NHS SCOTLAND

SICS

scottish intensive care society audit group

Audit of Critical Care in Scotland 2019
Reporting on 2018

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Foreword

This report describes the activities and outcomes for Scottish Intensive Care Units (ICU) and High Dependency Units (HDU) in 2018. It is a continuing development of the original critical care outcomes audit that has produced an ever expanding national dataset since 1995.

The Scottish Intensive Care Society Audit Group (SICSAG) is a national critical care audit and quality assurance program and a close collaboration between the Scottish Intensive Care Society and Information Services Division (ISD) of NHS National Services Scotland (NHSNSS). We remain fully funded through Information Services Division and NSS.

SICSAG seeks to improve the quality of care that is delivered to critical care patients across Scotland by continuously monitoring and transparently comparing and reporting on individual units. We are also closely aligned with the Scottish Government (2012) 2020 Vision[1].

This national critical care audit also seeks to inform healthcare professionals, the public and Scottish Government about the activity, interventions and outcomes of over 45,000 critically ill patients who were treated in Scotland last year. SICSAG provides ongoing quality assurance and national benchmarking for our critically ill patients.

It is pleasing to note that in 2018 the population based observed mortality for almost all diagnostic groups was lower than the expected (predicted) mortality. The exception to this is trauma, it will be interesting to see whether this observation changes going forward with the introduction of the major trauma centres.

The most common reasons for admission to a general ICU in Scotland during 2018 were sepsis, post cardiac arrest and respiratory infection. This reflects the importance of infection control in the critical care workload and the heterogeneity of case mix.

We highlight this year the increasing need for intensive care and high dependency beds to support hospitals caring for an aging population with increased co-morbidities and complex chronic health conditions.

There are challenges, particularly around delayed discharge from critical care and discharges taking place out of hours. There is also increasing evidence that some areas of Scotland still have inadequate critical care capacity.

The number of units participating in SICSAG continues to grow as critical care expands to encompass ever more patients. Health Board managers should question why any critical care unit that falls within their remit has not joined this national audit and seek to invest and provide sufficient resource to ensure accurate, detailed and timely data collection which will provide units with a rich source of intelligence for planning services and improving care.

We continue our close collaboration with Health Protection Scotland (HPS) to collect, analyse and report on Healthcare Associated Infection (HAI) surveillance across Scottish critical care units. Once again we are able to report jointly, reflecting the importance of ongoing continuous surveillance of HAI as a marker of quality within critical care.

To the best of our knowledge this audit remains the only one in the world which reports named unit level outcomes to this level of public scrutiny and detail.

SICSAG received an anonymous complaint in 2018 from a group of individuals concerned about a particular health board. Though anonymous, this complaint was taken seriously and was dealt with both through the ISD internal complaints system and by commissioning an

independent external review into SICSAG methodology by the Office for Statistics Regulation. The results of this are summarised within this publication and further details are available on the SICSAG website (https://www.sicsag.scot.nhs.uk/index.html).

We continue to seek a reduction in variation across Scotland through the transparent benchmarking of professionally agreed Minimum Standards and Quality Indicators (MSQI[2]).

The audit has evolved into an efficiently co-ordinated, process driven quality improvement programme which provides rapid data analysis and local feedback. The expressed aims of the audit are to seek to constantly raise standards and drive continued improvement in outcomes.

We will provide ongoing support to individual units through the transparent publication of data in order to seek to improve both patient care and patient experience in critical care units across Scotland.

This will be my final annual report as SICSAG chair and I will be handing over to my successor in the autumn. It has been a privilege and a real pleasure to chair the national critical care audit and I would like to thank all those who have been involved with SICSAG over the last 6 years and to wish my successor well.

The continued success of this world renowned critical care audit would not be possible without the enthusiasm, commitment, and hard work of the entire Scottish critical care clinical community.

Particular thanks go to the multidisciplinary SICSAG steering group, Dr Charles Wallis (Vice-Chair and Consultant in critical care), Paul Smith (National Clinical Coordinator), Ros Hall (Regional Coordinator), Lorraine Donaldson, (Senior Information Analyst), Clare McGeogh (Quality Assurance Manager), and the network of Local Audit Coordinators.

Dr Stephen Cole

Consultant in Intensive Care Medicine & Anaesthesia

SICSAG Chair

Contents

Unit Key

Letter	Abbreviation	Unit Name	NHSBoard
A	IRH ICU	Inverclyde Royal Hospital ICU	Greater Glasgow & Clyde
A2	IRH HDU	Inverclyde Royal Hospital HDU	Greater Glasgow & Clyde
AA1	Dr Grays HDU	Dr Gray's Hospital HDU	Grampian
AB1	WIH HDU	Western Isles Hospital Stornoway	Western Isles
AC1	Belford HDU	Belford Hospital HDU	Highland
AD1	GJNH CICU/CHDU	Golden Jubilee Hospital ICU/HDU	National Waiting Times Centre
AE1	Balfour HDU	Balfour Hospital, Orkney HDU	Orkney
B	VHK ICU	Victoria Hospital Kirkcaldy ICU	Fife
B2	VHK MHDU	Victoria Hospital Kirkcaldy Medical HDU	Fife
B3	VHK SHDU	Victoria Hospital Kirkcaldy Surgical HDU	Fife
B4	VHK RHDU	Victoria Hospital Kirkcaldy Renal HDU	Fife
C	PRI ICU	Perth Royal Infirmary ICU	Tayside
C2	PRI HDU	Perth Royal Infirmary HDU	Tayside
E	Ayr ICU	University Hospital Ayr ICU	Ayrshire & Arran
E2	Ayr HDU	University Hospital Ayr HDU	Ayrshire & Arran
G	CRH ICU	University Hospital Crosshouse ICU	Ayrshire & Arran
G2	CRH MHDU	University Hospital Crosshouse Medical HDU	Ayrshire & Arran
G3	CRH SHDU	University Hospital Crosshouse Surgical HDU	Ayrshire & Arran
G4	PRM OHDU	Princess Royal Maternity Hospital	Greater Glasgow & Clyde
H	DGRI ICU	D&G Royal Infirmary ICU	Dumfries & Galloway
H2	DGRI MHDU	D&G Royal Infirmary Medical HDU	Dumfries & Galloway
H3	DGRI SHDU	D&G Royal Infirmary Surgical	Dumfries & Galloway
H4	DGRI ICU/HDU	D&G Royal Infirmary Combined Unit	Dumfries & Galloway
I3	MDGH MHDU	University Hospital Monklands Medical HDU	Lanarkshire
I4	MNK ICU/HDU	University Hospital Monklands Combined Unit	Lanarkshire
I5	MNK level 1 HDU	University Hospital Monklands Level 1	Lanarkshire
J	RAH ICU	Royal Alexandra Hospital ICU	Greater Glasgow & Clyde
J2	RAH HDU	Royal Alexandra Hospital HDU	Greater Glasgow & Clyde
K	GRI ICU / HDU	Glasgow Royal Infirmary ICU	Greater Glasgow & Clyde
K2	GRI SHDU	Glasgow Royal Infirmary Surgical HDU	Greater Glasgow & Clyde
K3	GRI MDU	Glasgow Royal Infirmary Medical HDU	Greater Glasgow & Clyde
M	SJH ICU/HDU	St Johns Hospital, Livingston	Lothian
M2	SJH OHDU	St Johns Hospital, Livingston	Lothian
N	NWD ICU	Ninewells Hospital ICU	Tayside
N2	NWD MHDU	Ninewells Hospital Medical HDU	Tayside
N3	NWD SHDU	Ninewells Hospital Surgical HDU	Tayside
N5	NWD OHDU	Ninewells Hospital Obstetric HDU	Tayside

Letter	Abbreviation	Unit Name	NHSBoard
P	RGM ICU	Raigmore Hospital ICU	Highland
P2	RGM MHDU	Raigmore Hospital Medical HDU	Highland
P3	RGM SHDU	Raigmore Hospital Surgical HDU	Highland
Q3	FVRH ICU/HDU	Forth Valley Royal Hospital	Forth Valley
QE1	QEU ICU	Queen Elizabeth University Hospital ICU 3&4	Greater Glasgow & Clyde
QE2	QEU HDU1	Queen Elizabeth Univeristy Hospital HDU 1	Greater Glasgow & Clyde
QE3	QEU HDU2	Queen Elizabeth Univeristy Hospital HDU 2	Greater Glasgow & Clyde
QE4	QEU HDU6	Queen Elizabeth Univeristy Hospital HDU 6	Greater Glasgow & Clyde
QE5	QEU MHDU	Queen Elizabeth University Hospital Medical HDU 5	Greater Glasgow & Clyde
QE6	QEU OHDU	Queen Elizabeth University Hospital Obstetrics HDU	Greater Glasgow & Clyde
R	WGH ICU/HDU	Western General Hospital, Edinburgh ICU/HDU	Lothian
R3	WGH SHDU	Western General Hospital, Edinburgh Surgical (Level 1)	Lothian
R4	WGH NHDU	Western General Hospital, Edinburgh Neuro HDU	Lothian
R5	WGH NHDU (Level 1)	Western General Hospital, Edinburgh Level 1 Neuro HDU	Lothian
S	HRM ICU/HDU	University Hospital Hairmyers ICU/HDU	Lanarkshire
S2	HRM MHDU	University Hospital Hairmyers Medical HDU	Lanarkshire
U	BGH ICU/HDU	Borders General Hospital ICU/HDU	Borders
V	WSH ICU	Wishaw University Hospital ICU	Lanarkshire
V2	WSH SHDU	Wishaw University Hospital Surgical HDU	Lanarkshire
V3	WSH MHDU	Wishaw University Hospital Medical HDU	Lanarkshire
W	ARI ICU	Aberdeen Royal Infirmary ICU	Grampian
W14	ARI SHDU	Aberdeen Surgical HDU	Grampian
W2	ARI SHDU (31/32)	Aberdeen Royal Infirmary Surgical HDU	Grampian
W4	ARI SHDU (35)	Aberdeen Royal Infirmary Surgical HDU	Grampian
W7	ARI CICU	Aberdeen Royal Infirmary Cardiothoracic ICU	Grampian
W8	ARI MHDU	Aberdeen Royal Infirmary Medical HDU	Grampian
W9	ARI OHDU	Aberdeen Royal Infirmary Obstetric HDU	Grampian
X	RIE ICU/HDU	RI Edinburgh ICU/HDU (118)	Lothian
X13	RIE RTHDU	RIE joint Renal Transplant HDU	Lothian
X14	RIE OHDU	RIE Obstetrics HDU	Lothian
X2	RIE HDU	RI Edinburgh HDU (116)	Lothian
X6	RIE CICU	RI Edinburgh Cardiothoracic ICU (111)	Lothian
X7	RIE CHDU	RI Edinburgh Cardiothoracic HDU (112)	Lothian
Y	SGH NICU	QEUH Campus Neuro ICU	Greater Glasgow & Clyde
Y2	SGH NHDU	QEUH Campus Neuro HDU	Greater Glasgow & Clyde
Z1	GBH HDU	Gilbert Bain Hospital, Shetland	Shetland

List of Abbreviations

4AT	A rapid clinical instrument for delirium detection
ACP	Augmented Care Period
AMR	Antimicrobial Resistance
APACHE	Acute Physiology and Chronic Health Evaluation
BSI	Bloodstream Infection
CHDU	Cardiothoracic HDU
CI	Confidence Interval
CICU	Cardiothoracic ICU
CLABSI	Central Line-Associated Bloodstream Infection
CPAP	Continuous Positive Airway Pressure
CR-BSI	Catheter Related Bloodstream Infection
CRI	CVC Related Infection
CVC	Central Venous Catheter
ECDC	European Centre for Disease Prevention and Control
EoL	End of Life Care Policy
GDPR	General Data Protection Regulation
GI	Gastrointestinal
GPICS	Guidelines for the Provision of Intensive Care Services
HAI	Healthcare Associated Infection
HDU	High Dependency Unit
HPS	Health Protection Scotland
HQIP	The Healthcare Quality Improvement Partnership
IAP	Intubation Associated Pneumonia
ICH	Intracerebral haemorrhage
ICU	Intensive Care Unit
ICU/HDU	Combined Intensive Care Unit and High Dependency Unit
IRR	Inter-Rater Reliability
ISD	Information Services Division
MHDU	Medical HDU
MSQI	Minimum Standards and Quality Indicators
M & M	Morbidity and Mortality
NHDU	Neurological HDU
NHSNSS	National Health Service National Services Scotland

NICU	Neurological ICU
NIV	Non-Invasive Ventilation
OHDU	Obstetric HDU
PN	Pneumonia
PVC	Peripheral Venous Cannula
RHDU	Renal HDU
RRT	Renal Replacement Therapy
RTHDU	Renal Transplant HDU
SAH	Subarachnoid haemorrhage
SD	Standard Deviation
SDH	Subdural haematoma
SHDU	Surgical HDU
SICS	Scottish Intensive Care Society
SICSAG	Scottish Intensive Care Society Audit Group
SMaCC	Scottish Maternity critical care Group
SMR	Standardised Mortality Ratio
UKCCNA	UK critical care Nursing Alliance
VAP	Ventilator Associated Pneumonia
WTE	Whole Time Equivalent

Key findings

- No unit was found to have a significantly higher mortality rate compared to the rest of Scotland.
- Delayed discharges from critical care continue to be a challenge for units, which is mostly due to bed shortages in other areas of the hospital.
- The population of patients in intensive and high dependency care settings is ageing and is increasingly likely to have comorbidities and complex chronic health conditions, posing a challenge for services.
- Heath Boards highlighted staffing shortages in some areas with difficulty in filling medical and nursing staff posts.
- While many units have made progress over the last year towards attaining the minimum standards and achieving improvements in quality indicators, others continue to find this challenging.
- In 2018, 2.7% of patients in intensive care units developed a Healthcare Associated Infection. This remains unchanged from 2017.

Introduction

Critical care underpins emergency and elective work in all acute hospitals. Annually, more than 45,000 of the most severely ill or injured patients require specialist care and treatment in Scottish critical care units. SICSAG's aim is to improve the quality of care delivered to these patients by monitoring and comparing activities and outcomes across Scottish critical care.

Data were collected prospectively from all general adult Intensive Care Units, Combined Units and the majority of High Dependency Units using the WardWatcher system developed for this purpose. In February 2019, an initial extract of 2018 data was sent to ISD servers. Validation queries relating to discharges, outcomes, ages and missing treatment information were then issued and fed back to individual units for checking by local and regional audit coordinators. A final validated extract of 2018 data was submitted to ISD in March 2019, which has been used for this report. Along with the measures taken to ensure data validity, the comprehensiveness of the data, incorporating data on all patients receiving care in participating units during 2018, ensures that the findings included in this report have a high degree of reliability at the national, health board and individual unit level.

This report follows a patient's journey through critical care focusing on: outcomes, quality indicators, activity, interventions and HAI. All data are presented in tables and charts, with accompanying text to alert the reader to points of interest. When interpreting the unit-level charts it is very important to remember that each unit is unique in terms of case load, patient case-mix and geographical factors. These may all contribute to any differences seen. In addition, this is the third year of reporting the revised MSQIs. Whilst they remain stretching and ambitious, SICSAG have developed the reporting of these standards and indicators to reflect better the amount of work that units are doing to achieve them.

Please refer to the SICSAG website (www.sicsag.scot.nhs.uk) for information on the methodology of the audit and for Data Protection GDPR (General Data Protection Regulation) information.

New Chairperson

As stated in the SICSAG constitution a chairperson and vice chair can serve for a maximum of six years. During the course of 2019, Dr Stephen Cole will come to the end of his time serving as chair of SICSAG. We would like to take this opportunity to express our gratitude to Dr Cole for his leadership and expert guidance over the past six years. In addition, we would like to thank Dr Charles Wallis for all his advice and support as vice chair. Voting will take place over the summer to elect a new chair and vice chair by November 2019.

Funnel Plots

Throughout the report, funnel plots are used to allow comparisons to be made between different service providers. These control charts can help guide quality improvement activities by flagging up areas where there is evidence of variation. It should be recognised that in a comparison of 25 units, there is a reasonable chance of an outlier at the 2SD (5% or 1 in 20) level. Where there are significant statistical differences with the units and the Scottish mean, it may warrant further local investigation. Differences may arise from many sources for example, in data accuracy, case-mix, service provision or practice. Sometimes a difference will be just a random variation caused by chance alone. SICSAG encourage readers to use the data to examine practice in the context of the factors listed.

Inter-Rater Reliability (IRR)

IRR is a method of examining the consensus or homogeneity of data collection among different individuals. IRR cannot ensure 100% correlation of data extracted between different individuals at unit level, but it can assist with the estimation of the amount of error in the data collection process[3] and hence improve the quality of the data.

The Healthcare Quality Improvement Partnership (HQIP) suggests an agreement range of 90% to 95% being preferable but a minimum can be set at 85%[3]. SICSAG expects an agreement rate of 90% or greater.

SICSAG can report that after completing IRR across 8 units in Scotland to include some 6,000 variables that the mean IRR rate is 94% (range 87% to 98% for individual units).

Spring WardWatcher Workshop

For the fourth year running, in 2019 SICSAG held an annual workshop for WardWatcher and quality improvement discussions.

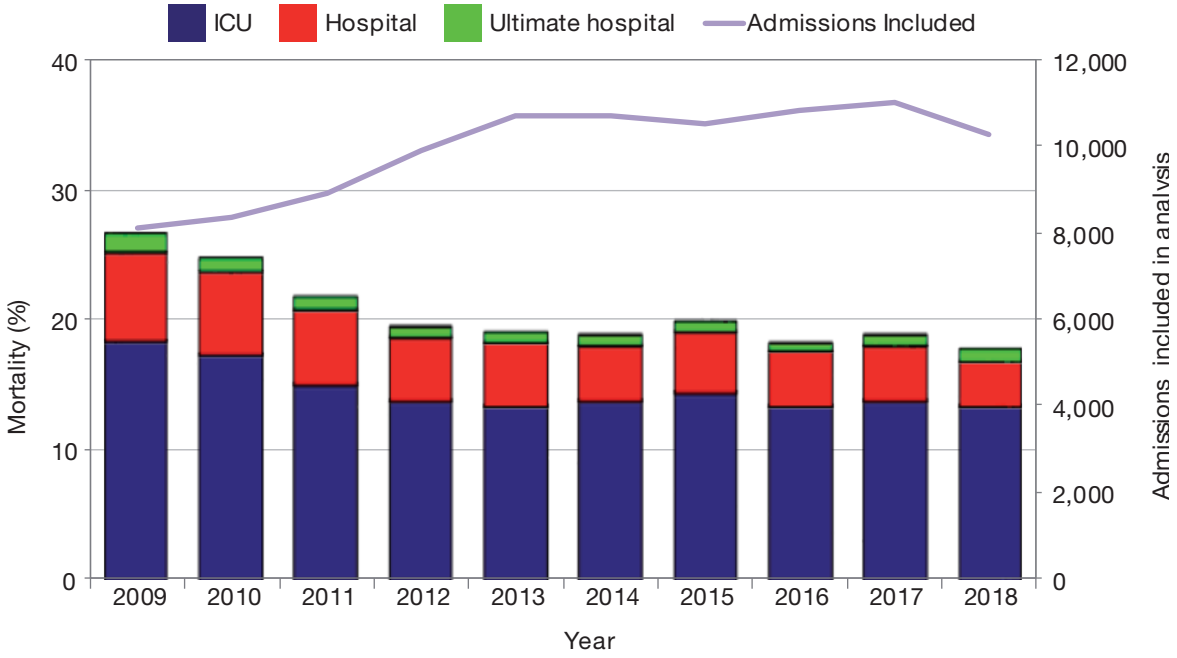
Due to the success and popularity of this workshop SICSAG intends to keep this free event running in 2020.

Paul Smith

Clinical Coordinator

Section 1 Outcomes

Figure 1 Scottish crude mortality of patients in ICU and combined units (2009-2018)



Note:
Only includes patients with mortality predictions.

Since 2009 the number of admissions to ICUs and combined units show a general increase, as shown by the solid grey line, though with a slight drop in 2018. Crude mortality has decreased over this period but has been at a similar percentage since 2012. In 2018 18% of patients admitted to ICUs and combined units died before ultimate hospital discharge, compared to 19% in 2017. ICU mortality relates to patients dying in the unit of admission. Hospital mortality relates to patients dying post ICU discharge in the same hospital as the unit. The ultimate hospital mortality relates to mortality of patients transferred from the original admitting hospital. It should be remembered that the above data are not adjusted for illness severity or case-mix, which can change over time.

Figure 2 **Scottish Standardised Mortality Ratios in ICU and combined units, using the Standard APACHE II model (2009-2018) and Recalibrated APACHE II model (2010-2018)**

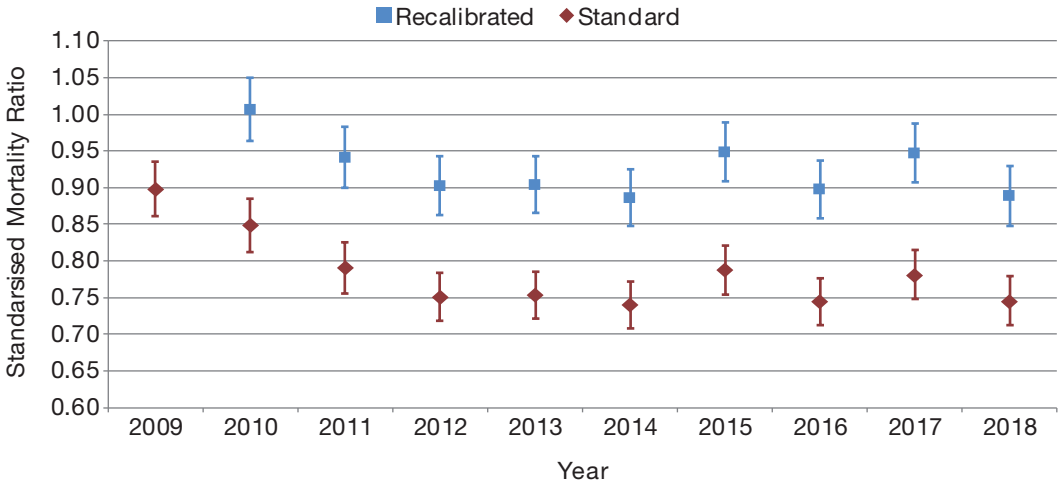


Figure 2 shows the Standardised Mortality Ratios (SMR) using both the standard and recalibrated APACHE models. The SMRs are calculated by dividing observed mortality by the expected mortality using APACHE II methodology (see www.sicsag.scot.nhs.uk). This allows a better comparison of mortality over time as illness severity and case-mix are adjusted.

The APACHE II scoring system was recalibrated to better reflect a Scottish population rather than an external reference population; however the standard is included here for international comparison. Both models follow a similar pattern over time and in 2018, the SMR remains at a similar level to previous years. The standard SMR was 0.75 and the recalibrated model was 0.89 which is closer to 1.0. This would be expected using a Scottish reference population.

Figure 3 **Standard Mortality Ratios using recalibrated APACHE II model in ICU and combined units (2018)**

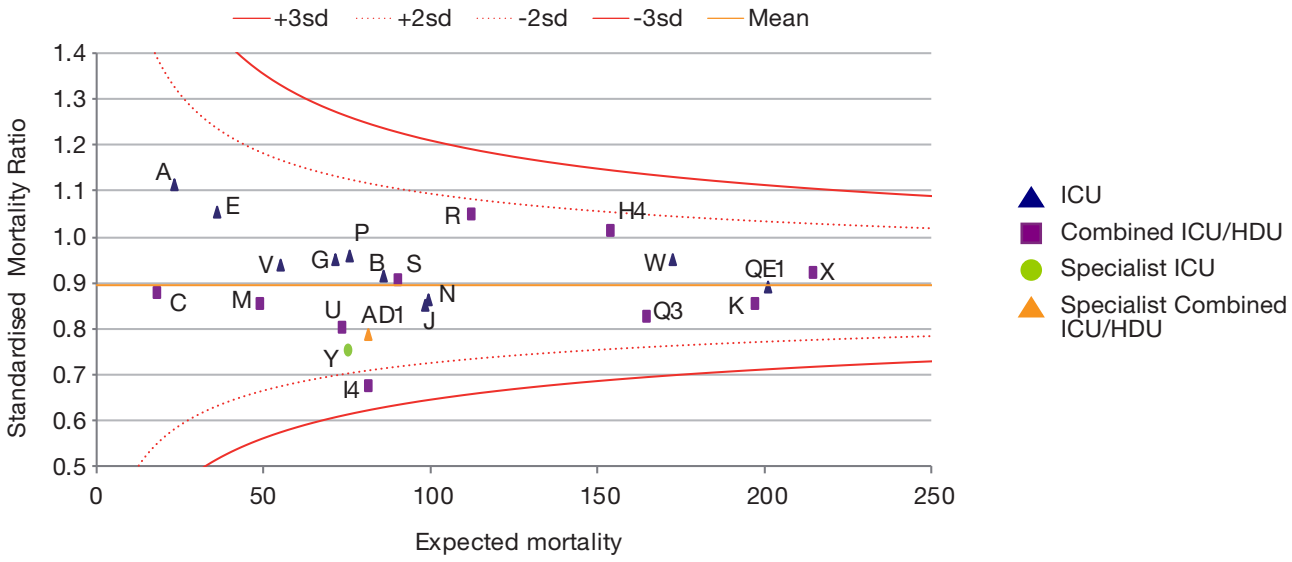


Figure 3 shows the SMR for ICU and combined units and is calculated using the recalibrated APACHE II model. Variation was within the limits of what would be expected. No units had

shown evidence of a higher SMR than the Scottish average. Unit I4 (MNK ICU/HDU) are an outlier 2SD below the mean, providing some evidence they have a statistically lower SMR than the Scottish average.

Figure 4 Observed and predicted ultimate hospital mortality according to grouped APACHE II diagnosis in ICU and Combined Units (2018)

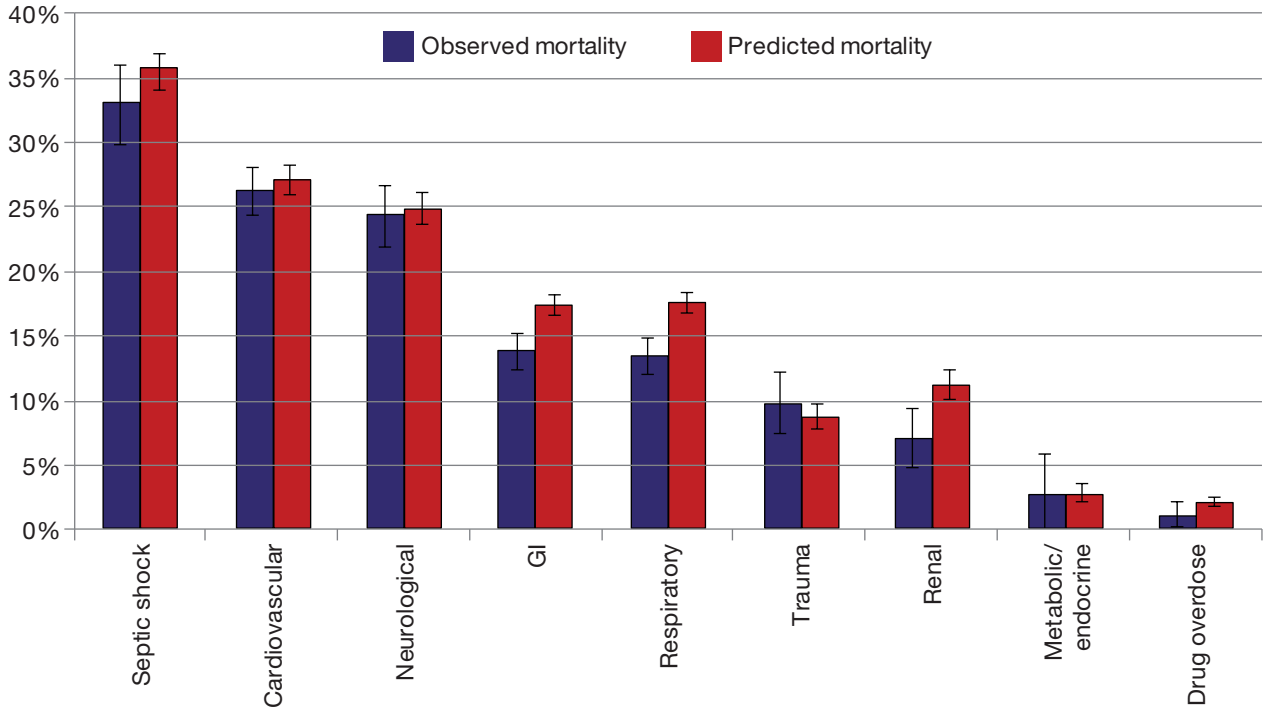
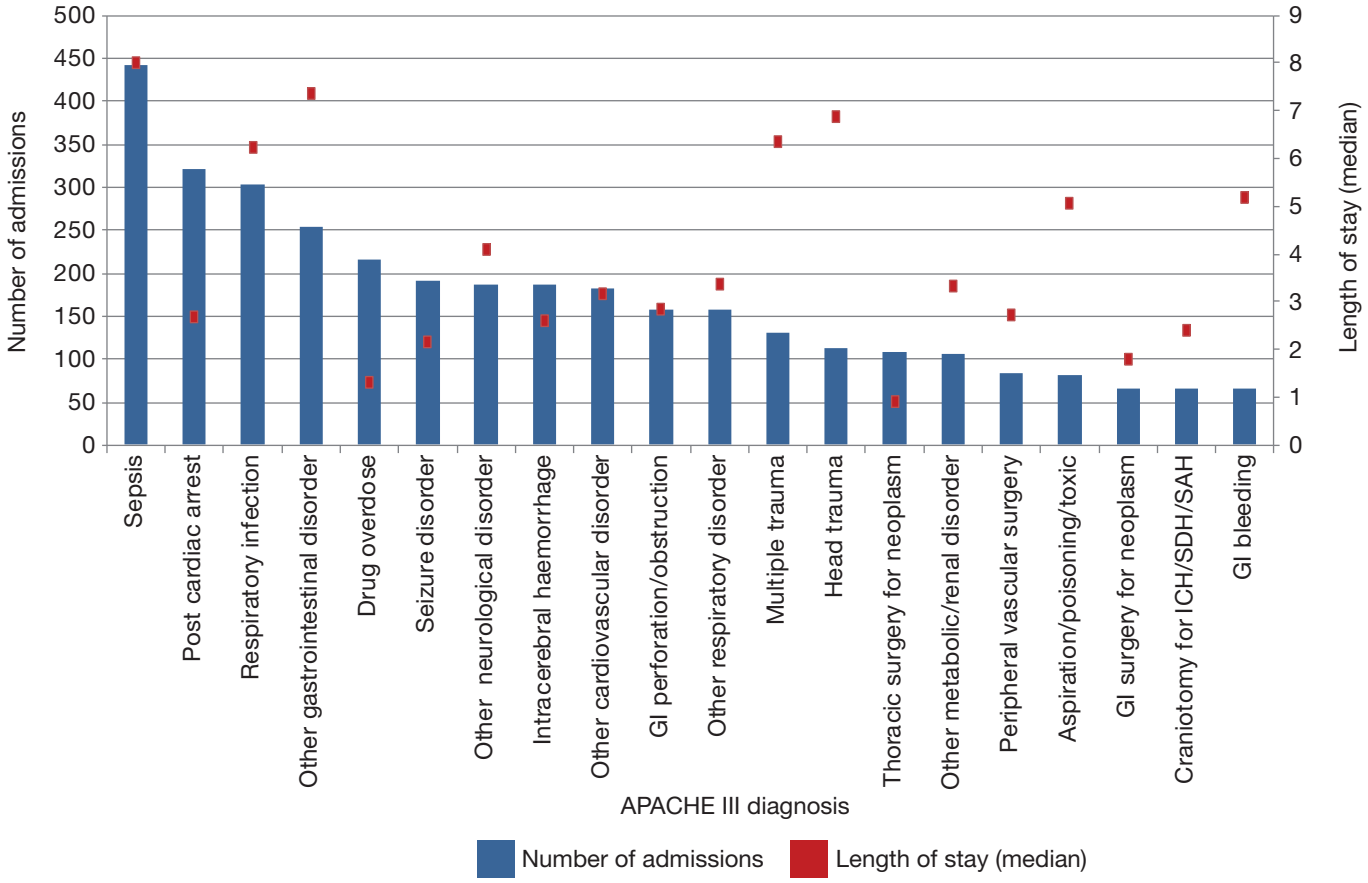


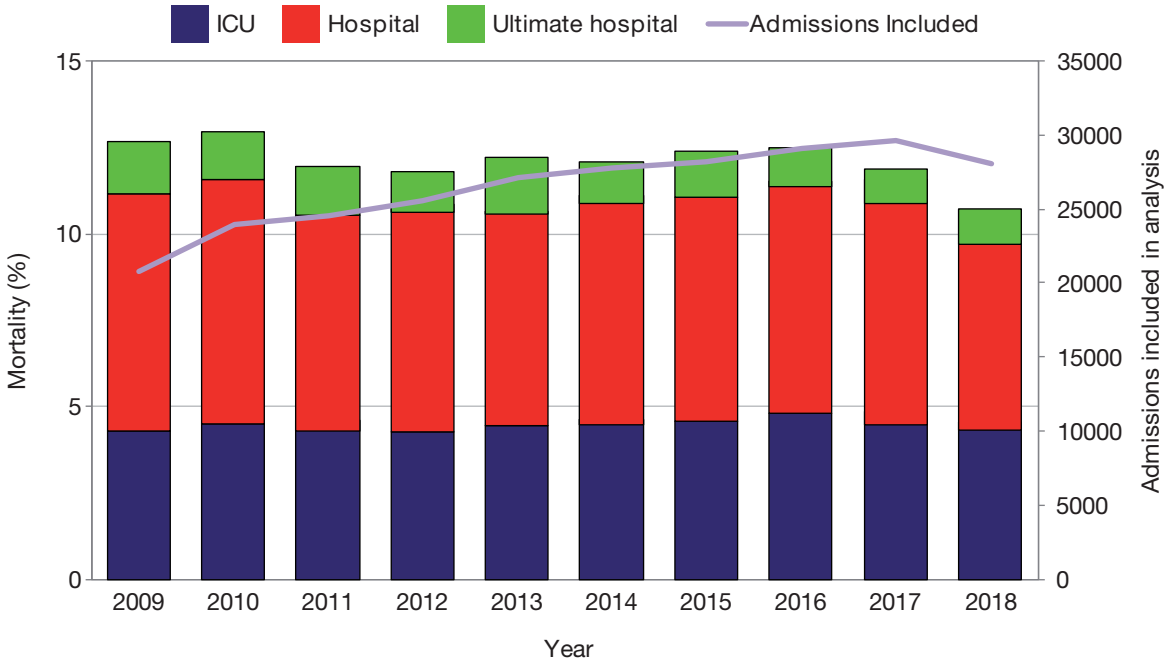
Figure 4 shows observed and predicted mortality for some of the most common diagnoses groups. This shows a wide range of mortality, which emphasizes the importance of entering the correct diagnosis in WardWatcher. Septic shock was the highest diagnosis group in 2018 reflecting the core activity for many ICUs and combined units. For most diagnostic groups the observed and predicted mortality appear reasonably well matched with the actual mortality lower than predicted, the exception to this is trauma, the significance of this is not clear.

Figure 5 **Top 20 Apache II diagnoses in ICU and combined units with median length of stay for each diagnosis (2018)**



In 2018 the three most common general ICU diagnoses are sepsis, post cardiac arrest and respiratory infection.

Figure 6 Scottish crude mortality of patients in HDUs (2009-2018)

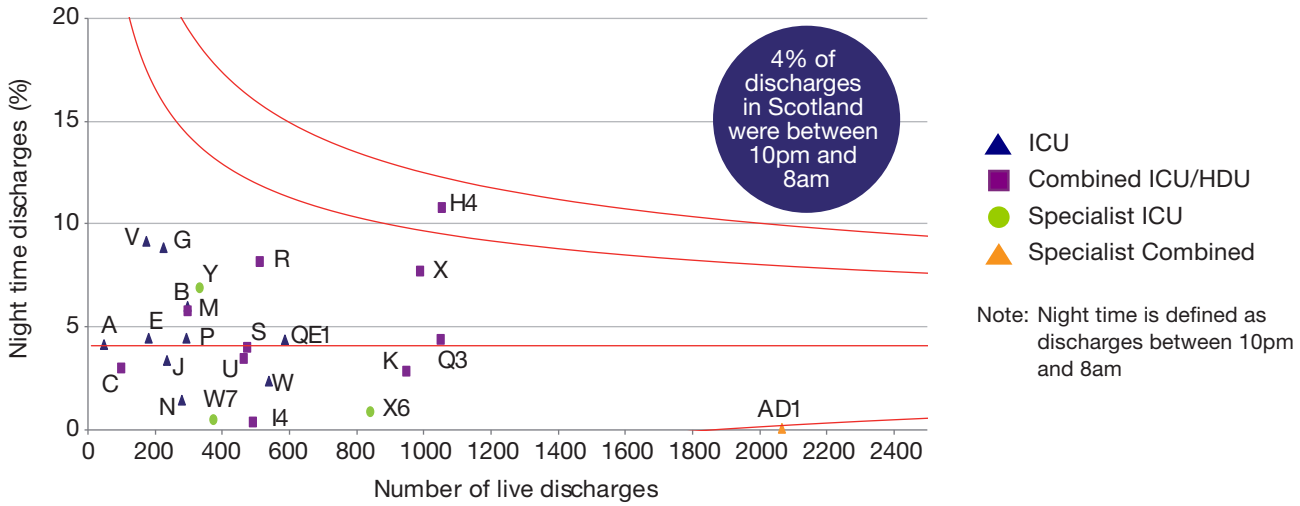


Crude mortality in patients admitted to HDUs is at similar levels to previous years. In 2018 11% of HDU patients died before their ultimate discharge from hospital as compared with 19% for ICU/combined units. It should be remembered that the above data are not adjusted for illness severity or case-mix, which can change over time.

Section 2 Quality Improvement

2.1 Night time discharges

Figure 7 Night time discharges from ICU and combined units (2018).



Night time discharges have been associated with worse outcomes for patients and should be avoided where possible[4,5,6]. The average discharge at night in 2018 was 4%. This is consistent with previous years.

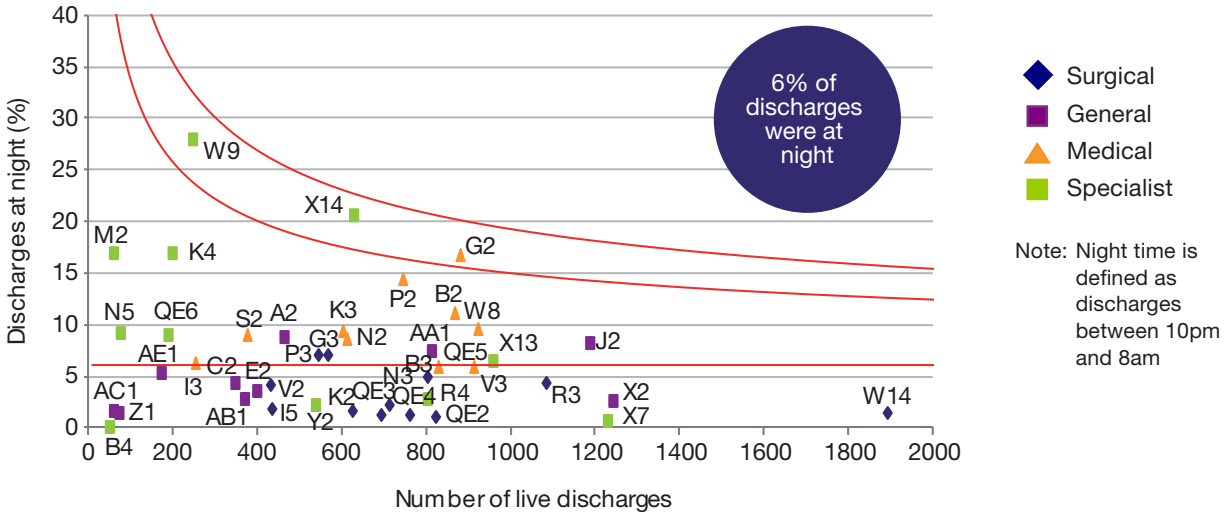
Unit H4 (DGRI ICU/HDU) is an outlier over the 2SD line, providing some evidence that night time discharges are significantly higher in this unit compared to the average in Scotland.

"This variation comes as no surprise to us. Moving to the new hospital, the front of house became the priority area to ensure efficient flow of patients. Quite a lot of resources have gone into this and we find that critical care is last in the order of patient bed allocation. The fact that we are now outlier in this area means that we are able to go back to our Managers and discuss this in further detail to try and improve the efficiency of discharge of critically ill patients.

Looking at the SICSAG data in more detail for 2018, 5.5% of our patients (71) had 3 or more level 0 days prior to discharge from critical care. This helps reassure us that we are not discharging ill patients in the middle of the night to the Wards and our re-admission rate is at Scottish average. I agree that 10% night time discharge is not ideal, we will make strong efforts to improve this figure in line with the Scottish average of around 5%."

Dumfries & Galloway Royal Infirmary, Combined Unit

Figure 8 Night time discharges in HDUs (2018)



In 2018 6% of discharges from HDUs were between 10pm and 8am.

Units W9 (ARI OHDU), X14 (RIE OHDU) and G2 (CRH MHDU) are outliers above the 2SD line, providing some evidence that the percentage of night time discharges in these units is significantly higher compared to the Scottish average. All three of these units were also outliers above the 2SD line in 2017. Unit G2 (CRH MHDU) were asked to comment but did not have anything to add, however are planning to review internally.

In reference to Units W9 (ARI OHDU) and X14 (RIE OHDU), obstetric units are unique in that patients to these units often improve quickly over a short period of time allowing a shorter stay in Obstetric HDU. ARI OHDU gave some context to this difference in the quote below. In addition, please see more detail about the Obstetric HDU units in section 2.5.

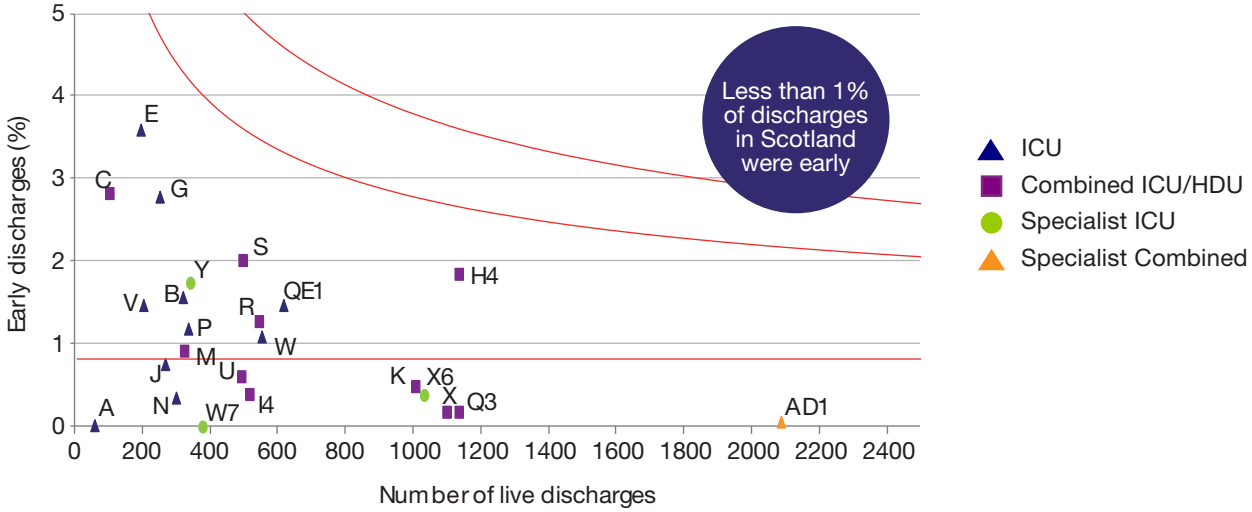
"In our unit there are many examples of patients who are admitted that require only a few hours of HDU care to facilitate fetal monitoring which ends at the time of delivery of the baby and subsequent transfer to the neonatal unit.

ARI OHDU is staffed by a Consultant Obstetrician or Specialist Trainee (ST)6/7 on-site 24/7 and, due to the high turnover of patients and the pressure on HDU beds, all patients are reviewed by a senior obstetrician prior to discharge."

Aberdeen Obstetrics HDU

2.2 Early discharges and readmissions

Figure 9 Early discharges in ICUs and combined units (2018)

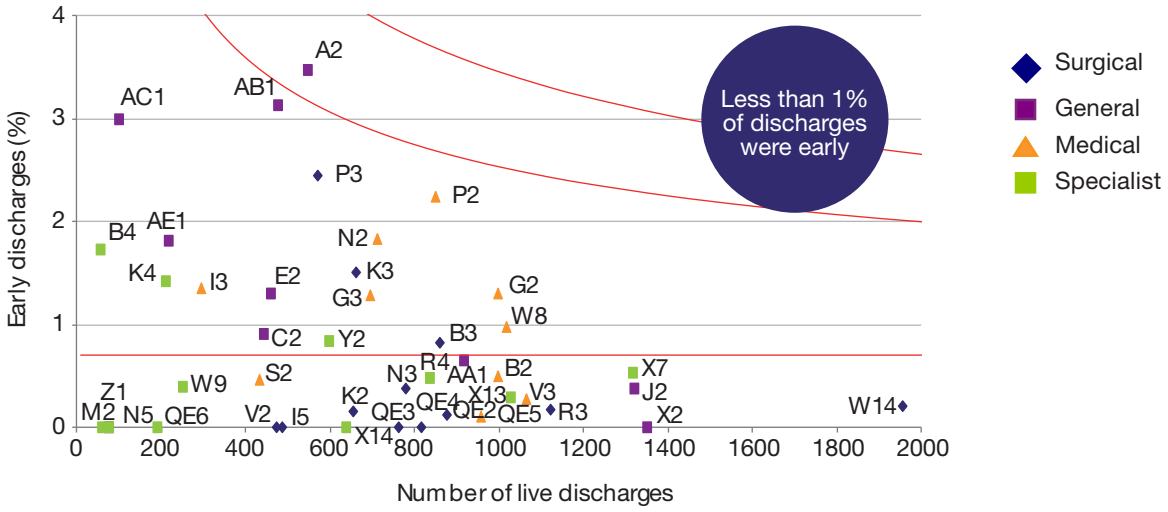


Note: Early discharge is defined as a transfer that is not in the best interest of a patient but necessary due to pressure on beds or staffing. From ICU, patients are usually discharged to another area in the hospital. The definitions have changed since 2016, with discharges to another area at the same level of care excluded from the figures.

The vast majority (over 95%) of patients that are marked as an early discharge from ICUs and combined units are discharged to another area in the same hospital. However, an early discharge is defined as a transfer that is not in the best clinical interest of the patient and should be avoided.

In the report of 2017 data, Unit N (NWD ICU) was an outlier 2SD above the Scottish mean with an early discharge rate of 7%. In 2018, their early discharge rate was below the Scottish mean at 0.3%. Unit N (NWD ICU) have commented that admission numbers and case mix are much the same but the peaks of intense activity in 2017 leading to early discharges were reduced in 2018.

Figure 10 Early discharges in HDUs (2018)

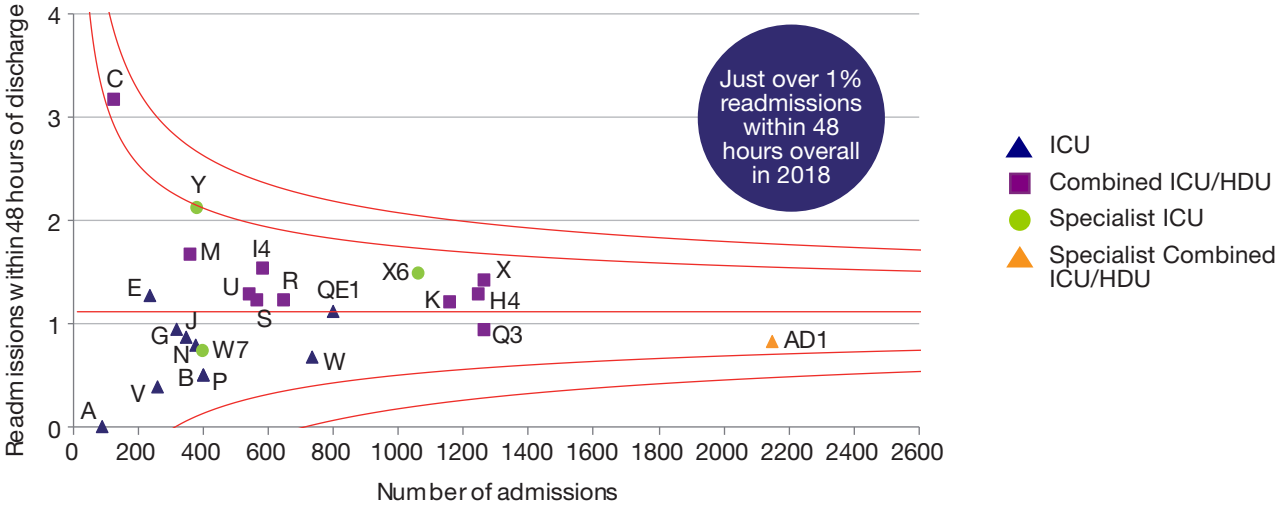


In 2018 the percentage of early discharges from HDUs remained consistently low. Unit A2 (IRH HDU) is an outlier above the 2SD line, providing some evidence that the percentage of early discharges in this unit is significantly higher than the Scottish average.

"Early discharges from A2 (IRH HDU) has been self reported at 3.5%. While the IRH ICU occupancy has declined over recent years the IRH HDU remains well utilised. There may be a subjective element to this response as individuals definition of "early" may vary. However, there is a plan to perform a critical care needs assessment on the site to help identify and describe any necessary changes to HDU provision required within the IRH."

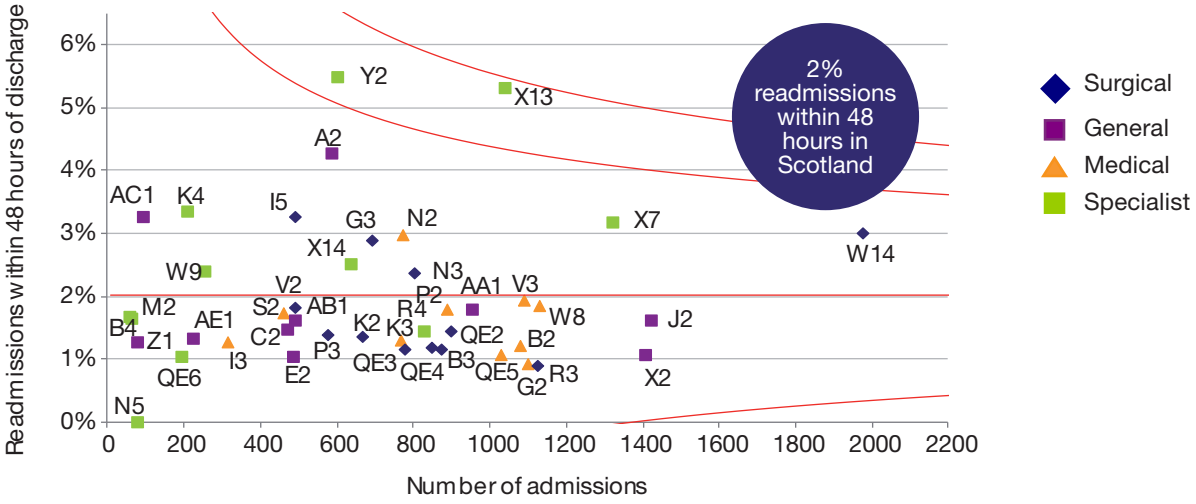
Inverclyde Royal Hospital HDU

Figure 11 Readmissions within 48 hours of discharge to ICUs and combined units (2018)



In 2018 just over 1% of discharges from ICUs and combined units were readmitted to the same unit within 48 hours of discharge from the same unit. Readmissions can be an indication that a patient was discharged to a downstream bed too soon. Unit C (PRI ICU) has the highest rate of readmissions in Scotland, and in addition is an outlier over the 2SD line. However this unit has lower total admissions compared to the majority of units in Scotland, therefore the 3.2% readmission rate relates to less than 5 patients. Unit Y (QEU NICU) is just within the 2SD line.

Figure 12 Readmissions within 48 hours of discharge to HDUs (2018)



In 2018 2% of admissions to HDUs were readmissions for patients that had been discharged from the unit less than 48 hours previously. Units X13 (RIE RTHDU) and Y2(QEU NHDU) are outliers above the 2SD level.

"Y2 (QEU NHDU) The higher rate of readmission is likely due to the nature of the specialty and case-mix of patients. Neurological conditions often fluctuate and many of the re-admissions are due to patients being re-admitted for treatment with vasospasm following subarachnoid haemorrhage. Another potential source of re-admissions are Oral and Maxillofacial Surgery patients who contract chest infections or who return with failed free tissue transfer after a theatre return."

QUEH Neuro HDU

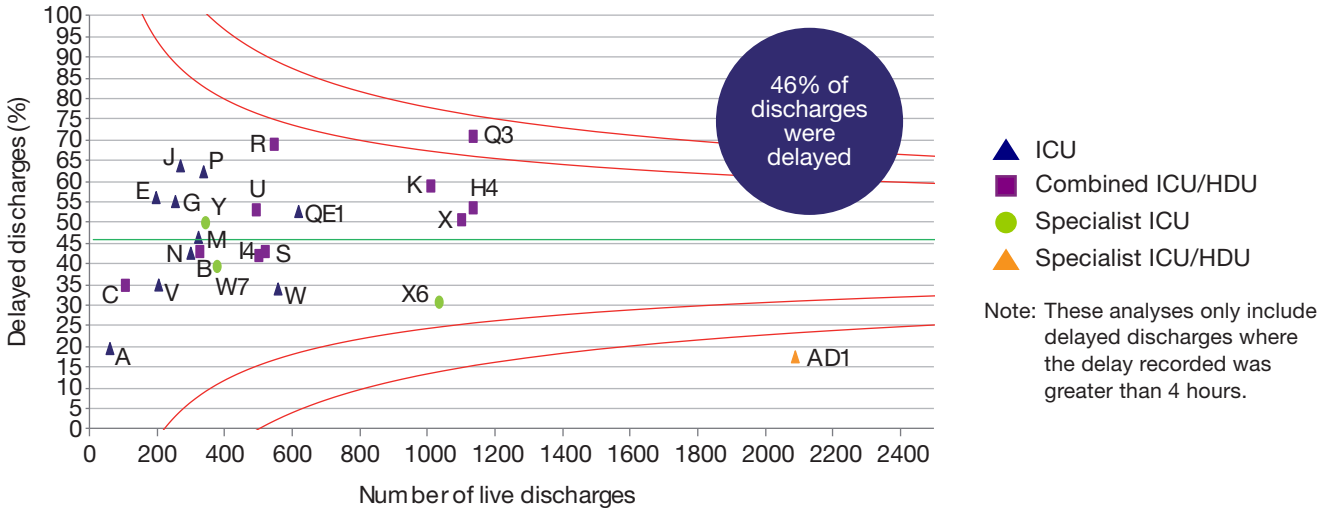
"Unit X13 (RIE RTHDU) admits patients prior to their transplant who then return post-transplant which may account for the higher readmission rate. This is a normal practice for this type of unit."

RIE Renal Transplant HDU

2.3 Delayed discharges

Delayed discharges are instances where patients are deemed clinically ready for discharge, but there is a delay or "gap" before actual discharge. The most common reason for delayed discharge is a shortage of available ward or HDU beds. This in turn can be due to delayed discharge of patients from acute hospital beds, often caused by lack of social care in the community. In times of peak demand, this effect can back up into critical care areas.

Figure 13 Delayed discharges of greater than 4 hours from ICU and combined units (2018)



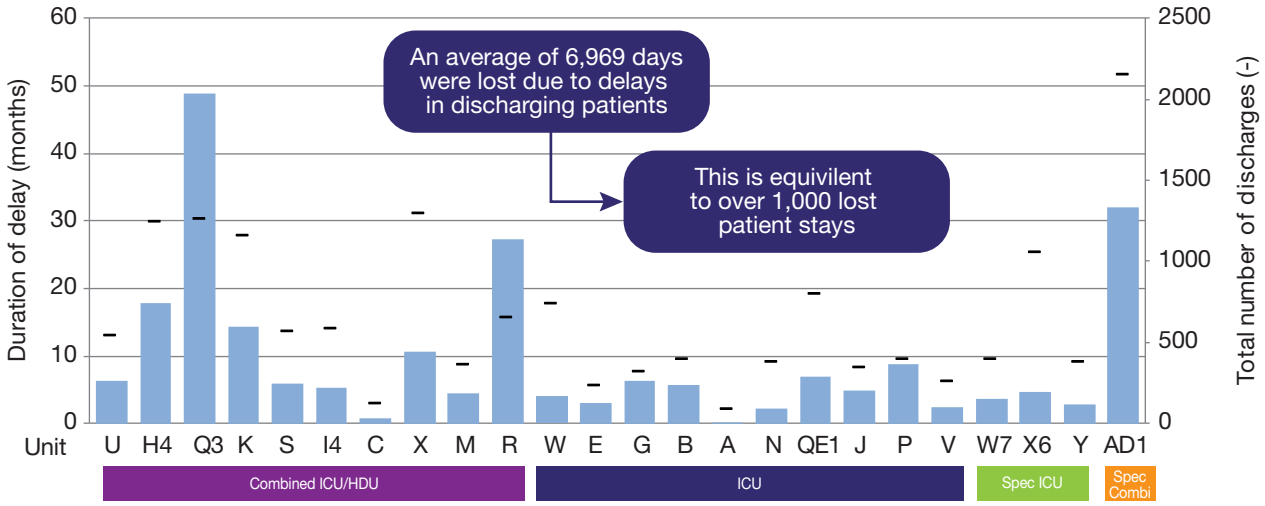
In 2018, almost half of patient-episodes had a delay in their discharge of over 4 hours from ICUs/combined units in Scotland.

Q3 (FVRH ICU/HDU) is an outlier 2SD above the Scottish mean, with 48% of discharges having a delay of over 4 hours. They were also an outlier above 3SD in 2016 and 2017.

"This is a result of capacity and flow issues across the hospital. Reassuringly local data confirms delayed admissions to critical care are extremely rare. There is ongoing work to improve patient flow across all areas of NHS Forth Valley."

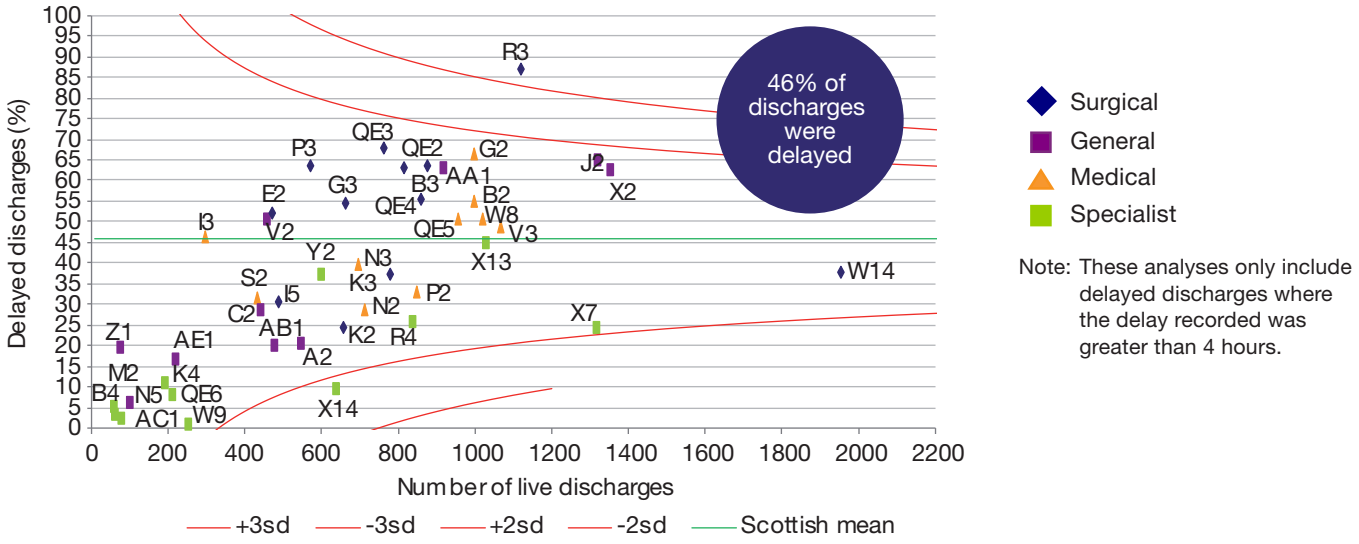
Forth Valley Royal Hospital Combined Unit

Figure 14 Sum total of delayed discharges from ICU and combined units (2018)



Unit Q3 (FVRH ICU/HDU) had the highest sum total of delayed discharges in ICUs and combined units. As seen in Figure 13, they are also an outlier for the number of delayed discharges of longer than 4 hours at 2SD. This delay is mainly due to a lack of available ward beds at the hospital. Overall in Scotland, 6,969 bed-days were occupied due to delays in discharging patients. Using the mean length of stay as a reference, this would be equivalent to over 1,000 additional patient stays that could have been accommodated. This is very similar to previous years, indicating a continuing trend of high delayed discharges from ICUs in Scotland.

Figure 15 Delayed discharges of greater than 4 hours to HDUs (2018)



Note: These analyses only include delayed discharges where the delay recorded was greater than 4 hours.

In 2018 46% of episodes in Scotland had a delay in their discharge of over 4 hours. Unit R3 (WGH SHDU) had significantly higher delayed discharges compared to the Scottish mean, with 60% of episodes having a delay of 4 hours or more. This is a reflection of the capacity issues in the wards in this hospital.

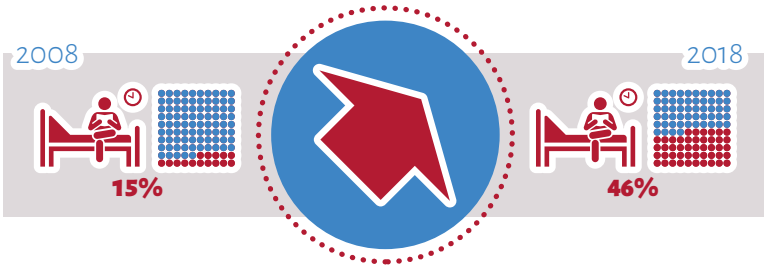
"In terms of delayed discharges, we do have a significant number of delays from downstream bed availability. However, there was a profiling exercise undertaken in October 2018 which included ring-fencing of elective beds to take the pressure of SHDU and this has led to fewer medical boarders and faster throughput of surgical patients out of SHDU. Following this work, we expect the figures to improve. There is an ongoing issue with higher acuity on the surgical wards than is recommended – a business case for an expansion of SHDU in particular for level 1 cases has been submitted to the board. It is in a queue of projects awaiting prioritisation."

Western General Hospital SHDU

Delayed Discharges from Scottish Critical Care

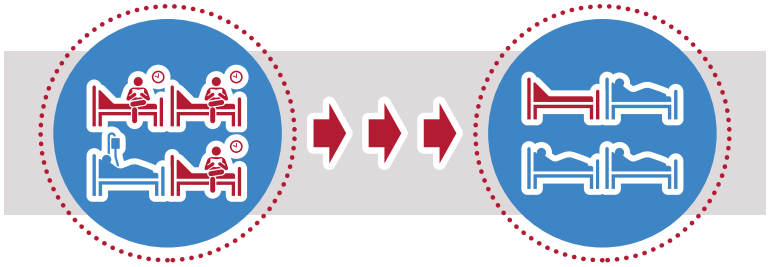
Delayed discharges are instances where patients are deemed clinically ready for discharge, but there is a delay or "gap" before actual discharge.

Almost half of discharges from Critical Care are **delayed by 4 hours** or more.



Since 2008, night-time, early and readmissions have decreased in Scottish ICUs, while **delayed discharges have increased**.

The main reason for delayed discharges are due to **bed shortages** in other areas of the hospital. Other reasons, though not as common, include **transport problems** and **staff shortages**.

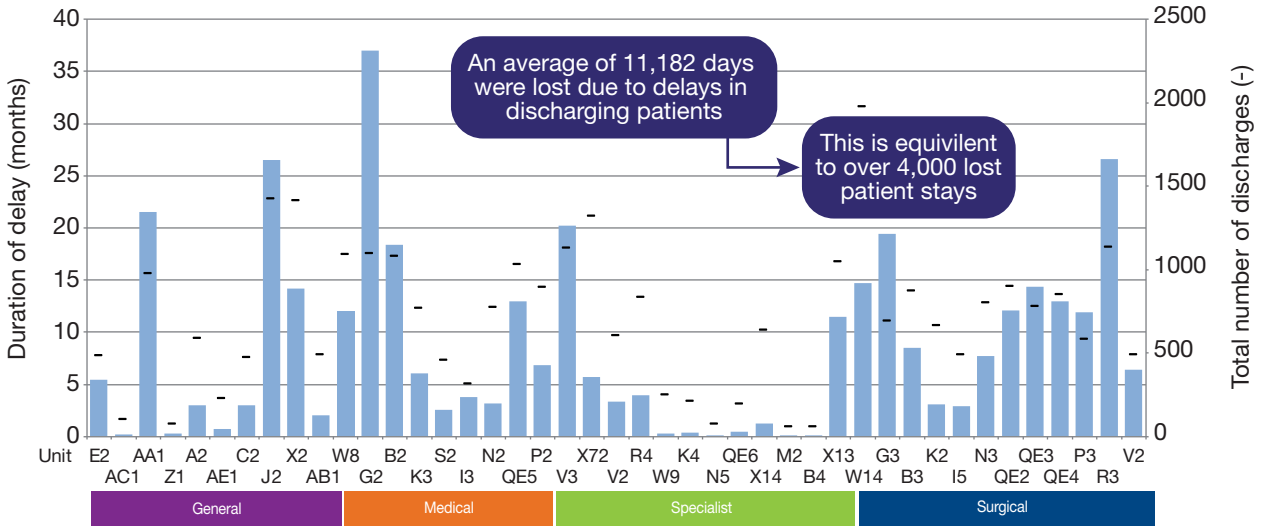


In 2018, the **average delay** from critical care was **16 hours** after the clinical decision was taken to discharge.

Delayed discharges in critical care costs the NHS money — **it is very expensive** to have a patient in an ICU bed.

this chart has been designed and crafted by NSS.PHIGraphics@nhs.net

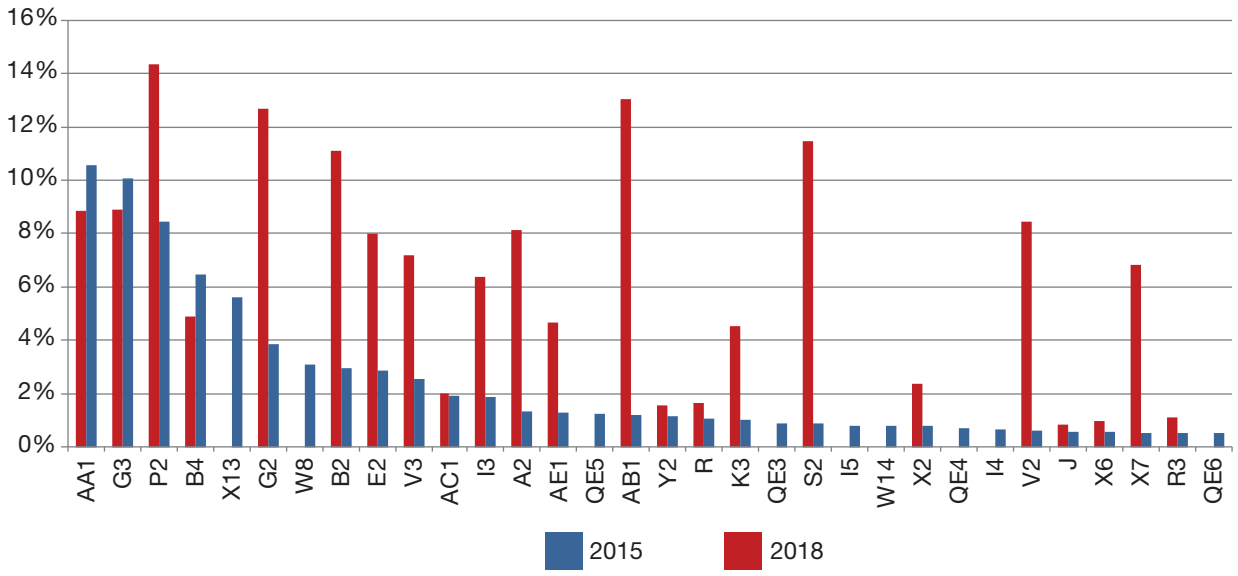
Figure 16 Sum total of delayed discharges from HDUs (2018)



Unit G2 (CRH MHDU) had the highest sum total of delayed discharge for HDUs in Scotland. Overall in Scotland 11,182 days were lost due to delays in discharging patients. Using the median length of stay as a reference, this would be equivalent to over 4,000 lost patient stays. This is very similar to previous years, indicating a continuing trend of high delayed discharges from critical care in Scotland. Unit G2 (CRH MHDU) were asked to comment but did not have anything to add, however are planning to review internally.

2.4 Data Quality

Figure 17 Highest level of care recorded as level 0 in all critical care units 2015 and 2018.



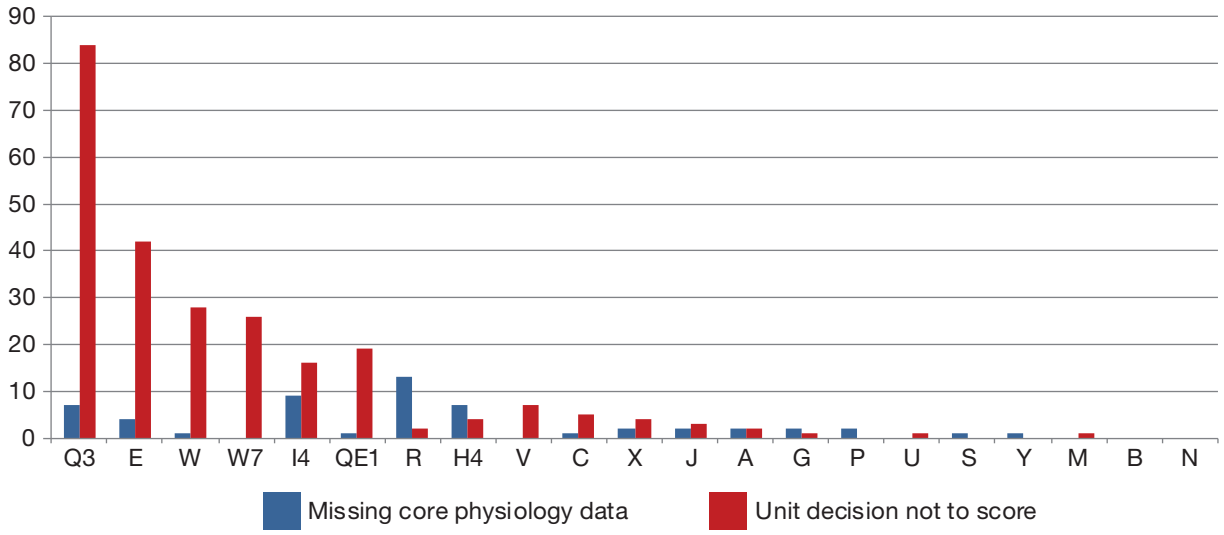
Please note units with 0% of patients with level 0 as the highest level of care in 2018 are not included in the chart.

For the past year the SICSAG Regional Coordinator has supported the units to improve and ensure accurate recording of levels of care. Providing care for level 0 patients in critical care beds is deemed a waste of critical care resource as this level of care could be provided

efficiently elsewhere in the hospital. In recent years the proportion of episodes requiring level 0 care has reduced from 8% in 2015 to 2% in 2017 and 2018. The reduction is likely due to improved education and data collection and better understanding of the levels of care definitions in the units. Patients in critical care at level 0 likely represent downstream bed availability issues.

The chart shows the improvements made in the recording of levels of care since 2015 by unit.

Figure 18 Missing APACHE scores, by reason for not scoring in ICUs and Combined Units (2018)



All ICU admission episodes should have an APACHE score calculated. There are a limited number of agreed reasons where episodes are excluded from scoring (see Appendix D). FVRH ICU/HDU has the highest percentage of episodes that are not scored which fall out with the agreed APACHE exclusions. The excluded episodes consist of coronary care patients under the care of cardiology, and patients admitted following thrombolytic therapy for stroke, who are currently admitted to the FVRH ICU/HDU.

"Going forward Unit Q3 (FVRH ICU/HDU) will no longer include coronary care patients under the care of cardiology in the WardWatcher dataset, and these patients will be admitted to defined beds in an area of critical care adjacent to the cardiology ward. The stroke thrombolysis patients will continue to be admitted on WardWatcher and will undergo severity scoring. Initiatives are currently under way to admit these patients directly to the stroke unit rather than critical care. The timescale for this is not presently determined."

Forth Valley Royal Hospital Combined Unit

"Unit E (Ayr ICU) have the second highest percentage of episodes that are not scored in 2018, however this unit has changed their practice from September 2018 and are now scoring all ICU admissions."

University Hospital Ayr Intensive Care Unit

2.5 Obstetrics

Women becoming critically ill during pregnancy or the peri-partum period is not a new phenomenon. When the Confidential Enquiry into maternal deaths[14] was launched in 1952, the maternal mortality rate was 90 per 100,000 maternities. It is now much reduced at 10 per 100,000 maternities with the report emphasizing the importance of tackling the indirect 'medical' causes of maternal death (cardiac disease, psychiatric illness, neurological causes) and morbidity.

The National Maternity and Perinatal Audit (run by the Royal College of Obstetricians and Gynaecologists) reported on 'Maternal admissions to intensive care in England, Wales and Scotland[15]' earlier this year. Overall 2.24 women per 1,000 maternities were admitted to intensive care during pregnancy or the first 6 weeks post-partum. In keeping with the Confidential Enquiry data, woman who are older, or who have a larger Body Mass Index (BMI) or those from an ethnic minority were found to be at an increased risk of admission to intensive care. This reflects the changing obstetric population, the patients are getting older, bigger and have more co-morbid disease. Obstetric haemorrhage is the most common reason for admission, mainly on day of birth and in the immediate postpartum period. Of infections causing admission to ICU, pneumonia was the most common (44%), followed by urinary tract and genital tract infections (40%).

The guideline 'Providing Equity of Critical and Maternity Care'[7] stated that a patient's obstetric needs should not suffer because she is in critical care, nor should her critical care needs suffer because she is in a maternity unit. This document was superseded by the Enhanced Maternal Care Guidelines in 2018[8] and sets out in detail how to run a maternal critical care service. Keeping patients in a maternity setting as far as possible to allow those with the expert knowledge of pregnancy and childbirth to lead their care and maximize the opportunity for babies to stay with their mothers is a key message.

SICSAG began to collect data in obstetric high dependency units in 2014 at Ninewells Hospital and has now expanded to cover Glasgow's Princess Royal Maternity and Queen Elizabeth University Hospitals, Aberdeen Royal Infirmary, Royal Infirmary of Edinburgh, St John's Hospital and University Hospital Crosshouse. Together these units account for nearly two thirds of Scotland's maternities.

Membership of SICSAG has been important for two key reasons. First, participation in the audit has allowed the activity and acuity of Scottish obstetric high dependency units to be measured for the first time. Second, the quality indicators and minimum standards have set standards such as access to physiotherapy and pharmacy that maternal critical care providers must aim to achieve.

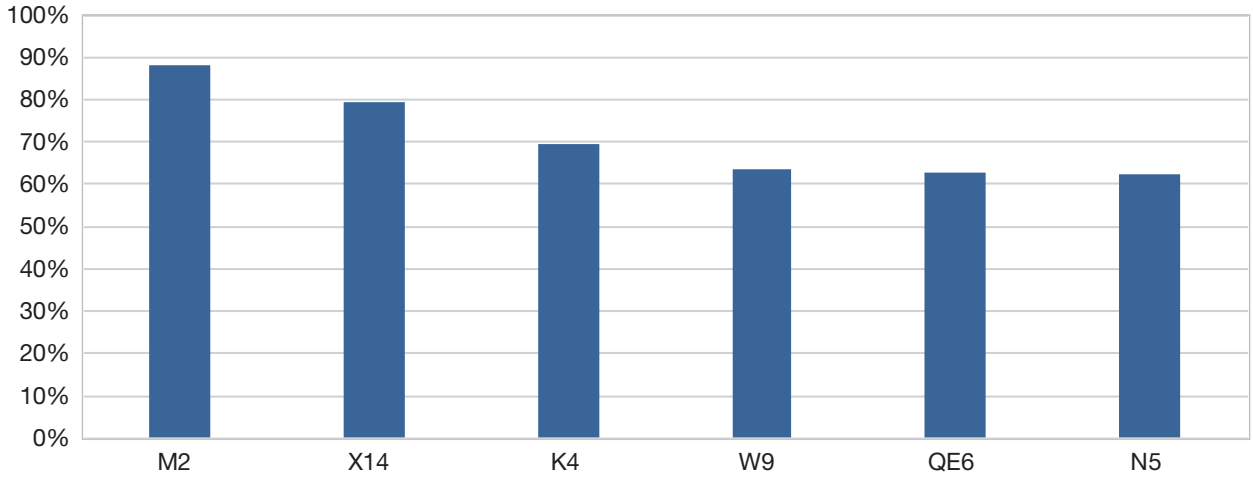
There continue to be, challenges: several units are persistent outliers for night time discharges (between 10pm to 8am). This is less of an issue than it might seem, the altered physiology of pregnancy means that obstetric patients, will usually normalise very quickly and the maternity wards to which they are discharged to are well resourced for night time activity.

Going forward, our challenge is to ensure that midwives are appropriately trained and resourced to be able to provide safe and reliable care. A further challenge is the lack of nationally agreed guidelines for staffing an obstetric HDU where there is not only the index patient, but also a baby, who needs looking after.

Finally, a heartfelt thank you from Scottish Maternity critical care Group (SMaCC) to SICSAG for your ongoing and unwavering support. It is crucially making a difference to the quality of care delivered to Scotland's mothers and their babies.

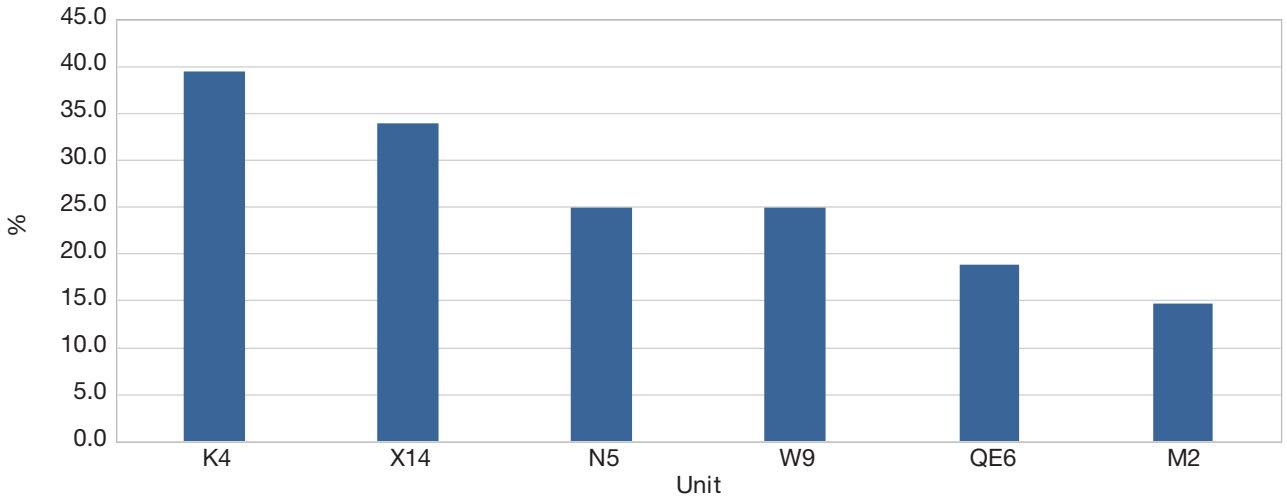
Arlene Wise
Chair of Scottish Maternal critical care network (SMaCC)

Figure 19 Percentage days in 2018 where babies were looked after with the mother



Keeping contact between a mother and her baby, where possible, during their hospital stay is a principle of Obstetric care. Reasons for the baby not being kept with mum can include baby not yet delivered, or baby being kept in neonatal care.

Figure 20 Percentage days in 2018 where the baby required extra care than normal



This question has recently been added to the local dataset, and overtime will allow units to quantify how many babies need extra care in the maternity HDU.

2.6 Quality indicators and staffing summary

Minimum Standards & Quality Indicators (MSQI)

It should be noted that with publishing these data, there is no intention to judge what is 'correct' but to demonstrate visually comparative benchmarking to inform quality improvement. We are sure that this will assist units in driving forward their plans and work to achieve these standards and indicators in the future. The Steering Group are also seeking to collaborate with networks across Scotland on achieving, and future review of these standards and indicators.

The MSQIs will be reviewed in 2020 for relevance and to keep up to date with the latest research and developments in critical care.

Table 1 Summary of ICUs and combined units compliance with SICSAG Quality Indicators (2018)

Table key

1 Not implemented and no plans to implement
2 Not implemented but a plan is in place to implement in the next 6 months
3 The unit complies with this indicator in some patients but not all OR it is implemented but not documented in the majority of cases
4 Unit complies with this indicator in the vast majority of patients OR is implemented and documented in the vast majority of cases
5 This is fully embedded into unit practice, and can evidence this fully if required

Unit Name	Daily Review	Consultant led review	Pharmacist	Physiotherapist	Care Bundles	Tracheostomy assessed	Delirium	Rehabilitation	End of life policy	M&M Meetings	Patient/family survey
Wishaw ICU	5	5	4	5	5	5	4	5	5	5	5
VHK ICU[1]	5	5	2	5	4	4	4	5	4	5	5
RAH ICU	5	5	4	5	5	5	5	4	5	5	5
Raigmore ICU[2]	5	4	4	5	5	5	5	5	5	5	2
QEU ICU	5	5	4	5	5	5	5	5	5	5	5
Ninewells ICU	5	5	4	5	5	4	4	4	4	5	5
IRH ICU[3]	4	3	4	3	5	5	5	5	5	4	2
Crosshouse ICU	5	4	4	4	5	3	4	3	5	4	5
Ayr ICU	4	3	4	4	5	4	4	4	4	4	5
ARI ICU	5	5	4	5	5	5	4	4	5	5	5
DGRI ICU/HDU[4]	4	3	3	5	5	5	4	4	3	4	5
WGH ICU/HDU	5	5	4	5	5	5	4	4	5	5	4
SJH ICU/HDU	4	4	4	5	5	4	5	4	5	5	5
RIE ICU/HDU	5	5	4	4	5	4	5	4	5	5	5
MNK ICU/HDU	5	5	4	5	5	5	5	5	5	5	5
Hairmyres ICU/ HDU	5	4	4	5	5	5	5	5	5	5	4
GRI ICU / HDU	5	5	4	5	5	4	5	5	5	5	5
FVRH ICU/HDU	5	3	4	5	5	5	5	4	5	5	5
BGH ICU/HDU	5	5	4	4	5	5	4	4	5	5	5
GJNH[21] CICU/ CHDU	5	5	4	5	5	5	5	5	2	5	5
PRI ICU/HDU	5	3	4	5	5	5	5	4	5	4	5
QEU NICU	5	5	4	5	5	5	5	4	5	5	5
RIE CICU[5]	5	5	4	5	5	5	5	4	2	5	2
ARI CICU	5	4	4	5	5	5	3	4	3	5	5

Note: Units with superscript numbers have commented on their quality indicators, please see section 2.7.

Table 2 Summary of HDUs compliance with SICSAG Quality Indicators (2018)

Table key

- 1 Not implemented and no plans to implement
- 2 Not implemented but a plan is in place to implement in the next 6 months
- 3 The unit complies with this indicator in some patients but not all OR it is implemented but not documented in the majority of cases
- 4 Unit complies with this indicator in the vast majority of patients OR is implemented and documented in the vast majority of cases
- 5 This is fully embedded into unit practice, and can evidence this fully if required
- / Not relevant for this unit

Unit Name	Daily consultant review and written management plan	Consultant-led twice daily ward rounds	Pharmacist	Physiotherapist	Care bundles in place for; IAP, CVC, and PVC	Screening for Delirium in critical care	Rehabilitation needs in critical care	End of life care policy in place	Deaths and adverse events discussed at regular clinical governance meetings	A regular patient/family experience survey is undertaken in the unit
WIH HDU	4	3	1	1	5	3	5	5	4	2
RIE HDU	5	4	4	5	5	5	3	5	5	5
RAH HDU[6]	4	1	4	5	5	4	5	5	3	5
PRI HDU	5	5	4	5	5	4	4	4	5	4
IRH HDU[6]	4	3	4	5	5	5	4	4	3	5
GBH HDU	5	5	4	5	5	4	4	5	5	4
Dr Grays HDU[7]	4	1	3	4	5	5	3	1	5	5
Belford HDU[8]	5	5	4	4	5	3	4	5	5	2
Balfour HDU[9]	5	4	4	4	5	2	4	4	4	2
Ayr HDU	4	3	4	4	5	3	4	4	3	5
Wishaw MHDU	1	1	1	5	5	1	4	2	1	5
VHK MHD[1]	5	5	2	5	5	3	5	5	5	5
Raigmore MHDU[10]	5	4	4	4	5	4	4	2	3	5
QEU MHDU	4	3	4	5	5	5	5	5	5	5
Ninewells MHDU	5	3	4	4	5	5	3	5	5	5
Monklands MHDU[19]	5	4	4	5	4	4	2	4	4	5
Hairmyres MHDU[11]	5	2	4	5	4	4	5	3	2	2
GRI MDU	5	5	4	5	5	5	4	5	5	5
Crosshouse MHDU	5	4	4	4	5	5	4	5	5	5
ARI MHDU	5	5	4	5	5	5	4	5	5	5
WGH NHDU	5	4	1	5	5	4	5	5	4	5
QEU NHDU[12]	5	5	4	5	5	4	4	1	5	5
RIE RTHDU	5	4	4	5	4	3	4	4	5	5
RIE CHDU[5]	5	5	4	5	5	5	4	2	5	2
RIE OHDU	5	5	4	4	3	/	/	/	5	3
QEU OHDU[13]	5	5	1	4	5	/	/	/	5	4
PRM OHDU	5	4	4	5	4	/	/	/	5	5
Ninewells OHDU	5	5	3	5	5	/	/	/	5	5
ARI OHDU	5	5	4	4	5	/	/	/	5	5

Unit Name	Daily consultant review and written management plan	Consultant-led twice daily ward rounds	Pharmacist	Physiotherapist	Care bundles in place for; IAP, CVC, and PVC	Screening for Delirium in critical care	Rehabilitation needs in critical care	End of life care policy in place	Deaths and adverse events discussed at regular clinical governance meetings	A regular patient/family experience survey is undertaken in the unit
SJH OHDU[20]	5	5	1	4	5				5	5
QEU SHDUs[14]	5	4	4	5	4	3	5	5	4	5
Wishaw SHDU	5	4	4	5	5	3	5	5	5	5
WGH SHDU[15]	4	4	2	4	5	5	4	1	5	4
VHK SHDU[1]	4	4	1	4	5	4	4	4	5	5
Raigmore SHDU[16]	5	4	4	4	5	3	1	4	5	5
Ninewells SHDU[18]	5	5	4	5	5	5	4	5	2	5
MNK level 1 HDU	5	3	4	4	4	4	5	4	5	4
GRI SHDU	5	4	4	4	5	5	4	5	4	5
Crosshouse SHDU[17]	4	4	4	4	5	4	5	2	4	5
ARI SHDU	4	4	4	5	5	4	4	4	4	5

Note: Units with superscript numbers have commented on their quality indicators, please see section 2.7.

MSQIs[2] are under the governance of SICSAG. These standards and quality indicators are defined as being person centred, safe, effective, evidence based, equitable and timely and are in line with the 2020 Vision[1]. The indicators are, in many cases, aspirational and searching but they strive to meet these challenging criteria. For each of the standards and indicators, all outliers are subject to the SICSAG governance procedure. Each unit is given the opportunity to respond to each governance issue reported here for 2018 data and encouraged to develop an action plan for improvement.

2.7 Unit feedback on the quality indicators

These comments have been received from the audit leads.

Footnote number	Unit	Comments
1.	VHK ICU, SHDU, MHDU Pharmacist	This is an issue across all three units. The issue of pharmacy provision to critical care in Fife is not new. Dr Cole wrote in 2018 to NHS Fife to highlight this deficiency and it has been taken very seriously at the organisational level. Four sequential attempts to appoint a Band 8 pharmacist have been unsuccessful over the past two years. This lack of success reflects trends at a national level. In the meantime the nursing and medical staff in Intensive care and Surgical HDU have been working on QI projects to improve the quality of prescription and drug administration. We are pleased to say that in May 2019 we appointed to a band 7 post with some responsibility for critical care. We anticipate that this issue will be at least partially resolved by the next report and thank SICSAG for their support with this issue.
2.	Raigmore ICU Patient and family experience	We have launched a redesigned Family Survey in early 2019 and this should be reflected in the data for the next report.

Footnote number	Unit	Comments
3.	IRH ICU Patient and family experience	A plan is in place to collect this information over the next 12 months.
3.	IRH ICU Twice Daily review	Due to site activity and staffing levels. Consultants in IRH cover ICU and emergency theatre both in daytime and in the out of hours period. On occasion when they are in theatre, ICU patients are reviewed by the resident anaesthetic staff.
4.	DRGI ICU/HDU Daily Review	All critically ill patients in Dumfries and Galloway are housed in one Unit of 17 beds. Because of staffing difficulties (not able to recruit Consultant Anaesthetists), some of the patients in critical care but not all are looked after by the Anaesthetic and critical care Team. The long term intention is to consider moving to a totally closed Unit and twice daily ward rounds, but due to current recruiting problems, this is not achievable.
4.	DGRI ICU/HDU Twice Daily Ward Round	All critically ill patients in Dumfries and Galloway are housed in one Unit of 17 beds. Because of staffing difficulties (not able to recruit Consultant Anaesthetists), some of the patients in critical care but not all are looked after by the Anaesthetic and critical care Team. The long term intention is to consider moving to a totally closed Unit and twice daily ward rounds, but due to current recruiting problems, this is not achievable.
4.	DGRI ICU/HDU Pharmacist	We are aware that the Pharmacist service has come under huge pressure since the move to the new building. We realise that this is a deficiency and the Team are making great efforts to try and provide us with a Pharmacist, at least at the scheduled weekday meetings.
5.	RIE CICU and CHDU	As a result of the SICSAG Audit Meeting (2018) we have investigated other centres EoL (End of Life) processes and from this developed our support package for the family. In addition to Lothian information booklet we can now provide support information booklets for children and young adults (Richmond Hope). We have sourced required materials for memory boxes and are in the process of having cards printed to enable us to contact bereaved families at 6 weeks and again at one year to give them the opportunity to discuss any concerns. To this end we now have a dedicated telephone answering service. We are hopeful this will go live at the end of June 2019.
5.	RIE CICU and CHDU Patient and family experience	We have enrolled in “Care opinion”, this is now functional and should show as an improvement in the 2020 annual report.
6.	RAH HDU Twice Daily Ward Round and IRH HDU Twice Daily Ward Round	RAH HDU is an open access busy mixed unit. Patients are managed and reviewed by parent specialties. There is a daily consultant review of all patients. It is the second daily review in which there are variations. Maintaining high quality care within this busy unit is fundamental. There are specialty as well as sector governance systems to identify and monitor any concerns regarding quality of care. There is discussion with site leads and medical managers about ways to address this minimum standard. The recent formation of the Clyde critical care delivery group is an excellent forum to raise and address a number of issues identified by the latest SICSAG report.
7.	Dr Gray’s, Elgin HDU Twice Daily Ward Rounds	DGH HDU is an open, mixed specialty unit with no designated consultant assigned to oversee all patients. Care within the HDU is consultant lead and consultant delivered. Patients are reviewed in person by a consultant within 12 hours of admission to HDU. The admitting consultant oversees and coordinates their patients care. Current review of unit function, roles and responsibilities has incorporated compliance with twice daily ward rounds as part of its action planning and aspirations for improvements over the coming 12 months.

Footnote number	Unit	Comments
7.	Dr Gray's, Elgin HDU End of life care	The ward works very closely with McMillan in ensuring delivery of national standards for Living and Dying Well. The overarching principle of the Grampian Integrated Palliative Care Plan is parity for all– equally high standards for every patient, every time, wherever they are, whatever their diagnosis when they progress to their end of life stage. Development of ward based End of Life Care policy to be progressed. We have spoken with critical care in ARI and will progress with this conversation.
7.	Dr Gray's, Elgin HDU Patient/Family Survey	We have liaised with ARI regards their 2018 patient and relative questionnaire development. We will progress to adopting the ARI patient and relative questionnaire as of July 2019.
7.	Dr Gray's, Elgin HDU Pharmacist	Currently a hospital pharmacist visits HDU every day Monday - Friday. These pharmacists are not recognised critical care Pharmacists. Any pharmacist covering HDU has access to the team at ARI for advice and support. Out of hours and at weekends HDU can access the on call pharmacist at ARI. There are currently no plans in place that would move pharmacy provision closer to the standard described.
7.	Dr Gray's, Elgin HDU Physiotherapist	The hospital Physio team attend 7 days per week in response to referral via ward view. (A weekend on call service is available between the hours of 8.30 – 4.30) Referrals from HDU are prioritised and are attended to by a senior Physiotherapist. DGH does not have a requirement for 24hr physiotherapy cover. All Physiotherapy input is documented in ward view and Physiotherapy clinical records.
8.	Belford HDU Patient and family experience	We do gather feedback from patients within the ward that HDU is based in but not specific to HDU. However, we have developed one specific to HDU and plan to roll out from June 2019.
9.	Balfour, ORK HDU End of life care	After completion of our hospital move (in June 2019) we will be able to focus our attention on further improving services on HDU, including implementing a patient satisfaction survey.
10.	Raigmore MHDU End of life care	We have been working with our palliative care team and the local hospice over the last few months to develop an End of Life Care Policy. We have been in contact with most of the HDUs in Scotland to gather information on their ELC policies to help put one in place at Raigmore. This is still a work in progress and we will strive to have it actioned/complete within the next 4 months.
11.	Hairmyres MHDU Twice Daily Ward Round	This unit has moved to a new site within the hospital and staff are now under the remit of the critical care team. The management team have agreed to fund twice daily ward rounds Monday to Friday. Out of hours the unit is covered by the on call team.
11.	Hairmyres MHDU End of life care	The hospital has recently introduced a new Record of End of Life Care which is aligned to Scottish Government guidance and Palliative Care guidelines. We are in the process of implementing this paperwork in our unit and hope to have it successfully embedded by the end of 2019.
11.	Hairmyres MHDU Patient and family experience	We are in the process of developing a patient experience questionnaire which we aim to test and implement before the end of 2019.
11.	Hairmyres MHDU M&M	Monthly meetings have now been set up. The nurses and medical staff are invited and moving forward we hope to include the physiotherapist, dietician and pharmacist.
12.	QEU NHDU End of life care	We have recently appointed a new end of care Care Assurance System (CAS) link nurse, who will take this QI work forward.
13.	QEU OHDU Pharmacist	At time of publication clinical pharmacy input to the HDU will be prioritised and provided by pharmacists on the QEUH site. This will commence by end July 2019.
14.	QEU SHDU'S Delirium Screening	Since January 2019 reliability of full completion of this screening tool has been shown to be above 95% on HDU 1,2+6 (the areas where compliance was believed to be inconsistent in 2018). We continuously measure compliance monthly via the Combined Care Assurance Audit Tool (CCAAT) and continuous improvement efforts are in place to maintain this high level of compliance.

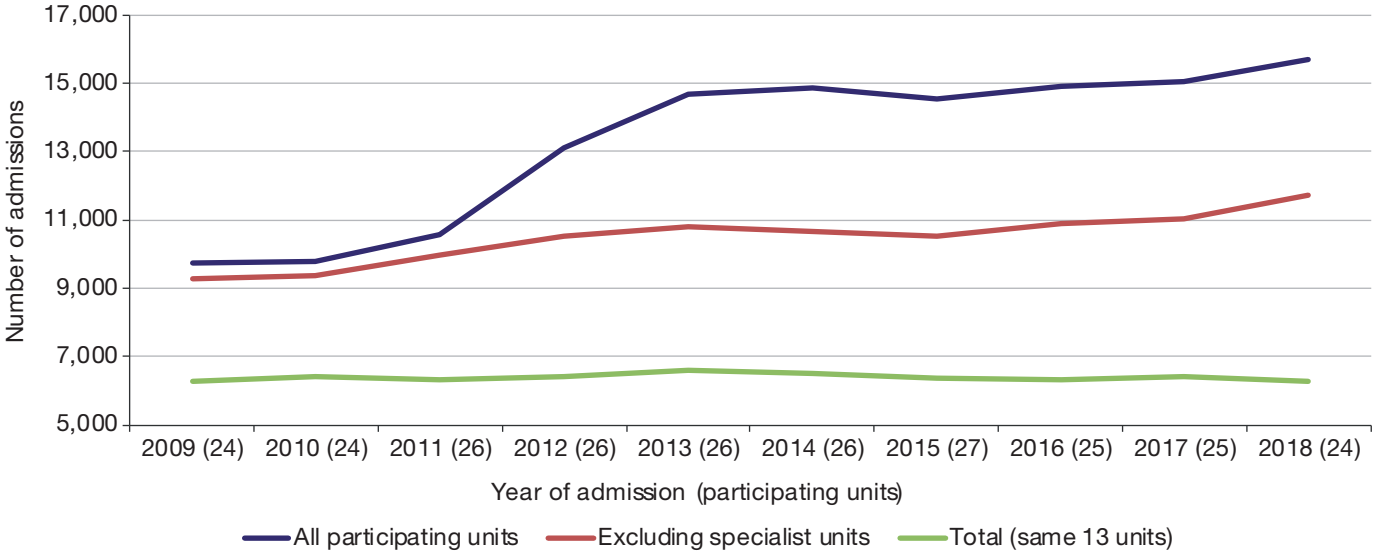
Footnote number	Unit	Comments
15.	WGH SHDU Pharmacist	The training of a critical care pharmacist has not yet been funded and will be discussed at the clinical management meetings within the surgical directorate.
15.	WGH SHDU HDU	Whilst awaiting the Care Assurance Standards, SHDU have implemented the Thistle logo for End of Life care. This is with a view to providing a visual cue for communication that a patient is imminently dying or has died and this should create a calm and dignified environment.
16.	Raigmore SHDU Delirium Screening	Currently, a 4AT score is done at the point of admission and again if there are any changes in patient mentation. We are now working with Surgical HDU Nursing Staff to ensure that this occurs on a daily basis.
17.	Crosshouse SHDU End of life care	With regards to the 'Written end of life care policy'. We had been waiting for a national policy being complete, to be able to initiate, but in the meantime ICU has devised one, which I had discussed with the charge nurse and aim to review and adapt where relevant.
18.	Ninewells SHDU M&M	NHS Tayside are committed to reviewing cases that have been treated in SHDU by running a Morbidity and Mortality meeting on a regular basis that will be attended by SHDU critical care Anaesthetists and the Multidisciplinary Team (MDT). There is agreed time dedicated for this in Consultant job planning starting from September 2019.
19.	University Hospital Monklands MHDU Rehabilitation	The median length of stay on MHDU is only 2 days, after which time patients are stepped down to an appropriate medical ward for on-going treatment and it is here that any rehabilitation needs tend to be assessed. We are looking to incorporate a section on mobility into the HDU medical notes proforma to prompt medical staff to consider whether referral is appropriate. Critical care at Monklands currently utilise daily goal setting and ultimate goal setting and this is recorded in a booklet which can transfer into primary care with a patient. Each patient is provided with an exercise programme and early mobilisation is commenced by physiotherapists and nursing staff. The physiotherapy lead is currently looking at which elements of these they can move into HDU. However, the relatively short length of stay in this area raises different challenges.
20.	SJH OHDU Pharmacist	No pharmacists review the obstetric HDU patients but there is access to a critical care pharmacist that medical staff can contact by phone during weekday working hours.
21.	GJH ICU/HDU End of life care	While we have no over-arching written policy, we do fulfil all the components of the End of Life Care QI.

Despite contact with the following units regarding compliance with the MSQIs there was no response; Wishaw MHDU (Daily Review, Ward Rounds, Pharmacist, delirium screening, end of life care policy, M&M meetings), WIH HDU (Pharmacist, Physiotherapist and patient survey) and WGH NHDU (Pharmacist).

Section 3 Activity

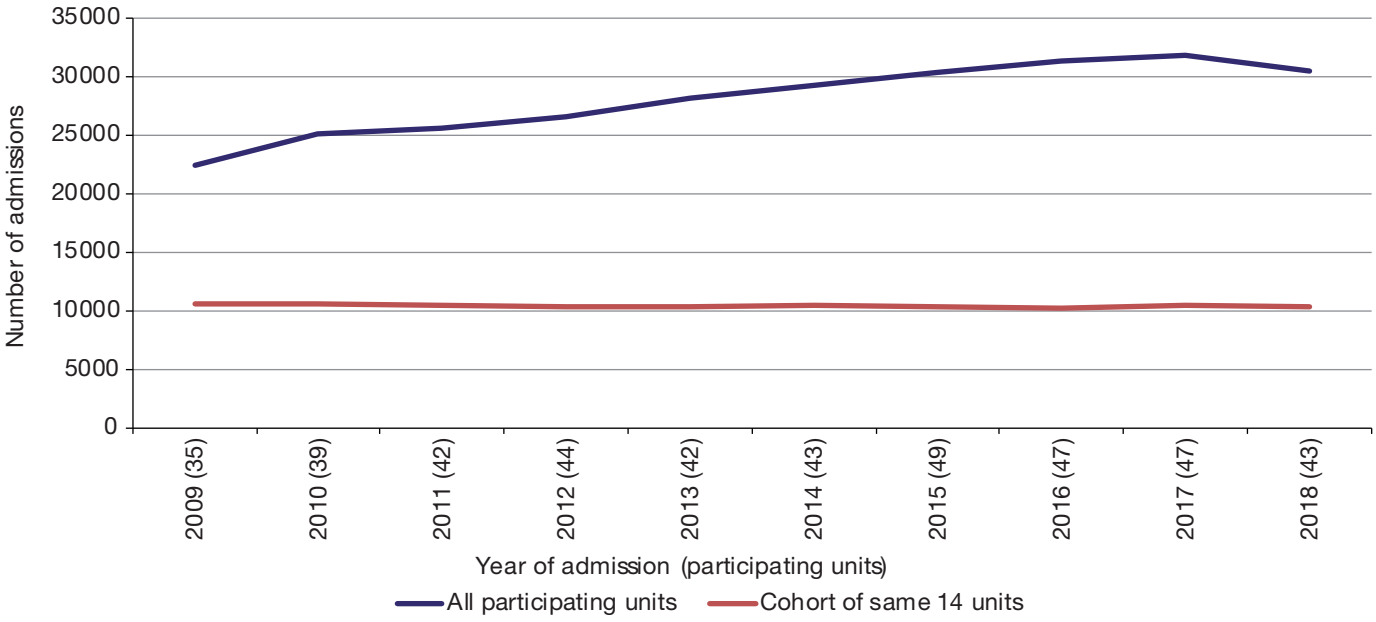
3.1 Number of admissions

Figure 21 Annual admissions to ICUs and combined units (2009-2018)



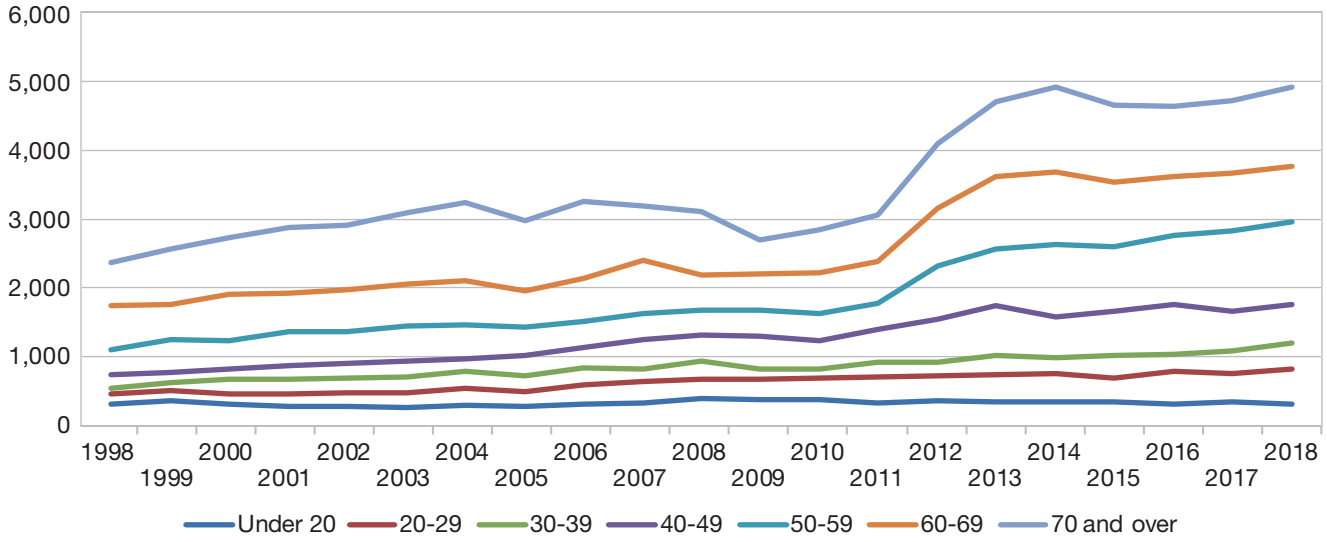
In 2018 there was an increase in admissions to all participating ICUs and combined units. This can be accounted for by the conversion of two ICUs into combined units, Perth Royal Infirmary and Dumfries and Galloway Royal Infirmary. In these hospitals, admissions that would have previously been admitted to a separate HDU, and so counted in the HDU chart, are now included here following unit amalgamation. Looking at the same 13 units contributing to the audit since 2009, admissions have stayed at a consistent level.

Figure 22 Annual admissions to HDU (2009-2018)



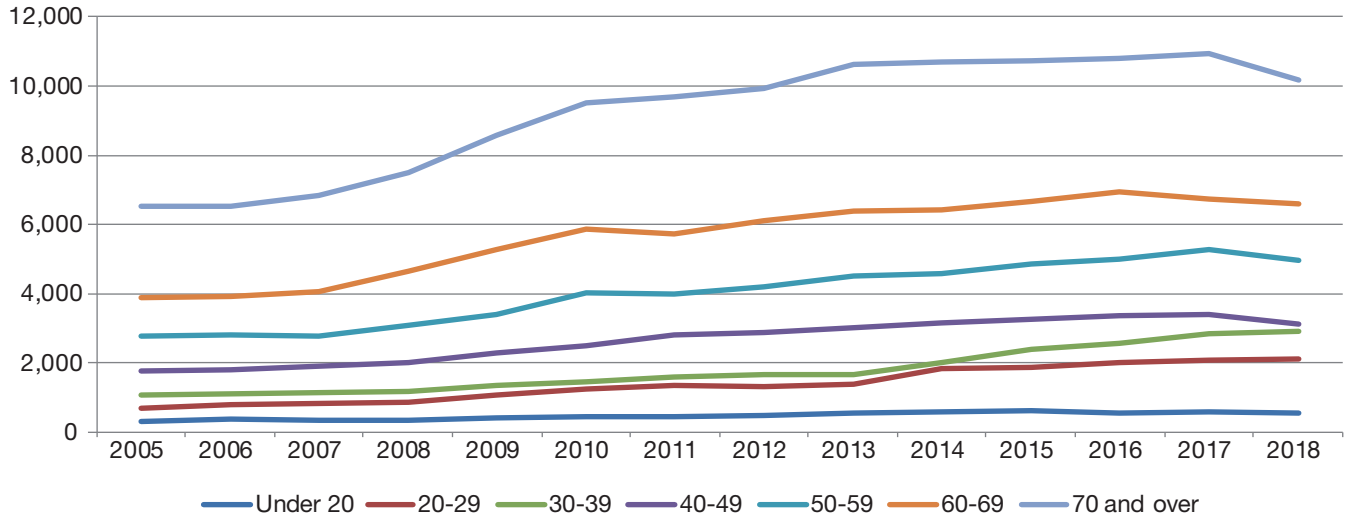
In 2018 it appears that the admissions to HDUs have decreased but the decrease is largely attributable to the creation of new combined units. The 14 units that have been contributing data continuously since 2009 show a more consistent pattern of admissions over the years.

Figure 23 Age profile of patients admitted to ICUs and combined units (1998-2018)



The chart shows over time that there are a greater number of older patients being admitted to ICUs and combined units. It is noted that from 2011 there has been a greater increase in ages 70 and over, which may reflect changes to organisation of critical care services as well as the aging population in Scotland.

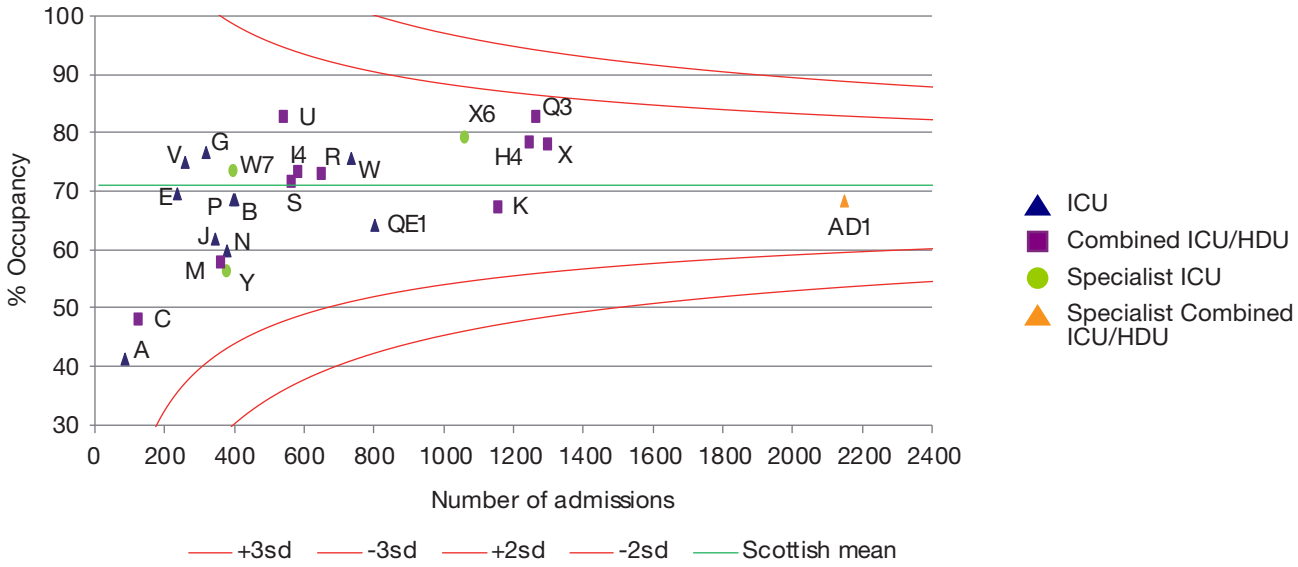
Figure 24 Age profile of patient admissions to High Dependency Units (2005-2018)



One in three admissions to Scottish HDUs was aged 70 or older, representing the largest age group of patients admitted. The oldest age group has reduced in 2018 compared to 2017, this is due to Dumfries & Galloway HDUs moving to the ICU part of the audit.

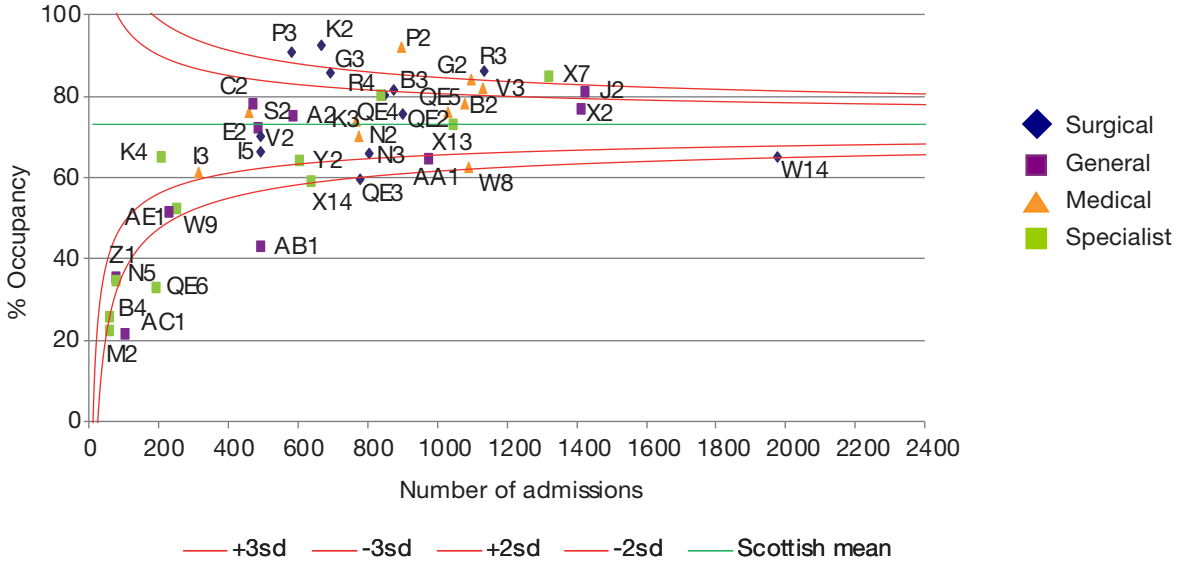
3.2 Bed occupancy

Figure 25 Bed occupancy rates for ICU and combined units (2018)



During 2018 the average occupancy in Scottish ICU and combined units was 71%. Two combined units, Forth Valley Royal Hospital and Borders General Hospital had annual occupancy levels greater than 80%.

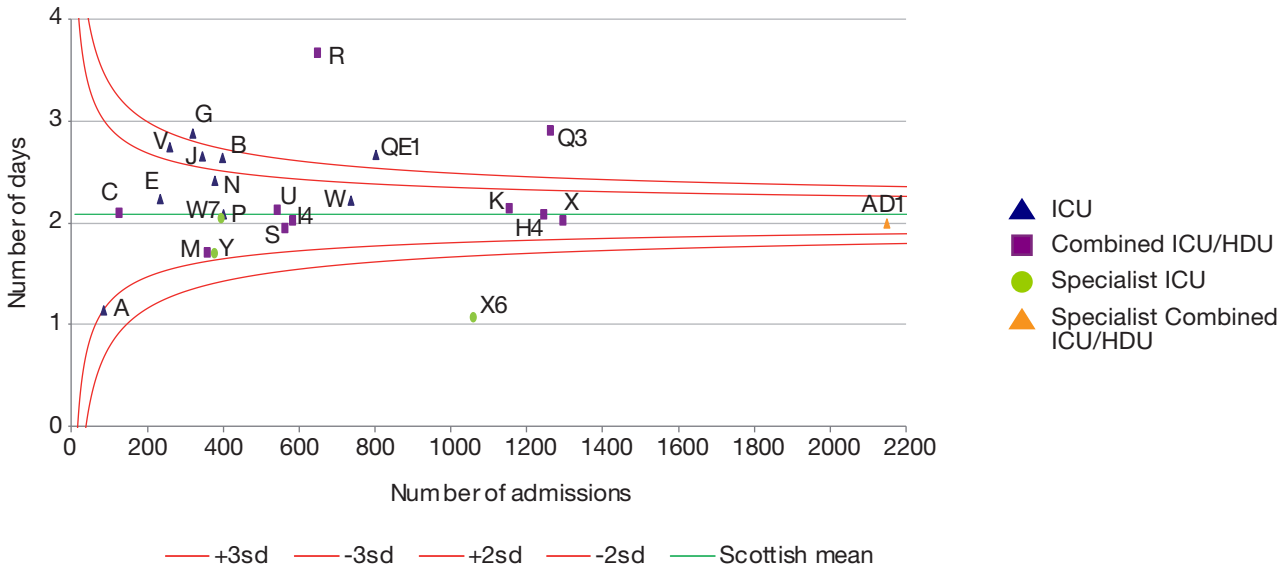
Figure 26 Bed occupancy rates for HDU (2018)



During 2018 the mean occupancy in HDUs was 73%. The spread of occupancy was greater than for ICUs/combined units, ranging from 21% to 93%. Units with the lowest occupancy included specialist obstetric HDUs and units located in smaller remote hospitals. In some of these locations, staff work within general wards until there is a need to open HDU beds. Further information on the Obstetrics units can be found in section 2.5.

3.3 Length of stay

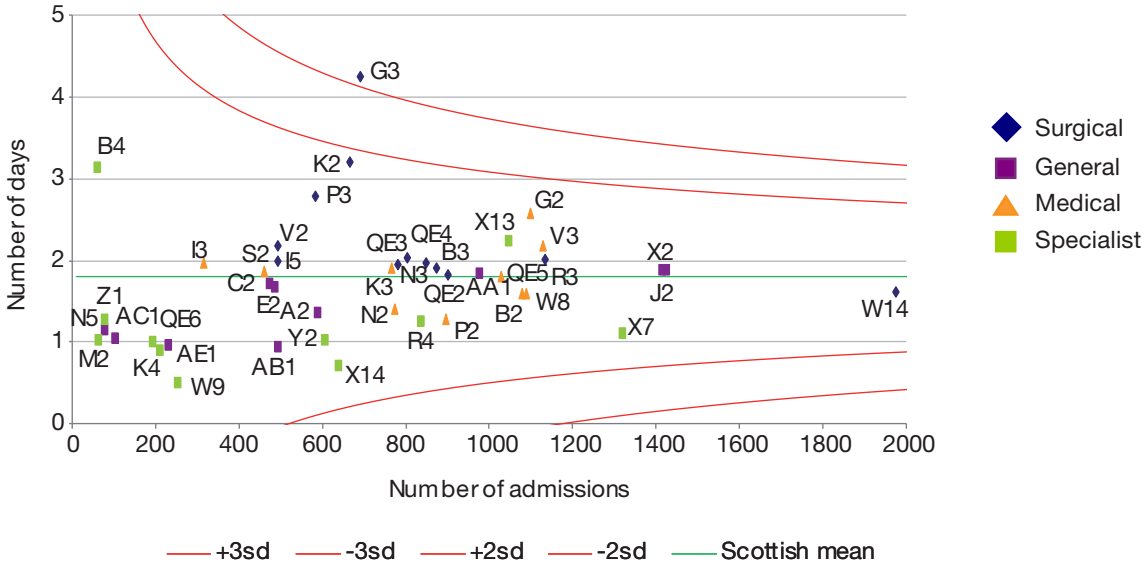
Figure 27 Median length of stay in ICU and combined units (2018)



The median length of stay for ICUs and combined units in 2018 was just over 2 days. Median length of stay in four units was 3SD greater than in Scotland overall. This may be due to a combination of differences in case-mix and delays in being able to discharge patients to HDU or ward beds due to capacity issues.

Unit R (WGH ICU/HDU) is a regional centre for neuroscience and receives patients from all over Scotland with subarachnoid haemorrhage for interventional radiology, this group often have a particularly long stay in ICU. The unit also looks after patients being prepared for home ventilation.

Figure 28 Mean length of stay in HDU (2018)

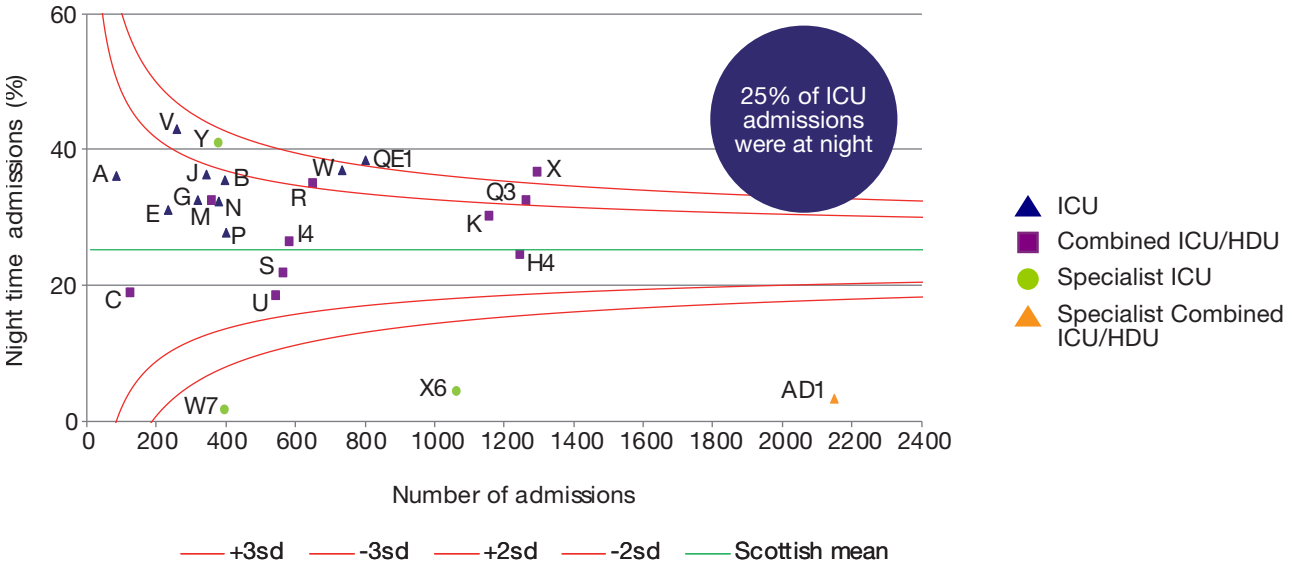


The median length of stay in HDUs was the same as that reported over the last few years at just over 2 days. Unit G3, (CRH SHDU) had the longest median length of stay in an HDU at over 4 days and is an outlier to 3 SD.

> *"This continues to be an ongoing issue due to the lack of available beds within the hospital to allow flow of step down patients when they no longer require HDU levels of care"*
>
> **Crosshouse SHDU**

3.4 Night time admissions

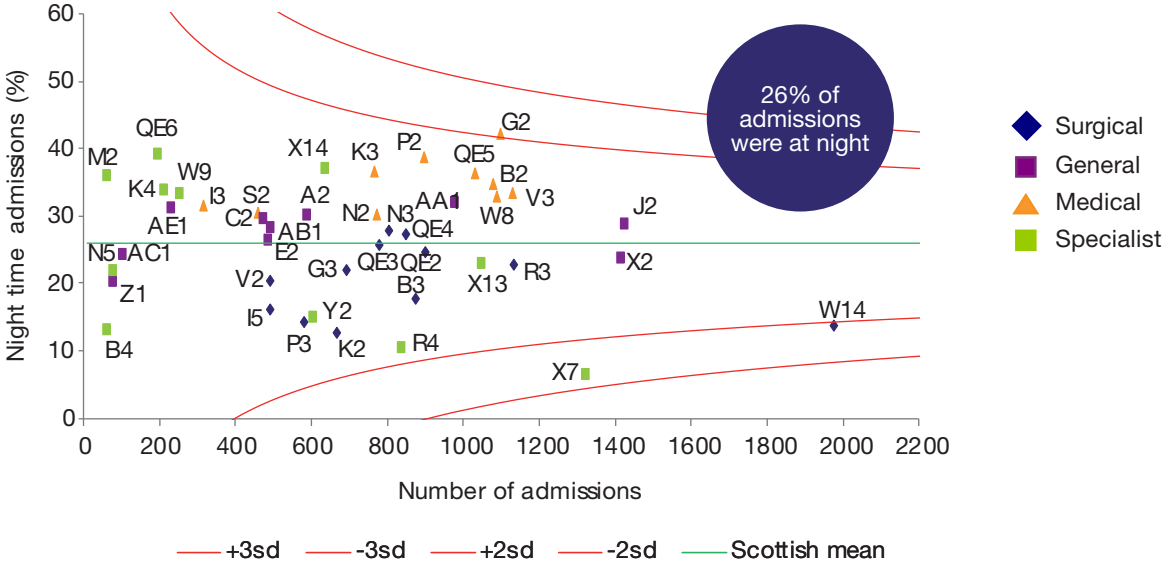
Figure 29 Night time admissions to ICU and combined units (2018)



'Night time' is defined as 10pm to 8am in line with the SICSAG Quality Indicators[2].

Units QE1 (QEU ICU) and X (RIE ICU/HDU) are outliers above the 3SD line, indicating significantly higher night time admissions than the Scottish mean. All units with a significantly lower night time admission compared to the Scottish mean are specialist cardiothoracic units; W7 (ARI CICU), X6 (RIE CICU), AD1 (GJH CICU).

Figure 30 Night time admissions to HDU (2018)



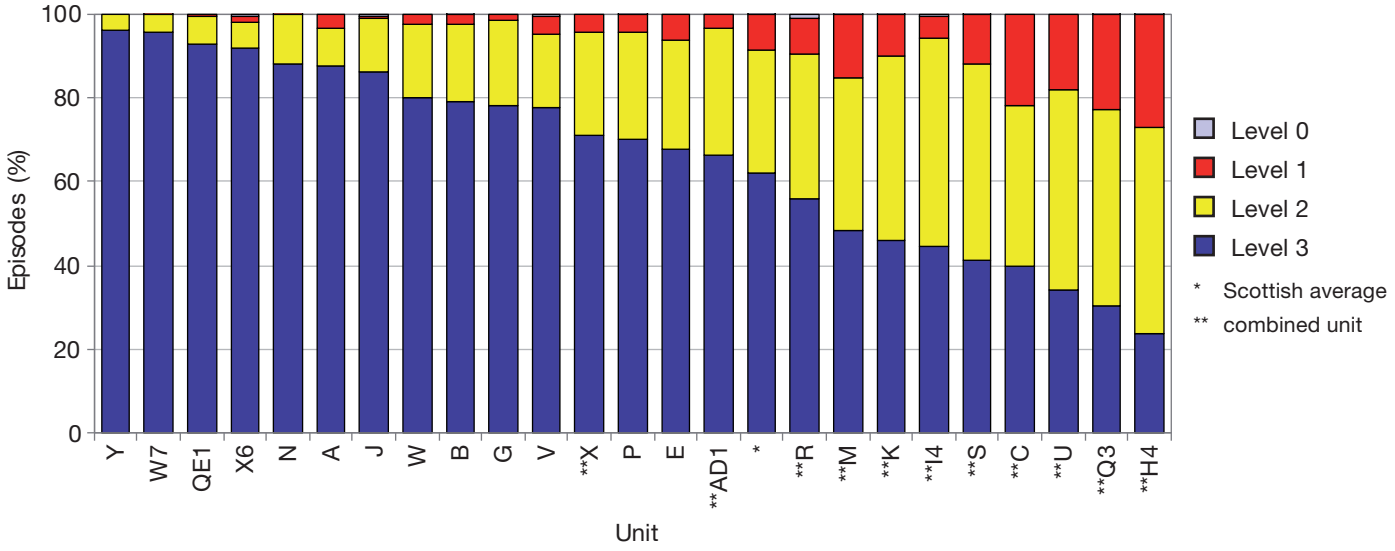
In 2018, 26% of admissions were at night. The burden of night time admissions is generally greater for MHDU than SHDU. Please see Figures 7 and 8 for data on night time discharges.

Section 4 Interventions

4.1 Level of care

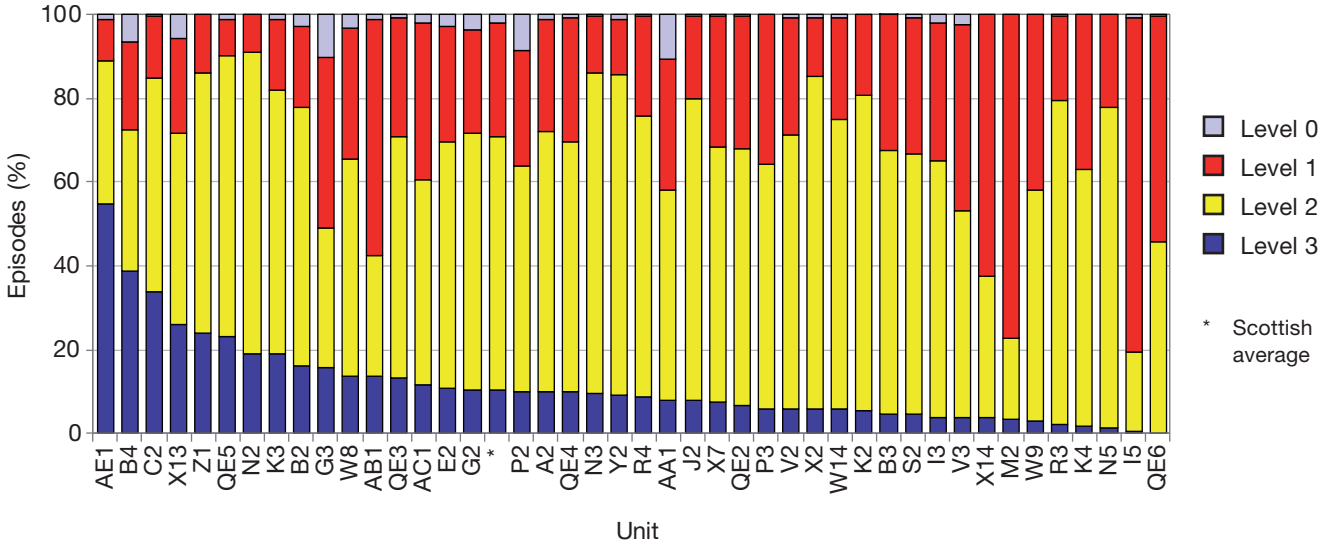
Level of care data are collected from the WardWatcher ACP page. It allows direct comparisons of interventions and levels of care to be made between critical care units. Some differences in the levels of care will be due to the differing specialty between hospitals. Level of care is defined in the methodology section of the SICSAG website (www.sicsag.scot.nhs.uk).

Figure 31 Highest level of care in ICUs and combined units (2018)



As in previous years the data are presented in order of descending proportion of level 3 care. In 2018 the highest level of care, level 3, was required in 62% of patient episodes in ICU and combined units and indicates the significant resource and skill-mix implications required by each unit in Scotland.

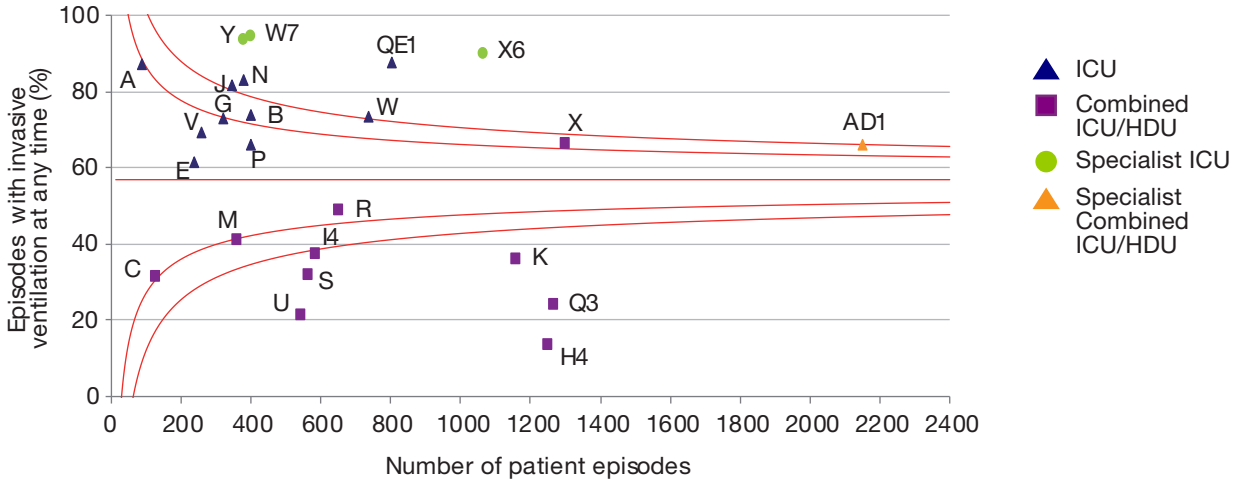
Figure 32 Highest level of care in HDU (2018)



It is reassuring that this graph shows that the highest level of care required for the majority of HDU episodes is at the appropriate level (level 2), with 71% of patients at level 2 or higher. There is variation in the pattern of the highest level of care demonstrating the heterogeneous nature of HDUs. Patients in critical care at level 0 likely represent downstream bed availability issues.

4.2 Respiratory support

Figure 33 Invasive ventilation at any time in ICU and combined units (2018)

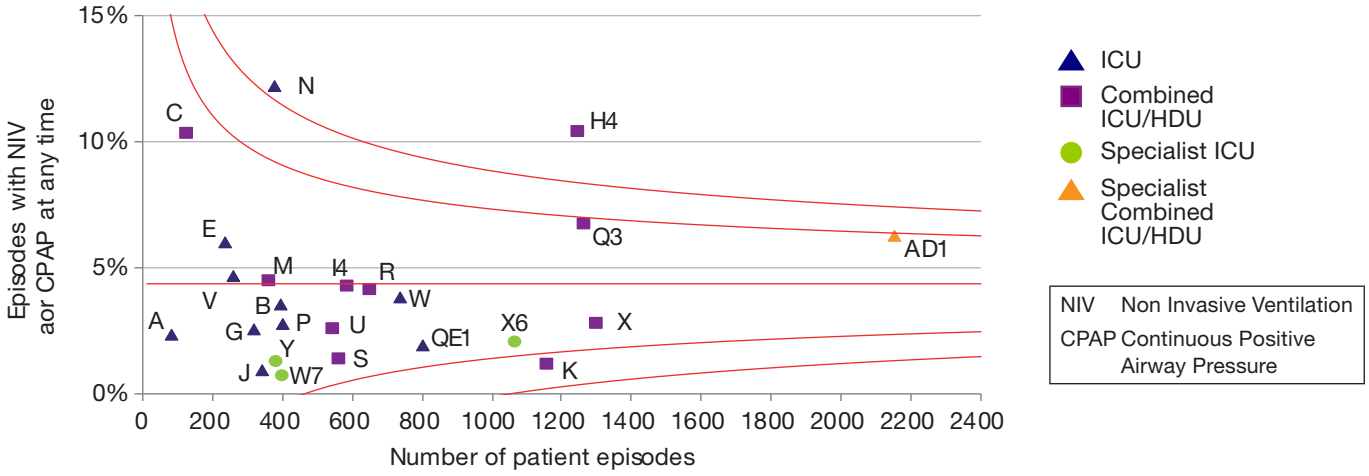


The Scottish percentage average of patients requiring invasive ventilation was 57% in 2018.

Units Y (QEU NICU), W7 (ARI CICU) and X6 (RIE CICU) are all specialist units (Neurosurgery and Cardiac Surgery) where a high level of ventilation may be expected as part of specialist care. Units J (RAH ICU), N (NWD ICU) and QE1 (QEU ICU) are all general ICUs, each having invasive ventilation rates in excess of 80% (and 3 standard deviations). This would suggest that the necessary level of intervention may be higher for the patients at admission and might be a marker of pressure upon the unit, especially if other parameters such as cardiovascular support and renal replacement therapy are similarly more than 2-3 standard deviations above the mean.

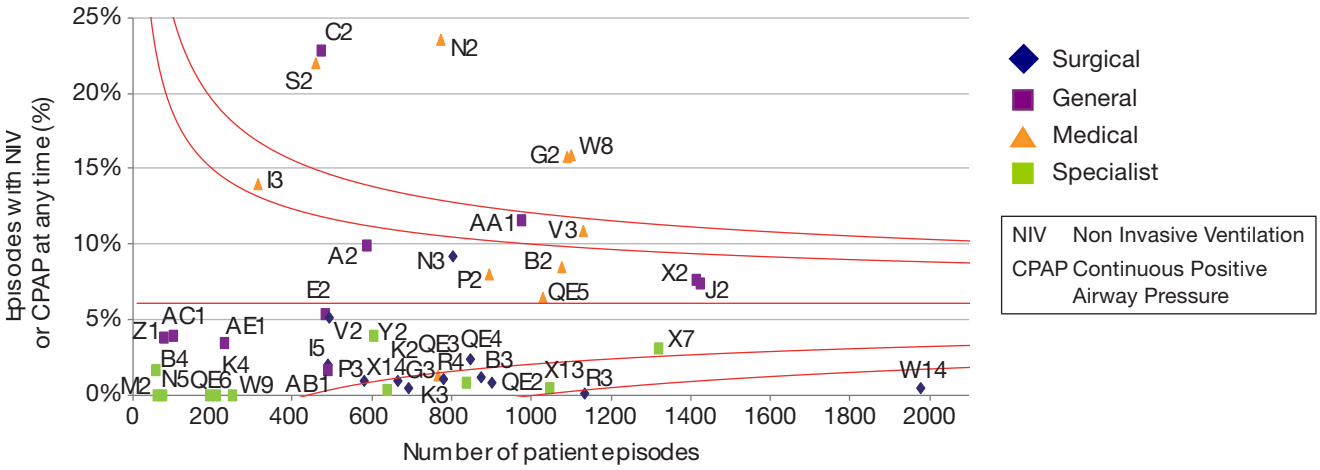
The lower area of the graph is dominated by the combined units where the case mix is generally more level 2 and level 3 patients.

Figure 34 NIV and CPAP rates in ICU and combined units (2018)



The incidence of this method of respiratory support remains low in ICU and combined units, at around 4% in 2018, with combined units dominating the lower part of the chart.

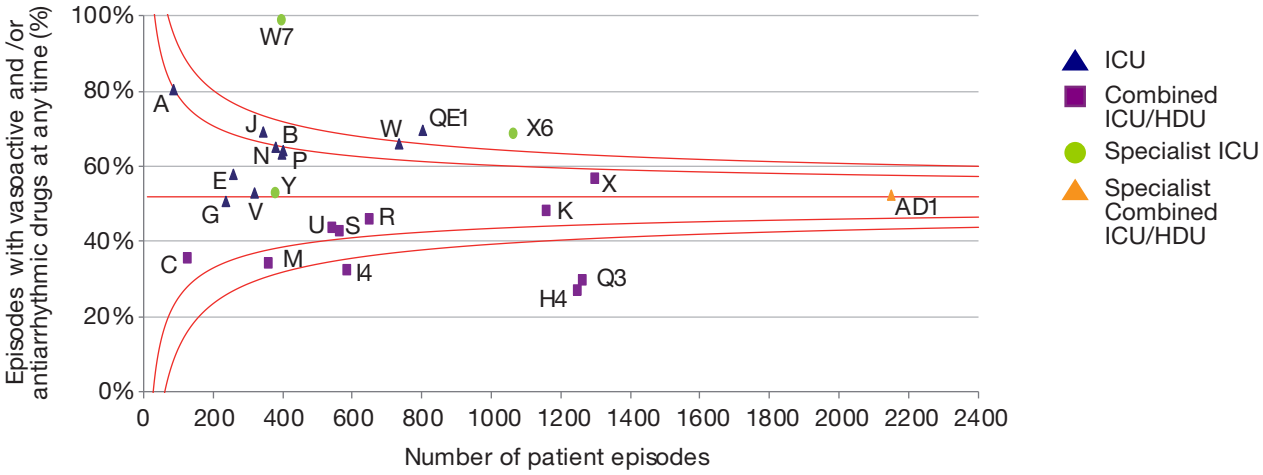
Figure 35 NIV and CPAP rates in HDU (2018)



The proportion of admissions to HDU who received NIV and/or CPAP has remained the same since 2012 at around 6%. The top of the chart is dominated by medical HDUs as would be expected, with 5 out of the 6 3SD unit outliers being medical HDUs. Unit C2 (PRI HDU) is a general unit but with a profile heavily toward medical admissions.

4.3 Cardiovascular support

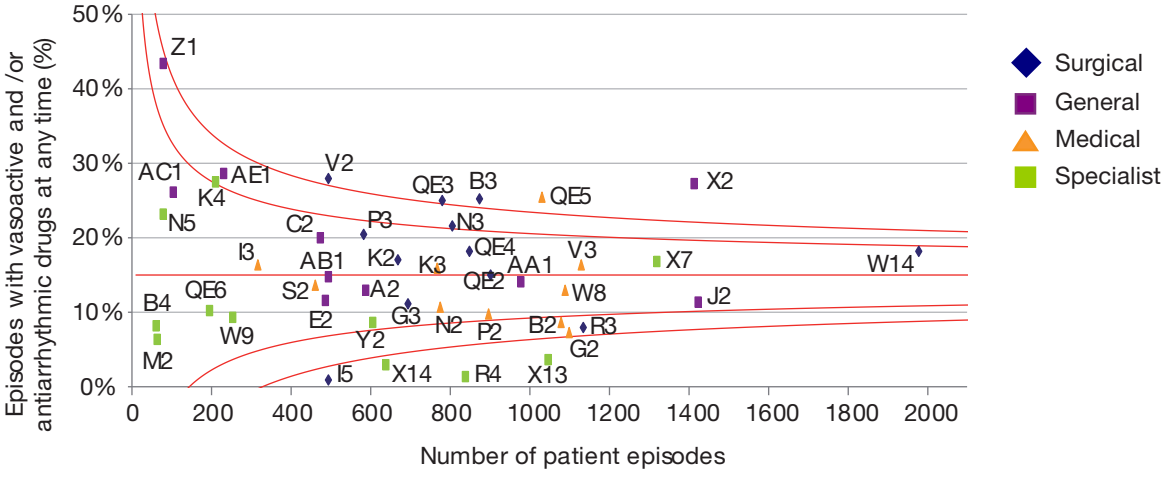
Figure 36 Use of vasoactive and/or antiarrhythmic drugs in ICU and combined units (2018)



The proportion of patient episodes with vasoactive and/or antiarrhythmic drugs in ICU and combined units in 2018 is 50%, similar to the percentage reported in previous years.

Unit W7 (CICU) is an outlier on this chart as expected, this is a specialised Cardiac ITU where the vast majority of patients admitted to this unit, require the use of vasoactive drugs during their stay.

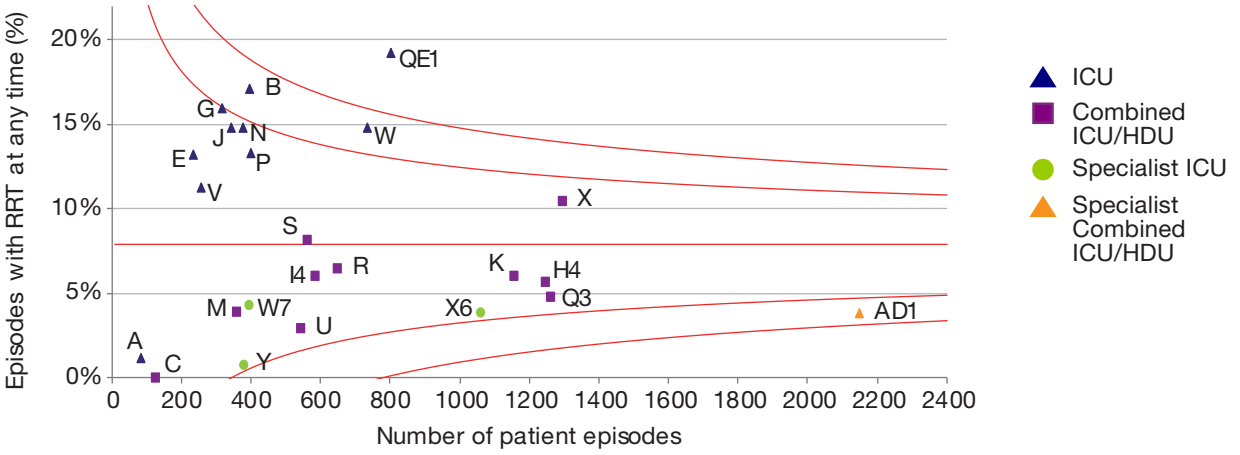
Figure 37 Use of vasoactive and/or antiarrhythmic drugs in HDU (2018)



Use of vasoactive and/or antiarrhythmic drugs in HDU has remained at a similar level to the last few years at 15%.

4.4 Renal support

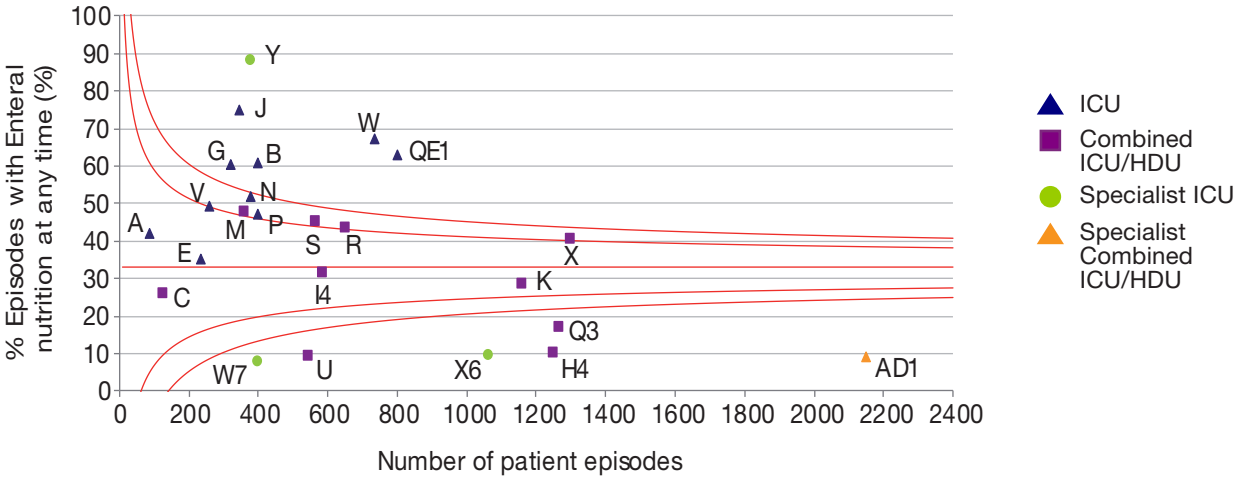
Figure 38 RRT in ICUs and combined units (2018)



The provision of Renal Replacement Therapy (RRT) across Scotland appears static at 8% since 2014. Unit QE1 (QEU ICU) has significantly more episodes with RRT compared to the Scottish mean. There is no evidence to suggest that differences in practice for RRT have any impact on outcomes.

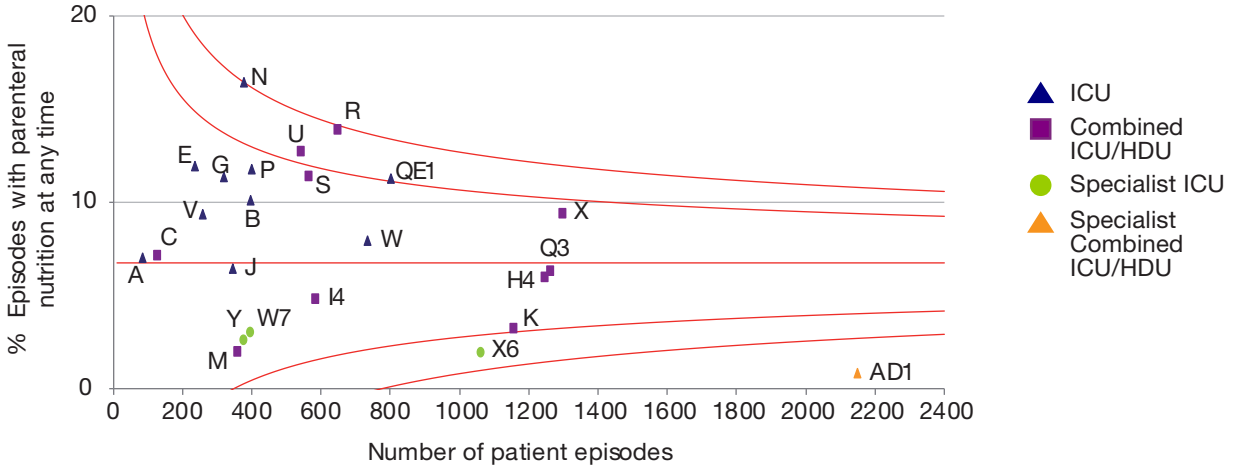
4.5 Nutrition

Figure 39 Enteral nutrition in ICU and Combined Units (2018)



The provision of enteral nutrition in Scotland ICUs was 33% in 2018.

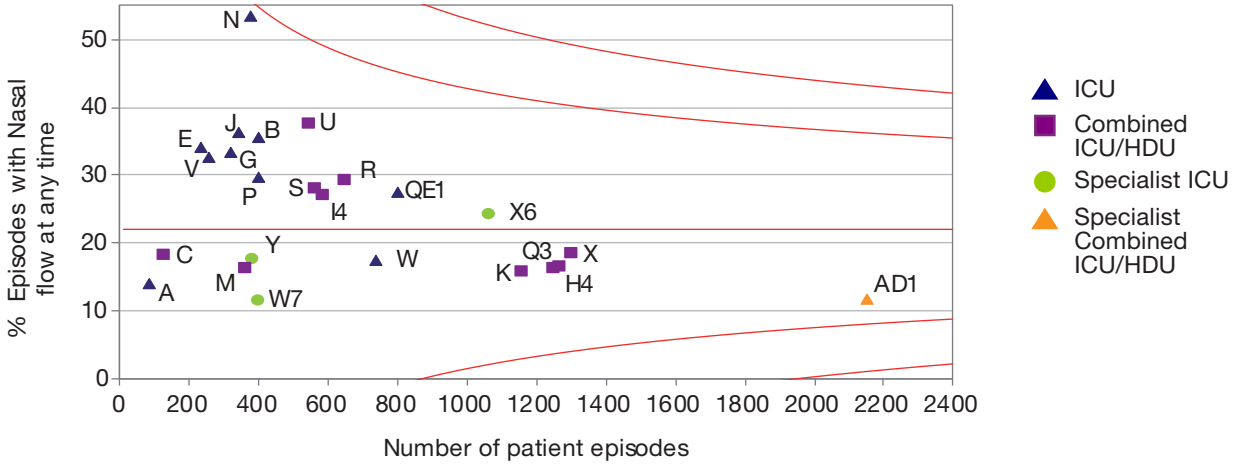
Figure 40 Parenteral nutrition in ICU and combined units (2018)



The provision of parenteral nutrition in Scotland ICUs was 7% in 2018.

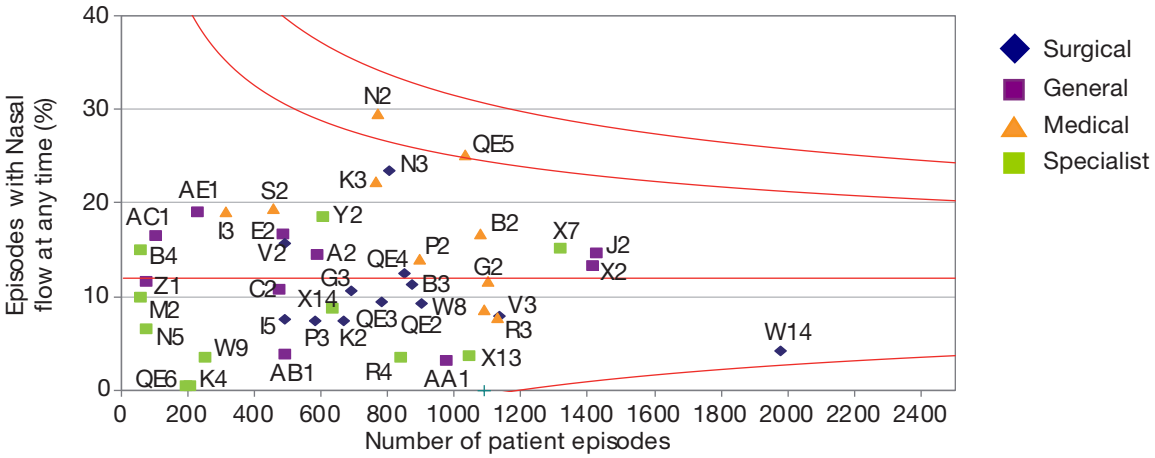
Enteral and parenteral nutrition have been reported for the past few years. These are not part of any quality indicators but by reporting here this should help inform future consultation and developing a quality indicator for nutrition in critical care.

Figure 41 High Flow Nasal given at any point during stay ICUs and combined units (2018)



In 2018 high flow nasal was given in 22% of admissions to ICUs and combined units.

Figure 42 High Flow Nasal given at any point during stay HDUs (2018)



In 2018 high flow nasal was given in 15% of admissions to ICUs and combined units.

Section 5 Surveillance of HAI in Intensive Care Units

5.1 Data collection and patient population

Data collected for the national HAI surveillance programme are presented in this section. Surveillance data were collected from adult patients (16 years or over) with a stay of more than two calendar days in ICU who were admitted to a participating unit between 01/01/2018 and 31/12/2018. It is noted that this represents a different patient population than that presented in the other sections of this report. For the purpose of this report, all units including the combined units will be referred to as ICU.

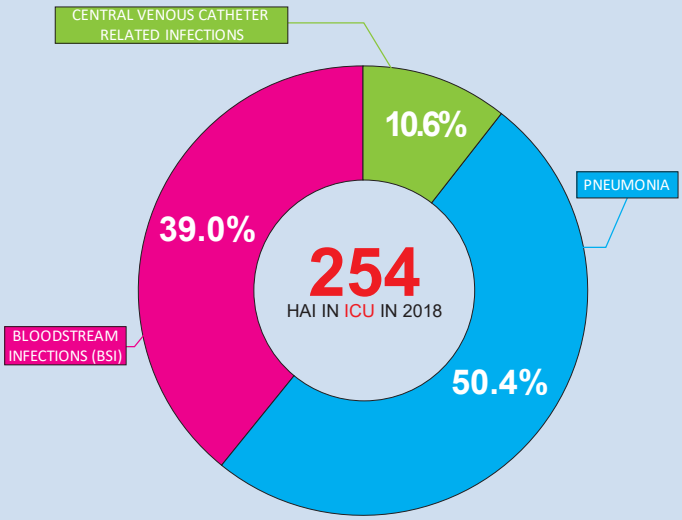
All infections reported were identified in accordance with the European Centre for Disease Prevention and Control (ECDC) surveillance protocol[9]. In addition to these routinely reported HAI, an additional category of ventilator associated pneumonia (VAP) where the x-ray evidence criteria for the case definition are not met/not available, the patient is pyrexial or has an abnormal white cell count, two other symptoms and positive microbiology has been included in the report. This category of VAP was added to allow the reporting of pneumonia where the x-ray evidence required for the case definition was not available. Clinical staff felt that the requirement for radiological evidence was preventing them from reporting VAP and in 2018 WardWatcher was updated to facilitate the reporting of VAP where radiological evidence was not available. This category, pneumonia without radiological evidence is referred to as “PNX” and although these VAP do not meet the ECDC case definition, it was proposed that the data may provide useful information to clinicians regarding the clinical burden of VAP. Data relating to PNX is reported separately and will not be aggregated with the routinely collected VAP data.

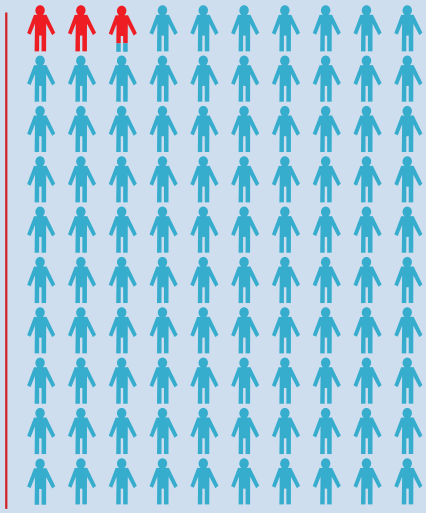
During 2018, a total of 22 units submitted data to the national ICU surveillance programme, this includes all general ICUs, one neuro ICU and one cardiac ICU. Due to the local reorganisation of critical care, one unit was unable to collect data during the first six months of the year and appropriate adjustments to calculations have accounted for this. Where year on year comparisons are made, the results must be interpreted with caution as changes at individual hospitals and units may have resulted in changes to case mix.

HAI in Intensive Care Units

PREVALENCE OF HAI IN ICU IS HIGHER THAN IN OTHER AREAS WITHIN THE ACUTE SETTING, THIS PATIENT GROUP IS AT INCREASED RISK OF INFECTION, THEREFORE HAI IN ICU IS A PRIORITY FOR SURVEILLANCE.

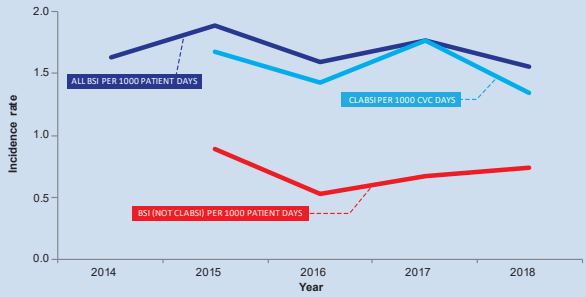
RELATIVE FREQUENCY OF HAI TYPE COLLECTED DURING 2018



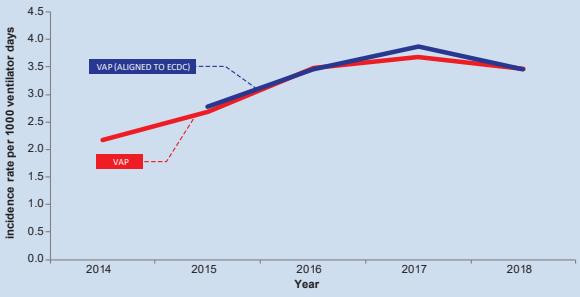


2.6% INCIDENCE OF HAI IN ICU IN 2018.

INCIDENCE RATES OF BSI FROM 2014 TO 2018



INCIDENCE RATES OF VAP FROM 2014 TO 2018



QUALITY IMPROVEMENT AND INTERVENTIONS TO REDUCE HAI IN CRITICAL CARE

- The incidence of HAI in ICU remains at a similar level to that reported from 2017.
- HPS is carrying out an evaluation of the HAI surveillance programme in critical care. The objective of the evaluation study is to identify the strengths and weaknesses of the system which will in turn inform a plan of improvements.
- Work will be carried out to determine how training and support can best be delivered to those collecting data for the surveillance programme.

Health Protection Scotland

NHS National Services Scotland

Healthcare Associated Infections (HAI) Case Definitions[9]

Bloodstream Infection (BSI)

BSI with positive blood culture(s).

Central Line-Associated Bloodstream Infection (CLABSI)

BSI where a central line was in place for at least two days at the day of onset and the onset was at the latest on the second calendar day after first exposure to the central line.

Catheter Related Infection (CRI)

CRI-1: Local infection, pus/inflammation at the insertion site with microbiological evidence.

CRI-2: General CRI, microbiological evidence and clinical symptoms improve on removal of catheter line.

CRI-3: Microbiologically confirmed CLABSI.

Ventilator Associated Pneumonia (VAP)

Pneumonia where an invasive device was present preceding infection, the pneumonia must occur at least one calendar day after intubation (to exclude cases where intubation was used in the treatment of pneumonia) and within two days following the end of intubation.

Pneumonia (PN)

Pneumonia where a patient has not been ventilated within the time parameters defined by VAP.

Pneumonia with no radiological evidence (PN1X-PN4X)

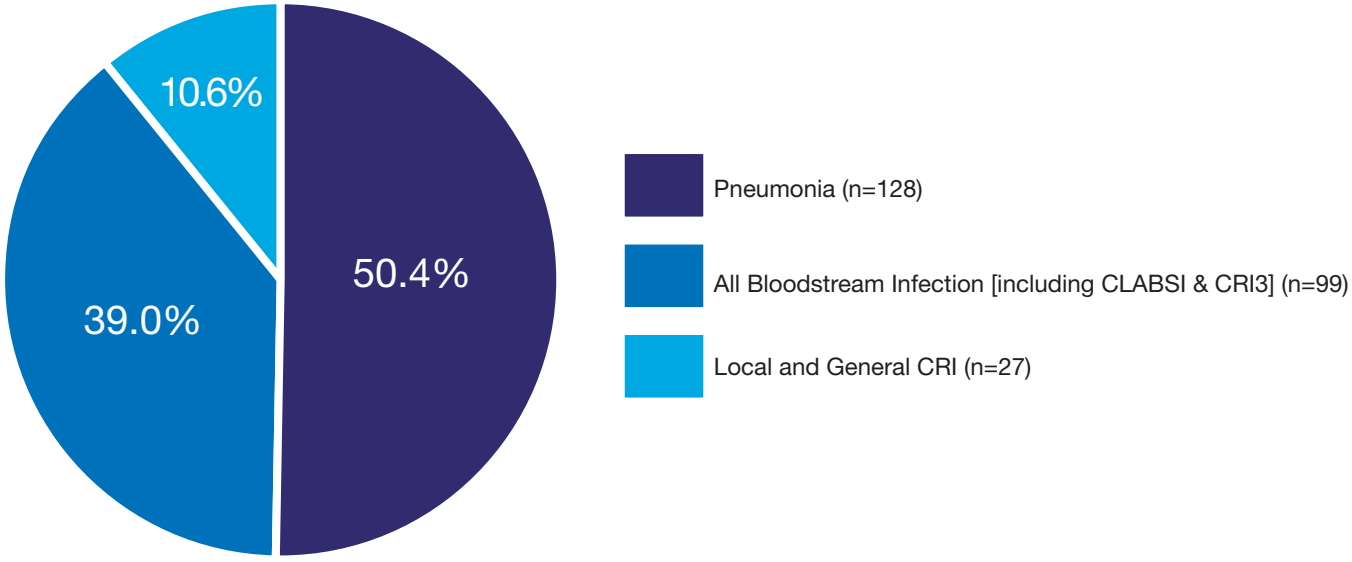
VAP where the x-ray evidence criteria for the case definition are not met/not available, the patient is pyrexial or has an abnormal white cell count, two other symptoms and positive microbiology.

Categories PN1X-PN4X denote the different levels of microbiological testing that can be applied in the PN/VAP case definition.

5.2 The epidemiology of HAI in intensive care

Data were collected from 8866 admissions and in total 254 infections were reported from 234 patients (2.6%, 95% Confidence Interval (CI): 2.3-3.0). As shown in Figure 43, 50.4% of infections were PN, 39.0% were BSI and 10.6% were Local and General CRI.

Figure 43 Percentage of each HAI type reported (n= 254)



Pneumonia

A total of 128 pneumonia were reported from 126 (1.4%, 95% CI: 1.2-1.7) admissions and the incidence of all pneumonia was 2.0 per 1000 patient days. A total of 111 (86.7%) were considered to be VAP§ and the remaining 17 (13.1%) had no invasive respiratory device present in the 48 hours preceding the onset of infection. The incidence rates for pneumonia are summarised in Table 3.

Table 3 Incidence of pneumonia

Invasive respiratory device present¶	Number of pneumonia	Incidence (95% Confidence Intervals)
Yes (VAP)§	111	3.5 per 1000 invasive device days (2.9 - 4.2)
No (non-VAP)	17	0.3 per 1000 patient days (0.2 - 0.4)
All	128	2.0 per 1000 patient days (1.7 - 2.4)

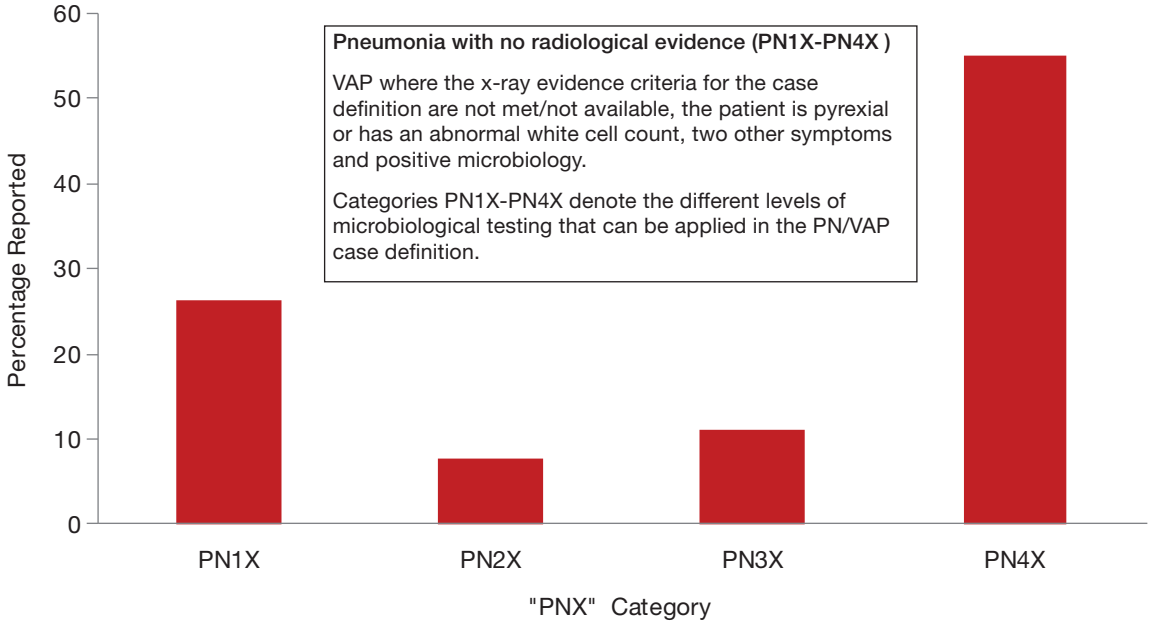
¶ Invasive respiratory device present in the 48 hours preceding the onset of infection.

§ Infections were considered to be VAP if the patient had an invasive respiratory device present in the 48 hours preceding the onset of infection.

Reporting of ventilator associated pneumonia with no radiological evidence (PNX)

The total number of "PNX" reported was 91 and these were reported by 13 units. The distribution of the PN1X-PN4X is shown in Figure 44. Of the PNX reported, the majority (55%) were PN4X and more than 50% of all PNX were reported by one unit. A more detailed analysis of these data and how the PNX case definition is being applied and utilised across the participating ICU will be carried out to determine how useful and reliable these data are.

Figure 44 The distribution of PNX categories reported



Bloodstream Infections (BSI)

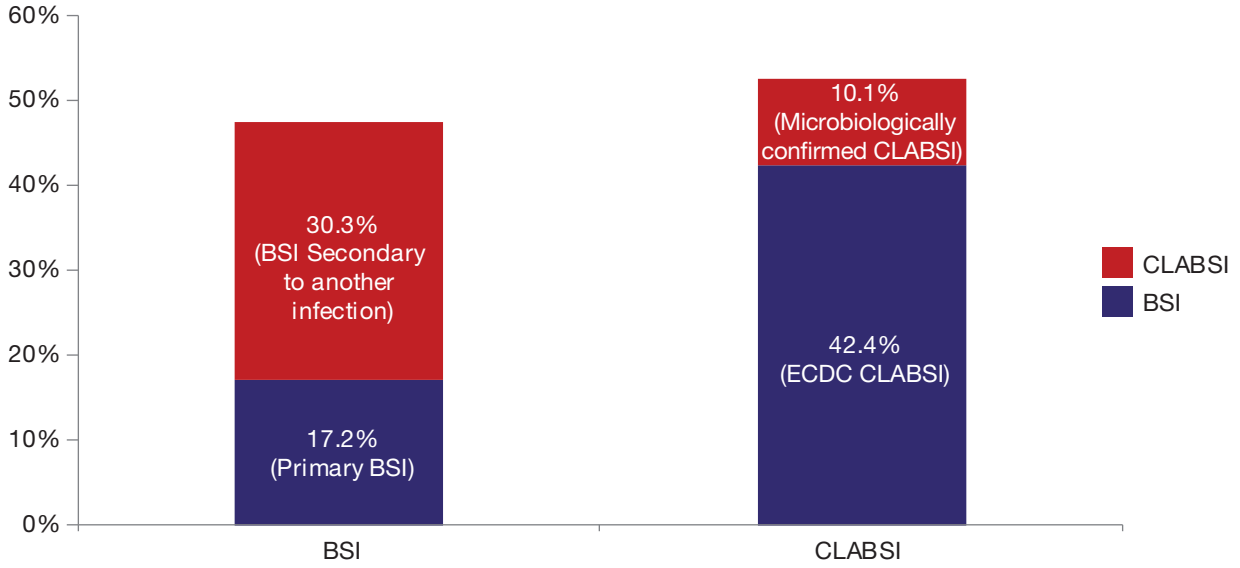
A total of 99 BSI were reported from 95 admissions, (1.1%, 95% CI: 0.9-0.3) and the incidence of all BSI was 1.6 per 1000 patient days. Of the BSI reported, 52 (52.5%) were CLABSI* and the incidence CLABSI was 1.3 per 1000 central venous catheter (CVC) days. Of the remaining 47 BSI, 30 (63.8%) were reported as BSI secondary to another infection. Table 4 shows the incidence of BSI by type and Figure 45 shows the relative proportions of BSI and CLABSI.

Table 4 Incidence of BSI

BSI Type	Number of BSI (%)	Incidence (95% Confidence Intervals)
CLABSI *	52	1.3 per 1000 patient days (1.0-1.8)
BSI	47	0.7 per 1000 patient days (0.5-1.0)
All BSI	99	1.6 per 1000 patient days (1.3-1.9)

* A patient with a BSI must have a central line in place for at least two days at the day of onset and the onset must be, at the latest on the second calendar day after first exposure to the central line or CRI-3 must be reported for the BSI to be defined as a CLABSI[9].

Figure 45 The relative proportions of BSI and CLABSI



CVC related infection (not including CR-BSI)

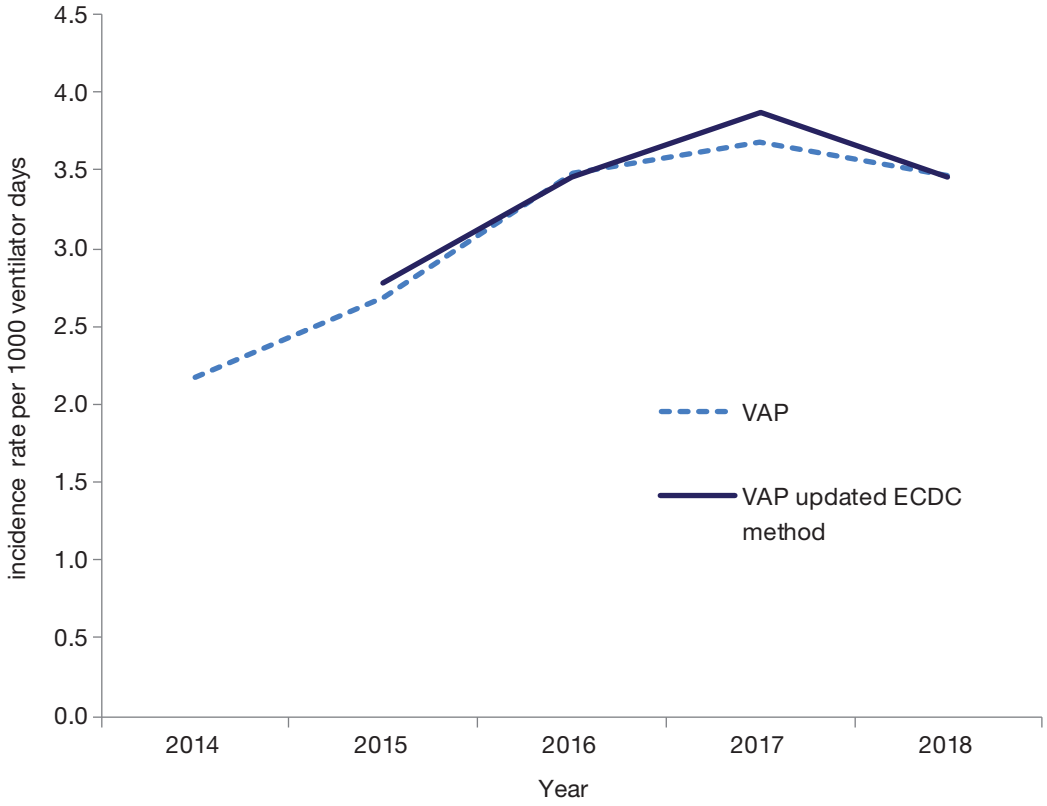
In total, 12 CRI-1 and 15 CRI-2 were reported, the incidence density of CRI-1 and CRI-2 was 0.7 per 1000 CVC days, (95% CI: 0.5, 1.0).

Year on Year Comparison of Incidence

A total of 2.6% of ICU admissions developed an HAI during their stay in ICU. This remains unchanged from 2017 (2.6% versus 2.7%, p=0.9).

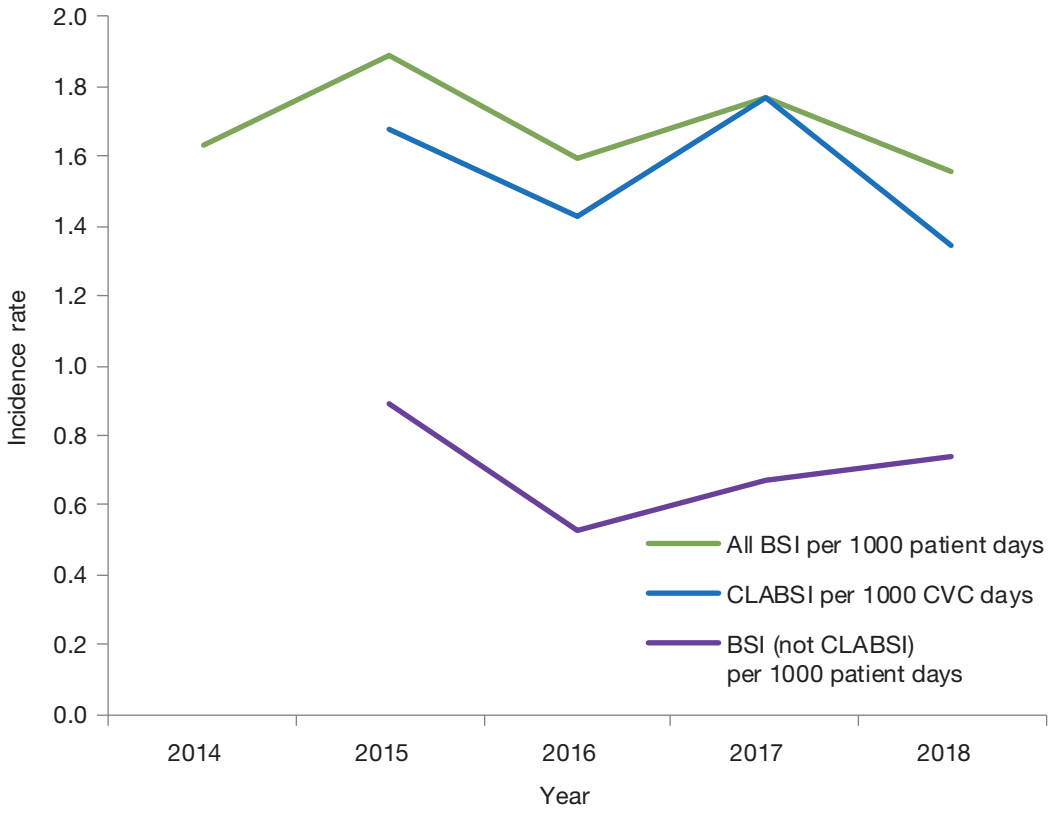
Incidence rates of VAP (aligned to the updated ECDC methodology for analysis[9]) for 2015 - 2018 are shown in Figure 46, as indicated by the solid blue line. The rate of VAP from 2014 - 2018 (as defined previously) is shown by the dashed blue line. Analyses of these data show that VAP has not changed between 2017 and 2018 (p=0.6).

Figure 46 Incidence rate of VAP from 2014-2018



Incidence rates of BSI for 2014 - 2018 are shown in Figure 47, the rate for all BSI (includes all BSI, CLABSI and CRI3) is shown by the green line. The CLABSI rate for 2015 - 2017 (aligned to the updated ECDC methodology for analysis[9]) is represented by the blue line and BSI which do not meet the ECDC definitions for CLABSI are represented by the purple line. Analysis of these data show no change in BSI rates between 2017 and 2018 ($p>0.05$ for all BSI subcategories).

Figure 47 Incidence rates of BSI and CLABSI from 2014 to 2018



Year on year comparison of micro-organisms isolated from HAI

The distribution of the top ten organisms isolated from BSI and pneumonia in 2018 and the corresponding distribution of these organisms in 2017 are shown in Figures 48 and 49. The number of individual organisms reported is small and these data should be interpreted with caution.

Figure 48 shows that a greater number of coagulase-negative staphylococci were reported in 2018, the reason for and significance of this is unclear. Preliminary investigation of these data has highlighted a potential issue in how the BSI case definition is being applied when these organisms are isolated from blood cultures. The data relating to this will be further evaluated and appropriate recommendations will be made.

Figure 48 The distribution of the top ten micro-organisms isolated from BSI in 2018 and the corresponding distribution of these organisms in 2017

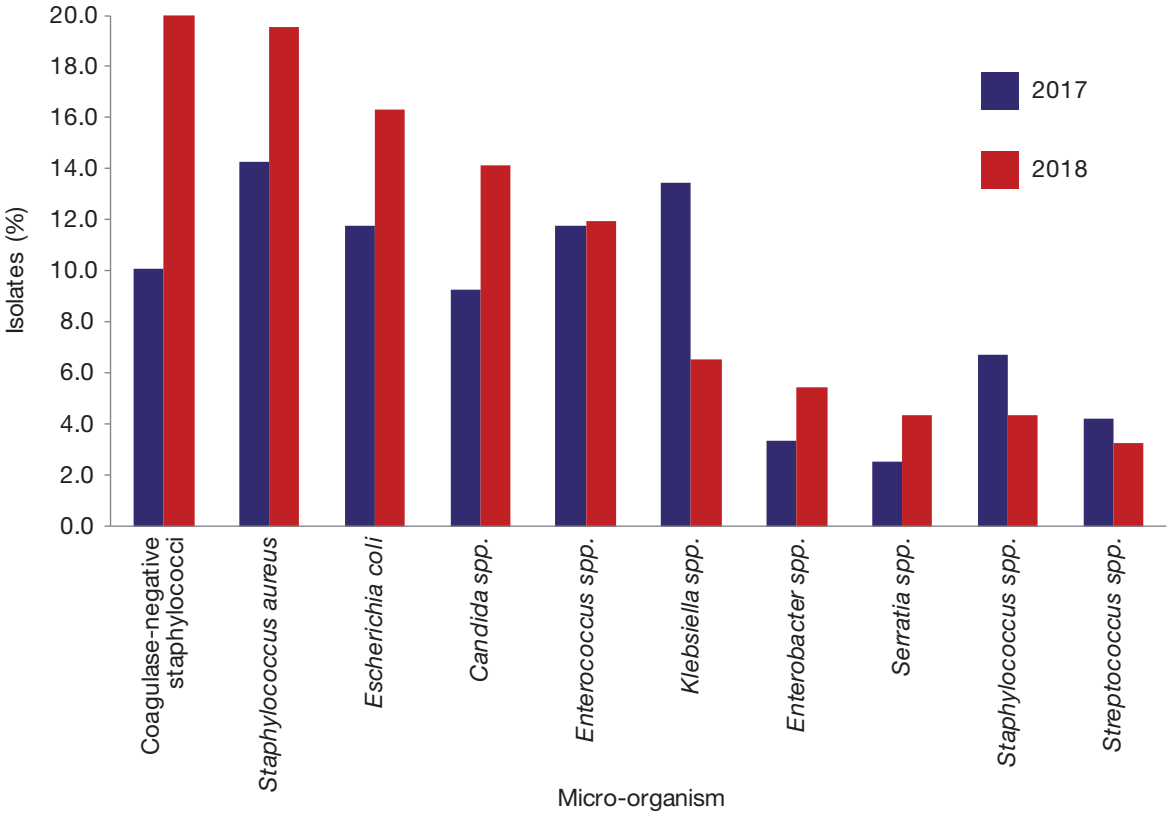
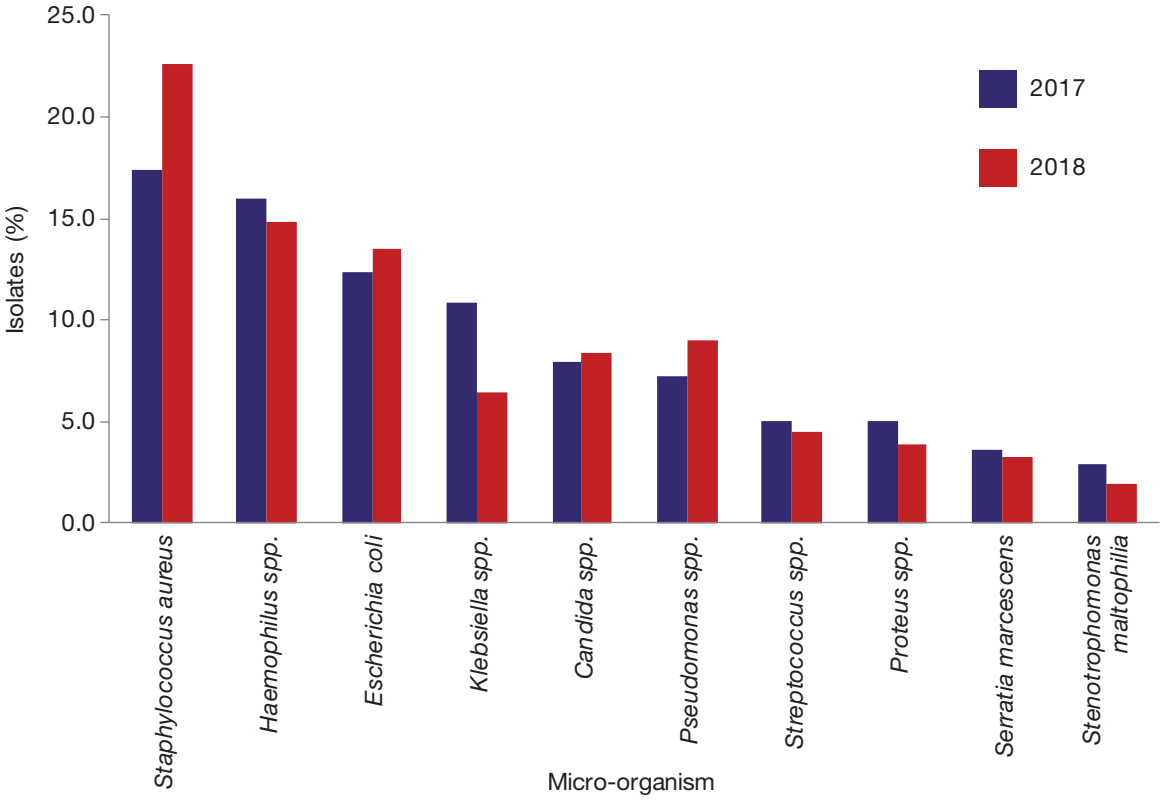


Figure 49 The distribution of the top ten micro-organisms isolated from pneumonia in 2018 and the corresponding distribution of these organisms in 2017



Antimicrobial resistance patterns (AMR) for a number of micro-organisms (based on antimicrobial resistance phenotypes detailed within the original HELICS protocol[10]) are reported through the surveillance system. AMR data were available from 32.7% (n=90) of all isolates. As the number of individual organisms reported is small and data is missing for a large proportion of organisms, we are unable to draw any conclusions relative to AMR in intensive care.

This highlights the need to work towards ensuring that we have better capture of AMR surveillance data using methods such as linking to Electronic Communication of Surveillance in Scotland (ECOSS) data (www.ecoss.scot.nhs.uk). A more complete AMR dataset would allow comparison of ICU patients with the general patient population to identify any potential epidemiological differences.

Evaluation of HAI Surveillance in Intensive Care Units

Health Protection Scotland is carrying out an evaluation of the HAI surveillance programme in critical care. The objective of the evaluation study is to identify the strengths and weaknesses of the system which will in turn inform a plan of improvements to the system.

Numerous aspects of the system will be evaluated including how the objectives of surveillance are being met, the usefulness and acceptability of surveillance, quality and completeness of data, and the timeliness and format of reporting. This will include evaluation of the data quality issues that have been highlighted in regard to coagulase-negative staphylococci, the application of the case definitions and antimicrobial resistance data.

Work will also be carried out in the coming months to determine how training and support can best be delivered to those collecting data for the surveillance programme.

Conclusion

The SICSAG audit remains a comprehensive and ever expanding report of the activity, interventions and outcomes of patients who require critical care in Scotland.

Detailed individual unit level information is presented for scrutiny and to inform the public, health care professionals and managers about the high quality of Scottish critical care. This report provides reassurance that the quality of critical care available within Scotland is of a very high standard. There is, however increasing evidence that some areas of the country lack sufficient numbers of intensive care beds.

The number of units participating in the audit continues to grow as critical care expands to encompass ever more patients. Health Board managers should question why any critical care unit that falls within their remit has not joined this national audit and seek invest and provide sufficient resource to ensure accurate, detailed and timely data collection which will provide units with a rich source of intelligence for planning services and improving care.

The audit has developed into an efficiently co-ordinated, process driven, quality improvement programme that provides data, analysis and feedback. The expressed aims are to constantly raise standards and drive continued improvement in outcomes.

It is evident in this report that there is widespread support, clinical engagement and enthusiasm for ongoing continuous improvement amongst the critical care clinicians who care for those requiring critical care in Scotland.

SICSAG data was used for a total of 23/49 (47%) abstracts/posters accepted for the SICS Annual Meeting in January 2019. There were also a few presentations made during the meeting that used either primary or secondary, data from SICSAG. There were two abstracts that specifically reviewed a unit's own performance from the governance process they had last year following not meeting one of the SICSAG Indicators and that is particularly good to see.

It is encouraging to see the value that the audit provides in critical care out with its core remit.

Stephen Cole

Intensive Care Consultant

SICSAG Chair

Appendix A Complaint Letter

In July 2018 ISD received an anonymous complaint about the Scottish Intensive Care Society Audit of critical care (SICSAG) annual report. The complaint letter requested that Mr Lewis MacDonald, MSP (Convener, Health and Sport Committee, The Scottish Parliament) be given the reply to the complaint. The Head of Profession for Statistics for NHS National Services Scotland (NHS NSS) led the review within ISD and the Office for Statistics Regulation (OSR) have separately investigated the issues raised.

The results of both the internal investigation undertaken by ISD and the investigation undertaken by the OSR have been sent to Mr Lewis MacDonald, MSP.

SICSAG welcomes the response from the ORS and believe it is overall very fair and balanced with some points for us to learn from and seek to improve as a group. SICSAG particularly welcomes the finding that its overall methodology, analysis and reporting in SICSAG "is appropriate, and that the approach taken for handling possible outliers follows international good practice in this area". For further information on the Scottish National Audit Program governance process (see Appendix F).

The report writing group have tried where possible to edit the text in this report to reflect "plain English". Section 5 however remains very technical and, this was discussed by the HPS team who decided to leave the section as it was written. The HAI case definitions are agreed nationally and internationally; any alterations to the technical terms of these definitions could result in a change of meaning or interpretation, which could potentially impact on data validity.

The overall data validation checking which is in place with the quarterly validations, annual validation and Inter-Rater Reliability that already is in practice will be expanded over the coming years. For the first time this year a closer look into the patients who had incomplete apache scoring was undertaken and the results published on page 17, figure 18. This continues to be monitored closely in 2019. In addition, this year we have collated more detailed feedback from the units (section 2.7) on MSQI compliance. We received a reply from the majority of the units with feedback and detail on the actions planned for MSQIs not being met. The units who did not respond, or continue not to comply with the MSQIs will move onto the next stage of the governance process (see Appendix F).

SICSAG seeks to always operate in as transparent manner that good information governance practice and data protection legislation will allow. We take pride in the fact that the audit is a world-leader when reporting individual unit identifiable mortality (SMR) every year. We understand that the audit will be challenged and we welcome the challenges as these help us learn and develop the audit in order that we help critical care units across Scotland deliver excellent care.

Further information can be found on the UK Statistics Authority website.

Dr Stephen Cole and Paul Smith

Appendix B Unit Profiles 2018

The percentages of total nurses that are post registration trained in critical care are presented in this appendix. Units and NHS Boards should scrutinise this appendix to consider their nurse training requirements in critical care set against guidance and quality indicators.

The SICSAG Quality Indicator 1.4 states that “critical care Units should deliver care using only appropriately trained and experienced registered nursing staff”. Whilst it does not specifically define “appropriately trained” it does recognise that “appropriately trained and experienced registered nursing staff is critical care’s greatest asset and it is known to be associated with quality of care and improved patient outcomes”[2].

This MSQI is based on guidance issued from the UK critical care Nursing Alliance (UKCCNA)[11], The Core Standards for Intensive Care[12] and the Guidelines for the Provision of Intensive Care Services (GPICS)[13] that state that 50% of nurses should be in possession of a post registration critical care award. The UKCCNA also clarifies what constitutes a post registration critical care Course which can be legitimately counted by units to meet this target by the following statement;

“Any critical care course commissioned by service providers and considered to meet the previous scope of the ENB 100; courses would need to have included academic and practical components of post registration critical care nurse education and a rigorous assessment process. This does not include short in house courses.”[11]

Table B1 ICUs and combined units Unit Profiles (2018)

Unit	Actual bed	Funded bed	Nurse wte	Trained nurses	Supernu-meracy	microbiologist	Dietetic review
ARI ICU	16	12	97.06	52%	14 shifts	1	2
ARI CICU	6	5	24.03	40%	14 shifts	1	2
Ayr ICU	5	4	27.51	81%	minimum 4 weeks	1	2
BGH ICU/ HDU	9	level 3 x 4, level 2 x 2	31	42%	2-3 weeks	1	2
CRH ICU	7 beds in unit	6 level 3 beds	36.95	38%	4-8 weeks	1	2
DGRI ICU	17	4 level 3, 11 level 2	64.07	30%	4 weeks	7 days	5 days
VHK ICU	10	9	55.4	25%	7 weeks	7	2
FVRH ICU/HDU	19	7 level 3/12 level 2	75.13	69%	2 weeks	2	2
GJNH CICU/ CHDU	22	20/12	105	50%	4 weeks	1	2
GRI ICU / HDU	20	12 level 3 8 level 2	104	78%	3 weeks	1	2
HRM ICU/ HDU	10	5 L3 + 4 L2 April - Nov, increasing to 6 L3 + 4 L2 Dec- Mar	41.56	63%	2 WEEKS	1	2
IRH ICU	2	2	37.66	45%	4 weeks	1	2
MNK ICU/ HDU	10	10 flexible	43.68	30%	2 weeks	1	2
NWD ICU	9	8 Fully Funded Level 3 beds	50.8	88%	4 weeks	1	2
PRI ICU	4 beds	3 level 3	16.9	50%	4 weeks	1	2
QEU ICU	20	18	111	66%	4 weeks	1	2
RAH ICU	8	7	42.02	45%	3-6 weeks	1	2
RGM ICU	8	7	47.75	26%	4 Weeks	1	2
RIE ICU/ HDU	18 beds	L3 - 16 L2 - 2	138	40%	2 weeks	1	2
RIE CICU	11	9 level 3	59.52	80%	4/5 weeks	1	2
SGH NICU	9	6 level 3 beds	37.31	62%	4 - 8 wks, depending on experience	1	2
SJH ICU/ HDU	7	3xL3 & 2XL2 (5)	25.4	100%	4weeks	1	other
WGH ICU/ HDU	16	10x L3 6x L2	73	68%	unchanged	1	2
WSH ICU	5	5.3 -L3	5.7 per level 3 bed	29%	4weeks	1	2
CRH ICU	7	6 LEVEL 3 BEDS	36.95	38%	4-8 weeks	1	2

Notes

1 Currently under review (ICU 2 beds, HDU 4 beds and CCU 11 beds has a total funded establishment of 43.79 wte with current staffing at 48.74 wte)

2 Funded beds increase in winter months.

3 Available beds vary daily from Friday to Tuesday.

* Whole Time Equivalent per level 3 bed.

Table B2 HDUs Unit Profiles (2018)

Unit	Actual bed	funded bed	nurse wte	trained nurses	supernumer-acy	microbiologist	Dietetic review
ARI MHDU	14	10	36.57	78%	13 shifts	1	2
ARI OHDU	2	No separate funding	7.1	100%	2 weeks	1	2
ARI SHDU	18	18	54.35	62%	4 Weeks	1	2
Ayr HDU	4	4	9.56	73%	4 weeks	1	2
BEL HDU	2	2	28.52	13%	2 weeks	on call	WEEK DAYS ONLY
CRH MHDU	12	8 level 2 4 level 1	27.1	41%	2 weeks	1	2
CRH SHDU	12	8 level 2/ 4 level 1	29.28	60%	4 weeks	1	2
DrG HDU	6	This is still under review with the management team	23.54	aiming for 100% at the end of 2019	4 WEEKS	ON CALL FROM ARI	2
VHK SHDU	8	8	26.12	0	4 weeks	2	2
VHK MHDU	8	8	25.17	4%	4-6 weeks	1	2
GBH HDU	2 HDU + 20 gen surg beds	No separate funding	13	75%	2 weeks	By phone from tertiary centre	2
GRI SHDU	8	8	28.65	90%	3 weeks	1	2
GRI MDU	8	8	25.27	70%	3 days	1	2
PRM OHDU	2	0	0	46%	N/A	1	2
HRM MHDU	4	4 level 2 beds	10.32	19%	2 weeks	1	2
IRH HDU	4	4	37.66	45%	4 weeks	1	2
MDGH MHDU	4 LEVEL 2 6 LEVEL 1 12 LEVEL 0	12 AND 6 LEVEL 1* Occupancy is calculated on 4 beds	27	0%	2 WEEKS	1	2
MNK1 HDU	24	6	24	90%	2 weeks	1	2
NWD MHDU	6	6	19.2	86%	2weeks	1	2
NWD SHDU	10	10	32.12	32%	4 weeks	1	2
NWD OHDU	2	No separate funding	No separate funding	100	10 days	1	2
ORK HDU	2	2	10.4	72%	2 weeks	1	2
PRI HDU	4	4	13	22%	1 month	1	2
QEU MHDU	9	Level 2 - 9 Beds	24.43	25%	4 weeks	1	2
QEU OHDU	2	0	91.4	36	5 days or weeks	1	2
QEU HDUs	30	26	84.05	75%	4 weeks	1	2
RAH HDU	12	12	36.45	24	4 weeks	1	2
RGM MHDU	Move to new unit in June 2018 and have increased to 6	6	18.4	0	1 week	1	2

Unit	Actual bed	funded bed	nurse wte	trained nurses	supernumeracy	microbiologist	Dietetic review
RGM SHDU	8 beds FROM 28/10/2018	8level 2	25.86	nil	2-3 weeks	2 plus on call weekends	2
RIE HDU	11	11 level 2	See ICU response	40%	4 weeks	1	2
RIE CHDU	10	8 funded level 2 beds	30.25	58	4 weeks	1 with planned visits Monday + Thursday	2
RIE RTHDU	16	12	45	75%	4 WEEKS	1	2
RIE OHDU	3	no seperate funding	80	All those working in HDU have been through in house training, but this is not accredited.	1-2 weeks	1	2
SGH NHDU	6	6	20.3	68%	12weeks	1	2
SJH ICU/HDU	2	0	n/a	Unsure - not many if any at all	0	1	2
WGH SHDU	10	6L2 4L1	23.5	65%	2 WEEKS	2	2
WGH NHDU	7	4/3	11.2	27%	2 weeks = 6 x 11.5	1	2
WIH HDU	4	0	8	40-50%	4 WEEKS	1	2
WSH SHDU	6.7	6.7	2.86 per level 2 bed	29%	4 weeks	1	2
WSH MHDU	12	6/6	25.3	most are trained to degree level but not critical care	2 weeks	1 via telephone	2

Beds are represented as a total equivalent of funded level 3 beds. Funded level 2 beds are counted as 0.5 of a funded level 3 bed.

Key:
SHDU – Surgical HDU
MHDU – Medical HDU
NHDU – Neurological HDU
CHDU – Cardiothoracic HDU
OHDU – Obstetric HDU
RHDU – Renal HDU
RTHDU – Renal Transplant HDU

Notes

1 Staff rotate from the general ward; two trained nurses are allocated to HDU every shift.

2 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on two beds in this unit.

3 Currently under review (ICU 2 beds, HDU 4 beds and CCU 11 beds has a total funded establishment of 43.79 wte with current staffing at 48.74 wte).

4 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on one bed in these units.

5 Level 0 patients are excluded from the occupancy calculations for this unit.

Quality Indicator

* Whole time equivalent per level 2 bed.

Appendix C Number of annual admissions

Table C1 Number of annual admissions to ICU and ICU/HDU units (2009-2018)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NHS Ayrshire & Arran										
Ayr ICU	330	292	252	268	243	255	270	223	238	235
Crosshouse ICU	294	305	319	302	276	269	287	273	307	319
NHS Borders										
BGH ICU/HDU	397	429	506	600	579	586	561	543	526	542
NHS Dumfries & Galloway										
DGRI ICU	285	298	293	314	323	286	313	301	299	
DGRI ICU/HDU1									84	1246
NHS Fife										
QMH ICU	437	439	449	22						
VHK ICU				394	453	428	407	391	398	398
NHS Forth Valley										
FVRH ICU/HDU			577	1189	1159	1260	1308	1264	1193	1263
SRI ICU	378	411	214							
NHS Grampian										
ARI ICU	717	748	665	676	821	765	669	655	712	736
ARI CICU					279	483	453	458	443	394
NHS Greater Glasgow and Clyde										
GRI ICU/HDU	426	461	793	952	1060	973	1056	1199	1210	1156
IRH ICU	82	120	150	138	137	130	112	100	111	86
RAH ICU	360	433	402	374	359	346	369	360	343	345
QEUH Neuro ICU	289	278	282	264	232	279	103	0		
QEUH Neuro HDU	461	451	395	347	377	437	456	411	383	376
Stobhill ICU	202	155	40							
VI ICU	317	298	280	284	289	246	99			
WIG ICU	495	485	475	393	421	391	136			
QEU ICU							497	842	839	802
NHS Highland										
Raigmore ICU	429	433	383	423	433	404	374	374	404	400
NHS Lanarkshire										
Hairmyres ICU/HDU	560	562	583	558	615	565	619	673	655	563
MDGH ICU	252	225	273	267	307	298	308	93		
MDGH ICU/HDU								471	593	583
Wishaw ICU	222	229	237	212	235	257	259	270	256	258
NHS Lothian										
RIE ICU/HDU	968	1110	1177	1230	1236	1267	1262	1297	1250	1296
RIE CICU			188	926	1011	1038	1023	1039	1061	1059
SJH ICU/HDU	465	424	444	452	458	387	371	365	386	359
WGH ICU/HDU	831	735	705	647	676	721	633	667	710	649
NHS National Waiting Times Centre										
Golden Jubilee National Hospital ICU/ HDU[1]				1318	2223	2255	2084	2130	2155	2150
NHS Tayside										
Ninewells ICU	386	357	349	417	378	391	368	386	383	379
PRI ICU/HDU[2]	136	122	119	140	124	166	132	123	132	126
Total	**9719**	**9800**	**10550**	**13107**	**14704**	**14883**	**14529**	**14908**	**15071**	**15720**
Total (excluding specialist units)	**9258**	**9349**	**9967**	**10516**	**10814**	**10670**	**10513**	**10870**	**11029**	**11741**
Total (same 13 units)	**6280**	**6399**	**6330**	**6432**	**6588**	**6523**	**6351**	**6327**	**6408**	**6285**

Notes:

1. Golden Jubilee have two ICUs and two HDUs but for the purpose of this audit are reported as one ICU/HDU ICU/HDU.
2. In June 2018 Perth ICU became a combined unit.

NHS Boards
Shaded areas refer to periods with incomplete data collection
Combined Unit

Key:

CICU – Cardiothoracic ICU

NICU – Neurological ICU

Table C2 Number of annual admissions to HDUs (2009-2018)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NHS Ayrshire and Arran										
Ayr HDU	527	498	487	469	474	498	500	484	447	485
Crosshouse MHDU	974	1033	1103	1193	1201	1102	1053	1084	1084	1099
Crosshouse SHDU	711	644	641	644	669	723	754	740	698	692
NHS Borders										
BGH Surgical (Level 1)	339	254								
NHS Dumfries and Galloway										
DGRI MHDU	392	431	418	437	431	456	434	395	376	
DGRI SHDU	804	854	731	788	824	868	759	736	773	
NHS Fife										
QMH SHDU	840	816	813	34						
QMH MHDU		525	724	37						
QMH RHDU			155							
Victoria Hospital SHDU				817	903	883	941	872	845	874
Victoria Hospital MHDU				937	1088	1084	1136	1104	999	1078
Victoria Hospital RHDU[1]				159	210	202	224	163	187	60
VHK Medical HDU (old unit)		429	444							
NHS Forth Valley										
Stirling HDU	963	992	558							
NHS Grampian										
ARI SHDU (Ward 503)	623	714	630	575	609	654	619	471	120	
ARI SHDU (Ward 506)	780	814	868	892	856	871	802	845	229	
ARI MHDU							575	1091	1040	1089
ARI OHDU								122	321	252
ARI SHDU									1407	1977
Dr Gray's HDU	797	1083	1169	1069	1068	986	950	1007	973	977
NHS Greater Glasgow and Clyde										
GRI Princess OHDU							95	235	248	210
QEU SHDU1							590	946	963	901
QEU SHDU2							494	824	914	780
QEU SHDU6							406	739	945	849
QEU MHDU							607	1101	1104	1031
QEU OHDU								76	238	194
GRI SHDU	1053	1026	765	629	621	650	624	647	659	667
GRI MHDU				533	671	679	720	735	726	767
IRH SHDU	266	432	469	439	485	526	479	550	569	587
RAH HDU	1289	1339	1459	1497	1418	1414	1453	1486	1481	1424
SGH SHDU	870	807	693	711	692	696	228			
QEU NHDU	660	647	621	594	637	706	681	594	602	605
Stobhill SHDU	337	287	58							
VI SHDU	636	700	812	847	873	835	317			
GGH HDU	882	904	755	755	761	806	304			
WIG HDU		75	413	438	427	443	123			
NHS Highland										
Raigmore MHDU	730	811	803	743	774	804	806	728	968	896
Raigmore SHDU	677	669	669	653	657	629	595	636	582	582
Belford HDU			74	78	114	100	63	101	108	103

Table C2 Number of annual admissions to HDUs (2009-2018)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NHS Lanarkshire										
Hairmyres MHDU			274	375	254	223	385	415	391	460
MDGH SHDU	593	569	565	588	618	592	574	164		
MDGH MHDU	56	278	283	377	438	406	452	425	358	316
MDGH L1								400	424	492
Wishaw SHDU	602	532	546	571	526	488	498	520	481	493
Wishaw MHDU				265	1245	1188	1172	1245	1171	1130
NHS Lothian										
RIE HDU	1390	1369	1366	1377	1329	1300	1282	1305	1434	1414
RIE RHDU	632	674	675	634	650	682	715			
RIE THDU	306	345	296	325	375	392	368			
RIE Vascular (Level 1)	112	452	378	372	330	331	341	361		
RIE CHDU			214	1118	1223	1249	1303	1403	1402	1320
RIE RTHDU								822	1064	1046
RIE OHDU									557	637
SJH OHDU2										61
WGH SHDU	1126	1119	1136	1112	1115	1160	1184	1094	1129	1133
WGH NHDU	285	404	476	431	481	493	480	469	654	837
WGH Neurological (Level 1)		52	418	364	475	469	432	419	111	
NHS Orkney										
Balfour HDU				78	138	258	277	267	230	230
NHS Shetland										
GBH HDU	49	58	74	65	77	69	66	54	63	78
NHS Tayside										
Ninewells SHDU	742	754	794	784	816	812	842	846	837	804
Ninewells MHDU	558	641	673	743	709	782	829	839	832	774
Ninewells OHDU[3]						822	915	716	75	77
Perth HDU	644	618	625	659	612	576	516	525	558	473
NHS Western Isles										
WIH HDU	145	414	448	417	301	344	414	496	482	492
Total	**22390**	**25063**	**25573**	**26623**	**28175**	**29251**	**30377**	**31297**	**31859**	**30446**
Total (13 units)	**10572**	**10585**	**10543**	**10419**	**10400**	**10443**	**10356**	**10223**	**10542**	**10352**

Notes:

1. Fife renal are no longer contributing to the SICSAG audit.
2. Unit joined August 2018.
3. The patients included in the audit have changed from previous years, with all level 0 and some level 1 patients not recorded in the audit from 2017.

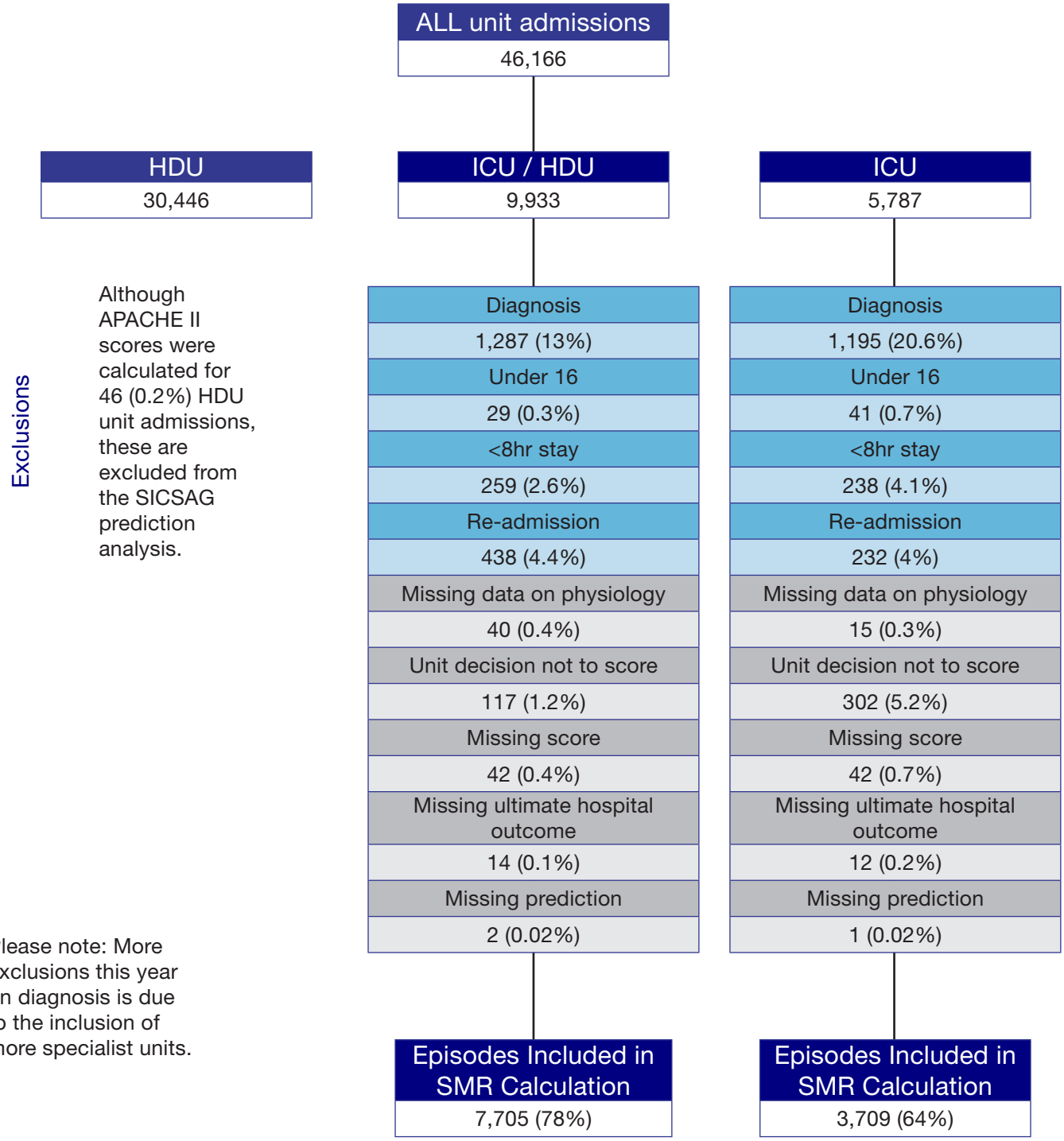
NHS Boards

Shaded areas refer to periods with incomplete data collection

Key:

SHDU – Surgical HDU
MHDU – Medical HDU
NHDU – Neurological HDU
CHDU – Cardiothoracic HDU
RHDU – Renal HDU
OHDU – Obstetrics HDU
RTHDU – Renal Transplant DHDU

Appendix D Eligibility for APACHE II scores and selection for analysis (2018)



Please note: More exclusions this year on diagnosis is due to the inclusion of more specialist units.

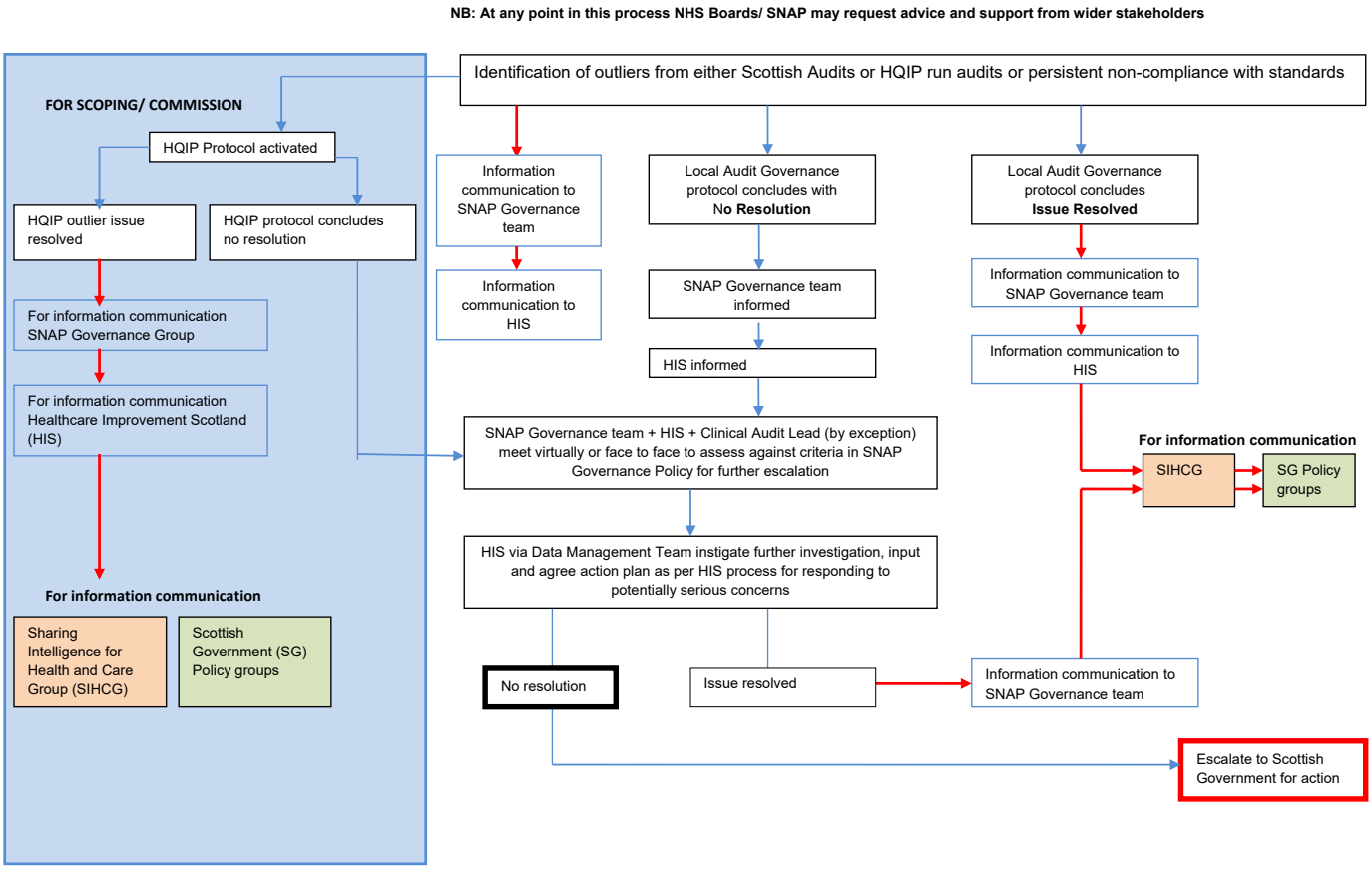
Appendix E Unit Key (2018)

Health Board	Funplot Label	ICU or HDU
Ayrshire & Arran	E Ayr ICU	ICU
Ayrshire & Arran	E2 Ayr HDU	HDU
Ayrshire & Arran	G Crosshouse ICU	ICU
Ayrshire & Arran	G2 Crosshouse MHDU	HDU
Ayrshire & Arran	G3 Crosshouse SHDU	HDU
Borders	U BGH ICU/HDU	ICU/HDU
Dumfries & Galloway	H4 DGRI ICU/HDU	ICU/HDU
Fife	B VHK ICU	ICU
Fife	B3 VHK SHDU	HDU
Fife	B2 VHK MHDU	HDU
Fife	B4 VHK RHDU	HDU
Forth Valley	Q3 FVRH ICU/HDU	ICU/HDU
Grampian	W ARI ICU	ICU
Grampian	W7 ARI CICU	ICU
Grampian	W8 ARI MHDU	HDU
Grampian	W9 ARI OHDU	HDU
Grampian	AA1 Dr Grays HDU	HDU
Grampian	W14 ARI SHDU	HDU
Greater Glasgow & Clyde	K GRI ICU / HDU	ICU/HDU
Greater Glasgow & Clyde	K2 GRI SHDU	HDU
Greater Glasgow & Clyde	K3 GRI MDU	HDU
Greater Glasgow & Clyde	K4 PRM OHDU	HDU
Greater Glasgow & Clyde	A IRH ICU	ICU
Greater Glasgow & Clyde	A2 IRH HDU	HDU
Greater Glasgow & Clyde	QE1 QEU ICU	ICU
Greater Glasgow & Clyde	QE2 QEU HDU1	HDU
Greater Glasgow & Clyde	QE3 QEU HDU2	HDU
Greater Glasgow & Clyde	QE4 QEU HDU6	HDU
Greater Glasgow & Clyde	QE5 QEU MHDU	HDU
Greater Glasgow & Clyde	QE6 QEU OHDU	HDU
Greater Glasgow & Clyde	J RAH ICU	ICU
Greater Glasgow & Clyde	J2 RAH HDU	HDU
Greater Glasgow & Clyde	Y QEU NICU	ICU
Greater Glasgow & Clyde	Y2 QEU NHDU	HDU
Highland	AC1 Belford HDU	HDU
Highland	P Raigmore ICU	ICU
Highland	P2 Raigmore MHDU	HDU
Highland	P3 Raigmore SHDU	HDU
Lanarkshire	S Hairmyres ICU/HDU	ICU/HDU
Lanarkshire	S2 Hairmyres MHDU	HDU
Lanarkshire	I3 MDGH MHDU	HDU
Lanarkshire	I4 MNK ICU/HDU	ICU/HDU
Lanarkshire	I5 MNK level 1 HDU	HDU
Lanarkshire	V Wishaw ICU	ICU
Lanarkshire	V2 Wishaw SHDU	HDU

Health Board	Funplot Label	ICU or HDU
Lanarkshire	V3 Wishaw MHDU	HDU
Lothian	X RIE ICU/HDU	ICU/HDU
Lothian	X2 RIE HDU	HDU
Lothian	X6 RIE CICU	ICU
Lothian	X7 RIE CHDU	HDU
Lothian	X13 RIE RTHDU	HDU
Lothian	X14 RIE OHDU	HDU
Lothian	M SJH ICU/HDU	ICU/HDU
Lothian	R WGH ICU/HDU	ICU/HDU
Lothian	R3 WGH SHDU	HDU
Lothian	R4 WGH NHDU	HDU
Lothian	M2 SJH OHDU	HDU
National Waiting Times Centre	AD1 GJNH CICU/CHDU	ICU/HDU
Orkney	AE1 Balfour HDU	HDU
Shetland	Z1 GBH HDU	HDU
Tayside	N Ninewells ICU	ICU
Tayside	N2 Ninewells MHDU	HDU
Tayside	N3 Ninewells SHDU	HDU
Tayside	N5 Ninewells OHDU	HDU
Tayside	C PRI ICU/HDU	ICU/HDU
Tayside	C2 PRI HDU	HDU
Western Isles	AB1 WIH HDU	HDU
Tayside	N	Ninewells ICU
Tayside	N2	Ninewells MHDU
Tayside	N3	Ninewells SHDU
Tayside	N5	Ninewells OHDU
Western Isles	AB1	WIH HDU

Appendix F Scottish National Audit Programme (SNAP) Escalation Policy

Identification and Management of outlier and potentially serious concerns in Scottish audits



References

1. The Scottish Government (2012) 2020 Vision. Available at: https://www.gov.scot/Topics/Health/Policy/2020-Vision [Last accessed: 26/07/2018].
2. SICSAG (2015) Minimum Standards and Quality Indicators for critical care in Scotland. Version 3.0, December 2015. Available at: http://www.sicsag.scot.nhs.uk/quality/20151215-Quality-Indicators-Booklet-V3-0.pdf [Last accessed: 26/07/2018].
3. HQIP (2011) Guide to Ensuring Data Quality in Clinical Audits - Clinical audit tool to promote quality for better health services. Available at: https://www.hqip.org.uk/resource/hqip-guide-to-ensuring-data-quality-in-clinical-audits/ [Last accessed: 26/07/2018].
4. Vollam S & Dutton S et al (2018) Out of hours discharge from intensive care, in hospital mortality and intensive care readmission rates: a systematic review and meta analysis, Intensive Care Med, 44:1115–1129.
5. Tobin AE & Santamaria JD (2006) After-hours discharges from intensive care are associated with increased mortality. Med J Aust, 184:334-7.
6. Goldfrad C & Rowan K (2000) Consequences of discharges from intensive care at night. Lancet, 355:1138-42.
7. Royal College of Obstetricians & Gynaecologists (2011) Providing Equity of Critical and Maternity Care for the Critically Ill Pregnant or Recently Pregnant Woman Available at; https://www.oaa-anaes.ac.uk/assets/_managed/cms/files/Maternal_Critical_Care.pdf [Last accessed: 14/06/2019].
8. Royal College of Anaesthetists (2018) 'Enhanced Maternal Care Guidelines 2018' Available at; https://www.rcoa.ac.uk/news-and-bulletin/rcoa-news-and-statements/enhanced-maternal-care-guidelines-2018 {Last accessed 15/07/19}
9. European Centre for Disease Prevention and Control (ECDC) (2017) Surveillance of healthcare associated infections and prevention indicators in European intensive care units. ECDC, Stockholm: 2017. Available at: http://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/healthcare-associated-infections-HAI-ICU-protocol.pdf [Last accessed 20/06/2019].
10. Hospitals in Europe Link for Infection Control through Surveillance (HELICS) (2004) Surveillance of Nosocomial Infections in Intensive Care Units. Protocol Version 6.1.
11. UK Critical Care Nursing Alliance (UKCCNA) (2017) Guidance by the UK Critical Care Nursing Alliance (UKCCNA.) What constitutes a post registration Critical Care Course from 2002 – 2012. Date of Issue September 2015 Review Date: September 2017. Available at: https://www.noeccn.org.uk/resources/Documents/Education%20Group/Standards/Guidance_on_Post_Registration_Critical_Care_Courses_from_2002_-_2012.pdf
12. The Faculty of Intensive Care Medicine (FICM) (2013) Core Standards for Intensive Care Units, Edition 1 / 2013, FICM. Available at: https://www.ficm.ac.uk/sites/default/files/Core Standards for ICUs Ed.1 (2013).pdf
13. The Faculty of Intensive Care Medicine (FICM) Guidelines for the Provision of Intensive Care Services, Edition 1 / 2015, FICM. Available at: https://www.ficm.ac.uk/sites/default/files/GPICS - Ed.1 %282015%29_0.pdf

14. W. D. Ngan Kee, Confidential Enquiries into Maternal Deaths: 50 years of closing the loop, BJA: British Journal of Anaesthesia, Volume 94, Issue 4, April 2005, Pages 413–416, https://doi.org/10.1093/bja/aei069

15. National Maternity and Perinatal Audit, Maternity Admissions to Intensive Care in England, Wales and Scotland in 2015/16. Available at: https://maternityaudit.org.uk/FilesUploaded/NMPA%20Intensive%20Care%20sprint%20report.pdf {last accessed 17th July 2019}

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www.scottishintensivecare.org.uk