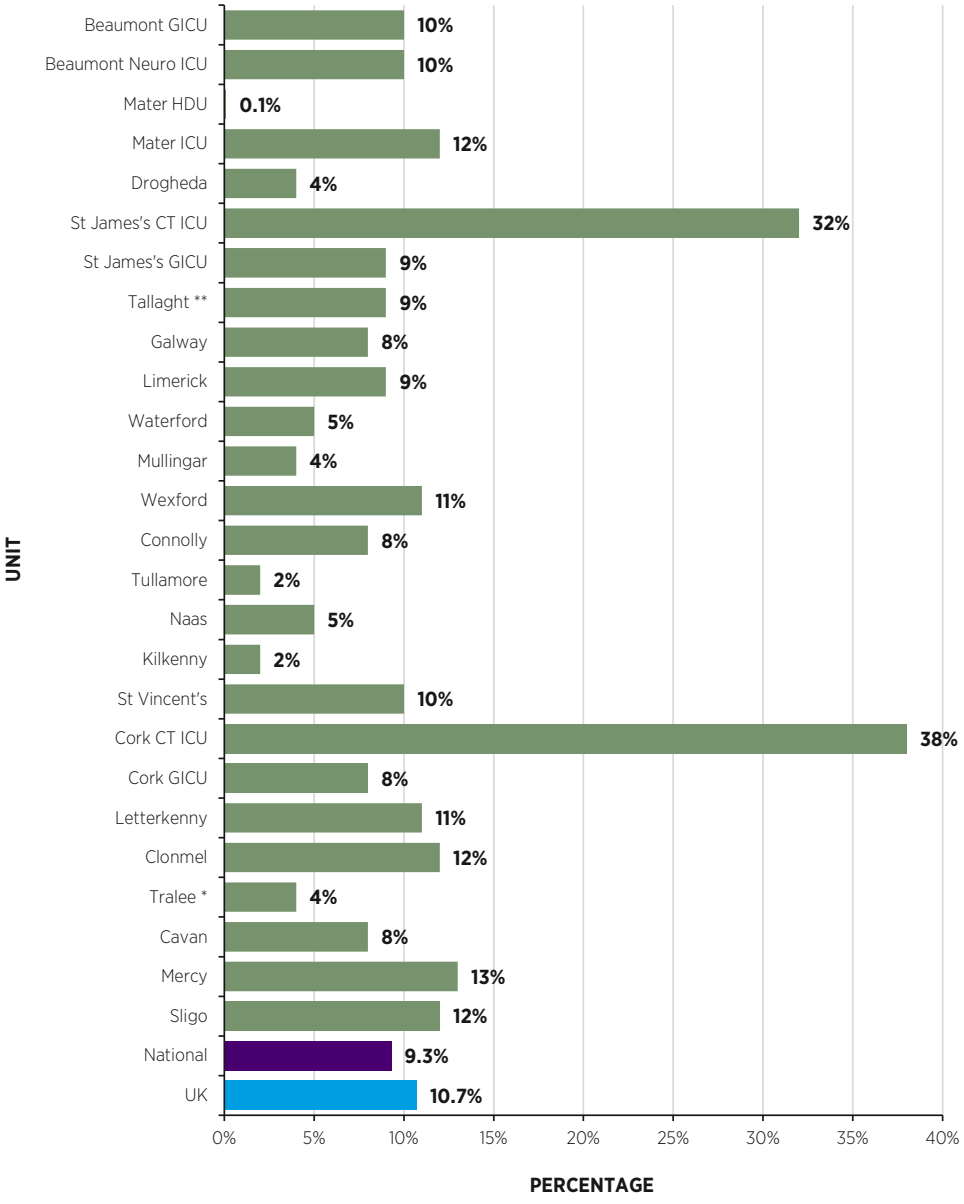


FIGURE 5.7: BED DAYS WITH ADVANCED CARDIOVASCULAR SUPPORT PROVIDED (AS A PERCENTAGE OF ALL PATIENT DAYS IN THE UNIT)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

RENAL SUPPORT AFTER ADMISSION TO ICU

Renal support (i.e., dialysis) in ICU may be required for acute kidney injury (which is common in acutely ill patients) or for patients on long-term dialysis who require ICU care. Dialysis may be provided by continuous renal replacement therapy (CRRT) or by intermittent haemodialysis (HD). Most dialysis in ICU is provided as CRRT. The data in Figures 5.8 and 5.9 do not distinguish between CRRT and HD.

There was considerable variability between Units in the percentage of patients requiring renal support and the percentage of total patient days when renal support was provided (Figures 5.8 and 5.9). Three smaller Units did not provide dialysis, and patients who required this had to be transferred to a larger Unit. Overall, 11.5% of patients received renal support, which is similar to the percentage for 2020.

Patients who require dialysis in ICU tend to be very ill with multi-organ failure. These patients are commonly ventilated, on vasopressors, and receiving enteral or parenteral feeding; and commonly have an impaired level of consciousness. Care of these patients is complex, requiring skilled nursing care. If Units have a high proportion of patient days providing renal support, this puts further pressure on finite skilled nursing resources.

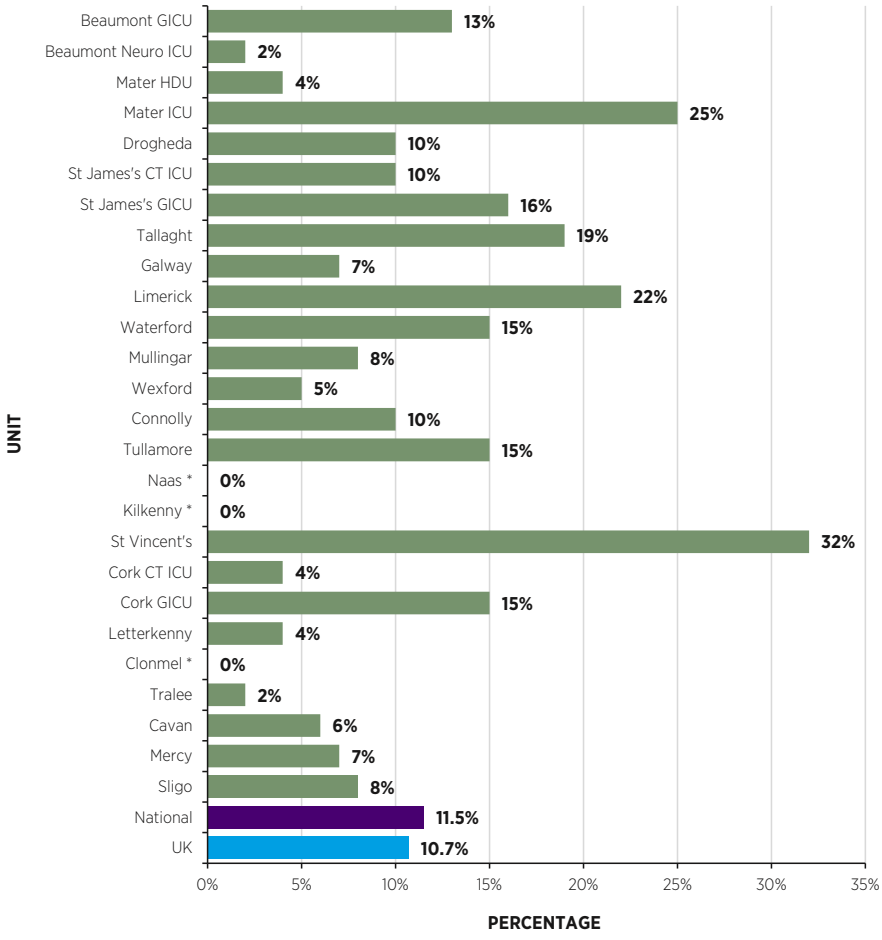


FIGURE 5.8: PATIENTS WHO UNDERWENT DIALYSIS (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Dialysis not provided in 2021.

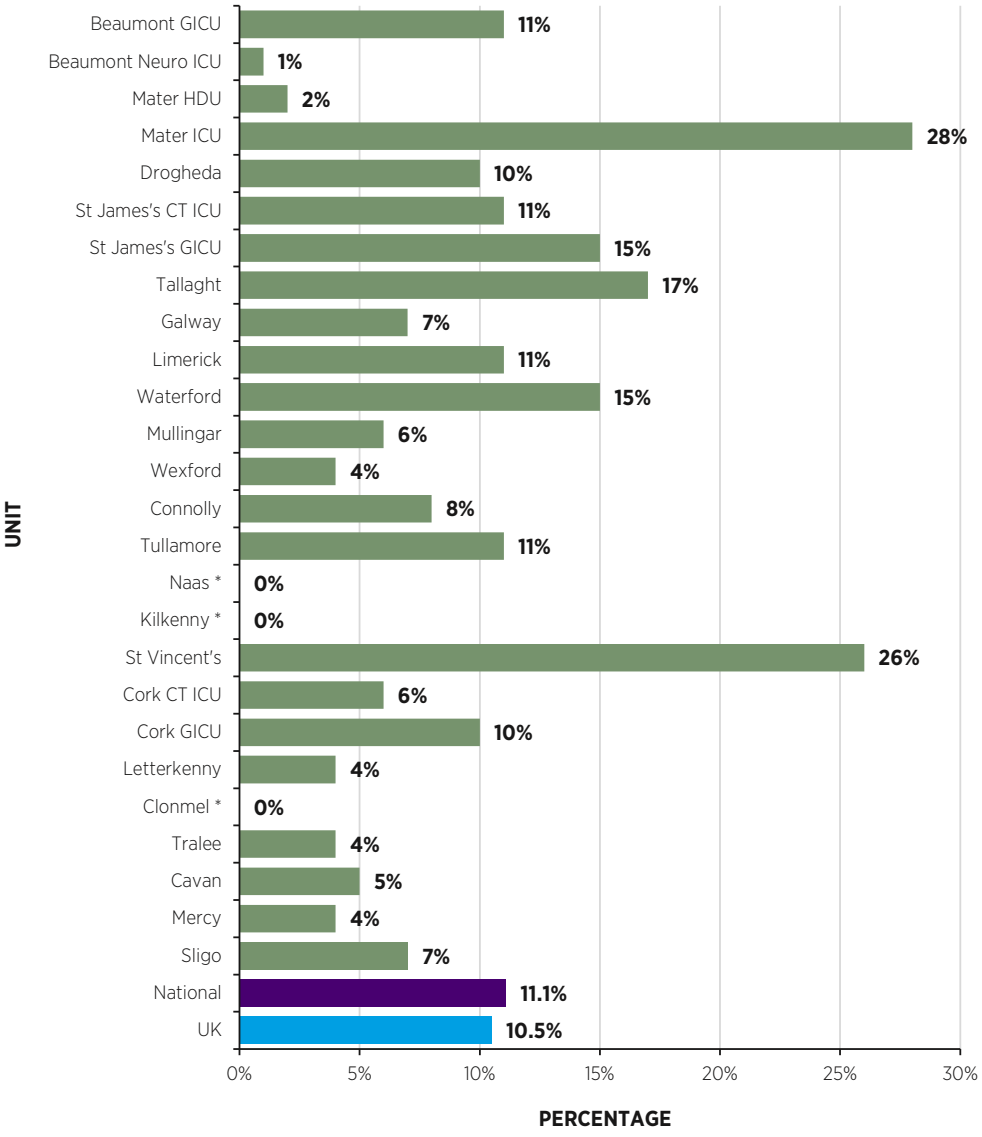


FIGURE 5.9: PATIENT DAYS WHILE UNDERGOING DIALYSIS (AS A PERCENTAGE OF TOTAL UNIT PATIENT DAYS)

* Dialysis not provided in 2021.

Figures 5.8 and 5.9 show marked variability in the proportion of patients undergoing dialysis and in days on dialysis as a proportion of total patient days. This variability is partly (but not fully) explained by differences in rates of acute kidney injury (Figure 4.4) and in the illness severity of patients on admission (Figures 5.1 and 5.2).

Patients receiving ARS (invasive ventilation) are a well-defined core group of seriously ill patients in ICU with a high rate of multi-organ failure. An interesting way of comparing rates of dialysis between Units is to compare days receiving dialysis as a proportion of days receiving ARS (invasive ventilation) (Figure 5.10). This is partly due to differences in case mix, but the data show such wide variability as to suggest interesting differences in clinical practice between hospitals.

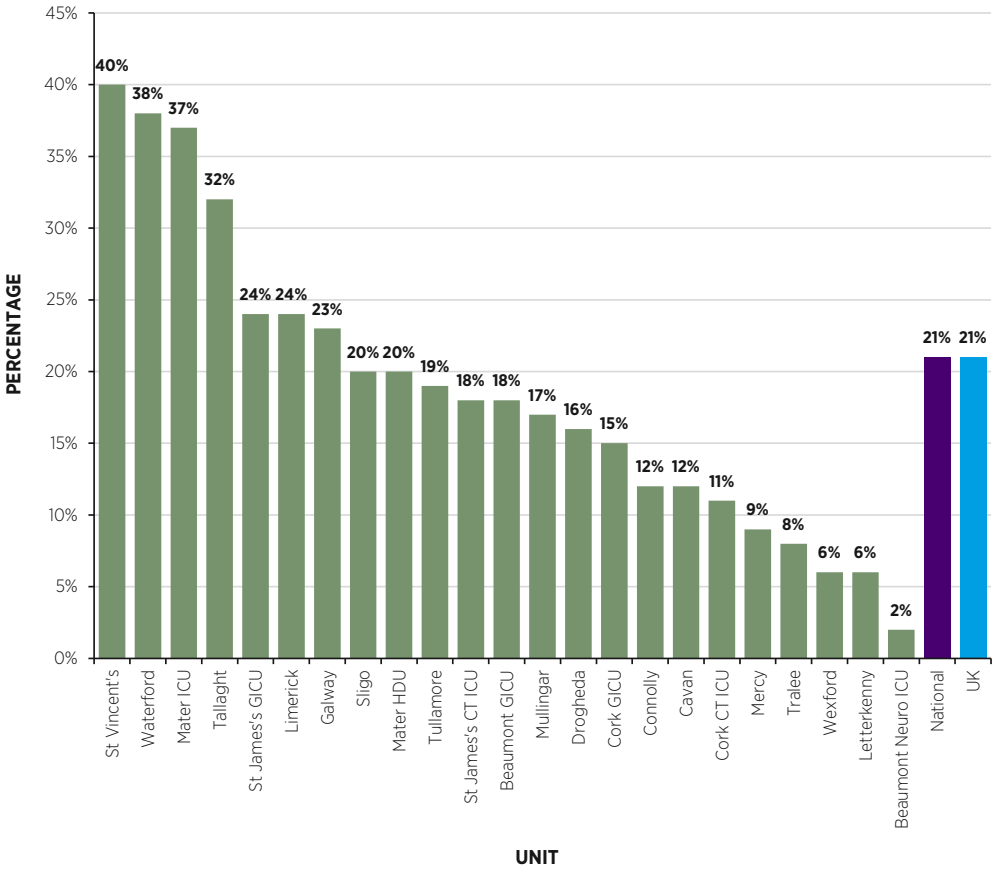


FIGURE 5.10: BED DAYS UNDERGOING DIALYSIS AS A PERCENTAGE OF BED DAYS UNDERGOING ADVANCED RESPIRATORY SUPPORT

Units which did not provide dialysis in 2021 have been excluded from Figure 5.10 (Naas, Kilkenny and Clonmel).

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 if patients are unable to eat due to coma or 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 — after surgery, for example. If the duration without nutrition is prolonged, it is good practice to initiate artificial nutrition support.

Figure 5.11 shows the proportion of patients who received enteral or parenteral nutrition at some point during their ICU stay in 2021. 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 — after cardiothoracic surgery, for example.

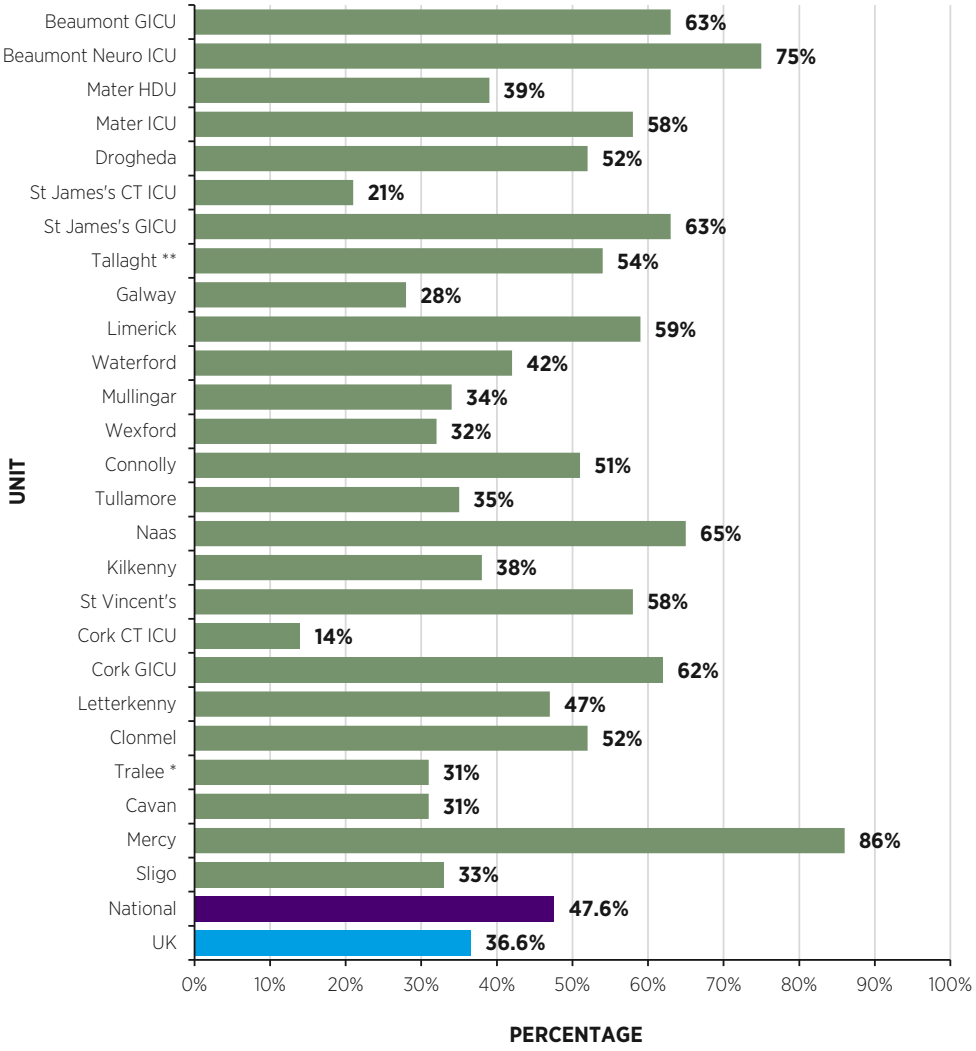


FIGURE 5.11: PATIENTS WHO RECEIVED ENTERAL OR PARENTERAL NUTRITION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

KEY FINDINGS FROM CHAPTER 5

- The mean APACHE II score for all patients admitted to ICU in 2021 was 16 in the ROI versus 14 in the UK. Mean APACHE II scores for individual Units ranged from 13 to 20.
- The median predicted risk of acute hospital mortality rate was 8.7% for all patients in the ROI versus 6.3% for patients in the UK.
- Thirteen of the 26 participating Units admitted more than 200 patients requiring multi-organ support (Level 3 patients), and 13 Units had fewer than 200 Level 3 admissions.
- Fifty-three percent of patients required invasive ventilation in the ROI compared with 47% in the UK. Requirements for complex cardiovascular support and for dialysis were similar in the ROI and in the UK.
- Three of the 26 participating Units did not provide dialysis in 2021. Any patients admitted to these Units who required dialysis had to be transferred to a different Unit.
- There was considerable variability between Units in the number of days receiving dialysis as a percentage of days in the Unit. This variability was not fully explained by variations in case mix, particularly when dialysis days were expressed as a proportion of days on invasive ventilation. It is likely that this reflects variability in clinical practice between Units.
- These data provide insights into variations between Units in the complexity of illness treated and into the various Units' requirements for resources.

CHAPTER 6

ICU BED AVAILABILITY AND UTILISATION

CONTENTS >

CHAPTER 6: **ICU BED AVAILABILITY AND UTILISATION**

The ICU Bed Information System (ICU-BIS) was set up by NOCA in March 2020 at the start of the COVID-19 pandemic. NOCA contacts all ICUs directly each morning for data on the numbers of ICU beds open and on the numbers of patients occupying ICU beds. The ICU-BIS website then provides real-time information on bed occupancy and bed availability in all ICUs, including paediatric and private hospitals. Bed occupancy is defined as the proportion of staffed beds which are occupied by a patient at the time of collecting the ICU-BIS data each morning.

The data collected for ICU-BIS can be used to provide reports on bed availability and bed utilisation over any time period required. Data on the average numbers of ICU beds open and the % bed occupancy for all INICUA Units during 2021 are shown in Table 6.1. Average ICU bed occupancy across these INICUA Units was 89%.

Recommendations on the appropriate bed occupancy rate range from 75% to 85% (respectively the European Society of Intensive Care Medicine (Valentin et al, 2011) and the Joint Faculty of Intensive Care Medicine in Ireland (National Standards for Adult Critical Care Services 2019)). Occupancy rates that are lower lead to wasted resources, while higher occupancy rates lead to deterioration in the quality of care.

TABLE 6.1: ICU BED OCCUPANCY RATES IN INDIVIDUAL INICUA UNITS DURING 2021
(Source: ICU Bed Information System)

UNIT	Open bed days	Occupied bed days	Occupancy rate
Beaumont Hospital General ICU	6861	6190	90.2%
Beaumont Hospital (Richmond) Neurosurgical ICU	3241	3176	98.0%
Mater Misericordiae University Hospital HDU	5836	5671	97.2%
Mater Misericordiae University Hospital ICU	5912	5755	97.3%
Our Lady of Lourdes Hospital Drogheda ICU	3776	3176	84.1%
St James's Hospital Cardiothoracic ICU	2857	2145	75.1%
St James's Hospital General ICU	9588	8415	87.8%
Tallaght University Hospital ICU	5148	4585	89.1%
University Hospital Galway ICU & CTICU	8108	6920	85.3%
University Hospital Limerick ICU	4325	3632	84.0%
University Hospital Waterford ICU	2138	1680	78.6%
Regional Hospital Mullingar ICU	2593	2221	85.7%
Wexford General Hospital ICU	2164	1871	86.5%
Connolly Hospital ICU	2391	2117	88.5%
Midland Regional Hospital Tullamore ICU	2216	1990	89.8%
Naas General Hospital ICU	1310	1130	86.3%
St Luke's General Hospital Carlow/Kilkenny ICU	1742	1517	87.1%
St Vincent's University Hospital ICU	6603	6458	97.8%
Cork University Hospital Cardiothoracic ICU	2080	1986	95.5%
Cork University Hospital General ICU	6028	5586	92.7%
Letterkenny University Hospital ICU	1956	1575	80.5%
Tipperary University Hospital Clonmel ICU	1835	1549	84.4%
University Hospital Kerry ICU	1994	1687	84.6%
Cavan General Hospital ICU	1471	1128	76.7%
Mercy University Hospital Cork ICU	2141	1996	93.2%
Sligo University Hospital ICU	1808	1381	76.4%
Total	**96,122**	**85,537**	**89.0%**

The data in Table 6.1 refer only to patients admitted to the 26 Units participating in NOCA ICU Audit. The ICU-BIS also collected data on patients admitted to 4 other hospitals (Mayo University Hospital, Midland Regional Hospital Portlaoise, Portiuncula University Hospital, and Our Lady's Hospital Navan) and to additional Units in Limerick, Tallaght and Waterford which were not participating in National ICU Audit in 2021. Data on bed occupancy in these Units is provided in Appendix 1, TABLE 6.1 (Extended).

Figure 6.1 below includes data from these additional Units to show comprehensive data on bed availability and on national bed occupancy with COVID and non-COVID patients in all adult public hospitals during 2021. These data demonstrate the variations in numbers of patients with and without the COVID-19 disease during 2021, and the variations in numbers of ICU beds open and ICU beds occupied throughout the year (Figure 6.1).

Including data from these additional ICUs and HDUs, the ICU-BIS documented 97,754 bed days occupied across all 26 adult HSE hospitals nationally. Of these, 28,054 bed days (28%) were occupied by patients with COVID-19. The total number of bed days available during 2021 was 110,450. Using this 'point prevalence' method, the bed occupancy rate for all critical care beds (ICUs and HDUs) during 2021 was 88.5%, which is almost identical to the occupancy rate for the 26 Units audited by INICUA (89.0%, Table 6.1).

Ireland had an average of 303 ICU/HDU beds open daily in adult publicly funded (HSE) hospitals in 2021 (ICU-BIS data). This corresponded to 6.0 critical care beds per 100,000 people[6], in comparison to the average value of 14.1 critical care beds per 100,000 people for the 33 countries of the Organisation for Economic Co-operation and Development (*OECD, 2021*).[7]

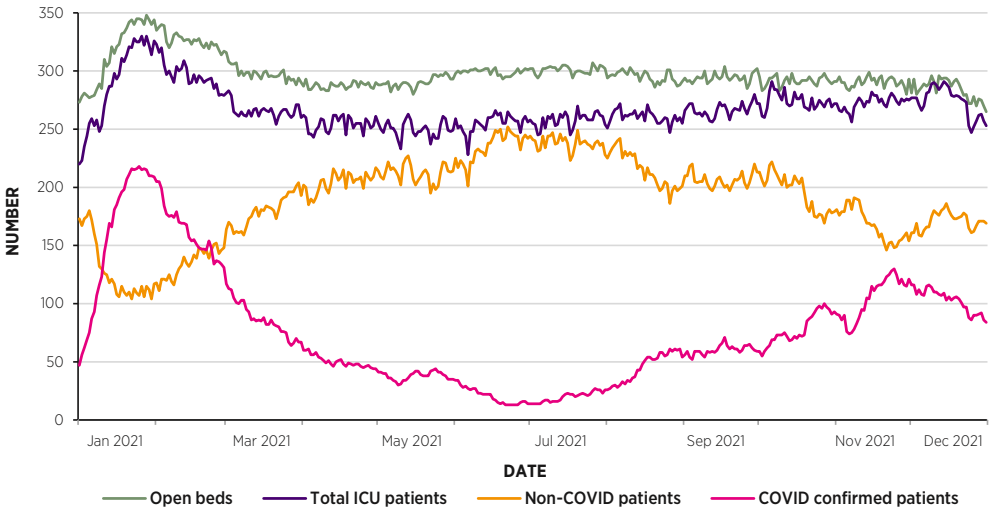
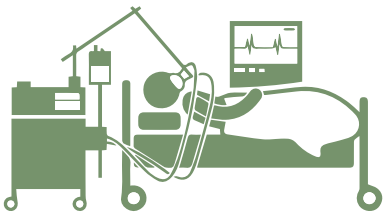


FIGURE 6.1: INTENSIVE CARE UNIT BED OCCUPANCY 2021; BEDS OPEN, BEDS OCCUPIED AND NUMBERS OF PATIENTS WITH AND WITHOUT COVID-19 (Source: ICU Bed Information System)

Note: Data are from all ICUs and HDUs in all 26 Adult HSE-funded public hospitals.

[6] 2021 population estimate for Ireland 5,033,000 from Eurostat, Demographic balance, 2021.
[7] Of note, the most recent data for ICU beds open (January-April 2023, ICU-BIS) showed an average 299 ICU/HDU beds open daily, equivalent to 5.9 beds/100,000 population.

BED UTILISATION



Irish National ICU Audit (INICUA) collected data for 22 of the 26 HSE-funded hospitals, with gaps in data for 2 of the 22 hospitals as noted. (Figure 6.2).

The number of bed days occupied while undergoing invasive ventilation (advanced respiratory support, or ARS) provides an insight into the complexity of care provided in each Unit, as patients requiring ARS are the core patient population in ICU who could not be cared for in any other ward (Figure 6.2). The percentage of total bed days with ARS provided is shown above, in Figure 5.4.

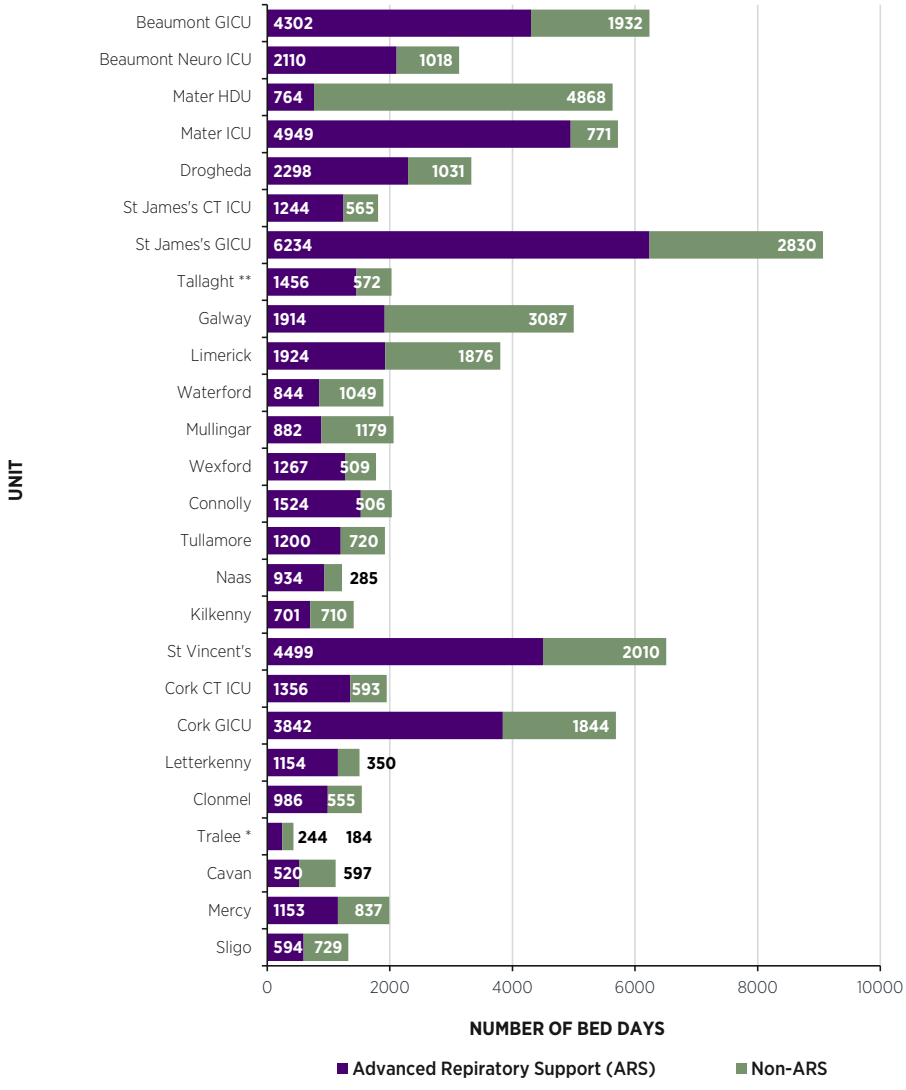


FIGURE 6.2: NUMBERS OF BED DAYS OCCUPIED IN 2021, WITH AND WITHOUT INVASIVE VENTILATION (Advanced Respiratory Support-ARS) (Source: INICUA)

Note: Total bed days in this figure are slightly different to the totals in table 6.1. This is because INICUA counts each day or part of a day a patient is in a bed as a bed day occupied, while ICU-BIS bed occupancy is based on beds occupied at a single time point each morning.

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

LENGTH OF STAY IN ICU (INICUA DATA)

LOS for patients admitted to ICU varied between Units (Figure 6.3). Individual factors in each Unit contributed to this, including case mix, whether hospitals had a step-down (HDU) facility to accept recovering patients, and the availability of ward beds to accept ICU discharges. LOS tended to be longer in Units with greater illness severity scores (Figures 5.1, 5.2), and shorter in Units classified as mixed ICU/HDU and in Units caring for patients after cardiothoracic surgery (Table 4.1). LOS may also be influenced by demand for beds; if beds are not required for new admissions, patients can stay longer in the Unit.

The median LOS was less than the mean LOS (3.0 versus 6.6 days) in both the ROI and the UK (3 versus 6 days (ICNARC rounds UK values to the nearest whole number)). This is because LOS is not normally distributed in ICU, and the mean LOS was increased by a small number of patients who stay for a long time. Mean LOS was greater than the median LOS for all Units.

INICUA uses a very precise method to calculate LOS by counting the exact proportion of each day a patient occupies a bed in the Unit to calculate total LOS. This method gives a lower estimation of the LOS compared to other methods (e.g. documenting the number of patients in the Unit at a single time point each day, or counting each day or part of a day a bed is occupied as a full day for the purposes of bed occupancy).

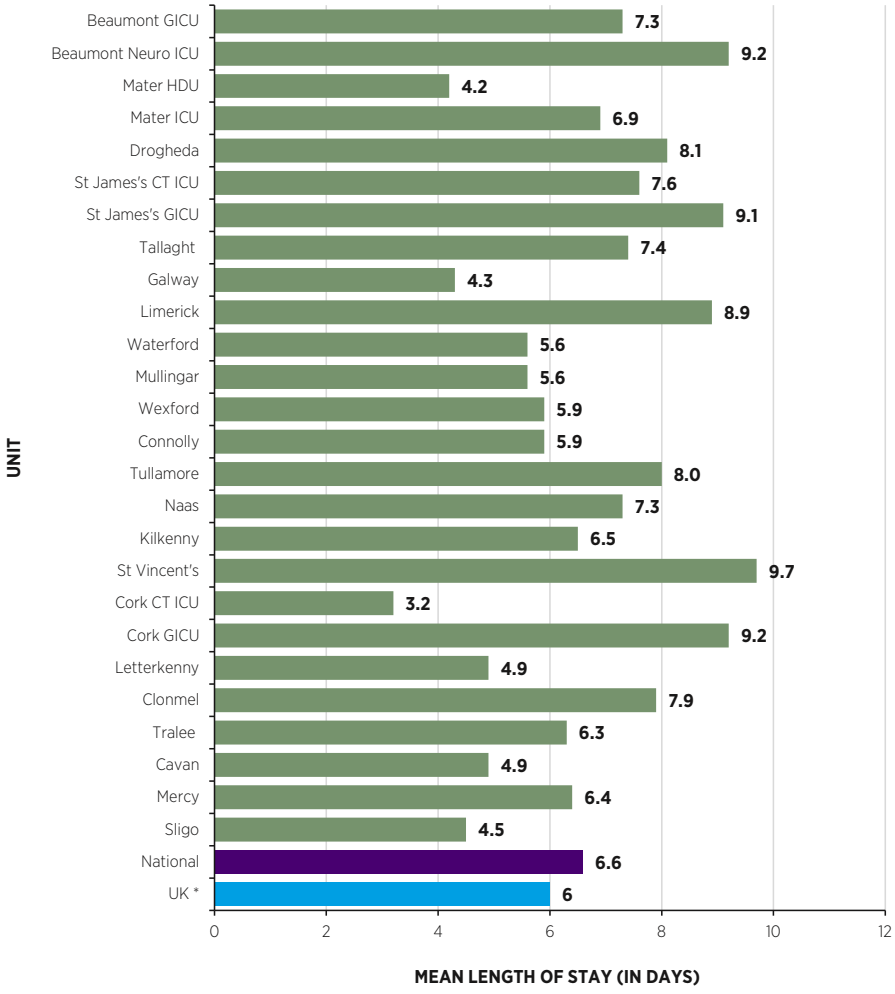


FIGURE 6.3: MEAN LENGTH OF STAY IN THE UNIT (DAYS) FOR ALL ADMISSIONS[8]

* National average for UK Units is rounded to the nearest day.

[8] Median length of stay in the Unit for all admissions is presented in the table for Figure 6.3, Appendix 1.

LOS: UNIT SURVIVORS VERSUS NON-SURVIVORS (INICUA DATA)

Comparing the LOS for ICU survivors with that for non-survivors provides useful insights into activity in each Unit, although local insights are needed to fully explain variability between Units.

Survivors in some Units had a longer mean LOS than non-survivors, while in other Units the opposite was seen (Figure 6.4). It is possible that this finding is random, or 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.

Mean LOS for ICU survivors across the ROI was 6.3 days, compared with 8.3 days for non-survivors. Mean LOS in the UK was 6 days for ICU survivors and 8 days for non-survivors (ICNARC rounds UK values to the nearest whole number).

At 24.9 days, mean LOS in non-survivors was considerably longer in St James's Hospital Cardiothoracic ICU compared with other Units; median LOS for non-survivors in this Unit was 9.6 days, indicating that the mean LOS was influenced by a relatively small number of patients who had a prolonged illness before they died.

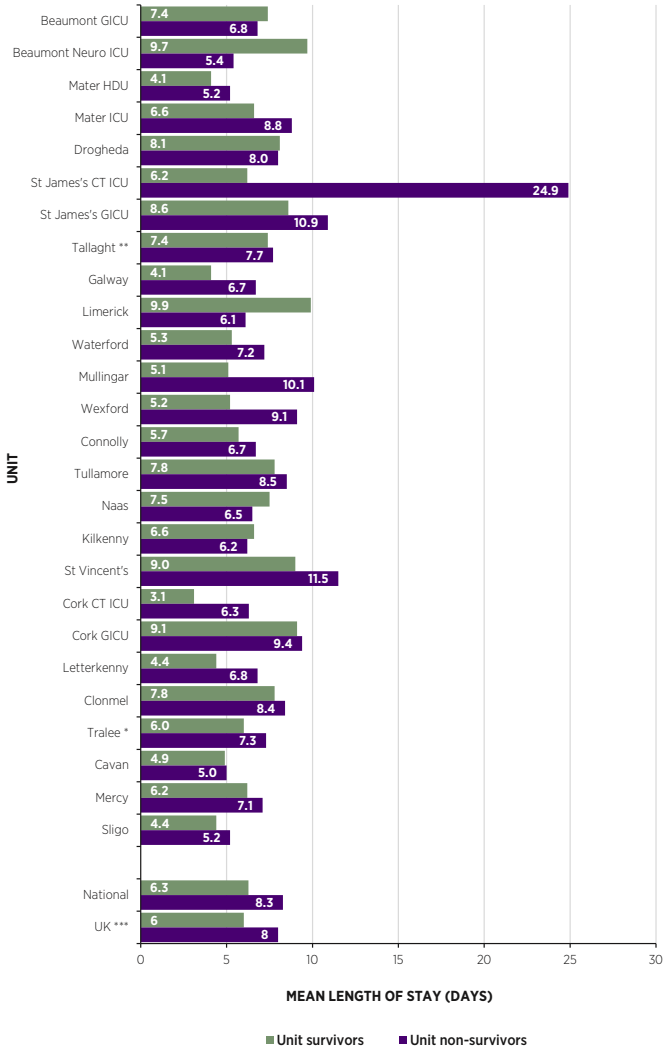


FIGURE 6.4: MEAN UNIT LENGTH OF STAY FOR UNIT SURVIVORS VERSUS NON-SURVIVORS (DAYS)[9]

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.
*** Averages for UK Units are rounded to the nearest day.
[9] Median length of stay for Unit survivors and Unit non-survivors is presented in the table for Figure 6.4, Appendix 1.

BED OCCUPANCY: COVID-19 PATIENTS (ICU-BIS DATA)

The ICU-BIS recorded 1,766 COVID-19 patients who were admitted to ICU in all Units in all 26 adult public hospitals during 2021.

These 1,766 COVID-19 patients occupied 28,054 bed days, giving a mean LOS of 15.9 days, which was considerably longer than the mean LOS for all ICU patients documented by INICUA as 6.6 days.

As noted above, a single count of bed occupancy once a day will slightly overestimate bed occupancy compared to the INICUA method of calculating bed occupancy very precisely by measuring the numbers of hours the bed was occupied. Nevertheless, the magnitude of the difference between LOS for COVID-19 patients (ICU-BIS data) and for the overall population of ICU patients highlights the greater requirement for ICU resources for COVID-19 patients compared with non-COVID-19 patients.

DELAYED DISCHARGES

Patients commonly stay in ICU after they have been declared clinically ready for ward care (Figure 6.5). In the ROI, 3.3% of available bed days were occupied by patients who had been declared ready for discharge more than 8 hours earlier (compared to 2.6% in the UK).

A factor to be considered 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 which are not available for patients because they are not staffed. This may explain some of the variability between Units.

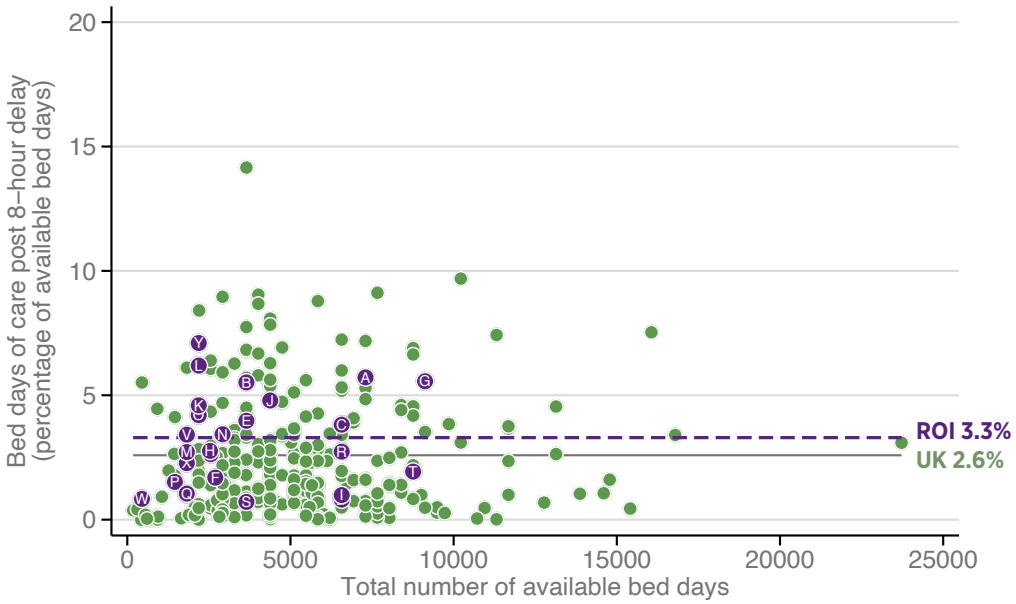


FIGURE 6.5: BED DAYS SPENT IN THE UNIT MORE THAN 8 HOURS AFTER BEING DECLARED READY FOR DISCHARGE (AS A PERCENTAGE OF ALL AVAILABLE UNIT BED DAYS), UNIT SURVIVORS ONLY (Source: INICUA and ICNARC UK data)

* Each purple circle with a letter marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1.

Fewer days were spent in ICU by patients after being cleared for discharge in 2020 and 2021 compared to 2019 (Figure 6.6A, Figure 6.6B), possibly related to the increased need for ICU beds during the COVID-19 pandemic. A similar trend was seen in the UK.

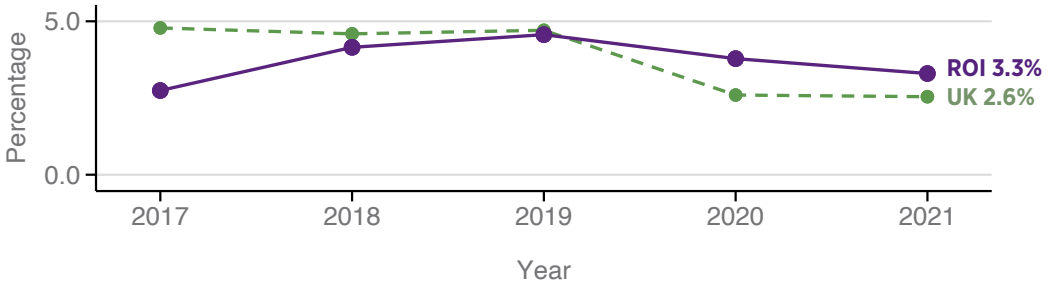


FIGURE 6.6A: TREND IN PERCENTAGE OF TOTAL AVAILABLE INTENSIVE CARE UNIT BED DAYS SPENT IN THE UNIT MORE THAN 8 HOURS AFTER PATIENTS WERE CLEARED FOR DISCHARGE, 2017–2021 (Source: INICUA and ICNARC UK data)

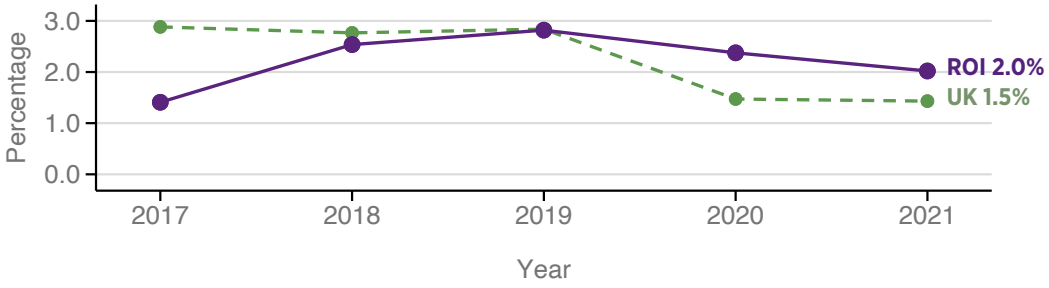


FIGURE 6.6B: TREND IN PERCENTAGE OF TOTAL AVAILABLE INTENSIVE CARE UNIT BED DAYS SPENT IN THE UNIT MORE THAN 24 HOURS AFTER BEING DECLARED READY FOR DISCHARGE, 2017–2021 (Source: INICUA and ICNARC UK data)

The percentages of patients who spent more than 24 hours waiting for a ward bed after being cleared for discharge to the ward are shown in Figure 6.7. Interestingly, many of the Units with the highest bed occupancy rates also had high rates of patients waiting more than 24 hours for a ward bed. If ward beds had been available for these patients, bed occupancy would have been lower, and new admissions to ICU would have taken place more quickly.

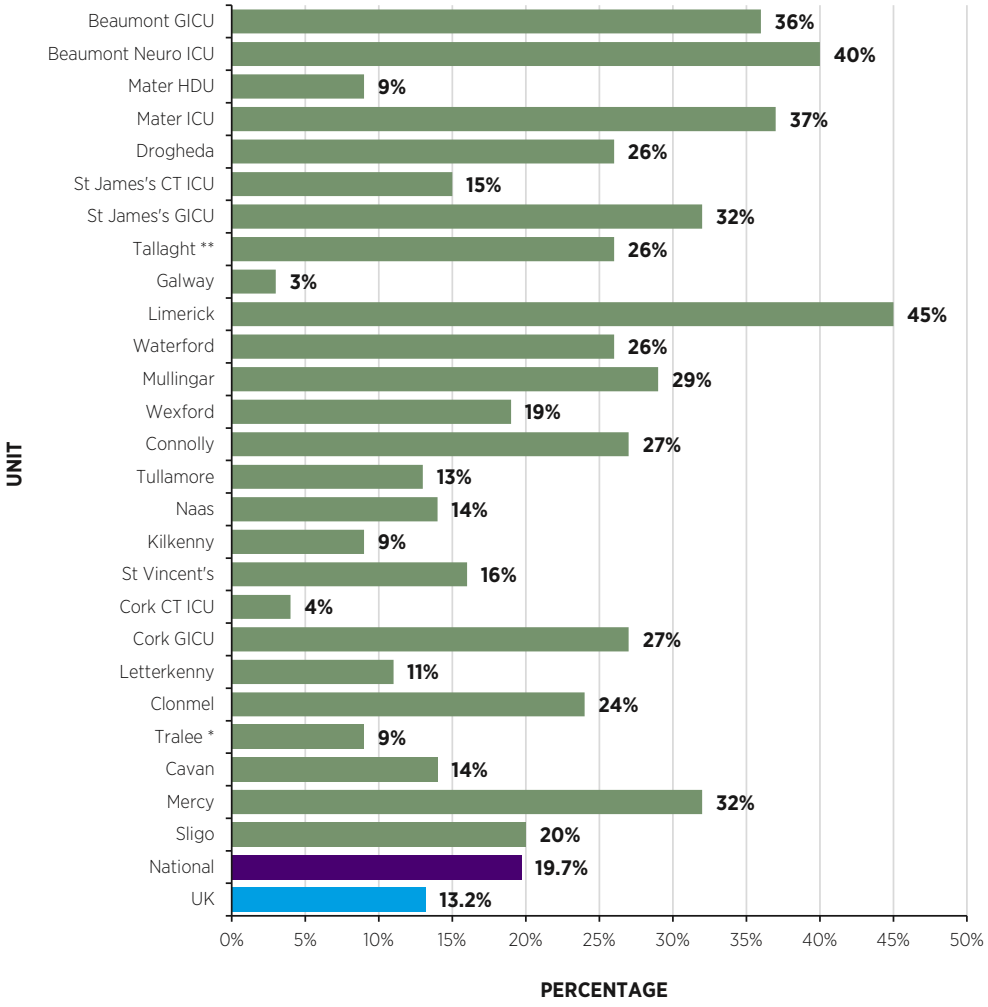


FIGURE 6.7: DISCHARGES TO THE WARD DELAYED > 24 HOURS AS A PERCENTAGE OF ALL DISCHARGES TO A WARD (2021)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

The ICU-BIS collects data each morning on the numbers of patients in each Unit who have been declared clinically fit for discharge. This is useful for identifying which Units are likely to have empty beds available later that day. It also provides an indication of how many ICU beds are occupied by patients who no longer need to be in ICU, although this does not necessarily mean inappropriate use of ICU beds as many of these patients will be discharged later that day, making their ICU bed available. Data from ICU-BIS showed that on average, 10% of available beds in 2021 were occupied by patients who had been cleared for discharge (Figure 6.8). The graph of the daily numbers of patients cleared for discharge nationally (Figure 6.8) shows a marked decrease at the time of maximum pressure on ICU beds in early 2021 (Figure 6.1).

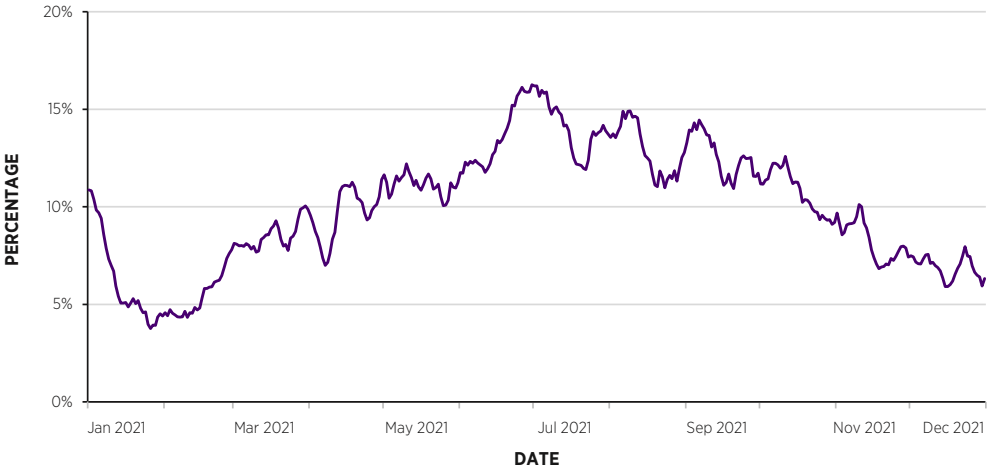


FIGURE 6.8: NUMBERS OF PATIENTS CLEARED FOR DISCHARGE EACH DAY AS A PERCENTAGE OF OPEN INTENSIVE CARE UNIT BEDS IN 26 ADULT HEALTH SERVICE EXECUTIVE-FUNDED PUBLIC HOSPITALS, 2021 (Source: ICU Bed Information System, rolling 7-day average)

EARLY WARNING SCORES ON DISCHARGE FROM THE UNIT

The Irish National Early Warning System (INEWS) is a risk-prediction score for patients in the ward. If a patient deteriorates, this should trigger an intervention or a referral to ICU in order to prevent further clinical deterioration. The INEWS is a composite score based on respiratory and cardiovascular observations, body temperature, and level of consciousness. The ideal value is 0, but values somewhat higher could be acceptable in patients being discharged from ICU, because the administration of oxygen alone gives an INEWS score of 3. However INEWS scores of 5 or 6 suggest that patients are not fully ready for discharge from ICU where this occurs in a hospital without a HDU.

INEWS scores are calculated before patients are discharged from ICU to the ward. Data collection for 2021 was incomplete in some Units. Moreover, in some Units a significant number of patients are discharged to another Critical Care Unit rather than the ward and are therefore not included in the data for INEWS at discharge. In Figure 6.9, data are displayed only for Units with INEWS scores recorded for more than 50% of patients discharged alive from ICU.

INEWS scores at ICU discharge were surprisingly high (Figure 6.9); the upper quartile was 5 or 6 for some Units, meaning that 25% of patients had an INEWS score greater than or equal to these values at the time of discharge. If this occurred in a hospital without a HDU, it means that a significant number of patients were discharged to a ward while still quite unwell. This indicates pressure on ICU beds and suggests that patients may have been discharged to make beds available for other patients who were sicker.

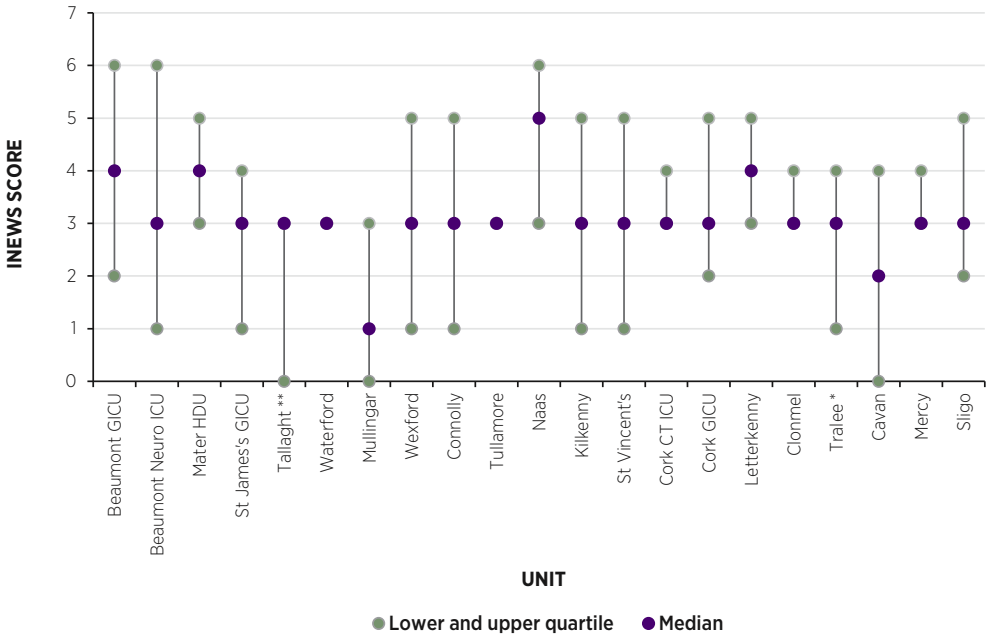


FIGURE 6.9: IRISH NATIONAL EARLY WARNING SYSTEM SCORES AT THE TIME OF DISCHARGE FROM THE UNIT (MEDIANS, QUARTILES), 2021

Note: Data are only presented for Units with documentation of INEWS scores for at least 50% of patients discharged alive from ICU. Where the median is equal to the lower or upper quartile, only the median is visible in the graph.

* Hospital submitted data for only 3 months of 2021.

** Hospital submitted data for only 6 months of 2021.

LENGTH OF STAY AFTER ICU DISCHARGE

Hospital LOS after discharge from ICU varied between hospitals (Figure 6.10). This may reflect differences in case mix, or differences in local-community or convalescent facilities. The national mean LOS in hospital after ICU discharge (23 days) was approximately twice the national median LOS (11 days), indicating that a small number of patients who stayed in hospital for a long time after discharge from ICU significantly increased the mean LOS. Mean and median values for the UK were 15 and 8 days, respectively.

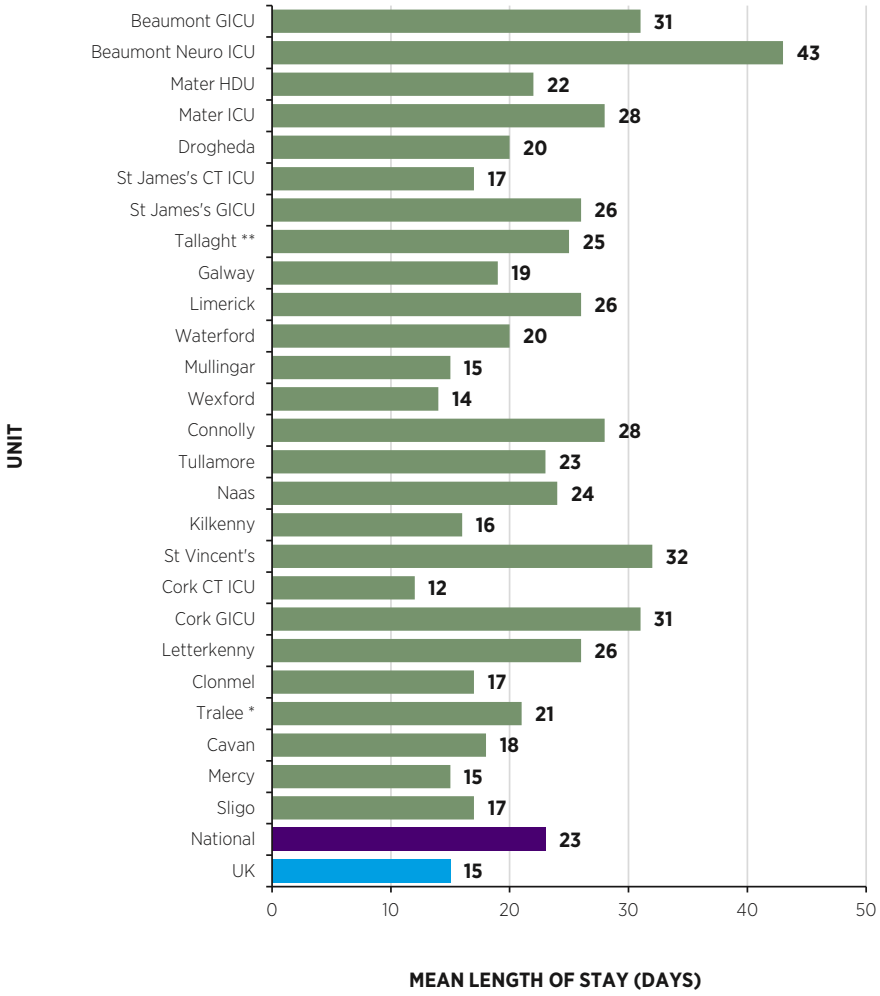


FIGURE 6.10: MEAN LENGTH OF STAY IN ACUTE HOSPITAL AFTER UNIT DISCHARGE FOR UNIT SURVIVORS (DAYS)[10]

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

[10] Median length of stay in acute hospital after Unit discharge for Unit survivors is presented in the table for Figure 6.10, Appendix 1.

KEY FINDINGS FROM CHAPTER 6

- An average of 303 ICU/HDU beds were open daily in publicly funded hospitals in 2021 (ICU-BIS data). This corresponded to 6.0 critical care beds per 100,000 population; the average for OECD countries was 14.1/100,000.
- The ICU-BIS documented 97,754 bed days occupied across all ICUs/ HDUs nationally. Of these, 28% were occupied by 1,766 patients admitted to ICU with COVID-19. Most of these COVID-19 admissions occurred in surges in January–February and November–December 2021.
- Average ICU/HDU bed occupancy nationally was 88.5%. A number of Units, including some of the larger Units, had bed occupancy rates > 90% for 2021 (St Vincent's University Hospital, Mater Misericordiae University Hospital, Cork University Hospital, and Beaumont Hospital).
- Bed days during which the patient was undergoing invasive ventilation are a useful measure of core ICU activity. Hospitals with the largest numbers of such bed days were St James's Hospital, Beaumont Hospital, Mater Misericordiae University Hospital, Cork University Hospital and St Vincent's University Hospital.
- Mean LOS for all patients was 6.6 days, compared with a mean LOS of 5.8 days in 2020 (INICUA data). Mean LOS for Unit survivors was 6.3 days, compared with 8.3 days for Unit non-survivors.
- ICU-BIS data indicated a mean LOS for COVID-19 patients almost 2.5 times longer than for the overall ICU population.
- Nationally, 3.3% of all potential ICU bed days were occupied by patients who had been cleared for discharge to a ward for more than 8 hours. This is equivalent to 3,172 bed days used for patients ready for ward care.
- INEWS scores at ICU discharge from some Units were surprisingly high with upper quartile values of 5 or 6, i.e. 25% of patients had an INEWS score ≥5 or ≥6 at the time of discharge. This suggests that some patients were discharged early to make beds available for other patients who were sicker.

CHAPTER 7
OUTCOME MEASURES AND QUALITY INDICATORS

CONTENTS >

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

Prompt admission to ICU for acutely ill patients improves outcomes (*Harris et al., 2018*). However, delays in admission to ICU are inevitable with the high levels of ICU bed occupancy seen in Units in the ROI in 2021 (Table 6.1).

The HSE has defined two key performance indicators (KPIs) for timely admission to ICU from the ward or Emergency Department in the same hospital: 50% of patients should be admitted within 1 hour of the decision to admit, and 80% of patients should be admitted within 4 hours of the decision to admit. Data for each hospital (rather than for individual Units) are shown in Figure 7.1. Data are shown only for hospitals where the time of the decision to admit was documented for at least 50% of admissions.

Eighteen hospitals had data on the time of decision to admit for at least 50% of relevant admissions (Figure 7.1). Only Beaumont Hospital achieved the KPI of 50% of patients being admitted to ICU within 1 hour of the decision to admit (although data on the time of decision to admit were available for only 69% of admissions). Fifteen of the 18 hospitals achieved the KPI of admitting 80% of patients to ICU within 4 hours of the decision to admit (Figure 7.1).

Once a decision is made to admit a critically ill patient to ICU, this should happen immediately. The findings from these two key performance indicators (KPIs) for timely admission to ICU have informed Recommendation 2 within this report. This recommendation is to develop and implement a national policy that each Unit should keep one staffed ICU bed empty to be available for immediate admission of critically ill patients, if this can be achieved by discharge of a patient who has been declared clinically ready for discharge.

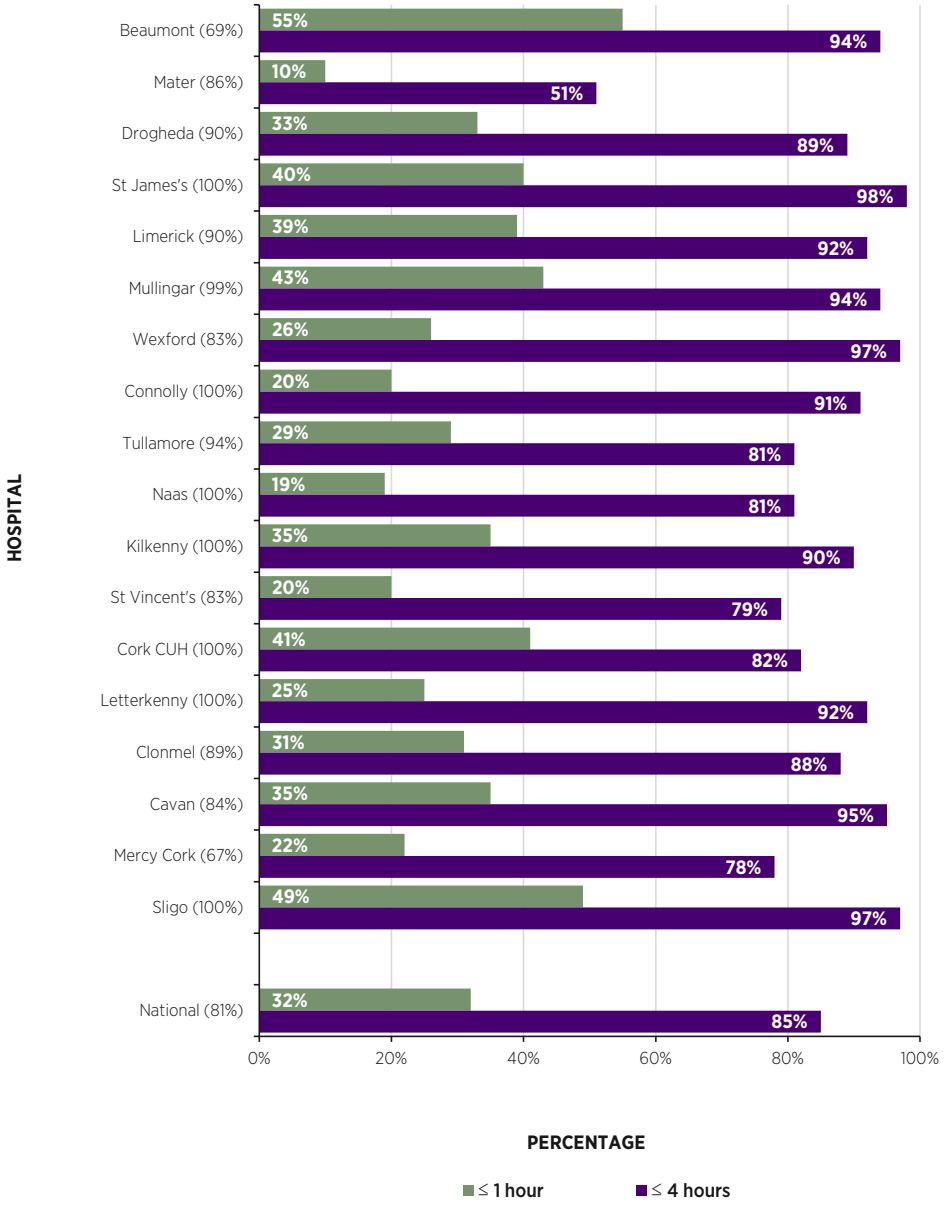


FIGURE 7.1: PERCENTAGE OF ADMISSIONS TO A CRITICAL CARE UNIT FROM A WARD OR EMERGENCY DEPARTMENT: (i) WITHIN 1 HOUR OF THE DECISION TO ADMIT, AND (ii) WITHIN 4 HOURS OF THE DECISION TO ADMIT (Q1–Q4 2021)

Note 1: The percentage of admissions for which the time of decision to admit was known, is shown in brackets for each hospital following the hospital names in Figure 7.1.

Note 2: Data are for each hospital rather than for individual Units. We have excluded from Figure 7.1 hospitals without data for all 4 quarters of 2021 (Tallaght University Hospital, University Hospital Kerry) or where the time of decision to admit was unknown for >50% of admissions (University Hospital Galway, University Hospital Waterford).

HIGH-RISK ADMISSIONS FROM THE WARD

This quality indicator (QI) measures the proportion of patients with multi-organ failure (defined as dysfunction in four or more organ systems) within 24 hours of admission to ICU from a ward in the same hospital. Patients may be admitted to ICU in a timely fashion but then deteriorate quickly to experience multi-organ failure. However, if an excessive number of patients have multi-organ failure within 24 hours after admission, it is likely that some of these should have been admitted to ICU earlier.

Reasons why patients were not admitted to ICU in a timely fashion could be that ward or ICU staff did not recognise the need for ICU admission, or that no ICU bed was available.

Seven percent of patients admitted from a ward in the ROI had organ failure in four or more organ systems within 24 hours of admission to ICU, compared to 4.7% in the UK (Figure 7.2A). St Vincent's Hospital ICU (Unit R), Connolly Hospital ICU (Unit N) and Cork University Hospital General ICU (Unit T) were outliers for this QI in 2021; all other Units were within acceptable limits.

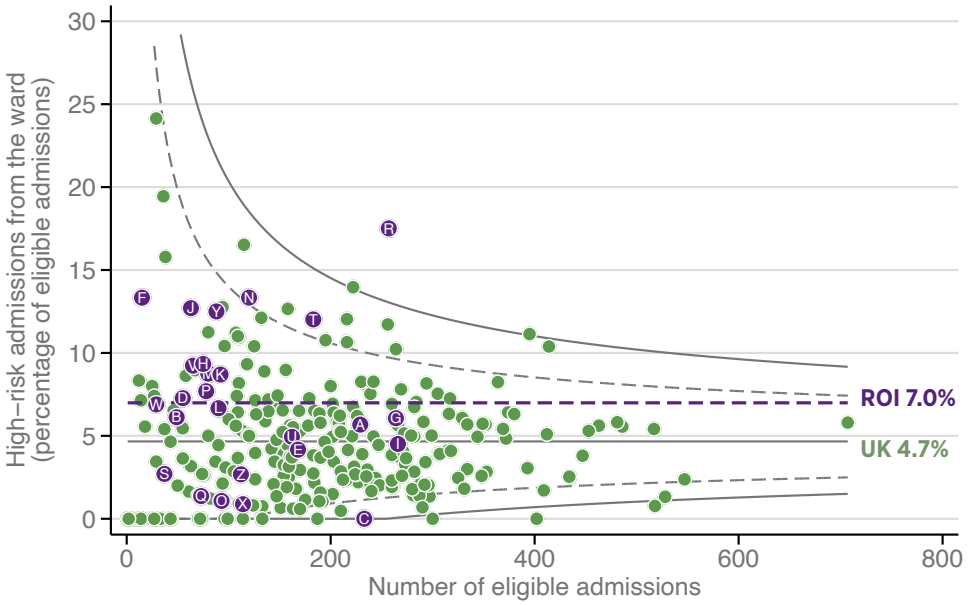


FIGURE 7.2A: ADMISSIONS FROM A WARD WITH ORGAN FAILURE IN FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS FROM A WARD) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1.

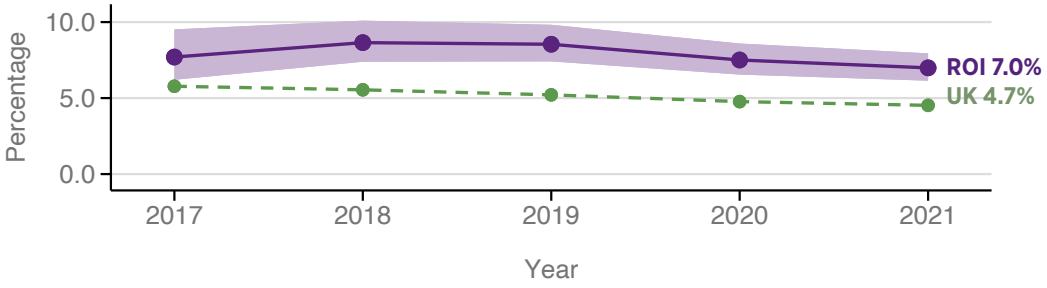


FIGURE 7.2B: ADMISSIONS FROM A WARD WITH FAILURE IN FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS FROM A WARD), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

Outlier Data: Responses from Outlier Units

As part of the audit process, outlier Units were asked to review these findings and outline their plans to address the issues identified. St Vincent's Hospital ICU had been an outlier for this QI in 2020 and provided a detailed plan to address the issues identified. This plan was summarised in the NOCA ICU Audit Report for 2020. The responses set out in the St Vincent's ICU plan began to be implemented in 2022 and had not been reflected in the data for 2021. Responses from Connolly Hospital ICU and Cork University Hospital General ICU are summarised below.

CONNOLLY HOSPITAL RESPONSE

Connolly Hospital responded to the outlier finding for 'High Risk admissions to ICU' by initiating a detailed review of the individual cases who developed organ failure in 4 body systems within 24 hours of ICU admission.

REVIEW FINDINGS

1. When a number of these patients deteriorated, the appropriate escalation process was not followed leading to delayed recognition and delayed decision to admit to ICU.
2. All patients were admitted within 4 hours of the decision to admit, facilitated by the hospital having 7 ICU beds open during 2021. However, bed capacity of ICU has been reduced to 5 since 2022.

ACTIONS

1. The issue of failure to follow recommendation re escalation based on Early Warning Score (EWS) was communicated to the Deteriorating Patient Committee for action.
2. Appropriate action is now being taken with respect to education and implementation of EWS protocols.

RECOMMENDATIONS

1. To ensure timely access, ICU should have a capacity of 8 beds.
2. Maintain an appropriate clinical space to quickly accommodate critically ill patients in the event of a surge.
3. Have a clear standard operational procedure (SOP) to arrange external ICU transfers if no beds available in Connolly.
4. Implement an advance nurse practitioner (ANP) outreach service to provide a 24/7 care to deteriorating patients.

CUH GENERAL ICU RESPONSE

CUH General ICU responded to the outlier finding for 'High Risk admissions to ICU' by pointing out they had fewer ICU beds relative to emergency admissions than other major hospitals. For this reason, a number of metrics from ICU Audit data showed that patients admitted to General ICU in CUH were sicker than in other hospitals. Addressing this issue would require the following actions;

1. Expand critical care capacity.
2. Prioritise allocation of ward beds to patients deemed fit for ICU discharge.
3. Protect an empty staffed ICU bed to facilitate the timely admission of critically ill patients (as happens in other clinical areas within CUH (e.g. ST Elevation Myocardial Infarction (STEMI) bed).
4. Address recruitment and retention of critical care nursing staff.

DELAYED ADMISSION TO ICU WITH SEPSIS

Sepsis is an important condition in critically ill patients and is notoriously difficult to diagnose in the early stages. Failure of four or more organ systems within 24 hours of ICU admission suggests that ICU admission was delayed. Data on sepsis (Sepsis-3 criteria) and failure of four or more organ systems within 24 hours of ICU admission are shown in Figure 7.3A; these data are a subgroup of the data in Figures 7.2A and 7.2B. Admissions meeting these criteria were 5.6% of admissions with sepsis from the ward in ROI, versus 3.8% in the UK. All participating Units in the ROI except St Vincent's Hospital ICU (Unit R) were within expected limits in 2021.

The greater proportion of patients in ROI admitted to ICU who develop failure in four or more organ systems compared with the UK (5.6% versus 3.8% for patients with sepsis, 7.0% versus 4.7% for all admissions from a ward) suggests that patients have to be sicker to get into ICU in ROI.

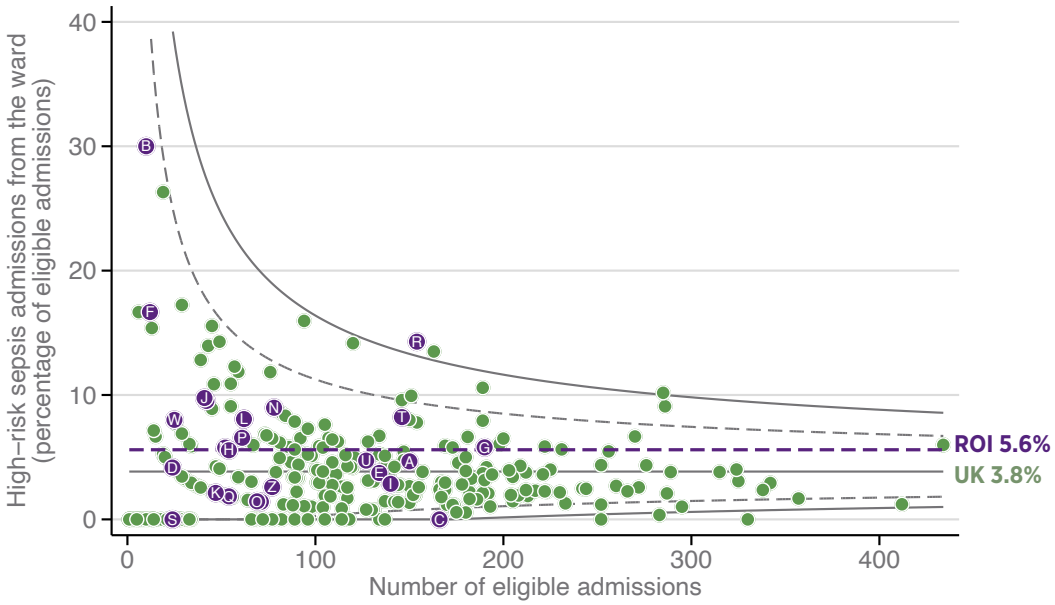


FIGURE 7.3A: UNIT ADMISSIONS FROM A WARD WITH A DIAGNOSIS OF SEPSIS (SEPSIS-3) AND DYSFUNCTION OF FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS WITH SEPSIS FROM A WARD IN THE SAME HOSPITAL) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1.

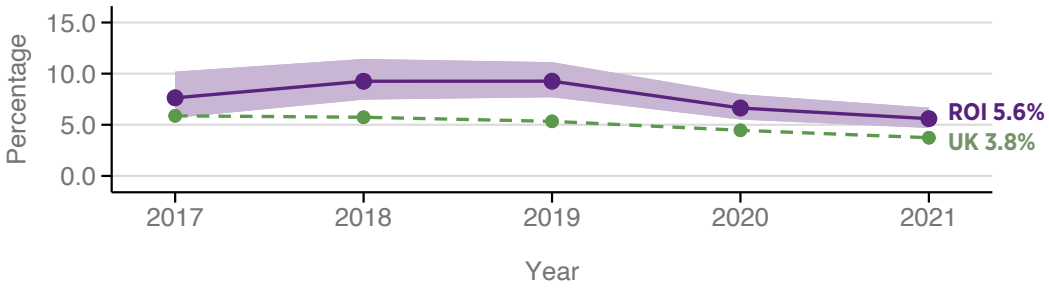


FIGURE 7.3B: TREND IN UNIT ADMISSIONS FROM A WARD WITH A DIAGNOSIS OF SEPSIS (SEPSIS-3) AND DYSFUNCTION OF FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS WITH SEPSIS FROM A WARD IN THE SAME HOSPITAL), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

UNPLANNED DISCHARGES FROM ICU AT NIGHT

Ideally, discharges to the ward from ICU should take place during normal working hours after patients have been declared fit for discharge by the ICU team. Unscheduled discharge of ICU patients outside normal working hours worsens outcomes (*Azevedo et al., 2015*). Unplanned discharges outside normal hours may be related to factors in the wards such as reduced staffing levels, Units having less experienced staff, or lack of knowledge of the patient's history. Additionally, if an ICU bed was needed for an urgent admission, patients may have been discharged without being fully ready.

The proportion of patients discharged out of hours (22.00–07.00) who had not been cleared for discharge by 18.00 the previous evening is a useful QI to reflect good practice in documenting which patients are fit for discharge, and for highlighting the numbers of ICU beds needed to avoid discharges outside normal working hours. The numbers of unplanned discharges from ICU at night were within expected limits for all Units in 2021 except University Hospital Galway ICU and Cavan General Hospital ICU (Figure 7.4).

University Hospital Galway was an outlier for this QI in 2020 also; their response is outlined in the NOCA ICU Audit report for 2020, and the actions that they outlined then were not yet reflected in the audit data for 2021. The response from Cavan Hospital is summarised below.

Cavan Hospital Response

Cavan General Hospital ICU reviewed the finding of outlier data for unplanned discharges at night. Their findings were:

1. There was a failure to document patients as being fit for discharge.
2. There were also issues relating to the management of beds for COVID patients.

Their recommendations were:

1. All patients discharge status should be documented in the Healthcare record.
2. Patients' readiness for discharge should be identified to patient flow staff before 18.00 and ideally before the 12.00 daily bed meeting.

This recommendation was implemented on 1 December 2022.

The national mean value for patients discharged out of hours without being cleared for discharge by 18.00 the previous evening was 4.4% for patients in the ROI, versus 2.5% for the UK (Figure 7.4).

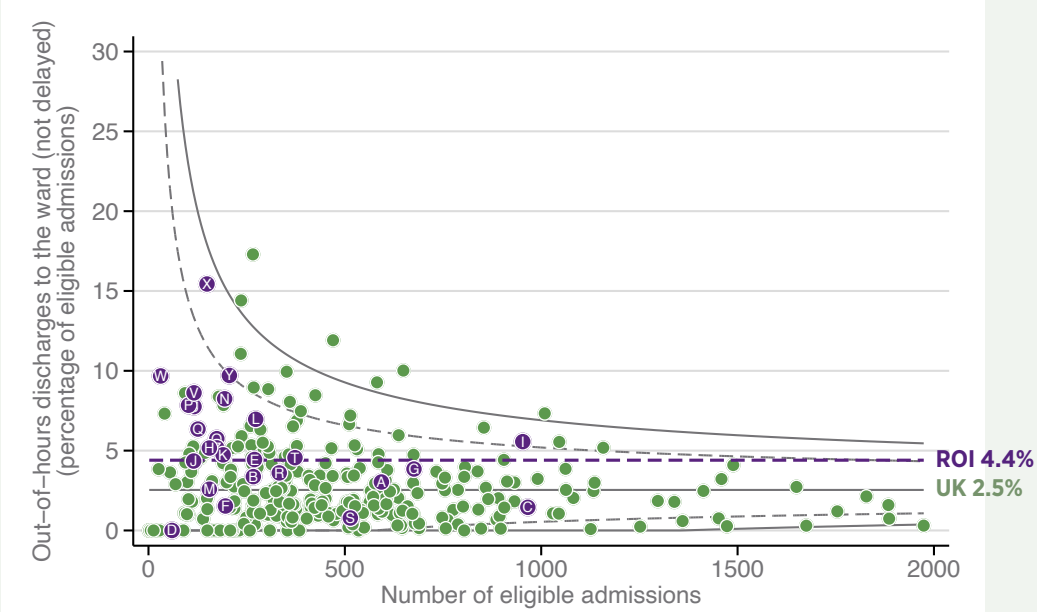


FIGURE 7.4: UNIT DISCHARGES TO THE WARD AT NIGHT (22.00–07.00) WHO HAD NOT BEEN CLEARED FOR DISCHARGE BY 18.00 (AS A PERCENTAGE OF ALL UNIT SURVIVORS) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1.

UNPLANNED READMISSION TO ICU

Unplanned readmission to the Unit within 48 hours of discharge is an important indicator of quality of care in ICU. Unplanned readmission may occur due to an unpredictable event after appropriate Unit discharge, or due to an error in clinical judgement when a patient has been assessed as ready for ward care. However, an excessive number of unanticipated readmissions after ICU discharge suggests that patients were discharged too early in order to free ICU beds for patients who were sicker.

The overall rates of unplanned readmission to ICU in 2021 were 0.9% for the ROI and 1.2% for the UK (Figures 7.5A and 7.5B). There were no outlier Units for this QI in 2021.

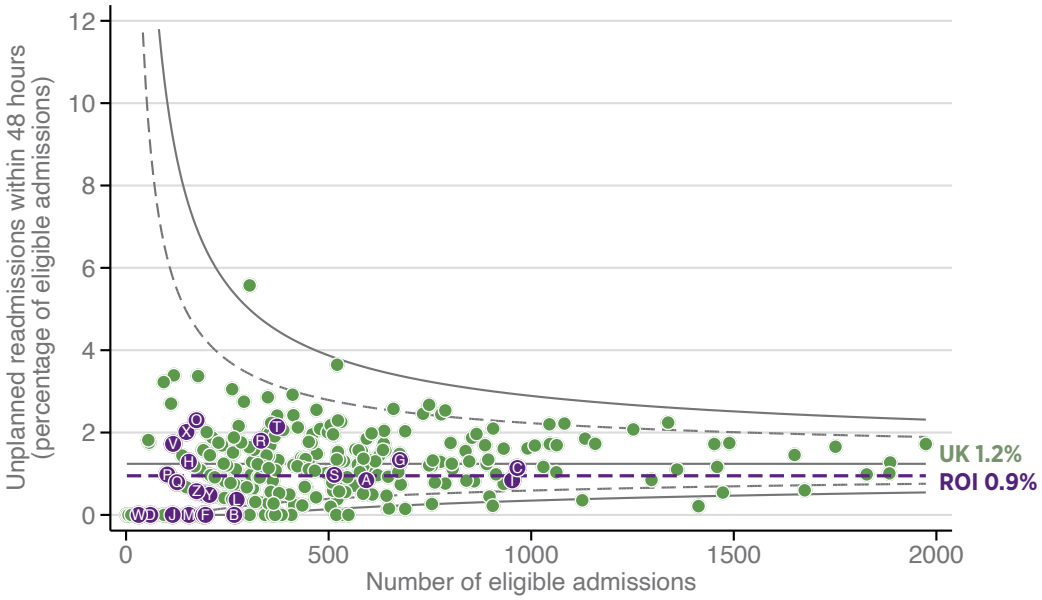


FIGURE 7.5A: UNPLANNED READMISSIONS WITHIN 48 HOURS OF DISCHARGE FROM THE SAME UNIT (AS A PERCENTAGE OF UNIT SURVIVORS DISCHARGED TO A WARD) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1.

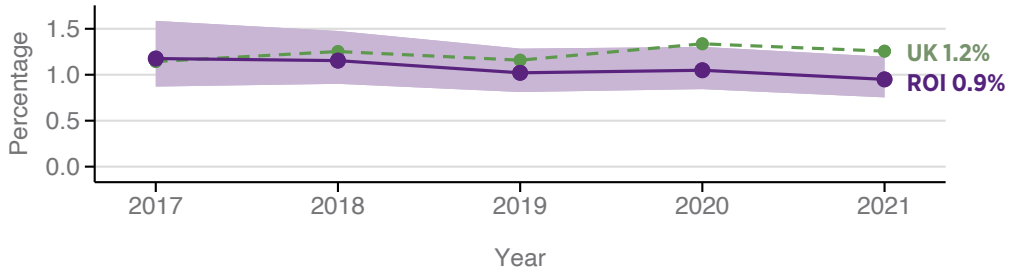


FIGURE 7.5B: TREND IN UNPLANNED READMISSIONS WITHIN 48 HOURS OF DISCHARGE FROM THE SAME UNIT (AS A PERCENTAGE OF UNIT SURVIVORS DISCHARGED TO A WARD), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

MORTALITY AFTER ADMISSION TO CRITICAL CARE

Patients admitted to ICU or HDU are the sickest patients in the hospital; they often have significant coexisting illnesses, and many are elderly, which puts them at high risk of death. Figure 7.6 presents the actual (crude) mortality rate before discharge from acute hospital for all patients included in INICUA. This includes deaths in the Unit and subsequent deaths in the ward before discharge from an acute hospital.

Eighty-two percent of patients in 2021 survived to leave critical care, and 76% survived to leave acute hospital (Figure 7.6). 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. The survival rates at each of these steps were lower than the survival rates for 2020; survival rates at each step in the cascade in 2020 were 100%, 87%, 86%, and 79%.

Risk-adjusted mortality as assessed by the standardised mortality ratio (SMR) also showed an increase in 2021 (1.16 versus 1.05 in 2020, Figure 7.7) but the value of 1.16 was within the acceptable range statistically. Nevertheless, we should note the possibility that the increase in crude mortality and in risk-adjusted mortality is clinically significant, particularly if sustained in future years.

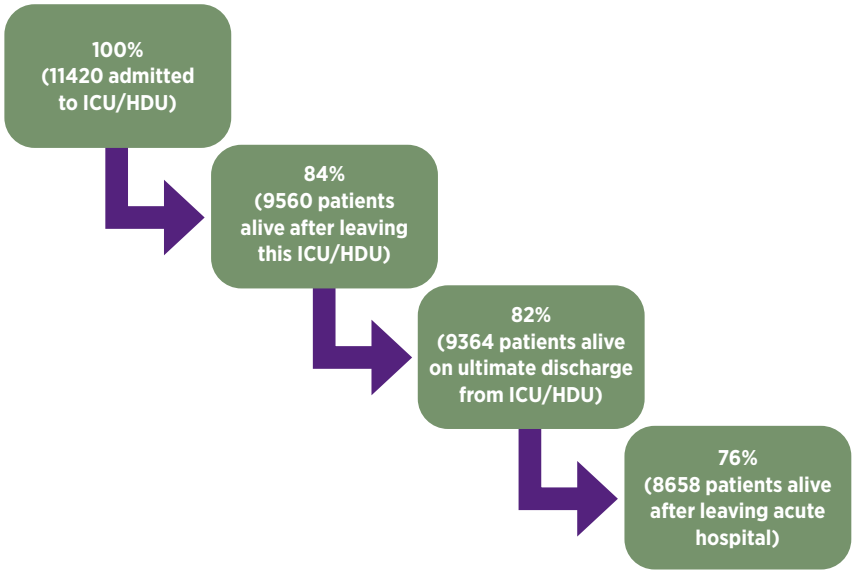


FIGURE 7.6: PERCENTAGE OF PATIENTS (N=11,420) ADMITTED TO INTENSIVE CARE UNITS WHO WERE ALIVE: (i) ON DISCHARGE FROM ORIGINAL UNIT, (ii) ON DISCHARGE FROM INTENSIVE CARE UNIT/HIGH DEPENDENCY UNIT, AND (iii) ON DISCHARGE FROM ACUTE HOSPITAL

STANDARDISED MORTALITY RATIOS (SMR)

Mortality in ICU depends primarily on the case mix of patients admitted to a Unit. Units with a large proportion of high-risk patients will have a high mortality rate, regardless of the quality of care. Benchmarking mortality rates between Units must adjust for the relative risk of death for the patient populations of the individual Units. Risk-adjusted mortality ratios take account of the severity of illness on admission, as well as age, pre-existing conditions, underlying diagnoses, etc.

ICNARC uses a mathematical model to predict the risk of acute hospital death of individual patients. This incorporates data including age; pre-existing conditions; source of referral; admission diagnosis; and illness severity, as assessed by physiological and laboratory data. The analytic model is based on ICNARC's large database of ICU patients collected since 1995. The model is updated and recalibrated regularly to account for changes in ICU practice and demographics, as well as for the generally improving ICU outcomes observed in recent years. The $ICNARC_{H\text{-}2018}$ model is used for the analyses in this report.

ICNARC calculates the expected number of deaths for each Unit based on this mathematical model. The ratio of the observed to the predicted numbers of deaths is the standardised mortality ratio (SMR). Patients who are readmissions to the Unit are excluded from analysis to ensure that they are included in the mortality figures only once. If the SMR is 1.0, it means that the Unit had exactly the expected number of deaths. With variability in case mix and unavoidable limitations in the mortality prediction model, some variability in SMRs is expected. To allow for this variability, a range for SMRs of ±2 standard deviations (SDs) around the value of 1.0 is considered acceptable. Statistically, these limits should encompass 95% of all Units. Units outside these limits are considered to be outliers for this QI. When a Unit is found to be an outlier, this finding acts as a signal to consider whether the quality of care is affecting clinical outcomes in the Unit.

SMR data for Units in the ROI are shown in Figures 7.7A and 7.7B. There were no outlier Units with an SMR outside the acceptable range of ±2 SDs in 2021. The SMR for all eligible Irish admissions in 2021 was 1.16 (compared to the 2020 value for SMR of 1.05). The most likely reason for this increase in SMR is that the $ICNARC_{H\text{-}2018}$ risk-prediction model underestimates the severity of illness with COVID-19 (which commonly affects only a single organ system initially). Reassuringly, the ROI value is slightly better than the UK value (Figure 7.7B).

The SMR for aggregated data for patients admitted to the 13 smaller Units (< 200 Level 3 admissions each per annum, Figure 5.5) was 1.19, compared with an SMR of 1.14 for admissions to the 13 larger Units (> 200 Level 3 admissions each per annum) (Figure 7.7A). These similar outcomes indicate 'equality of outcome' whether patients are admitted to smaller-volume Units or to larger-volume Units.[11]

[11] Provisional data for Quarters 1-3 2022 show an SMR value of 1.07.

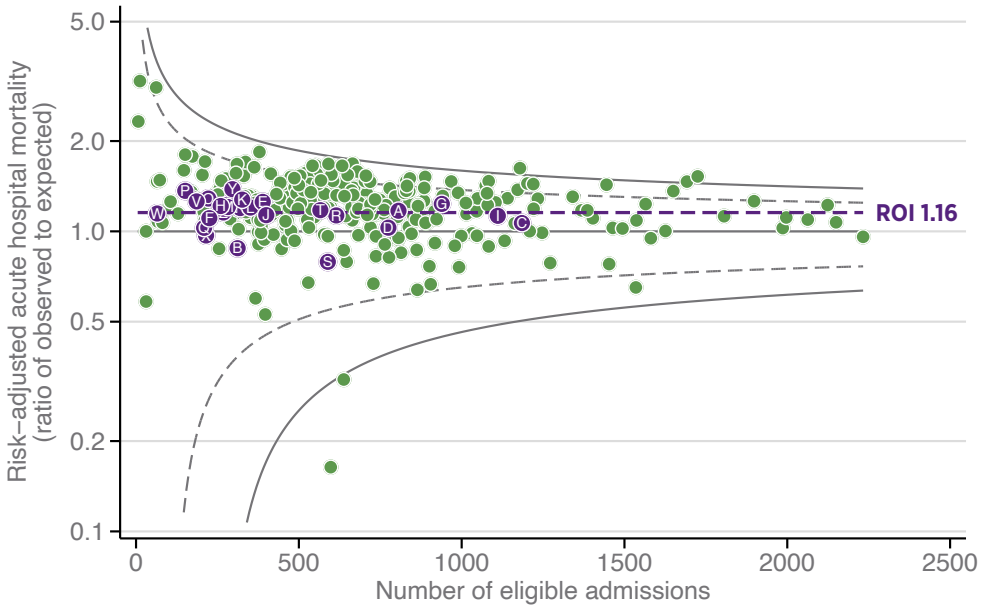


FIGURE 7.7A: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO, ICNARC$_{H\text{-}2018}$ MODEL) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1. The overall value for risk-adjusted mortality for UK Units is not available.

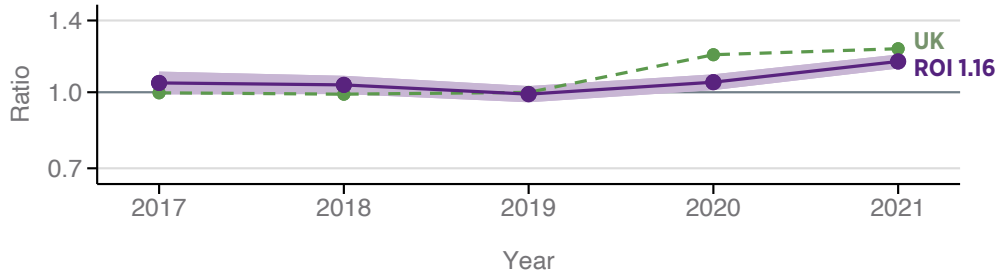


FIGURE 7.7B: TREND IN RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO, ICNARC$_{H\text{-}2018}$ MODEL), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

MORTALITY IN LOW-RISK PATIENTS

Figure 7.8A shows the SMR for patients who were judged to have a relatively low (less than 20%) risk of death when admitted to ICU. These patients are a subset of the patients shown in Figure 7.7A. While some deaths are expected in this group, an excess number of deaths could be a signal to have concerns about the quality of care.

There were no outlier Units for this QI in 2021 (Figure 7.8A). The overall SMR for low-risk admissions in the ROI was 1.4, compared to 1.16 in 2020 (Figure 7.8B).[12]

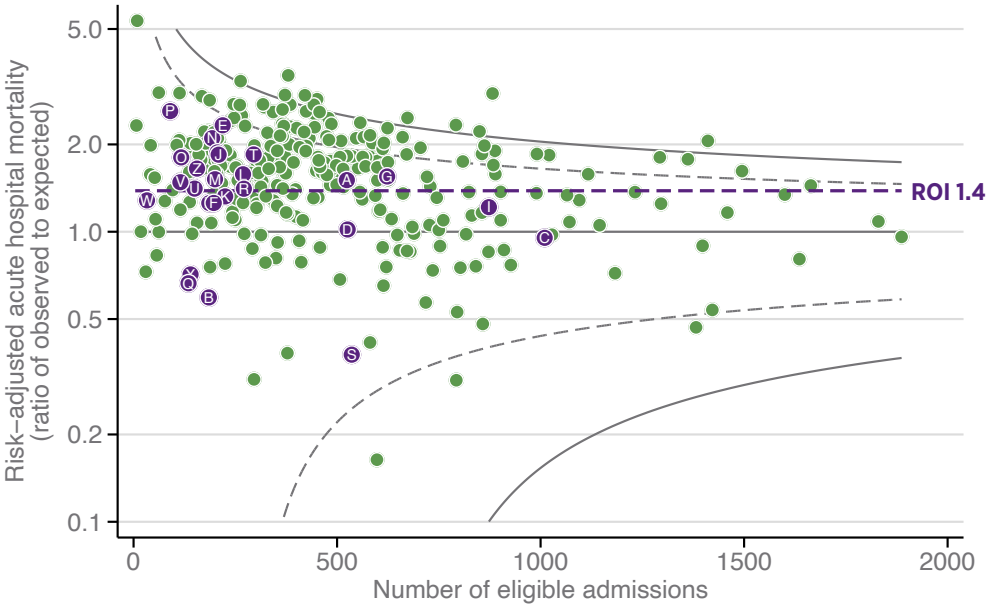


FIGURE 7.8A: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO) FOR PATIENTS WHOSE PREDICTED RISK OF DEATH WAS LESS THAN 20% (ICNARC$_{H\text{-}2018}$ MODEL) (Source: INICUA and ICNARC UK data)

Note: Each purple circle marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1. The overall value for risk-adjusted mortality for UK Units is not available.

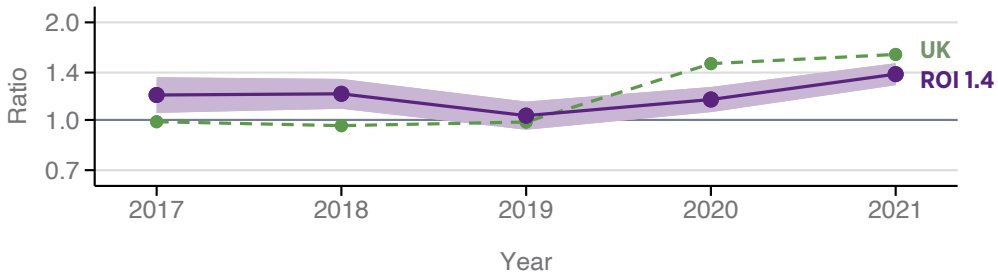


FIGURE 7.8B: TREND IN RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO) FOR PATIENTS WHOSE PREDICTED RISK OF DEATH WAS LESS THAN 20% (ICNARC$_{H\text{-}2018}$ MODEL), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

[12] Provisional data for Quarters 1-3 2022 show an SMR value for low-risk patients of 1.18.

NOCA analysed the ICNARC data to determine the proportion of patients admitted to each Unit with a predicted risk of death greater than 20%, as predicted by the ICNARC$_{H\text{-}2018}$ risk-prediction model. The percentages of patients admitted to each Unit who had a predicted risk of death greater than 20% are shown in Figure 7.9A. St Vincent's University Hospital ICU had the greatest proportion of admissions (56%) with a predicted risk of death greater than 20%.

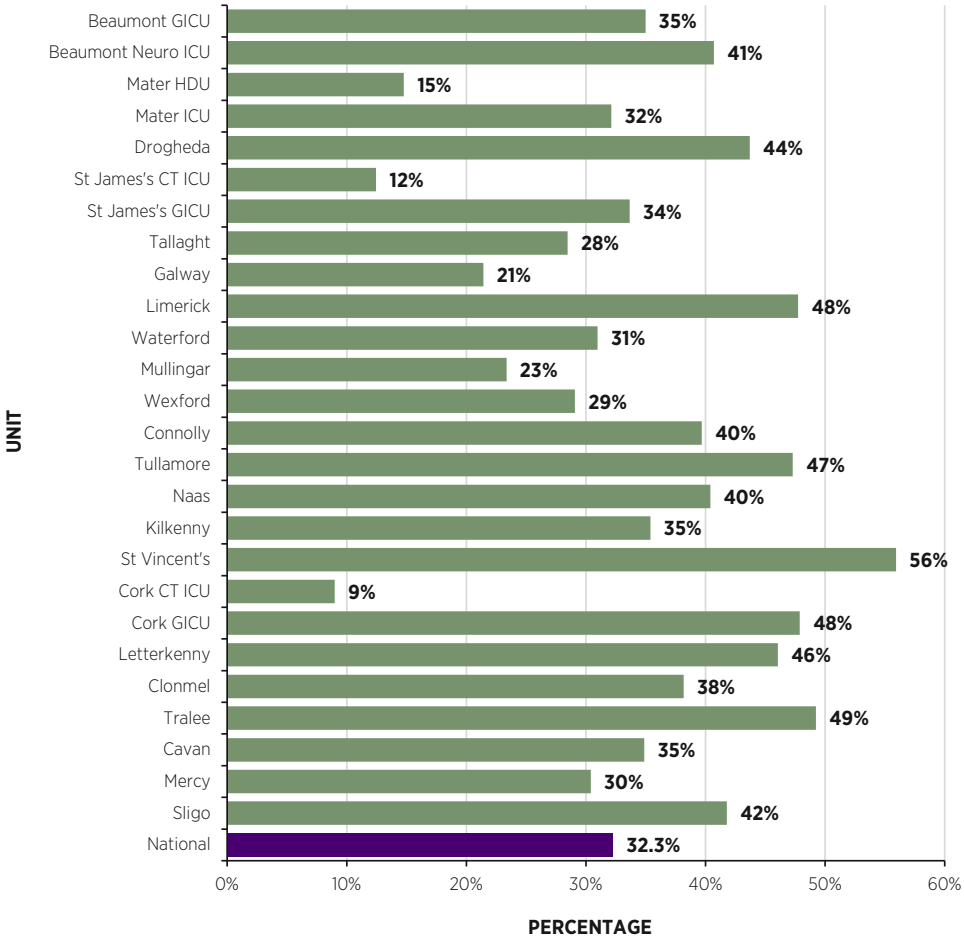


FIGURE 7.9A: PATIENTS WITH A PREDICTED RISK OF DEATH GREATER THAN 20%, AS A PERCENTAGE OF ALL ADMISSIONS

Patients with a predicted risk of death greater than 20% are the sickest patients in ICU. NOCA calculated the SMR for patients in each Unit whose predicted risk of death was greater than 20%. The SMR was the number of patients who died before discharge from acute hospital as a proportion of the number of patients who were predicted to die. The SMRs for high-risk patients in each Unit have been plotted against the numbers of high-risk patients (greater than 20% predicted risk of death) admitted (Figure 7.9B).

There was a wider variation in SMRs between Units with fewer admissions, as would be expected statistically. The national mean SMR for all patients with > 20% predicted risk of death was 1.11, meaning that the mortality rate was close to the rate predicted by the ICNARC predictive model. We are not able to calculate the acceptable limits around the mean value, but there were no large variations for any Unit above the mean (Figure 7.9B).

The SMR for aggregated data on high-risk admissions to the 13 Units with fewer than 200 Level 3 admissions each per annum (Figure 5.5) was 1.16, compared with an SMR of 1.08 for high-risk admissions to the 13 Units with more than 200 Level 3 admissions each. This information reassuringly suggests that the quality of care for very sick patients initially admitted to smaller-volume Units is similar to the quality of care received by very sick patients initially admitted to larger-volume Units. Many patients were transferred from smaller to larger volume Units during their care, and these data suggest that the national network for critical care is working well to ensure equality of outcomes as measured by risk-adjusted mortality.

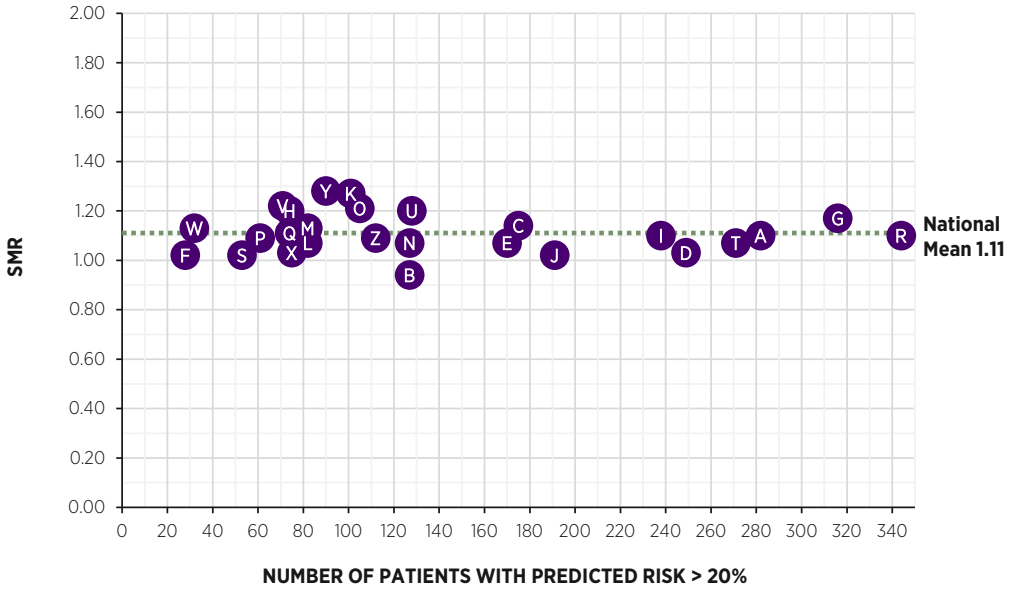


FIGURE 7.9B: OBSERVED DEATHS AS A PROPORTION OF PREDICTED DEATHS (STANDARDISED MORTALITY RATIO) FOR PATIENTS WITH AN INDIVIDUAL PREDICTED RISK OF DEATH GREATER THAN 20%

Note: Each purple circle with a letter marks a Unit in the ROI; the letter in the circle is linked to the relevant Unit in the list of Units in Table 4.1. Units are shown in order of increasing numbers of eligible patients.

INFECTION

Multidrug-resistant organisms (MDROs) are a major problem in ICU, and great care is taken to prevent transmission of these organisms. Our data indicate that the majority of ICU patients who had MDROs detected in 2021 were colonised before ICU admission (Table 7.1).

Our data refer to colonisation with MDROs rather than to clinically significant infections; normally only a small proportion of patients who are colonised develop clinically significant infections.

It is not routine practice to test for *Clostridioides difficile* (*C. difficile*) unless the patient is symptomatic.

TABLE 7.1: NATIONAL RATES OF (i) TESTING FOR MULTIDRUG-RESISTANT ORGANISMS AT TIME OF ADMISSION TO THE UNIT, (ii) COLONISATION AT ADMISSION TO THE UNIT AS A PERCENTAGE OF THOSE TESTED (iii) COLONISATION ACQUIRED IN THE UNIT AS A PERCENTAGE OF ALL ADMISSIONS AND (iv) ACQUISITION IN THE UNIT PER 1,000 PATIENT DAYS (FOR PATIENTS IN THE UNIT FOR MORE THAN 48 HOURS)

Organism	Samples taken (percentage of all admissions)	Colonised at admission to Unit (percentage of admissions tested)	Unit-acquired colonisation (percentage of all admissions)	ICU acquisition rate per 1000 patient days
Methicillin-resistant *Staphylococcus aureus* (MRSA)	96.2%	2.0%	0.2%	0.3
C. difficile	13.4%	3.7%	0.3%	0.4
Vancomycin-resistant enterococci (VRE)	84.2%	11.0%	3.4%	5.1
Carbapenemase-producing *Enterobacterales* (CPE)	94.5%	0.4%	0.2%	0.2

TESTING FOR MULTIDRUG-RESISTANT ORGANISMS

Most Units undertook testing a high proportion of patients for MRSA, VRE and CPE (Figure 7.10). In keeping with national guidelines, *C. difficile* is only tested for when there are clinical indications.

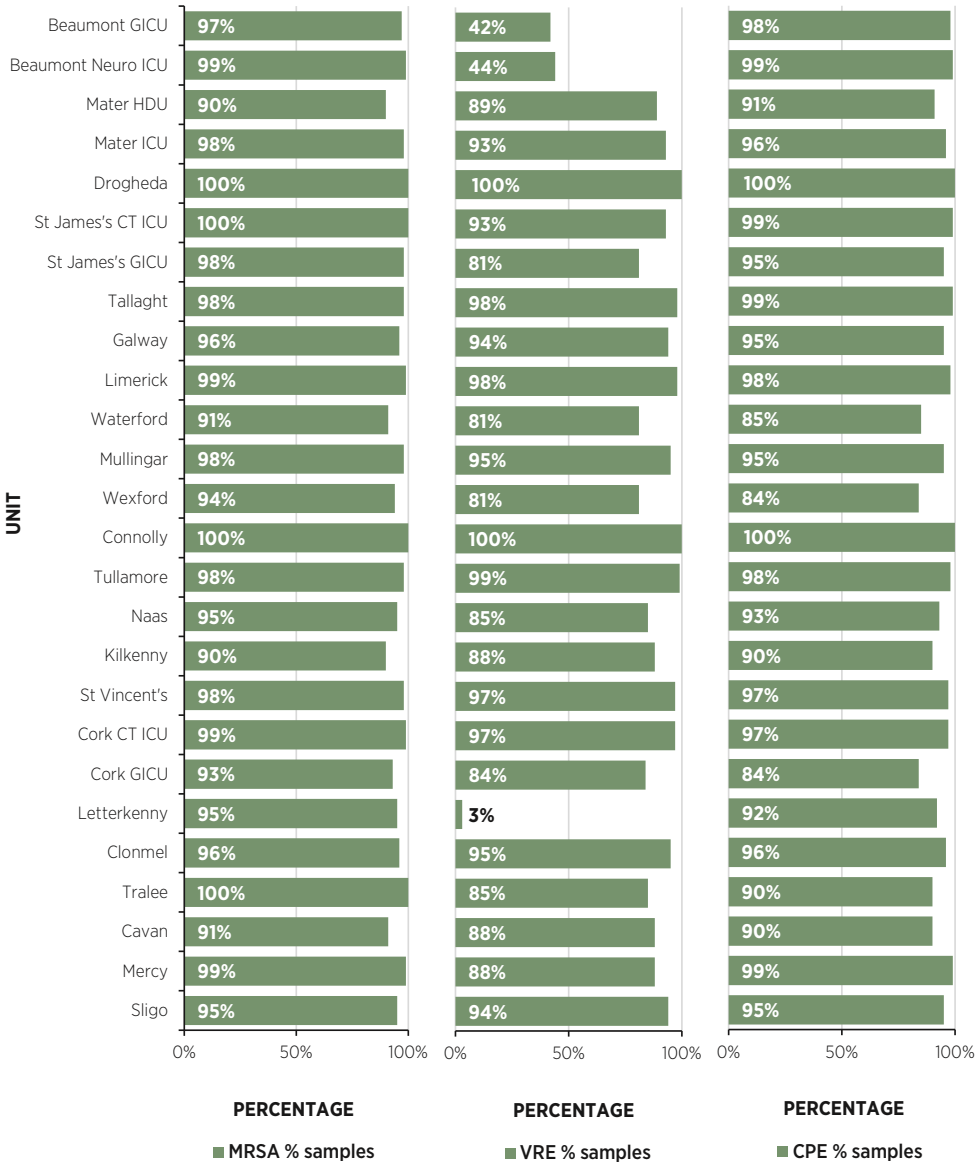


FIGURE 7.10: PERCENTAGE OF PATIENTS TESTED FOR EACH MULTIDRUG-RESISTANT ORGANISM IN EACH UNIT (METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS,* VANCOMYCIN-RESISTANT ENTEROCOCCI AND CARBAPENEMASE-PRODUCING *ENTEROBACTERALES)*

COLONISATION BEFORE ADMISSION TO ICU

Rates of colonisation with MDROs at the time of admission to ICU, as a percentage of the patients who were tested, are shown in Table 7.2.

TABLE 7.2: RATES OF COLONISATION BY MULTIDRUG-RESISTANT ORGANISMS ON ADMISSION TO EACH UNIT (AS A PERCENTAGE OF PATIENTS TESTED)

UNIT	Colonised on admission to unit		
	MRSA	VRE	CPE
Beaumont Hospital General ICU	2.9%	12.8%	0.4%
Beaumont Hospital (Richmond) Neurosurgical ICU	3.3%	4.1%	0.0%
Mater Misericordiae University Hospital HDU	1.1%	11.0%	0.4%
Mater Misericordiae University Hospital ICU	0.6%	8.8%	0.1%
Our Lady of Lourdes Hospital Drogheda ICU	1.0%	4.1%	0.2%
St James's Hospital Cardiothoracic ICU	1.3%	13.5%	0.4%
St James's Hospital General ICU	1.6%	14.2%	0.4%
Tallaght University Hospital ICU	1.1%	15.2%	0.4%
University Hospital Galway ICU	3.0%	10.6%	1.2%
University Hospital Limerick ICU	2.4%	8.6%	0.2%
University Hospital Waterford ICU	0.7%	11.4%	0.0%
Regional Hospital Mullingar ICU	2.2%	5.4%	0.0%
Wexford General Hospital ICU	1.1%	5.3%	0.0%
Connolly Hospital ICU	0.9%	4.7%	0.3%
Midland Regional Hospital Tullamore ICU	5.5%	21.0%	0.0%
Naas General Hospital ICU	9.4%	25.4%	0.0%
St Luke's General Hospital Carlow/Kilkenny ICU	4.6%	14.1%	0.5%
St Vincent's University Hospital ICU	1.4%	26.7%	0.6%
Cork University Hospital Cardiothoracic ICU	1.3%	6.6%	0.5%
Cork University Hospital General ICU	1.1%	9.0%	0.0%
Letterkenny University Hospital ICU	2.4%	*	0.4%
Tipperary University Hospital Clonmel ICU	2.7%	8.6%	0.5%
University Hospital Kerry ICU	0.0%	15.5%	0.0%
Cavan General Hospital ICU	1.0%	6.0%	0.5%
Mercy University Hospital Cork ICU	2.6%	6.2%	0.3%
Sligo University Hospital ICU	4.3%	4.3%	0.4%

* Less than 20% of admissions were tested on admission to the Unit.

UNIT-ACQUIRED COLONISATION

Unit-acquired colonisation is defined as newly positive cultures of an organism in any sample taken more than 48 hours after admission to the Unit and while the patient is still in the Unit. This somewhat underestimates the true rate of unit-acquired colonisation, as there is no follow up on samples taken on the wards after Unit discharge and those identified within 48 hours after discharge from an ICU will be missed. Nevertheless, the available data indicate that Unit-acquired colonisation by MDROs in 2021 was relatively rare (Table 7.3).

Rates of colonisation also depend on frequency of testing; the more testing that is undertaken, the more cases that will be detected. Our data document whether the patient was tested at least once but do not specify how many times an individual patient was tested.

Testing for these organisms, including testing of asymptomatic patients, is carried out routinely in most Units; Assuming that such testing, including testing of asymptomatic patients, was routinely carried out in 2021, rates of colonisation with MDROs in ICU were relatively low. Units where less than 90% of patients were tested are marked with an asterisk.

TABLE 7.3: UNIT-ACQUIRED COLONISATION BY MULTIDRUG-RESISTANT ORGANISMS (RATE PER 1,000 PATIENT DAYS) (ALL PATIENTS)

Unit	Unit-acquired infections (rate per 1000 patient days)			
	MRSA	*C. difficile*	VRE	CPE
Beaumont Hospital General ICU	0.3	0.8*	3.8*	0.2
Beaumont Hospital (Richmond) Neurosurgical ICU	0.6	1.5*	2.1*	0.3
Mater Misericordiae University Hospital HDU	0.5	0.2*	2.4*	0.0
Mater Misericordiae University Hospital ICU	0.0	0.3*	4.7	0.2
Our Lady of Lourdes Hospital Drogheda ICU	0.6	0.6*	3.2	0.3
St James's Hospital Cardiothoracic ICU	1.1	0.0*	13.4	0.0
St James's Hospital General ICU	0.3	0.2*	7.5*	0.2
Tallaght University Hospital ICU	0.5	0.5*	5.8	0.0
University Hospital Galway ICU	0.2	0.0*	1.8	0.2
University Hospital Limerick ICU	0.0	0.0*	4.0	0.7
University Hospital Waterford ICU	1.5	1.0*	7.6*	0.5*
Regional Hospital Mullingar ICU	0.5	0.0*	6.2	0.5
Wexford General Hospital ICU	0.0	0.0*	0.6*	0.6*
Connolly Hospital ICU	0.5	0.0*	2.9	0.5
Midland Regional Hospital Tullamore ICU	0.0	0.0*	3.6	0.0
Naas General Hospital ICU	0.0	0.0*	7.1*	0.0
St Luke's General Hospital Carlow/Kilkenny ICU	0.0*	0.7*	4.1*	0.7
St Vincent's University Hospital ICU	0.1	0.3*	9.1	0.0
Cork University Hospital Cardiothoracic ICU	0.0	1.0*	5.2	0.0
Cork University Hospital General ICU	0.5	0.5*	7.1*	0.2*
Letterkenny University Hospital ICU	0.0	1.9*	3.2*	0.0
Tipperary University Hospital ICU	0.6	0.6*	1.9	0.0
University Hospital Kerry ICU	0.0	0.0*	4.6*	0.0*
Cavan General Hospital ICU	0.9	0.9*	6.0*	0.9*
Mercy University Hospital Cork ICU	0.0	0.5*	5.1*	0.0
Sligo University Hospital ICU	0.0	0.8*	1.5	2.3

* Fewer than 90% of patients were tested during their stay in the Unit.

KEY FINDINGS FROM CHAPTER 7

- Of the 18 hospitals with adequate data for ICU-access KPI analysis, only one met the target of 50% of admissions occurring within one hour of a decision to admit. Fifteen hospitals met the target of 80% of patients being admitted within 4 hours of a decision to admit. Once a decision is made to admit a critically ill patient to ICU, this should happen immediately. The findings from these two key performance indicators (KPIs) have informed Recommendation 2 within this report. This recommendation is to develop and implement a national policy that each Unit should keep one staffed ICU bed empty to be available for immediate admission of critically ill patients, if this can be achieved by discharge of a patient who has been declared clinically ready for discharge.
- 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 range in St Vincent's University Hospital ICU, Connolly Hospital and Cork University Hospital General ICU; this was most likely due to a shortage of ICU beds. All other participating Units were within acceptable limits.
- Two Units (University Hospital Galway ICU and Cavan General Hospital ICU) were outside the expected limits for numbers of unplanned discharges from ICU at night. This usually indicates that patients were discharged to the ward between 22.00 and 07.00 without being fully ready in order to provide a bed for another patient who was sicker. This is not good practice.
- Unplanned readmission to ICU within 48 hours of discharge is a key metric for the quality of care of critically ill patients. All Units were within acceptable limits for this Quality Indicator.
- Mortality in ICUs nationally was 18%, and a further 6% of patients died before leaving the acute hospital. Thus, 76% of patients admitted to ICU/HDU in 2021 survived to leave hospital. This compares to a 79% survival rate in 2020.
- Risk-adjusted mortality expressed by the standardised mortality ratio (SMR, the ratio of observed deaths to predicted deaths, $ICNARC_{H\text{-}2018}$ model) in the ROI was similar to that in the UK.
- All individual Units in the ROI were within the acceptable limits for risk-adjusted mortality rates. This is a very important finding demonstrating consistently acceptable outcomes across Units of varying sizes, with different patient characteristics, and with differences in case mix.
- The overall national value for SMR was 1.16, an increase from the 2020 value of 1.05.[13]
- Risk-adjusted mortality as assessed by SMRs was examined for both low-risk patients (those whose predicted risk of death was less than 20% on admission to ICU) and high-risk patients (those whose predicted risk of death was greater than 20% on admission to ICU). No Units were outliers for risk-adjusted mortality rates for either low-risk or high-risk patients in 2021.
- The SMR for aggregated data from high-risk admissions for the 13 Units with fewer than 200 Level 3 admissions each per annum (Figure 5.3) was 1.16, compared with an SMR of 1.08 for the 13 Units with more than 200 Level 3 admissions each. This provides encouraging data on the outcomes for patients admitted initially to smaller Units, which are similar to outcomes for patients admitted to larger Units.
- Rates of testing for MDROs were high in most Units. Rates of colonisation with MDROs were high at the time of admission to ICU, but rates of transmission while in ICU were low.

[13] Reassuringly, provisional data for Quarters 1-3 2022 show an SMR value of 1.07

CHAPTER 8
ORGAN DONATION

CONTENTS >

CHAPTER 8: **ORGAN DONATION**

The majority of patients admitted to ICU survive to leave hospital (76% in 2021; Figure 7.6). Of the 24% who die, some may have the potential to help patients suffering from failure of a vital organ through organ donation and transplantation, if that is consistent with their values and beliefs.

Death can be defined according to either circulatory criteria or neurological criteria. Most deaths are defined by loss of circulation function (circulatory death). A smaller number of deaths are defined by neurological criteria, where patients have adequate circulatory function, but no brainstem function (brain death).

Patients who have been diagnosed as 'dead by neurological criteria' or 'brain dead' are the most important group of potential organ donors. Brain death is rare and is becoming even rarer with improvements in road safety and in the management of brain injury. Maximising the number of brain-death patients who become organ donors is key to maximising the number of patients who receive life-saving organ transplantation. The benefits of organ donation for the donor's family cannot be overemphasised, and we should aim to offer the option of organ donation where appropriate as an integral part of end-of-life care. To drive improvements in this area, it is vitally important to audit both clinical practice and the numbers of organ donors.

END OF LIFE AND ORGAN DONATION

Brain death was diagnosed in 103 patients in the Units audited in 2021, representing 5.2% of all Unit non-survivors (Table 8.1 and Figure 8.1). This was a lower rate of diagnosed brain death than in 2020 (6.5% of all Unit deaths, 98 patients) in 2020. The conversion rate from brain death to organ donation was 48.5% in 2021 (50 patients) compared to a conversion rate of 50% in 2020.

Ten patients became organ donors after circulatory death, up from six in 2020 (Tables 8.1 and 8.2) This represented 0.5% of all circulatory deaths, a considerably lower percentage than in the UK (1.7%).

TABLE 8.1: BRAIN DEATH AND ORGAN DONATION IN THE REPUBLIC OF IRELAND AND THE UNITED KINGDOM

Brain death and organ donation	ROI	UK
Number of Unit deaths (% of all admissions)	1991 (16.4%)	(14.8%)
Number of brain-death patients (% of Unit deaths)	103 (5.2%)	(5.0%)
Number of patients who donated organs after brain death (% of brain deaths)	50 (48.5%)	(49.1%)
Number of patients who donated organs after circulatory death (% of circulatory deaths)	10 (0.5%)	(1.7%)

Numbers of organ donors fell during the period of the COVID pandemic (Table 8.2). This was related to a decrease in the numbers of brainstem deaths and a decrease in the conversion rate from brain death to organ donation. The reasons for these changes are likely to be multiple.

TABLE 8.2: TRENDS IN ORGAN DONATION 2019–21

Organ Donation Process	2019	2020	2021
Total number of deaths audited	1429	1518	1991
Brainstem deaths	110	98	103
Brainstem death as % of all deaths	7.7%	6.5%	5.2%
Donors after brainstem death	59	49	50
Brainstem death; donation rate	53.6%	50.0%	48.5%
Circulatory deaths	1319	1420	1888
Donors after circulatory death	8	6	10
Circulatory death; donation rate	0.6%	0.4%	0.5%
Total deceased donors	67	55	60
Overall organ donation rate (% of deaths)	4.7%	3.6%	3.0%

RATE OF DIAGNOSIS OF BRAIN DEATH

Any patient who is likely to fulfil the criteria for brain death should have this confirmed by the formal diagnostic process for establishing brain death (Dwyer et al., 2020). This provides certainty to staff and family that the patient has died, allows a rapid end to futile care, maximises the potential for organ donation, and provides meaningful data on the potential for organ donation after brain death (DBD).

The incidence of brain death may vary because of the case mix in a Unit, so that a Neuro Critical Care Unit will have a high incidence and a Cardiothoracic Unit will have a low incidence. Lower rates of determination of brain death may also occur because of unfamiliarity with the procedure for brainstem testing, or because awareness of organ donation is not high. The percentage of deaths in each Unit diagnosed using neurological criteria to establish death (i.e. brain death) is shown in Figure 8.1.

The rate of diagnosis of death by brain-death criteria was highest in the Neurosurgical centres (Beaumont and Cork University Hospital). Outside these, rates varied from 0% to 7% (Figure 8.1).

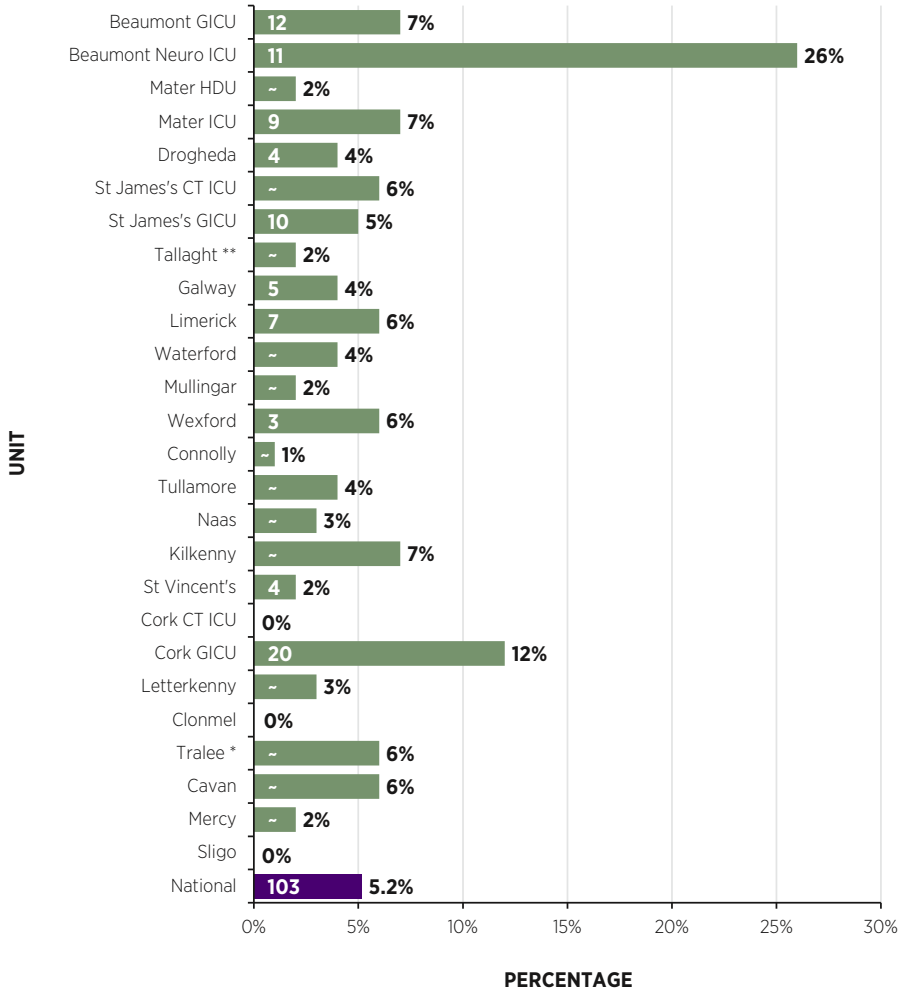


FIGURE 8.1: NUMBERS OF BRAIN-DEATH PATIENTS IN EACH UNIT AND PERCENTAGE OF ALL UNIT DEATHS DIAGNOSED AS BRAIN DEATHS, 2021

~ Fewer than three brain death patients
* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

PROGRESSION FROM BRAIN DEATH TO ORGAN DONATION

The numbers of patients nationally who progressed from diagnosis of brain death to organ donation are shown in Figure 8.2. The assent rate by families when organ donation was requested was 72%, which is high by international standards.

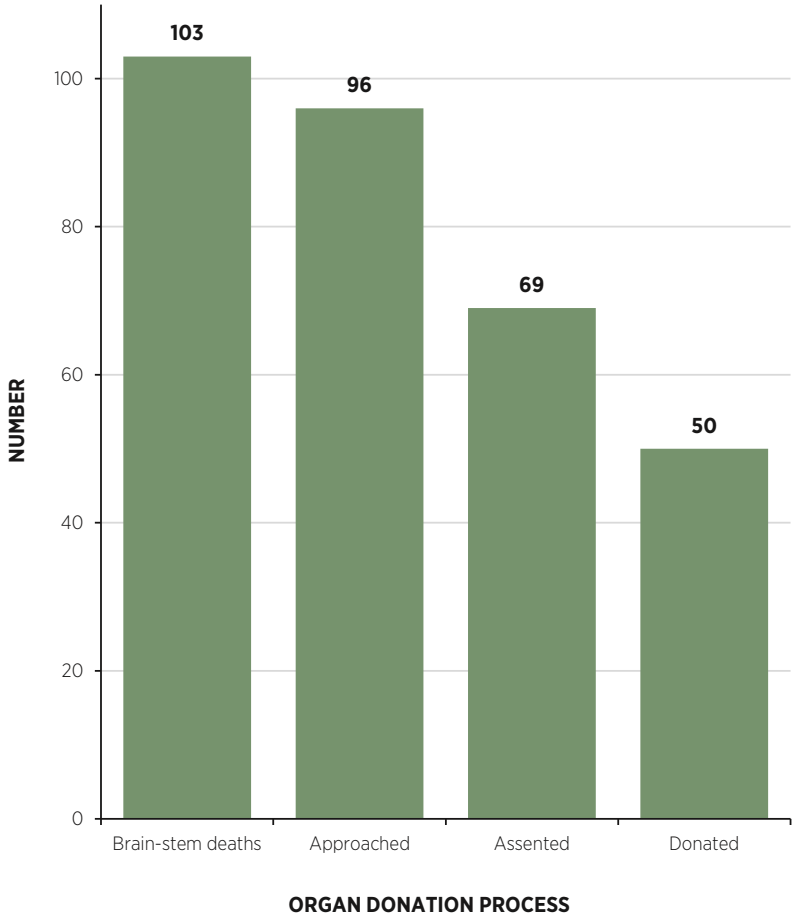


FIGURE 8.2: PROGRESSION OF PATIENTS ALONG THE PATHWAY FROM BRAIN DEATH TO ORGAN DONATION; NATIONAL DATA

The reasons why patients with brain death did not progress to organ donation are shown in Figure 8.3. The most common reason was families withholding assent to organ donation (27 patients). The reasons for not approaching potential organ donors or for not proceeding with organ donation despite assent from families are also included in Figure 8.3.

For a variety of reasons, 19 patients (28% of those whose families assented) did not proceed to donation (Figure 8.3); this compares to 21% not progressing to donation in 2020. The most common reason for non-progression to donation (12 patients) was that the organs were considered unsuitable by the transplant teams.

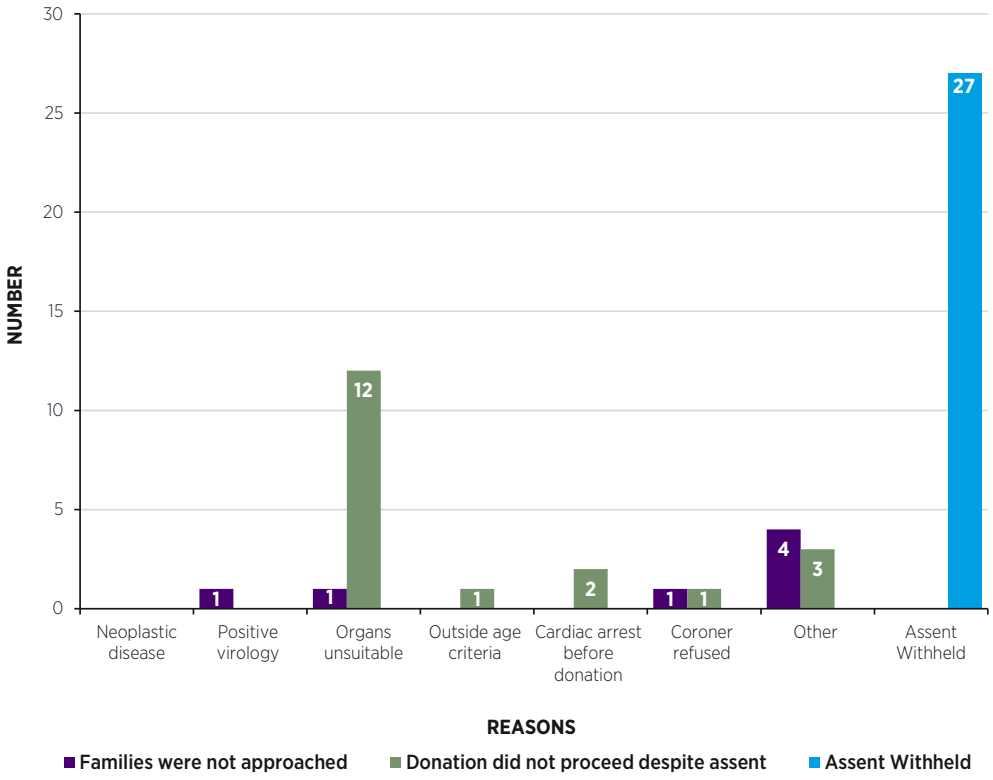


FIGURE 8.3: BRAIN-DEATH PATIENTS WHO DID NOT BECOME ORGAN DONORS (i) REASONS FAMILIES WERE NOT APPROACHED, (ii) REASONS DONATION DID NOT PROCEED DESPITE ASSENT, (iii) ASSENT WITHELD

Data from individual Units show the percentages of brain-death patients in each Unit: (i) who progressed to organ donation; (ii) whose families assented but the patient did not progress to organ donation for a variety of reasons; (iii) whose families were not approached to seek assent; or (iv) whose families withheld assent (Figure 8.4).

The percentage of brain-death patients who progressed to organ donation in 2021 varied considerably between Units with > 3 patients, (ranging from 0% to 70%, and with a national rate of 48.5%; Figure 8.4). The reasons for this variability should be examined locally in Units with low rates of conversion from brain death to organ donation, by local organ donation staff and by Organ Donation and Transplant Ireland (ODTI).

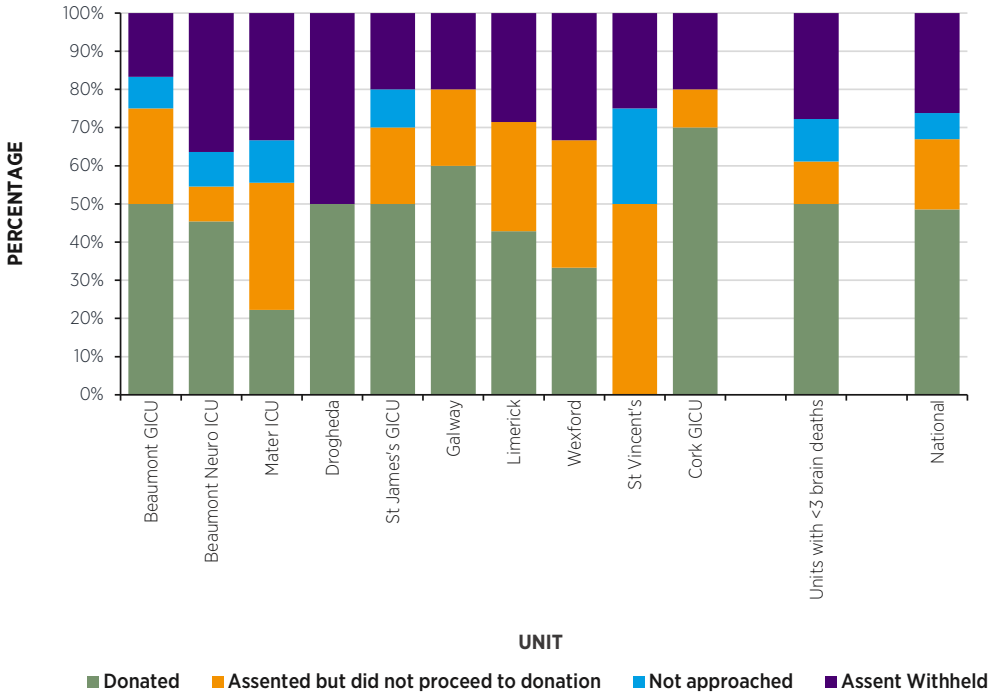


FIGURE 8.4: BRAIN-DEATH PATIENTS WHO DONATED ORGANS, OR REASONS FOR NOT DONATING; UNIT LEVEL DATA, 2021

Note: Only Units with three or more brain-death patients are shown individually. Data from all Units with fewer than three brain death patients each are aggregated and displayed together.

It is considered good practice to refer all patients diagnosed with brain death to organ donation personnel for consideration as organ donors. There are few absolute contraindications to organ donation from brain-death patients, and even patients who seem unsuitable as donors may be considered in certain circumstances. Data on rates of referral for each Unit are shown in Figure 8.5.

Failure to refer potential organ donors may have occurred because families had already indicated that they would not assent to donation; this situation is not documented in this audit.

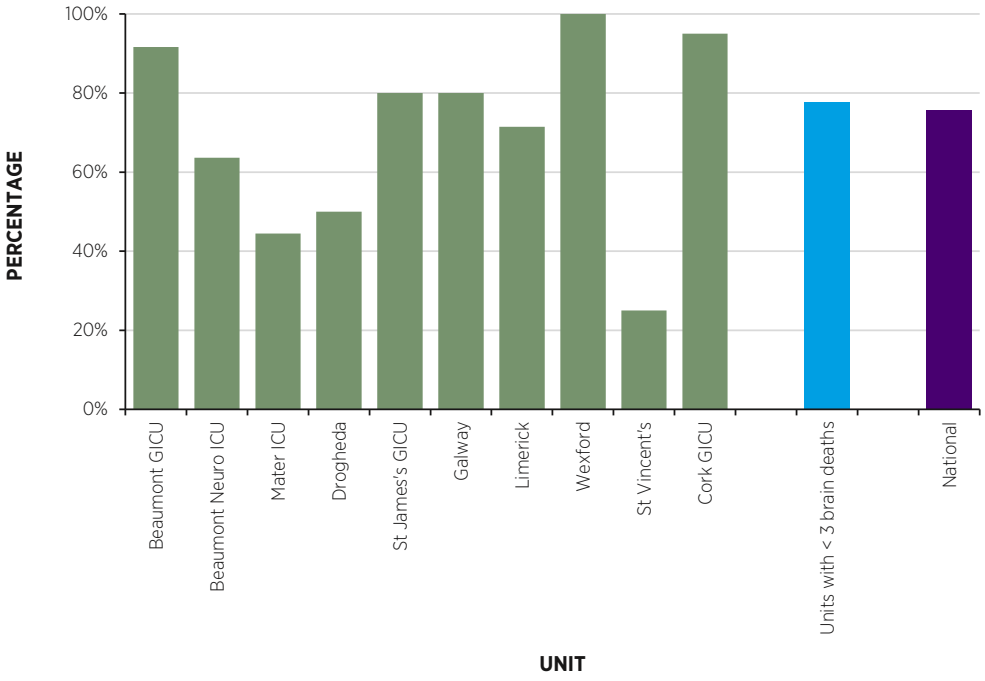


FIGURE 8.5: PERCENTAGE OF PATIENTS DIAGNOSED AS BRAIN-DEAD WHO WERE REFERRED TO ORGAN-DONATION PERSONNEL

Note: Only Units with three or more brain death patients are shown individually. Data from all Units with fewer than three brain death patients are aggregated and displayed together.

ORGAN DONATION AFTER CIRCULATORY DEATH

The number of patients diagnosed with brain death has diminished in recent years, and it will become increasingly important to offer opportunities for donation after circulatory death (DCD) to families of relevant potential donors. Almost without exception, only patients who die from a neurological condition are suitable for DCD, and only a small proportion of patients with neurological conditions are suitable to become organ donors. It is important, therefore, that all patients dying from a neurological condition are considered as potential organ donors, and all such patients should be referred to organ donation personnel for consideration. Figure 8.6 shows the percentage for each Unit of those who died as defined by circulatory criteria and who had been referred to organ donation personnel in 2021 before death.

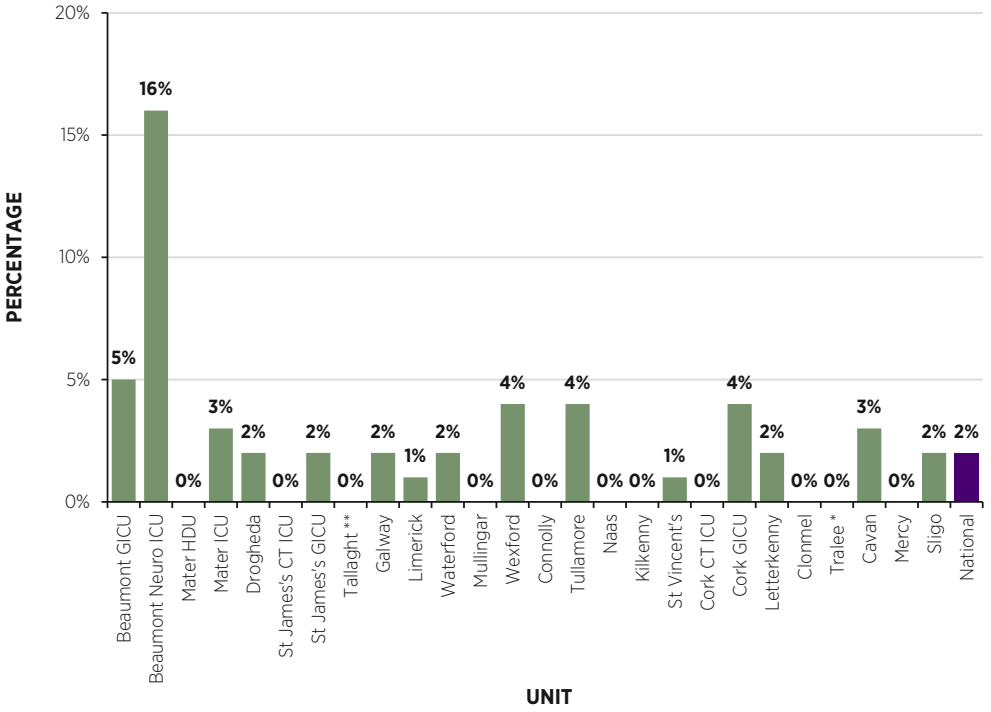


FIGURE 8.6: PERCENTAGE OF CIRCULATORY DEATHS REFERRED TO ORGAN-DONATION PERSONNEL

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

Only a very small proportion of patients became organ donors after death confirmed by circulatory criteria (Figures 8.7 and 8.8).

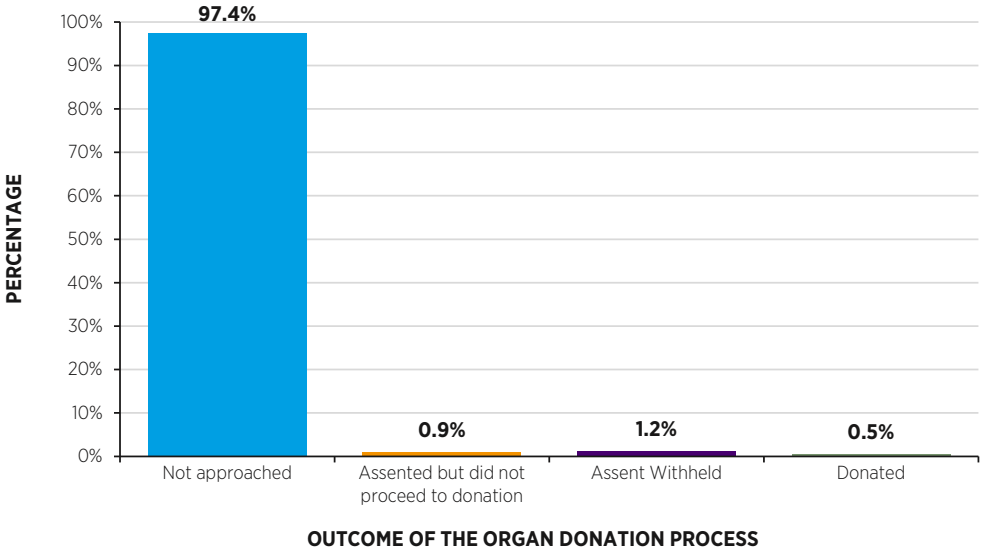


FIGURE 8.7: PERCENTAGE OF PATIENTS NATIONALLY WHO DID AND DID NOT BECOME ORGAN DONORS AFTER DEATH DIAGNOSED BY CIRCULATORY CRITERIA

Figure 8.8 shows the rates for individual Units of approaching families and progressing to organ donation in patients with circulatory death. The Neuro Critical Care Units were the most active, in keeping with their case mix of patients with neurological disease.

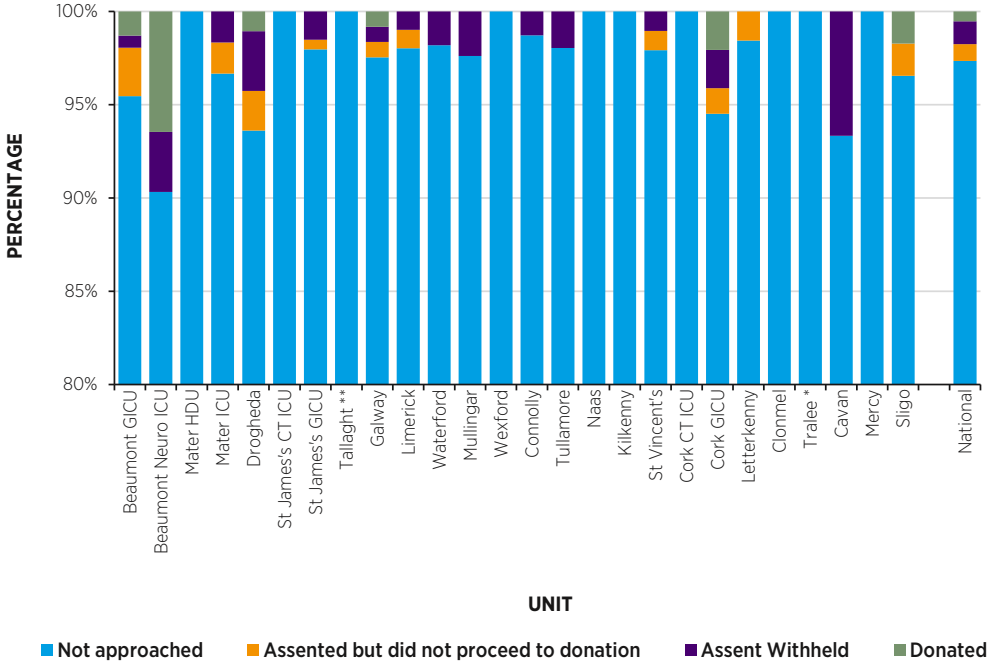


FIGURE 8.8: PERCENTAGE OF PATIENTS IN EACH UNIT WHO DID AND DID NOT BECOME ORGAN DONORS AFTER DEATH DIAGNOSED BY CIRCULATORY CRITERIA

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

Patients are not normally suitable for DCD unless they have died from a neurological condition. The most common reason why patients do not become organ donors after circulatory death is because they died from a cause other than a neurological condition (Figure 8.9). Other reasons are also shown in Figure 8.9.

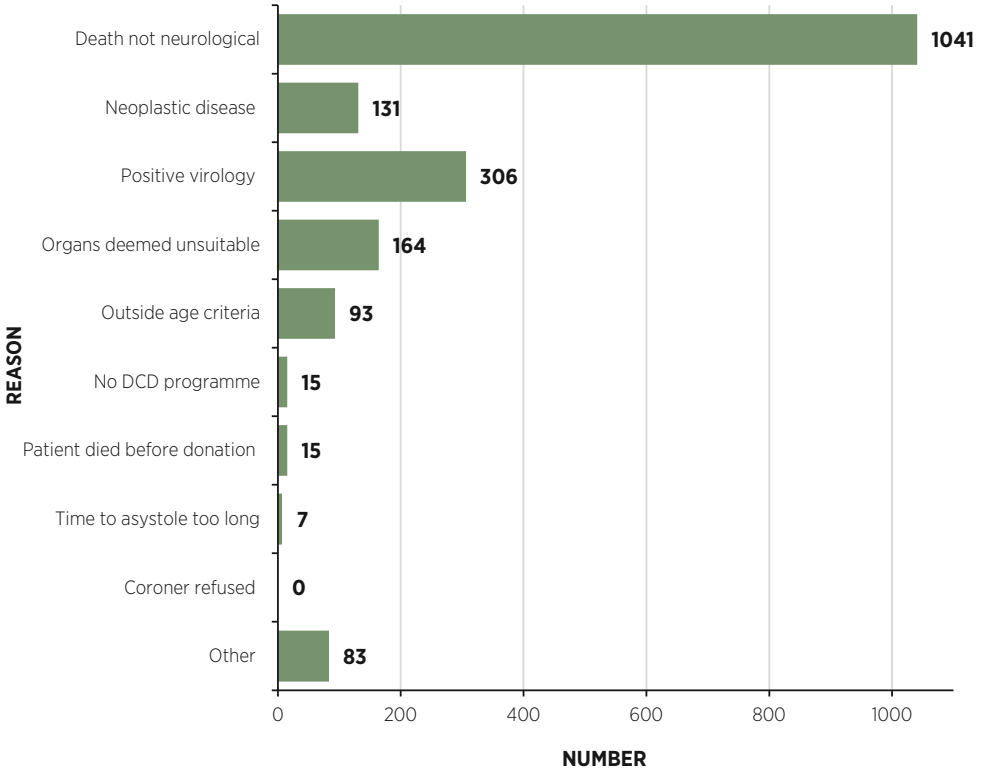


FIGURE 8.9: REASONS FOR NOT APPROACHING FAMILIES TO REQUEST ORGAN DONATION AFTER CIRCULATORY DEATH AND REASONS FOR NOT PROCEEDING DESPITE ASSENT

The numbers of organ donors from each hospital participating in INICUA in 2021 are shown in Table 8.3.

TABLE 8.3: ORGAN DONORS AFTER BRAIN DEATH AND AFTER CIRCULATORY DEATH IN EACH PARTICIPATING HOSPITAL (DATA FROM HOSPITALS WITH FEWER THAN THREE DONORS ARE AGGREGATED)

Hospital	Donors after brain death	Donors after circulatory death
Cork University Hospital	14	3
Beaumont Hospital	11	4
St James's Hospital	5	0
University Hospital Galway	3	1
University Hospital Limerick	3	0
Our Lady of Lourdes Hospital, Drogheda	2	1
Other hospitals (< three donors each)	12	1
Total	**50**	**10**

KEY FINDINGS FROM CHAPTER 8

- The numbers of brain death patients documented by ICU Audit increased from 98 in 2020 to 103 in 2021 as the number of all deaths covered by the audit increased, but brain deaths as a percentage of all deaths fell from 6.5% to 5.2%.
- The rate of diagnosis of death by brain-death criteria was highest in the Neurosurgical centres (Beaumont and Cork University Hospital). Outside of these centres, rates varied from 0% to 7% (Figure 8.1). Nationally, brain death patients made up 5.2% of all deaths.
- The number of donors after brain death (DBD) was 50. This represented a conversion rate from brain death to organ donation of 48.5% nationally, compared with 50% in 2020.
- Conversion rates from brain death to organ donation ranged from 0% to 70% in Units with three or more brain-death patients in 2021. The reasons for this variability are unknown and should be reviewed by ODTI and within each Unit.
- The rate of assent by families when organ donation was requested was 72%. This is high by international standards.
- Nineteen (28%) out of 69 patients whose families assented did not proceed to donation, most commonly (12 patients) because the organs were considered unsuitable by the transplant teams.
- 76% of all brain-death patients were referred to organ donation personnel for consideration regarding organ donation.
- Only 2% of circulatory death patients were referred to organ donation personnel, and referral rates were very low or zero in some Units. Even though the number of patients suitable for DCD is small, there is potential to increase DCD by considering this option for more patients
- Ten patients became organ donors after circulatory death in 2021, an increase from six in 2020. These donors made up 0.5% of all circulatory deaths, compared with 1.7% in the UK.

CHAPTER 9

COVID-19 PATIENTS IN ICU

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CHAPTER 9: **COVID-19 PATIENTS IN ICU**

COVID-19 PATIENTS IN ICU, 2021

The year 2021 was dominated by COVID-19, both in daily life and in healthcare. This was especially true in ICU because of the large numbers of patients with COVID-19 who required care in ICU.

The data presented in this chapter comes from both INICUA and the ICU-BIS. There may be minor variations between the data presented from each source, both because ICU-BIS collects data from 26 hospitals compared to 22 hospitals audited by INICUA and because data from INICUA is collected in a more standardised way and is validated by ICNARC.

Numbers of admissions fluctuated throughout the year, with a pronounced peak in January and a lesser peak in November 2021 (Figure 9.1).

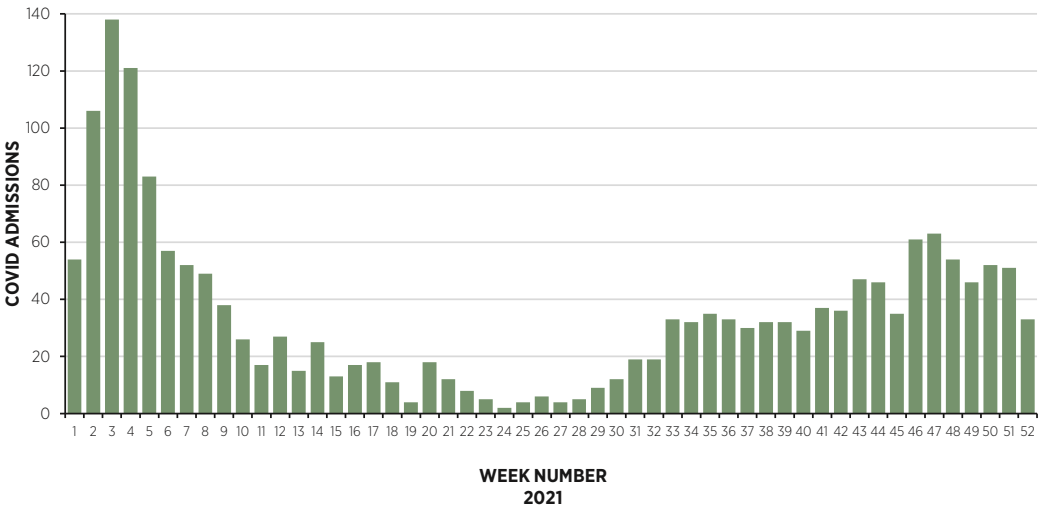


FIGURE 9.1: NUMBER OF NEW PATIENTS CRITICALLY ILL WITH CONFIRMED COVID-19 ADMITTED BETWEEN JANUARY AND DECEMBER 2021, BY WEEK OF ADMISSION TO CRITICAL CARE (Source ICU Bed Information System)

EPIDEMIOLOGY AND MORTALITY

INICUA data for 2021 documented 1,785 admissions of 1,671 patients admitted to ICU with a diagnosis of COVID. This represented 14.6% of all patients admitted to ICU in 2021. Five hundred and fifty-seven patients died before leaving ICU, giving a crude ICU mortality rate of 33.4%. Six hundred and three patients died before discharge from acute hospital, giving a crude hospital mortality rate of 36%. This compares to a 24% hospital mortality rate for the overall ICU population.

The crude ICU mortality rate for COVID-19 patients admitted to ICU in Quarters 1 and 2 (Q1-2) in 2020 was 16%. This increased to a crude mortality rate of 31% in Quarters 3 and 4, (Q3-4), giving an overall mortality rate for COVID-19 patients admitted to ICU during 2020 of 22%. Patients admitted during Q1–2 2020 were less hypoxic on admission to ICU (median PaO2/FiO2 ratio = 17.1, compared to 14.0 during Q3-4 2020 and 13.1 during 2021), which partly explains better outcomes. A more virulent strain of COVID-19 is also a possible explanation for higher mortality rates during later phases of the pandemic. Patient characteristics are described in Tables 9.1 and 9.2.

TABLE 9.1: CHARACTERISTICS OF PATIENTS ADMITTED TO ICU IN IRELAND AND THE UNITED KINGDOM WITH COVID-19 DURING 2021

	Republic of Ireland	United Kingdom
Age (years); mean (SD)	57.7 (14.5)	56.2 (14.4)
Age (years); median (IQR)	60 (48, 69)	58 (47, 67)
Sex (male / female)	61% / 39%	63% / 37%
BMI > 40	12.3%	12.8%
% females aged 16-49 currently or recently pregnant	33.2%	22.6%
Fully independent living before hospital admission	88.4%	88.9%
Very severe comorbidities	14.9%	10.9%

TABLE 9.2: INDICATORS OF ILLNESS SEVERITY AT THE TIME OF ADMISSION IN PATIENTS ADMITTED TO ICU WITH COVID-19 DURING 2021

	Republic of Ireland	United Kingdom
Invasively ventilated within 24 hours	36.7%	28.8%
PaO2/FiO2 ratio (kPa, median)	13.1	13.2
APACHE II score (mean / median)	15.3 / 15	14.0 / 13

TABLE 9.3: CRITICAL CARE OUTCOMES OF PATIENTS ADMITTED TO ICU WITH COVID-19 DURING 2021

	Republic of Ireland	United Kingdom
Survival to ICU discharge	68.4%	65.3%
Duration of ICU care (days, median) Survivors / non-survivors	9 / 15	7 / 12
Organ support; invasive ventilation	58.1%	53.1%
Advanced CVS support	18.7%	21.9%
Renal support	15.4%	15.6%

An important sub-group to consider is patients admitted to ICU who received invasive ventilatory support, as this defines a similar degree of illness severity in each country.

Data in Tables 9.4 and 9.5 show a number of prognostic indicators which would predict a worse outcome in the ROI patients (age, comorbidities, APACHE II score) but mortality was lower in the ROI patients Table 9.6).

TABLE 9.4: CHARACTERISTICS OF PATIENTS ADMITTED TO ICU IN IRELAND AND THE UNITED KINGDOM WITH COVID-19 DURING 2021 WHO RECEIVED INVASIVE VENTILATORY SUPPORT

	Republic of Ireland	United Kingdom
Age (years); mean (SD)	58.8 (13.7)	56.6 (13.2)
Age (years); median (IQR)	61 (50, 69)	58 (49, 66)
Sex (male / female)	62% / 38%	65% / 35%
BMI > 40	11.6%	12.5%
% female admissions aged 16-49 who were currently or recently pregnant	34.0%	21.7%
Fully independent living before hospital admission	90.1%	90.3%
Very severe comorbidities	13.9%	10.7%

TABLE 9.5: INDICATORS OF ILLNESS SEVERITY AT THE TIME OF ADMISSION IN PATIENTS ADMITTED TO ICU WITH COVID-19 DURING 2021 WHO RECEIVED INVASIVE VENTILATORY SUPPORT

	Republic of Ireland	United Kingdom
Days in hospital stay before ICU admission (mean / median)	7.1 / 3	3.2 / 1
PaO2/FiO2 ratio (kPa, median)	12.0	12.0
APACHE II score (mean / median)	16.4 / 16	15.1 / 14

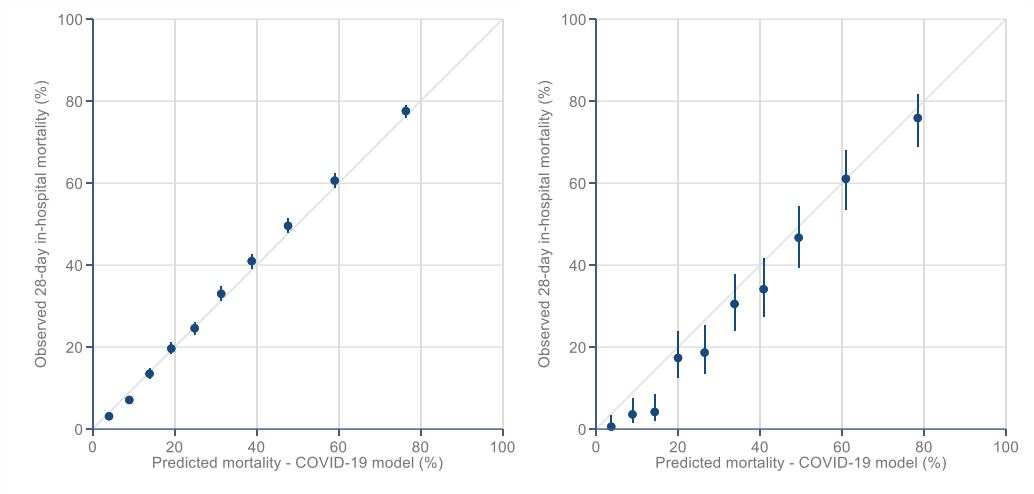
TABLE 9.6: CRITICAL CARE OUTCOMES OF PATIENTS ADMITTED TO ICU WITH COVID-19 DURING 2021 WHO RECEIVED INVASIVE VENTILATORY SUPPORT

	Republic of Ireland	United Kingdom
Survival to ICU discharge	51.4%	47.2%
Duration of ICU care (days, median) Survivors / non-survivors	25 / 17	19 / 14
Organ support; Advanced CVS support	30.8%	39.5%
Renal support	24.7%	26.3%

RISK-ADJUSTED 28-DAY IN-HOSPITAL MORTALITY FOR COVID-19 PATIENTS (NATIONAL DATA 2021)

Because of the multiple factors that contribute to the risk of death in COVID patients, the crude mortality rate quoted above does not assess the quality of care provided. ICNARC developed a 28-day in-hospital mortality risk-prediction model using early UK pandemic data (March-April 2020) data; this was subsequently recalibrated for the second wave (September–December 2020). For the INICUA 2021 COVID-19 report, ICNARC then refitted this model, using data for patients admitted from January to December 2021. Using this risk-prediction model, ROI risk-adjusted 28-day in-hospital mortality data for 2021 are benchmarked below against UK data for 2021.

Figure 9.2 shows the observed mortality rate compared to predicted mortality in UK Units and in ROI Units across a range of predicted mortality rates. Observed mortality for UK Units aligned closely with predicted mortality across the range of predicted mortality rates. The observed mortality for ROI Units was less than predicted for patients in the lower range of predicted mortality but was aligned with predicted mortality at higher levels of predicted mortality.



UK: Q1-Q4 2021 **ROI: Q1-Q4 2021**

FIGURE 9.2: OBSERVED 28-DAY MORTALITY FOR EACH DECILE OF PREDICTED MORTALITY IN COVID-19 PATIENTS ADMITTED TO INTENSIVE CARE UNITS IN THE UNITED KINGDOM AND IN THE REPUBLIC OF IRELAND, 2021 (Source: INICUA and ICNARC UK data)

STANDARDISED MORTALITY RATIOS

ICNARC has reported SMRs for patients admitted to individual Units during 2021 (Figure 9.3 and Table 9.7). The reported SMR relates to the Unit to which patients were first admitted, even if those patients were subsequently transferred elsewhere. Transfers into a Unit from another ICU are not included when calculating the SMR for the receiving Unit. The SMRs for all Units were within the expected range, i.e. ± 2 SDs from the mean (Figure 9.3). The overall national SMR (ratio of observed to predicted deaths) for all COVID patients admitted to ICU in ROI was 0.87.

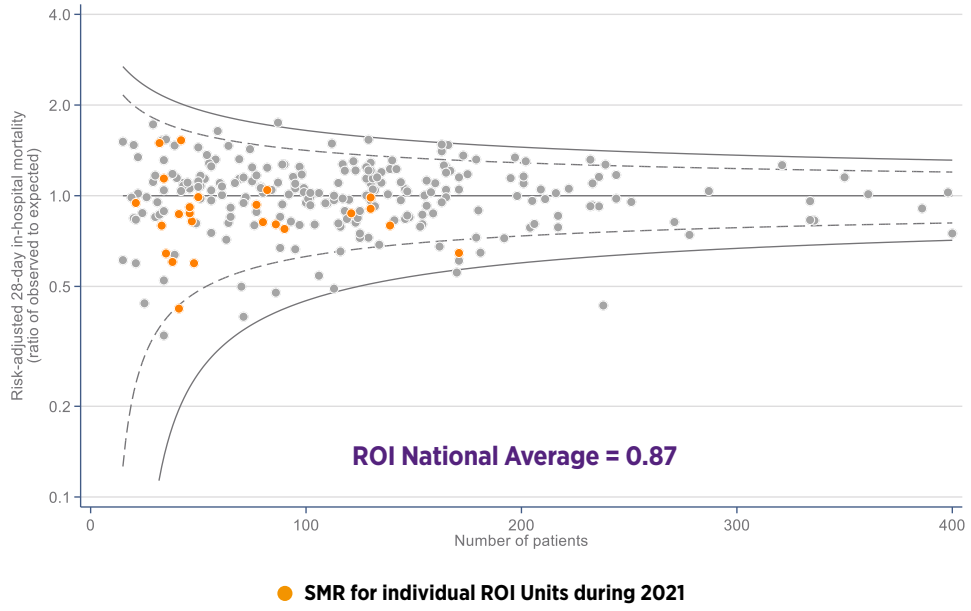


FIGURE 9.3: STANDARDISED MORTALITY RATIOS FOR INDIVIDUAL UNITS FOR PATIENTS ADMITTED WITH COVID-19, 2021 (Source: INICUA and ICNARC UK data)

Values for the numbers of patients with COVID-19 initially admitted to each Unit and the SMR for these patients are shown in Table 9.7. The SMR for aggregated data for patients initially admitted to 13 smaller Units (< 200 Level 3 admissions per annum, Figure 5.5) was 0.87. The SMR for aggregated data for patients initially admitted to 13 larger Units (> 200 Level 3 admissions per annum, Figure 5.5) was 0.87.

TABLE 9.7: NUMBERS OF COVID-19 PATIENTS ADMITTED TO INTENSIVE CARE UNITS PARTICIPATING IN THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT AND STANDARDISED MORTALITY RATIOS (SMR)

Unit	Number of patients	SMR
Beaumont Hospital General ICU	130	0.99
Mater Misericordiae University Hospital HDU	171	0.65
Mater Misericordiae University Hospital ICU	130	0.91
Our Lady of Lourdes Hospital Drogheda ICU	82	1.04
St James's Hospital Cardiothoracic ICU & General ICU ***	147	0.81
Tallaght University Hospital Intensive Care Unit **	41	0.42
University Hospital Galway Intensive Care Unit	121	0.87
University Hospital Limerick Intensive Care Unit	77	0.93
University Hospital Waterford Intensive Care Unit	46	0.92
Regional Hospital Mullingar Intensive Care Unit	42	1.53
Wexford General Hospital Intensive Care Unit	38	0.60
Connolly Hospital Intensive Care Unit	50	0.99
Midlands Regional Hospital Tullamore Intensive Care Unit	46	0.87
Naas General Hospital Intensive Care Unit	34	1.14
St Luke's General Hospital Intensive Care Unit	48	0.60
St Vincent's University Hospital Intensive Care Unit	80	0.82
Cork University Hospital Cardiothoracic Intensive Care Unit	35	0.64
Cork University Hospital General Intensive Care Unit	90	0.78
Letterkenny University Hospital Intensive Care Unit	86	0.80
Tipperary University Hospital Intensive Care Unit	33	0.80
University Hospital Kerry Intensive Care Unit *	21	0.95
Cavan General Hospital Intensive Care Unit	47	0.82
Mercy University Hospital Intensive Care Unit	32	1.50
Sligo University Hospital Intensive Care Unit	41	0.87
Total	1668	0.87

Note: there were no admissions of COVID-19 patients to Beaumont Neurosurgical ICU.

* University Hospital Kerry ICU submitted data for only 3 months of 2021.
** Tallaght University Hospital ICU submitted data for only 6 months of 2021.
*** Units combined for the hospital, as CTICU has less than 15 patients admitted.

KEY FINDINGS FROM CHAPTER 9

- One thousand six hundred and seventy-one patients with COVID-19 were admitted to the audited ICUs during 2021. The crude ICU mortality rate was 33%, and the hospital mortality rate was 36%. This compared to a crude hospital mortality rate of 24% for the overall ICU population.
- Demographic data for ROI patients were comparable to those for UK patients.
- The ICNARC 28-day in-hospital mortality SMR for COVID-19 patients in the ROI during 2021 (observed versus predicted number of deaths) was 0.87 compared to the benchmark value for the UK of 1.0.
- In patients who required invasive ventilatory support, indicators of illness severity were worse in ROI patients, but ICU survival was slightly better (51% versus 47% for the UK).
- Risk-adjusted 28-day in-hospital mortality rates for COVID-19 patients in the ROI were lower than those in the UK for patients with a lower predicted risk of 28-day in-hospital mortality, but were similar to UK rates for those with higher predicted risk.
- All individual Units had an SMR within the expected range i.e. risk-adjusted 28-day in-hospital mortality rates were acceptable indicating that the quality of care provided was acceptable across all Units.
- The SMR for patients initially admitted to smaller hospitals (< 200 Level 3 admissions per annum) was 0.87, and the SMR for patients admitted to larger hospitals (> 200 Level admissions) was 0.87. Outcomes as assessed by risk-adjusted mortality were identical.

CHAPTER 10
INTER-HOSPITAL TRANSFERS OF CRITICALLY ILL PATIENTS

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CHAPTER 10: **INTER-HOSPITAL TRANSFERS OF CRITICALLY ILL PATIENTS**

Transfers of critically ill patients between hospitals are an integral part of all modern healthcare systems. Patients may be transferred for specialist medical or surgical care, so that they can receive more complex levels of critical care, or because of a lack of critical care capacity in the referring hospital. It is essential to have comprehensive data on transfers of critically ill patients in order to plan ICU services and in order to define requirements for critical-care transfer services and to identify shortfalls in the existing service.

The Units audited provided approximately 96% of critical care in HSE-funded hospitals in 2021, although the activity audited is somewhat less than this because two Units did not participate for all four quarters of 2021. Nevertheless, this report has captured the vast bulk of critical-care transfers by analysing INICUA data on patients transferred to another hospital and patients admitted from another hospital. These data provide useful insights into the volume, complexity, and resource requirements for inter-hospital transfers of critically ill patients.

Transfers of critically ill patients between hospitals fall into three categories: (i) transfers directly from one ICU to another ICU, (ii) transfers from a non-ICU location (ward, Emergency Department (ED), theatre, etc.) in the referring hospital directly to ICU in the receiving hospital, and (iii) transfers to a non-ward location (ED, theatre, etc.) in the receiving hospital before admission to ICU.

All these patients are considered to have been critically ill, and the aggregated data on patients from these three groups best represents critical care transfers.

The total number of critically ill patients transferred between hospitals audited in 2021 was 913 (Table 10.1A). This number includes transfers for more specialist care, transfers because of a lack of ICU bed capacity, and transfers for repatriation.

Four small regional hospitals and the five private hospitals did not participate in INICUA in 2021, and there are incomplete data from two other hospitals. Taking this into account, the figure of 913 transfers is broadly aligned with previous estimates by MICAS of around 1,000 critical-care transfers per annum. This represents a 30% increase in numbers of transfers documented compared to 2020. This is partly due to increased coverage by the audit compared to 2020 and partly due to increased transfers related to the COVID pandemic. Other factors may also have been involved.

The MICAS service of the National Ambulance Service undertook 469 transfers of the critically ill (*HSE.ie, 2022*), almost all of whom would have been included in the overall figure of 913 transfers nationally. Thus approximately 50% of transfers were undertaken by a non-specialist transfer service provided by staff in the referring hospital.

TABLE 10.1A: NUMBER OF CRITICALLY ILL PATIENTS TRANSFERRED TO AN INTENSIVE CARE UNIT IN ANOTHER HOSPITAL

	Transfers-in 2020	Transfers-in 2021
Transfers direct from ICU to ICU	349	486
Patients were transferred from a non-ICU location (ward, ED, theatre, etc.) in referring hospital direct to ICU in receiving hospital	285	333
Patients initially transferred to a non-ward location (ED, theatre, etc.) in receiving hospital before their admission to ICU	69	94
Total inter-hospital critical care transfers	**703**	**913**

Characteristics of the 913 critically ill patients transferred to ICU in 2021 are shown in Table 10.1B. Trauma (17%), sepsis (39%) and surgery (10%) were common conditions associated with transfer. Seventy-two percent of patients received Level 3 care in the first 24 hours after admission to the receiving ICU.

Forty-four percent of admissions to ICU after transfer from another hospital were between 20.00 and 08.00, i.e. outside normal daytime working hours. Twenty six percent occurred at weekends or on bank holidays. This has significant implications for the organisation of the national critical care transport service.

TABLE 10.1B: CHARACTERISTICS OF CRITICALLY ILL PATIENTS TRANSFERRED TO AN INTENSIVE CARE UNIT FROM ANOTHER HOSPITAL

	Transfers-in 2020	Transfers-in 2021
Median age, in years (IQR)	60 (47–70)	58 (44-69)
Number of male patients (%)	422 (60%)	548 (60%)
Median Body Mass Index (kg/m^2) (IQR)	26 (23–31)	27 (24-32)
Number of patients with a significant pre-existing medical condition (%)	92 (13%)	95 (10%)
Number of transfers following trauma (%)	118 (17%)	155 (17%)
Number of transfers following traumatic brain injury (%)	65 (9%)	73 (8%)
Number of patients admitted to ICU direct from operating theatre (%)	79 (11%)	92 (10%)
Number of patients with acute kidney injury on day 1 in receiving ICU (%)	352 (50%)	451 (49%)
Number of patients with sepsis (%)	235 (33%)	358 (39%)
Percentage of patients who received Level 3 care on day 1 in receiving ICU	66%	72%
Number of patients admitted to ICU at night (20.00–08.00) after transfer from another hospital (%)	319 (45%)	398 (44%)
Number of patients transferred at weekends/bank holidays (%)	179 (26%)	237 (26%)

The patients transferred were relatively sick, with a mean APACHE II score of 15 and a predicted hospital mortality rate of 26% (Table 10.1C). The mean Unit LOS (10.4 days) was greater than the overall figure for all ICU admissions in 2021 (6.6 days, INICUA data).

TABLE 10.1C: ILLNESS SEVERITY AND OUTCOMES OF CRITICALLY ILL PATIENTS TRANSFERRED TO AN INTENSIVE CARE UNIT IN ANOTHER HOSPITAL

	Transfers-in 2020	Transfers-in 2021
Mean APACHE II score (SD)	16 (7)	15 (7)
Median predicted hospital mortality rate* (IQR)	14.7% (4.8–34.7)	14.8% (4.6–34.3)
Mean Unit LOS, in days (SD)	9 (14)	10 (15)
Unit mortality rate	17%	19%
Hospital mortality rate	24%	26%

* Statistics computed using the ICNARC$_{H\text{-}2018}$ model

Figure 10.1 shows the number of critically ill patients who were admitted to each Unit after transferring from another hospital without being admitted to a ward in the receiving hospital. The hospitals receiving the greatest numbers of transfers were Beaumont Hospital (n=177), University Hospital Galway (n=130) and Mater Misericordiae University Hospital (n=129).

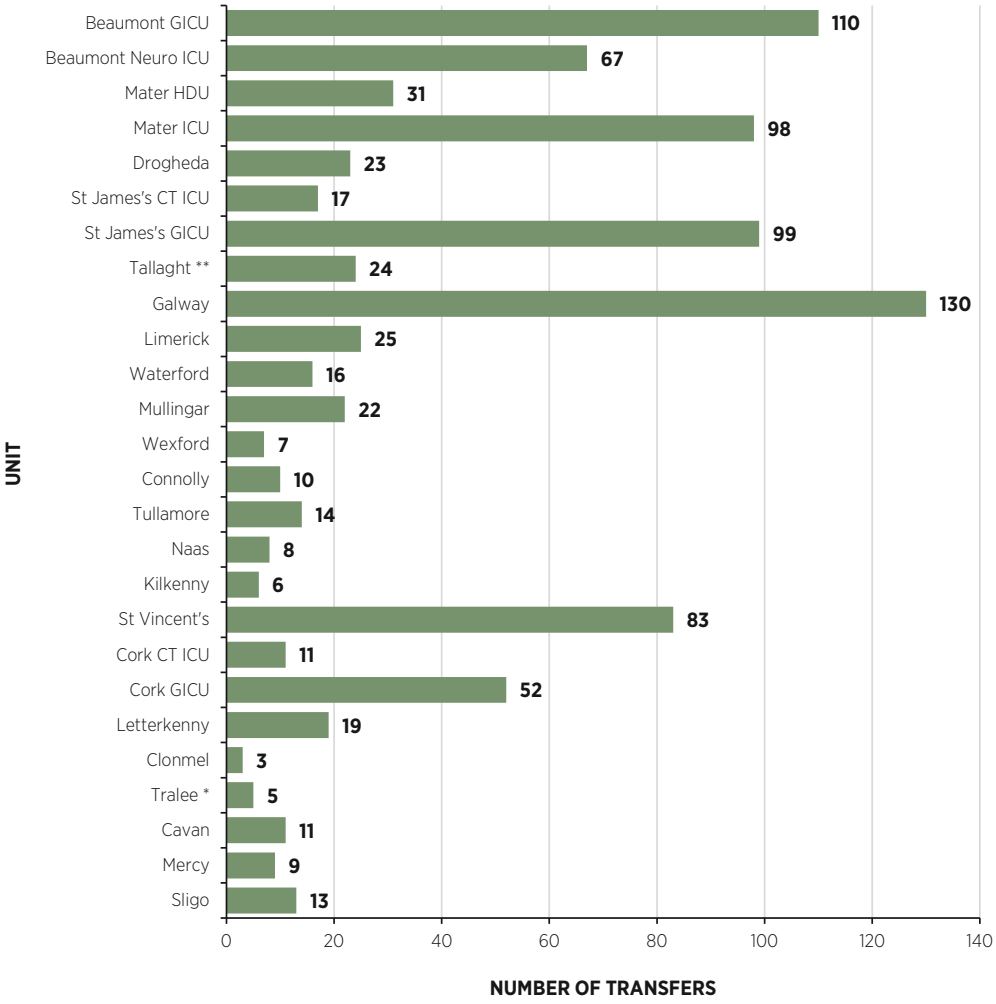

FIGURE 10.1: ALL CRITICAL CARE TRANSFERS-IN TO EACH UNIT (n=913)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

Figure 10.2 shows the number of critical care transfers received by each Unit directly from another ICU. This is a subset of the patients described in Figure 10.1. The hospitals receiving the greatest numbers of direct ICU to ICU transfers were University Hospital Galway (n=98), Beaumont Hospital (n=90), Mater Misericordiae University Hospital (n=82) and St James's Hospital (n=51).

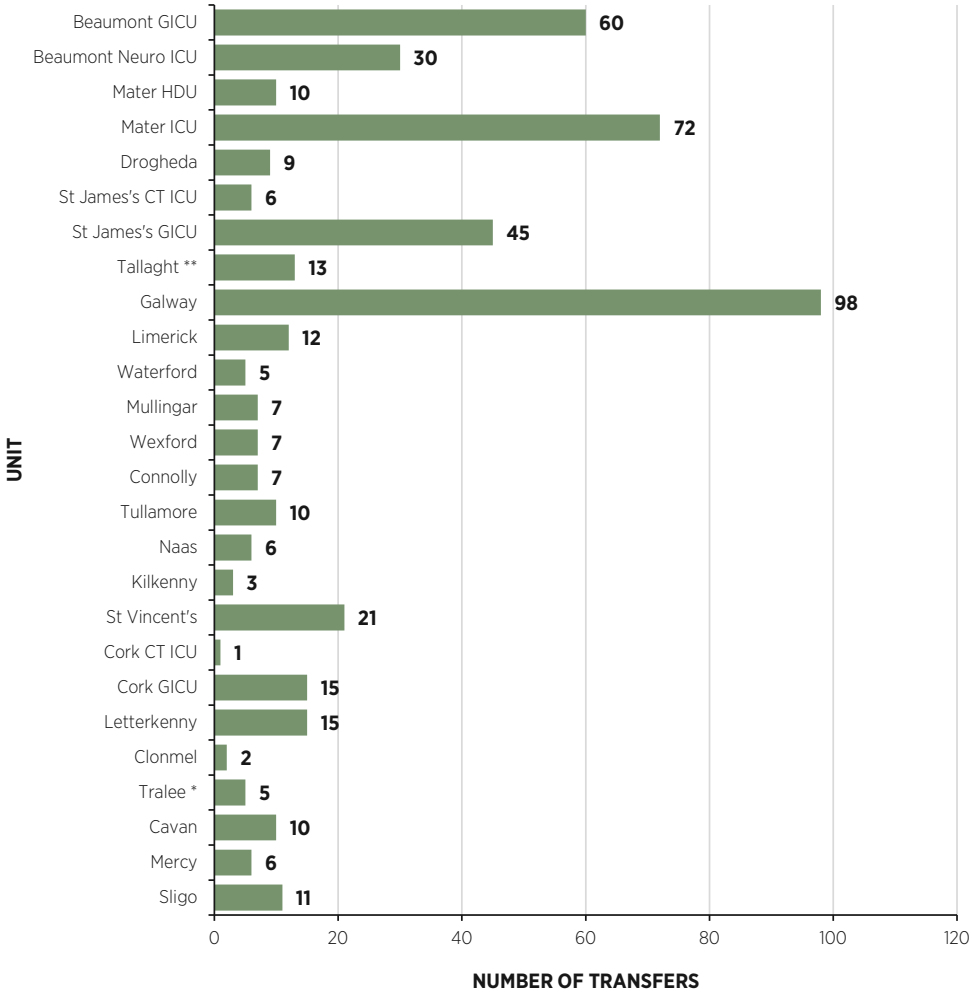

FIGURE 10.2: CRITICAL CARE TRANSFERS-IN TO EACH UNIT DIRECTLY FROM ANOTHER INTENSIVE CARE UNIT (n=486)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

Figure 10.3 shows the number of critical care transfers received by each Unit directly from another ICU as a percentage of all admissions to each receiving Unit. The highest percentages of admissions to a Unit directly from another ICU were to Beaumont Hospital, Mater Misericordiae University Hospital ICU, University Hospital Galway and University Hospital Kerry.

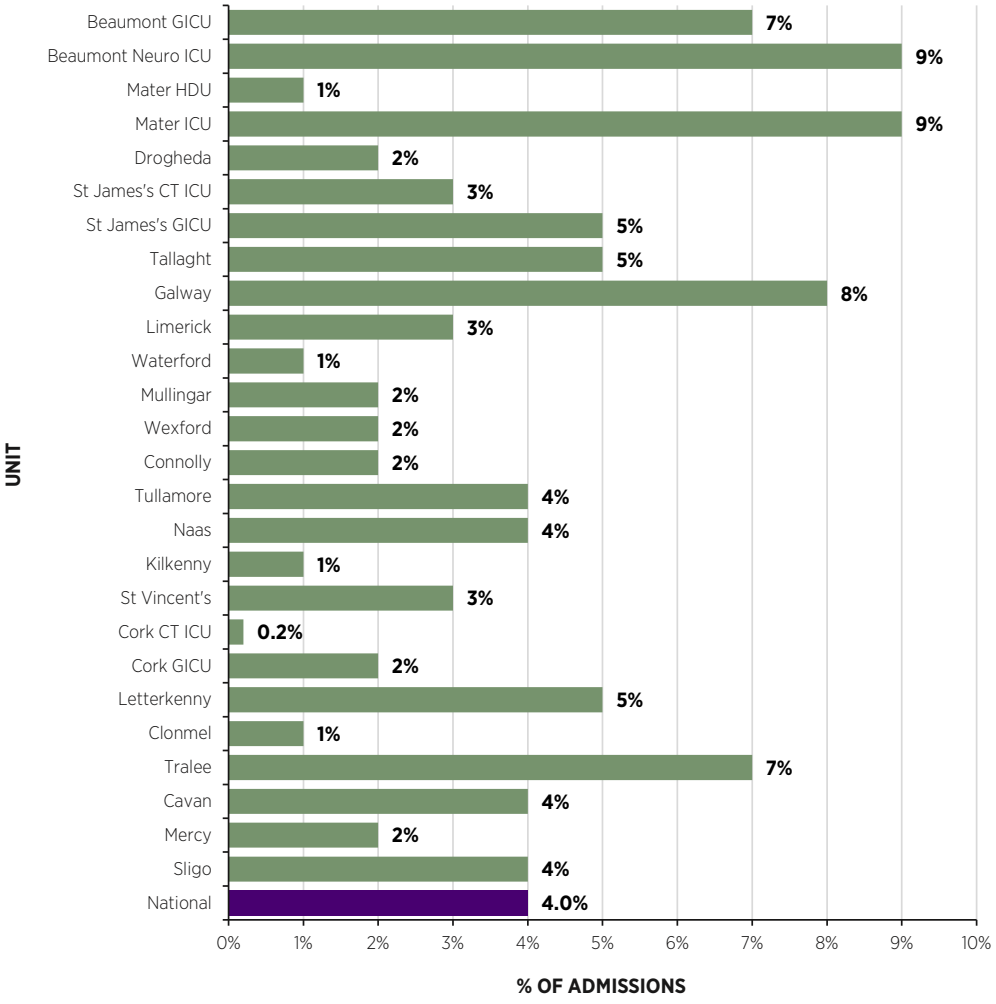

FIGURE 10.3: CRITICAL CARE TRANSFERS-IN TO EACH UNIT DIRECTLY FROM ANOTHER INTENSIVE CARE UNIT, AS A PERCENTAGE OF ALL UNIT ADMISSIONS

Critical care transfers-out were defined as patients transferred directly from one ICU to another ICU. This represents many of the same patients who are documented in Figure 10.2, although total numbers are slightly different because of transfers to or from hospitals which did not participate in INICUA during 2021 or had gaps in coverage. Figure 10.4 shows the number of patients transferred out from each Unit directly to another ICU. The largest numbers of transfers-out to another ICU were from Beaumont Hospital (n=56), Mater Misericordiae University Hospital (n=41), Letterkenny University Hospital (n=41) and University Hospital Galway (n=40).

The percentage of critically ill patients who were transferred out directly to another ICU at night (20.00 to 08.00) was 18%, compared with 44% for all critical care transfers-in. This discrepancy is likely to be because the time that a patient is transferred out of the originating Unit will be earlier than the time that they arrive at the receiving Unit, and because the patients transferred-in include patients who went to the operating theatre or the ED at the receiving hospital before being admitted to ICU.

The percentage of critically ill patients transferred out to another ICU at weekends (Saturday and Sunday) and bank holidays was 24%.

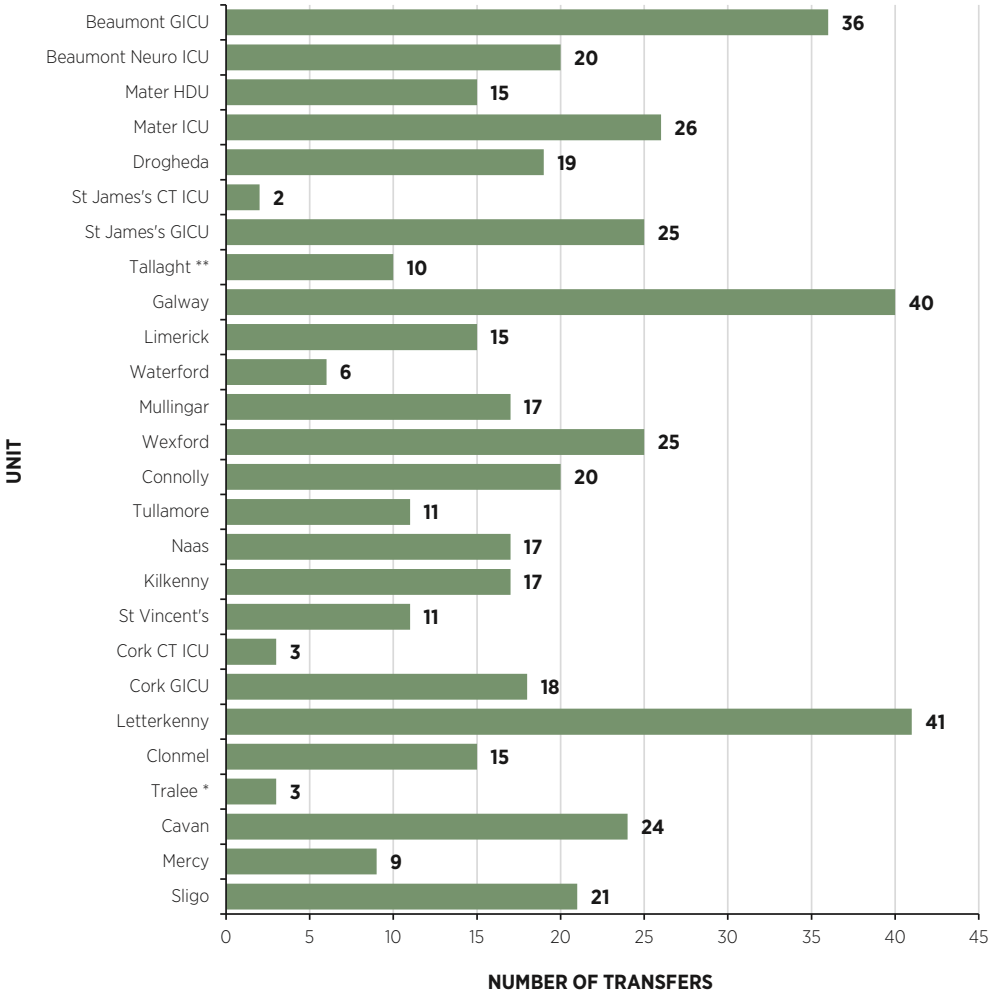

FIGURE 10.4: CRITICAL CARE TRANSFERS-OUT FROM EACH UNIT DIRECTLY TO ANOTHER INTENSIVE CARE UNIT (n=466)

* Hospital submitted data for only 3 months of 2021.
** Hospital submitted data for only 6 months of 2021.

Critical care transfers-out directly to another ICU as a percentage of all Unit survivors are shown in Figure 10.5. The Units with the highest percentages of transfers-out directly to another ICU were Letterkenny University Hospital, Naas General Hospital ICU and Cavan General Hospital ICU.

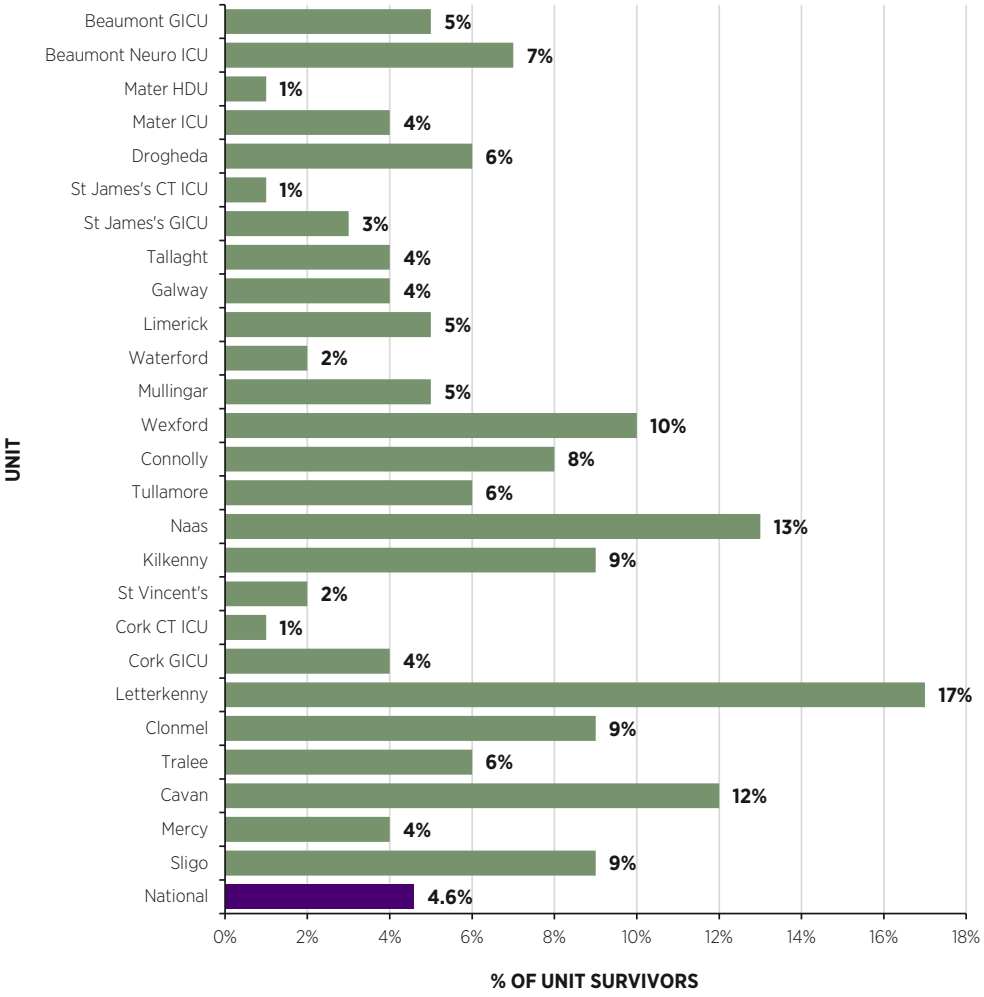

FIGURE 10.5: CRITICAL CARE TRANSFERS-OUT FROM EACH UNIT DIRECTLY TO ANOTHER UNIT AS A PERCENTAGE OF ALL UNIT SURVIVORS

The number of critical care transfers-in to each receiving specialty is shown in Figure 10.6. The specialties receiving the largest numbers of critically ill transfers were respiratory medicine (presumably due to transfers of COVID-19 patients), neurosurgery, and general medicine.

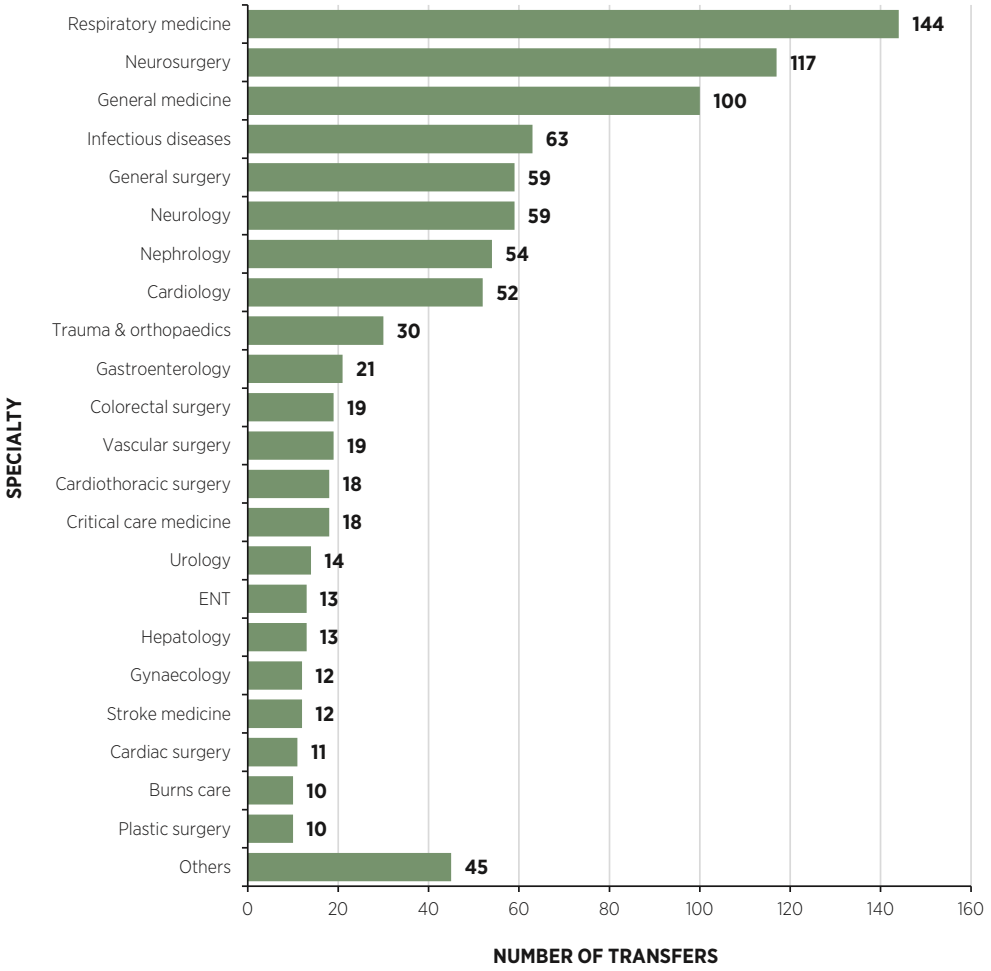

FIGURE 10.6: NUMBERS OF CRITICALLY ILL PATIENTS TRANSFERRED IN, BY RECEIVING SPECIALTY

The number of critical care transfers-out from each specialty is shown in Figure 10.7. The specialties transferring out the largest numbers of critically ill patients were respiratory medicine, general medicine, and neurosurgery.

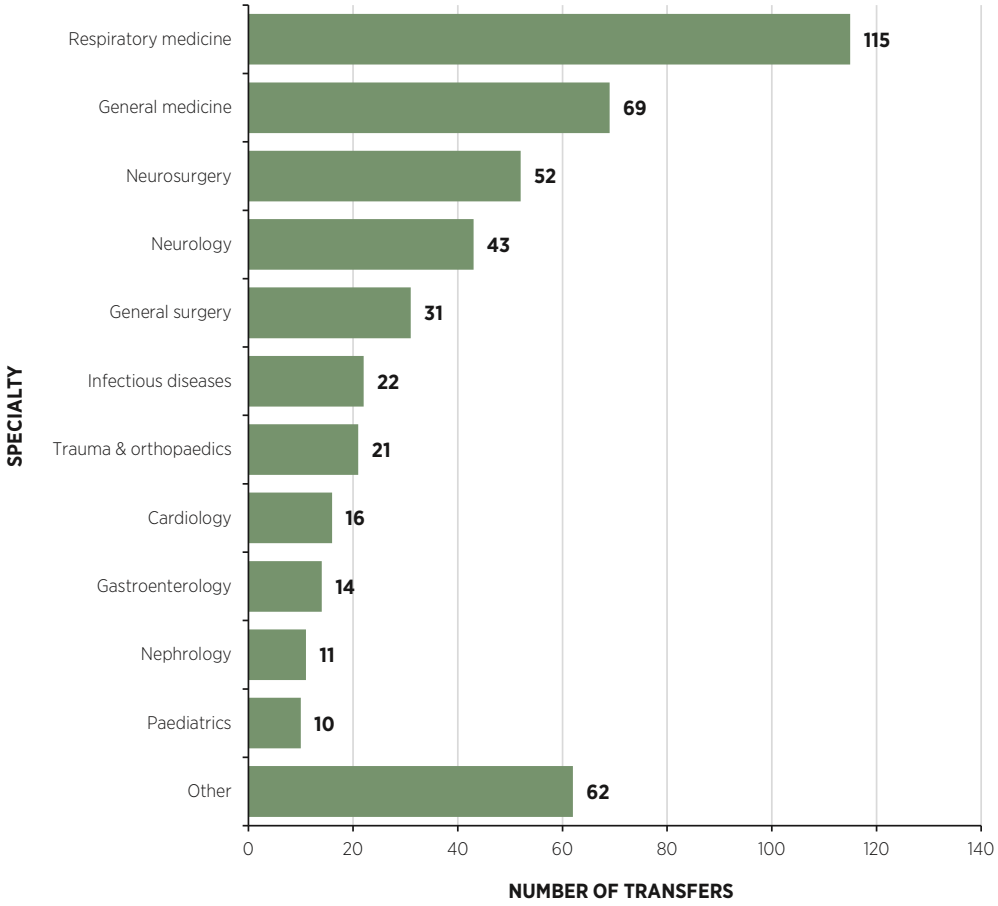

FIGURE 10.7: NUMBERS OF CRITICALLY ILL PATIENTS TRANSFERRED OUT TO ANOTHER INTENSIVE CARE UNIT FROM EACH SPECIALTY

KEY FINDINGS FROM CHAPTER 10

- INICUA documented 913 critically ill patients who were transferred to ICU in another hospital in 2021. This is an underestimate of total national figures because data from two hospitals were incomplete and there were no data from four smaller hospitals or from five private hospitals. Nevertheless, this Report indicates the scale of inter-hospital transfers of critically ill patients and provides data on patient characteristics.
- Forty-four percent of transfers occurred at night, i.e. between 20.00 and 08.00; 26% occurred at weekends or on bank holidays.
- Transferred patients were sicker than the overall ICU population, with higher illness severity scores and a higher predicted mortality rate. Their mean ICU LOS (10 days) was greater than the national average, as was their hospital mortality rate (26%).
- The largest number of inter-hospital transfers directly into ICU was received by Beaumont Hospital (n=177).
- The specialty accepting the largest number of inter-hospital transfers directly into ICU was respiratory medicine. This was likely to be related to the COVID-19 pandemic.

CHAPTER 11
QUALITY IMPROVEMENT

CONTENTS >

CHAPTER 11: **QUALITY IMPROVEMENT**

The purpose of this chapter is to highlight quality improvements (QI) based on data derived from Irish National ICU Audit (INICUA), and to identify and promote potential areas for QI in the future.

Clinical audit is one of a range of quality improvement methodologies that can deliver improved processes and outcomes for patients (HQIP, 2020). Clinical audit can provide data to support quality improvement at all levels, from the local clinical team through to hospital management and national policymakers. The INICUA wants to ensure that the findings of the audit support quality improvement at local, national and policy levels. The figures presented below illustrate how Key Quality Indicators and metrics have changed over time, and highlight both areas for improvement and areas where immense progress has been made since the first INICUA report was published in 2017.

IMPLEMENTATION OF INICUA NATIONALLY

When INICUA was initiated in 2015, data was being collected by only four adult ICUs. By 2021, however, due to the determination and hard work of the INICUA team and the Audit Coordinators, INICUA was capturing data from 26 Units, which were responsible for 96% of the HSE Level 3 ICU activity (Figure 11.1).

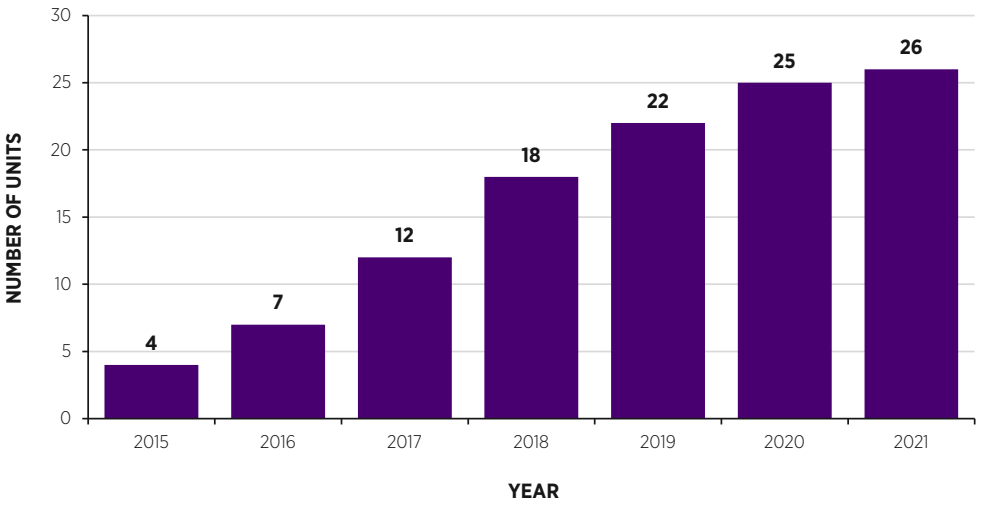

FIGURE 11.1: NUMBER OF ICUs INCLUDED IN INICUA BY YEAR (2015–2021)

Figure 11.2 presents the number of ICU admissions captured each year from 2017 to 2021 and the corresponding coverage of all ICU activity that this represents nationally. The number of admissions has increased over the reporting period from 6,186 admissions in 2017 to 12,151 in 2021, with coverage increasing from 58% in 2017 to 96% in 2021.

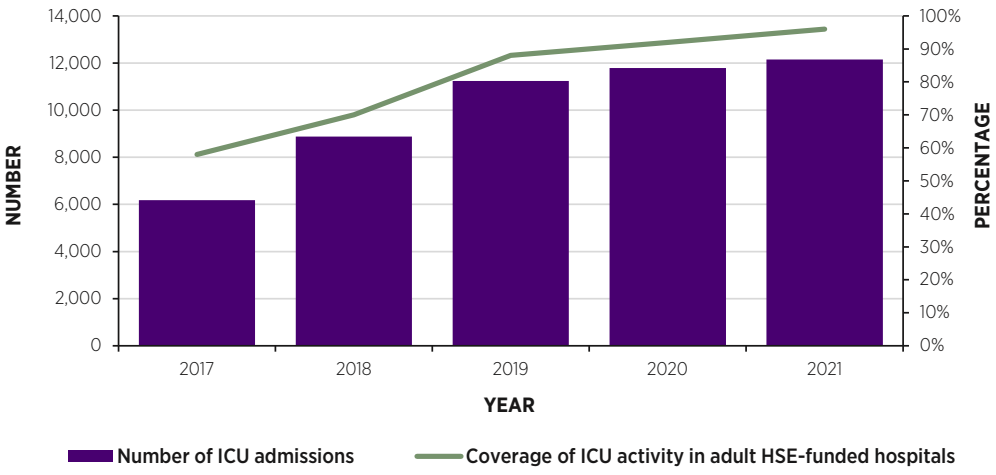

FIGURE 11.2: NUMBER OF INTENSIVE CARE UNIT ADMISSIONS INCLUDED IN THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT AND PERCENTAGE COVERAGE OF ICU ACTIVITY IN ADULT HSE-FUNDED HOSPITALS, 2017–2021

MORTALITY

The overall national value for risk-adjusted mortality (standardised mortality ratio - SMR)[14] in the Republic of Ireland (ROI) was within the acceptable range for each year from 2017 to 2021 (Figure 11.3). There has been an increase in the national value from 2019 (SMR = 1.00) to 2020 (SMR = 1.05), and to 2021 (SMR = 1.16). This increase in SMR may be because the risk-prediction model underestimates the risk of mortality in COVID-19 patients, who commonly had only single-organ failure at the time of admission to ICU. Reassuringly, the SMR value for ROI in 2021 is less than the value for the UK (Figure 7.7B).

The overall national value for SMR is a blunt measure which could conceal issues in individual Units. Reassuringly, only one Unit has been an outlier for SMR throughout this period; this was related to an increase in activity in the Unit without an increase in bed capacity. After bed capacity was increased, the SMR for this Unit returned to within the acceptable range the following year. All Units were within the acceptable range for 2021 (Figure 7.7A).

These data are an important reassurance that quality of care for patients who are admitted to Units in Ireland reaches a consistent and acceptable standard.

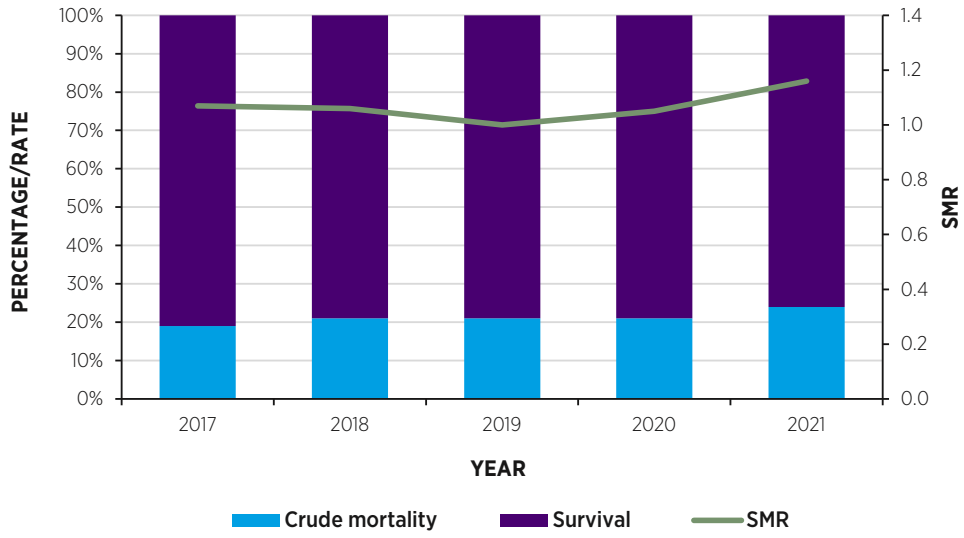

FIGURE 11.3: CRUDE MORTALITY RATE AND STANDARDISED MORTALITY RATIO (SMR) BY YEAR

[14] For an explanation of SMR refer to section STANDARDISED MORTALITY RATIOS (SMR) in chapter 7.

ICU ACCESS

Prompt admission to ICU for acutely ill patients improves outcomes. The HSE has defined two key performance indicators (KPIs) for timely admission to ICU:

- 50% of patients should be admitted within 1 hour of the decision to admit.
- 80% of patients should be admitted within 4 hours of the decision to admit.

These KPIs apply to patients admitted to ICU from the ward or Emergency Department (ED) in the same hospital. Only one hospital achieved the KPI of 50% of patients being admitted to ICU within 1 hour of the decision to admit in any of the three years. However, the proportion of hospitals achieving the KPI of 80% (percentage of patients being admitted to ICU within 4 hours of the decision to admit) has been increasing steadily from 36% in 2019 to 83% in 2021.

HOSPITALS COMPLYING WITH ICU ACCESS KPI

50% of patients should be admitted to ICU within 1 hour of a decision to admit

2019	2020	2021
0%	0%	6%

80% of patients should be admitted to ICU within 4 hours of a decision to admit

2019	2020	2021
36%	47%	83%

BED OCCUPANCY

Bed occupancy is a key metric in ICU. Bed occupancy rates which are too low suggest over-provision of expensive resources. Bed occupancy rates which are too high lead to a lack of reserve capacity needed to cope with surges in ICU activity, to delays in admission to ICU of patients who are critically ill and to increased stress for ICU staff.

Recommendations for optimal bed occupancy in ICU depend on the method for calculation of the occupancy figure, and they range from 75% to 85%. (The highest figure (85%) is recommended if using the methodology in this Report.) Overall, national bed occupancy was 79% in 2020, which increased to 89% in 2021. This overall national number can obscure issues arising in individual Units, and there were a number of the larger Units with bed occupancy greater than 90% in 2021 (Table 6.1).

DELAYED DISCHARGES

The trend in bed days spent in ICU more than 8 hours after being cleared for discharge decreased in 2020 and 2021 in the ROI, and this decrease was presumably related to the increased need for ICU beds during the COVID-19 pandemic (Figure 11.4). Delayed admission to ICU worsens patient outcomes (Cardoso et al 2011, Young et al 2003, Chalfin et al 2007), which suggests that it should be policy to always have an ICU bed available for urgent admissions. A similar trend was seen in the bed days spent in ICU by patients more than 24 hours after being cleared for discharge (Figure 11.5).

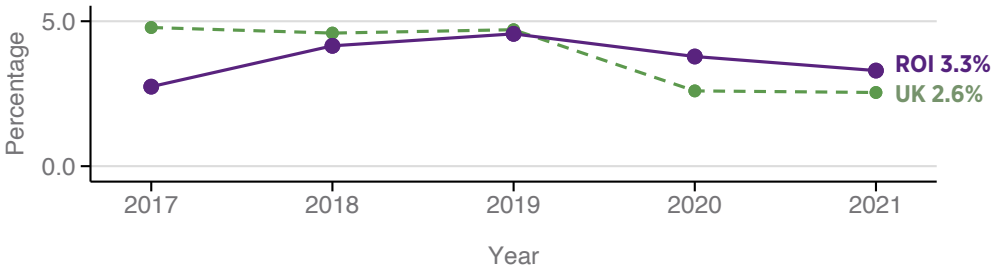

FIGURE 11.4: TREND IN PERCENTAGE OF TOTAL AVAILABLE INTENSIVE CARE UNIT BED DAYS SPENT IN THE UNIT MORE THAN 8 HOURS AFTER PATIENTS WERE CLEARED FOR DISCHARGE, 2017–2021

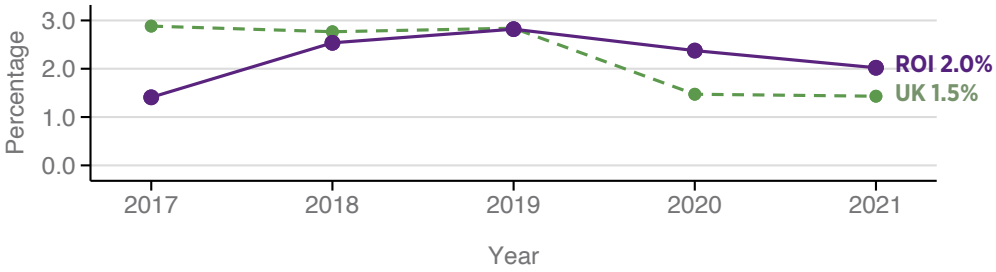

FIGURE 11.5: TREND IN PERCENTAGE OF TOTAL AVAILABLE INTENSIVE CARE UNIT BED DAYS SPENT IN THE UNIT MORE THAN 24 HOURS AFTER BEING DECLARED READY FOR DISCHARGE, 2017–2021

The proportion of patients discharged out of hours is a useful QI to reflect: (i) good practice in documenting which patients are fit for discharge, and (ii) adequate numbers of ICU beds to avoid discharge of patients from ICU outside normal working hours. The national mean value had been falling steadily over the reporting period, with a slight increase in 2021 for both ROI (4.4%) and UK (2.5%) patients (Figure 11.6)

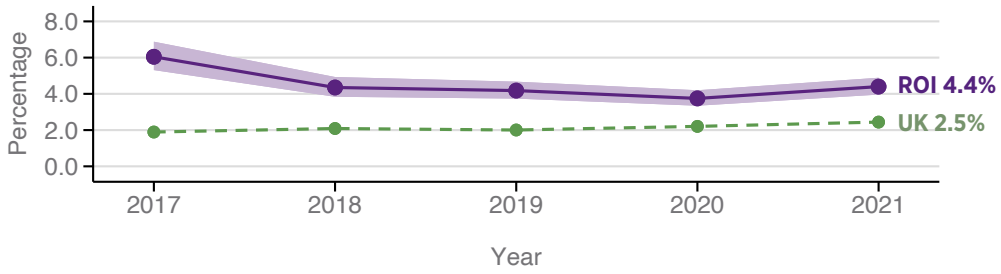

FIGURE 11.6: UNIT DISCHARGES TO THE WARD AT NIGHT (22.00–07.00) WHO HAD NOT BEEN CLEARED FOR DISCHARGE BY 18.00 (AS A PERCENTAGE OF ALL UNIT SURVIVORS), 2017–2021 (Source: INICUA and ICNARC UK data)

Note: The purple shaded area in the trend graph is the 95% confidence interval.

IN-HOSPITAL CARDIOPULMONARY RESUSCITATION WITHIN 24 HOURS OF ICU ADMISSION

If a patient deteriorates in the ward to the point of requiring cardiopulmonary resuscitation (CPR), this commonly indicates that appropriate supportive treatment was delayed, either because deterioration was not noticed or because admission to ICU was delayed (NCEPOD 2012). Patients who required CPR before ICU admission have a poor prognosis. Thus, rates of requirement of CPR are an important predictor of patient outcomes and give an insight into patient care on the ward.

Despite strenuous efforts nationally to improve care in the wards (outreach programmes, INEWS scores, the Deteriorating Patient Programme), national rates of patients requiring CPR within 24 hours of ICU admission have not improved (Figure 11.7).

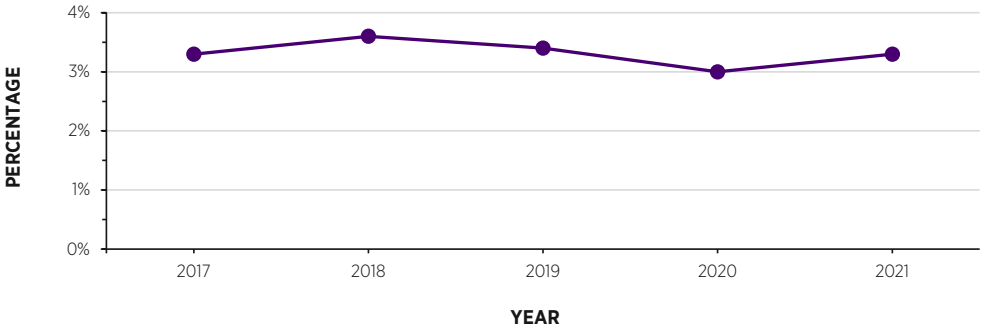

FIGURE 11.7: ADMISSIONS FOLLOWING IN-HOSPITAL CARDIOPULMONARY RESUSCITATION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS) 2017–2021 (Source: INICUA and ICNARC UK data)

TRENDS IN ORGAN DONATION

Numbers of organ donors fell during the period of the COVID-19 pandemic (2020 and 2021). This was related to a decrease in the numbers of brainstem deaths and a decrease in the conversion rate from brain death to organ donation (Figures 11.8–11.9). The reasons for these changes are likely to be multiple.

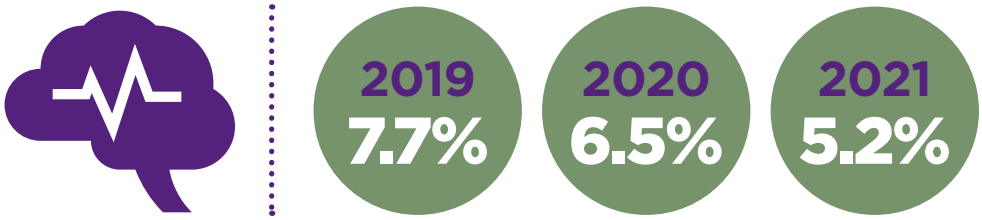

FIGURE 11.8: DEATHS DIAGNOSED BY BRAIN-DEATH CRITERIA AS A PERCENTAGE OF ALL DEATHS IN ICU

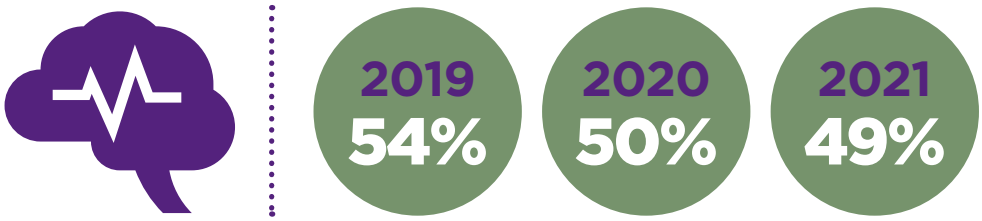

FIGURE 11.9: PERCENTAGE OF BRAIN-DEATH PATIENTS WHO PROGRESSED TO ORGAN DONATION

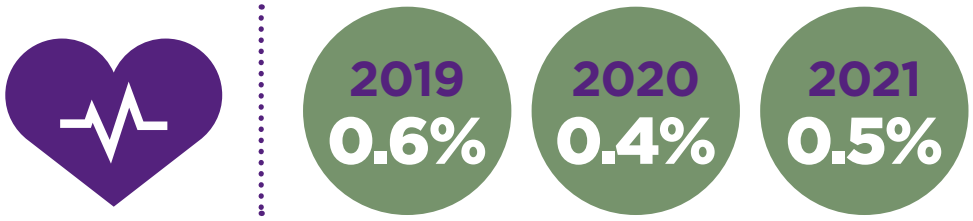

FIGURE 11.10: PATIENTS WHO PROGRESSED TO ORGAN DONATION AFTER CIRCULATORY DEATH AS A % OF ALL CIRCULATORY DEATHS

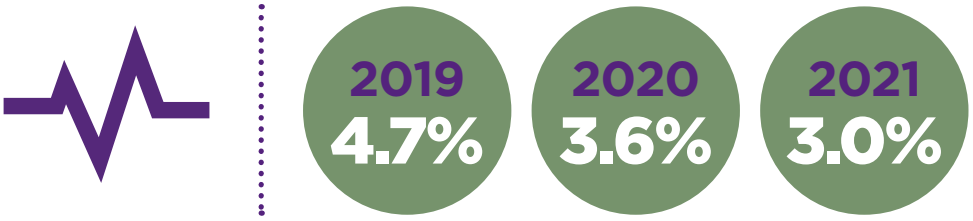

FIGURE 11.11: PATIENTS WHO PROGRESSED TO ORGAN DONATION AS A % OF ALL DEATHS

In 2022, NOCA published the results of a feasibility study of organ-donation practices in Ireland. Following this, the ODTI commissioned NOCA to develop a Potential Donor Audit for Irish hospitals, which commenced in May 2022. The quality improvement aim of the Potential Donor Audit (PDA) is to ensure that every person who is approaching the end of life in ICU and ED is offered the possibility of becoming an organ donor, where this is appropriate. The final report from the PDA development work is available on the NOCA website.

ST JAMES'S HOSPITAL QUALITY IMPROVEMENT PROJECT

Using NOCA Data to Reduce Delays in Unplanned Admissions to the ICU

In this section, St James' Hospital has shared details on how it has used INICUA data for quality improvement purposes.

ICU ANP Staff at St James Hospital

BACKGROUND

"Delayed ICU admissions is significantly associated with mortality of critically ill adults and highlights the importance of providing timely critical care" (Kiekkas et al. 2022).

The HSE monitors timely admission to ICU using 2 KPIs:

1.	50% of patients should be admitted to ICU within one hour of decision to admit.
2.	80% of patients should be admitted to ICU within four hours of decision to admit.

INICUA data showed that in St James' ICU in 2018, only 10% of patients were admitted to ICU within one hour of the decision to admit, while 70% were admitted within four hours. The results of all Irish Units for these KPIs have been presented in the INICUA National Report since 2018, where hospitals are benchmarked against other Irish Units and UK Units. As St James was performing significantly below the target for both KPIs in 2018, it was felt that a number of measures were required to improve these results and thus improve the care of patients.

A number of quality improvement initiatives were introduced in St James' from 2019 onwards:

- A policy was introduced in 2019 to make an 'Emergency Bed' available for urgent admission of critically ill patients by prioritising, wherever feasible, the discharge of patients who were clinically ready for ward care.
- In 2020, an outreach programme staffed by Critical Care Advanced Nurse Practitioners was introduced to support the care of critically ill patients outside ICU. Initially, this was a five-day-a-week service, but it was extended in 2022 to include partial weekend cover.
- The existing HSE KPI for timely access to ICU (50% admitted within 1 hour, 80% within 4 hours) was extended to a target of 80% admitted within 1 hour, 100% within 4 hours.
- Considerable effort was put into documenting the time of the decision to admit to ICU, in order to fully document compliance with the ICU-access KPI.
- Additional ICU beds were opened: 3 in 2019 and a further 3 in 2021.

RESULTS FROM THE QUALITY IMPROVEMENT INITIATIVES

The impact of these changes can be seen in the graphs below. The percentages of patients achieving the targets for access time to ICU increased steadily over the four-year period (Figure 11.12A). The percentage of admissions to ICU who developed organ failure in four or more organ systems within 24 hours of ICU admission declined steadily each year, presumably due to better care in the ward and faster access to ICU (Figure 11.12B).

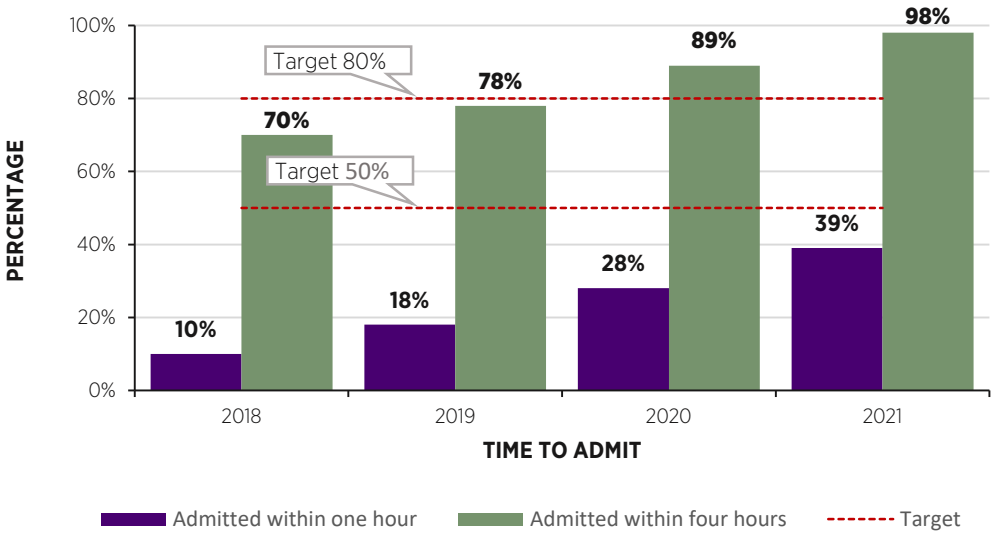

FIGURE 11.12A: PERCENTAGE OF ADMISSIONS TO ST JAMES'S GENERAL ICU: (i) WITHIN 1 HOUR OF THE DECISION TO ADMIT, AND (ii) WITHIN 4 HOURS OF THE DECISION TO ADMIT (2018–2021)

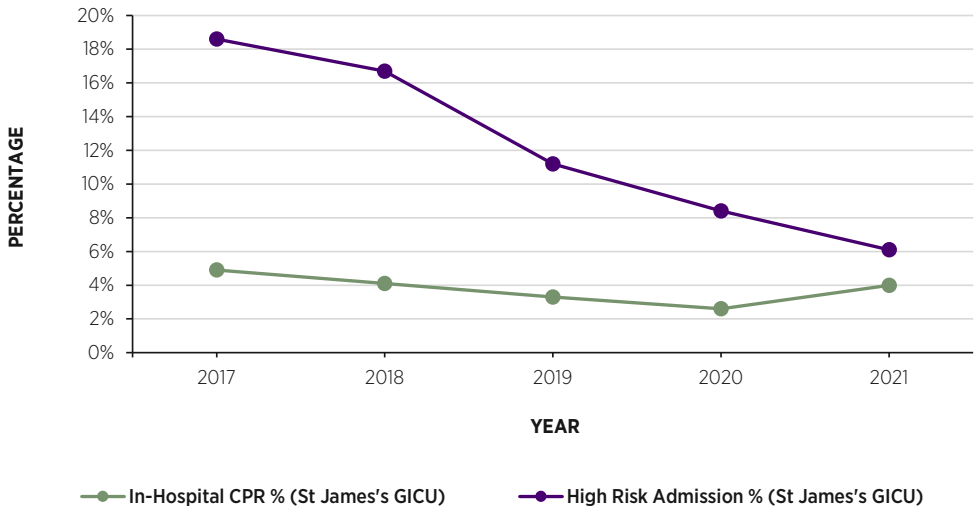

FIGURE 11.12B: (i) ADMISSIONS FOLLOWING IN-HOSPITAL CPR (AS A PERCENTAGE OF ALL UNIT ADMISSIONS) AND (ii) HIGH-RISK ADMISSIONS (AS A PERCENTAGE OF ALL UNIT ADMISSIONS FROM A WARD), ST. JAMES'S HOSPITAL GENERAL ICU, 2017–2021

QUALITY IMPROVEMENT LEARNINGS (ST JAMES'S QI PROJECT)

- The introduction of a policy of keeping a bed free for emergency admissions helped to ensure that additional ICU bed capacity was made available for emergency admissions.
- Audit of quality indicators in ICU and of the ICU access KPI helped make the case for the 'emergency bed' policy and for additional ICU bed capacity.
- The introduction of the outreach service with CCANPs facilitated the achievement of the HSE KPI for timely access to ICU, and the documentation of this KPI

SUMMARY OF QUALITY IMPROVEMENTS IN CHAPTER 11

- Coverage of ICU activity by ICU audit has steadily increased to almost 100%, which provides a comprehensive overview of both activity and quality of care in the national network for critical care. Reassuringly, the SMR value for ROI in 2021 is less than the value for the UK.
- While some metrics for quality of care indicate improvements (e.g. access times to ICU), others remain relatively constant (rates of in-hospital CPR before ICU admission).
- Rates of requirement of CPR are an important predictor of patient outcomes. In November 2022, funding was approved by the National Quality and Patient Safety Directorate for participation of IEHG hospitals in the ICNARC National Cardiac Arrest Audit (NCAA).
- ODTI commissioned the National Office of Clinical Audit to develop a Potential Donor Audit for Irish hospitals, which commenced in May 2022. The quality improvement aim of the Potential Donor Audit (PDA) is to ensure that every person who is approaching the end of life in ICU and ED is offered the possibility of becoming an organ donor, where this is appropriate.

CHAPTER 12
AUDIT UPDATE

CONTENTS >

CHAPTER 12: **AUDIT UPDATE**

NOCA requested an update from the bodies who accepted responsibility for addressing the Recommendations made in the *Irish National ICU Audit Annual Report 2020* as to progress on implementation of these Recommendations. Below is a summary of the responses received.

RECOMMENDATION 1

Continue the ongoing HSE programme to expand ICU capacity in line with the Critical Care strategic plan and with approval from the Department of Health.

UPDATE

Update received from Acute Operations, HSE

Strategic Plan for Adult Critical Care (2020)

The Government's strategic multi-year plan for additional permanent adult critical care capacity was developed in 2020 to support the long-term strategic goal of increasing overall adult critical care capacity. The plan is clinically led and aligns with the National Critical Care Clinical Programme "hub and spoke" Model of Care and the vision set out in Sláintecare of "right care, right place, right time".

Phase 1 provided for the following developments to improve the provision of critical care nationally:

- providing additional beds, subject to completion of the necessary infrastructural development and planning processes;
- developing the critical care workforce by increasing the numbers of onsite critical care nurse educators and by increasing access to critical-care nurse education at foundation and post-graduate levels;
- increasing the number of hospitals with critical-care outreach teams to improve patient care and reduce re-admissions to critical care units; and
- increasing the capacity of the National Ambulance Service's critical care retrieval services.

Phase 2 provides as follows:

- developing new-build capacity at 5 prioritised sites (Sites have been identified); and
- supporting the delivery of additional beds in line with the Strategic Plan for Critical Care as noted by Government in December 2020.

Significant investment of €77m between 2021 and 2022 has enabled an increase in the number of critical care beds from 258 in March 2020 to 323 in April 2023.

A further 28 critical care beds are funded for delivery (19 under Phase 1 and 9 in relation to the prioritised service development of additional beds under Phase 1+).

Phase 1	MMUH – 10 beds	SVUH – 8 beds	CUH – 1 bed
Phase 1+*	SJH – 3 ICU beds	CUH – 4 ICU beds	Sligo – 2 HDU beds

UPDATE FOR RECOMMENDATION 1 *Continued*

Phase 2 of the strategy supports the delivery of an additional 106 beds critical care beds with the development of new-build capacity at 5 prioritised sites – Beaumont Hospital (22), St James Hospital (19), St Vincents University Hospital (19), Mater Misericordiae University Hospital (12) and Cork University Hospital (34).

The timelines for the delivery of the new capacity under Phase 2 will be identified as part of the project planning process.

NOCA note: The most recent data that NOCA has on bed availability is ICU-BIS data from January to April 2023. The average number of beds open on a daily basis was 299. This translates to a 6.0 ICU/HDU beds /100,000 population. The discrepancy between the numbers of beds funded and the number of beds open highlights the importance of the point highlighted in the HSE strategy above regarding development and retention of a skilled workforce to staff-funded ICU beds.

RECOMMENDATION 2

Develop a national care pathway to ensure appropriate patient flow to optimise use of ICU bed capacity for critically ill patients. This should include compliance with the HSE KPI targets for timely admission to ICU (50% of admissions within one hour of a decision to admit and 80% of admissions within four hours of a decision to admit) and prioritisation of discharges from ICU once patients are ready.

UPDATE

No update on progress on this recommendation has been received to date.
As part of a process to progress this area, NOCA has provided a more specific recommendation (Recommendation 2) in this current report:

> *Develop and implement a national policy that each Unit should keep one staffed ICU bed empty to be available for immediate admission of critically ill patients, if this can be achieved by discharge of a patient who has been declared clinically ready for discharge.*

Meetings have commenced with HSE to explore the implementation of this recommendation.

RECOMMENDATION 3

HSE Acute Operations and Hospital Groups should ensure that all ICUs either provide renal dialysis on-site or have transfer pathways in place in order to ensure the immediate admission of patients who require dialysis to a 'hub' ICU for treatment.

UPDATE

Update received from Acute Operations, HSE

Investment under the Critical Care Strategic Plan in NAS Critical Care Retrieval:

Under the Strategic Plan, investment has been made to develop the following initiatives:

Neonatal Transport (NNTP):

The investment has stabilised the consultant cover for 24/7-365 for the NNTP. In September 2022, a nurse/midwife-led non-Acute service started, which will improve patient flow by enabling the transfer of an estimated 500 infants between Level 3 and 4 NICU's to lower levels of neonatal care. This will free up critical infrastructure in the Level 4 NICUs and allow care nearer the infant's home.

Paediatric Retrieval (IPATS):

The investment will enable the recruitment of clinical staff for the IPATS service to resource a 24/7-365 paediatric retrieval service in advance of the opening of the NCH. A nurse-led Non-Acute Team (IPATS-NAT) is being recruited to facilitate the interfacility transfer of complex paediatric patients, improving patient flow within the paediatric network.

Adult Retrieval (MICAS):

The investment will enable the Dublin MICAS-East Hub to provide a reliable, rapid-response service with dedicated consultant support for high-complexity undifferentiated interfacility transport to meet the needs of the Trauma Networks, while maintaining scheduled inter-ICU transport between Model 3 and 4 Hospitals.

This initiative involves putting in place 31.5 WTEs across NNPT, MICAS, IPATS and CCRS. There are 4 WTEs in place and recruitment is underway with a further 14.5 WTEs to be in place by Q4 2023 and the balance of 13 EMT, EMDs and Clinical Engineering posts WTEs are progressing.

RECOMMENDATION 4
Continue implementation of measures to provide optimal care for critically ill patients outside ICU, including outreach of critical care services, better documentation, and uniform use of INEWS system in hospital wards.
UPDATE
Update received from Acute Operations, HSE Critical-care, on-site Advanced Nurse Practitioner posts have considerable impact on patient experience, patient outcome and provides positive support for nurses and NCHDs. Critical Care Outreach Teams (CCOT) offer intensive care skills to patients with, or at risk of, critical illness receiving care in locations outside the intensive care unit – for example, on ordinary wards. This service is in place across 14 sites. The objective is for continued investment in this initiative to reach the objective of 8 WTE across all Model 3 & 4 sites. This service model has been credited in being attractive to nurses who trained in Ireland but who moved abroad to work as Critical Care Advanced Nurse Practitioners. 17 of an additional 26 WTE ANPs are in place and a further 6 ANP posts have been approved as part of the prioritised service developments in 2023.

RECOMMENDATION 5

Implement a national in-hospital cardiac arrest audit.

UPDATE

Update received from Patient Safety Strategy Improvement Coordinator, Ireland East Hospital Group

Background

In November 2022 funding was approved by the National Quality and Patient Safety Directorate for participation of all twelve IEHG hospitals in the ICNARC National Cardiac Arrest Audit (NCAA). Enrolment in this audit will facilitate the collection of a standardised dataset of resuscitation and deterioration in the in-patient setting with a view to supporting a cycle of continuous quality improvement.

Introduction

This quality improvement project seeks to establish an Ireland East Hospital Group in-hospital cardiac arrest audit to augment existing governance structures for Quality and Patient Safety across the IEHG for the deteriorating patient. The project involves all twelve IEHG hospitals joining the existing UK National Cardiac Arrest Audit (NCAA) which is a joint initiative between the Resuscitation Council (UK) and ICNARC.

The HSE's Patient Safety Strategy (2019-2024) Commitment Four has identified improvement of care of the clinically deteriorating patient as a key patient safety priority. In response, the HSE Deteriorating Patient Improvement Programme (DPIP) commissioned NOCA to conduct a feasibility study to determine the feasibility of conducting a national clinical audit of key elements of the deteriorating patient pathway for the non-pregnant adult in -patient (greater than 16 years) in the acute hospital setting. One of the three key recommendations from this study was the development and establishment of a national clinical audit of in-hospital cardiac arrest (NOCA, 2021). The INICUA report 2020 (NOCA 2022) also identified as a key recommendation the implementation of a national in-hospital cardiac arrest audit (recommendation 5).

The purpose of NCAA is to monitor and report on the incidence & outcome from inpatient cardiac arrest in UK and Ireland to inform practice and policy. This also identifies and facilitates necessary improvements in the prevention of in-hospital cardiac arrest, delivery and outcomes from pre- arrest, resuscitation, and post resuscitation care, within acute hospitals.

The NCAA aim is to:

1. Improve patient outcomes
2. decrease incidence of avoidable cardiac arrest
3. decrease incidence of inappropriate resuscitation
4. promote adoption and compliance with evidence-based practices

Local Progress Update

An IEHG in hospital cardiac arrest audit implementation group has been established with membership from IEHG QPS, clinical leads for IEHG deteriorating patient governance group, NQPSD, ICNARC, NCCA, NOCA, and DPIP.

A Terms of Reference (TOR) for the group have been developed and ratified.

The Data Privacy Impact Assessment has been completed and process for data collection and collation agreed in line with the required information governance.

Communication with the hospital's General Managers/CEO has commenced requesting support to progress this quality initiative.

The NCAA plan was presented at The Irish Association of Resuscitation Officers (IARO) conference on 21st April 2023.

Plan to commence enrolment in July 2023 for a one-year proof of concept pilot.

It is expected that this audit will inform the enrolment and implementation of all hospitals in a national cardiac arrest audit.

RECOMMENDATION 6

Focus efforts to improve organ donation on Units with lower rates of testing for brain death, of conversion of brain death patients to become organ donors and of consideration for donation after circulatory death. Actions should include the implementation of a potential donor audit as recommended in the Potential Donor Audit Feasibility Study Report (NOCA 2022).

UPDATE

Update received from Organ Donation Transplant Ireland (ODTI)

ODTI commissioned the National Office of Clinical Audit to develop a Potential Donor Audit for Irish hospitals, which commenced in May 2022. The quality improvement aim of the Potential Donor Audit (PDA) is to ensure that every person who is approaching the end of life in ICU and ED is offered the possibility of becoming an organ donor, where this is appropriate. As part of the development project, pilot data collection began in six acute hospital ICUs on 14th November 2022 for three months. The objectives of the PDA are to:

- quantify the potential for organ donation in acute Irish hospitals;
- assess if the PDA identifies opportunities for improvement in organ donation and where in the patient journey these opportunities occur;
- identify reasons for non-donation outcome; and
- systematically assess the degree to which best-practice standards in organ donation are met.

The final report from the PDA development work will present the findings and recommendations arising from this work and is expected to be published by Q3 2023. Due to the success of the PDA Development Project, ODTI has commissioned an extension to the pilot as an additional piece of work to maintain the momentum of the audit and to provide baseline data for one full calendar year. More information is available on the NOCA PDA webpage.

NATIONAL ICU AUDIT DATABASE

INICUA is an initiative of the HSE's Critical Care Programme and was set up in 2014 primarily to measure the quality of patient care in Intensive Care Units nationwide. One of the objectives of INICUA is the provision of a National ICU Audit Database. The INICUA dataset records the numbers of patients admitted, demographics, duration of stay in ICU, severity of illness, complexity of care provided, and the quality of care provided as measured by outcomes. The National Office of Clinical Audit (NOCA) manages and governs the Irish National ICU Audit.

The aims of the INICUA are (i) to provide information for the appropriate allocation of (expensive) resources for care of the critically ill and (ii) to monitor and to improve the quality of care provided to critically ill patients.

Quality of care has been assessed by benchmarking a large number of patient outcomes against outcomes in other Units in Ireland and against outcomes in Units in England, Wales and Northern Ireland.

The national dataset has two parts:

- The ICNARC dataset for benchmarking internationally makes up 75% of the national dataset. Data analysis is undertaken by the Intensive Care National Audit and Research Centre (ICNARC) in London for the ICNARC dataset. ICNARC currently provide this service for approximately 250 Units in the UK. In addition NOCA produce ICU Audit related Reports which are available per individual Hospital site.
- The Irish specific dataset capturing information specific to the Irish Healthcare setting makes up 25% of the national dataset.

This availability of the full national dataset in a consolidated single database will help to provide a true picture of the care given to the sickest patients in the healthcare system, with implications for planning, reconfiguration of services, and resource allocation. Once the data is validated by NOCA it will be available for data requests for clinical audit, service evaluation/improvement, quality improvement and research.

The technical work to provision the consolidated database is underway. Subject to security and data governance approval, data will be transferred to NOCA in 2023 with a view to commence reporting from the full dataset in 2024.

ICU AUDIT COORDINATORS' WORKSHOP

In association with Intensive Care National Audit and Research Centre (ICNARC), NOCA hosted a workshop for Irish National ICU Audit (INICUA) Coordinators on the 15th March 2023 in the Royal College of Surgeons (RCSI) in Dublin. Many ICU Audit Coordinators from across the country attended in person, while others joined via Microsoft Teams videoconferencing technology. NOCA was delighted to welcome Andrew Fleming and Ray Stewart from ICNARC, who travelled from the UK to deliver training. A number of guest speakers were invited to present on their particular areas of expertise throughout the day.

NOCA's ICU Audit Manager, Mary O'Dwyer Baggot, opened the meeting, introduced the speakers, and was followed by Dr Rory Dwyer, Clinical lead for INICUA, who gave a presentation on Unit Acquired Bloodstream infections (UABSI). Eileen Tormey, National Quality and Patient Safety Directorate, then presented on QI and the resources available to healthcare workers to help progress this most important initiative locally and nationally.

Following a short break, the morning session resumed with NOCA's partners from ICNARC giving the group a refresher on the new INICUA dataset. This presentation was focused on data quality, data validation and reporting. The morning session concluded with Q & A's, and the attendees then gladly availed of the opportunity to catch up with one another over lunch. The afternoon session offered further training from ICNARC.

We were delighted then to have our own ICU Audit Coordinators (Anita Mc Glynn, Annette Gerety and Tanya Quinn Faherty) present to the group on their own hospital's QI to a statistical outlier. Fionnuala Treanor ICU-BIS manager, NOCA completed the afternoon session with an outline of plans for INICUA focused on more timely data reporting, and an update on the National database for critical care.

The workshop was very successful. We also had new ICU Audit Coordinators present, and this was a great opportunity for them to meet the rest of the team and build relationships. Covering a wide range of important subjects, the programme engaged the attention and interest of all present. There was a great level of active participation and discussion throughout the day. Feedback was very positive and highlighted the importance of bringing all the ICU Audit Coordinators and Clinical Leads together.

INICUA will host another workshop in October 2023.

Picture taken on the day of the workshop includes ICU Audit Managers; ICU Audit Coordinators; Andrew Fleming & Ray Stewart (ICNARC); Carol Pentony (ICU-BIS Coordinator); and Jay Gibson (ICU-BIS Development Coordinator).

CHAPTER 13
RECOMMENDATIONS

CHAPTER 13: **RECOMMENDATIONS**

RECOMMENDATION 1

Continue the ongoing HSE programme to expand ICU capacity in line with the Critical Care strategic plan.

Rationale	
1.	The overall national bed occupancy rate was 89% of total open beds, with higher figures in some of the larger Units (ICU-BIS data, Figure 6.1). This rate is greater than the recommended levels of bed occupancy (between 75% (ESICM) and 85% (JFICMI).
2.	Metrics of illness severity on admission to ICU show that patients are sicker in the ROI than in the UK (Figures 5.1, 5.2, 5.3 and 5.4). Patients need to be more seriously ill to be admitted to ICU in the ROI, especially in the larger hospitals, which suggests that some patients would benefit from earlier admission to ICU if a bed were available.
3.	High bed-occupancy rates meant that a bed was not always immediately available for critically ill patients, leading to delays in admission to ICU (Figure 7.1).
4.	Patients in some Units had unacceptably high INEWS scores at the time of discharge from ICU (Figure 6.), which suggests that they were being discharged early in order to make a bed available for patients who required admission.
5.	The Department of Health identified a major shortfall in critical-care bed capacity in its *Health Service Capacity Review 2018* (Department of Health, 2018).
What action should be taken?	
1.	Identify the Units with the greatest need for additional critical-care bed capacity, using the data on bed occupancy, delay in admission to ICU, and the complexity of care that are provided in this report.
2.	Identify additional funding to increase the number of critical care beds in these Units.
3.	Identify measures to address the difficulties in recruiting specialist staff.
Who will benefit from this action/recommendation?	
1.	Earlier admission to ICU in critical illness leads to a shorter stay in ICU, lower mortality and, ultimately, reduced costs (*Cardoso et al., 2011; Chalfin et al., 2007; Young et al., 2003*).
2.	Critically ill patients will receive appropriate treatment earlier.
3.	Patients can stay in ICU or HDU until ready for discharge, thereby reducing early and out-of-hours discharges.
4.	Units will not operate over capacity, which impacts on the care received by all patients in the Unit.
5.	Staff will experience lower levels of stress and burnout.

Who is responsible for implementing this action/recommendation?
HSE Acute Operations will work with the Department of Health to seek the necessary investment for the implementation of *The Strategic Plan for Critical Care*. All funding for Phase 1 and Phase 1+ is in place. Phase 2 developments are subject to Strategic Assessment or Business Case analysis at present.
When should this be implemented?
This recommendation should be implemented as soon as possible in order to correct the existing deficit in beds. Realistically, implementation is likely to be gradual due to funding limitations and the existing difficulty in recruiting specialist critical care staff. However, commitment to a programme of continual expansion of critical care beds is essential in order to correct the existing deficit and to meet future increased needs.
Evidence base for recommendation:

1.	The average number of ICU beds open daily (from January to April 2023, ICU-BIS) was 6.0 ICU beds per 100,000 population. This is below the numbers in most other countries that are members of the Organisation for Economic Co-operation and Development *(OECD, 2021)*. See this link for the number of ICU/HDU beds open today: https://www.hse.ie/eng/services/news/newsfeatures/covid19-updates/coronavirus-daily-operations-updates.html
2.	The Department of Health report *Health Service Capacity Review 2018* recommended an increase to 430 ICU beds by *2031 (*Department of Health, 2018).
3.	*Cardoso*, L.T.Q., Grion, C.M., Matsuo, T., Anami, E.H., Kauss, I.A., Seko, L. and Bonametti, A.M. (2011) Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. *Critical Care,* 15(1), pp. R28.
4.	*Chalfin*, D.B., Trzeciak, S., Likourezos, A., Baumann, B.M., Dellinger, R.P. and DELAYED-ED study group (2007) Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Critical Care Medicine,* 35(6), pp. 1477-1483.
5.	Young, M.P., Gooder, V.J., McBride, K., James, B. and Fisher, E.S. (2003) Inpatient transfers to the intensive care unit: Delays are associated with increased mortality and morbidity. *Journal of General Internal Medicine*, 18(2), pp. 77-83.

RECOMMENDATION 2

Develop and implement a national policy that each Unit should keep one staffed ICU bed empty to be available for immediate admission of critically ill patients, if this can be achieved by discharge of a patient who has been declared clinically ready for discharge.

Rationale	
1.	Discharge of patients when fit for discharge would make their ICU beds available for the rapid admission of critically ill patients. At present, new admissions often have a prolonged wait while existing ICU patients are being discharged.
2.	The HSE's KPI for timely admission to ICU (50% of patients admitted to ICU within 1 hour of the decision to admit) was achieved in only one Unit in 2021 (Figure 7.1).
3.	In 2021, 3.3% of available bed days (2,823 bed days) in ICU were occupied by patients who had been cleared for discharge for more than 8 hours (Figure 6.5, source: INICUA and ICNARC UK data).
4.	Data from ICU-BIS showed that 10% of available beds in 2021 were occupied by patients who had been cleared for discharge (Figure 6.8).
5.	Discharging patients from ICU when they no longer require this level of care would reduce overcrowding in ICU, which impacts on the care of other ICU patients and on staff burnout
6.	Discharging patients as soon as they are cleared for discharge would reduce discharges from ICU at night, which increases risk for patients.
7.	A quality improvement project in St James's Hospital that included the introduction of a policy of keeping an 'emergency bed' available was associated with major improvements in QIs relating to ICU bed availability (CHAPTER 11).

What action should be taken?
Make it policy in all hospitals to keep an ICU bed empty for urgent admissions whenever it is possible to achieve this by discharge of a patient who is clinically ready for discharge.

Who will benefit from this action/recommendation?	
1.	Patients who require urgent admission to ICU.
2.	All patients already in ICU.
3.	ICU staff will no longer have to undergo stress and waste 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?
HSE Acute Operations should implement this as a national policy

When should this be implemented
This recommendation should be implemented immediately. Delayed admission to ICU worsens patient outcomes (Cardoso *et al.,* 2011; Chalfin *et al*., 2007; Young *et al*., 2003). The only way to ensure rapid admission to ICU is to keep an ICU bed vacant and available for urgent admissions at all times. Discharging patients from ICU to the ward at night worsens patient outcomes (Priestap and Martin, 2006). If ward beds were made available during daytime for patients cleared for discharge, this would prevent night-time discharges.

RECOMMENDATION 3

Develop the Critical Care Retrieval Service of the National Ambulance Service to provide a 24-hour, 7-day transport service for inter-hospital transfers of critically ill patients.

Rationale
INICUA and MICAS data suggest that only 50% of critical care transfers were undertaken by the specialist transfer service, MICAS. The other 50% of transfers were undertaken in a non-specialist vehicle by staff from the referring hospital who did not have training in transport medicine. Moreover, the absence of these staff members left their hospital understaffed.
What action should be taken?
Develop the MICAS service to provide a 24-hour, 365 day a year service.
Who will benefit from this action/recommendation?
1. Critically ill patients being transferred between hospitals
2. Patients in the transferring hospital who are receiving less care while critical care staff are absent
3. Medical and nursing staff in the transferring hospital who have no specialist training in transport medicine and who lack the equipment available to the MICAS team.
Who is responsible for implementing this action/recommendation?
The Director of the National Ambulance Service at Health Service Executive is responsible for the implementation of this recommendation.
When should this be implemented
This recommendation should be implemented as soon as is practical. The NAS has accepted this recommendation in principle, noting that any future implementation will be dependent on available resources.
Evidence base for recommendation
Data from *INICUA Report 2021* documents 913 inter-hospital critical care transfers of patients who were admitted to ICU in the receiving hospital without prior admission to a ward. When the fact that there are some gaps in the INICUA transfer data is taken into account, this figure suggests there were a total of around 1,000 transfers of critically ill adult patients in 2021. This figure is in line with previous MICAS / NAS estimates of numbers. Data from the 2021 MICAS report on adult critical care transfers show that only 469 of these transfers were undertaken by the specialist transfer service. The remaining transfers was undertaken by a non-specialist team in a non-specialist ambulance, probably outside normal working hours, which would have left the transferring hospital short-staffed, with on-call staff absent.

RECOMMENDATION 4

Adequately staff ICU audit by providing one whole-time equivalent (WTE) ICU audit coordinator for every 10 Unit beds audited.

Rationale	
1.	Auditing ICU activity is essential to identify shortfalls in quality of care, to guide improvements in care and to document activity in ICU to guide resource allocation.
2.	The INICUA dataset is extensive and complex; our experience is that a ratio of one WTE is required for every 10 beds in an ICU or HDU.
Units which do not have this ratio of Audit Coordinators to ICU beds have in 2021 and 2022 had large gaps in data collection.	
What action should be taken?	
The HSE should resource hospitals to achieve a ratio of one WTE assigned to every 10 beds for audit in ICU or HDU.	
Who will benefit from this action/recommendation?	
1.	Patients will benefit from timely and comprehensive data on ICU activity and quality of care.
2.	Hospital management and clinicians will benefit from earlier access to reports on ICU activity.
3.	National planning of hospital activity requires accurate and comprehensive data on ICU activity.
Who is responsible for implementing this action/recommendation?	
HSE Acute Operations is responsible for the implementation of this recommendation.	
When should this be implemented	
This recommendation should be implemented immediately.	
Evidence base for recommendation	
Chapter 4 within this report highlights the fact that University Hospital Kerry ICU and Tallaght University Hospital ICU had three and two quarters of data, respectively, that were unavailable for reporting in 2021. There are greater gaps in data completeness for 2022. Data for a total of 18 quarters across 9 hospitals are not available for reporting. This is because of inadequate staffing, including redeployment of ICU Audit Coordinators to the clinical area. This is a worrying trend that undermines the validity and usefulness of national ICU audit.	

RECOMMENDATION 5

Continue the development of the National ICU Audit database at NOCA to allow wider reporting of data nationally.

Rationale

The Irish National ICU Audit dataset is housed within InfoFlex, the ICU Audit Software.

This national dataset contains both the ICNARC dataset items and dataset items specific to the Irish Healthcare setting. Currently national reporting is supported by an aggregated ICNARC Report for Ireland. Reporting on specific data for Ireland will be augmented by a National ICU Audit database at NOCA which will contain both datasets. This is one of the aims of the National ICU Audit.

- Reporting from the national database will allow NOCA to provide more detailed reports on: Unit acquired infection including Unit Acquired Bloodstream Infections (UABIs), organ donation to support Organ Donation and Transplant Ireland (ODTI), and reports on currently/recently pregnant patients in ICU.
- Develop national dashboards on ICU activity and outcomes.
- Respond more quickly to data and research requests for service evaluation, planning and improvement to support the Irish healthcare system in the future.

What action should be taken?

Continue the development of the National ICU Audit database at NOCA to allow wider reporting of data nationally.

Who will benefit from this action/recommendation?

1.	Patients will benefit from the availability of detailed and complex analysis of the large database that will now be available.
2.	Clinicians will have access to bespoke reports on issues of importance to them, including research.
3.	Management will have access to timely data on hospital activity, and this data will guide decision-making.

Who is responsible for implementing this action/recommendation?

NOCA is responsible for this.

When should this be implemented

This recommendation should be implemented immediately.

Evidence base for recommendation

NOCA receives regular requests for new analyses of the large database which has now built up, both from researchers and from stakeholders in the health service. These requests demonstrate the need for the National ICU Audit database.

CONSIDERATION AND LEARNING POINT

NOCA is committed to including the patient voice at the centre of national clinical audit, thereby providing a broader picture of quality and safety, and of the patient's experience of healthcare. From previous INICUA reports that incorporated patients' stories, a recognisable gap in psychological and practical support for patients, and for families of critically ill patients, was identified.

Perceptions of vulnerability: Barbara's experience of ICU and recovery (*INICUA Annual Report 2017*) emphasised the need for effective step-down care for ICU patients within the hospital, and for support when they return home. Barbara believes if, on discharge, she had been given information outlining what to expect while in recovery, this would have made her life after ICU more manageable. Barbara and her husband, together with some ICU nurses, have set up ICUsteps Dublin, a voluntary support group for ICU patients and their families. ICUsteps Dublin provides ICUs with patient information leaflets that outline physical, emotional, and cognitive challenges. Support is also provided through a drop-in facility held one evening in every month. Former patients, relatives along with ICU nurses can meet either in person or on line and share experiences.

Shaun's story (*INICUA Annual Report 2018*) also offered very important lessons. Shaun and his family recognised a gap in support for families of critically ill patients. They describe the fear, uncertainty, and powerlessness of the days they spent in the ICU waiting rooms. As a result, they recommend early support for families, in the form of advocacy groups, which would step in where healthcare was lacking, and the displaying in ICU waiting rooms of information on the services that are available.

The importance of providing psychological care for ICU Patients was also a strong message from the Patient Story in this report, "'Beyond Frustrating and Absolutely Terrifying': One Young Person's Experience of an ICU and Hospital Journey".

Dr Melanie Ryberg has recently been appointed by Tallaght University Hospital as the first full-time Clinical Psychologist *permanently* appointed to an ICU Department in Ireland. The Mater Hospital ICU also now has a permanent Clinical Psychologist.

As a Principal Specialist Clinical Psychologist, Dr Ryberg is working in Critical Care, where her role is to identify and meet the psychological needs of patients and their families during an ICU (Intensive Care Unit) admission. Dr Ryberg highlights the importance of providing psychological support for patients and families who are coping with critical illness:

> *The experience of critical illness is frequently overwhelming, confusing, frightening and deeply upsetting for our patients and their families. Leaving critical care is often only the beginning of a long, uncertain and arduous journey, often made more difficult by the lack of appropriate and timely multidisciplinary support. The physical, psychological and social legacy of critical illness can persist for years, with an associated burden for the individual and the family and health systems. From our patient stories, and from the large and growing literature documenting the psychological needs of ICU patients, both in terms of mental health and cognitive outcomes, we can have no doubt that professional psychological support, starting during the admission and following to discharge and beyond, is not just indicated, but necessary. The question now must surely be not "if", but "when".*

Learning points can highlight key lessons for practice that have been revealed by the audit, and these lessons can have a positive impact on outcomes and service delivery. It will be important to investigate what services, including psychological-care services, are available nationally for patients and their families during an ICU admission and post ICU discharge. A research question on this topic should be used as a starting point for investigating this service during the patient journey. NOCA has included this in is research agenda for 2023 onwards.

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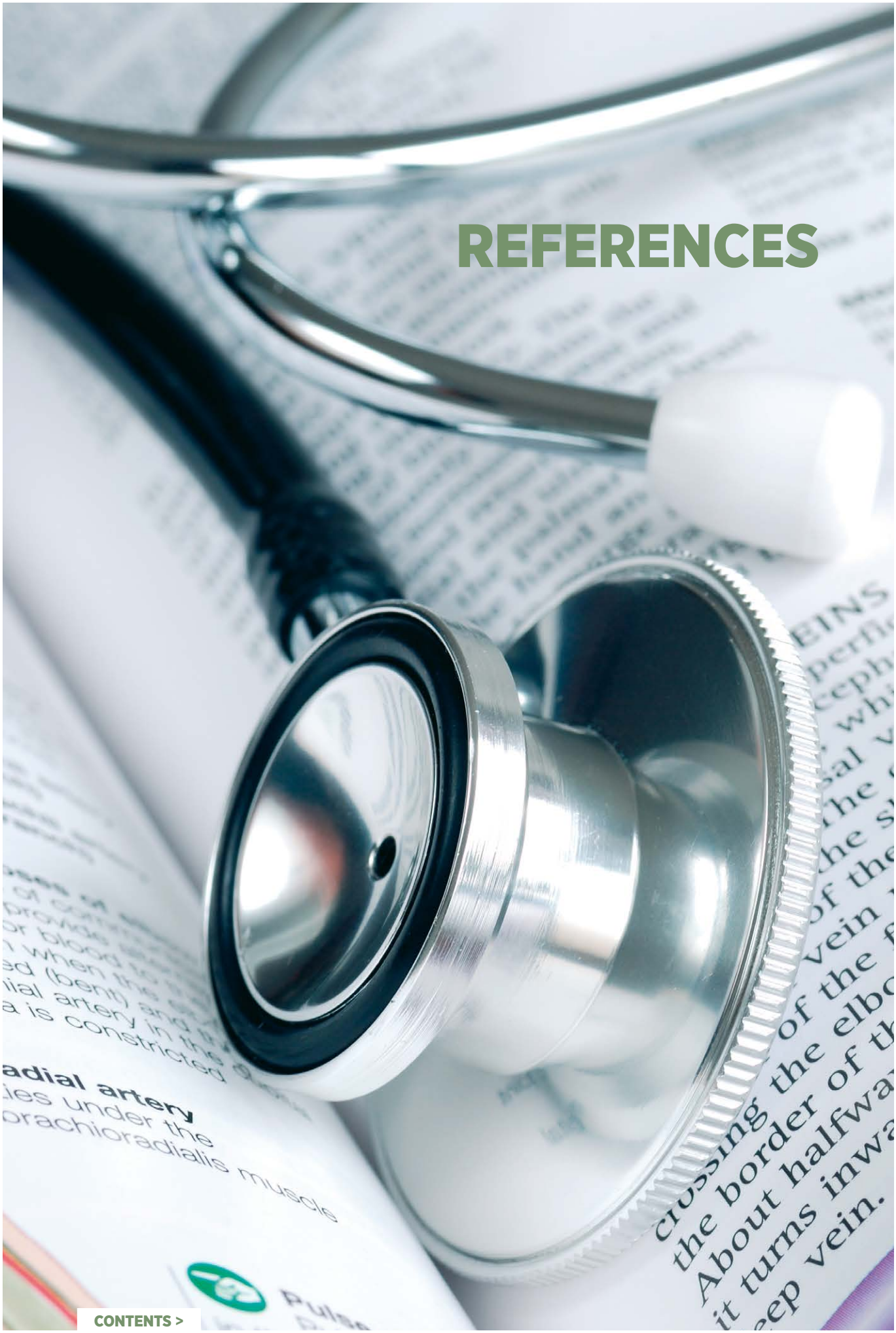

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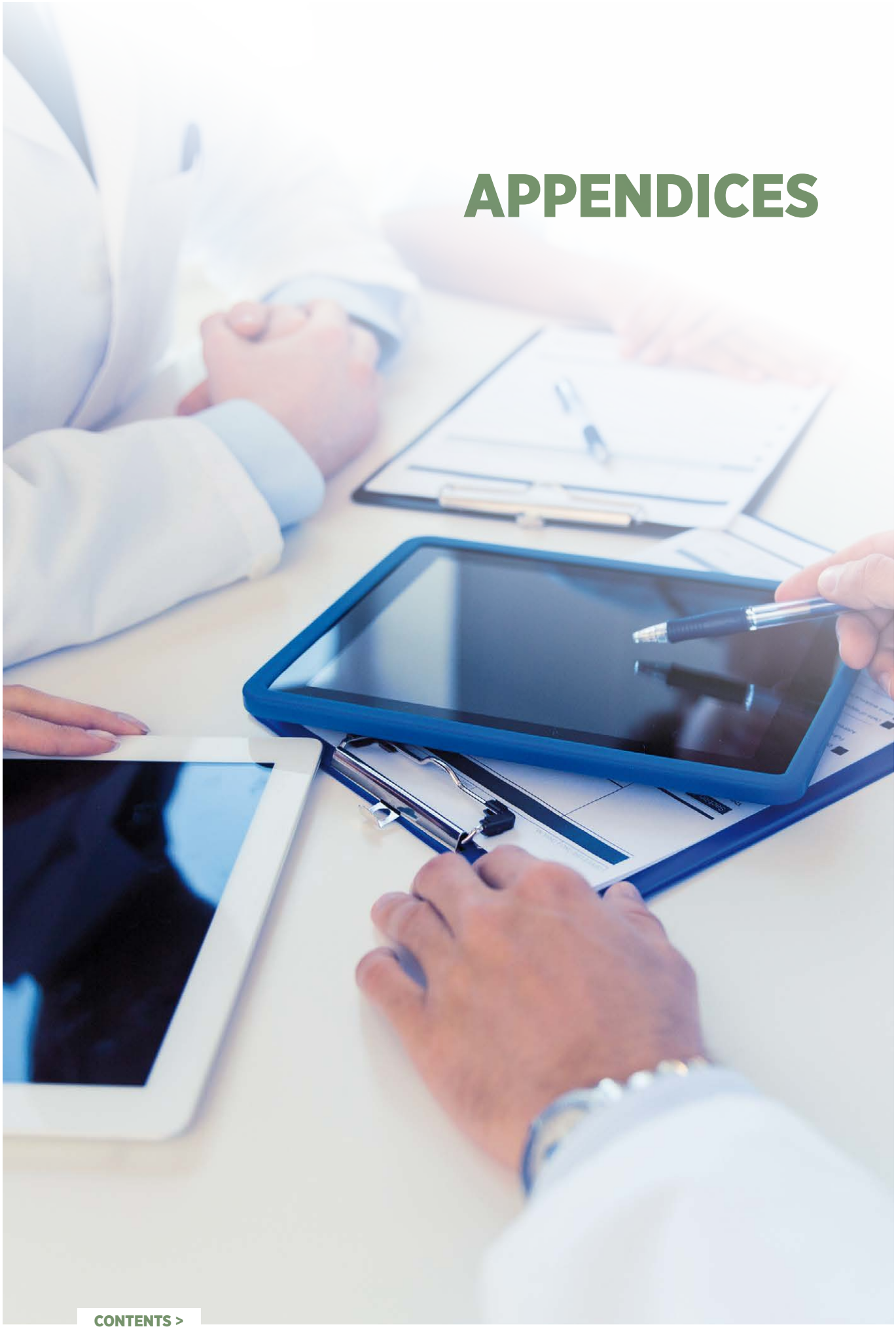
APPENDICES



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ACCESSING REPORT APPENDICES

National Office of Clinical Audit (2023)
Irish National ICU Audit Report 2021 - Appendices.
Dublin: National Office of Clinical Audit.
Available at: https://www.noca.ie/publications/publications-listing/PO/category/3

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FREQUENCY TABLES

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APPENDIX 3:
ICU AUDIT GOVERNANCE COMMITTEE

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National Office of Clinical Audit

Phone: **+353 1 402 8577**
Email: **icu@noca.ie**
Twitter: @**noca_irl**

www.noca.ie