National Office of Clinical Audit

Irish National ICU Audit

IRISH NATIONAL ICU AUDIT
INTERIM REPORT 2019

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ACKNOWLEDGEMENTS

This work uses patient data collected by their healthcare providers as part of their care.

The National Office of Clinical Audit (NOCA) would like to thank all participating hospitals for their valuable contributions, and the ICU Audit Coordinators and Clinical Leads. Without their continued support and input, this audit could not continue to produce meaningful analysis of critical care in Ireland.

NOCA greatly appreciates the ongoing commitment and support received from the Health Service Executive National Quality Improvement Team and its Director, Dr Philip Crowley, which has led to major growth and development in clinical audit in Ireland.

NOCA would also like to thank DMF Systems and Chameleon Information Management Services Ltd (CIMS), software providers for the Irish National Intensive Care Unit Audit.

GLOSSARY OF TERMS AND DEFINITIONS

NAME	DEFINITION
AKI	Acute kidney injury
APACHE II	Acute Physiology and Chronic Health Evaluation; this is designed to measure the illness severity of adult patients admitted to Intensive Care Units.
ARS	Advanced respiratory support; this is a measure to support lungs that are failing in their function using a tube into the trachea.
Calendar days	A calendar day is defined as any complete calendar day (00.01 to 23.59) or part thereof, e.g. a patient admitted on 1 January 2012 at 23.45 and discharged on 3 January 2012 at 00.10 would be recorded as having received 3 calendar days of care.
CMP	Case Mix Programme; this is the data collection undertaken by the Intensive Care National Audit and Research Centre (ICNARC) within the United Kingdom (UK).
CPR	Cardiopulmonary resuscitation; this is resuscitation of the heart and lungs requiring chest compressions with or without ventilation of the lungs.
CRRT	Continuous renal replacement therapy
CT ICU	Cardiothoracic Intensive Care Unit
CVS	Cardiovascular system
Dialysis	Removal of waste products from the body when the kidneys are not functioning.
ED	Emergency Department; also known as Accident and Emergency.
ESICM	European Society of Intensive Care Medicine
GICU	General Intensive Care Unit
HD	Haemodialysis
HDU	High Dependency Unit
HSE	Health Service Executive
ICNARC	Intensive Care National Audit and Research Centre
ICU	Intensive Care Unit
InfoFlex	ICU Audit software
Invasive monitoring	Using direct measurement from within the body of a patient. This type of monitoring is common in the ICU and involves inserting a cannula in a suitable artery or vein.
IQR	Interquartile range
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.

NAME	DEFINITION
Levels of care	Specifies the level of care provided on each day of Unit stay. Levels of care range from 0 to 3 and are allocated based on the monitoring and support of organ failure: Level 3 – Monitoring and support for two or more organs Level 2 – Monitoring and support for one or more organs Level 1 – Admissions receiving a greater degree of observation, monitoring, intervention(s), clinical input or advice than normal ward care Level 0 – Admissions receiving normal ward care.
Level of care days	Specifies the total number of calendar days during which the patient received a particular level of care.
LOS	Length of stay; the number of days that a patient spends in ICU and/or hospital.
MDRO	Multidrug-resistant organism
MDT	Multidisciplinary team
Mean	The mean is the average of a set of numbers.
Mechanical ventilation	Use of a machine to support breathing.
Median	The median is the middle value in a set of numbers.
NEWS	National Early Warning Score
NICU	Neurosurgical Intensive Care Unit
NOCA	National Office of Clinical Audit
Organ failure	When one or more organs of the body fail to function correctly.
QI	Quality indicator
ROI	Republic of Ireland
SD	Standard deviation
Sepsis	When an infection leads to effects on the whole body. It occurs when chemicals released into the bloodstream to fight the infection trigger inflammatory responses throughout the body.
SMR	Standardised mortality ratio; the ratio of the number of observed deaths in a Unit to the number of deaths predicted by the ICNARC risk-prediction model.
TBI	Traumatic brain injury
UK	United Kingdom
UK Units	Pooled data for Intensive Care Units in England, Wales and Northern Ireland; this is reported on by ICNARC and used as a comparator within this report.

Executive summary

This report is a comprehensive overview of activity and outcomes in 2019 in Units which provide 88% of critical care in hospitals funded by the Health Service Executive (HSE). The report includes four hospitals not previously audited: Cork University Hospital, Letterkenny University Hospital, South Tipperary General Hospital, and University Hospital Kerry.

Nationally, there were no major changes in findings compared with 2018.

Units varied widely in admission volumes and case mix, reflecting the heterogeneity of the Units included. Patients were very ill on admission, with higher scores for illness severity and requirements for organ support than patients in the United Kingdom (UK). Fifty-four percent of Irish patients required invasive ventilation versus 41% in the UK.

Units were very busy, with an overall bed occupancy rate of 90% (compared to 88% in 2018). There were a number of indicators of ICU bed shortage, including high National Early Warning Scores (NEWS) on discharge from a number of Units, suggesting early discharge. A number of Units did not achieve the targets of 50% of patients admitted to the ICU within 1 hour of a decision to admit and 80% within 4 hours. Conversely, delayed discharge from ICU was common, with 4.6% of bed days occupied by patients who had been cleared for discharge for more than 8 hours.

Children aged under 16 years were rarely admitted to adult Intensive Care Units (ICUs) except in University Hospital Galway ICU and Beaumont Hospital Richmond ICU (Neuro). A new report on obstetric patients showed 147 ICU admissions of patients who were currently or recently pregnant.

Despite the pressures on ICUs, the overall national risk-adjusted mortality rate was at the expected level and no individual Units had excess mortality. There were outlier data for quality indicators which indicated shortages of ICU beds in some Units, e.g. delayed admission (Cork University Hospital GICU and St James's Hospital GICU). The hospitals have responded to these outlier findings with actions to expand ICU bed capacity.

Data are provided on infection with multidrug-resistant organisms, showing high rates of colonisation on admission to ICU and relatively low rates of transmission within Units.

In summary, Irish ICUs were very busy in 2019 but provided high-quality care with good outcomes. However, the system operated at the limits of capacity and there was very little reserve capacity.

INTRODUCTION

This is an interim national report by the National Office of Clinical Audit (NOCA) Irish National Intensive Care Unit Audit Governance Committee for 2019. It presents comprehensive data on Intensive Care Unit (ICU) admissions to Units participating in the Irish National Intensive Care Unit Audit (INICUA). These were 22 Units in 18 hospitals, encompassing 88% of all ICU activity in adult hospitals funded by the Health Service Executive (HSE). Data coverage in participating Units during 2019 is illustrated in the table below.

This report is provided 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 users of intensive care services in the Republic of Ireland (ROI).

We have produced a condensed version of the usual INICUA Annual Report in order to provide earlier access to key data to support the planning of ICU expansion due to take place in 2021 and in later years.

NATIONAL OFFICE OF CLINICAL AUDIT

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

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

DATA COVERAGE IN PARTICIPATING ICUs, 2019

KEY	HOSPITAL NAME	UNIT NAME	N	Q1	Q2	Q3	Q4
A	Beaumont Hospital, Dublin	General Intensive Care Unit	668	Y	Y	Y	Y
B	Beaumont Hospital, Dublin	Richmond Intensive Care Unit	388	Y	Y	Y	Y
C	Mater Misericordiae University Hospital, Dublin	High Dependency Unit	1302	Y	Y	Y	Y
D	Mater Misericordiae University Hospital, Dublin	Intensive Care Unit	1140	Y	Y	Y	Y
E	Our Lady of Lourdes Hospital, Drogheda	Intensive Care Unit	442	Y	Y	Y	Y
F	St James's Hospital, Dublin	Cardiothoracic Intensive Care Unit	384	Y	Y	Y	Y
G	St James's Hospital, Dublin	General Intensive Care Unit	949	Y	Y	Y	Y
H	Tallaght University Hospital, Dublin	Intensive Care Unit	214	N	N	N	Y
I	University Hospital Galway	General Intensive Care Unit	1155	Y	Y	Y	Y
J	University Hospital Limerick	Intensive Care Unit	444	Y	Y	Y	Y
K	Waterford Regional Hospital	Intensive Care Unit	401	Y	Y	Y	Y
L	Regional Hospital Mullingar	Intensive Care Unit	370	Y	Y	Y	Y
M	Wexford General Hospital	Intensive Care Unit	308	Y	Y	Y	Y
N	Connolly Hospital, Dublin	Intensive Care Unit	291	Y	Y	Y	Y
O	Midlands Regional Hospital Tullamore	Intensive Care Unit	251	Y	Y	Y	Y
P	Naas General Hospital	Intensive Care Unit	207	Y	Y	Y	Y
Q	St Luke's General Hospital, Kilkenny	Intensive Care Unit		N	N	N	N
R	St Vincent's University Hospital, Dublin	Intensive Care Unit	700	Y	Y	Y	Y
S	Cork University Hospital	Cardiothoracic Intensive Care Unit	678	Y	Y	Y	Y
T	Cork University Hospital	General Intensive Care Unit	618	Y	Y	Y	Y
U	Letterkenny University Hospital	Intensive Care Unit	78	N	N	N	Y
V	South Tipperary General Hospital, Clonmel	Intensive Care Unit	118	N	N	Y	Y
W	University Hospital Kerry	Intensive Care Unit	135	N	N	Y	Y

N; number of admissions during the period of data collection

DATA INCLUDED IN REPORT	DATA NOT COLLECTED	UNIT NOT PARTICIPATING

CHAPTER 1: DESCRIPTION OF PARTICIPATING UNITS

The Units participating in INICUA differ considerably from each other in size (Table 1.1) and case mix.

Beds provided for critically ill patients are classified as ICU beds (Level 3, more complex care provided) or High Dependency Unit (HDU) beds (Level 2, less complex care provided). The Units participating in INICUA 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. Furthermore, some Units have patients receiving care predominantly from a particular specialty – for example, cardiac surgery, neurosurgery, etc. 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 1.1.

TABLE 1.1: CHARACTERISTICS OF THE UNITS PARTICIPATING IN THE IRISH NATIONAL INTENSIVE CARE UNIT AUDIT

Key	Unit	Description	Staffed beds (by end 2019)
A	**Beaumont Hospital General ICU**	General ICU for medical and surgical patients with a significant number of neurosurgical patients as overflow from the hospital Neurosurgical ICU	9
B	**Beaumont Hospital (Richmond) Neurosurgical ICU**	Specialist Unit for neurosurgical patients with a significant number of general medical/surgical patients as overflow from the hospital General ICU	8
C	**Mater Misericordiae University Hospital HDU**	High Dependency Unit for general medical and general surgical patients	16
D	**Mater Misericordiae University Hospital ICU**	General ICU for medical and surgical patients. Significant influences on case mix include cardiothoracic surgery, heart and lung transplantation, extracorporeal life support	17
E	**Our Lady of Lourdes Hospital, Drogheda ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	8
F	**St James's Hospital Cardiothoracic ICU**	Specialist ICU for patients after cardiothoracic surgery	8
G	**St James's Hospital General ICU**	General ICU for medical and surgical patients with 20 beds. The Audit Report also includes data from two Burns Unit beds, totaling 22 critical care beds.	22
H	**Tallaght University Hospital ICU**	General ICU for medical and surgical patients, with nine beds. The Audit Report	12

		also includes data from three beds in the Post Anaesthesia Care Unit, totaling 12 critical care beds.	
I	**University Hospital Galway ICU**	General ICU and separate HDU are combined for Audit purposes. Casemix includes medical, surgical, obstetric and paediatric patients.	15
J	**University Hospital Limerick ICU**	General ICU for medical and surgical patients. The hospital also has an eight-bed HDU, which is not included in this report.	10
K	**University Hospital Waterford ICU**	General ICU for medical and surgical patients. The hospital also has a four-bed HDU, which is not included in this report.	5
L	**Regional Hospital Mullingar ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	6
M	**Wexford General Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	5
N	**Connolly Hospital Blanchardstown ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	4
O	**Midland Regional Hospital Tullamore ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	4
P	**Naas General Hospital ICU**	General Unit (mixed ICU/HDU) for medical and surgical patients	4
R	**St Vincent's University Hospital ICU**	General ICU for medical and surgical patients, with a significant number of patients with liver-related illness	16
S	**Cork University Hospital**	General ICU for medical, surgical and neurosurgical patients	6
T	**Cork University Hospital**	Specialist ICU for patients after cardiothoracic surgery	12
U	**Letterkenny University Hospital**	General Unit (mixed ICU/HDU) for medical and surgical patients	5
V	**South Tipperary General Hospital, Clonmel**	General Unit (mixed ICU/HDU) for medical and surgical patients	4
W	**University Hospital, Kerry**	General Unit (mixed ICU/HDU) for medical and surgical patients	4

ACTIVITY IN CRITICAL CARE

COVERAGE

The Units participating in INICUA in 2019 provided 88% of all critical care in HSE-funded hospitals (Critical Care Programme (2020).

VOLUME

Participating Units differed widely in numbers of admissions (Figure 1.1). This was related to their numbers of beds and to patient length of stay (LOS) – Units with a shorter LOS had more admissions for a given number of beds.

Two Units participated for only 3 months (Tallaght University Hospital ICU and Letterkenny University Hospital ICU) and two Units participated for 6 months (South Tipperary General Hospital, Clonmel ICU and University Hospital Kerry ICU) in 2019, with a corresponding effect on the numbers of admissions noted in Figure 1.1.

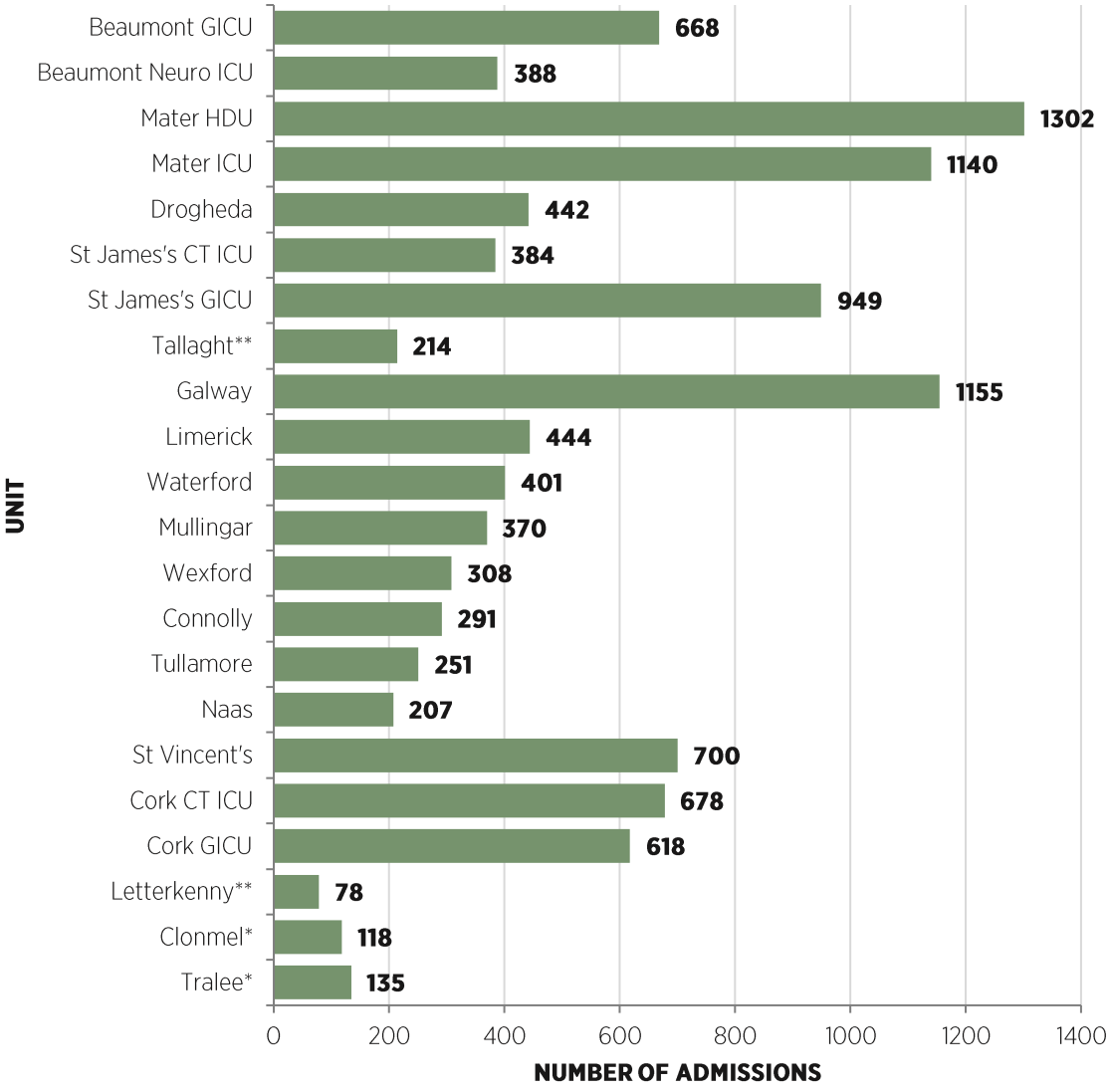

FIGURE 1.1: NUMBER OF ADMISSIONS TO EACH UNIT IN 2019 (N=11,241)

* Hospitals submitted data for only 6 months of 2019.

** Hospitals submitted data for only 3 months of 2019.

AGE PROFILE

The mean age of patients was similar across different Units in the ROI (Figure 1.2). The mean age was somewhat lower in Beaumont Hospital Richmond ICU (Neuro) than in the other participating Units, reflecting its case mix, which includes younger patients with traumatic brain injury. The mean age of patients across all Units in the ROI was 61 years, the same as for Units in the UK (England, Wales, and Northern Ireland).

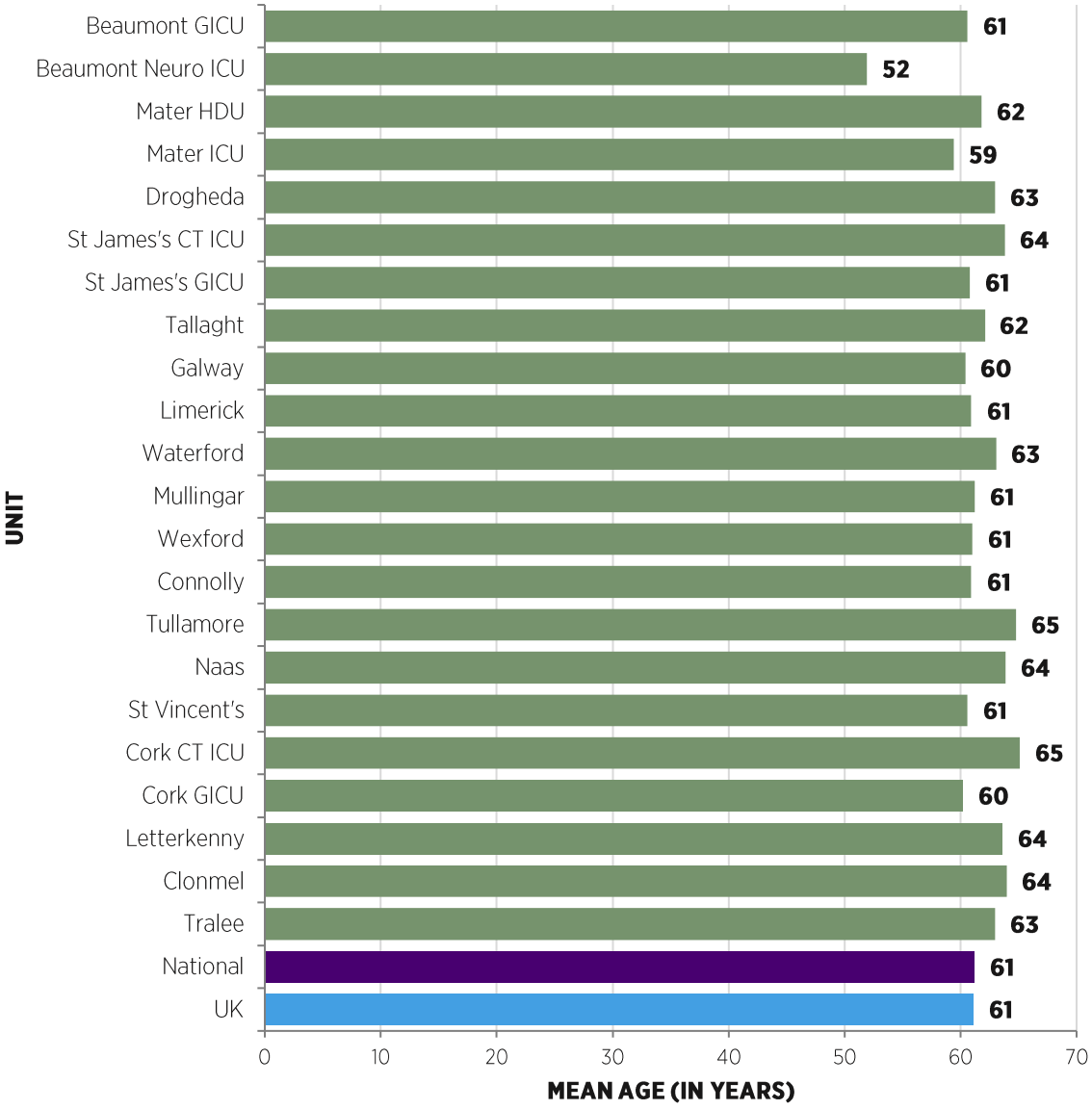

FIGURE 1.2: MEAN AGE OF PATIENTS (YEARS) ON ADMISSION TO EACH UNIT

GENDER

Gender distribution showed a predominance of male patients, in line with international experience (Figure 1.3). Seventy-seven percent of admissions to St James's Hospital Keith Shaw Unit (Cardiothoracic ICU) were male and 72% of admissions to Cork University Hospital Cardiothoracic ICU were male, reflecting a characteristic of patients undergoing cardiac surgery.

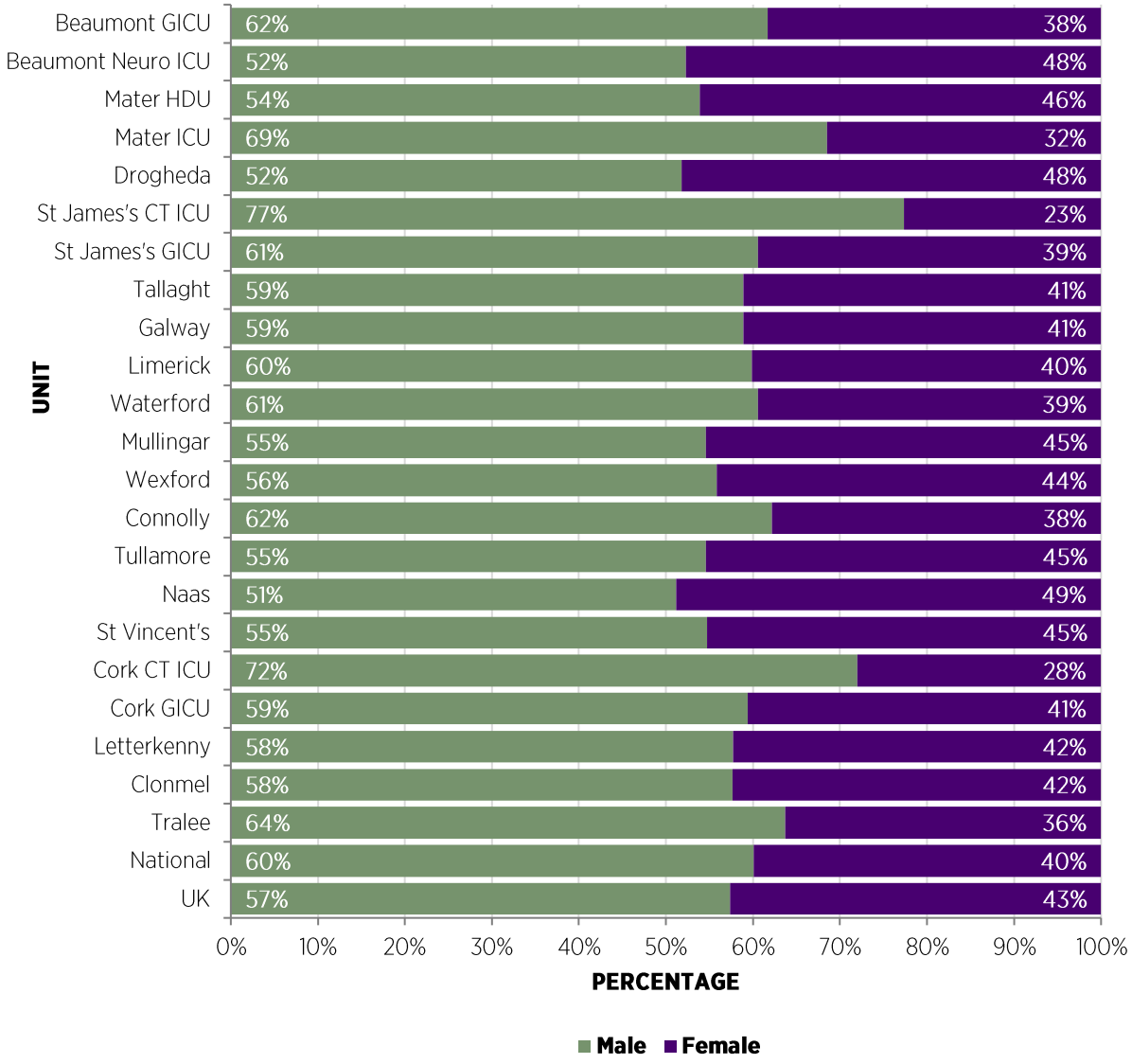

FIGURE 1.3: GENDER DISTRIBUTION IN EACH UNIT

ICU ADMISSIONS AFTER SURGERY

Unit admissions after emergency surgery varied from 47% in Beaumont Hospital Richmond ICU (Neuro) to 3% in St James's Hospital Keith Shaw Unit (Cardiothoracic ICU) (Figure 1.4). Patients admitted to ICU after emergency surgery are known to have a higher mortality in ICU than after elective surgery.

Patients not included in the percentages shown in Figure 1.4 came to the Unit from a location other than the operating theatre. They may have suffered from a non-surgical condition (e.g. sepsis, cardiac arrest, liver disease, haemorrhage, etc.) or may have been postoperative but were initially transferred to a ward. These patients are usually admitted to ICU as an emergency and in an unpredictable manner.

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

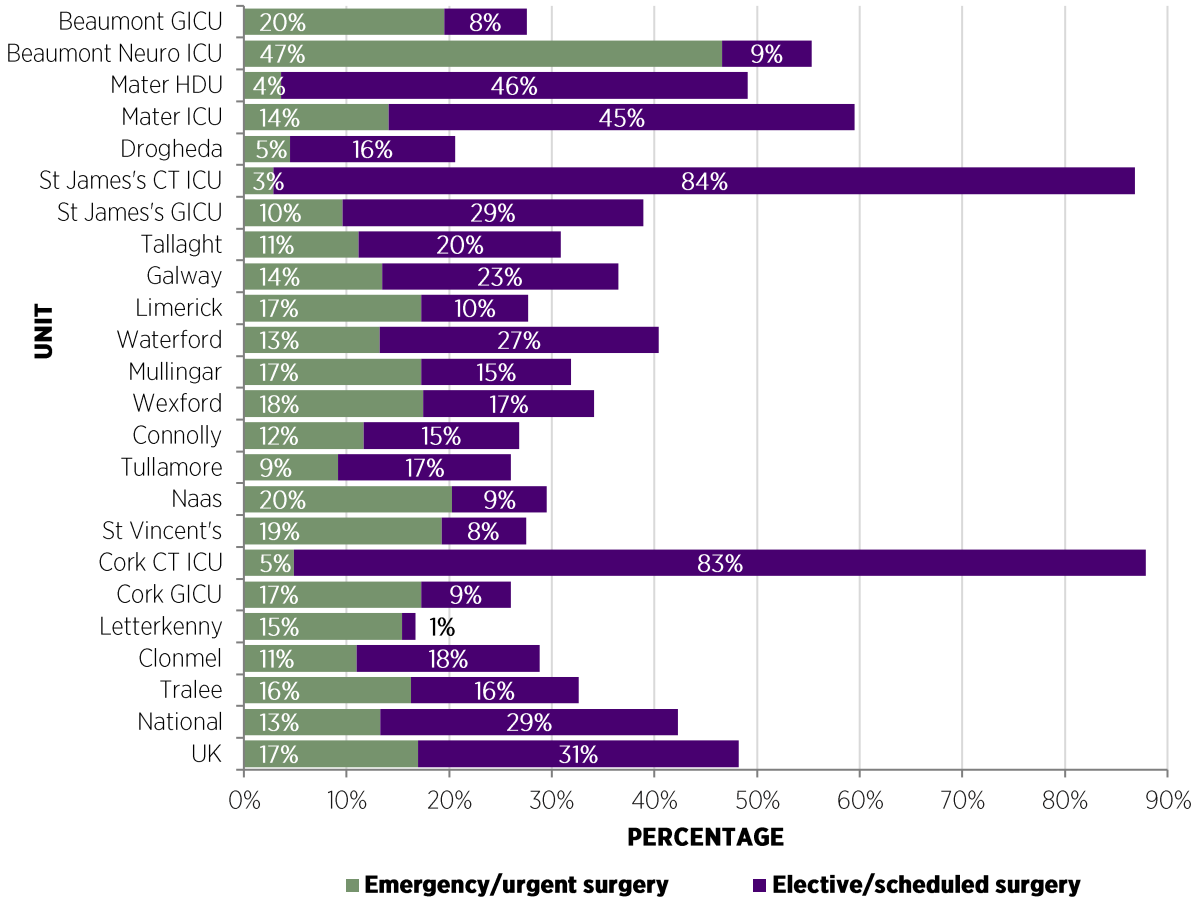

FIGURE 1.4: ADMISSIONS FROM THE OPERATING THEATRE TO EACH UNIT AFTER EMERGENCY SURGERY AND AFTER ELECTIVE SURGERY (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

ICU ADMISSIONS AFTER TRAUMA

The percentages of ICU admissions after trauma (Figure 1.5A) and, as a subset of these, after traumatic brain injury (TBI) (Figure 1.5B) were consistently around 8% and 3%, respectively. University Hospital Galway ICU had the largest number of trauma admissions (n=106), which represented 9% of its total number of admissions (Figure 1.5B). Beaumont Hospital Richmond ICU (Neuro) had the largest number of TBI admissions (n=78), 20% of its total number of admissions.

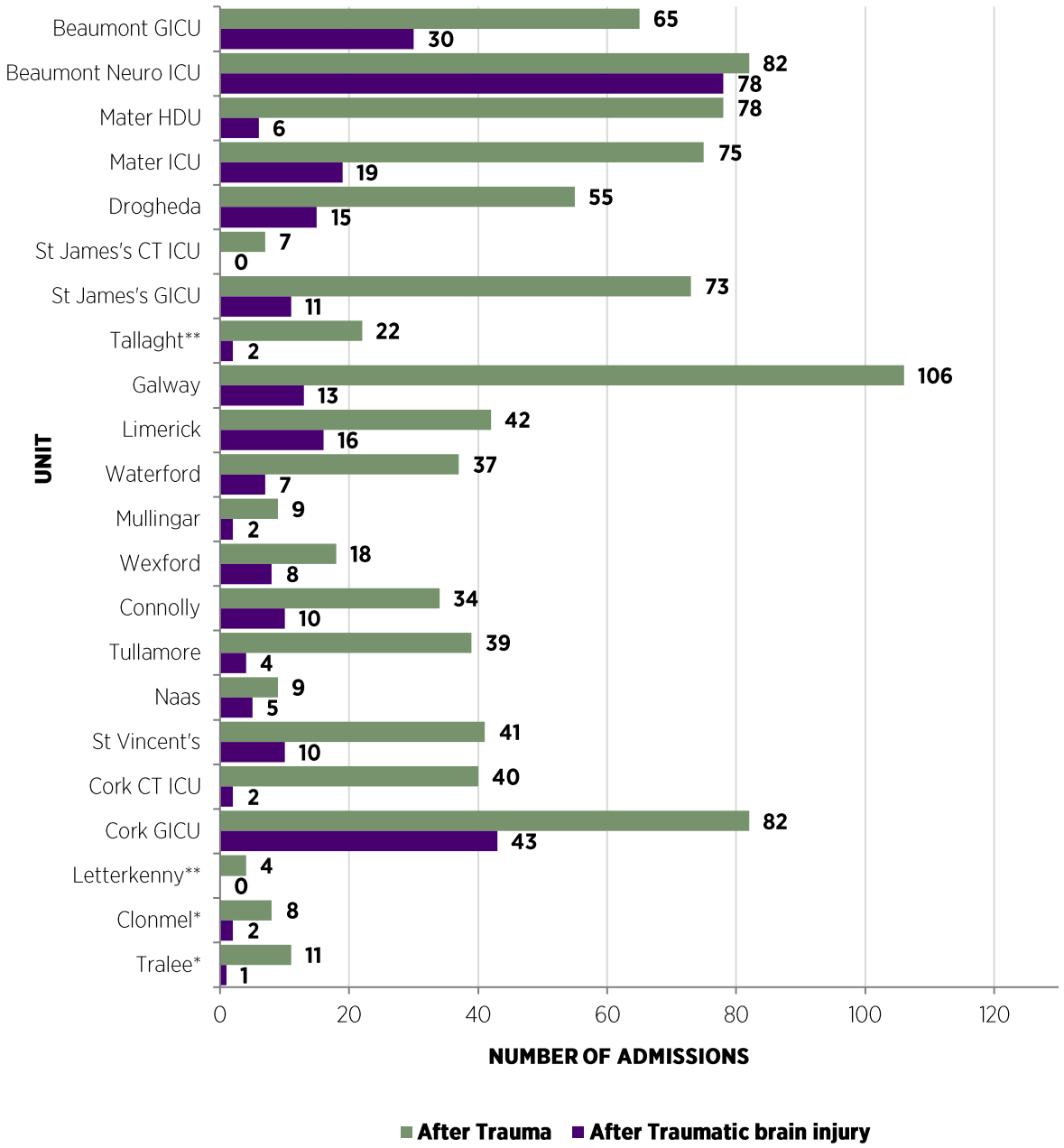

FIGURE 1.5A: NUMBER OF ADMISSIONS TO EACH UNIT (I) AFTER ALL TRAUMA AND (II) AFTER TRAUMATIC BRAIN INJURY

* Hospitals submitted data for only 6 months of 2019.

** Hospitals submitted data for only 3 months of 2019.

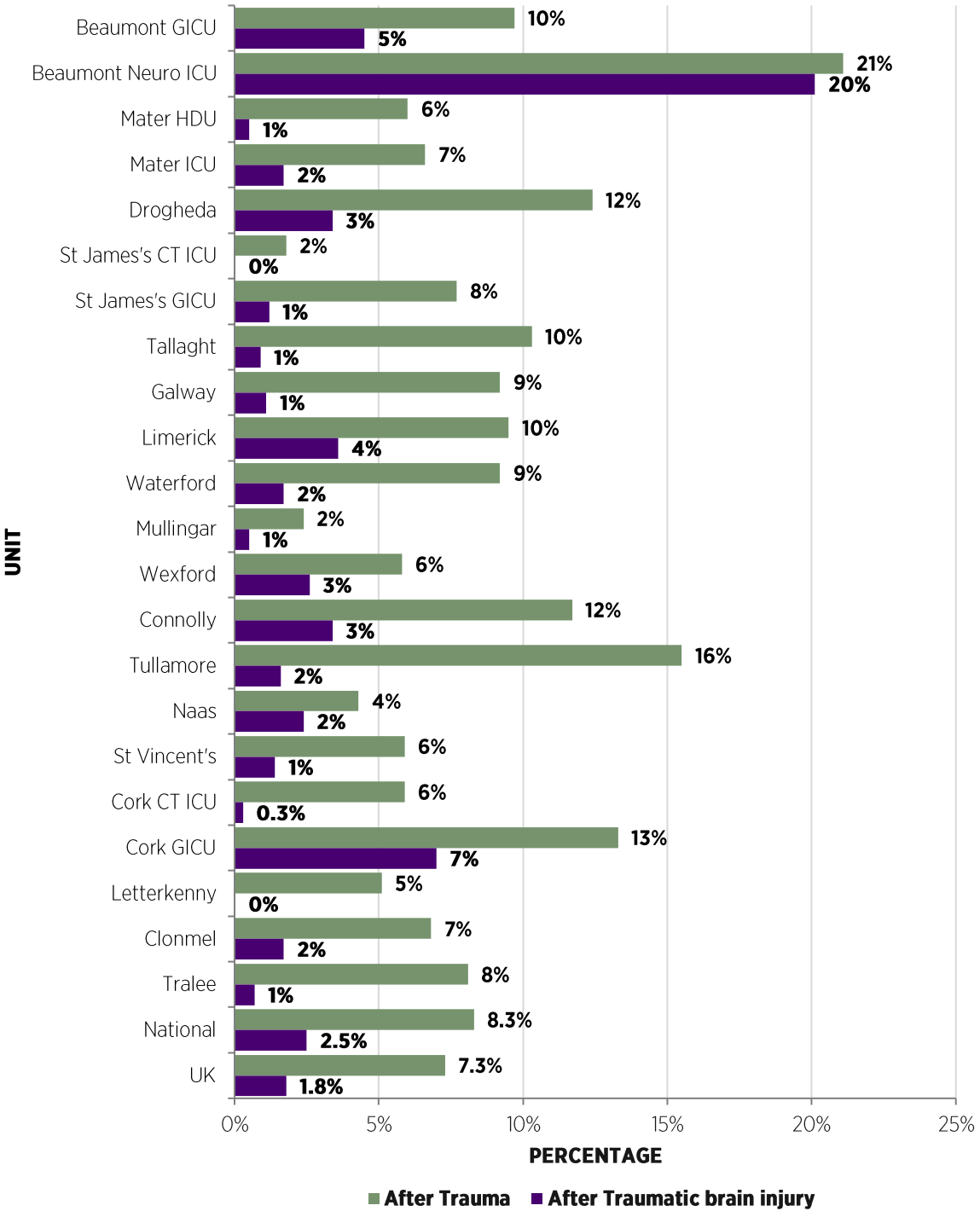

FIGURE 1.5B: ADMISSIONS TO EACH UNIT (I) AFTER ALL TRAUMA AND (II) AFTER TRAUMATIC BRAIN INJURY (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

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 long term. The Kidney Disease: Improving Global Outcomes (KDIGO) classification system is used to define and grade AKI as KDIGO Stages 1–3. KDIGO Stage 1 is defined as an increase in serum creatinine more than 1.5 times above the baseline value or oliguria (urine output <0.5 ml/kg/hr for <6 hours). Nationally, 52% of patients had AKI (KDIGO Stages 1–3) in the first 24 hours after admission (Figure 1.6). AKI within 24 hours of admission usually reflects kidney injury which occurred in the period before admission to ICU.

KDIGO Stage 3 is defined as an increase in serum creatinine to more than three times the baseline value or more prolonged oliguria (Kidney Disease: Improving Global Outcomes, 2012). KDIGO Stage 3 indicates a greater severity of AKI with a greater requirement for dialysis and increased mortality. The incidence of KDIGO Stage 3 within 24 hours of admission to General ICUs (GICUs) ranged from 7% (Regional Hospital Mullingar ICU) to 24% (Cork University Hospital GICU). This indicates a sicker population being admitted to ICU and/or delay in admission to ICU. Across all Irish Units, 13% of patients had KDIGO Stage 3 AKI, similar to the UK (11%).

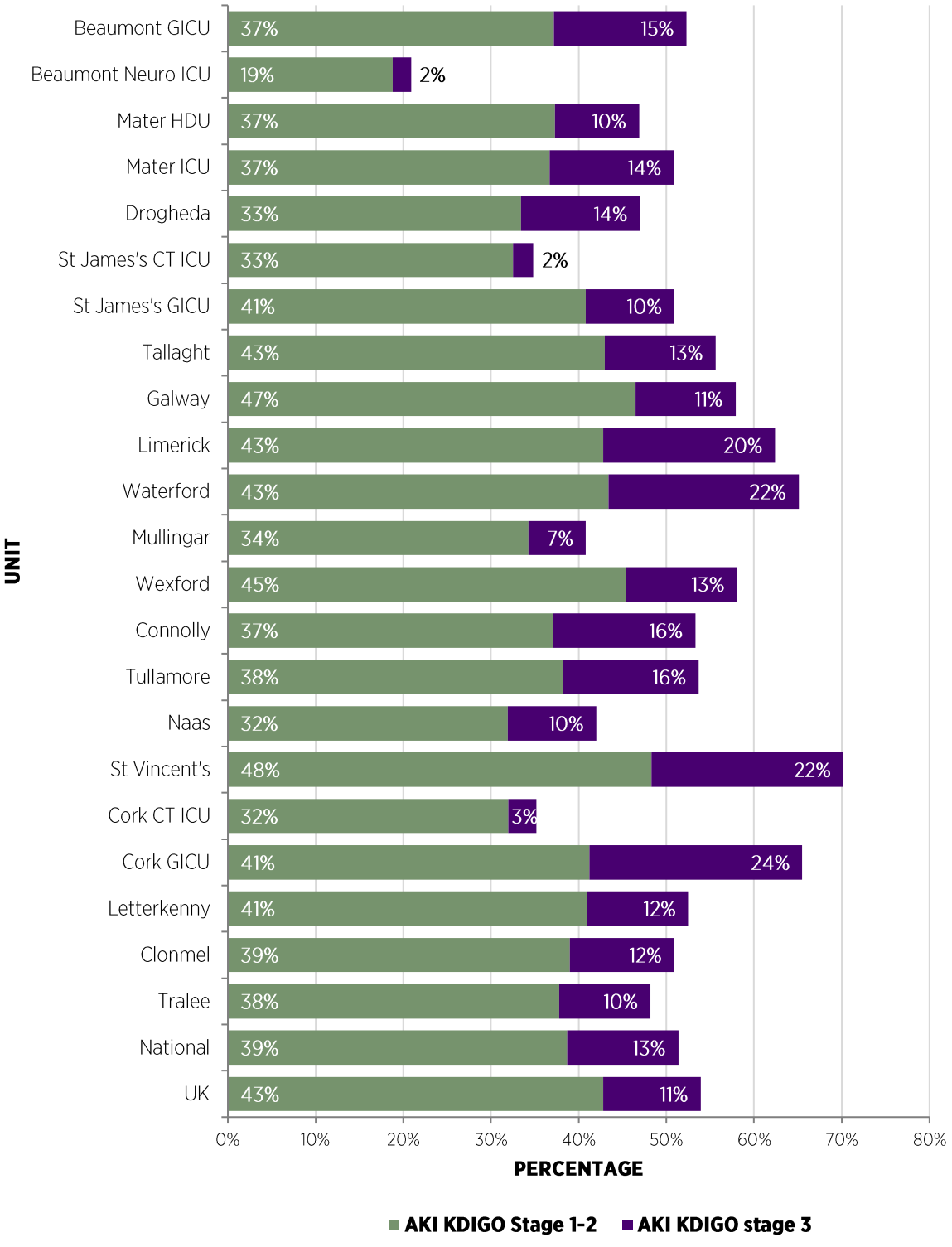

FIGURE 1.6: PATIENTS WITH ACUTE KIDNEY INJURY DURING THE FIRST 24 HOURS AFTER ADMISSION (KDIGO STAGES 1–3) (AS PERCENTAGES OF ALL UNIT ADMISSIONS)

ICU ADMISSIONS WITH SEPSIS (SEPSIS-3)

Sepsis is a leading reason for admission to ICU, reflected in the consistently high percentage of admissions with sepsis (Figure 1.7). The incidence was lower in specialist Units (cardiothoracic and neurosurgical), where admissions are commonly postoperative (Figure 1.4). Sepsis with dysfunction in four or more organ systems is associated with a high mortality rate and a requirement for support of multiple organ systems.

This severity of illness usually reflects the course of the illness in the period before admission to ICU and possibly indicates delayed admission to ICU. The proportion of patients with sepsis and dysfunction in four or more organ systems ranged from 0% to 8.6% (Cork University Hospital GICU).

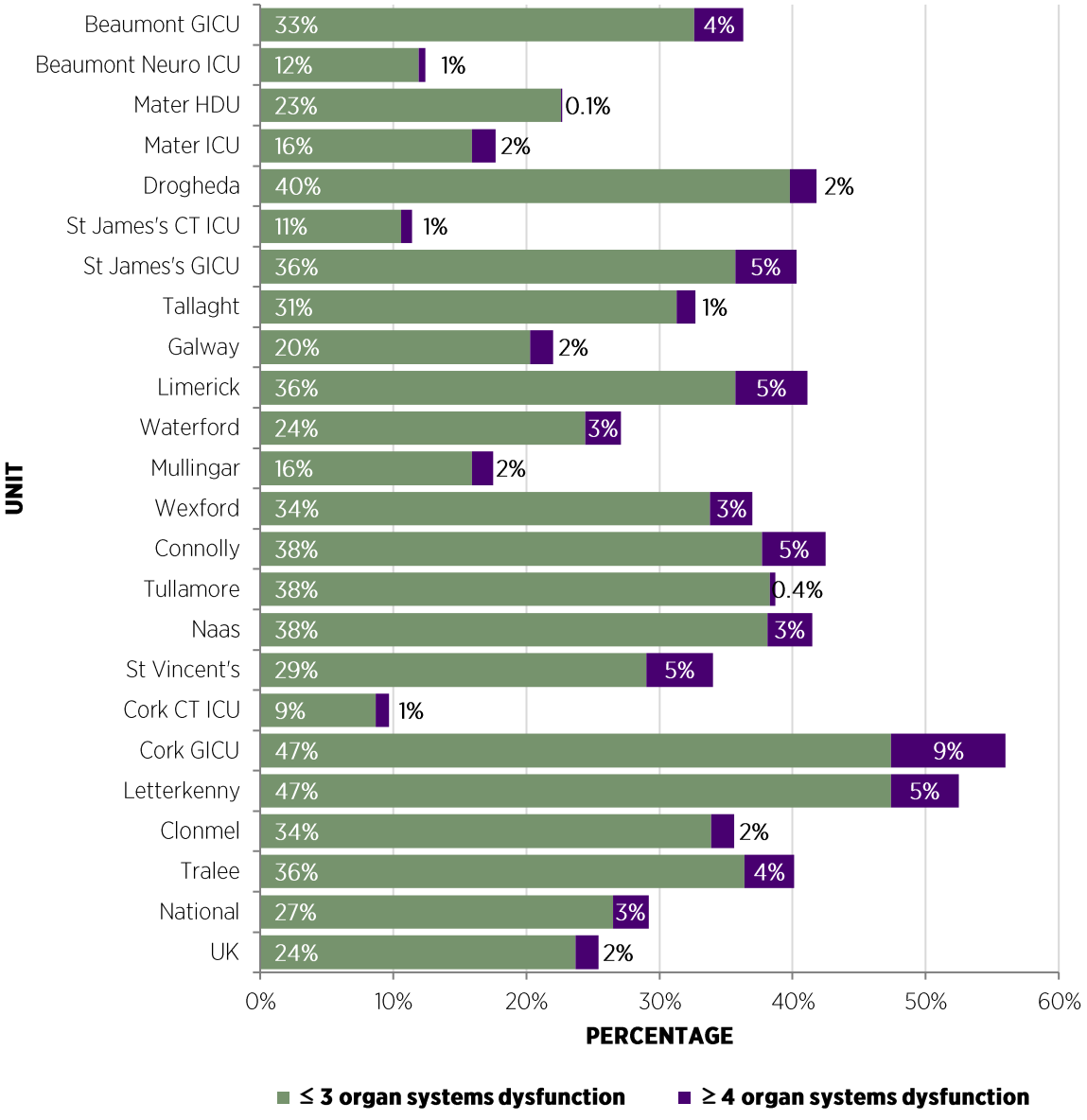

FIGURE 1.7: ADMISSIONS TO THE UNIT WITH A DIAGNOSIS OF SEPSIS (SEPSIS-3) WITH (I) THREE OR FEWER AND (II) FOUR OR MORE ORGAN SYSTEMS DYSFUNCTION WITHIN 24 HOURS OF ADMISSION (AS PERCENTAGES OF ALL UNIT ADMISSIONS)

ADMISSIONS TO ICU AFTER CARDIOPULMONARY RESUSCITATION

The proportion of patients admitted to general ICUs following cardiopulmonary resuscitation (CPR) ranged from 3% to 13% (Figure 1.8). Overall, proportions of ICU admissions after CPR were similar in the ROI (6%) and the UK (5%). A requirement for CPR before ICU admission is a negative prognostic indicator.

Admissions to general ICUs after in-hospital CPR ranged from 1% to 7%. The numbers of hospital inpatients who require ICU admission after CPR can be an indication of the quality of care outside the ICU. However, there are too many variables involved for direct comparisons between Units to be valid.

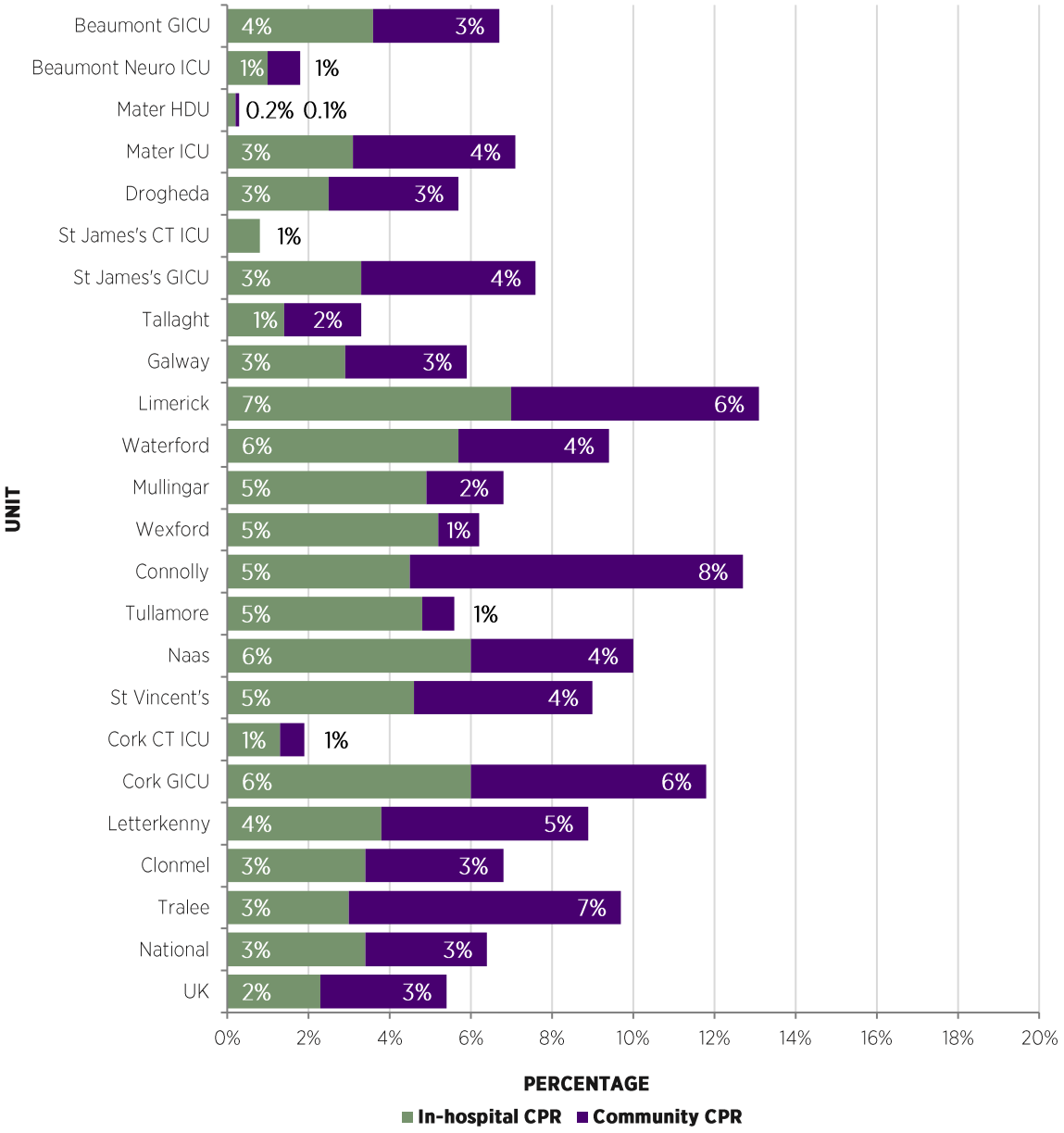

FIGURE 1.8: ADMISSIONS FOLLOWING CPR IN THE COMMUNITY OR IN HOSPITAL (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

SEVERE LIVER DISEASE, HAEMATOLOGICAL MALIGNANCY, METASTATIC DISEASE

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

Patients admitted with severe liver disease ranged from 0% of admissions to 8% (St Vincent's University Hospital ICU, which is the national specialist liver centre) (Figure 1.9A). Patients admitted with haematological malignancy ranged from 0% to 6% (Figure 1.10A). Admissions with metastatic disease ranged from 0% to 12% (Figure 1.11A). ICU admissions with each of these three diagnoses were similar in the ROI and the UK.

For all three conditions, there were wide variations between Units in mortality rates (Figures 1.9B, 1.10B and 1.11B). This may be due to the small numbers of patients reported with these three conditions.

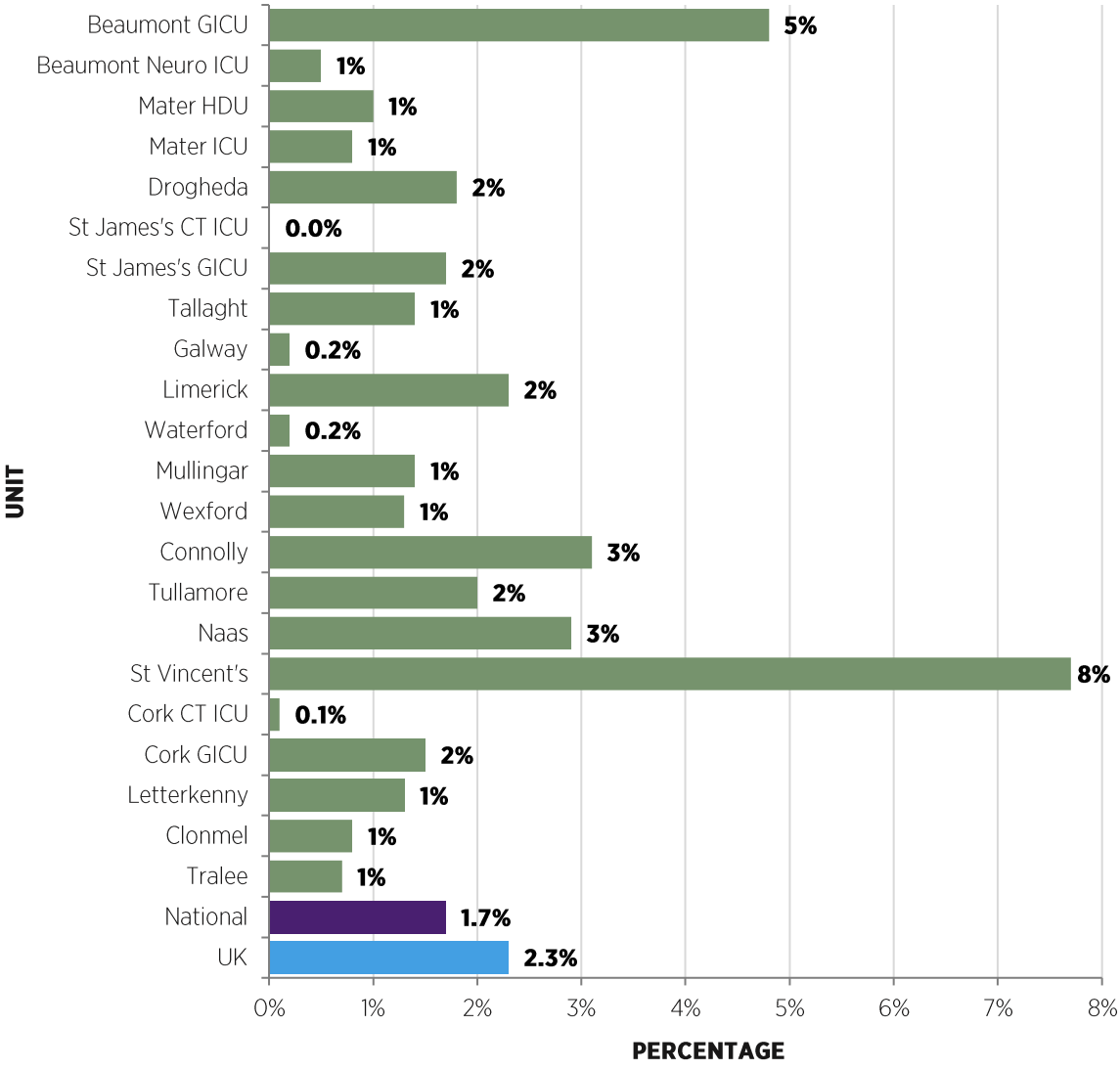

FIGURE 1.9A: ADMISSIONS WITH SEVERE LIVER DISEASE (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

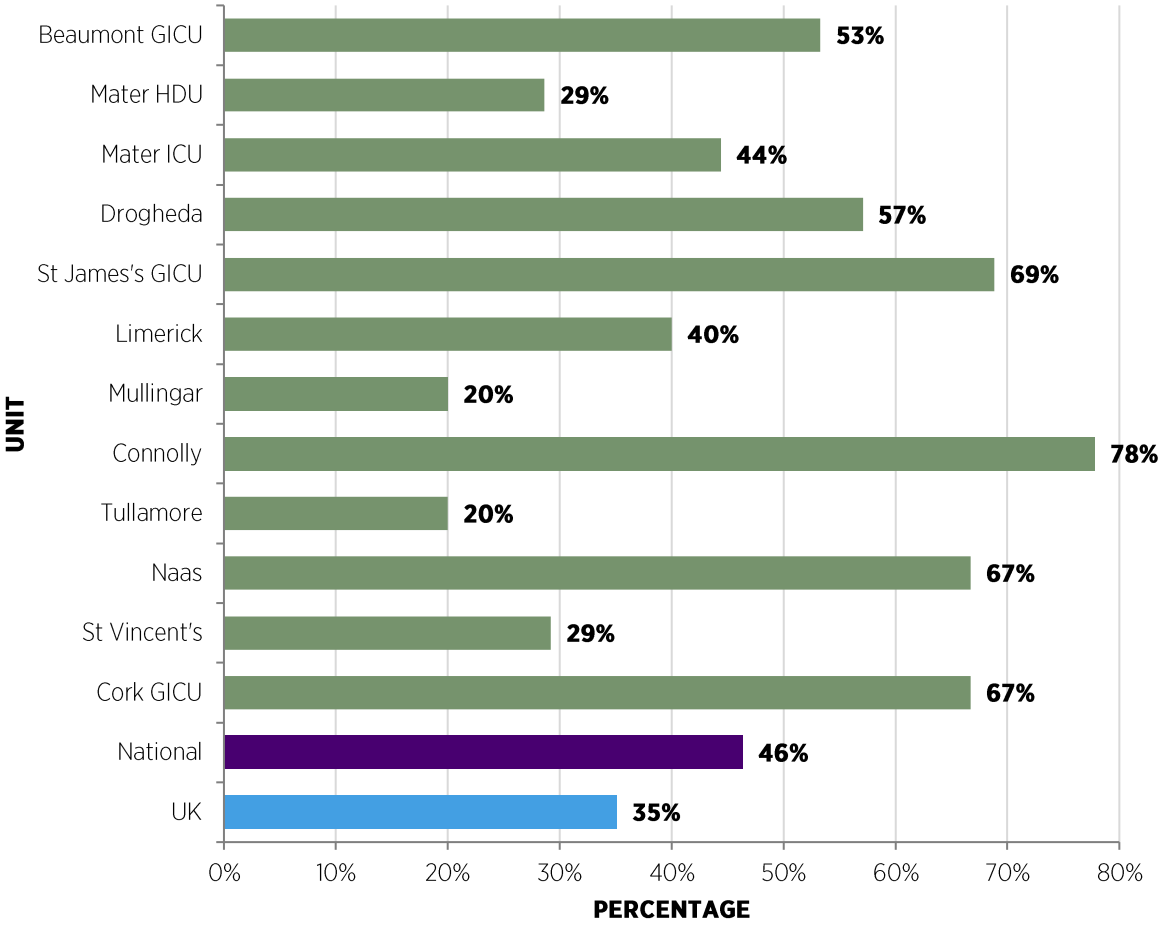

FIGURE 1.9B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH SEVERE LIVER DISEASE (UNITS WITH ≥5 ADMISSIONS ONLY)

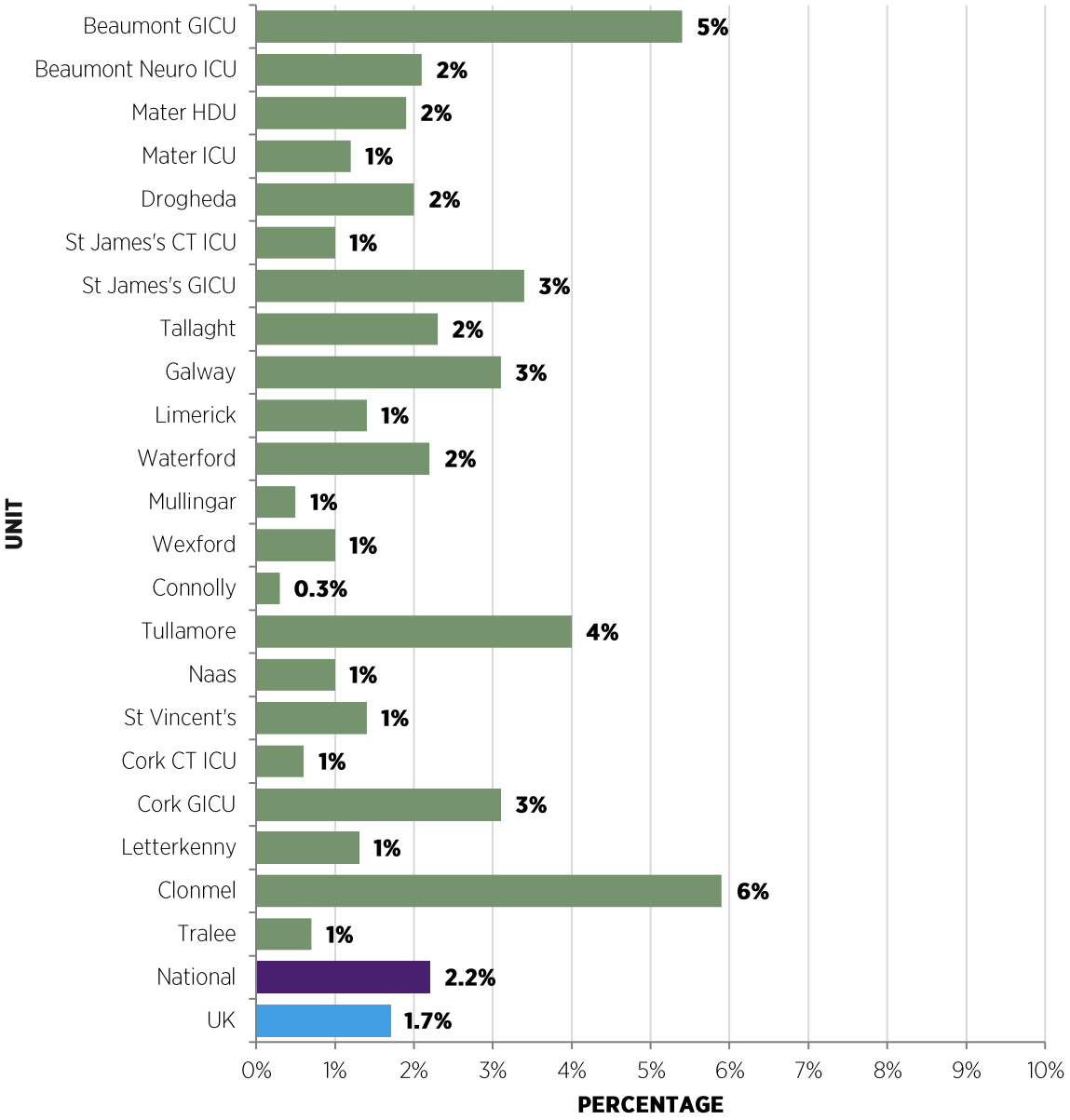

FIGURE 1.10A: ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

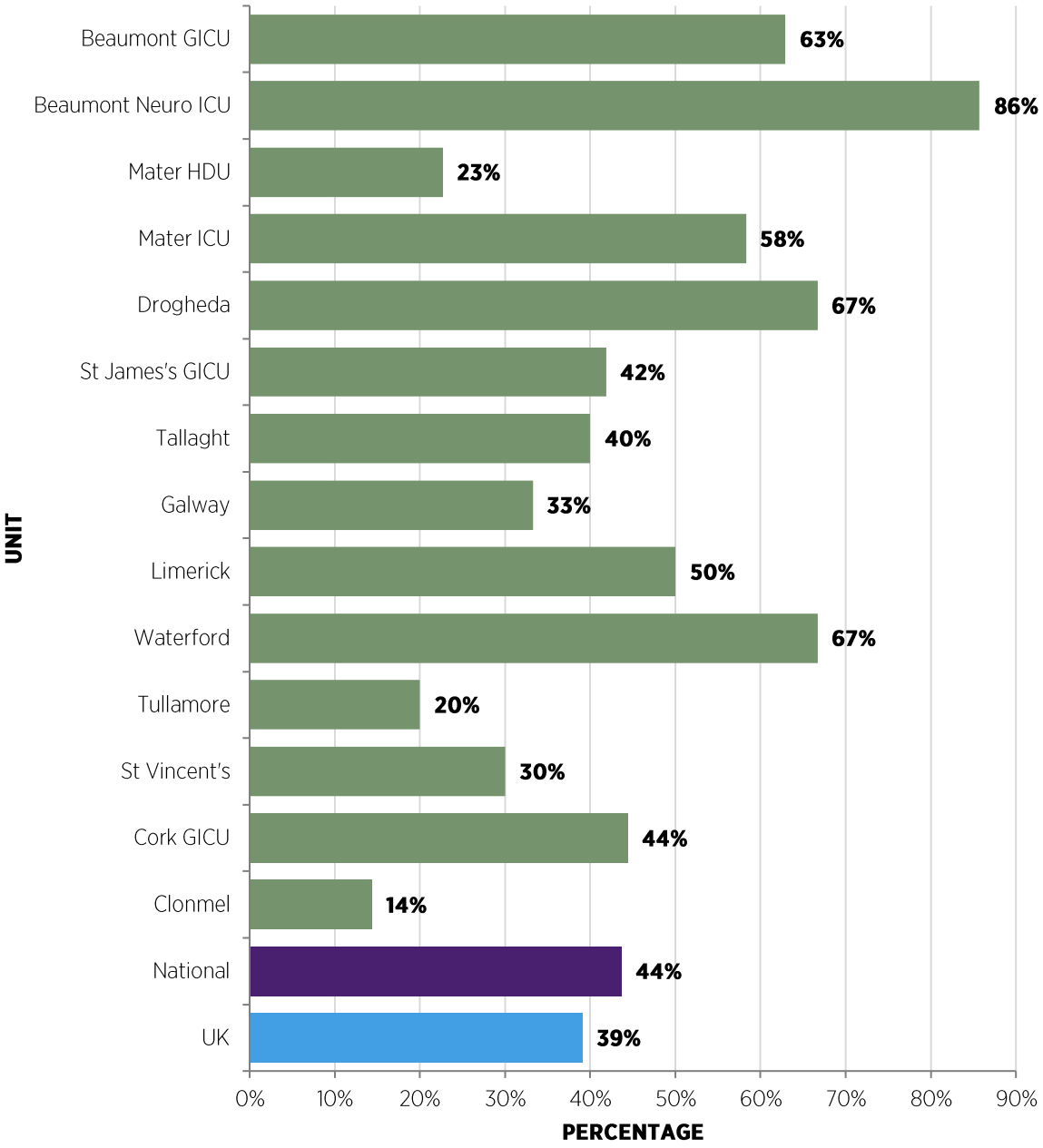

FIGURE 1.10B: HOSPITAL MORTALITY RATE IN UNIT ADMISSIONS WITH HAEMATOLOGICAL MALIGNANCY (UNITS WITH >5 ADMISSIONS ONLY)

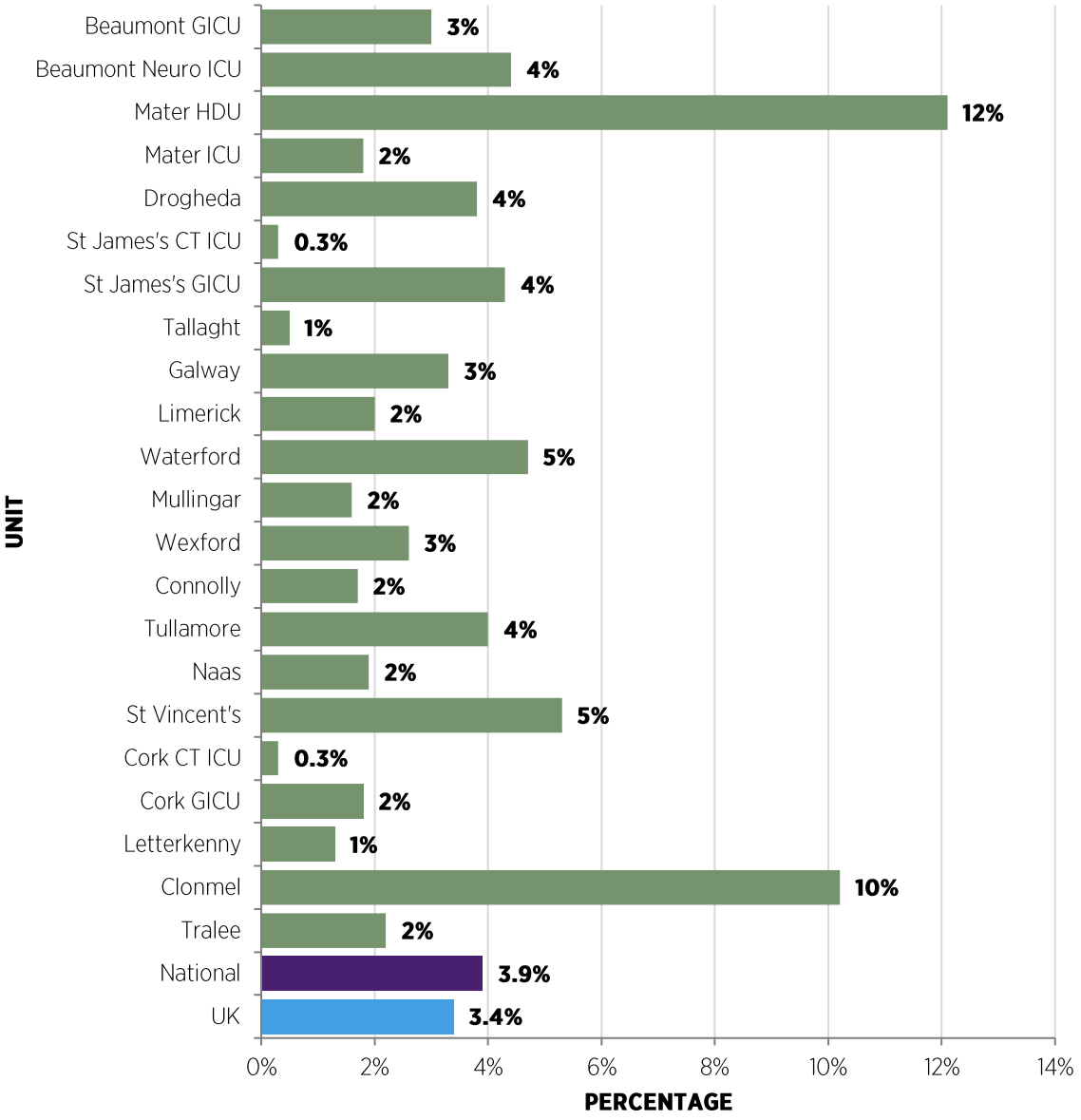

FIGURE 1.11A: ADMISSIONS WITH METASTATIC DISEASE (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

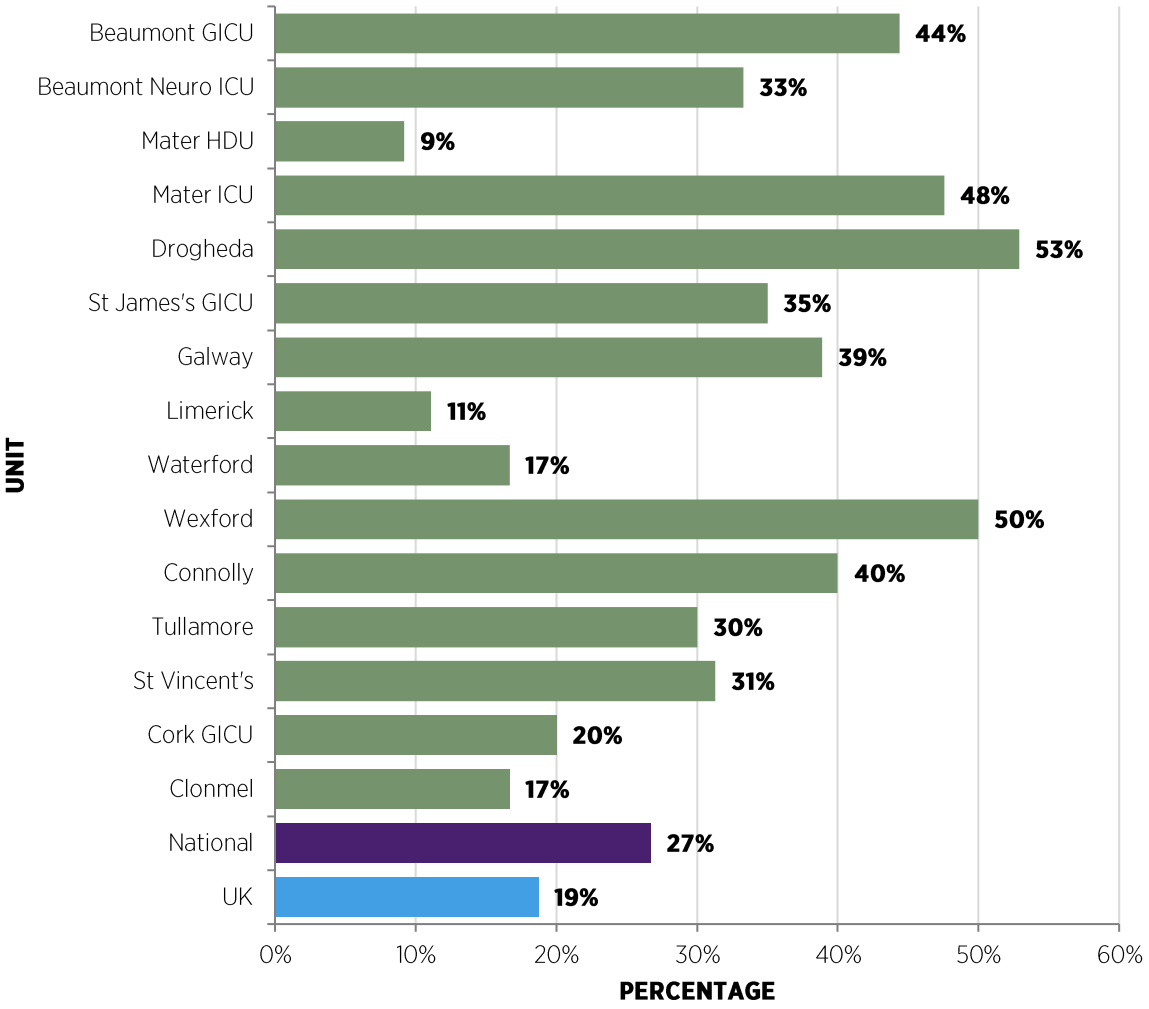

FIGURE 1.11B: HOSPITAL MORTALITY IN UNIT ADMISSIONS WITH METASTATIC DISEASE (UNITS WITH >5 ADMISSIONS ONLY)

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 2019, 111 children aged under 16 years were admitted to the adult ICUs included in this report (1% of all Unit admissions) (Table 1.2).

TABLE 1.2: CHILDREN AGED <16 YEARS ADMITTED TO INTENSIVE CARE UNITS: AGE, CASE MIX, VENTILATION, LENGTH OF STAY, AND SURVIVAL TO HOSPITAL DISCHARGE

Parameter	n
Patients <16 years old	111
Age, mean (median; interquartile range (IQR)	7.5 (8; 2, 13)
Age <1 year	18
Age <6 years	44
Admissions after surgery	34
Admissions with sepsis	22
Invasive ventilation	20 (18%)
Unit LOS; mean (median; IQR) (hours)	27 (18; 12,24)
Unit survival (n)	110
Hospital survival (n)	107

Numbers of children admitted to individual Units were very small, with the exceptions of Beaumont Hospital Richmond ICU (Neuro) and University Hospital Galway ICU (Table 1.3). This presumably reflects either a requirement for specialist care (neurosurgery in Beaumont Hospital Richmond ICU (Neuro)) or geographical distance (University Hospital Galway ICU). 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.

LOS was longer in the specialist neurosurgical Unit, reflecting the lack of options for transferring out. University Hospital Galway ICU was the only adult ICU which regularly admitted children aged under 6 years (Table 1.3).

TABLE 1.3: NUMBERS OF PATIENTS AGED <16 YEARS, PATIENTS AGED <6 YEARS, AGED < 1 YEAR: LENGTH OF STAY, NUMBERS VENTILATED

	Patients (<1 year)	Patients (<6 years)	Patients (6-16 years)	Mean LOS (hours)	Ventilated (n)
Beaumont Neuro ICU	0	0	24	19	3
St James' GICU	0	0	2	226	2
Galway ICU	17	23	22	17	8
Limerick ICU	0	0	1	11	1
Waterford ICU	0	0	2	16	1
Wexford ICU	0	0	1	20	0
Tullamore ICU	0	0	2	53	0
St Vincent's ICU	0	0	1	167	1
Cork GICU	1	2	7	17	3
Letterkenny ICU	0	1	2	14	1
Clonmel ICU	0	0	2	32	0
Tralee	0	0	1	24	0

OBSTETRIC ADMISSIONS TO ICU IN 2019

This is the first year we have reported on admissions to ICU who were pregnant or recently (within the past 6 weeks) pregnant. These made up 1.3% of all ICU admissions in 2019. They were younger than the average ICU admission and had lower illness severity scores (Table 1.4). Nevertheless, 41% required invasive ventilation, and 6% and 5% required advanced cardiovascular system support and dialysis, respectively. We do not have data on how many of these admissions were repeat admissions.

LOS in ICU was relatively short. One patient died in ICU and one additional patient died after discharge from ICU. Both of these deaths were related to serious underlying disease.

Seventeen patients (12% out of 147) were pregnant at the time of admission to ICU, with gestations ranging from 4 to 34 weeks (Table 1.5). We do not have data on fetal outcome for these patients.

Most patients who were recently pregnant were admitted to ICU very soon after delivery (Table 1.6). More than two-thirds had had a caesarean section, and fetal outcomes were good (97% live births).

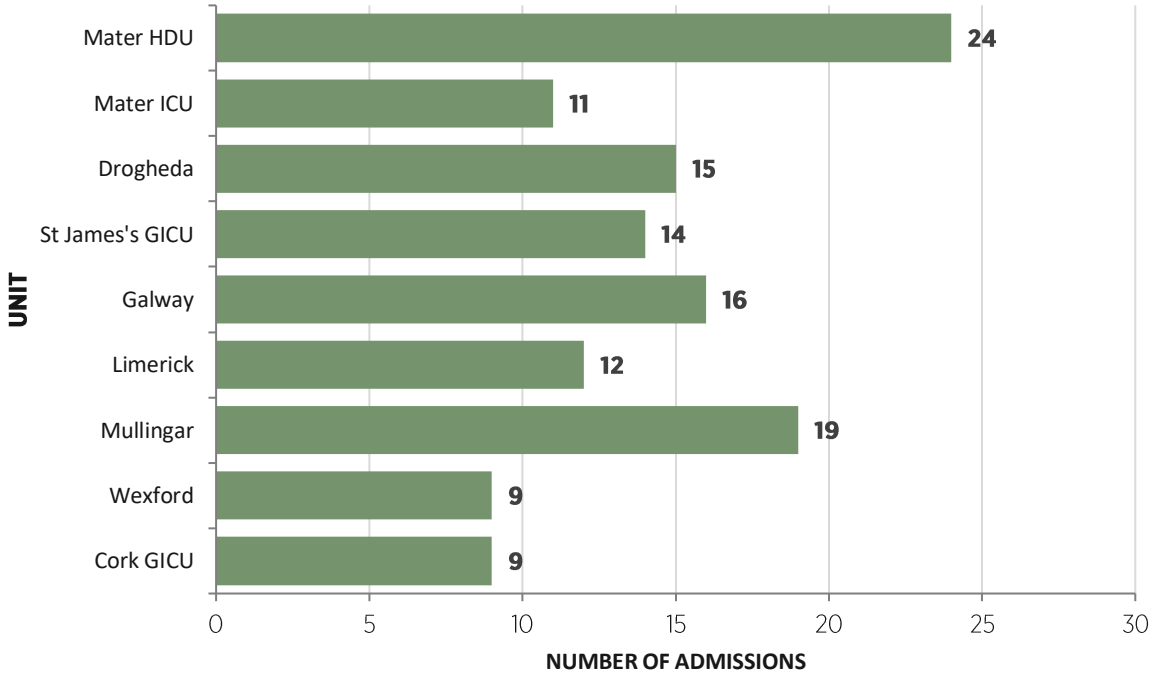

FIGURE 1.12: NUMBER OF OBSTETRIC ADMISSIONS TO CRITICAL CARE UNITS IN 2019*

Units with <5 obstetric admissions have been excluded from Figure 1.12 (Beaumont Hospital General ICU, Connolly Hospital ICU, Letterkenny University Hospital ICU**, South Tipperary General Hospital ICU*, University Hospital Kerry ICU*, St Vincent's University Hospital ICU, Beaumont Hospital Richmond ICU (Neuro),Tallaght University Hospital** and University Hospital Waterford ICU).

* Hospitals submitted data for only 6 months of 2019.
** Hospitals submitted data for only 3 months of 2019.

TABLE 1.4: PREGNANT OR RECENTLY PREGNANT ADMISSIONS TO INTENSIVE CARE UNITS IN 2019

Total admissions	147
Age, (years), mean (SD)	33 (6)
Age, (years), median (IQR)	34 (29,37)
Age, (years) range	16-50
BMI, mean (SD)	27.8 (7)
BMI, median (IQR)	26 (22,31)
BMI, range	16-54
APACHE II score, median (IQR)	9 (7,12)
ICNARC Physiology score, median (IQR)	9 (6,14)
Predicted % mortality risk, mean (SD)	3% (9%)
Receipt of any advanced respiratory support, n (%)	41 (28)
Receipt of any advanced cardiovascular support, n (%)	6 (4)
Receipt of any renal support, n (%)	5 (3)
Unit Length of stay, hours, median (IQR)	37 (21,79)
Discharged alive from ICU, n (%)	146 (99)

TABLE 1.5: CURRENTLY PREGNANT ADMISSIONS TO INTENSIVE CARE UNITS IN 2019

Currently pregnant admissions	17
Gestation of current pregnancy on ICU admission, (weeks), mean (SD)	23 (7)
Gestation of current pregnancy on ICU admission, (weeks), range	4-34

TABLE 1.6: RECENTLY PREGNANT ADMISSIONS TO INTENSIVE CARE UNITS IN 2019

Recently Pregnant admissions	130
Gestation at delivery of recent pregnancy, (weeks), Mean (SD)	35 (8)
Gestation at delivery of recent pregnancy, (weeks), Range	4-42
Days from delivery to ICU admission, median (IQR)	0 (0,2)
Molar pregnancy associated with recent pregnancy, N (%)	0
Recent pregnancy; outcomes N (% of admissions)	**N (%)**
Vaginal delivery	24 (19)
Caesarean section	91 (70)
Ectopic pregnancy	9 (7)
Termination of Pregnancy	5 (4)
Data missing	1(1)
Hysterectomy at or since delivery	11 (9)
Number of previous live births and/or stillbirths from previous pregnancies	**N (%)**
0	55 (42)
1	37 (29)
2+	31 (24)
Number of previous Caesarean sections	**N (%)**
0	99 (76)
1	15 (12)
2+	9 (7)
Assisted conception used, N (%)	9 (6)
Number of live births (babies) from recent pregnancy	**N (%)**
0	4 (3)
1	99 (76)
2+	10 (8)

KEY FINDINGS FROM CHAPTER 1

- The Units participating in INICUA in 2019 provided 88% of all ICU care in HSE-funded hospitals.
- This chapter provides an overview of the demographics and case mix of the patients admitted to ICU.
- Units varied widely in terms of bed numbers, numbers of admissions and case mix. These differences must be considered in all comparisons between Units.
- The mean age of patients across Units in the ROI in 2019 was 61 years; 60% of patients were male.
- Admissions after trauma were widely distributed throughout all hospitals, with the largest number (n=106) admitted to University Hospital Galway ICU and the largest number after TBI admitted to Beaumont Hospital Richmond ICU (Neuro) (n=78).
- Fifty-two percent of admissions had AKI within 24 hours of admission, with 13% having severe AKI (KDIGO Stage 3).
- Twenty-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% to 8.6% in different Units.
- The proportion of admissions to GICUs which followed in-hospital CPR ranged from 2.5% to 7.0%.
- A small proportion of admissions had severe liver disease (2%), haematological malignancy (2%) or metastatic disease (4%). Patients in these groups had a high mortality rate.
- Comparisons of data for age, gender and case mix between Units in the ROI and UK Units showed no major differences.
- Numbers of children (aged under 16 years) admitted to adult ICUs were very small, with the exceptions of Beaumont Hospital Richmond ICU (Neuro) and University Hospital Galway ICU. Mean LOS was very short, except in the Beaumont Hospital Richmond ICU (Neuro). Survival to discharge from acute hospital was 97%.
- Patients who were pregnant or recently pregnant made up 1.3% of all admissions to ICU. Eighty-eight percent had delivered before admission to ICU, the majority by caesarean section. Mortality was low, with one maternal death while in ICU and one additional death after ICU discharge.

CHAPTER 2: SEVERITY OF ILLNESS AND ORGAN SUPPORT IN ICU

ILLNESS SEVERITY SCORES ON ADMISSION TO ICU

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

Mean APACHE II scores ranged from 13.1 to 20.5 across different Units, reflecting differences in case mix between Units (Figure 2.1). The mean APACHE II score for all admissions in participating Units in the ROI was 16.2 (versus 14.6 in the UK).

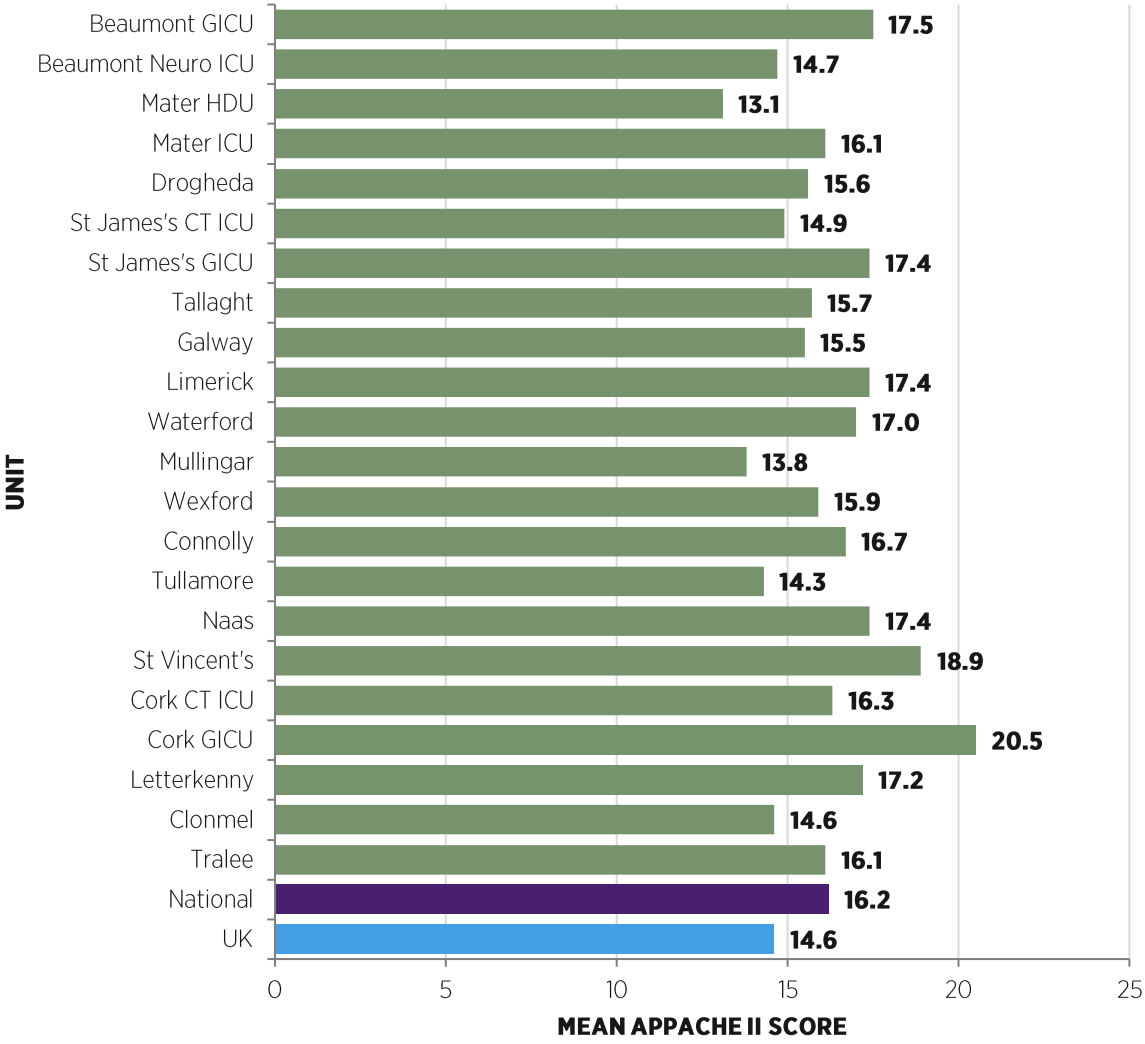

FIGURE 2.1: MEAN APACHE II SCORES FOR EACH UNIT

PREDICTED RISK OF DEATH ON ADMISSION TO ICU

Mortality is predicted by the ICNARC$_{H\text{-}2018}$ model, which is frequently updated and has excellent predictive value.

The predictive model is based on multiple variables, including age, pre-existing conditions, dependency before admission, CPR before admission, admission diagnosis, source of admission, acute physiological status, and requirement for ventilation in the first 24 hours after admission.

Predicted mortality shows more variability between Units than APACHE II scores (Figure 2.2), reflecting important differences in case mix between participating Units. The highest predicted mortality rate was for Cork University Hospital GICU (20.4%).

The median predicted mortality rate was 7.2% for patients in the ROI versus 4.7% for UK patients. While a statistical comparison has not been undertaken (NOCA does not have access to individual patient data), this suggests that ICU patients are sicker on admission in the ROI than in the UK. This may reflect either delayed access to ICU in the ROI, limited bed capacity, or both.

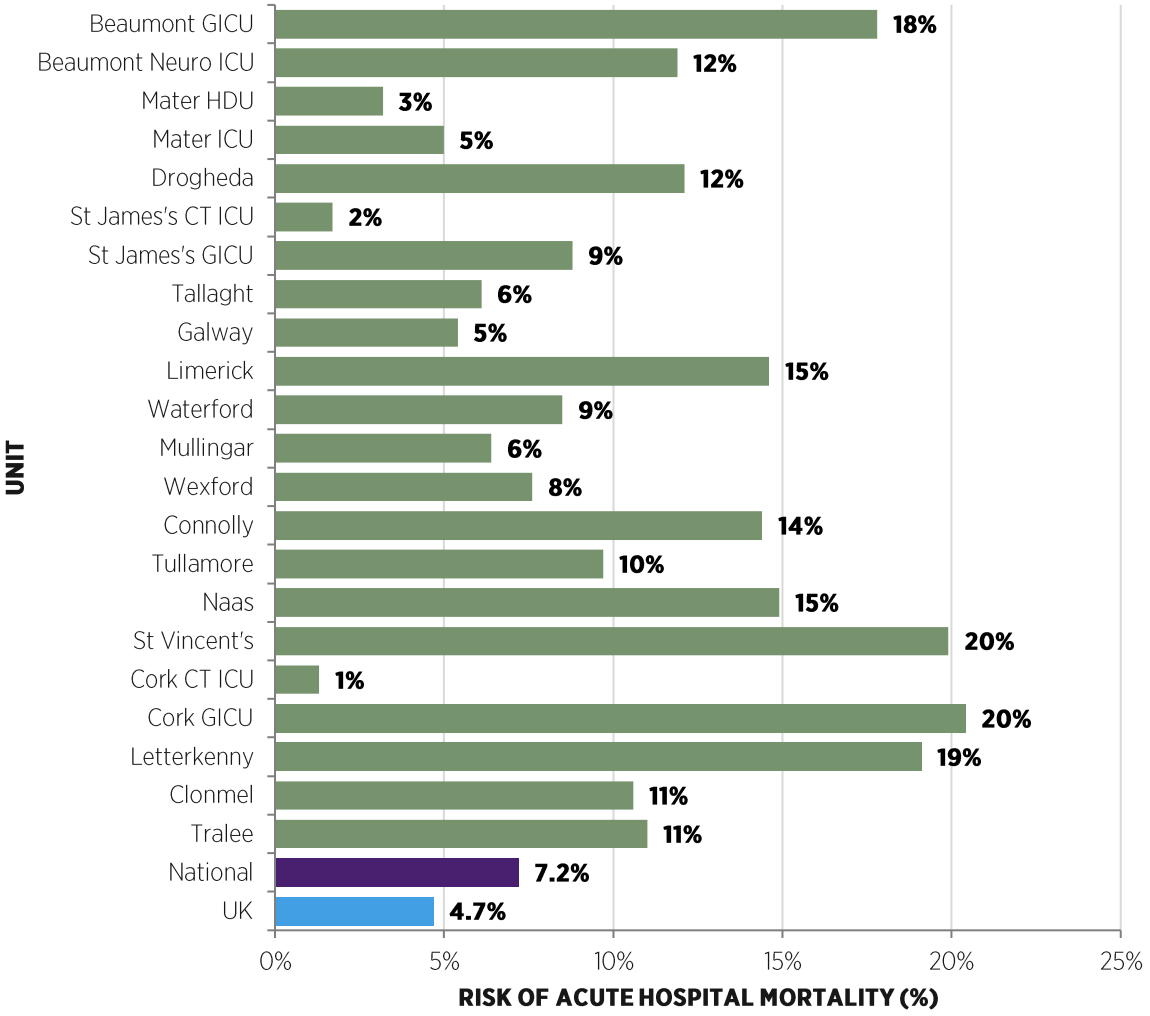

FIGURE 2.2: PREDICTED RISK OF ACUTE HOSPITAL MORTALITY (ICNARC$_{H\text{-}2018}$ MODEL) (MEDIANS)

ADVANCED RESPIRATORY SUPPORT AFTER ADMISSION TO ICU

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

There was wide variability in the percentage of patients receiving ARS in 2019 (Figure 2.3), as might be expected with Units ranging from a pure HDU to mixed ICU/HDUs to a specialist cardiothoracic ICU. Some 54% of patients in the ROI received ARS in 2019 versus 41% in the UK.

The percentage of Unit patient days when ARS was provided followed a similar pattern to the percentage of patients who received ARS (Figure 2.4). ARS was provided on 48% of patient days in Units in the ROI versus 38% in UK Units. This is consistent with other indicators of greater illness severity in patients on admission to ICU in the ROI; for example, APACHE II scores and predicted mortality.

These data provide useful insights into the relative requirements for ICU beds versus HDU beds. Patients receiving ARS cannot be safely managed outside ICU (although patients who are ventilated long term via a tracheostomy may be managed in a HDU or even on the ward).

Many patients who are not receiving ARS nevertheless need to be in ICU for other reasons; for example advanced cardiovascular support, renal support, invasive monitoring (intra-arterial, intracranial), for close observation in the case of high-risk patients, in the periods before and after the provision of ARS, or due to the general complexity of their care. While the number of patients requiring ARS significantly underestimates the requirement for ICU (Level 3) beds, it is a useful objective indicator of the numbers of patients likely to require Level 3 (ICU) care. It is also useful for comparisons between Units.

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

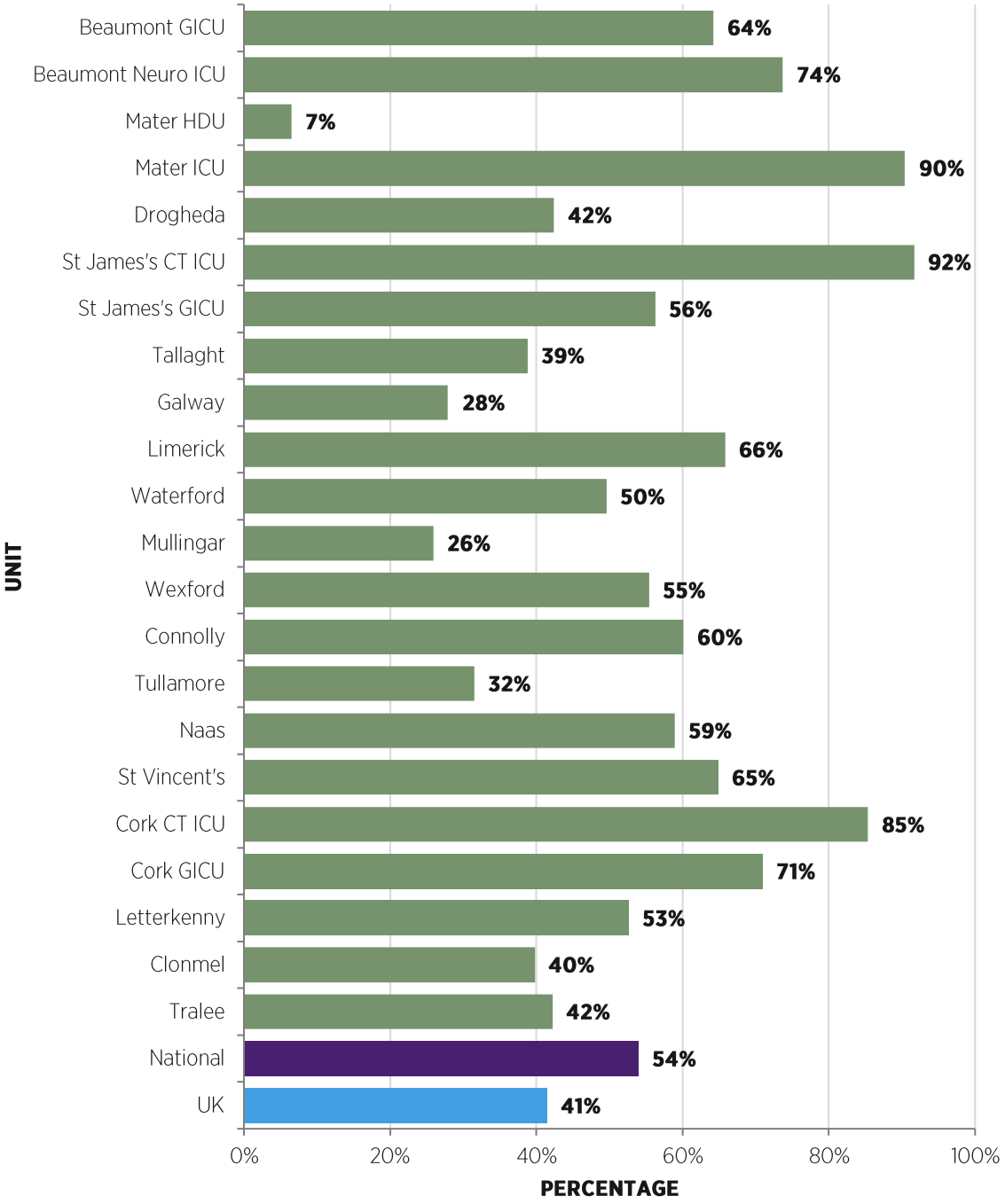

FIGURE 2.3: PATIENTS WHO RECEIVED ADVANCED RESPIRATORY SUPPORT (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

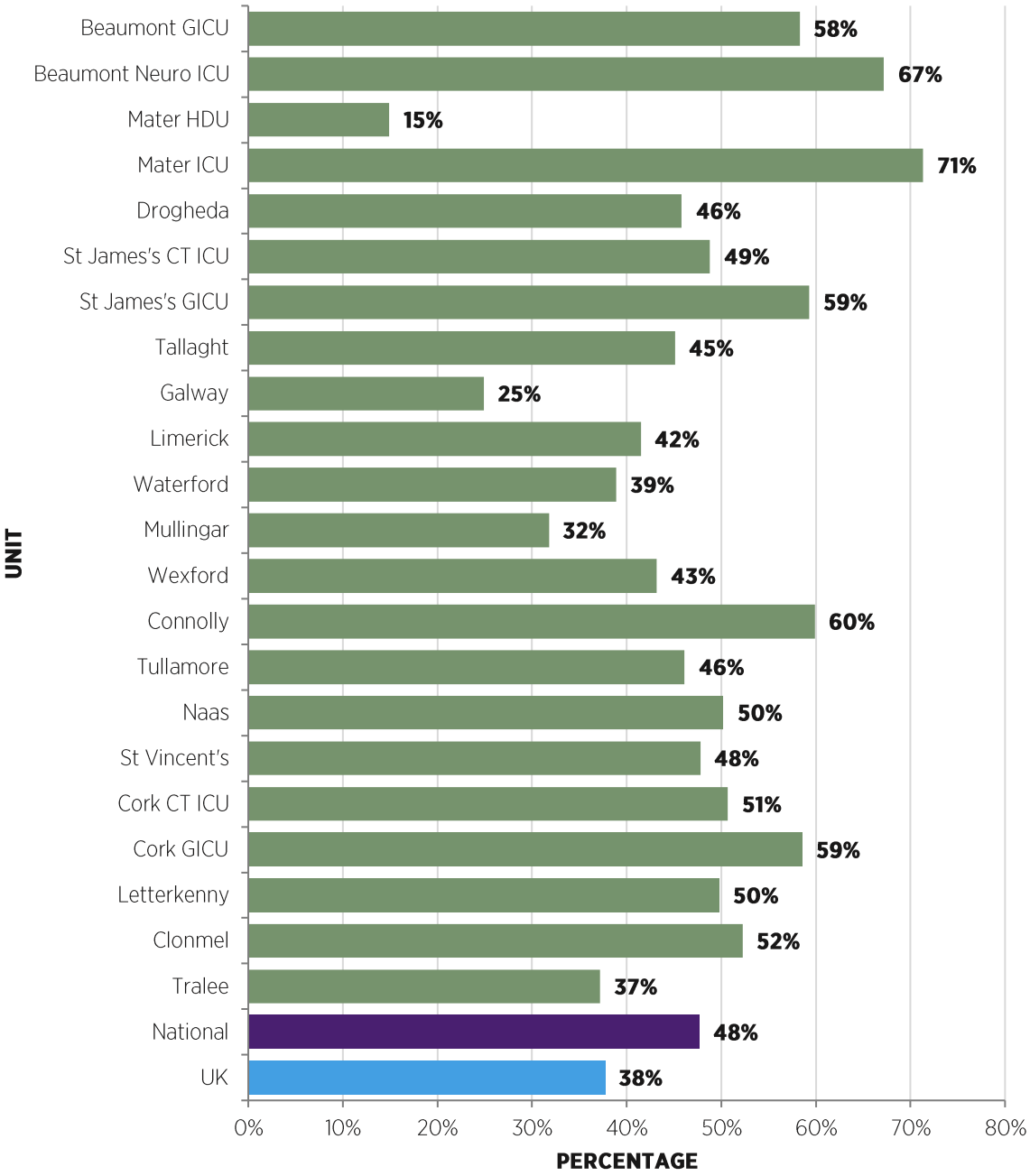

FIGURE 2.4: PATIENT DAYS WHEN ADVANCED RESPIRATORY SUPPORT WAS PROVIDED (AS A PERCENTAGE OF ALL UNIT PATIENT DAYS)

ADVANCED CARDIOVASCULAR SUPPORT AFTER ADMISSION TO ICU

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

Not surprisingly, 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 2.5). The proportion of bed days receiving advanced CVS support was also greatest in Units which admit patients postoperatively after cardiac surgery (Figure 2.6).

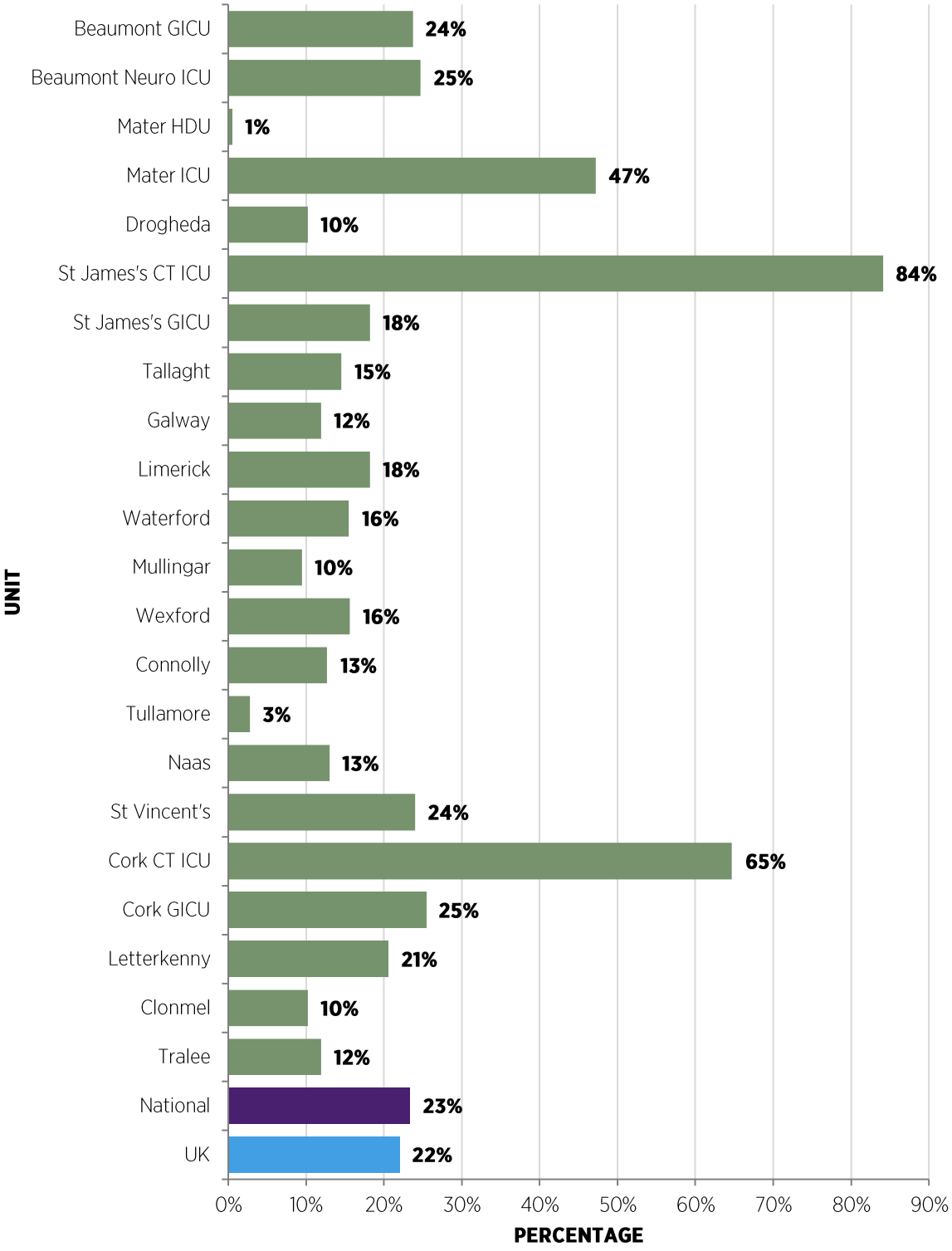

FIGURE 2.5: PATIENTS WHO RECEIVED ADVANCED CARDIOVASCULAR SUPPORT (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

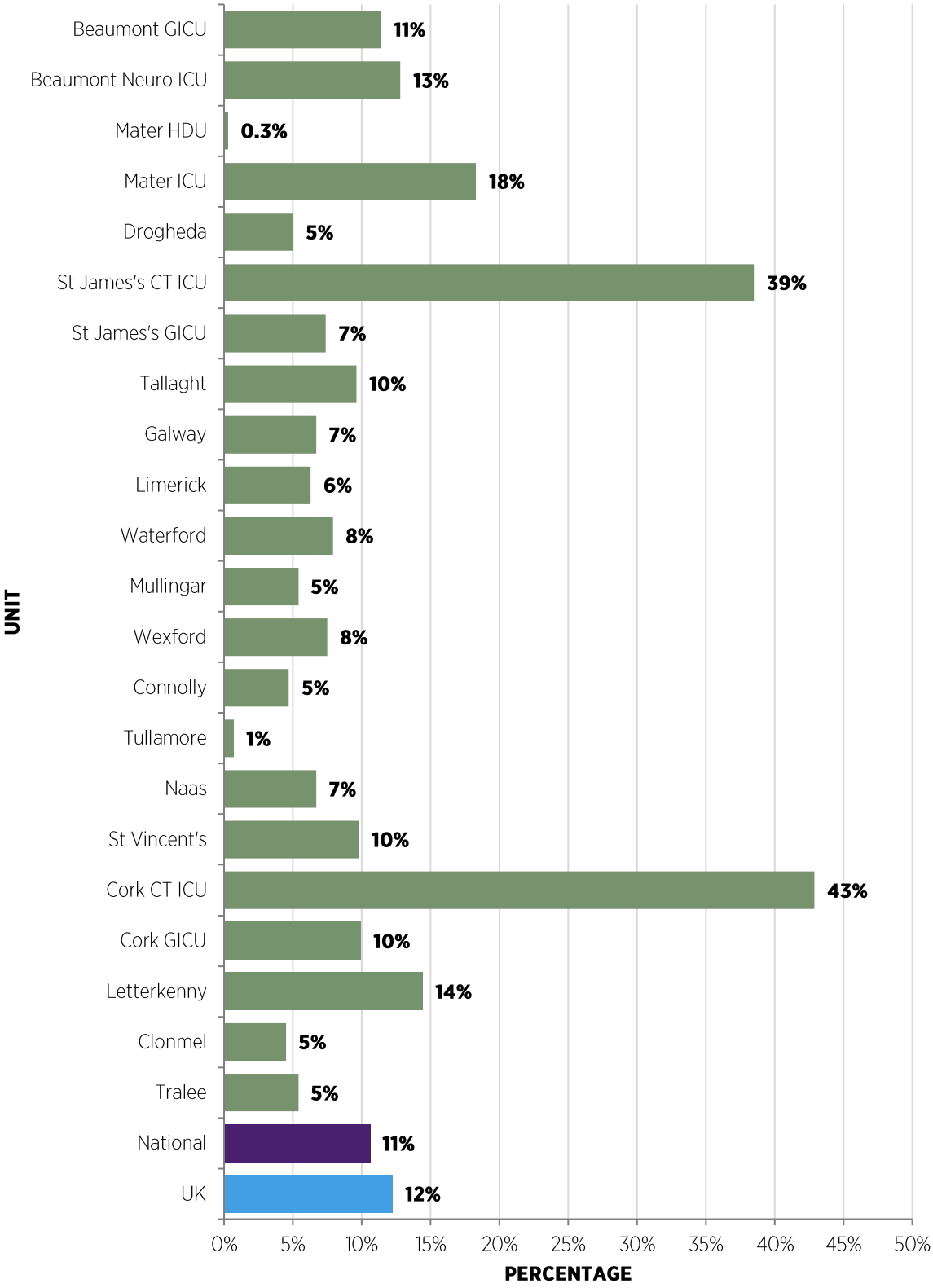

FIGURE 2.6: BED DAYS WHEN ADVANCED CARDIOVASCULAR SUPPORT WAS PROVIDED (AS A PERCENTAGE OF ALL UNIT PATIENT DAYS)

RENAL SUPPORT AFTER ADMISSION TO ICU

Renal support is defined as dialysis either for acute renal failure or for patients on long-term dialysis who are also receiving other acute organ support. Dialysis may be provided as intermittent haemodialysis (HD) or as continuous renal replacement therapy (CRRT). Long-term HD for chronic renal failure is normally provided in a Dialysis Unit, but if patients are too sick to be managed off-Unit, HD may be provided in ICU with vasopressor support. However, most dialysis in ICU is provided as CRRT. The data in Figures 2.7 and 2.8 do not distinguish between CRRT and HD (Figure 2.7).

There was considerable variability between Units in the percentage of patients requiring renal support and the percentage of patient days when renal support was provided (Figures 2.7 and 2.8). Some Units do not provide renal support, and patients who require this must be transferred to a larger Unit.

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

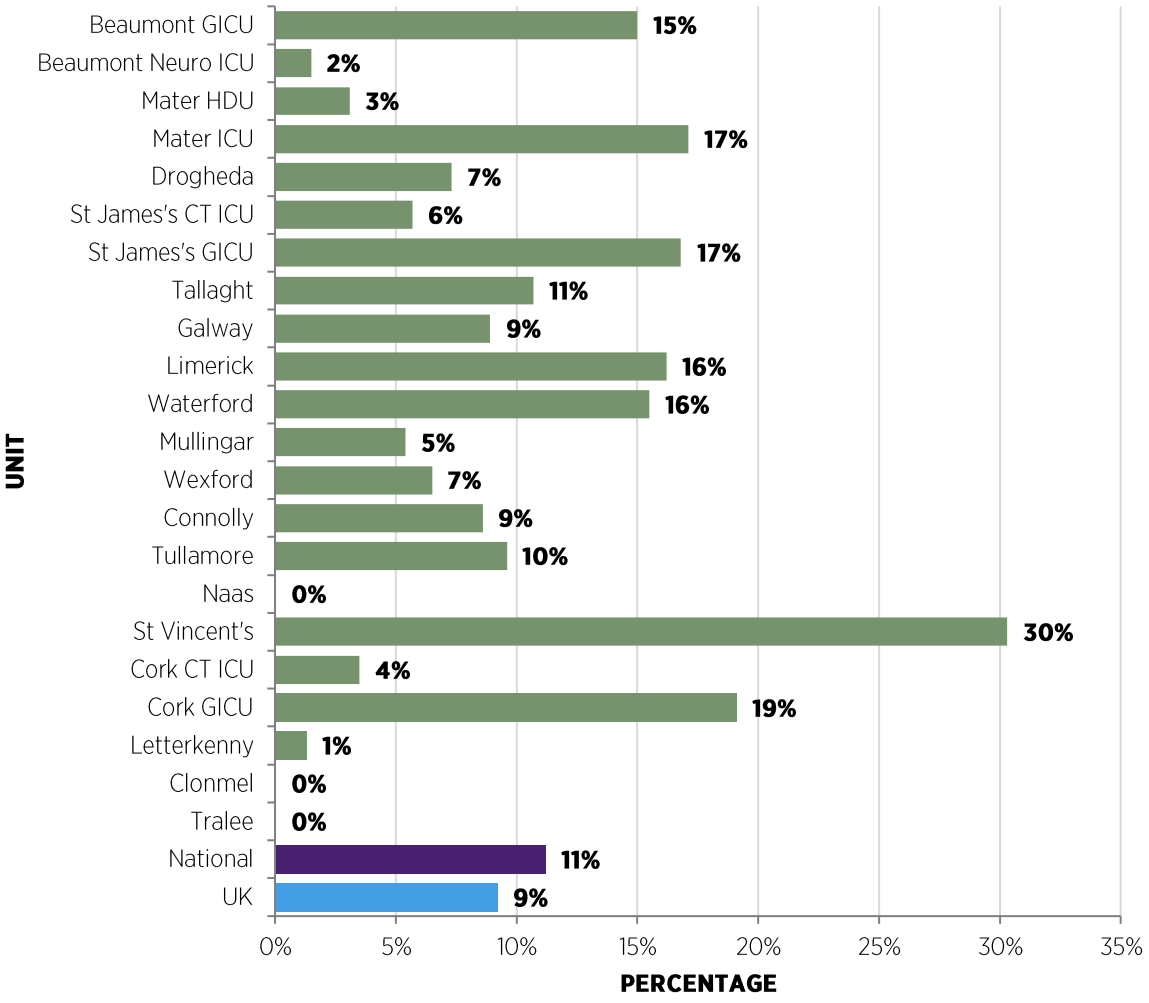

FIGURE 2.7: PATIENTS WHO UNDERWENT DIALYSIS (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

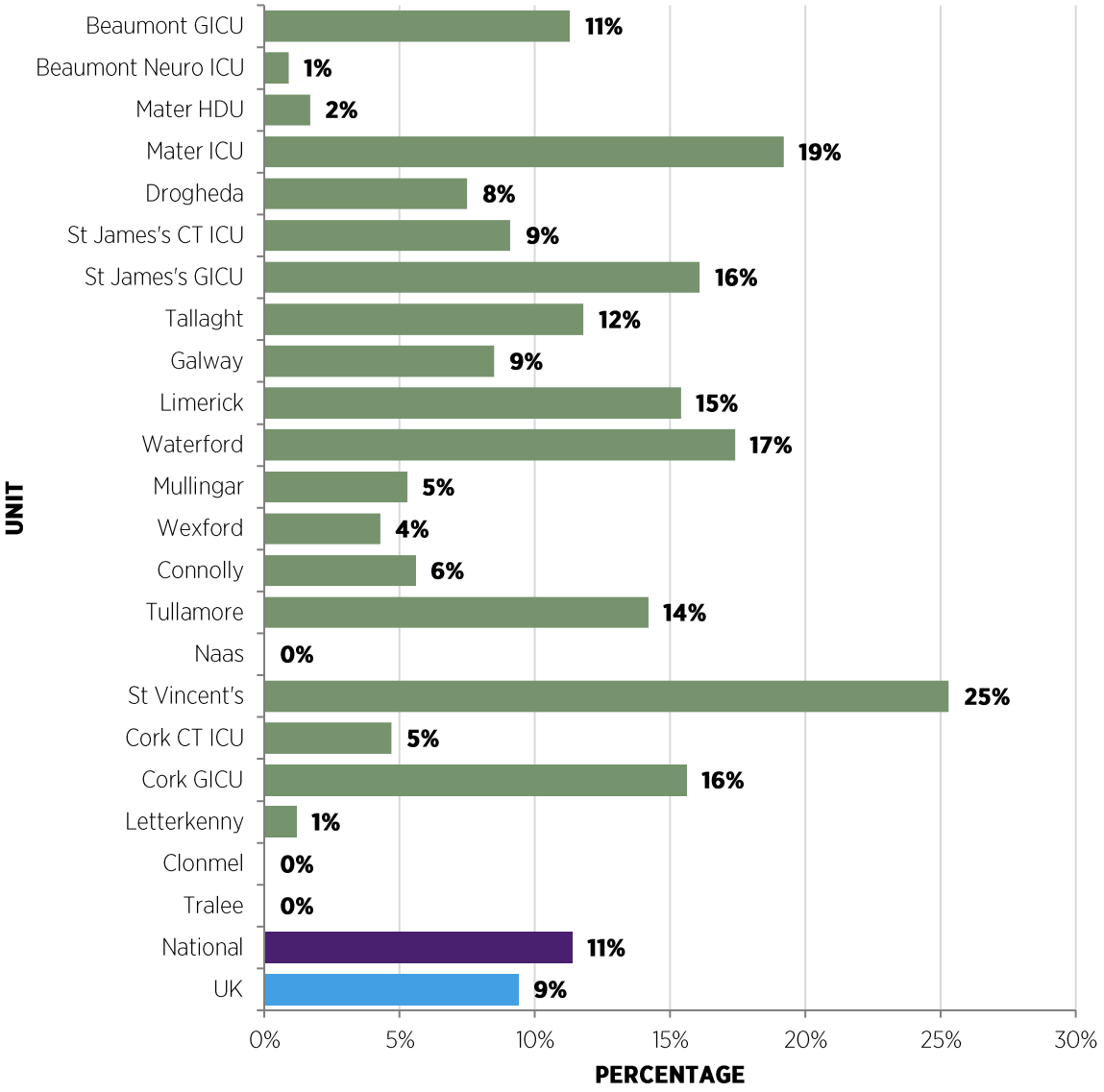

FIGURE 2.8: BED DAYS WHILE PROVIDING DIALYSIS (AS A PERCENTAGE OF ALL UNIT PATIENT DAYS)

GASTROINTESTINAL SUPPORT AFTER ADMISSION TO ICU

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

Figure 2.9 shows the proportion of patients who received enteral or parenteral nutrition at some point during their ICU stay. Figure 2.10 shows the proportion of patient days when enteral or parenteral nutrition was provided. While higher values indicate good practice, some of the lower values are explained by patients having a short stay in the Unit or being able to eat normally while still in the Unit – for example, after recovery from cardiothoracic surgery.

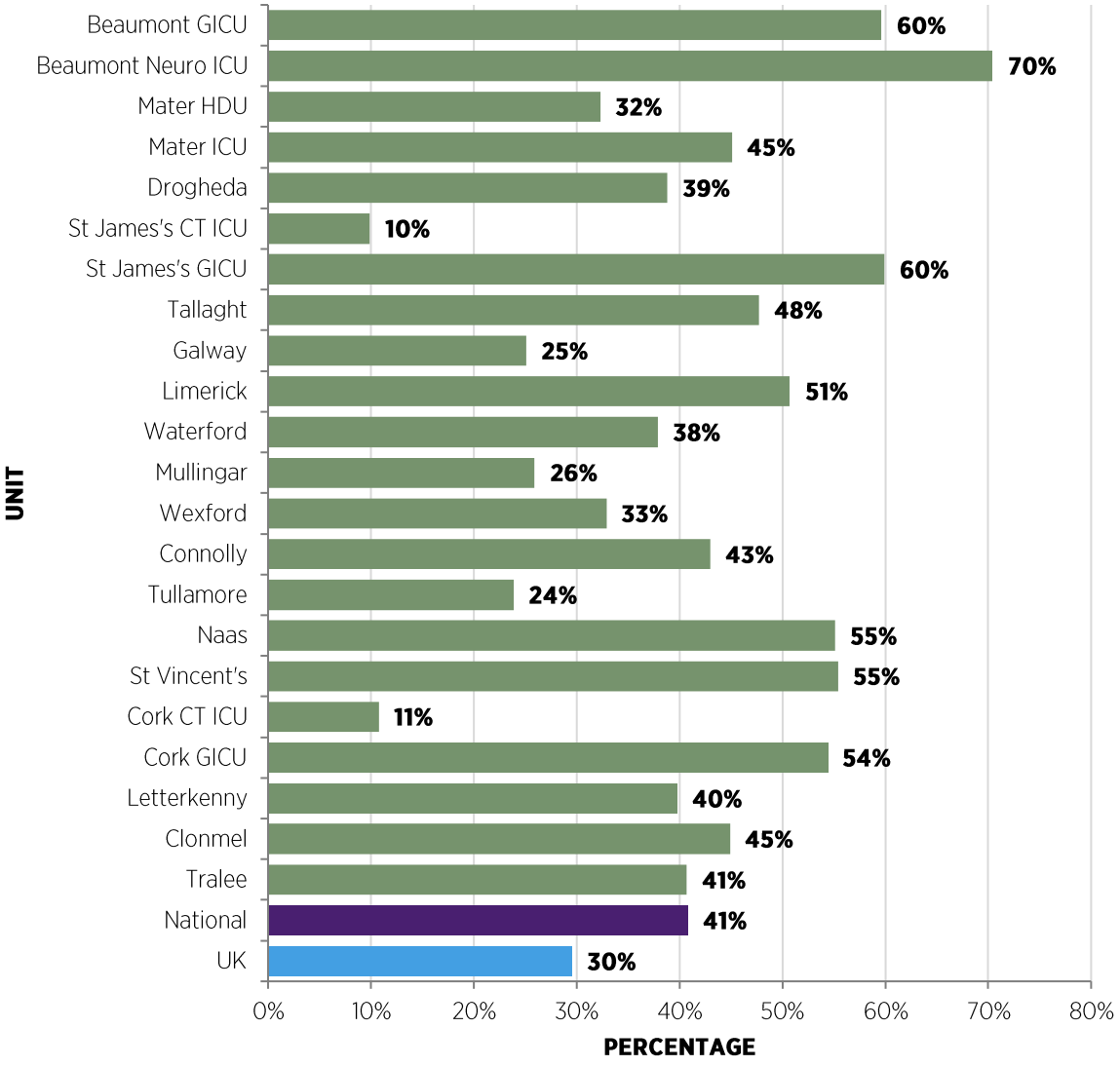

FIGURE 2.9: PATIENTS WHO RECEIVED ENTERAL OR PARENTERAL NUTRITION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

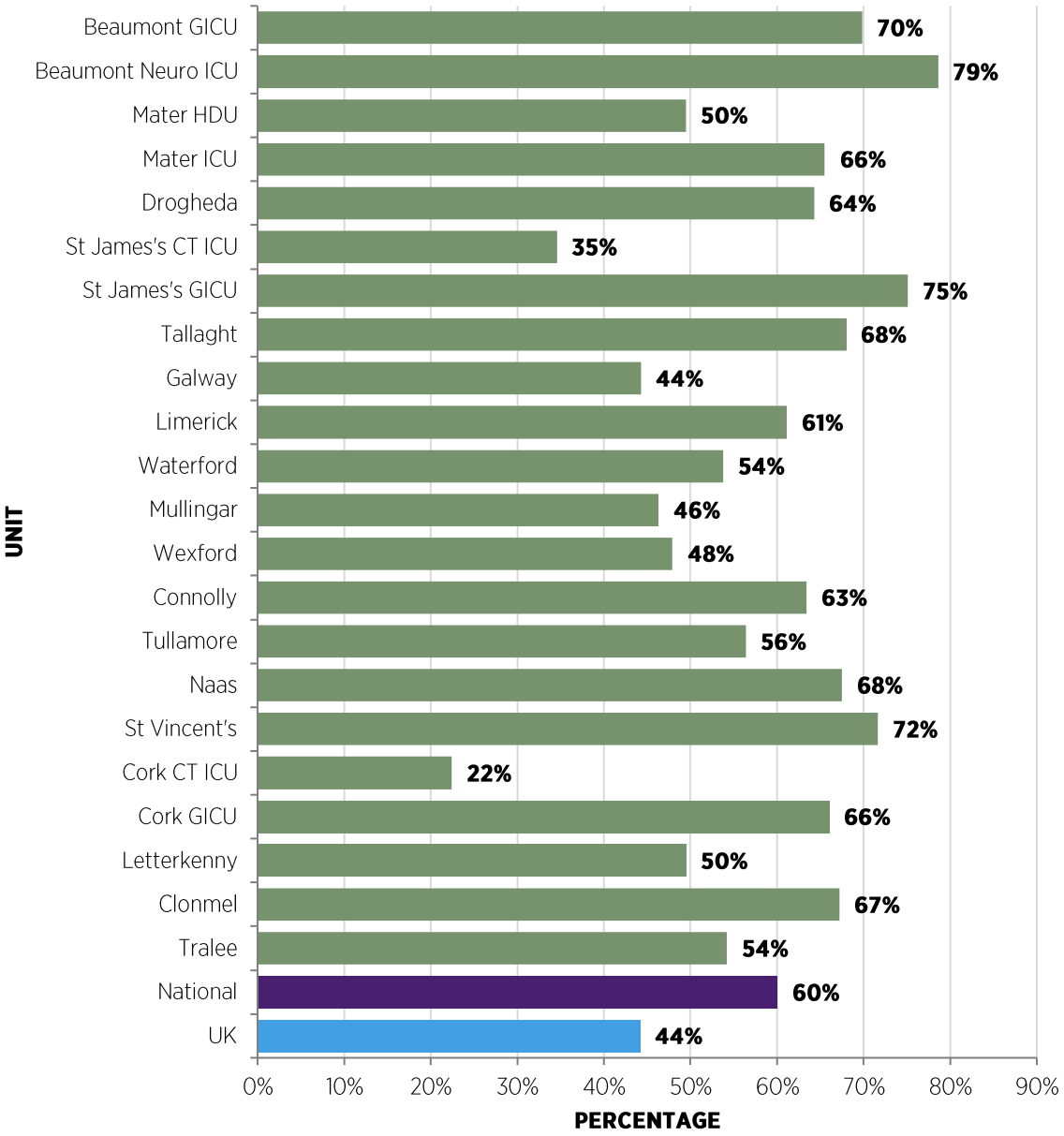

FIGURE 2.10: BED DAYS WHEN ENTERAL OR PARENTERAL NUTRITION WAS PROVIDED (AS A PERCENTAGE OF ALL UNIT PATIENT DAYS)

NUMBER OF ORGAN SYSTEMS SUPPORTED IN ICU

ICNARC reports the number of organ systems supported and the duration of this support. Figures 2.11 and 2.12 show the percentage of patients who had three or more organ systems supported and the proportion of all bed days when this support was provided. This gives an indication of the severity of illness treated in a Unit and the resources utilised. These data are consistent with other indicators of illness severity, such as APACHE II scores, the provision of ARS and advanced CVS support, renal support (dialysis), etc.

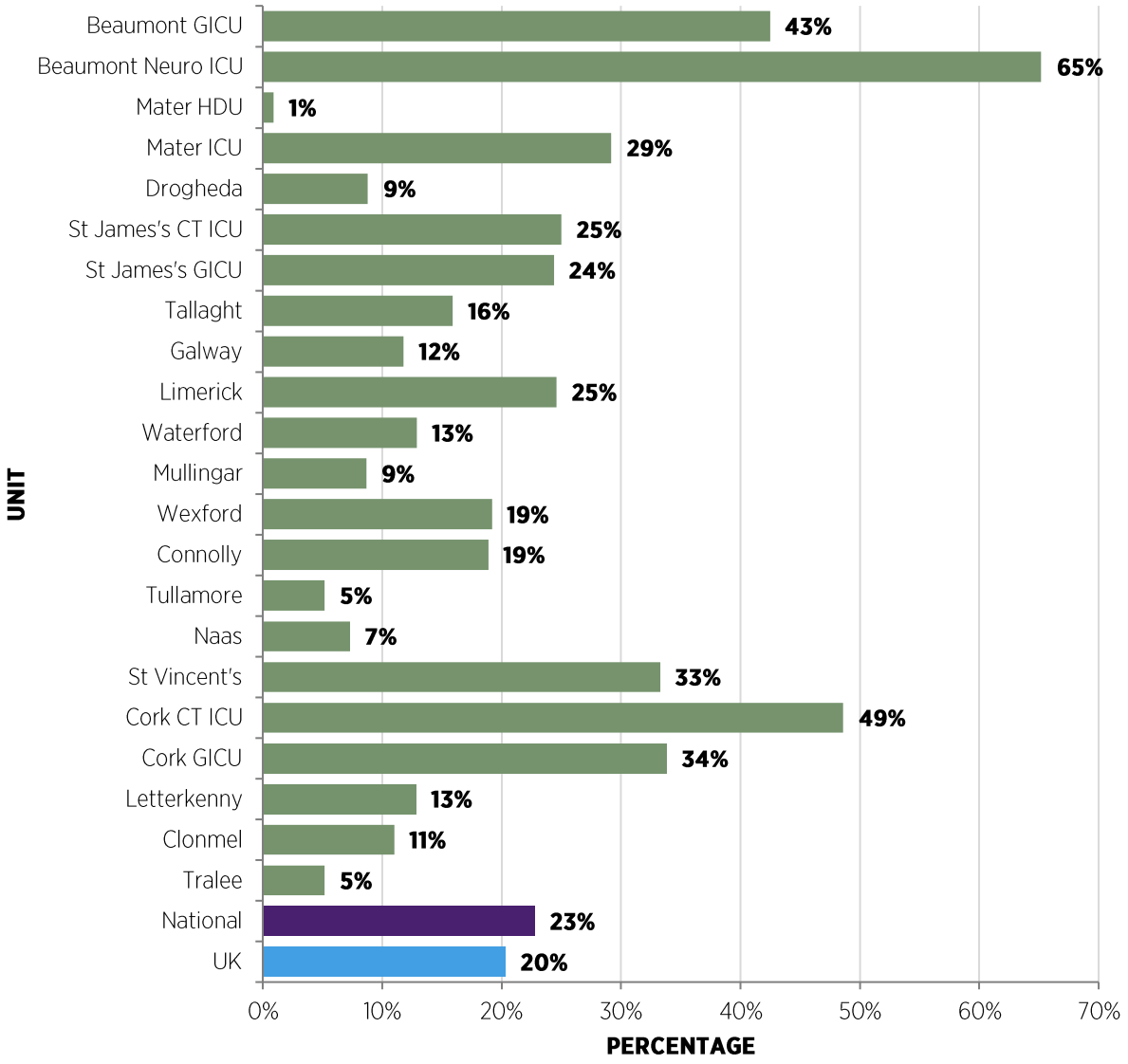

FIGURE 2.11: PATIENTS WHO RECEIVED SUPPORT FOR THREE OR MORE ORGAN SYSTEMS (AS A PERCENTAGE OF ALL UNIT ADMISSIONS)

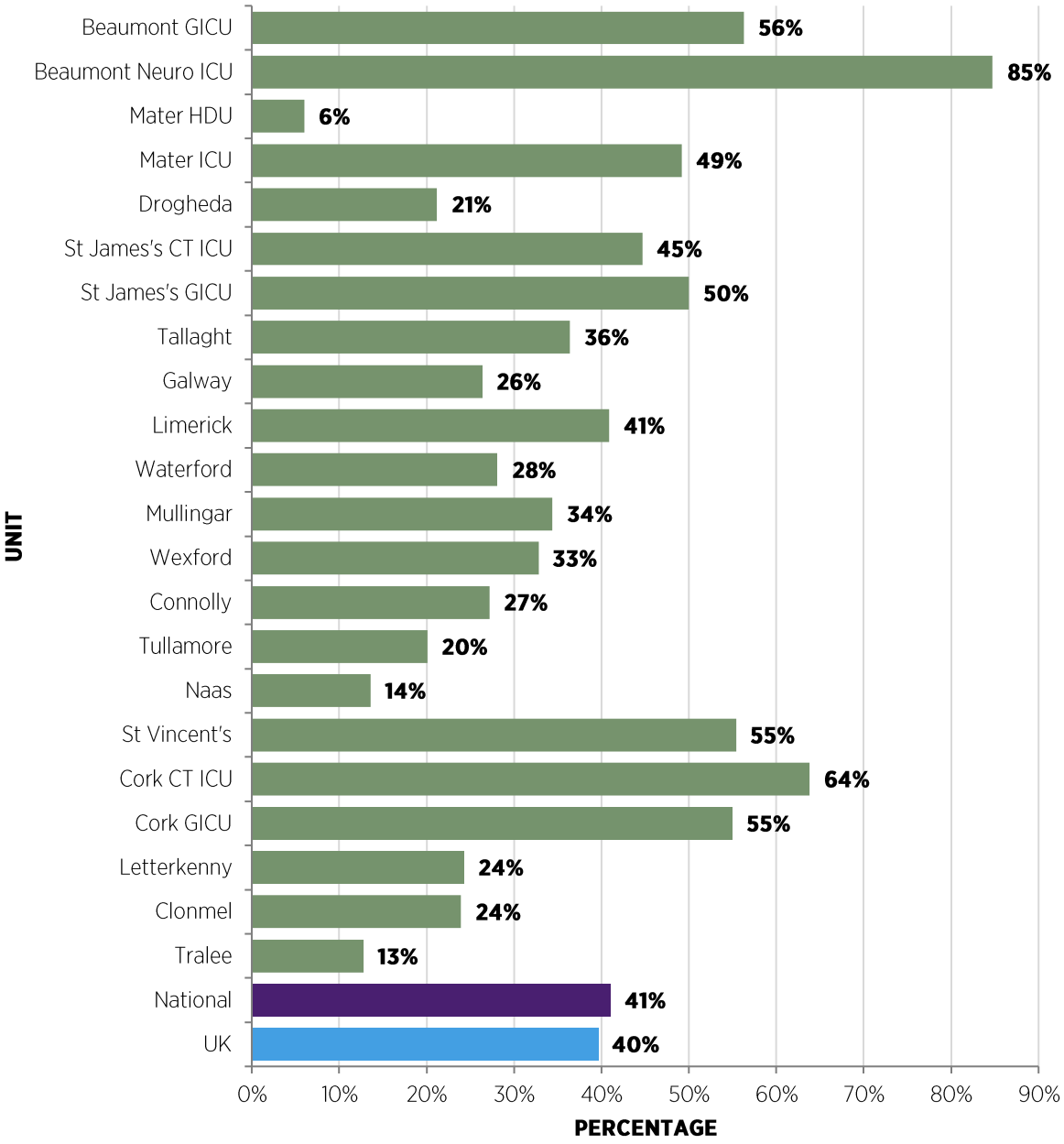

FIGURE 2.12: PATIENT DAYS WITH THREE OR MORE ORGAN SYSTEMS SUPPORTED (AS A PERCENTAGE OF ALL UNIT PATIENT DAYS)

END OF LIFE AND ORGAN DONATION

Brain death was diagnosed in 110 patients, or 7.7% of all Unit non-survivors (Table 2.1), in 2019. Sixty-one of these patients became organ donors, a conversion rate of 56%, which is comparable to previous years.

A small percentage of patients became donors after cardiac death (0.5%), a considerably lower percentage than in the UK (2.5%).

TABLE 2.1: BRAIN DEATH AND ORGAN DONATION

Brain death and organ donation	INICUA	UK Units
Unit non-survivors (%)	1429 (12.7%)	(11.3%)
Brain death (% Unit non-survivors)	110 (7.7%)	(6.2%)
Organ donation after brain death n (% brain deaths)	61 (55.5%)	(52.8%)
Organ donation after cardiac death n (% cardiac deaths)	6 (0.5%)	(2.5%)

KEY FINDINGS FROM CHAPTER 2

- There was considerable variability between Units in measures of illness severity and in the levels of organ support provided. This is to be expected in view of the heterogeneity of participating Units.
- Patients in the larger Units in major referral centres required higher levels of organ support.
- The mean APACHE II score for all admissions in participating Units in the ROI was 16.2, versus 14.6 in the UK.
- The median predicted mortality rate was 7.2% for patients in the ROI versus 4.7% for UK patients, suggesting that patients are sicker on admission to ICU in the ROI than in the UK. This is also suggested by the higher proportion of patients who required invasive ventilation in the ROI than in the UK (54% versus 41%), although requirements for complex cardiovascular support and for dialysis were similar in the ROI and in the UK.
- These data provide insight into variations between Units in the complexity of illness treated and requirements for resources.
- The numbers of patients requiring invasive ventilation varied widely between Units, some of which had relatively low patient numbers. Similarly, some Units had small numbers of patients requiring support of multiple organ systems, which means that those Units have less experience in managing these patients. These data should be taken into account in any future planning for reconfiguration of critical care services.
- The incidence of brain death and organ donation in 2019 was similar to previous years. The proportion of patients diagnosed as brain dead who became organ donors was 56%. A comprehensive report on organ donation is not available for 2019, pending development of an Irish National ICU Audit database.

CHAPTER 3: BED UTILISATION

BED OCCUPANCY

Ireland had 255 ICU/HDU beds in publicly funded hospitals in 2019 (249 in 2018). This corresponds to 5.2 critical care beds in public hospitals per 100,000 population, less than half the European average (Rhodes et al, 2012; Walsh *et al.*, 2020).

Recommendations for appropriate levels of ICU bed occupancy differ between different authorities, generally due to differences in the method of calculating bed occupancy. The most accurate method of calculating ICU bed occupancy is by documenting the exact times of admission and discharge and calculating the duration of time in ICU to the nearest hour. That is the method we used; using this method, the recommended bed occupancy is 75% (Valentin et al, 2011).

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

There was wide variability between Units in numbers of bed days provided, in keeping with the different bed numbers in each Unit (Figure 3.1A). In addition, some Units only had data for 3 months (Tallaght University Hospital ICU and Letterkenny University Hospital ICU) or 6 months (South Tipperary General Hospital ICU and University Hospital Kerry ICU).

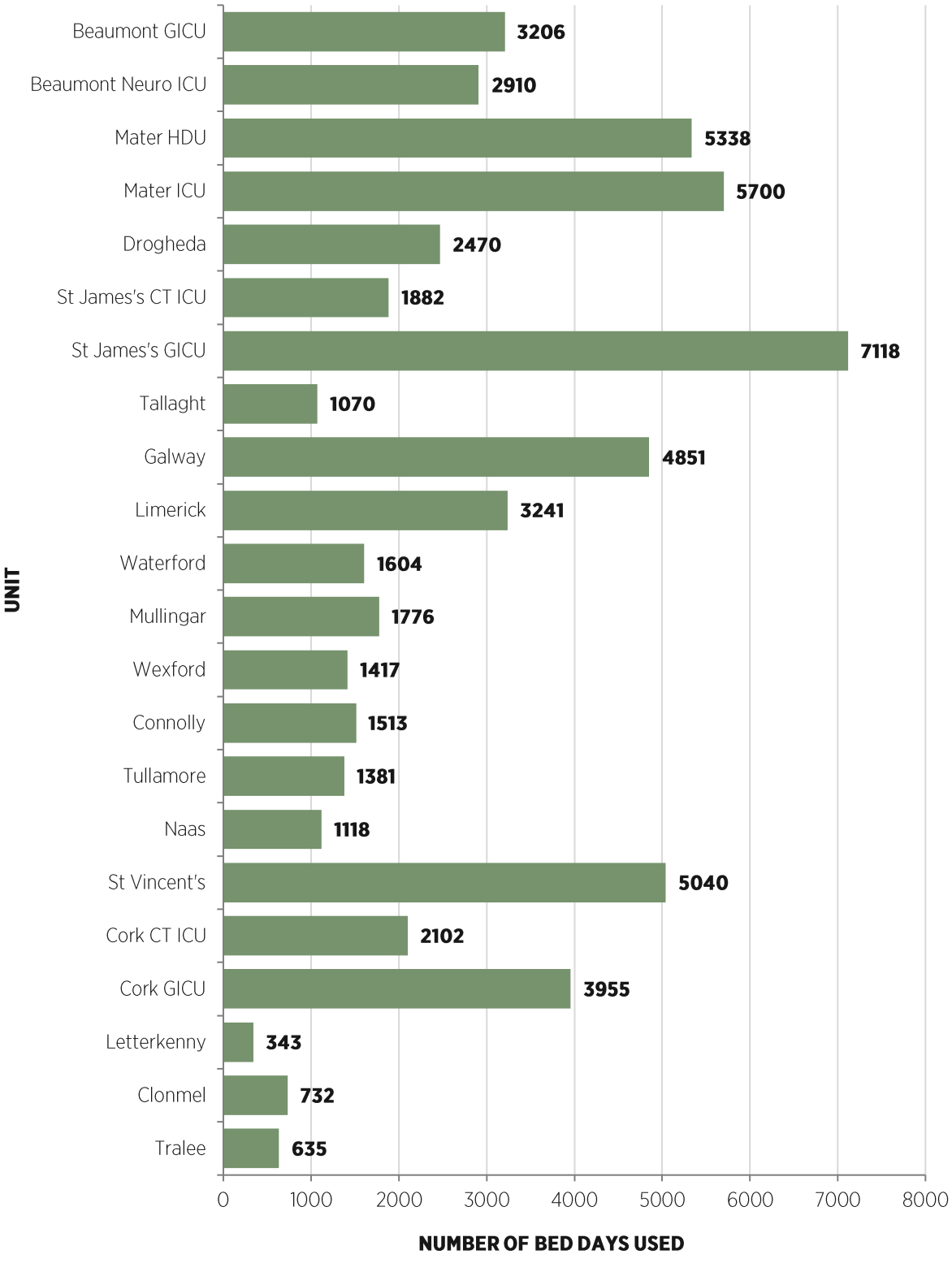

FIGURE 3.1A: NUMBERS OF BED DAYS OCCUPIED IN 2019

The numbers of bed days occupied in each Unit were relatively consistent between 2018 and 2019 (Figure 3.1B). This is because bed occupancy is supply led rather than demand led and supply is fixed. Exceptions were the Mater Misericordiae University Hospital HDU and University Hospital Limerick ICU, where the number of bed days occupied increased by 22% and 19%, respectively; both Units had opened additional beds since 2018.

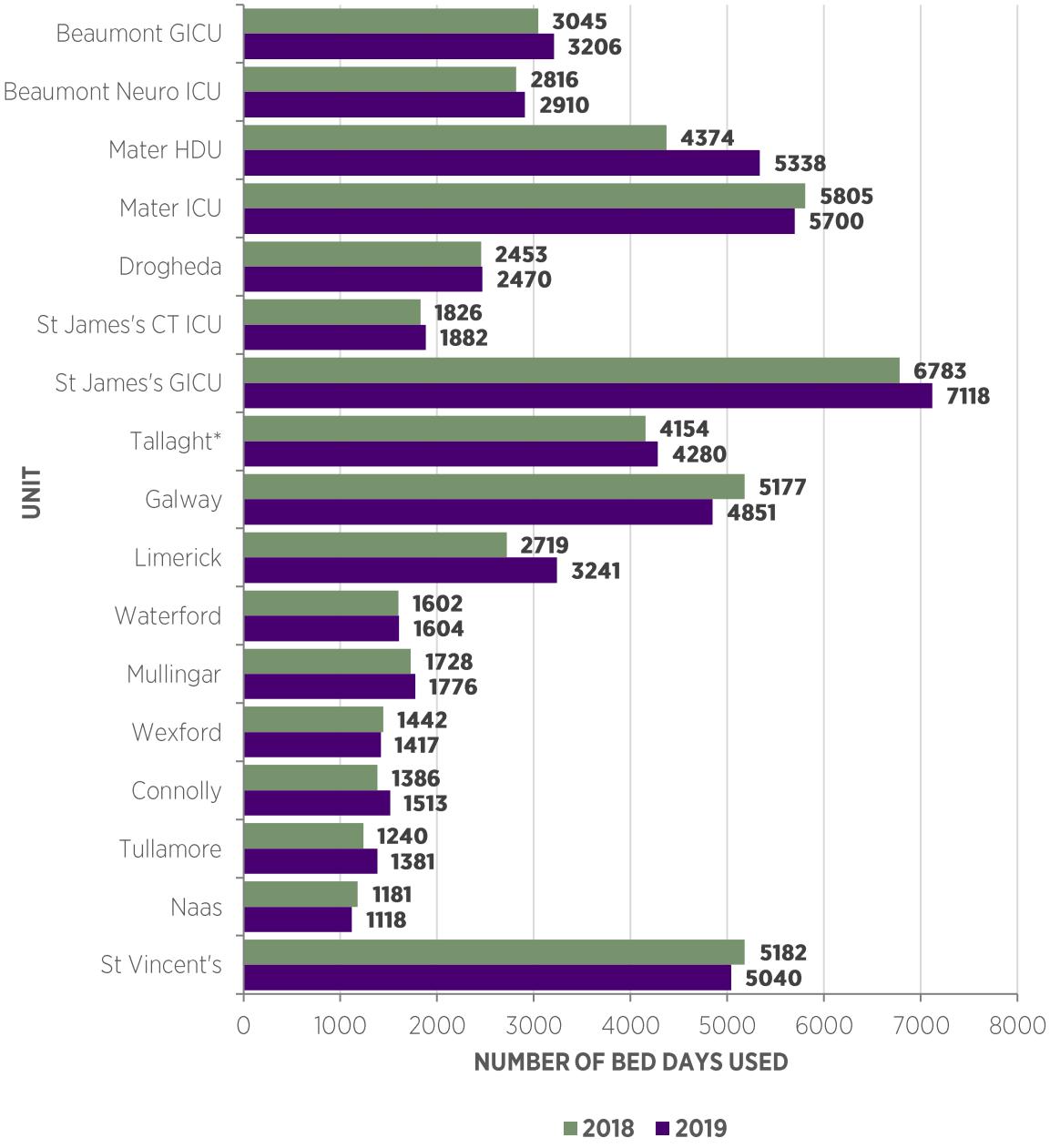

FIGURE 3.1B: NUMBER OF BED DAYS OCCUPIED IN 2018 AND 2019

* Tallaght University Hospital ICU, Connolly Hospital ICU, Midland Regional Hospital Tullamore ICU, Naas General Hospital ICU and St Vincent's University Hospital ICU had data for only 6 months in 2018, while Tallaght University Hospital ICU had data for only 3 months in 2019. Available data have been extrapolated in order to provide an estimated value for 12 months. Cork University Hospital Cardiothoracic ICU, Cork University Hospital ICU, Letterkenny University Hospital ICU, South Tipperary General Hospital ICU and University Hospital Kerry ICU are not included in Figure 3.1B, as 2018 data were not available.

The ICU Audit Coordinators in each Unit documented the number of beds staffed and open each quarter, and the total number of available bed days for the year was calculated. Bed occupancy was the percentage of available bed days that the bed was occupied. If this method of calculating bed occupancy is used, the recommended level of bed occupancy is 75% (Valentin *et al.*, 2011).

Mean bed occupancy levels ranged from 75% to 104% (Figure 3.1C). All participating Units except one had bed occupancy levels above the 75% level recommended by the ESICM – some by a wide margin. Demand for ICU beds tends to fluctuate widely. High levels of bed occupancy indicate that there were periods when the number of beds occupied was greater than the number of beds formally staffed, in order to cope with the numbers of patients who required admission to ICU.

The overall bed occupancy level for the Units audited was 90% (versus 88% in 2018) (Figure 3.1D). ICNARC reports do not supply the data to allow estimation of bed occupancy in UK Units.

The reasons that the recommended bed occupancy level is 75% are: (i) time is required between patients for cleaning the environment; (ii) times of admission are unpredictable, and so the bed may be vacant even if booked for a patient; (iii) levels of demand are unpredictable, with wide fluctuations in numbers of admissions resulting in a need to have adequate capacity for peak demand rather than average demand; and (iv) the need to have a bed immediately available for critically ill patients.

If average levels of bed occupancy are high, Units commonly have to manage this by opening additional, non-resourced beds in times of high demand. This means that nursing and medical staff have to manage an additional patient, possibly leading to compromise in the care of all other patients in the Unit. In addition, ICU admissions may be delayed and patients may need to be discharged early or outside normal working hours. High levels of ICU bed occupancy also lead to cancellation of elective surgery and increased incidence of hospital-acquired infection.

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

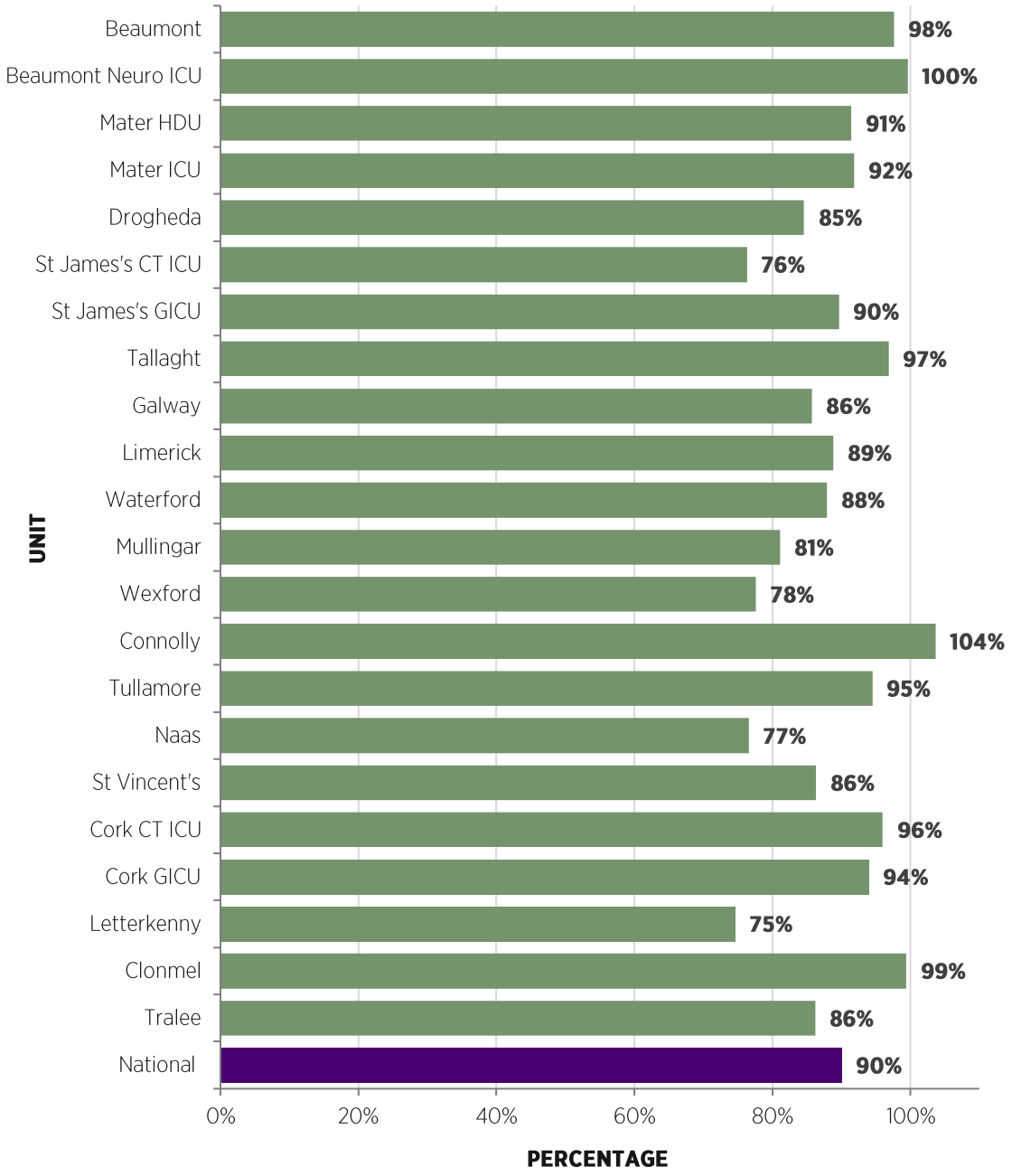

FIGURE 3.1C: BED OCCUPANCY IN 2019 (BED DAYS OCCUPIED AS A PERCENTAGE OF UNIT BED DAYS AVAILABLE)

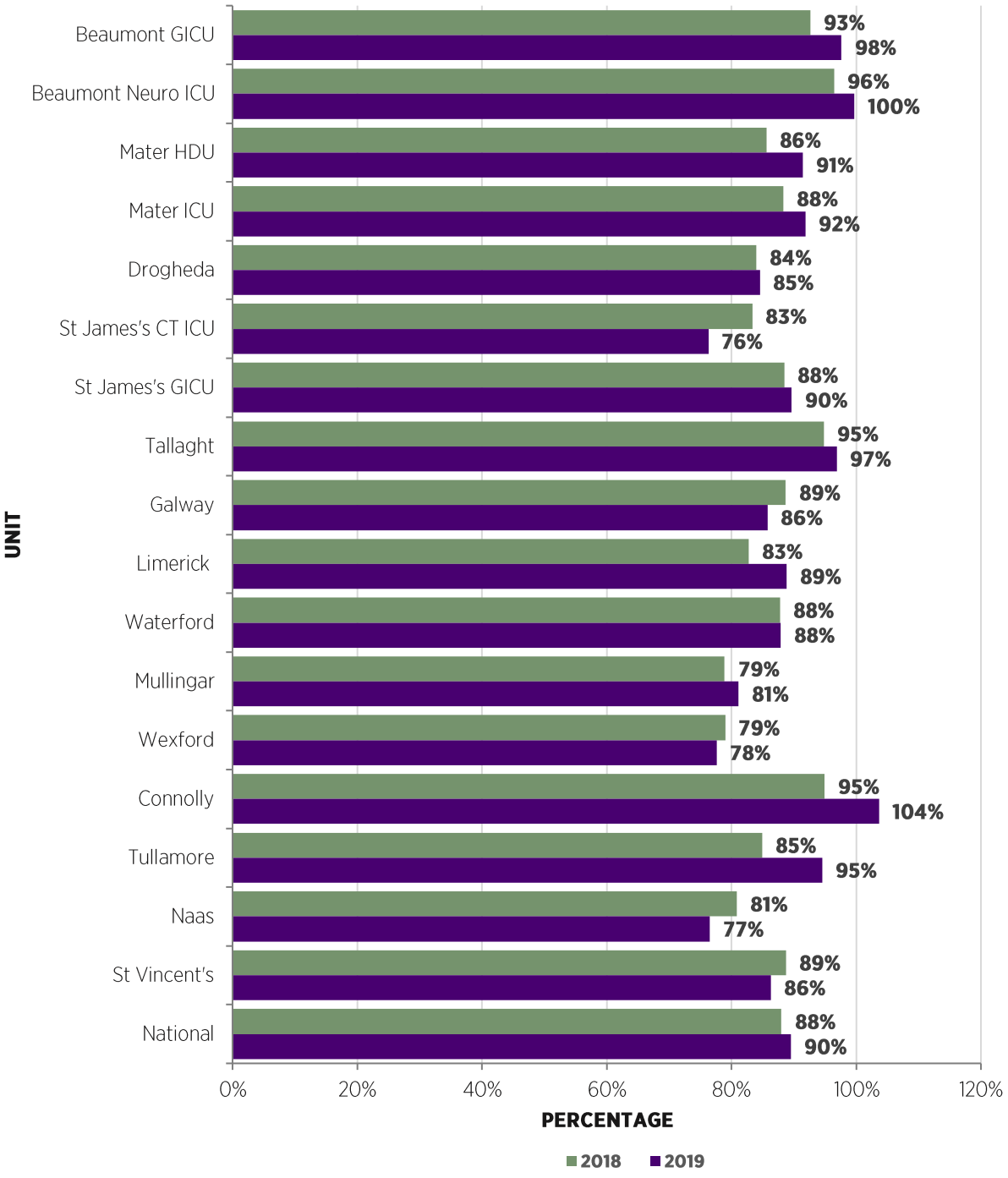

FIGURE 3.1D: BED OCCUPANCY IN 2018 VERSUS 2019 (BED DAYS OCCUPIED AS A PERCENTAGE OF UNIT BED DAYS AVAILABLE)

LENGTH OF STAY IN ICU FOR ICU SURVIVORS

LOS for ICU survivors varied between Units (Figure 3.2). LOS tended to be longer in Units with greater illness severity scores (Figure 2.1), and shorter in Units classified as 'mixed ICU/HDU' and in Units for patients after cardiothoracic surgery (Table 1.1); this is explained by case mix. LOS may also be influenced by demand for beds; if beds are not required for new admissions, patients can stay longer in the Unit. Mean LOS in 2019 was 5 days in the ROI and 4 days in the UK (values are rounded; the actual value for Units in the ROI was a mean LOS of 5.3 days)

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

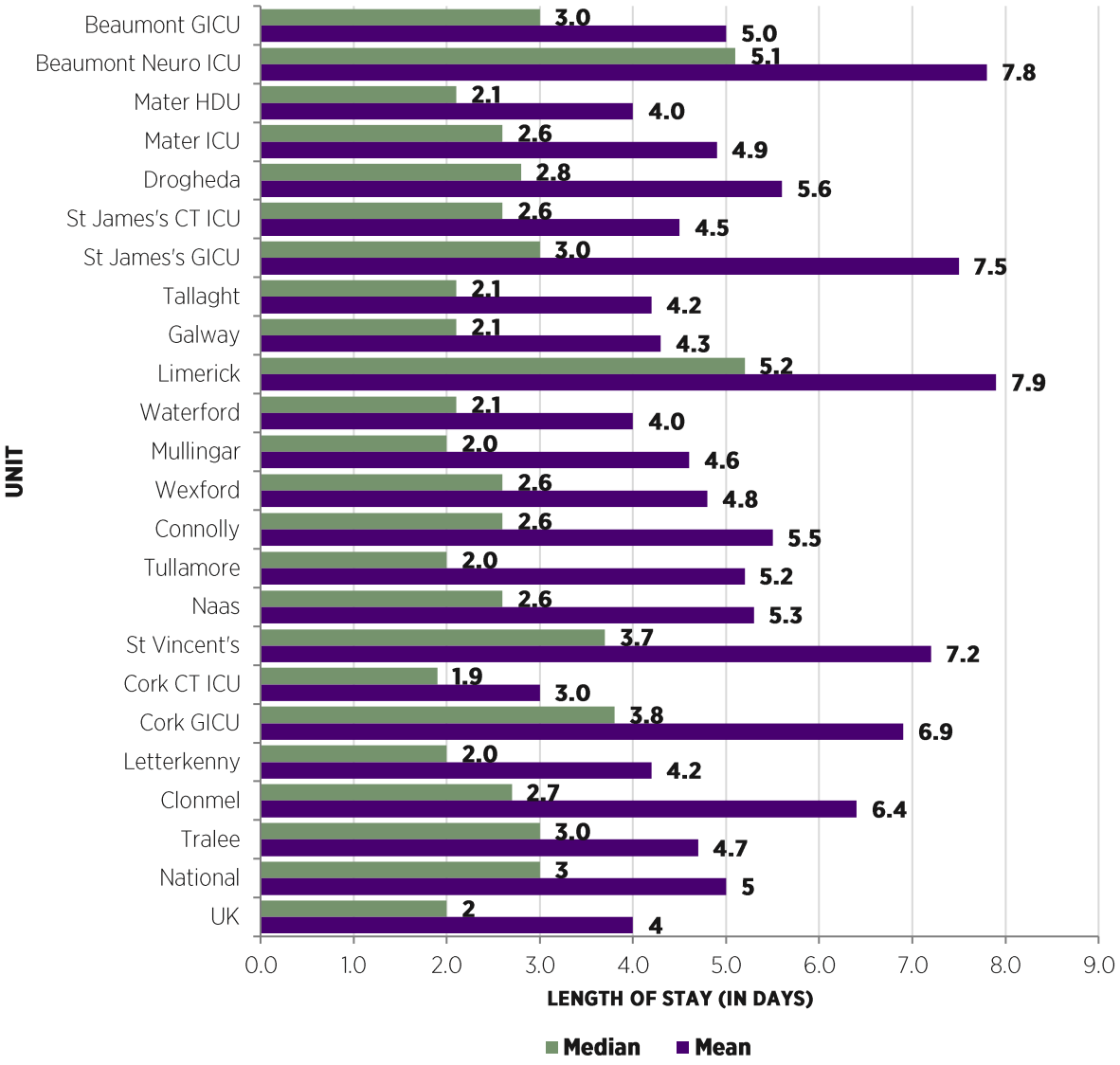

FIGURE 3.2: UNIT SURVIVORS: MEAN AND MEDIAN LENGTH OF STAY IN THE UNIT (DAYS)

LOS: UNIT SURVIVORS VERSUS NON-SURVIVORS

Survivors in some Units had a longer mean LOS than non-survivors, while in other Units the picture was the opposite (Figure 3.3). It is possible that this finding is random, that it reflects the case mix in certain Units, or that it reflects earlier decision-making regarding withdrawal of life-sustaining therapies in some Units.

Mean LOS for ICU survivors in the ROI was 5 days, compared with 6 days for non-survivors (values rounded to nearest integer). In the UK, mean LOS was 4 days for ICU survivors and 5 days for non-survivors.

Mean LOS in non-survivors was considerably longer in St James's Hospital Keith Shaw Unit (Cardiothoracic ICU), at 12.8 days; this value may have been influenced by a small number of patients who had a prolonged illness before they died, especially as the number of patients who died in this Unit was small.

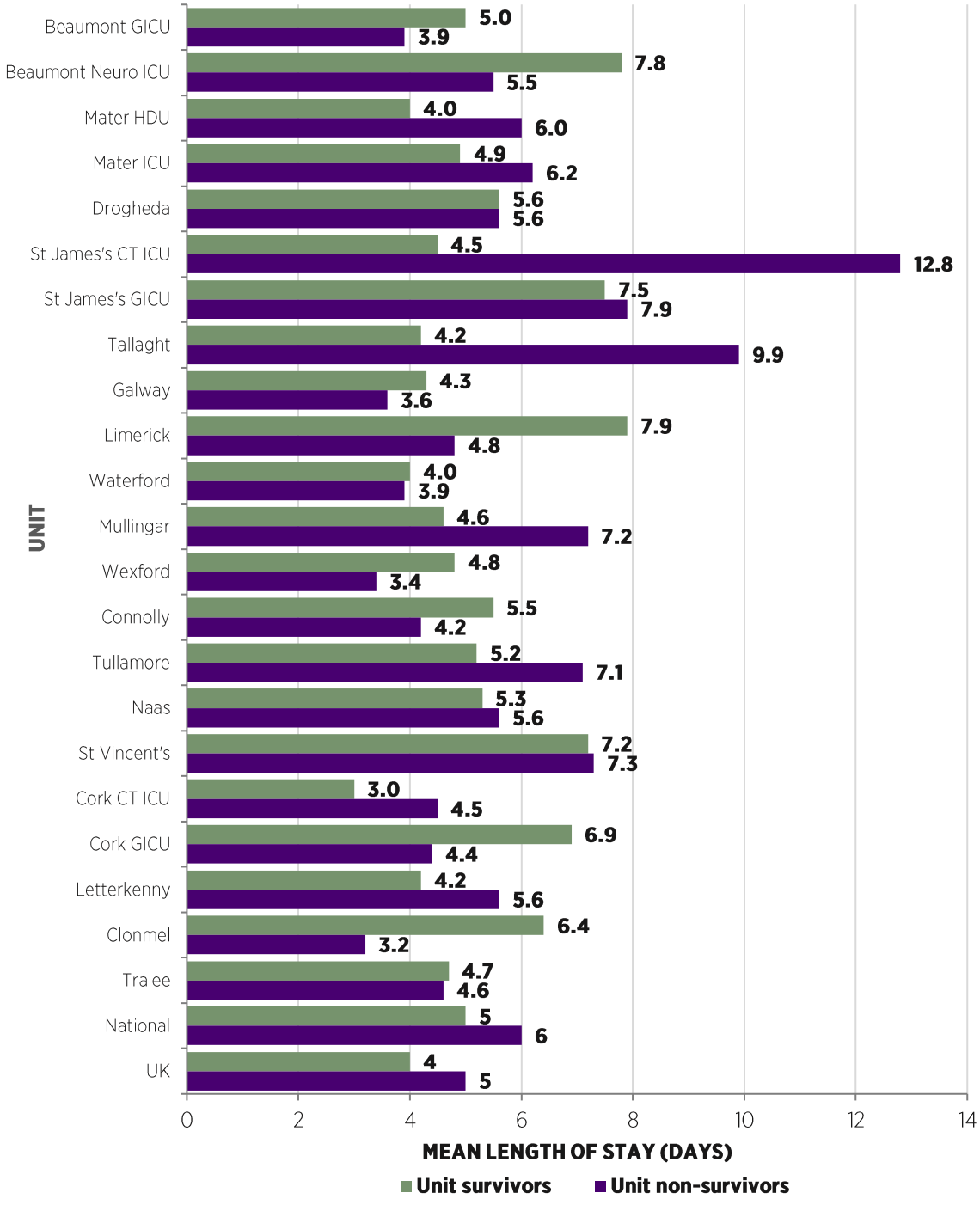

FIGURE 3.3: UNIT LENGTH OF STAY FOR UNIT SURVIVORS VERSUS NON-SURVIVORS (MEAN, DAYS)

DELAYED DISCHARGE FROM ICU >24 HOURS

There is a shortage of hospital beds in the ROI, leading to well-publicised delays in the transfer of patients from the Emergency Department (ED). Similarly, there are delays in discharging patients from ICU after they are cleared for discharge. There were large differences between Units in the proportion of patients whose discharges were delayed for more than 24 hours (Figure 3.4). The reasons for this can only be explained locally. The overall figure for the ROI was comparable to the UK (22% versus 18%).

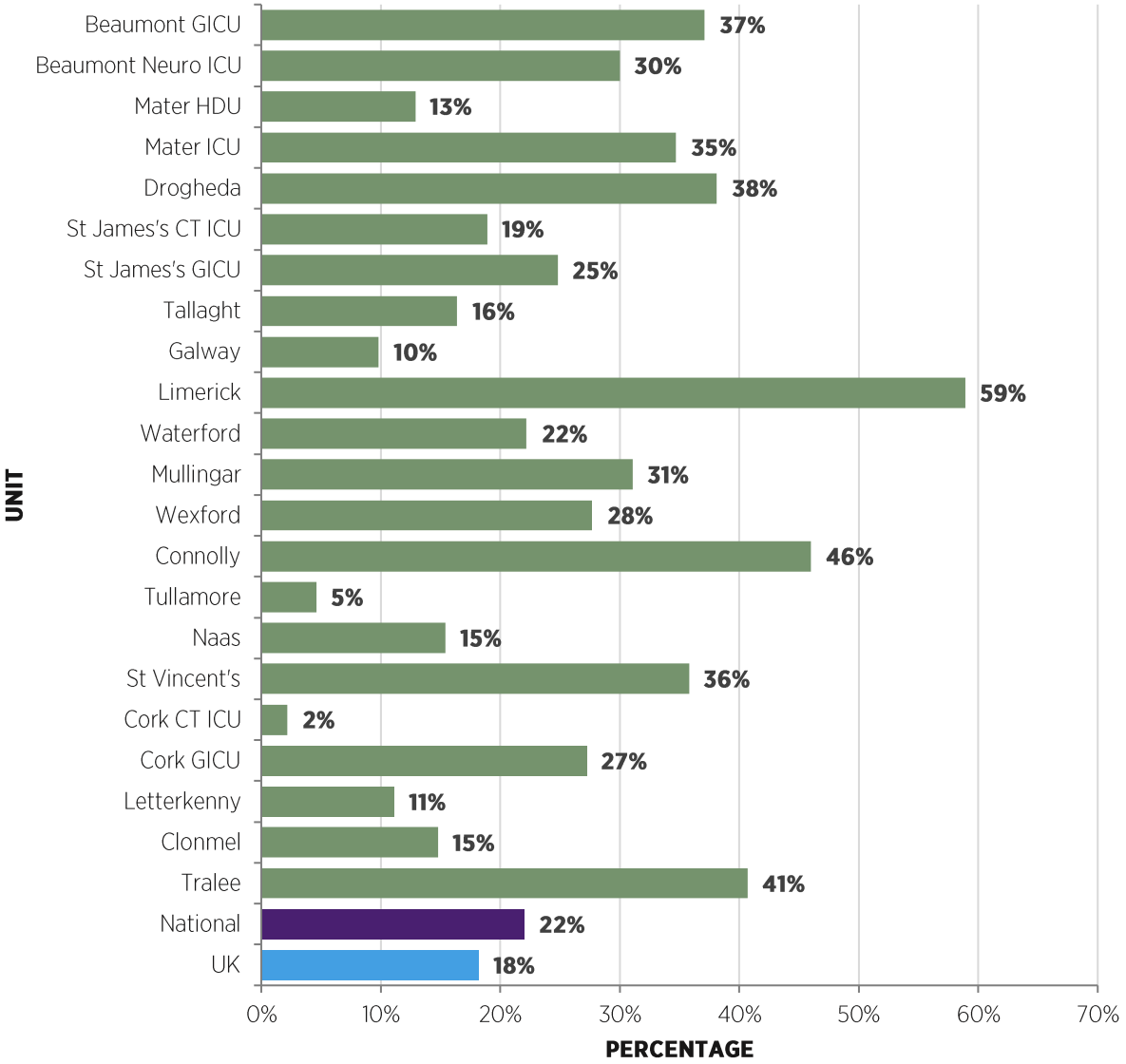

FIGURE 3.4: DISCHARGES TO THE WARD DELAYED >24 HOURS (AS A PERCENTAGE OF ALL DISCHARGES TO THE WARD

DELAYED DISCHARGES: DAYS OF DELAY

Patients commonly stay in ICU after they have been declared clinically ready for ward care (Figures 3.5 and 3.6). There were considerable variations between Units (that are likely to be explained by local factors) in requirements for ICU beds and in bed management policies. Units in the ROI had similar values as UK Units; 4.6% of available bed days were occupied by patients who had been declared ready for discharge more than 8 hours earlier versus 4.7% in the UK. Patients who had been declared ready for discharge more than 24 hours earlier occupied 2.8% of available bed days in the ROI versus 2.9% in the UK.

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

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

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 but the beds are not staffed. This may explain some variability between Units.

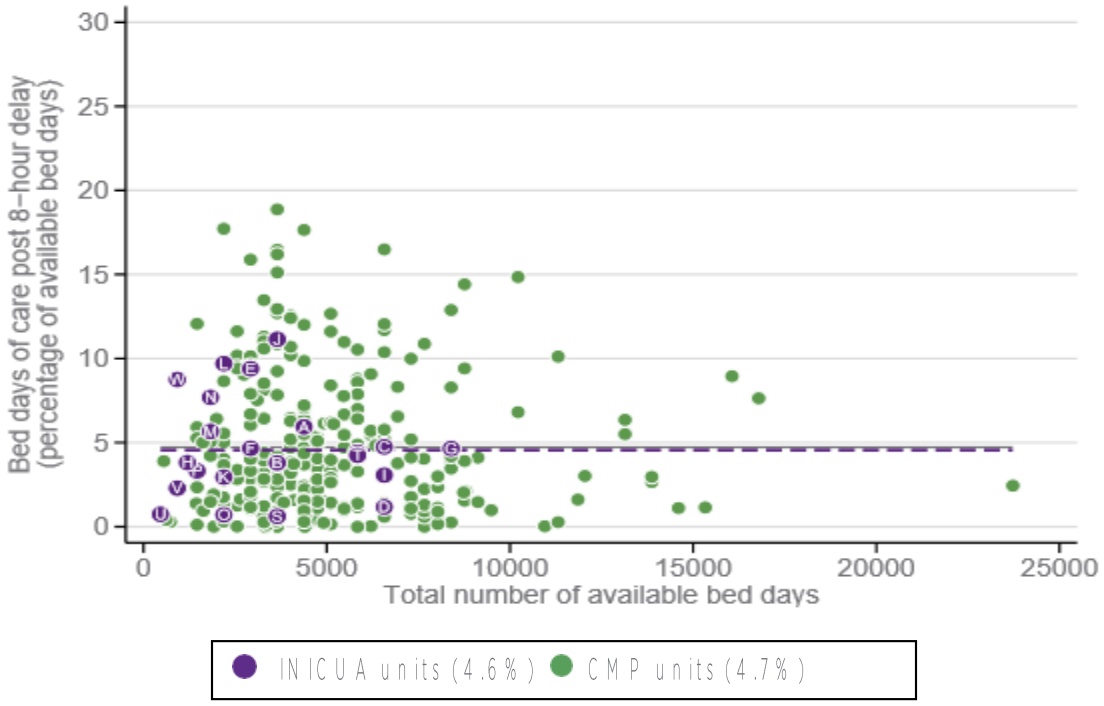

FIGURE 3.5: BED DAYS SPENT IN THE UNIT MORE THAN 8 HOURS AFTER BEING DECLARED READY FOR DISCHARGE (AS A PERCENTAGE OF AVAILABLE UNIT BED DAYS)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

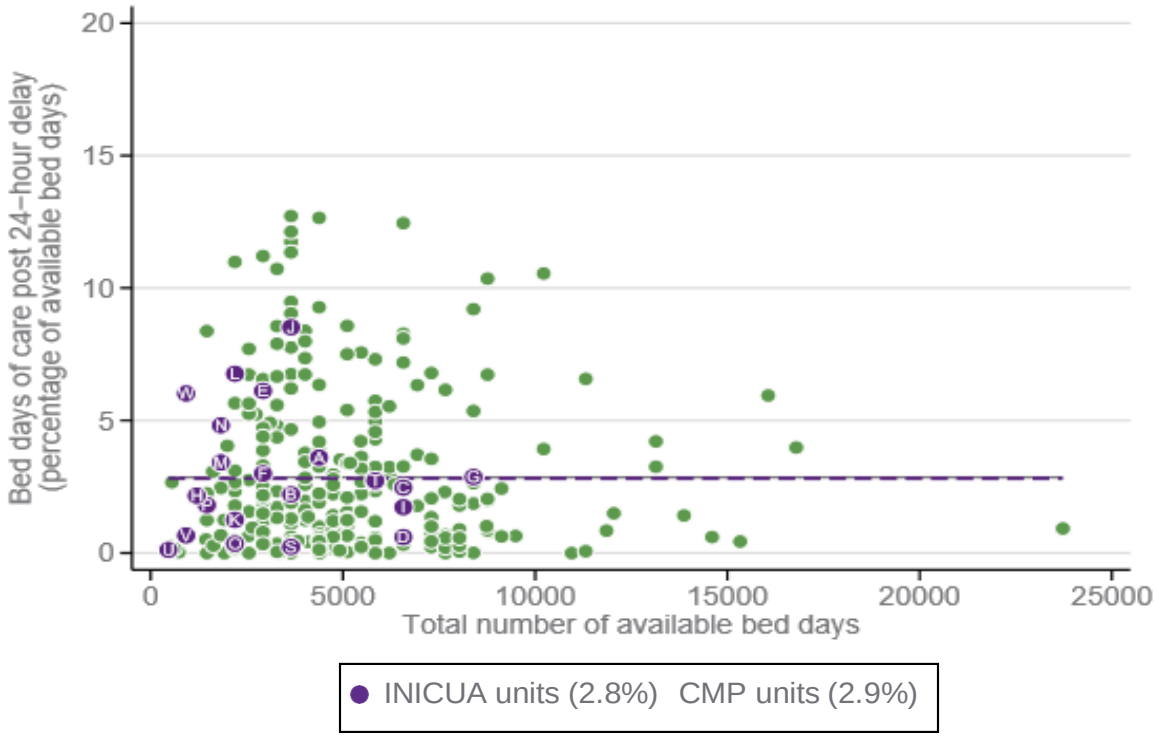

FIGURE 3.6: BED DAYS SPENT IN THE UNIT MORE THAN 24 HOURS AFTER BEING DECLARED READY FOR DISCHARGE (AS A PERCENTAGE OF AVAILABLE UNIT BED DAYS)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

NATIONAL EARLY WARNING SCORES ON DISCHARGE FROM THE UNIT

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

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

Median NEWS values at ICU discharge were surprisingly high for a number of Units (Figure 3.7). The upper quartile was as high as 5 for a number of Units, meaning that 25% of patients had a NEWS ≥5 at the time of discharge to the ward. This means that a significant number of patients were discharged to the ward while still unwell (assuming they were not discharged to an ICU or HDU). This indicates pressure on ICU beds, and that patients were possibly discharged to make beds available for other patients who were sicker.

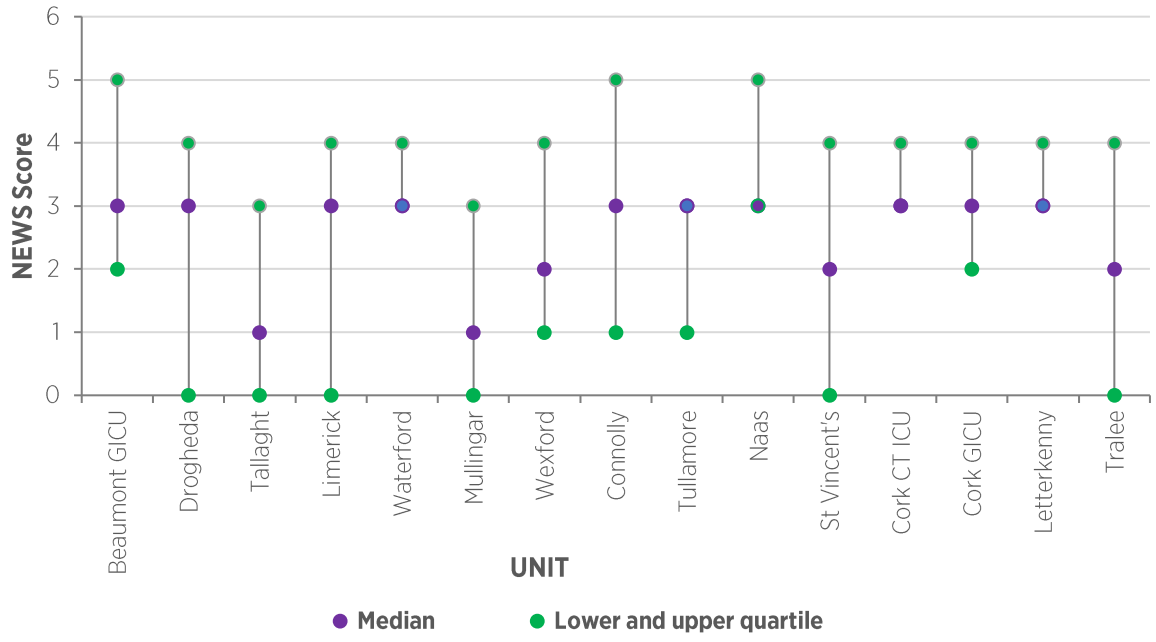

FIGURE 3.7: NEWS VALUES AT THE TIME OF DISCHARGE FROM THE UNIT (MEDIANS, QUARTILES)*

* Data are only presented for Units with documentation of NEWS values for >50% of discharged patients.
Where the median is equal to the lower or upper quartile, only the median is visible in the graph.

LOS AFTER ICU DISCHARGE

Hospital LOS after Unit discharge varied between hospitals (Figure 3.8). This may reflect differences in case mix or differences in local community or convalescent facilities. The mean LOS was greater than the median LOS in hospital after ICU discharge in all hospitals, suggesting that a small number of patients who stayed for a long time increased the mean LOS. Mean hospital LOS was 22 days in the ROI versus 14 days in the UK.

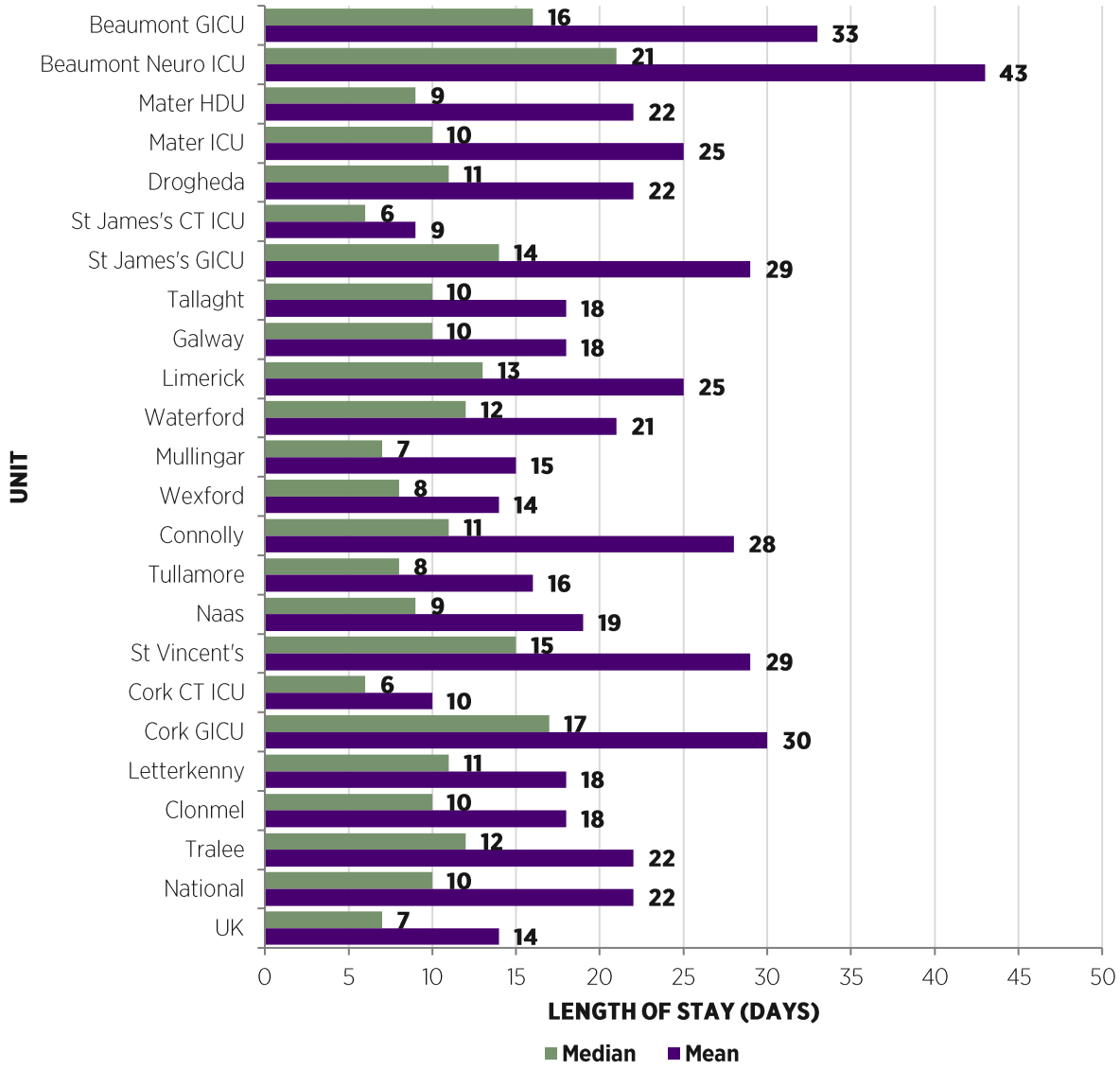

FIGURE 3.8: LENGTH OF STAY IN ACUTE HOSPITAL AFTER UNIT DISCHARGE FOR THOSE WHO SURVIVED TO DISCHARGE FROM ACUTE HOSPITAL (DAYS, MEAN AND MEDIAN)

Hospital LOS after ICU discharge was longer for non-survivors than survivors in most Units, but not all. Mean LOS in hospital after Unit discharge in the ROI was 22 days for hospital survivors versus 26 days for non-survivors (Figure 3.9). In the UK, the mean LOS after ICU discharge was 14 days for hospital survivors versus 18 days for non-survivors. The shorter LOS for hospital survivors in the UK may be explained by better community facilities to facilitate earlier hospital discharge. However, better community facilities would not explain shorter LOS for hospital non-survivors in the UK, and the reason for this difference is unknown.

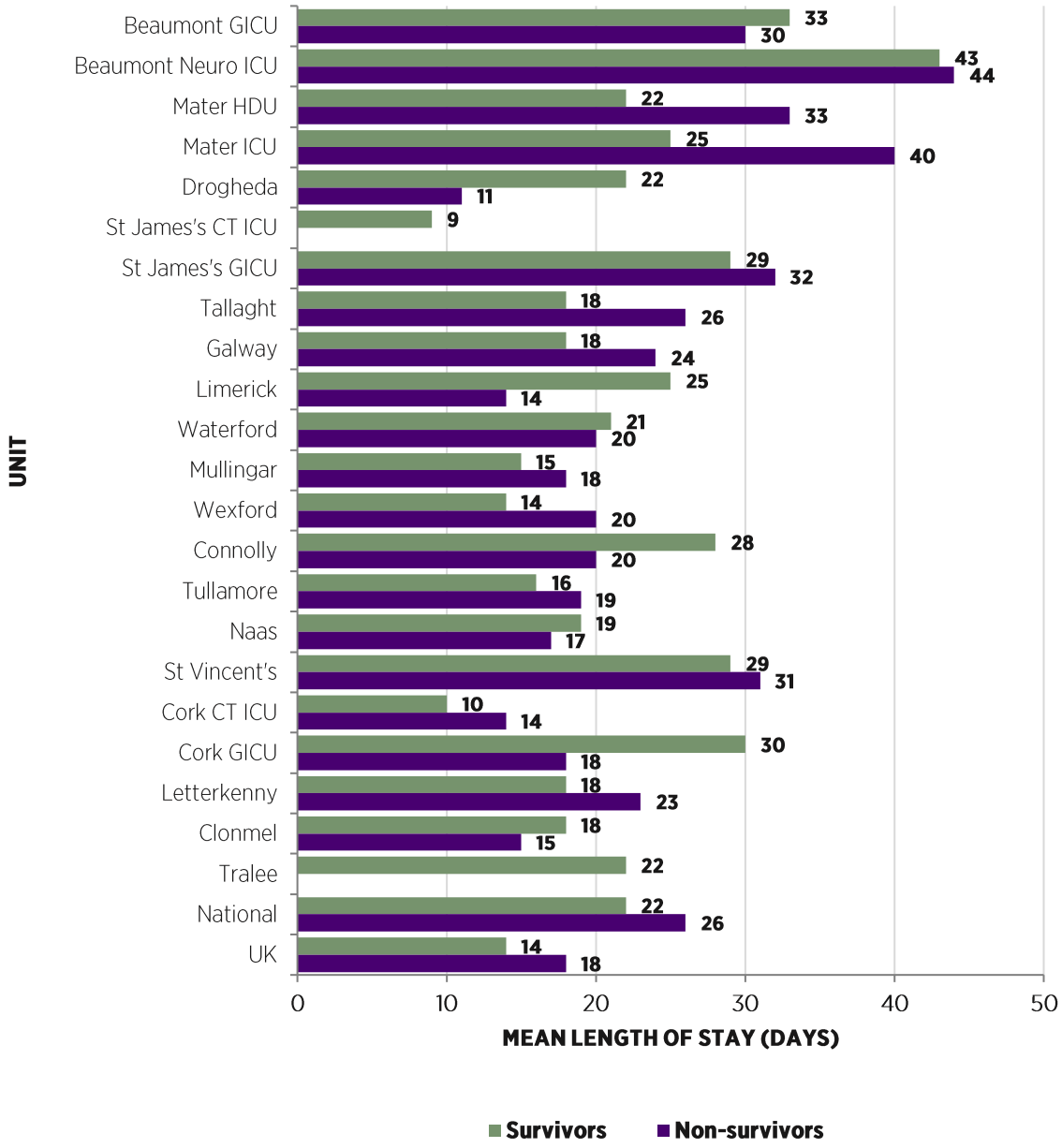

FIGURE 3.9: LENGTH OF STAY IN ACUTE HOSPITAL AFTER UNIT DISCHARGE: HOSPITAL SURVIVORS VERSUS NON-SURVIVORS (MEAN, DAYS)

KEY FINDINGS FROM CHAPTER 3

- The numbers of bed days occupied in each ICU was similar between 2018 and 2019, except in Units which opened additional beds.
- Mean bed occupancy levels ranged from 75% (Letterkenny University Hospital ICU) to 104% (Connolly Hospital ICU). Thus, occupancy was greater than the recommended level of 75% in all the Units audited except one.
- The overall bed occupancy level for all the Units audited was 90%, an increase from 88% in 2018.
- LOS varied considerably between Units, usually in keeping with differences in their case mix. Mean LOS for all patients was 5.3 days in 2019. Mean LOS for Unit survivors across all Units in the ROI was 5 days, compared with 6 days for Unit non-survivors (values rounded); the mean LOS for Unit survivors versus non-survivors in the UK was 4 days and 5 days, respectively.
- Delayed discharges from ICU were common across most Units. This led to utilisation of ICU beds by patients who could have been cared for in a ward. Nationally, 4.6% of all potential ICU bed days were occupied by patients who had been cleared for discharge to a ward for more than 8 hours (versus 4.7% of bed days for UK Units).
- NEWS values at discharge from ICU were relatively high in a number of Units, with median NEWS values of up to 3 and upper quartile NEWS values of up to 5. This indicates that patients were discharged from ICU while still relatively unwell. We do not know whether patients were discharged to a HDU or to a ward. If a patient with a high NEWS value was discharged to a ward rather than a step-down Unit (HDU), it suggests that discharge was because of a shortage of ICU beds.
- LOS in acute hospital after an ICU stay was consistent with the case mix of the individual Units. Mean hospital LOS after ICU discharge was 22 days in the ROI versus 14 days in the UK for those who survived to be discharged from acute hospital.
- Hospital LOS after ICU discharge was longer for non-survivors than survivors in most Units, but not all. Nationally, mean hospital LOS was 26 days for non-survivors versus 22 days for survivors. Corresponding figures for the UK were 18 days versus 14 days.

CHAPTER 4: OUTCOME MEASURES AND QUALITY INDICATORS

If patients are acutely ill and require admission to ICU, the faster they are admitted, the better the patient outcome (Harris *et al*., 2018). Delays in admission to ICU are inevitable with the high levels of ICU bed occupancy seen in Units in the ROI (Figure 3.1C). Most ICU beds are occupied by patients who are critically ill and cannot be discharged to the ward. However, some beds may be occupied by patients who have been cleared for discharge to the ward but remain in ICU because of a shortage of ward beds. This occurs commonly in ICUs in the ROI (Figures 3.4, 3.5 and 3.6).

In order to audit delays in admission to ICU, the HSE agreed on targets of 50% of patients to be admitted within 1 hour of a decision to admit and 80% of patients to be admitted within 4 hours of a decision to admit. This metric applies only to patients admitted to ICU from the ward or ED in the same hospital. Data are only provided here for Units where the time of the decision to admit was documented for at least 50% of admissions. Data are provided for a hospital rather than for an individual Unit.

There was wide variability between Units in the proportions of patients achieving the target times to admission (Figure 4.1). Only one hospital (Cork University Hospital) achieved the target of 50% of patients being admitted to ICU within 1 hour of the decision to admit. A number of Units achieved the target of 80% of patients being admitted within 4 hours of the decision to admit (Figure 4.1), which is a positive finding. The Units with rates below 80% tended to be some of the larger Units with very high occupancy levels (86% to 100%; Figure 3.1).

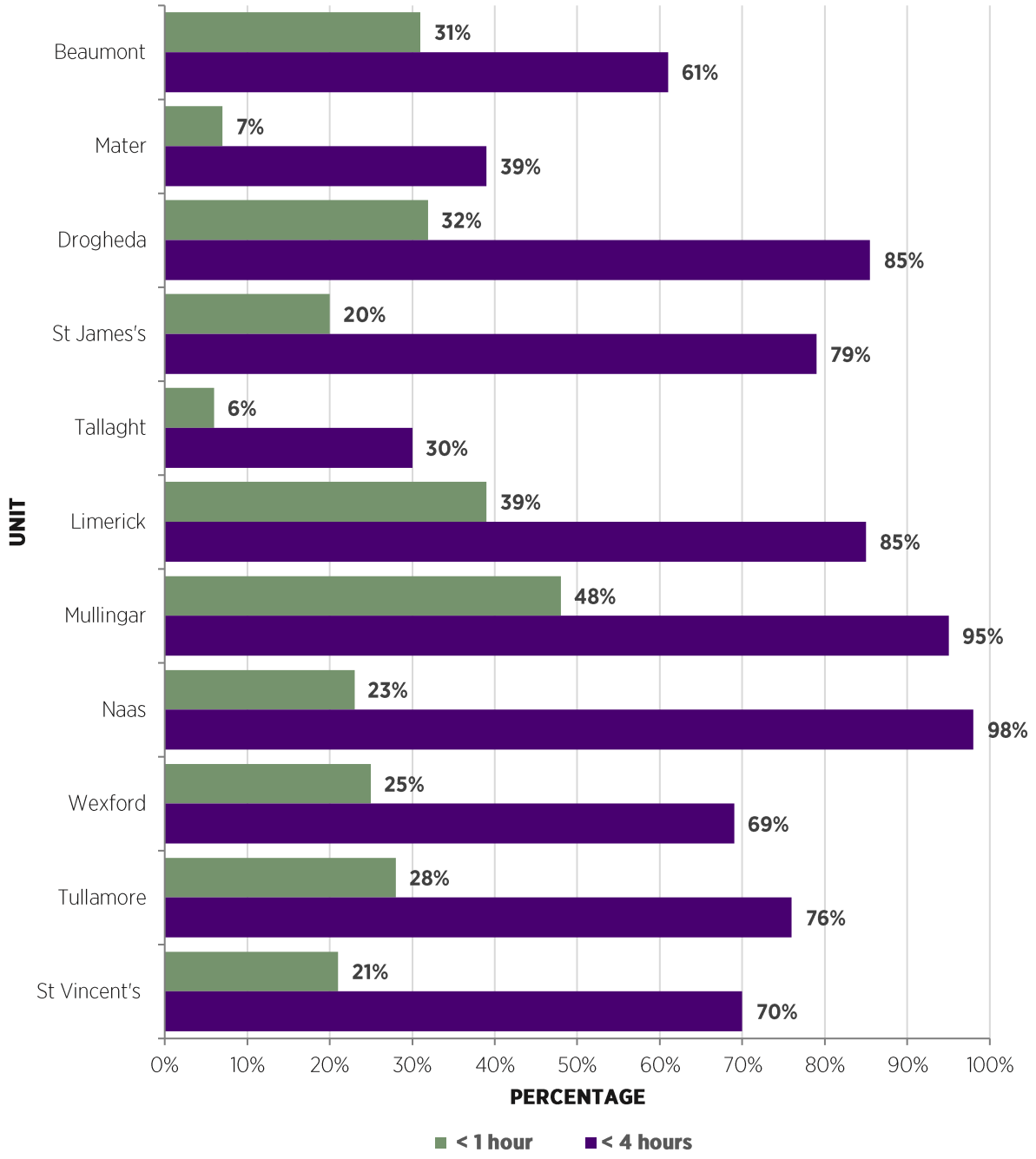

FIGURE 4.1: PERCENTAGE ADMITTED TO A CRITICAL CARE UNIT FROM WARD OR EMERGENCY DEPARTMENT: (I) <1 HOUR FROM THE DECISION TO ADMIT, AND (II) <4 HOURS FROM THE DECISION TO ADMIT (Q1–Q4 2019)*

* We have excluded from Figure 4.1 hospitals without full coverage for all four quarters of 2019 (Connolly and Cork) or where the time of decision to admit was unknown for >50% of patients (Galway and Waterford).

The time of the decision to admit was unknown for a high proportion of patients (Figure 4.2).

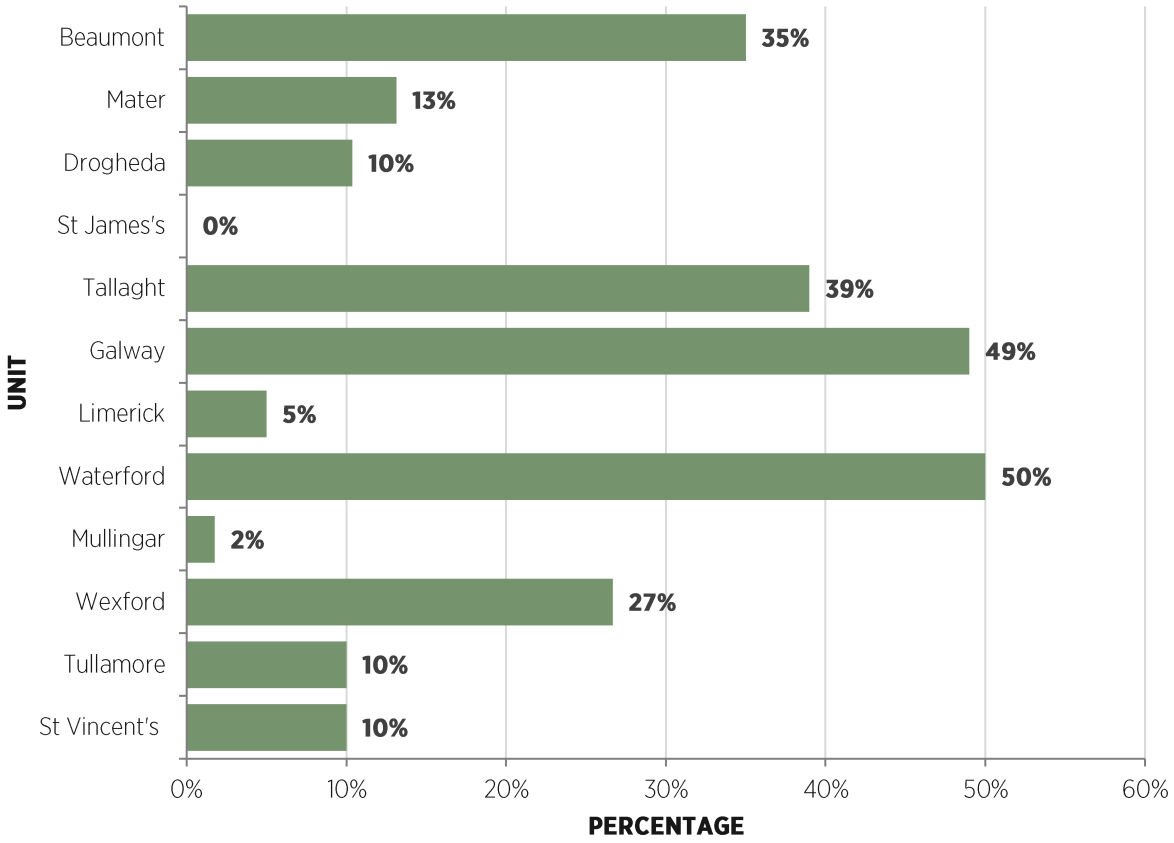

FIGURE 4.2: TIME OF DECISION TO ADMIT TO CRITICAL CARE UNIT NOT KNOWN (Q1–Q4 2019)*

* Only hospitals with full coverage for all four quarters of 2019 are included in Figure 4.2.

DELAYED ADMISSION TO ICU

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. This metric is considered to indicate patients whose admission to ICU was delayed.

Some patients may be admitted to ICU with failure of one or two organ systems and then deteriorate quickly to multi-organ failure, despite the support they receive in ICU. However, if excessive numbers of patients have multi-organ failure within 24 hours of admission, it is likely that some of these patients were deteriorating on the ward after the time they should have been admitted to ICU. The reasons why very sick patients were not admitted to ICU in a timely fashion could be: (i) staff did not recognise the severity of their illness, or (ii) the severity of their illness

was recognised but no ICU bed was available. St James's Hospital GICU and Cork University Hospital GICU were outliers for this QI in 2019; all other Units were within acceptable limits (Figure 4.3).

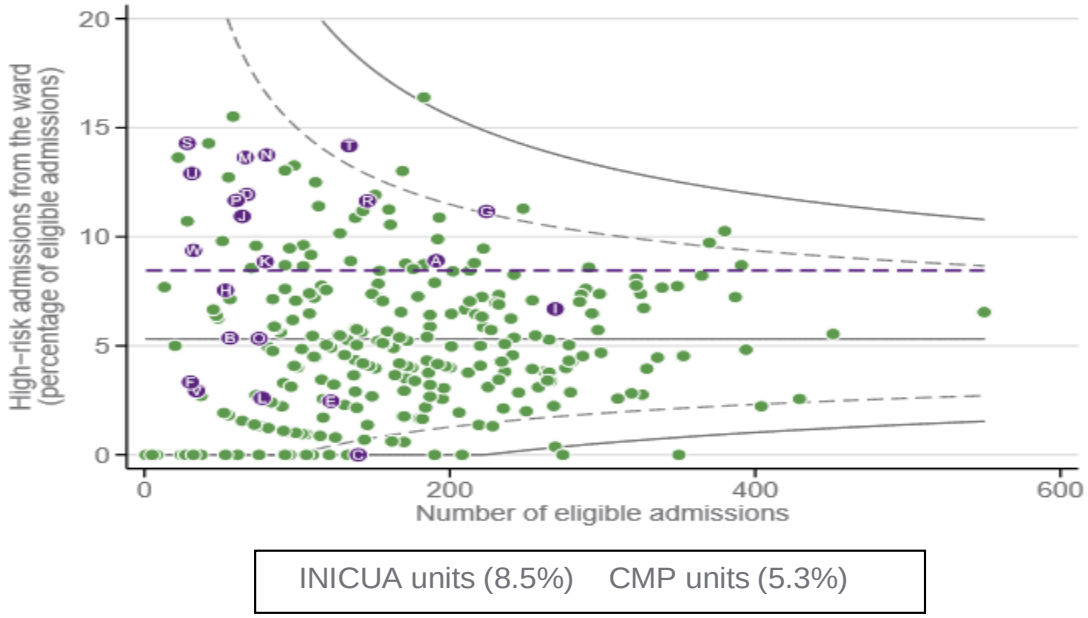

FIGURE 4.3: UNIT ADMISSIONS FROM A WARD WITH ORGAN FAILURE IN FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS FROM A WARD)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

DELAYED ADMISSION TO ICU WITH SEPSIS

Patients with sepsis and failure of four or more organ systems within 24 hours of ICU admission are a subgroup of the data shown in Figure 4.3. Sepsis is a very 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. This could have been because staff did not recognise the severity of their illness, or because no ICU bed was available. Cork University Hospital GICU was an outlier for this QI in 2019 (Figure 4.4).

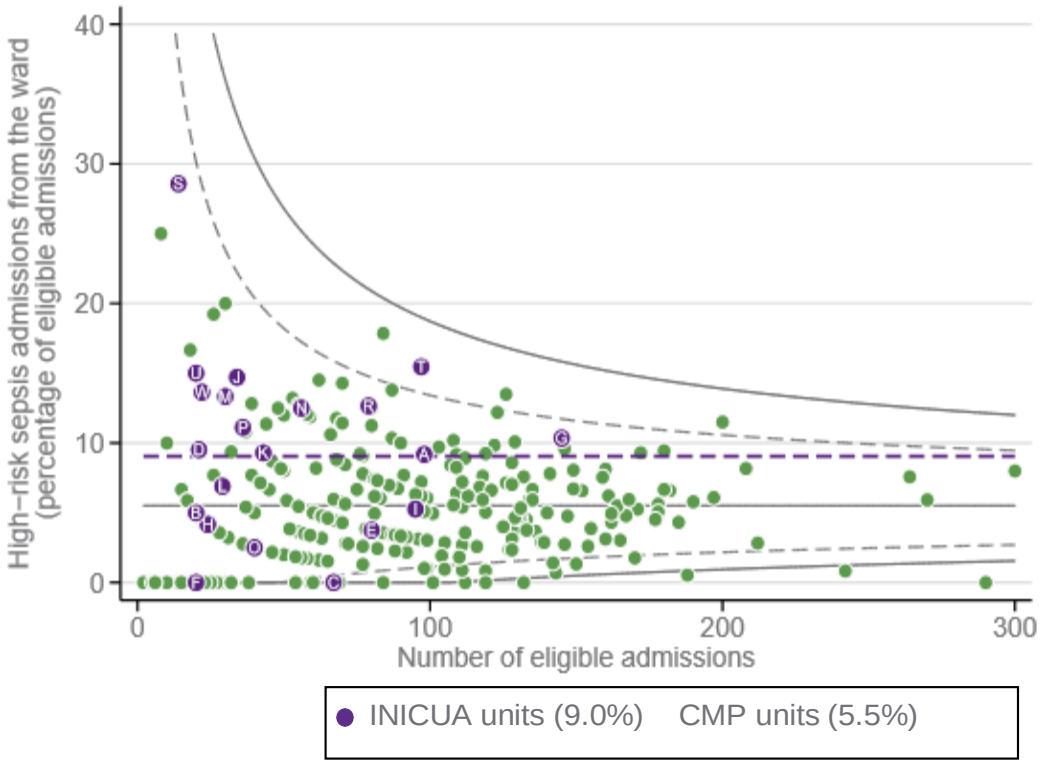

FIGURE 4.4: UNIT ADMISSIONS FROM A WARD WITH A DIAGNOSIS OF SEPSIS (SEPSIS-3) AND DYSFUNCTION OF FOUR OR MORE ORGAN SYSTEMS WITHIN 24 HOURS OF UNIT ADMISSION (AS A PERCENTAGE OF ALL UNIT ADMISSIONS FROM A WARD IN THE SAME HOSPITAL)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

NON-CLINICAL TRANSFERS

Non-clinical transfers occur when a patient is transferred out of the Unit for reasons other than for specialist care (e.g. for neurosurgery, cardiothoracic surgery, liver transplant, etc.). The commonest reason for non-clinical transfers to another hospital is shortage of beds in the referring Unit. However, if an ICU bed is not available, it is usually the new admission coming from ED or a ward who will be transferred out, and these transfers are not documented by INICUA. Thus, these data underestimate the true number of transfers which are required because of ICU bed shortages.

Non-clinical transfers are less common in the ROI than in the UK (Figure 4.5).

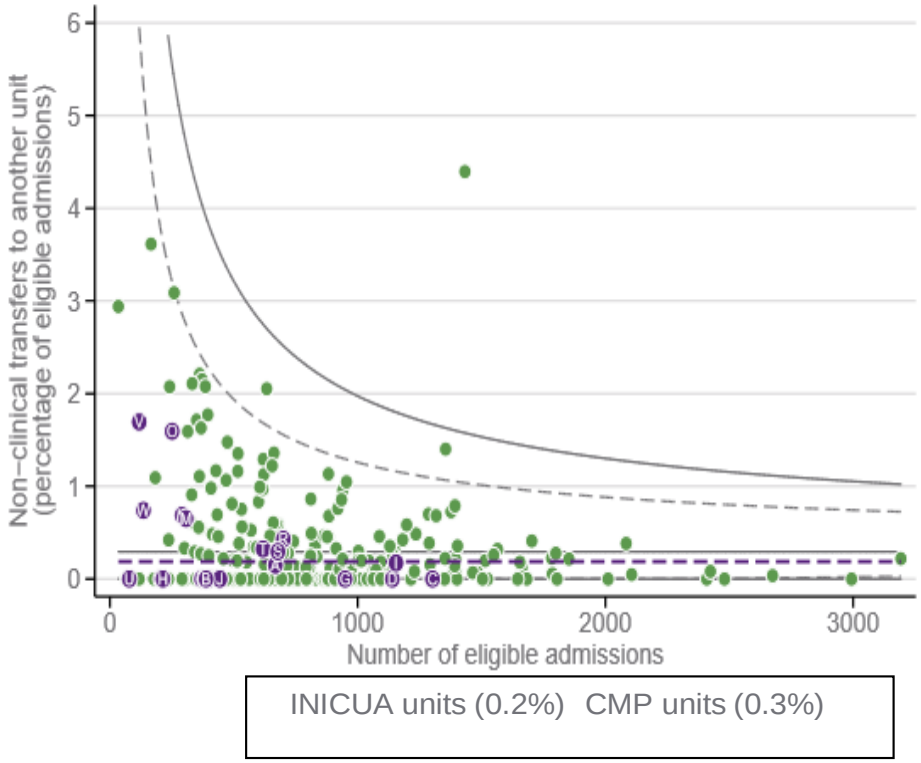

FIGURE 4.5: NON-CLINICAL TRANSFERS TO ANOTHER UNIT*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

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 consultant. ICU patients discharged outside of normal working hours have worsened outcomes (Azevedo *et al.*, 2015). This may be related to factors in the wards such as reduced staffing levels, less experienced staff or lack of knowledge of the patient's history. Additionally, patients may have been discharged without being fully ready if an ICU bed was needed for an urgent admission.

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 outside normal working hours. The number of unplanned discharges from ICU at night was outside the expected limits in University Hospital Galway ICU (Figure 4.6). Other hospitals were within expected limits for this QI.

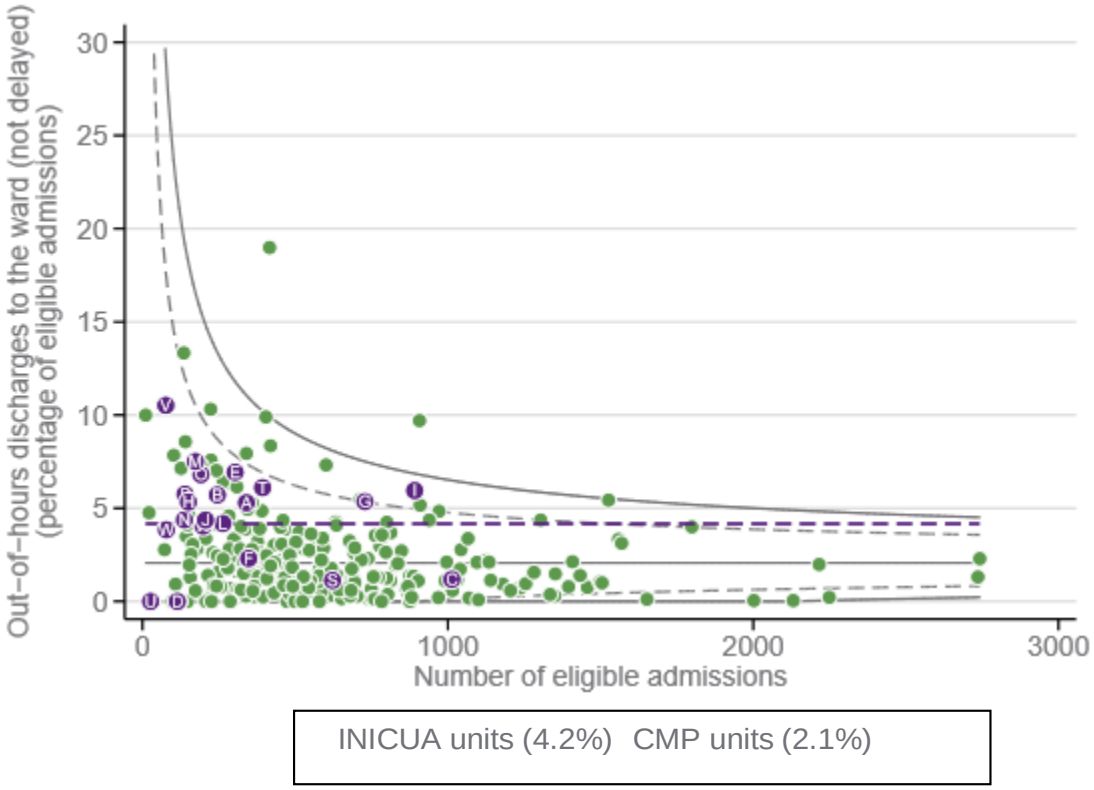

FIGURE 4.6: UNIT DISCHARGES TO THE WARD AT NIGHT (22.00–07.00) THAT WERE NOT CLEARED FOR DISCHARGE BY 18.00 THAT EVENING (AS A PERCENTAGE OF ALL UNIT SURVIVORS)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

DISCHARGE DIRECTLY FROM ICU TO HOME

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

No Units in the ROI were outliers for this QI in 2019 (Figure 4.7). Of all discharges from ICU/HDU in the ROI, 2.7% were direct to home (compared with 5.4% in the UK).

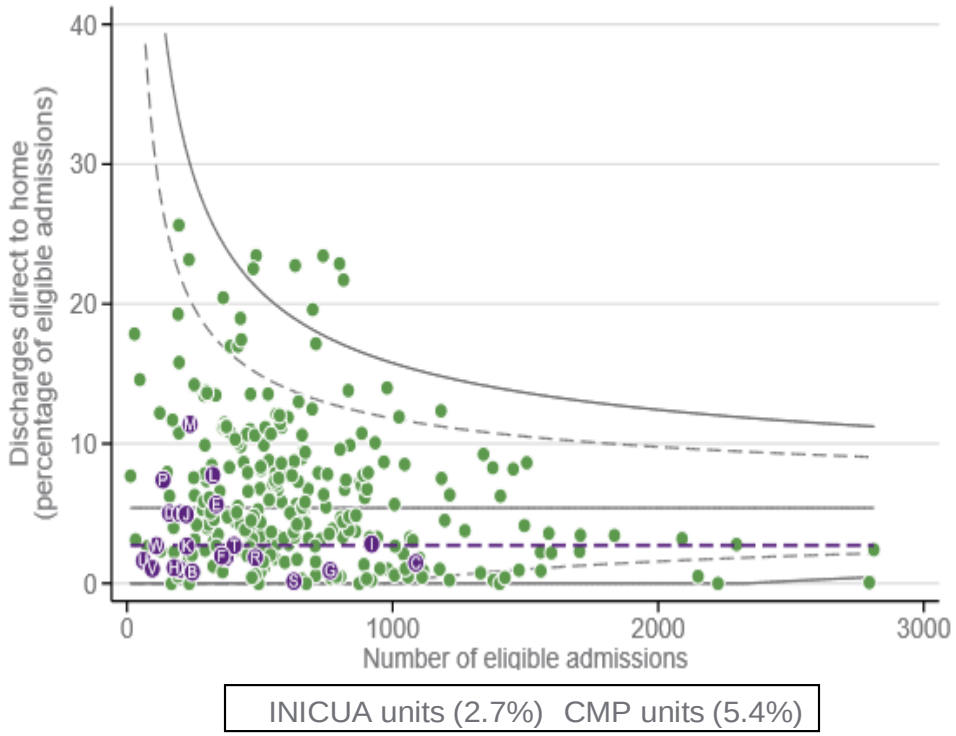

FIGURE 4.7: DISCHARGES DIRECTLY FROM THE UNIT TO HOME*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

UNPLANNED READMISSION TO ICU

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

The overall rates of unplanned readmission to ICU in 2019 for the ROI and the UK were 1.0% and 1.1%, respectively (Figure 4.8). There were no outlier Units for this QI in 2019; this is a positive development, as there have been outliers for this QI in previous years.

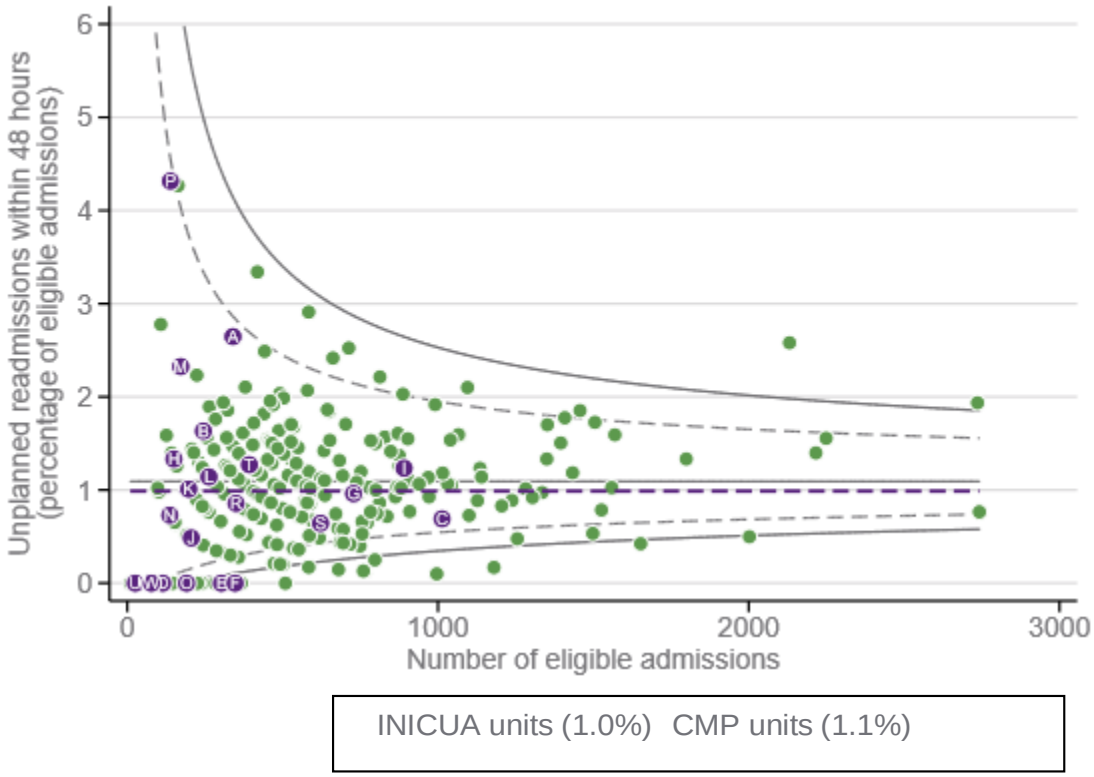

FIGURE 4.8: UNPLANNED READMISSIONS TO THE UNIT WITHIN 48 HOURS OF DISCHARGE FROM THE UNIT (AS A PERCENTAGE OF UNIT SURVIVORS DISCHARGED TO A WARD)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units.

MORTALITY AFTER ADMISSION TO CRITICAL CARE

Patients admitted to ICU or HDU are the sickest patients in the hospital, often have significant coexisting illnesses and are elderly, putting them at high risk of death. Figure 4.9 presents the actual (crude) mortality rate for all patients included in INICUA, showing deaths in the Unit and subsequent deaths in the ward before discharge from the acute hospital.

Eighty-six percent of patients survived to leave critical care and 79% survived to leave acute hospital (Figure 4.9). This mortality rate is similar to international experience and reflects: (i) the severity of the underlying condition (e.g. brain injury), (ii) serious pre-existing conditions (e.g. cardiac disease, metastatic cancer), and (iii) patient age.

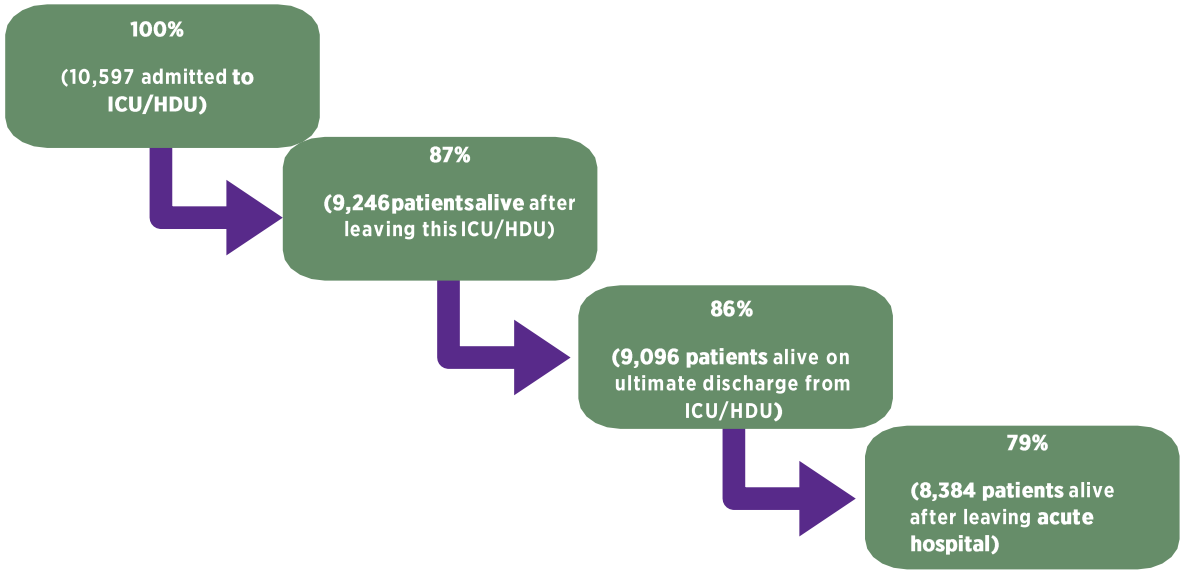

FIGURE 4.9: PERCENTAGE OF PATIENTS ALIVE: (I) ON DISCHARGE FROM ORIGINAL UNIT, (II) ON DISCHARGE FROM INTENSIVE CARE UNIT/HIGH DEPENDENCY UNIT, AND (III) ON DISCHARGE FROM ACUTE HOSPITAL (N=10,957)

STANDARDISED MORTALITY RATIOS

Crude mortality does not reflect the quality of care in ICU because mortality depends predominantly on the case mix of patients admitted to the Unit. Units with a large proportion of high-risk patients will have a high mortality rate, independent of the quality of care. 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 death of individual patients. This incorporates data on age, pre-existing conditions, source of referral, admission diagnosis and illness severity, as assessed by physiological and laboratory data. Patients who are readmissions to the Unit are excluded from analysis in order to ensure that they are only included in the mortality figures once. The analysis is based on outcomes from ICNARC's large database of ICU patients collected since 1995. The model is updated and recalibrated regularly in order to account for changes in ICU practice and demographics, as well as for the generally improving ICU outcomes observed in recent years.

For each Unit, ICNARC will calculate an expected number of deaths based on this mathematical model. The ratio of the observed to the predicted numbers of deaths is the standardised mortality ratio (SMR). If the SMR is 1.0, it means the Unit had exactly the expected number of deaths. With variability in case mix and unavoidable flaws 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 of these limits are considered to be outliers for this QI. This is a signal to consider whether the quality of care is affecting clinical outcomes.

SMR data for Units in the ROI are shown in Figure 4.10. There were no outlier Units with an SMR outside the acceptable range of ±2 SDs in 2019. The SMR for all 10,488 eligible Irish admissions in 2019 was 1.00 – exactly the number that was expected.

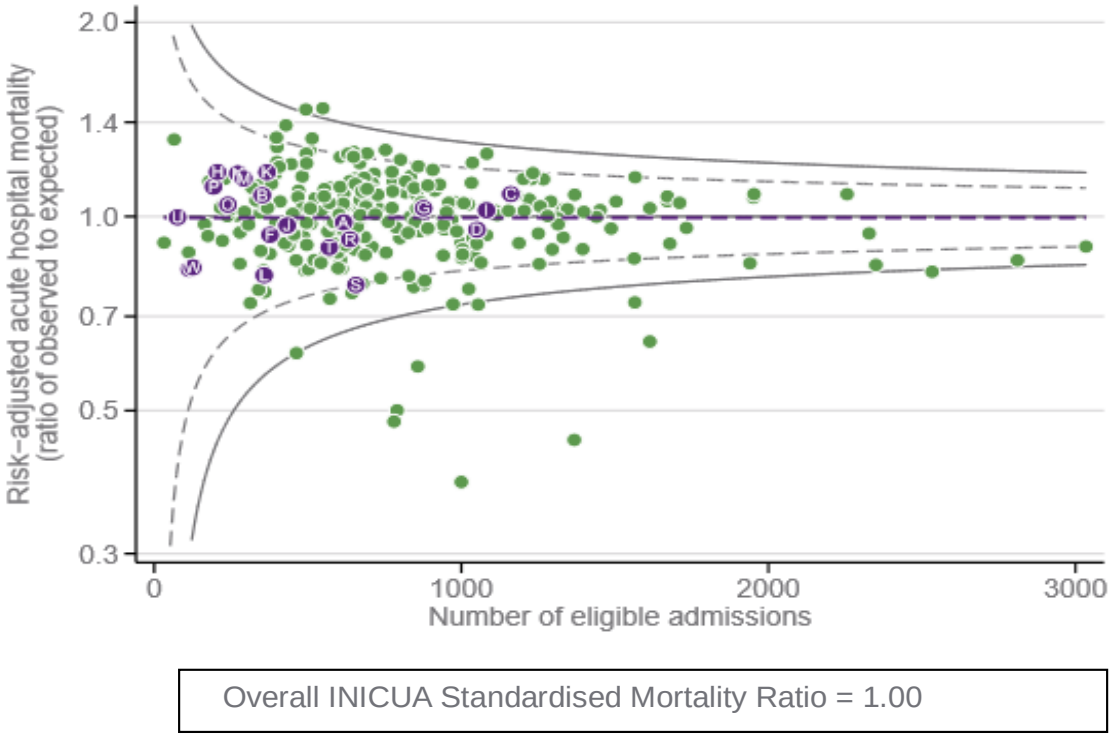

FIGURE 4.10: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO) (ICNARC$_{H\text{-}2018}$ MODEL)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units. The overall value for risk-adjusted mortality for CMP Units is not available.

MORTALITY IN LOW-RISK PATIENTS

Figure 4.11 shows the SMR for patients who were judged to have a relatively low (<20%) risk of death when admitted to ICU. These patients are a subset of the patients shown in Figure 4.10. While some deaths are expected in this group, an excess number of deaths would suggest an issue with the quality of care.

This metric is useful as a QI in its own right and is also very useful in order to gain further insight into Units that have outlier data for overall mortality. There were no outlier Units for this QI in 2019. The overall SMR for low-risk admissions in the ROI was 1.03.

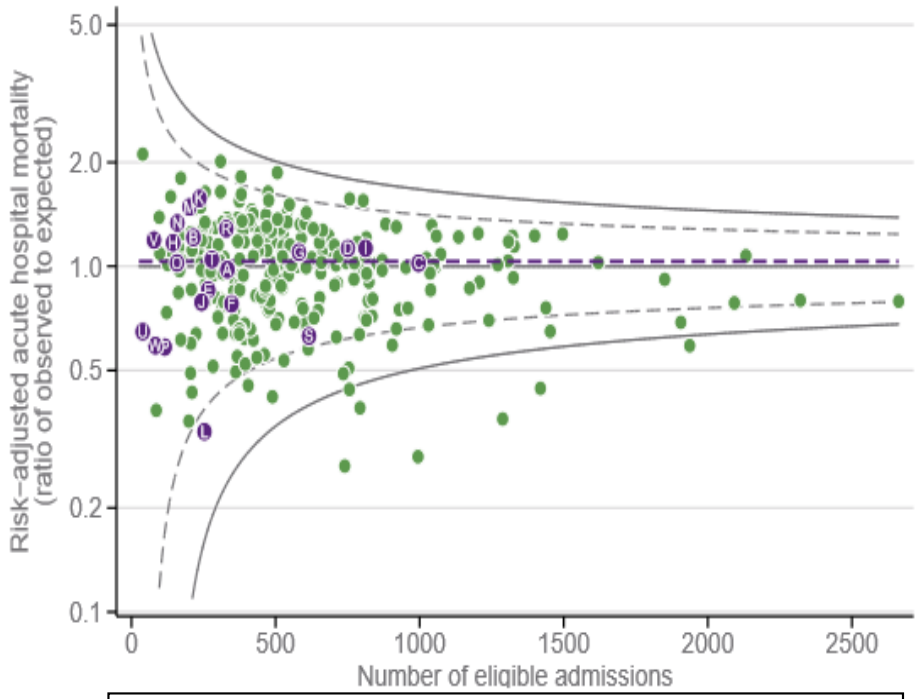

FIGURE 4.11: RISK-ADJUSTED ACUTE HOSPITAL MORTALITY (STANDARDISED MORTALITY RATIO) FOR PATIENTS WHOSE PREDICTED RISK OF DEATH WAS <20% (ICNARC$_{H\text{-}2018}$ MODEL)*

* 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 1.1. CMP refers to Case Mix Programme, the term ICNARC uses to describe data from UK Units. The overall value for risk-adjusted mortality for CMP Units is not available.

INFECTION

Multi-drug resistant organisms (MDROs) are a major problem in ICUs. Great care is taken to prevent transmission of these organisms in ICU, and our data indicate that the majority of ICU patients with MDROs detected were colonised before ICU admission (Table 4.1).

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

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

TABLE 4.1: NATIONAL RATES OF MULTIDRUG-RESISTANT ORGANISM COLONISATION (AS % OF THOSE TESTED): (I) AT TIME OF ADMISSION TO THE UNIT, (II) ACQUIRED IN THE UNIT, AND (III) ICU ACQUISITION RATE PER 1,000 PATIENT DAYS BY PATIENTS IN THE UNIT >48 HOURS

Organism	Samples taken (% of patients)	Colonised at admission to Unit (%)	Unit-acquired (%)	ICU acquisition rate /1,000 pt days
MRSA	94.7%	2.6%	0.3%	0.6
C. difficile	12.2%	0.7%	0.3%	0.5
VRE	87.8%	15.7%	3.1%	5.9%
CPE	91.1%	0.5%	0.1%	0.1%

Meticillin resistant *S. aureus* (MRSA), vancomycin resistant enterococci (VRE), carbapenemase producing Enterobacterales (CPE)

Rates of colonisation with MDROs at the time of admission to ICU as a percentage of the patients who had tests undertaken are shown in Table 4.2.

TABLE 4.2: RATES OF COLONISATION BY MULTIDRUG-RESISTANT ORGANISMS ON ADMISSION TO UNIT (AS % OF PATIENTS TESTED).

UNIT	COLONISED ON ADMISION TO UNIT		
	Admission MRSA %	Admission VRE %	Admission CPE %
Beaumont GICU	3.8%	24.6%	1.4%
Beaumont Neuro ICU	1.3%	5.9%	0.0%
Mater HDU	1.5%	12.0%	0.2%
Mater ICU	0.5%	16.4%	0.4%
Drogheda	0.9%	12.2%	0.5%
St James's CT ICU	0.8%	10.9%	0.0%
St James's GICU	1.8%	19.7%	0.8%
Tallaght	1.9%	16.4%	0.5%
Galway	4.3%	12.5%	0.9%
Limerick	7.7%	16.8%	0.9%
Waterford	3.4%	21.2%	0.6%
Mullingar	1.9%	8.1%	0.0%
Wexford	3.5%	14.8%	0.0%
Connolly	2.7%	7.2%	0.7%
Tullamore	1.7%	14.7%	0.4%
Naas	7.0%	20.3%	0.0%
St Vincent's	6.1%	29.4%	1.2%
Cork CT ICU	1.6%	9.6%	0.2%
Cork GICU	2.0%	21.0%	0.0%
Letterkenny	0.0%	0.0%	0.0%
Clonmel	0.9%	9.4%	0.0%
Tralee	2.3%	13.6%	0.0%

Unit-acquired colonisation by MDROs in 2019 was relatively rare (Table 4.3). Unit-acquired colonisation is defined as the presence of an organism in any sample taken after 48 hours following admission to the Unit and while the patient is still in the Unit. This underestimates the true rate of unit-acquired colonisation as we do not follow samples taken on the wards after Unit discharge and will miss those identified within 48 hours after discharge from your Unit.

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

Most Units test routinely on a regular basis, including asymptomatic patients; with the assumption that this was undertaken, rates of transmission of MDROs in ICU were relatively low. Units where less than 90% of patients were tested are marked with an asterisk. *C. difficile* is only tested for when there are clinical indications, in keeping with national guidance.

TABLE 4.3: UNIT-ACQUIRED COLONISATION BY MULTIDRUG-RESISTANT ORGANISMS; RATE PER 1,000 PATIENT DAYS (all patients)

Unit	Unit-acquired infections, rate per 1,000 patient days			
	Unit-acquired MRSA	Unit-acquired *C. difficile*	Unit-acquired VRE	Unit-acquired CPE
Beaumont GICU	0.3	0.6*	6.3	0.0
Beaumont Neuro ICU	0.0	1.0*	4.5	0.0
Mater HDU	0.7*	0.6*	2.2*	0.2*
Mater ICU	0	0.7*	3.9*	0.3
Drogheda	0.8	0.4*	2.4	0.4
St James's CT ICU	0.5	1.0*	9.4	0.5
St James's GICU	0.4	0.9*	9.0	0
Tallaght	0	0.9*	5.6	0
Galway	2.3	0*	2.7*	0
Limerick	1.2	0*	7.3	0.3
Waterford	1.9*	0*	9.3*	0*
Mullingar	0.6	0*	6.3	0
Wexford	0	0*	5.6*	0*
Connolly	0	0.6*	6.5	0
Tullamore	0.7	0.7*	1.5	0.7
Naas	0	0*	0.9	0
St Vincent's	0	1.0*	5.3	0
Cork CT ICU	0	0.5*	4.1*	0*
Cork GICU	0.7*	0.5*	4.4*	0*
Letterkenny	0	0*	0	0
Clonmel		0*	0*	0
Tralee	0	0*	0	0

* <90% of patients tested during their stay in the Unit.

KEY FINDINGS FROM CHAPTER 4

- There were delays from the time of the decision to admit a patient to ICU until the time of admission in some Units, especially in the larger Units in major referral centres.
- 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 James's Hospital GICU and Cork University Hospital GICU; all other Units were within acceptable limits. This was most likely due to a shortage of ICU beds.
- The number of unplanned discharges from ICU at night was outside the expected range in University Hospital Galway ICU. Other Units were within the expected limits for this quality indicator.
- 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 14%, and a further 7% of patients died before leaving the acute hospital. Thus, 79% of patients admitted to ICU/HDU survived to leave hospital.
- Mortality adjusted for illness severity, pre-existing conditions and admission diagnoses showed that outcomes in Units in the ROI were similar to those in UK Units.
- All Units in the ROI were within the acceptable limits for mortality (adjusted for risk factors). This is a very important finding demonstrating consistently good outcomes across Units of varying sizes and patient characteristics.
- Rates of colonisation with multi-drug resistant organisms (MDRO) show high rates of colonisation with MDROs at the time of admission to ICU and relatively low rates of transmission while in ICU.

CONCLUSION

This report provides a comprehensive overview of activity and outcomes during 2019 in Critical Care Units (ICUs and HDUs) which undertake 88% of critical care in HSE-funded hospitals.

The report contains data from four hospitals which were not included in previous reports, including Cork University Hospital, one of the largest hospitals in the country.

The data in this report are consistent with data from 2018, with no major changes in activity or outcomes.

Units are very busy and have high bed occupancy rates. Patients are very ill, with high scores for illness severity and requiring high levels of organ support compared to the UK. The larger referral centres were under particular pressure in 2019 with very ill patients and high occupancy levels.

Outcomes were acceptable, with the overall national risk-adjusted mortality rate exactly at the expected level. There were sporadic outlier data for QIs which indicated shortages of ICU beds, e.g. delayed admission and early discharge. Hospitals have responded to these outlier findings and proposed actions to address the problem, usually by expanding ICU bed capacity.

This is the first INICUA report to include a section on admissions of patients who were pregnant or recently pregnant. Outcomes were good in these patients with just 2 deaths, both related to serious underlying disease.

In summary, Irish ICUs are very busy but are managing to provide high-quality care with good outcomes. However, there is little reserve capacity in the system.

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