NHS National Services Scotland

SICS
scottish intensive care society

Audit of Critical Care in Scotland 2015
Reporting on 2014

Contents

Foreword

This report describes the activities and outcomes for Scottish Intensive Care Units (ICU) and High Dependency Units (HDU) in 2014. It is a continuation of the original critical care outcomes audit and has covered an ever expanding national dataset since 1995.

The Scottish Intensive Care Society Audit Group (SICSAG) is a national Critical Care audit, funded through Public Health and Intelligence, NHS National Services Scotland. We exist to improve the quality of care that is delivered to critical care patients across Scotland by continuous monitoring and comparing activities and outcomes. We are also closely aligned with the Scottish Government's strategic vision for healthcare quality in Scotland and the 2020 Vision[1].

This national audit seeks to inform the public and healthcare professionals and provides transparent quality assurance about the outcomes and the quality of care for this group of critically ill patients.

We continue our close collaboration with Health Protection Scotland (HPS) to collect, analyse and report on Healthcare Associated Infection (HAI) Surveillance across Scottish ICUs. For the first time we are able to report jointly reflecting the importance of continuous surveillance of healthcare associated infection as a marker of quality within critical care.

The continued expansion of the audit together with the increasing number of units now participating means that for 2014 we report on over 45,000 of our hospitals' sickest patients.

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

One of the signs of a successful programme is that other Critical Care areas seek to join and become part of the transparent Critical Care Audit in Scotland. I am pleased to report that this continues to be the case this year and that we have started to collect additional data from critically ill obstetric patients to be reported on next year.

Measures of success include the reporting of professionally agreed Standards and Quality Indicators across Critical Care in Scotland[2]. We report for the third year in a detailed and transparent way on adherence to these.

We will continue to support units through the publication of data in order to improve both patient care and patient experience in Critical Care Units across Scotland.

I note for the first time that some units are struggling with the provision of time to collect data and would urge Boards to continue to provide the necessary support required to ensure that they are able to participate in this quality assurance programme.

The continued success of the audit would not be possible without the ongoing commitment, support and hard work of the entire Scottish Critical Care clinical community.

Particular thanks go to the SICSAG steering group, Paul Smith (National Clinical Coordinator), Lorraine Smyth (Senior Information Analyst), Clare McGeoch (Quality Assurance Manager), Roselind Hall (Regional Coordinator), and the network of Local Audit Leads and Team Coordinators.

The annual conference held in conjunction with the Scottish Critical Care Trials Group will take place this year on 3rd and 4th September 2015, details of this and further data are available at www.sicsag.scot.nhs.uk.

Dr Stephen Cole

Chairman

Introduction

2014 has seen SICSAG continue to work within the Scottish Critical Care community and other NHS bodies to promote person-centred care with the focus on safety and improved quality of care and outcomes as set out in the Healthcare Quality Strategy for NHS Scotland 2010[3] and 2020 Vision[1].

This year a milestone was reached with the SICSAG annual report being published in collaboration with critical care HAI data from Heath Protection Scotland (HPS). This is a significant move forward in the collaborative working relationships towards person-centred quality care for critical care patients in Scotland.

This year we are reporting on the management of 14,884 patients admitted to ICU and Combined Units (units with a combination of ICU and HDU beds) and 30,322 patients admitted to HDU during 2014. This report summarises data that have been collected via a bespoke electronic database (WardWatcher), within Critical Care Units in Scotland. The format of the report starts with units compliance with Quality Indicators/Minimum Standards and then follows the patient's journey through to activity, level of care, interventions and outcomes. Data is presented in tables and charts with accompanying text to alert the reader to points of interest.

The information presented is for comparative benchmarking to highlight differences and inform quality improvement and is not intended as a judgement of what is 'correct'. We recommend units who are outliers to examine the reason for this. Careful judgement should be taken when interpreting the control charts used in this report and reference can be made to the appendix and web site for explanations on methodology and interpretation of these charts that can suggest some reasons why units may be different.

The codes used in the charts to identify each unit can be found in the front and back flaps of paper copies or on the last page of the electronic copy and are consistent with previous years.

SICSAG developments

Quality Indicators

We are reporting for the third year, ten Quality Indicators (QIs) for Critical Care in Scotland[2], which have been developed and published by The Scottish Intensive Care Society Quality Improvement Group. Once again we are able to show whether there has been local improvement.

Also for this year the SICSAG Steering Group moved to make all QIs come under its governance process and thus any units not meeting the required QIs would be subject to the same follow-up procedures.

The Steering group has also put in place a mechanism where the QIs will be reviewed later in 2015 with the intention of publishing revised QIs for their introduction in 2016.

End of Life

With reference to the End of Life QI there has been issues relating to this QI in 2014. In the past many units used the Liverpool Care Pathway (LCP) as their End of Life Policy[4]. However in 2014 the LCP was withdrawn and units are now using local or Health Board wide policies/ pathways or having to revise their policies entirely. Therefore this indicator is less tested in terms of benchmarking whether units are performing at the stated level for the indicator for the year 2014. This will be reviewed for 2015.

Clinical Outcomes and Measures for Quality Improvement working group (COMQI)

SICSAG is part of the Scottish Healthcare Audits (SHA) which maintains and supports a spectrum of clinical audits across Scotland, involving a wide range of clinical, government and voluntary sector stakeholders.

The work of the SHA is accountable to the Clinical Outcomes and Measures for Quality Improvement working group (COMQI), joint chaired by Dr Aileen Keel and Professor Jason Leitch.

The agreed governance arrangements reached between Public Health and Intelligence (PHI, previously ISD) and the National Clinical Data Advisory Group (NCDAG) remain, however NCDAG has now been subsumed into COMQI and they will now provide national governance across the SHA. In light of the introduction of these new governance arrangements, SHA is proactively auditing the remit, scope, outputs and value of all the Scottish Healthcare Audits to ensure continued improvement and demonstrable value for money. The auditing of SICSAG took place in May 2015 and the findings of this work are expected to be presented to COMQI in a full report in the Autumn of 2015.

This gives an opportunity to:

- increase the visibility and influence of the Scottish Healthcare Audits to improve public health in Scotland;
- share our achievements and demonstrate the impact of our efforts;
- focus on improving our effectiveness, and work more efficiently to improve outcomes for patients;
- make the case for appropriate investment to build a functional Clinical Audit Platform that will support collection of high quality national audit data; and
- better support COMQI in its commitment to improve patient care.

Obstetric HDU involvement

Ninewells Obstetric HDU joined SICSAG during 2014. Whilst the necessary resources are still been investigated and sought for inclusion of all HDUs in Scotland, including Obstetrics, we are still not quite there yet. In 2015 the Princess Royal Maternity in Glasgow is joining SICSAG and we would expect another 2 obstetric units to join in 2016.

The Scottish Obstetric working group, which includes representatives from most hospitals in Scotland, continue to meet on a regular basis to progress this Critical Care specialty and a member of this group continues to sit on the SICSAG Steering Group.

New units

SICSAG continues its expansion with the addition of 3 more units in 2015:

- Neurological HDU, Ninewells Hospital, Dundee
- Obstetric HDU, Princess Royal Infirmary, Glasgow
- Medical HDU, Aberdeen Royal Infirmary

This expansion, along with the need for all HDUs to participate in a national audit, puts strain on the finite resources allocated to SICSAG at present. Whilst we continually review SICSAG in this matter to enable the inclusion of all HDUs in the audit, we are not able at this time to include all units.

Paul Smith

National Clinical Coordinator

Key Findings

45,206 admissions to Critical Care were included in the audit in 2014. This is higher than in any previous year, and reflects an increase in the number of participating units.

Compliance with the Quality Indicators for Critical Care in Scotland 2012[3] are published for the third time:

- All ICUs in Scotland participate in the audit and only a handful of, mainly specialist, HDUs do not participate at this time.
- **Quality Indicator 1.2** states that all patients are seen every day by an appropriately trained consultant. In 2014 there was a reduction in the percentage of ICUs that reported patients were seen every day from 85% to 77%. In HDUs there was an increase in the number of units that reported patients were seen every day from 66% in 2013 to 76% in 2014.
- **Quality Indicator 2.1** focuses on night time discharges. This remained at a similar percentage overall to that reported in 2013 with 13% of patients being discharged at night time in ICUs and HDUs. Units should be supported to reduce the number of patient discharges at night time where it is not in the patient's best interest. Night time admissions to ICU and HDU are 33% and 34% respectively highlighting the unpredictability of demand.
- **Quality Indicator 3.2** is concerned with early discharges from critical care due to bed or staff shortages. From 2013 to 2014 the percentage of early discharges fell from 3.7% to just over 2% in ICUs and 2.5% to 2% in HDUs.
- **Quality Indicator 3.3** states that all unit deaths should be discussed in an open forum in order to learn from any complications or errors. In 2014 92% of ICUs and 44% of HDUs reported having monthly Morbidity and Mortality meetings.
- The percentage of delayed discharges in 2014 has decreased overall in ICUs and HDUs from the 2013 figure.
- Patients are now more likely than ever before to survive their admission to Intensive Care.
- At 19% in 2014 crude mortality in ICU and Combined Units remained unchanged from last year.
- Case-mix adjusted mortality reduced slightly this year which is consistent with the trend seen over the last ten years. This year there are no outliers in the SMR chart.
- **HAI Key points**
  - 2.5% of patients developed an HAI.
  - Incidence of HAI remains unchanged from 2013.

In 2014, the bed occupancy rate for Scotland remained stable, at 73% in ICU and Combined Units and 78% in HDUs. However, there was considerable variation seen in HDUs.

The intensity of treatment remains high with 68% of patients treated in ICU and Combined Units receiving level 3 care and 63% of patients treated in HDU receiving level 2 or higher care. Level of care definitions are based on the Intensive Care Society Standards 2009[5] (appendix 3).

The pattern of interventions is essentially unchanged over the past few years and continues to show the heterogeneity of units. It is important to realise that units are not identical; they admit patients with differing problems, reflecting the ranging specialty mix between hospitals.

Section 1 Quality Indicators

The SICS Quality Improvement Group produced an agreed list of ten Quality Indicators (QIs) in 2012[2]. We have relied on self reporting for many of them and this is a situation which requires review for future. The SICSAG steering group plan to review the indicators in 2015/16 in order to refine some of the definitions and ensure the measures are stretching for the units. Managers and health boards with responsibility for delivery of these services will be interested to see their unit and health board performance and may wish to target development informed by this. For the first time SICSAG have moved all Quality Indicators into a standardised governance process, with units showing a need for improvement being formally contacted by the SICSAG steering group.

Quality Indicator: This is a measure of a structure, process or outcome that could be used by local teams to improve care. A QI helps to understand a system, compare it and improve it but they all will have limitations. They can only serve as flags or pointers, which summarise and prompt questions about complex systems of clinical care and they must be understood in that context.

Some Quality Indicators for intensive care (level 3) patients may not be relevant to high dependency (level 2) patients. Some may be regarded as minimum standards for level 3 units and Quality Indicators for level 2. Each indicator has these caveats in place as necessary. These should be measurable, realistic, achievable, but for many, stretching.

For more information please refer to:
http://www.sicsag.scot.nhs.uk/SICSQIG-report-2012-120209.pdf

Where appropriate we have used a traffic light system with explanation for each QI and in Tables 1 and 2 to show complete (green), partial (amber) or no (red) delivery of each QI.

Part 1 Structure

1.1 Participating units

QI 1.1 - All Scottish Critical Care Units (ICUs and HDUs) should participate in, and submit data to, the Scottish Intensive Care Society Audit Group.

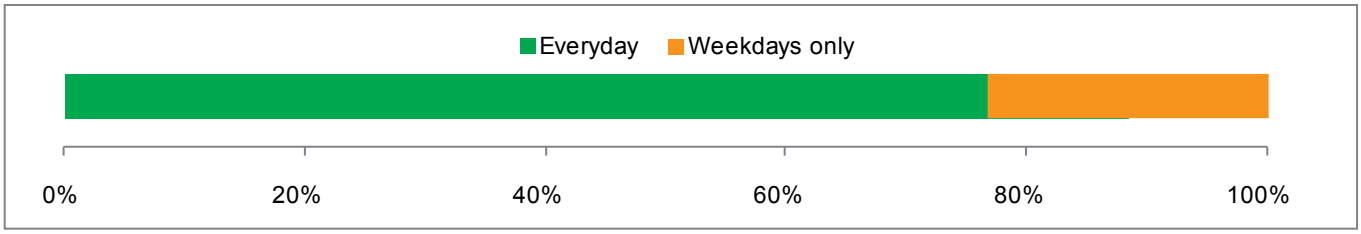
Tables 1 and 2 (pages 10 and 11) of the report show all the units which are actively participating in the audit. Being a nationally accepted governance standard, Boards and managers of non-participating units should question why they are not contributing to the audit. The number of non-participating units is now just a handful of HDUs particularly those units specialising in obstetrics or renal admissions.

1.2 Daily review and written management plans

QI 1.2 - All patients in ICU or Combined Units should be seen every day by a consultant who has regular weekday commitments to intensive care. This consultant will ensure there is a written management plan each day. All patients in HDU should be seen every day by an appropriately trained consultant. This may be a Critical Care consultant or another medical or surgical specialty depending on the service model for a particular unit. This consultant will ensure there is a written management plan each day.

In 2015 Guidelines for the Provision of Intensive Care Services (GPICS)[6] was published by the Faculty of Intensive Care Medicine (FICM) and the Intensive Care Society (ICS). The document stated that "Consultant intensivist led multi-disciplinary clinical ward rounds within intensive care must occur every day (including weekends and national holidays). The ward round must have daily input from nursing, microbiology, pharmacy and physiotherapy". It states that "For units where recommendations are not currently met there should be a clear strategy to meet these as soon as possible." While much of GPICS is intended for the commissioning process in England, it is intended to set standards for Intensive Care Services across the UK. The Scottish Intensive Care Society is currently looking at the implications for Scotland and how it links with our Quality Indicators.

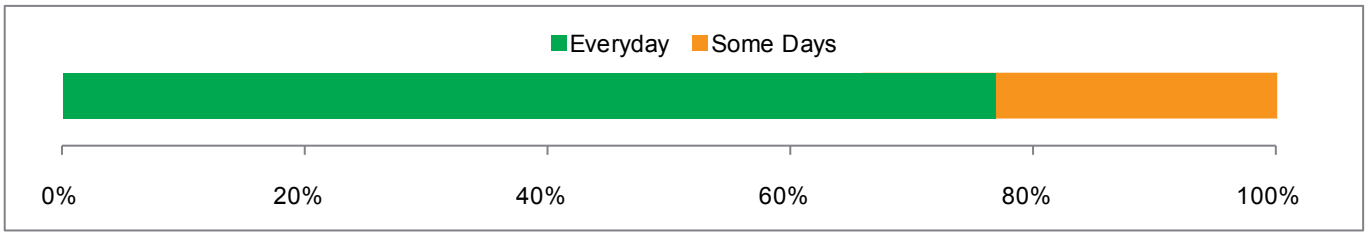
Figure 1 Percentage of ICU and Combined Units with a daily review and written management plan



77% of ICUs and Combined Units are achieving QI 1.2 in 2014, this is a decrease from the 85% reported in 2013.

This QI can only be met where it is possible to man a 7-day per week rota from the consultants who practice weekday ICU. In smaller hospitals and departments this may be very difficult due to a lack of sufficient numbers. However, there may also be different ways of working which could be explored to improve weekend patient review. See Table 1 on page 10 for individual units.

Figure 2 Percentage of HDUs with a daily review and written management plan



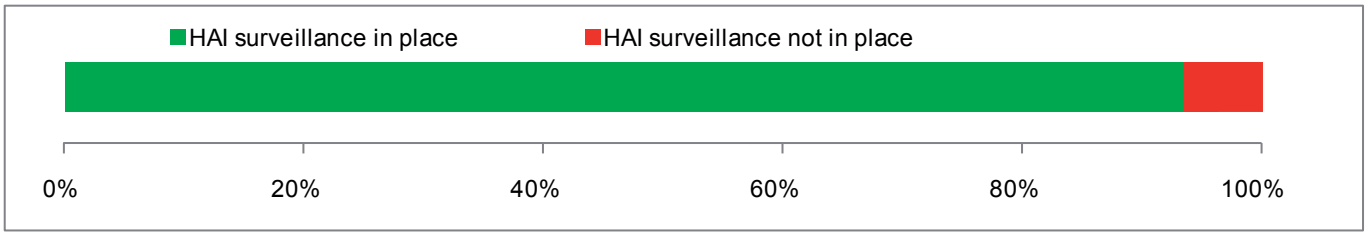
76% of HDUs are achieving QI 1.2 in 2014 this is a continuing increasing trend from to 52% reported in 2012.

See Table 2 on page 11 for individual units.

1.3 HAI surveillance systems

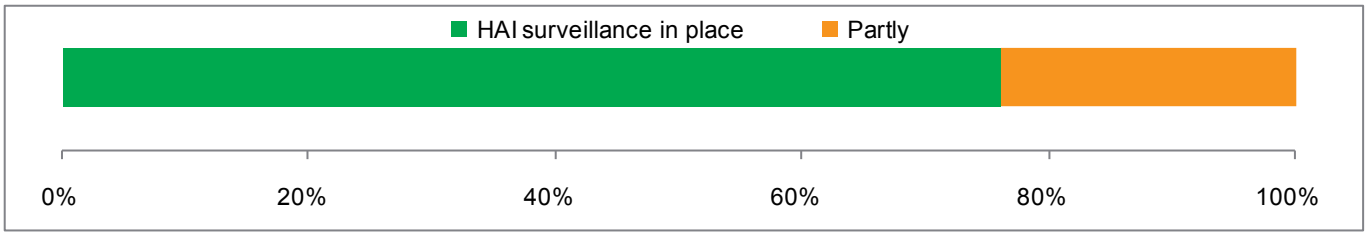
QI 1.3 - ICU and HDUs should have a HAI surveillance system in place which reports incidence of important infections on a monthly basis to unit staff and Scottish Patient Safety Programme (SPSP). ICUs and Combined Units report Ventilator Associated Pneumonia (VAP) and Catheter Related Bloodstream Infection (CRBSI) incidences. HDUs report Catheter Related Bloodstream Infection (CRBSI) incidence.

Figure 3 Percentage of ICU and Combined Units with HAI surveillance system



92% of ICUs met this minimum standard in 2014 with a HAI surveillance system reporting data to staff and SPSP. See Table 1, page 10 for details by unit. More information of incidence of HAI in critical care can be found in section 5 of this report.

Figure 4 Percentage of HDUs with HAI surveillance system



76% of HDUs have a surveillance system in place which fully complies with the indicator, 24% have a system that monitors *Staphylococcus aureus* bacteraemia (SAB) only, therefore partly complying with the indicator.

This data is most commonly collected by Infection Control Teams in HDU.

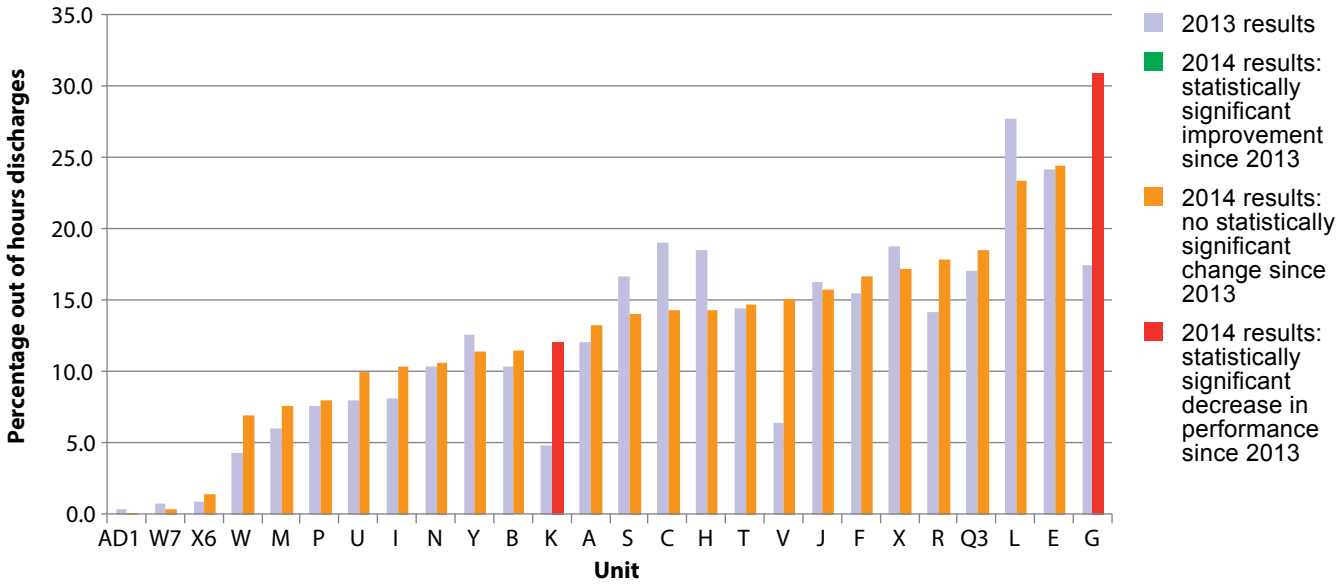
Table 2, page 11 has detailed information by unit and Health Board.

Part 2 Process

1.4 Night time discharges

QI 2.1 - All Scottish ICUs and HDUs should participate in, and submit data to, the Scottish Intensive Care Society Audit Group to measure night time discharges. The aim is to encourage and support local improvement to reduce night time Critical Care discharges.

Figure 5 Night time discharges from ICU and Combined Units (2013-2014)



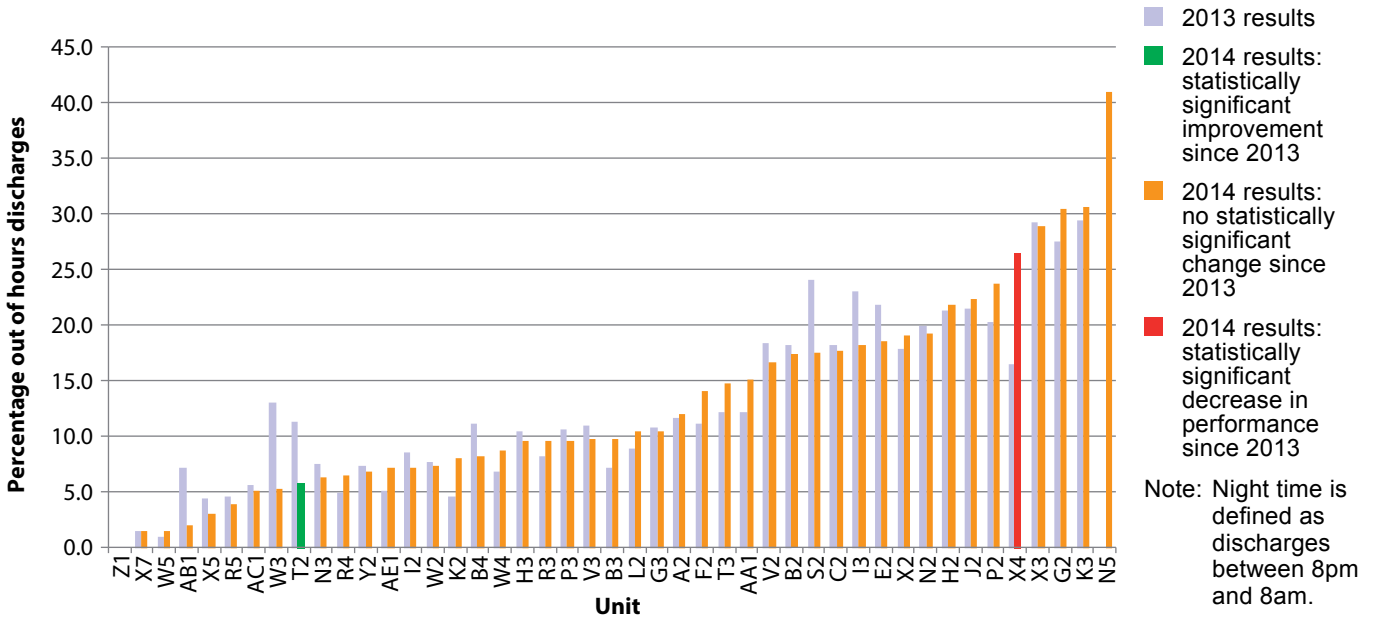
Note: Night time is defined as discharges between 8pm and 8am.

Unit G had the highest percentage of night time discharges at 31%, and this proportion was significantly more than the figure reported for this unit in 2013. Unit K also had significantly more than reported last year with 12% of discharges at night time in 2014.

Overall in Scotland night time discharges are at a similar percentage than reported in 2013, although they have increased slightly since last year from 12% to 13%.

Night time discharges are associated with worse outcomes for ICU patients [7,8].

Figure 6 Night time discharges from HDU (2013-2014)



Unit N5 had the highest percentage of night time discharges at 41%, however this is the only obstetrics unit in the audit. Unit X4 had a significantly higher percentage of night time discharges than last year. Both of these units are specialist HDUs and therefore these results should be interpreted with caution.

Unit T2 had a significantly lower percentage of night time discharges than reported in 2013.

Overall in Scotland night time discharges are similar to 2013 at 13% of patient episodes in HDU being discharged.

1.5 Care Bundles

QI 2.2 - Units should have the following Care Bundles in place: (a) Ventilator Associated Pneumonia (VAP) prevention, (b) Central Venous Catheter (CVC) insertion and maintenance (c) Peripheral Venous Cannula (PVC) insertion and maintenance.

All units contributing to the audit have care bundles in place in 2014.

1.6 End of Life Care

QI 2.3 - All ICUs and HDUs have a written end of life care policy. The two important elements are to ensure that patients are both identified and then cared for appropriately.

Figure 7 Percentage of ICU and Combined Units with an end of life care policy

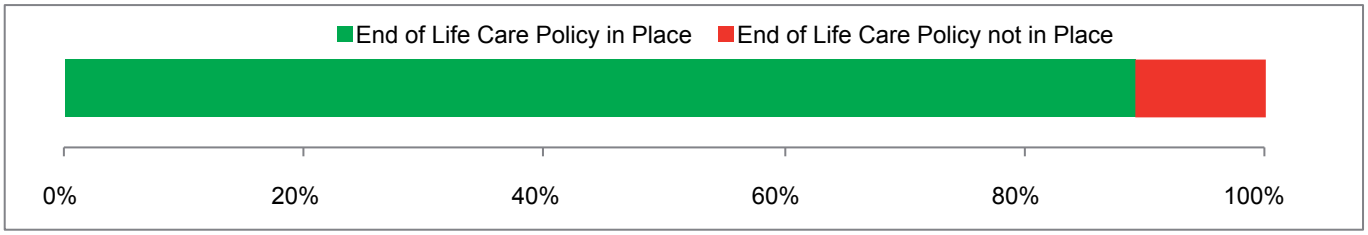
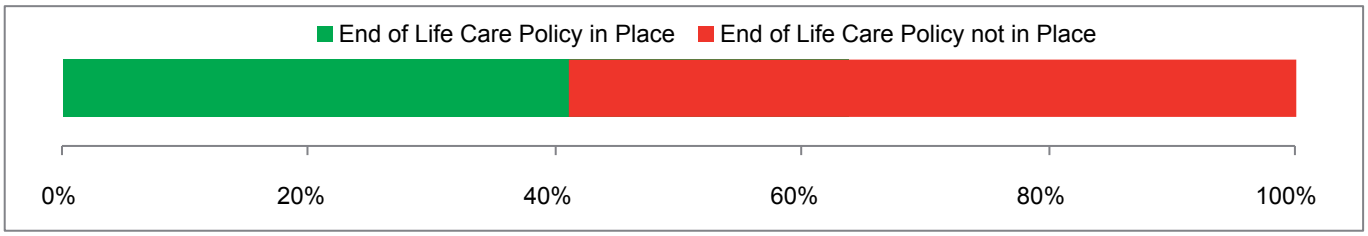


Figure 8 Percentage of HDUs with an end of life care policy



89% of ICUs and 41% of HDUs have an end of life care policy in place. In the past most units used the Liverpool Care Pathway (LCP) as their End of Life Policy. An independent review [4] of the Liverpool Care Pathway was carried out in 2013 and recommended that use of the Liverpool Care Pathway be replaced by an end of life care plan for each patient, backed up by condition-specific good practice guidance. Therefore in 2014 the LCP was withdrawn and units are now using local or Health Board wide policies/pathways or having to revise their policies entirely and therefore this indicator is less tested in terms of benchmarking whether units are performing at the stated level for the indicator for the year 2014. This will, of course, be reviewed for 2015.

Part 3: Outcomes

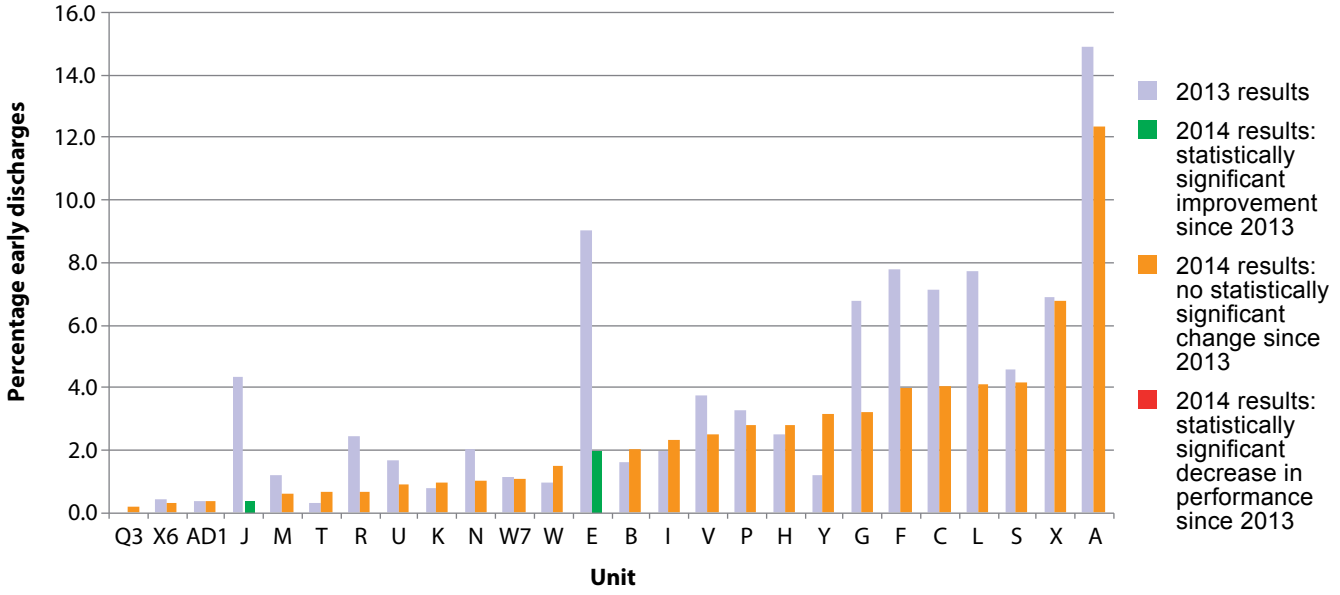
1.7 Standardised Mortality Ratio (SMR)

QI 3.1 - Please refer to Section 4, page 30 for further information on SMR Outcomes.

1.8 Early discharges

QI 3.2 - Early discharges from Critical Care may be a marker of insufficient resource. This has been reported by SICSAG in annual reports for some years.

Figure 9 Early discharges from ICU and Combined Units (2013-2014)



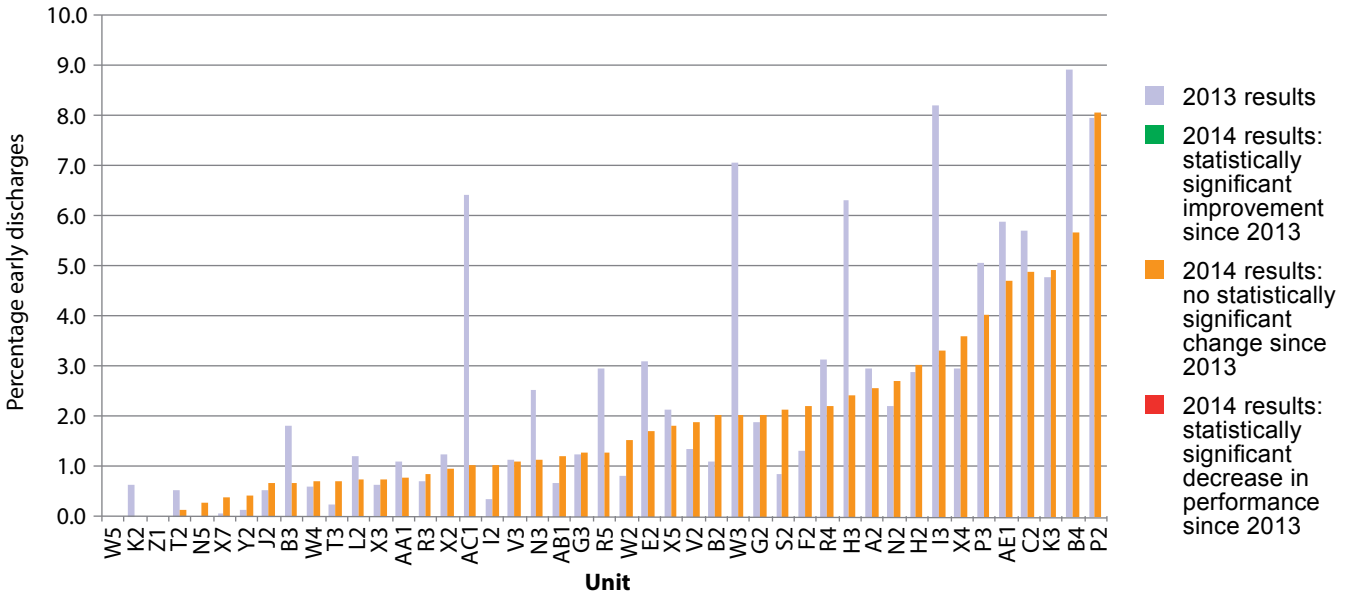
Note: Early discharge is defined as a transfer that is not in the best interest of a patient but necessary due to pressure on beds or staffing.

Unit A had the highest percentage of early discharges just over 12%.

Units J and E had significantly less early discharges than reported last year at 0.4% and 2% respectively.

Overall for ICUs in Scotland early discharges has reduced from 3.7% in 2013 to just over 2% in 2014, and within this the majority of units have seen a reduction.

Figure 10 Early discharges from HDU (2013-2014)



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.

Unit P2 had the highest percentage early discharges at 8%.

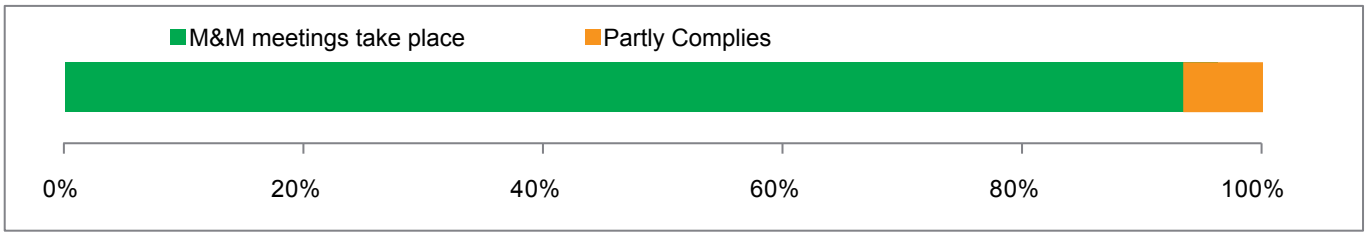
Overall in Scotland early discharges for HDUs has reduced from 2.5% in 2013 to 2% in 2014.

No units had significantly different percentages than reported last year.

1.9 Morbidity and Mortality meetings

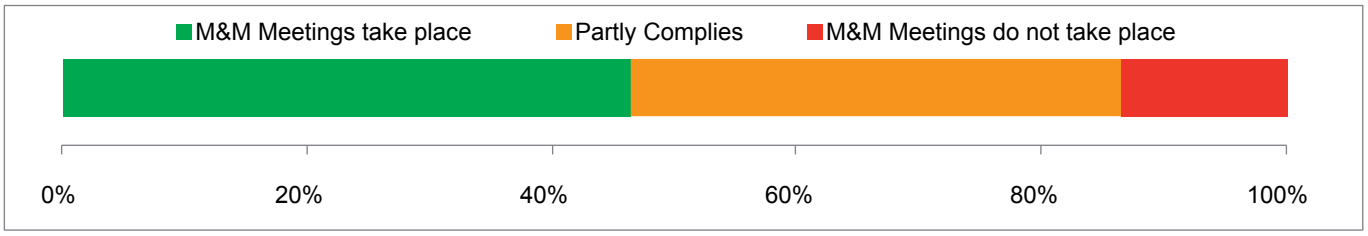
QI 3.3 - Every unit should discuss in open forum significant critical incidents and the care of all patients who die in a Critical Care ward.

Figure 11 Percentage of ICU and Combined Units with Morbidity & Mortality Meetings



92% of ICUs meet this minimum standard to discuss and learn from all unit deaths.

Figure 12 Percentage of HDUs with Morbidity & Mortality Meetings

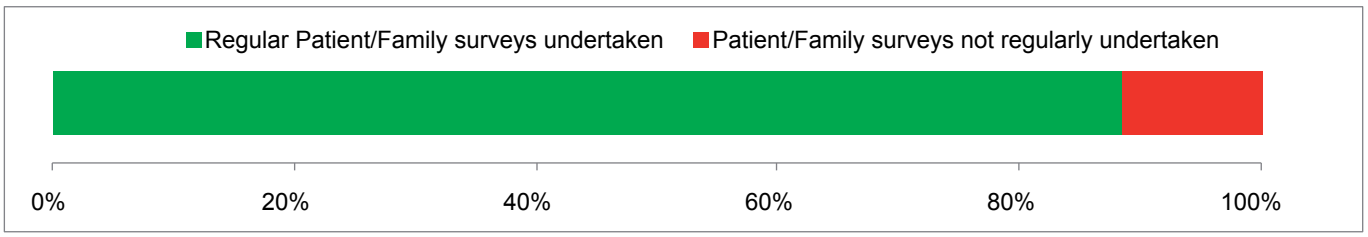


44% of HDUs meet this minimum standard to discuss and learn from all unit deaths. Units without this fully in place should reflect on this standard of governance which is widely practised by clinicians in similar units. Unit level information can be found in Table 2, page 11.

1.10 Patient/family experience surveys

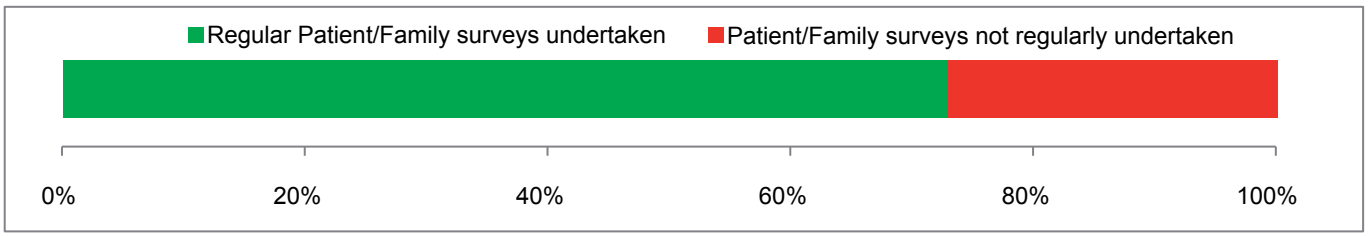
QI 3.4 - Critical Care units should undertake patient/relative satisfaction surveys on an annual (or more frequent) basis.

Figure 13 Percentage of ICU and Combined Units undertaking regular patient/family experience surveys.



89% of ICUs undertake patient/family surveys. Unit level information can be found in Table 1, page 10.

Figure 14 Percentage of HDUs undertaking regular patient/family experience surveys



74% of HDUs undertake patient/family surveys. Unit level information can be found in Table 2, page 11.

Table 1 Responses to ICU Quality Indictors (2014)

	1.1 Unit participate in a national audit	1.2 Daily review and written management plan	1.3 HAI Surveillance system	2.2 Care bundles	2.3 End of life care	3.3 M &M meetings	3.4 Patient/ family experience surveys
NHS Ayrshire and Arran							
Ayr ICU	Yes	Weekdays only	Yes	Yes	No	Yes	Yes
Crosshouse ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Borders							
BGH ICU/HDU	Yes	Weekdays only	Yes	Yes	Yes	Yes	Yes
NHS Dumfries and Galloway							
DGRI ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Fife							
VHK ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Forth Valley							
FVRH ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Grampian							
ARI ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARI CICU	Yes	Yes	Yes	Yes	No	Yes	Yes
NHS Greater Glasgow and Clyde							
GRI ICU / HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IRH ICU	Yes	Weekdays only	Yes	Yes	Yes	Yes	Yes
RAH ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SGH ICU	Yes	Yes	Yes	Yes	Yes	Yes	No
SGH NICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VI ICU	Yes	Yes	No	Yes	Yes	Yes	No
WIG ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Highland							
Raigmore ICU	Yes	Weekdays only	Yes	Yes	Yes	Medical Staff Only	Yes
NHS Lanarkshire							
Hairmyres ICU/HDU	Yes	Weekdays only	Yes	Yes	Yes	Yes	Yes
MDGH ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wishaw ICU	Yes	Weekdays only	Yes	Yes	Yes	Medical Staff Only	Yes
NHS Lothian							
RIE ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE CICU	Yes	Yes	Yes	Yes	No	Yes	No
SJH ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WGH ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS National Waiting Times Centre							
Golden Jubilee National Hospital ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Tayside							
Ninewells ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PRI ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Fully complies with indicator	Yes	Key:
Partly complies with indicator	Weekdays	NICU – Neurological ICU
Does not comply with indicator/No Information Provided	No	CICU – Cardiothoracic ICU

Table 2 Responses of HDU to Quality Indicators (2014)

	1.1 Unit participate in a national audit	1.2 Daily review and written manage-ment plan	1.3 HAI Sur-veillance system	2.2 Care bundles	2.3 End of life care	3.3 M &M meetings	3.4 Patient/ family experience surveys
NHS Ayrshire and Arran							
Ayr HDU	Yes	Yes	Yes	Yes	No	Yes	Yes
Crosshouse MHDU	Yes	Yes	Yes	Yes	No	Yes	Yes
Crosshouse SHDU	Yes	Yes	Yes	Yes	No	Medical staff only	Yes
Crosshouse RHDU	Currently not part of audit						
NHS Dumfries and Galloway							
DGRI MHDU	Yes	Yes	Yes	Yes	No	No	No
DGRI SHDU	Yes	Yes	Yes	Yes	Yes	Specialty	No
NHS Fife							
VHK SHDU	Yes	Yes	Yes	Yes	No	Specialty	Yes
VHK MHDU	Yes	Yes	Yes	Yes	No	Yes	Yes
VHK RHDU	Yes	Yes	Yes	Yes	No	Yes	No; Under development
NHS Grampian							
ARI SHDU (Ward 31/32)	Yes	Yes	Yes	Yes	Yes	Medical Staff Only	Yes
ARI SHDU (Ward 35)	Yes	Weekdays only	Partly (SABs only)	Yes	Yes	Yes	Yes
ARI CHDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARI NHDU	Yes	Yes	Yes	Yes	No	Yes	No
ARI MHDU	Joining 2015						
Dr Gray's HDU	Yes	Yes	Yes	Yes	No	Speciality	Yes
NHS Greater Glasgow and Clyde							
GRI SHDU	Yes	Yes	Partly (No feedback)	Yes	Yes	Yes	Yes
GRI MHDU	Yes	Weekdays only	Partly (No feedback)	Yes	No	Yes	Yes
IRH SHDU	Yes	Weekdays only	Yes	Yes	No	Speciality	No
RAH HDU	Yes	Weekdays only	Partly (SABs only)	Yes	No	Yes	Yes
SGH SHDU	Yes	Yes	Yes	Yes	No	Speciality	Yes
SGH NHDU	Yes	Yes	Partly (SABs only)	Yes	No	Speciality	Yes
VI SHDU	Yes	Yes	Partly (SABs only)	Yes	Yes	Yes	Yes
GGH HDU	Yes	Weekdays only	Yes	Yes	No	Speciality	No
WIG HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Princess Royal Maternity	Joining 2015						
NHS Highland							
Raigmore MHDU	Yes	Yes	Yes	Yes	Yes	No; Case Reviews	Yes
Raigmore SHDU	Yes	Weekdays only	Yes	Yes	Yes	Medical Staff Only	Yes
Caithness HDU	Currently not part of audit						
Lorne & Islands HDU	Currently not part of audit						
Belford HDU	Yes	Yes	Yes	Yes	Yes	Medical Staff Only	Yes
NHS Lanarkshire							
Hairmyres MHDU	Yes	Yes	Partly (SABs only)	Yes	No	Medical Staff Only	Yes
MDGH SHDU	Yes	Yes	Partly (SABs only)	Yes	Yes	Yes	Yes
MDGH MHDU	Yes	Weekdays only	Partly (SABs only)	Yes	Yes	Medical Staff Only	Yes

Table 2 Responses of HDU to Quality Indicators (2014)

	1.1 Unit participate in a national audit	1.2 Daily review and written management plan	1.3 HAI Surveillance system	2.2 Care bundles	2.3 End of life care	3.3 M &M meetings	3.4 Patient/ family experience surveys
Wishaw SHDU	Yes	Yes	Yes	Yes	Yes	Medical Staff Only	Yes
Wishaw MHDU	Yes	Yes	Yes	Yes	Yes	Speciality	Yes
NHS Lothian							
RIE HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE RHDU	Yes	Yes	Partly (SABs only)	Yes	Yes	Yes	Yes
RIE Transplant HDU	Yes	Yes	Yes	Yes	No	Yes	Yes
RIE Vascular (Level 1)	Yes	Weekdays only	Yes	Yes	No	Medical Staff Only	No
RIE CHDU	Yes	Yes	Yes	Yes	No	Yes	No
RIE Obstetric HDU	Currently not part of audit						
WGH SHDU	Yes	Weekdays only	Yes	Yes	No	Medical Staff Only	Yes
WGH NHDU	Yes	Yes	Yes	Yes	No	Medical Staff Only	Yes
WGH Neurological (Level 1)	Yes	Yes	Yes	Yes	No	Medical Staff Only	Yes
NHS National Waiting Times Centre							
Golden Jubilee National Hospital HDU	Yes	Weekdays only	Yes	Yes	Yes	Yes	Yes
NHS Orkney							
Balfour HDU	Yes	Yes	Yes	Yes	No	Yes	No
NHS Shetland							
GBH HDU	Yes	Yes	Yes	Yes	Yes	Yes	No
NHS Tayside							
Ninewells SHDU	Yes	Yes	Yes	Yes	Yes	No	Yes
Ninewells MHDU	Yes	Yes	Yes	Yes	No	No; Remodelling	Yes
Ninewells Obstetric HDU	Yes	Yes	Yes	Yes	No	No	No
Ninewells NHDU	Joining 2015						
Perth HDU	Yes	Weekdays only	Yes	Yes	No	No	Yes
NHS Western Isles							
WIH HDU	Yes	Yes	Yes	Yes	No	No; Case review all deaths	No

Fully complies with indicator	Yes	Key:
Partly complies with indicator	Somedays/Specialty/Medical staff only/Partly	SHDU – Surgical HDU
Does not comply with indicator/No Information Provided	No/Currently not part of audit	MHDU – Medical HDU
Data not yet available	Joining 2015	NHDU – Neurological HDU CHDU – Cardiothoracic HDU RHDU – Renal HDU

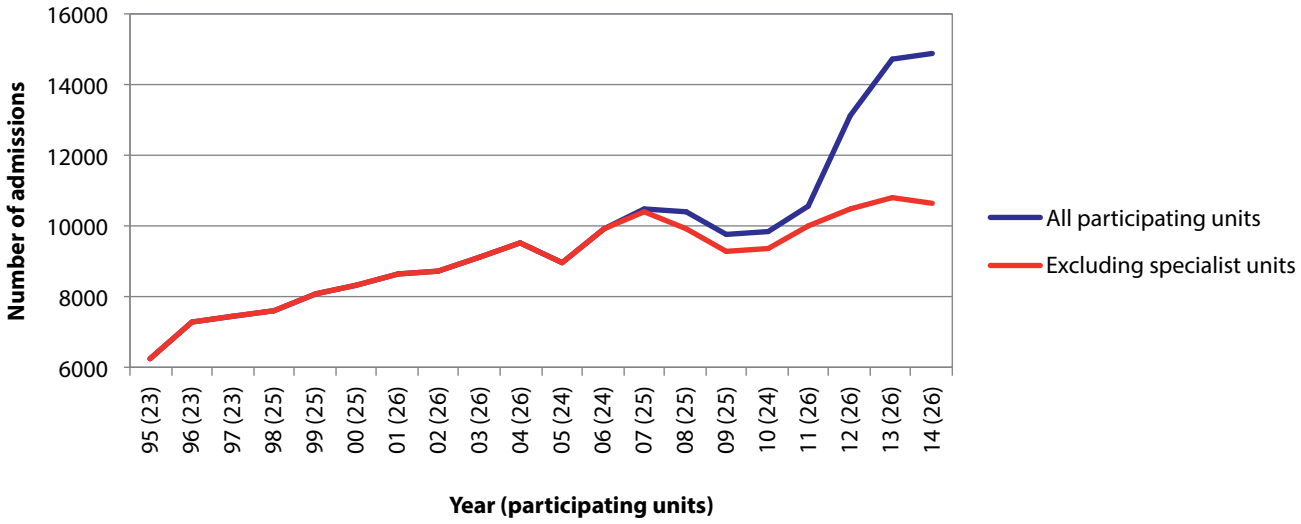
Section 2 Activity

Data regarding Critical Care activity is presented in this section. These data are presented in a variety of formats; information on funnel plots is given in the methodology section of the SICSAG website at; http://www.sicsag.scot.nhs.uk/

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, and these may all account for any differences seen.

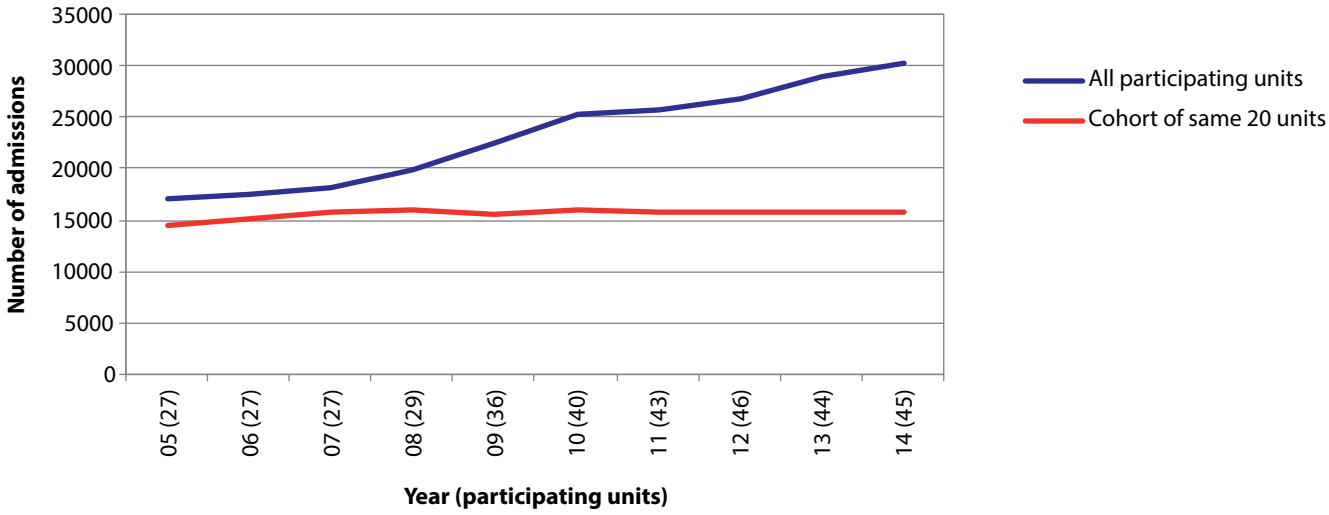
2.1 Number of admissions

Figure 15 Annual admissions to ICU and Combined Units (1995-2014)



Since 1995 SICSAG have maintained a national database of patients admitted to adult general intensive care units (ICUs). The trend shows an overall increase in admissions over the last 20 years, with a sharp increase from 2010 which has levelled off from 2013 but still increasing slightly each year. The red line shows ICUs and combined units excluding specialist units. When the specialised cardiac and neurosurgical units are excluded, there is a slight decrease in admissions which may represent normal fluctuation in activity. It will be interesting to see if this trend continues in the data for 2015.

Figure 16 Annual admissions to HDU (2005-2014)



The number of admissions to HDU increased by 5% from 2013 to 2014, the cohort line refers to units that have participated in the audit for the past ten years.

Table 3 Number of annual admissions to ICU and Combined Units (2005-2014)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NHS Ayrshire and Arran										
Ayr ICU	271	266	307	330	330	292	252	268	243	255
Crosshouse ICU	290	285	302	304	294	305	319	302	276	269
NHS Borders										
BGH ICU/HDU	398	709	691	406	397	429	506	600	579	586
NHS Dumfries and Galloway										
DGRI ICU	331	304	324	316	285	298	293	314	323	286
NHS Fife										
QMH ICU	406	377	373	382	437	439	449	22		
VHK ICU								394	453	429
VHK ICU/HDU	152	145	179	124	38					
NHS Forth Valley										
FVRH ICU/HDU							577	1189	1159	1260
SRI ICU	267	480	471	443	378	411	214			
NHS Grampian										
ARI ICU	746	781	778	762	717	748	665	676	821	765
ARI CICU									279	483
NHS Greater Glasgow and Clyde										
GRI ICU / HDU	320	321	348	395	426	461	793	952	1060	973
IRH ICU	155	122	104	104	82	120	150	138	137	130
RAH ICU	310	318	367	359	360	433	402	374	359	346
SGH ICU	287	279	296	299	289	278	282	264	232	279
SGH NICU			76	454	461	451	395	347	377	437
Stobhill ICU	199	220	201	233	202	155	40			
VI ICU	314	340	391	284	317	298	280	284	289	246
WIG ICU	460	532	512	554	495	485	475	393	421	391
NHS Highland										
Raigmore ICU	359	389	436	391	429	433	384	423	433	404
NHS Lanarkshire										
Hairmyres ICU/HDU	506	531	522	505	560	562	583	558	615	565
MDGH ICU	264	307	301	278	252	225	273	267	307	298
Wishaw ICU	744	756	829	619	222	229	237	212	235	257
NHS Lothian										
RIE ICU/HDU	1032	1059	1041	1092	968	1110	1177	1230	1236	1267
RIE CICU							188	926	1011	1038
SJH ICU/HDU	225	352	367	443	465	424	444	452	458	387
WGH ICU/HDU	497	504	714	772	831	735	705	647	676	721
NHS National Waiting Times Centre										
Golden Jubilee National Hospital ICU/HDU[1]								1318	2223	2255
NHS Tayside										
Ninewells ICU	339	352	370	404	386	357	349	417	378	391
PRI ICU	119	163	151	156	136	122	119	140	124	166
Total	**8991**	**9892**	**10451**	**10409**	**9757**	**9800**	**10551**	**13107**	**14704**	**14884**
Total (excluding specialist units)	**8991**	**9892**	**10375**	**9955**	**9296**	**9349**	**9968**	**10516**	**10814**	**10671**

Notes:

1 Golden Jubilee have two ICUs and two HDUs but for the purpose of this audit are reported as one combined ICU/HDU.

NHS Boards

Shaded areas refer to periods with incomplete data collection

Combined Unit

Key:

NICU – Neurological ICU

CICU – Cardiothoracic ICU

Table 4 Number of annual admissions to HDU (2005-2014)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NHS Ayrshire and Arran										
Ayr HDU			413	542	527	498	487	469	474	498
Crosshouse MHDU	880	966	992	997	974	1033	1103	1193	1201	1102
Crosshouse SHDU	667	657	696	728	711	644	641	644	669	723
NHS Borders										
BGH Surgical (Level 1)				310	339	254				
NHS Dumfries and Galloway										
DGRI MHDU	841	783	793	823	804	854	731	788	824	868
DGRI SHDU	313	336	360	393	392	431	418	437	431	456
NHS Fife										
QMH SHDU	827	821	853	849	840	816	813	34		
QMH MHDU						525	724	37		
QMH RHDU							155			
Victoria Hospital SHDU								817	903	883
Victoria Hospital MHDU						429	444	937	1088	1084
Victoria Hospital RHDU								159	210	202
NHS Forth Valley										
Stirling HDU				1089	963	992	558			
NHS Grampian										
ARI SHDU (Ward 503)	684	654	587	582	623	714	630	575	609	654
ARI NHDU[1]	90	170	251	237	235	241	240	202	86	99
ARI SHDU (Ward 506)					780	814	868	892	856	871
ARI CHDU								42	703	728
Dr Gray's HDU					797	1083	1169	1069	1068	986
NHS Greater Glasgow and Clyde										
GRI SHDU	899	693	1028	1051	1053	1026	765	629	621	650
GRI MHDU								533	671	679
IRH SHDU					266	432	469	439	485	529
RAH HDU	905	1188	1201	1291	1289	1339	1459	1497	1418	1414
SGH SHDU	691	796	809	861	870	807	693	711	692	696
SGH NHDU	591	642	703	675	660	647	621	594	637	706
Stobhill SHDU	353	317	327	327	337	287	58			
VI SHDU	608	605	702	692	636	700	812	847	873	835
GGH HDU	796	771	849	885	882	904	755	755	761	806
WIG HDU						75	413	438	427	443
NHS Highland										
Raigmore MHDU	588	651	732	718	730	811	803	743	774	804
Raigmore SHDU	685	672	714	620	677	669	669	653	657	629
Belford HDU[2]							74	78	114	100
NHS Lanarkshire										
Hairmyres Thoracic HDU	354	340								
Hairmyres MHDU[3]							274	375	254	223
MDGH SHDU	443	632	628	601	593	569	565	588	618	593
MDGH MHDU					56	278	283	377	438	406
Wishaw SHDU[4]				154	602	532	546	571	526	488
Wishaw MHDU								265	1245	1189

Table 4 Number of annual admissions to HDU (2005-2014)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NHS Lothian										
RIE HDU	1531	1530	1517	1541	1390	1369	1366	1377	1329	1300
RIE RHDU	596	607	683	667	632	674	675	634	650	685
RIE Transplant HDU	305	269	330	338	306	345	296	325	375	393
RIE Vascular (Level 1)					112	452	378	372	330	331
RIE CHDU							214	1118	1223	1249
WGH HDU	491	502	117							
WGH SHDU	1198	1229	1139	1192	1126	1119	1136	1112	1115	1160
WGH NHDU	577	450	362	230	285	404	476	431	481	493
WGH Neurological (Level 1)						52	418	364	475	469
NHS Orkney										
Balfour HDU								78	138	258
NHS Shetland										
GBH HDU	54	72	64	63	49	58	74	65	77	69
NHS Tayside										
Ninewells SHDU	703	652	723	832	742	754	794	784	816	812
Ninewells MHDU					558	641	673	743	709	782
Ninewells OHDU[5]										1057
Perth HDU	499	536	569	623	644	618	625	659	612	576
NHS Western Isles										
WIH HDU					145	414	448	417	301	344
Total	**17169**	**17541**	**18142**	**19911**	**22625**	**25304**	**25813**	**26867**	**28964**	**30322**
Total (20 units)	**14405**	**15069**	**15644**	**15971**	**15570**	**15875**	**15682**	**15683**	**15684**	**15685**

Notes:
1. Unit began submitting data again in August 2014.
2. Unit has missing data for Oct/Nov 2014.
3. Unit has missing data from August to December 2014.
4. Unit did not include orthopaedic patients in November 2014.
5. Unit began submitting in March 2014.

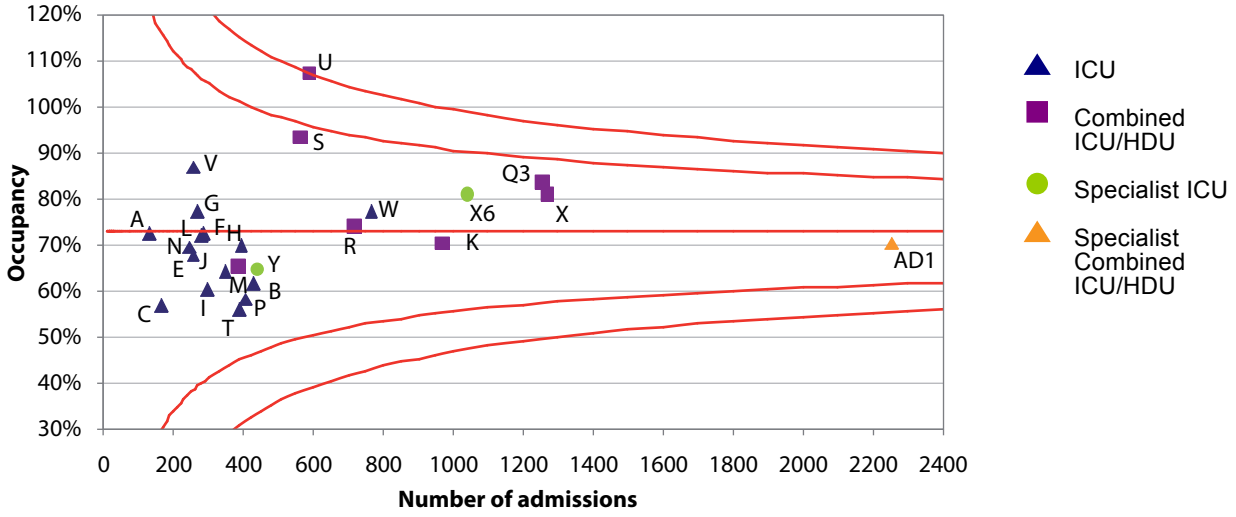
NHS Boards

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

2.2 Bed occupancy

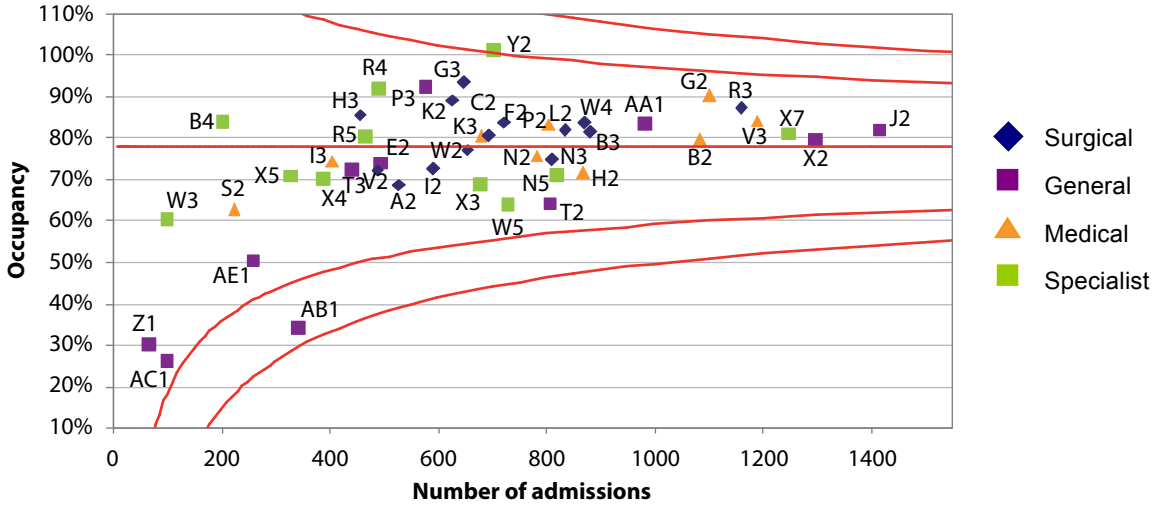
Figure 17 Bed occupancy rates for ICU and Combined Units (2014)



Mean bed occupancy in 2014 was 73%. Unit U was above 3 Standard Deviations (SD) from the Scottish mean.

Unit U has a combination of level 1, 2 and 3 beds and may admit nine level 1 patients but only admit five level 3 patients at any one time. For this analysis we have calculated their occupancy using nine beds and therefore caution should be taken when comparing it to other units.

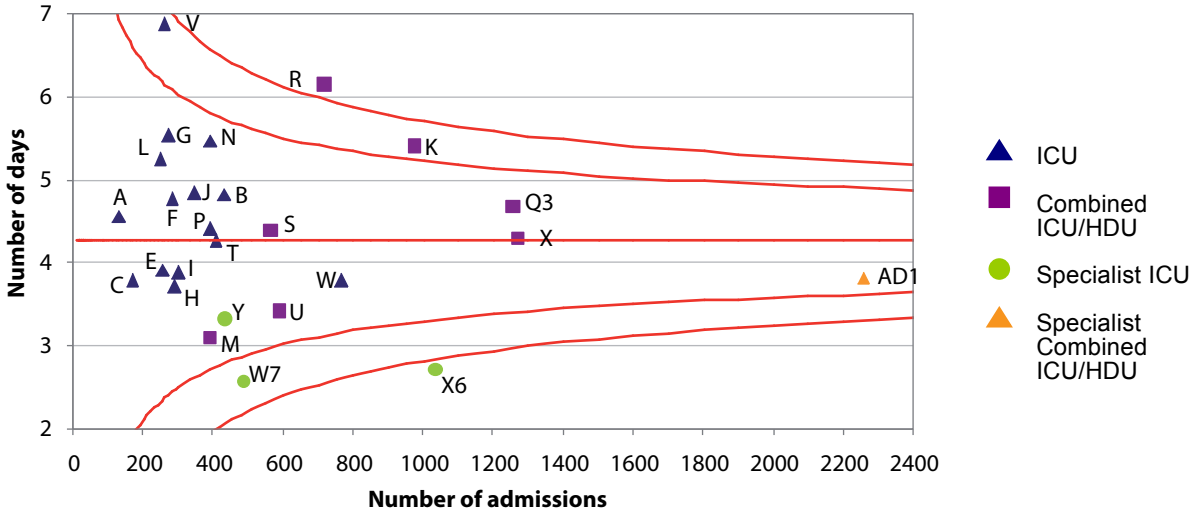
Figure 18 Bed occupancy rates for HDU (2014)



Mean bed occupancy in 2014 was 78%. Some of the units with low occupancy are in smaller remote hospitals and staff work within general wards until there is a need to open HDU beds.

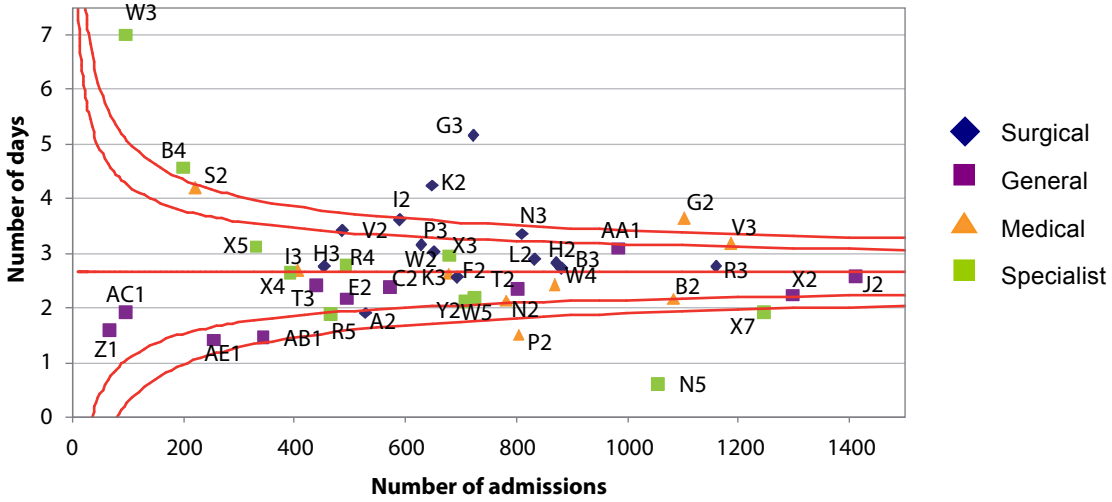
2.3 Length of stay

Figure 19 Mean length of stay in ICU and Combined Units (2014)



The mean length of stay for ICUs and combined units in 2014 was 4.3 days; this figure is similar to that seen in recent years. Unit R continued to have a significantly longer length of stay, and one specialist unit (X6), continued to have a significantly shorter length of stay than the Scottish mean.

Figure 20 Mean length of stay in HDU (2014)

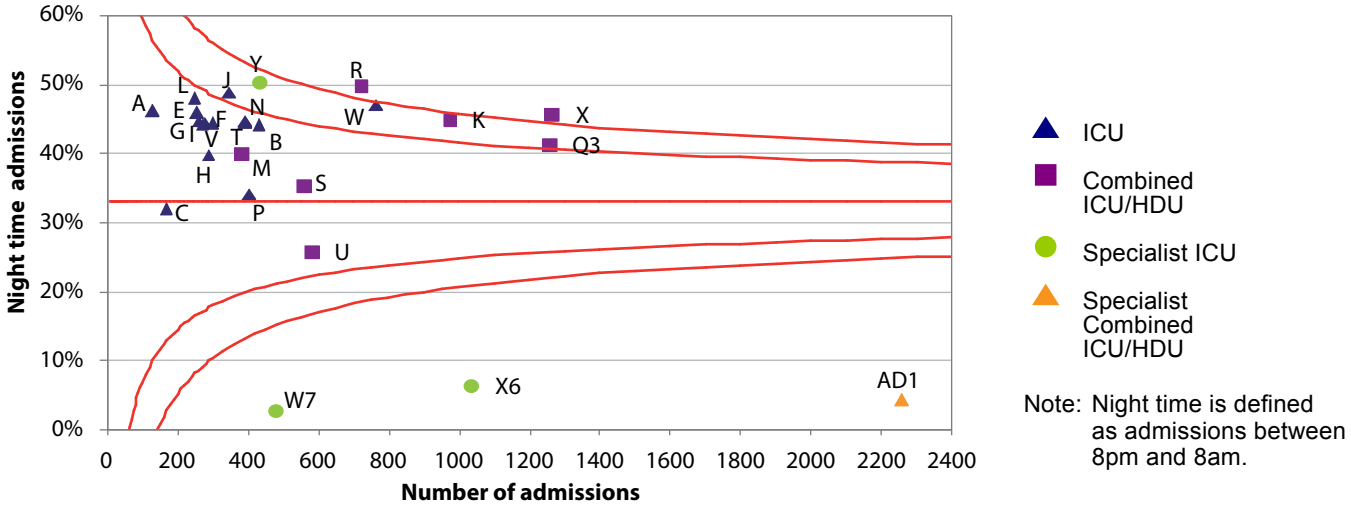


The mean length of stay was similar to previous years at 2.7 days. Two surgical units (K2 and G3), two specialist units (B4 and W3) and one medical unit (G2) had significantly longer lengths of stay than the Scottish mean for HDUs.

Median lengths of stay for all units are published on the SICSAG website.

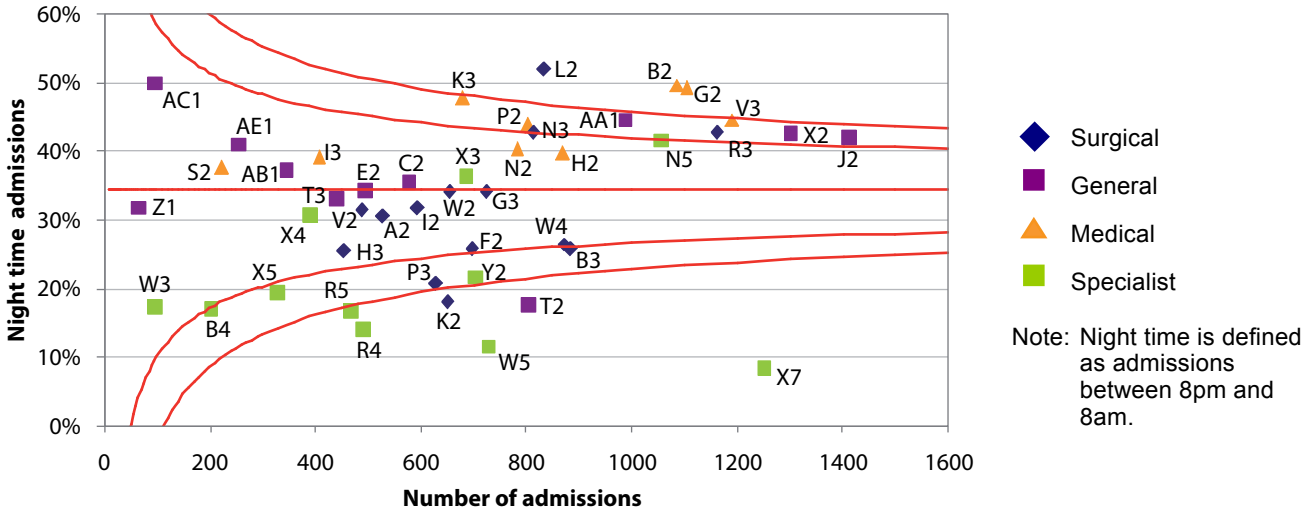
2.4 Night time admissions

Figure 21 Night time admissions to ICU and Combined Units (2014)



Units X and R had significantly more night time admissions to the other units in Scotland. Specialist units W7, X6 and AD1 admitted significantly fewer patients out of hours reflecting their predominantly elective workloads.

Figure 22 Night time admissions to HDU (2014)

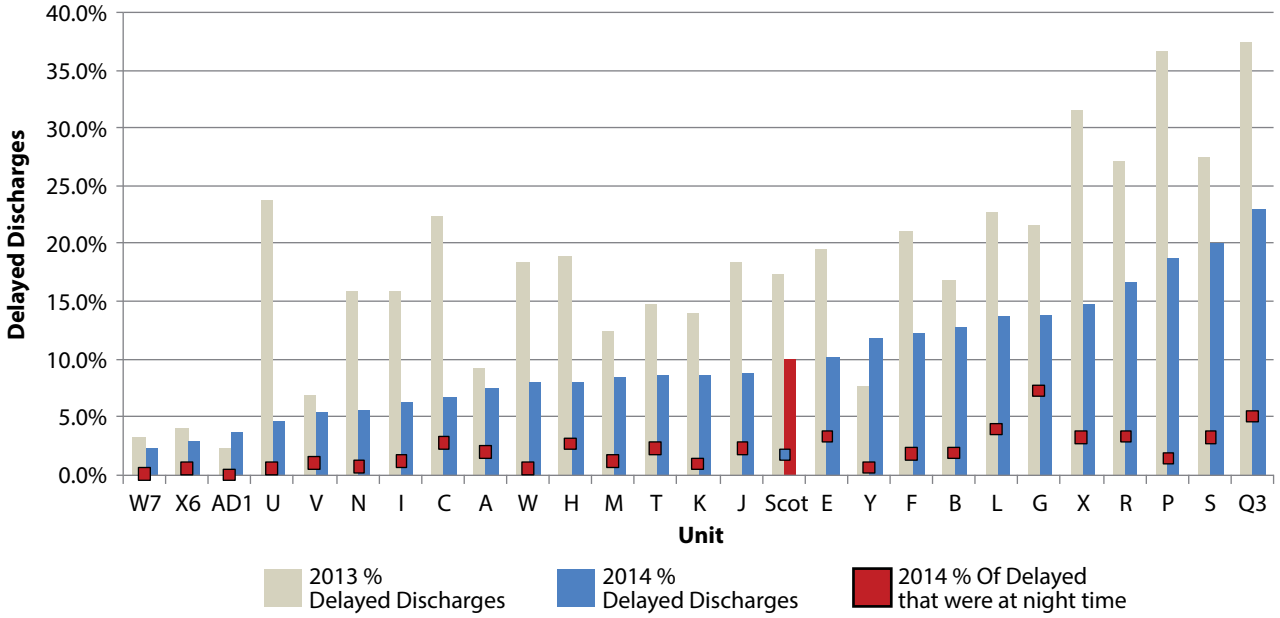


Three units were above 3 SD from the mean (L2, B2, G2). Six units were below the 3 SD line (R4, R5, W5, K2, T2, X7).

Please see Figures 5 and 6 for data on night time discharges.

2.5 Delayed discharges

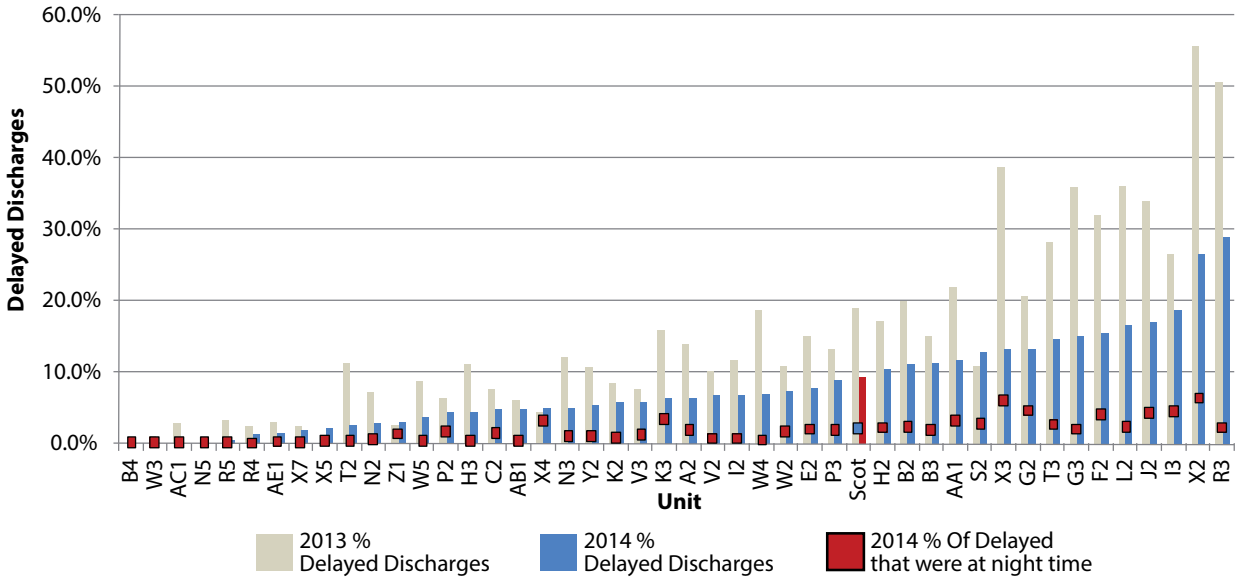
Figure 23 Delayed Discharges in ICU and Combined Units (2013-2014)



The average percentage delayed discharges in ICUs and combined units in Scotland have decreased from 17% in 2013 to 10% in 2014. Following this reduction trend, although Unit Q3 has the most delayed discharges at 23% this has reduced for this unit by 14% since 2013. For Unit Q3 there has also been a reduction in the percentage of delayed discharges that were at night time from 10% in 2013 to 5% in 2014.

The main reason for discharges being delayed was a shortage of available ward or HDU beds.

Figure 24 Delayed Discharges in HDU (2013-2014)



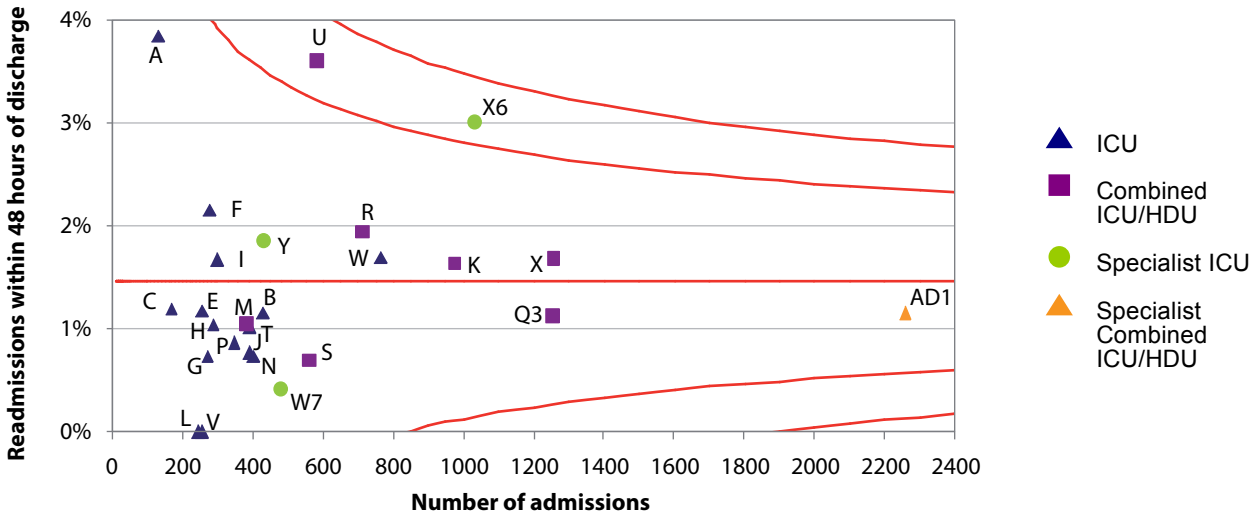
Overall for Scotland the average percentage delayed discharges has decreased from 19% in 2013 to 9% in 2014.

Unit R3 had the most delayed discharges at 29%; 2% of these patients were discharged at night time, for this unit this is a reduction from 51% reported delayed discharges reported in 2013. Unit X2 also had a reduction in delayed discharges from 56% in 2013 to 27% in 2014. The main reason for discharges being delayed from HDU was a shortage of ward beds.

2.6 Readmissions to Critical Care

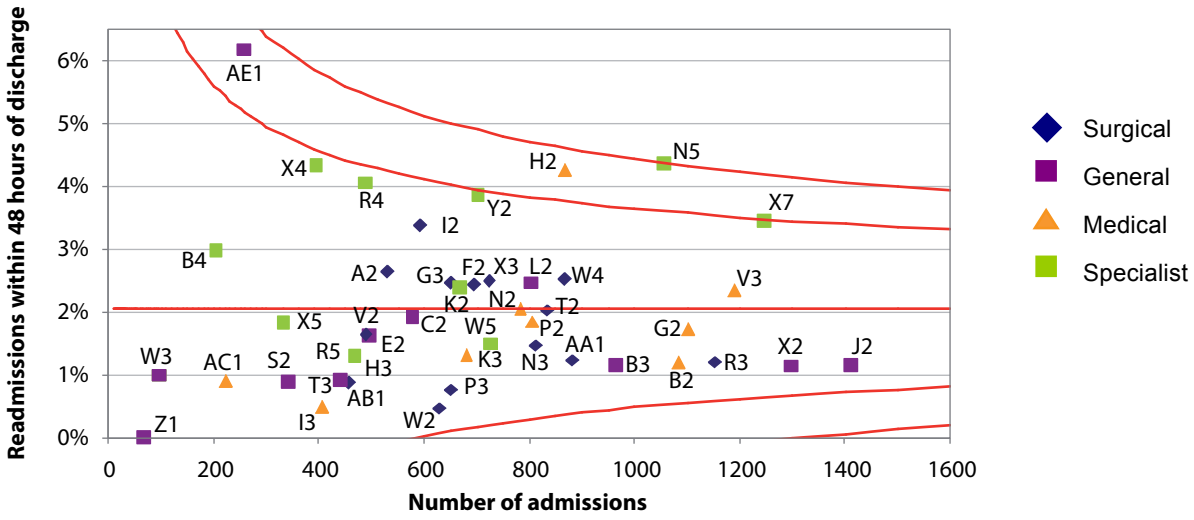
High readmission rates to critical care may be an indicator that discharge was too early, or that downstream care was not of a sufficient standard.

Figure 25 Readmissions within 48 hours of discharge to ICU and Combined Units (2014)



The mean readmission rate in ICUs and Combined Units in Scotland was 1.5% - this figure has not changed since 2012. Units U and X6 are outliers to 2SDs both of these may have significantly more readmissions than the average in Scotland.

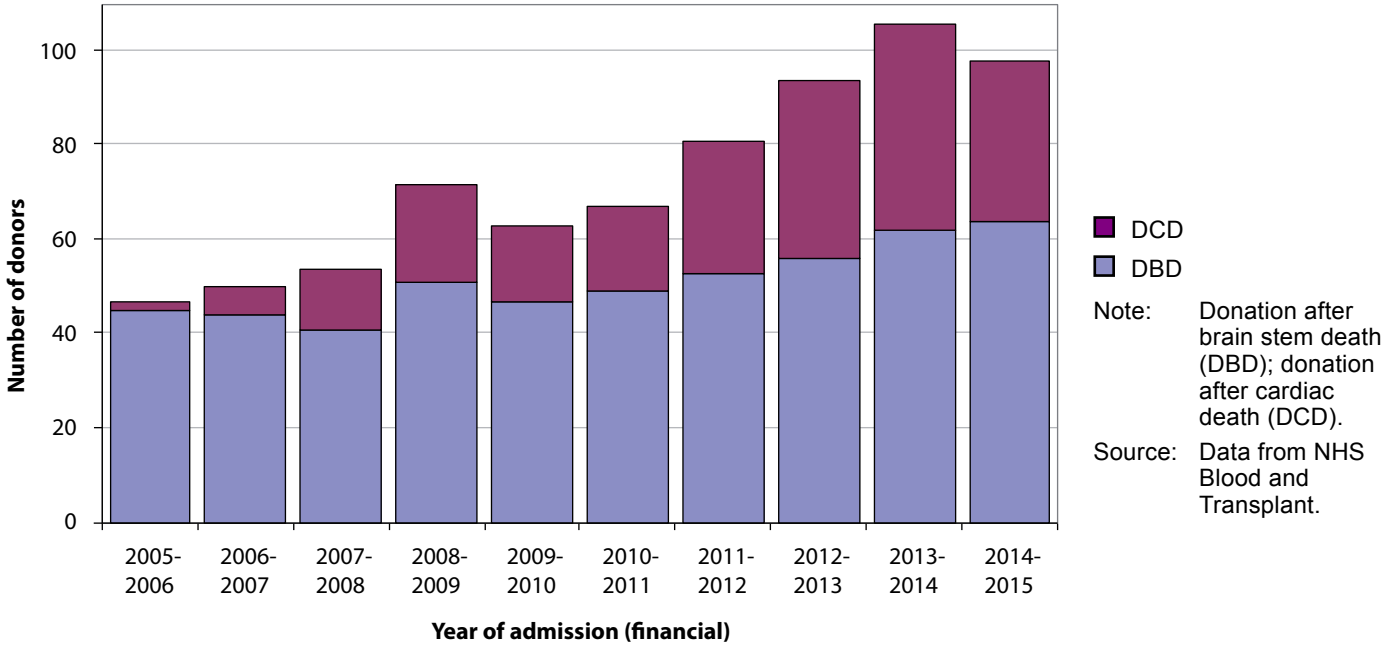
Figure 26 Readmissions within 48 hours of discharge to HDU (2014)



Unit AE1, H2 and N5 may have a significantly higher number of readmissions than the Scottish average.

2.7 Organ donation

Figure 27 Scottish deceased organ donors (2005-2015)



Note: Donation after brain stem death (DBD); donation after cardiac death (DCD).

Source: Data from NHS Blood and Transplant.

The latest figures for organ donation in Scotland show a slight fall in overall numbers over the past financial years (from 106 in 2013/14 to 98 in 2014/15). This is mainly due to a reduction in DCD numbers (from 44 to 34). Numbers of DBD donors continue to rise (from 62 to 64). This fall is mirrored across the whole of the UK.

There are a number of potential reasons for this fall. The most likely being that with the rise in older and more marginal DCD referrals there are increased numbers of declines from the transplant centres. This is supported by the evidence that the number of referrals from intensive care units continues to rise.

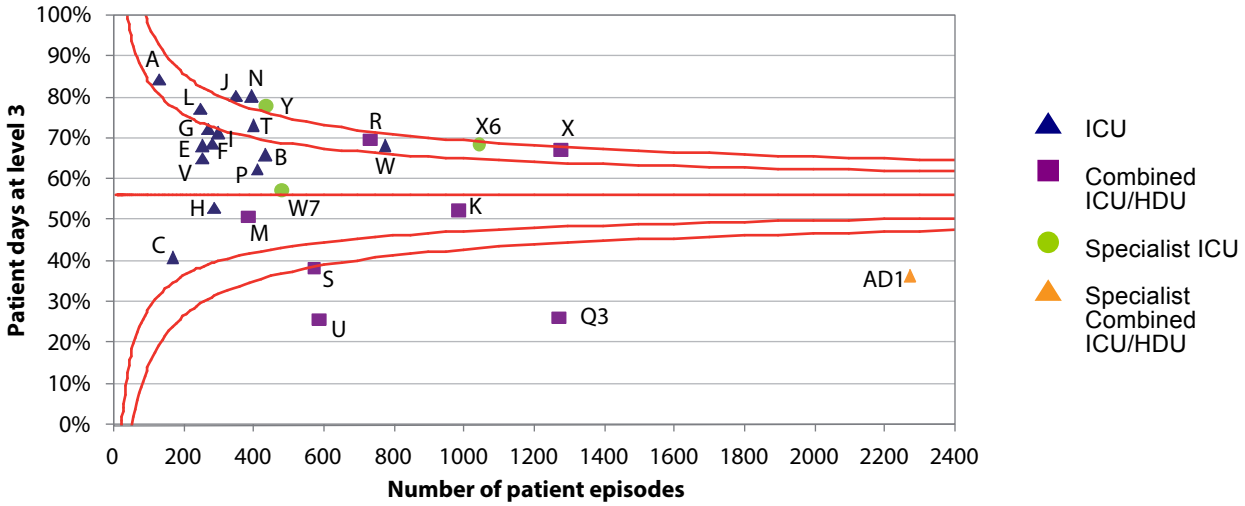
Section 3 Level of care and Interventions

3.1 Level of care

Level of care data are collected from the WardWatcher Augmented Care Period (ACP) page. It allows direct comparisons of interventions and levels of care to be made between critical care units. Level of care is defined in the methodology section of the SICSAG website and Appendix 3.

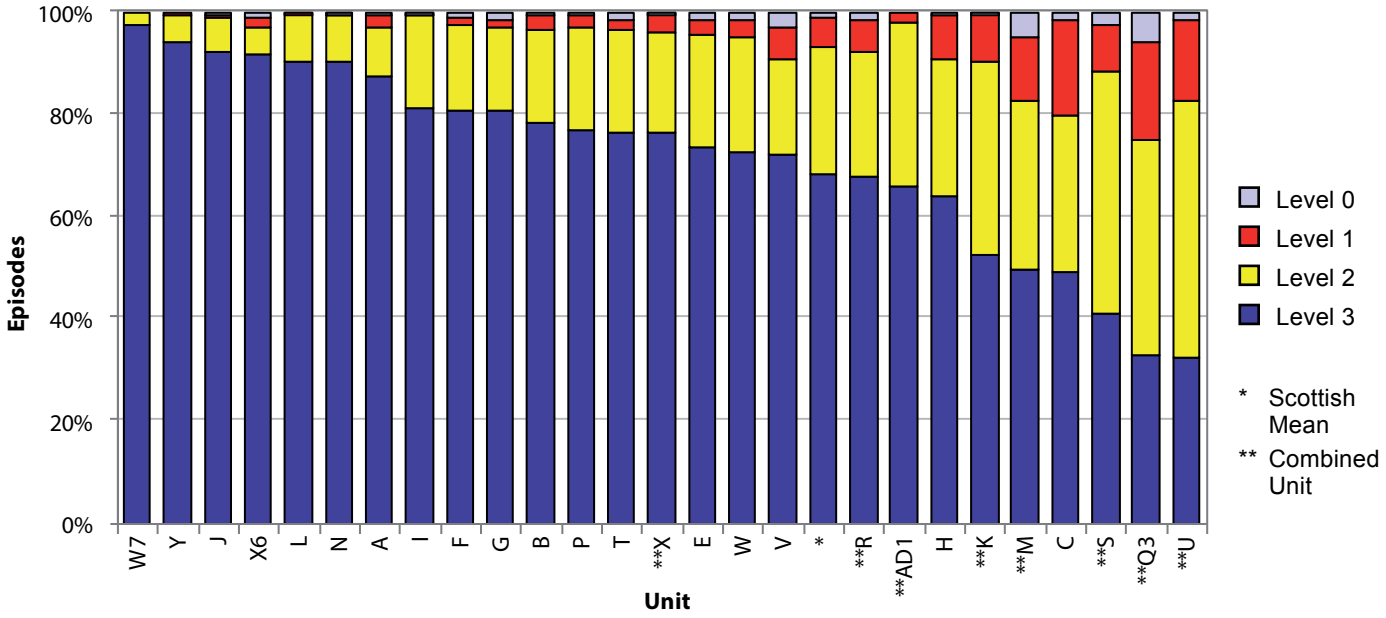
It is important to realise that units are not identical, as they admit patients with a different range of problems, reflecting the differing specialty mix between hospitals.

Figure 28 Level 3 days in ICU and Combined Units (2014)



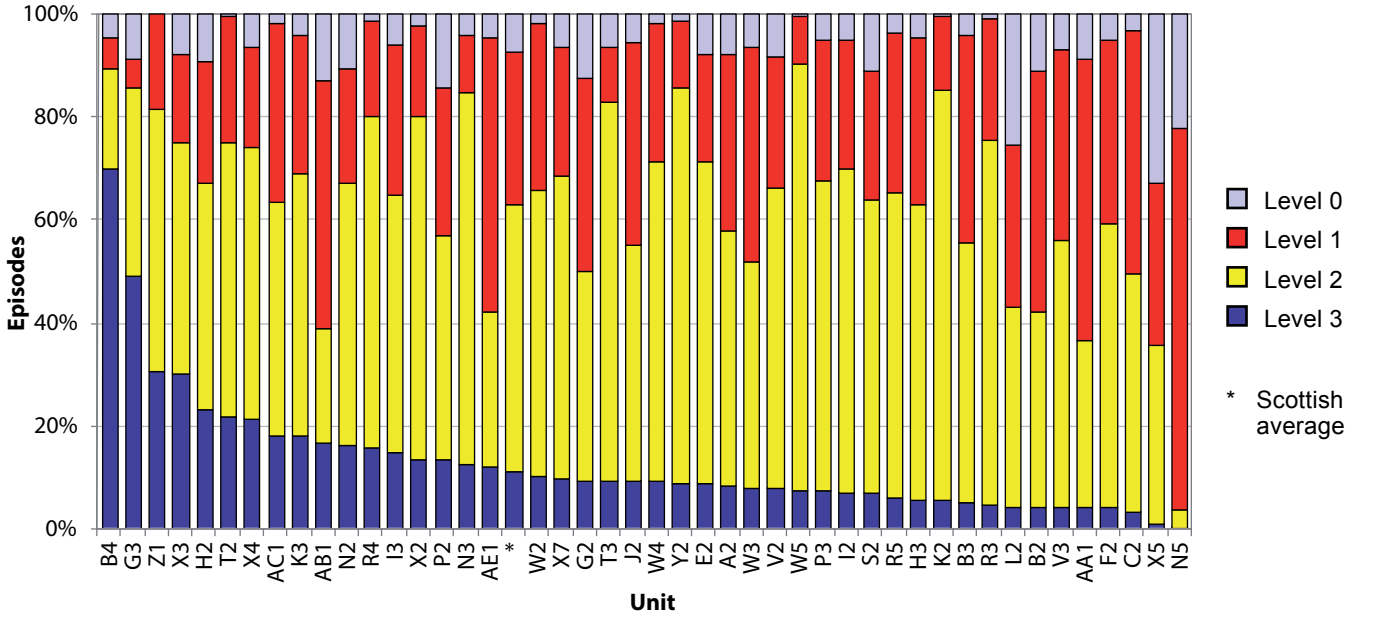
56.2% of patient days in ICU and Combined Units were recorded as level 3. This has increased very slightly since last year. Two ICUs and one specialist ICU (J, N and Y) had a significantly higher percentage of level 3 patients compared to the Scottish mean. N has been in this position in this respect for a number of years likely reflecting the workload and number of beds in this unit. The lower portion of this graph is again dominated by Combined Units as would be expected.

Figure 29 Highest level of care in ICU and Combined Units (2014)



As in last year's report the data are presented in order of descending proportion of level 3 care. In 2014 the highest level of care, level 3, was required in 68% of patient episodes in ICU and Combined Units, and indicates the significant resource and skill-mix implications required by each unit in Scotland. Specialist ICUs – cardiothoracic or neurological (W7 and Y) have the highest percentage of patient episodes requiring level 3 care.

Figure 30 Highest level of care in HDU (2014)



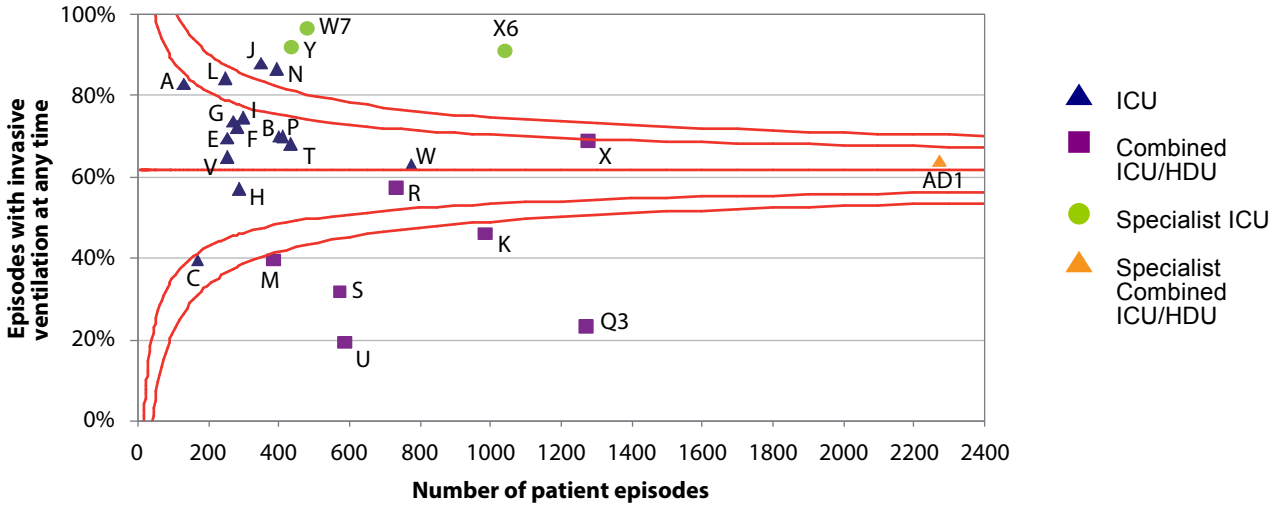
It is reassuring that this graph shows that the highest level of care required for the majority of HDU episodes is at the appropriate level (level 2). There is variation in the pattern of the highest level of care demonstrating the heterogeneous nature of HDUs.

B4 has 70% of its patients at level 3 – it is a specialist HDU and may well have staffing implications for safe care. Unit N5 is a specialist unit and the only obstetrics HDU in the audit.

The proportion of HDU episodes requiring only level 0 (ward level) care has stayed static since 2012 at 7% and likely represents downstream bed availability which remains an issue in Critical Care.

3.2 Respiratory support

Figure 31 Invasive ventilation at any time in ICU and Combined Units (2014)

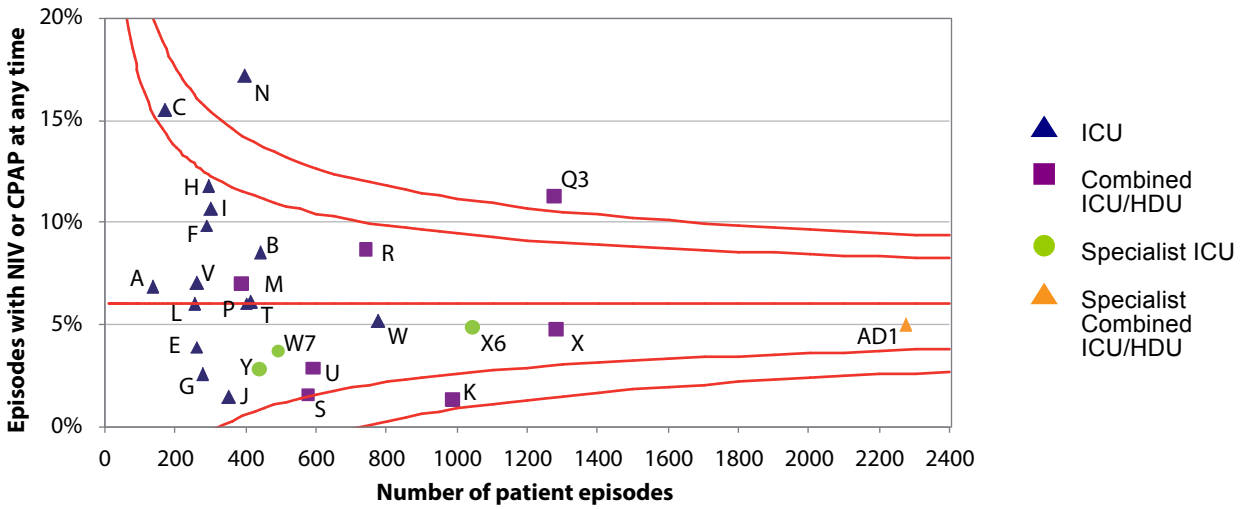


The Scottish percentage average of patients requiring invasive ventilation was 62% in 2014.

The Specialist units are again invasively ventilating a statistically significant higher numbers of patients-but this is entirely appropriate.

Again, the lower area of the graph is dominated by the Combined Units.

Figure 32 NIV and CPAP rates in ICU and Combined Units (2014)

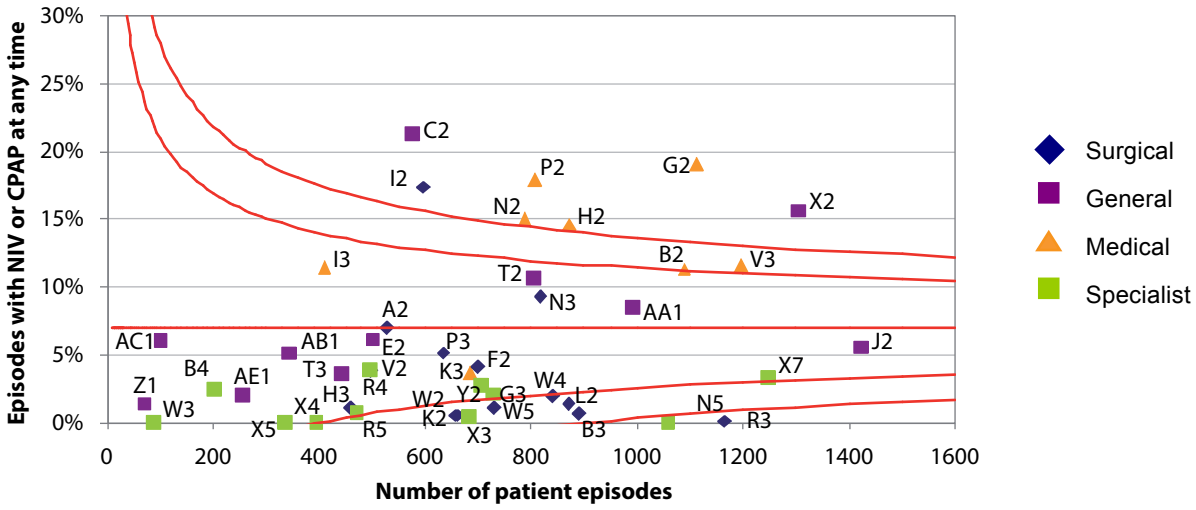


The incidence of this method of respiratory support remains low in ICU and Combined Units.

The percentage of admissions to ICU and Combined Units receiving Non-Invasive Ventilation (NIV) or/and Continuous Positive Airway Pressure (CPAP) is 6% in 2014, continuing a decreasing trend since 2008.

Units N and Q3 have a significantly higher percentage of patient episodes receiving this method of respiratory support-but this is not a new finding and may represent a different ventilation practice or weaning protocol.

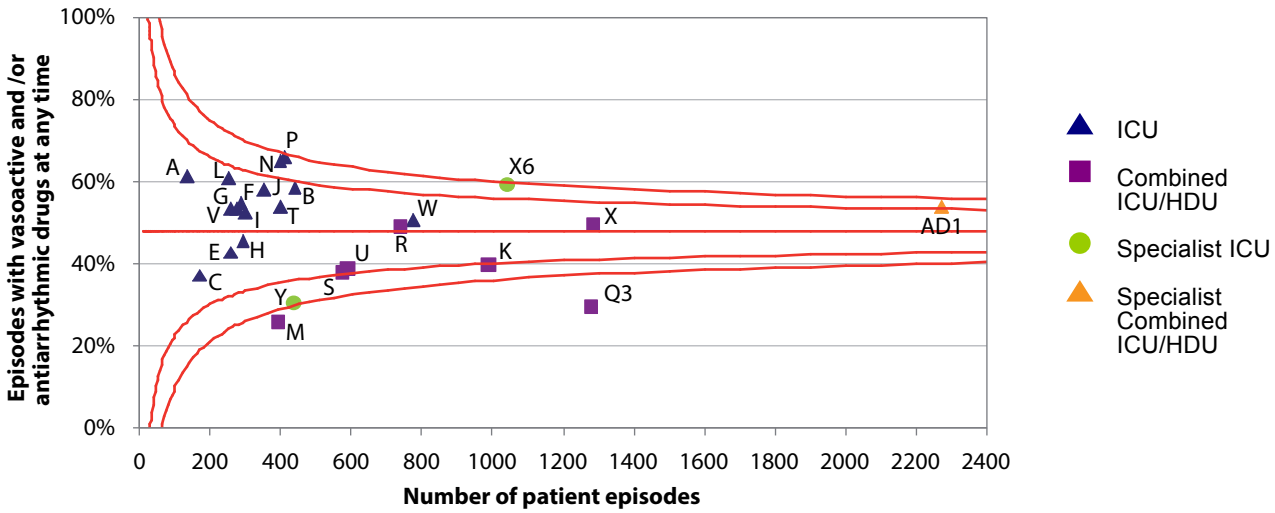
Figure 33 NIV and CPAP rates in HDU (2014)



The proportion of admissions to HDU who received NIV and/or CPAP has remained the same since 2012 at 7%. The top of the chart is dominated by medical HDUs as would be expected.

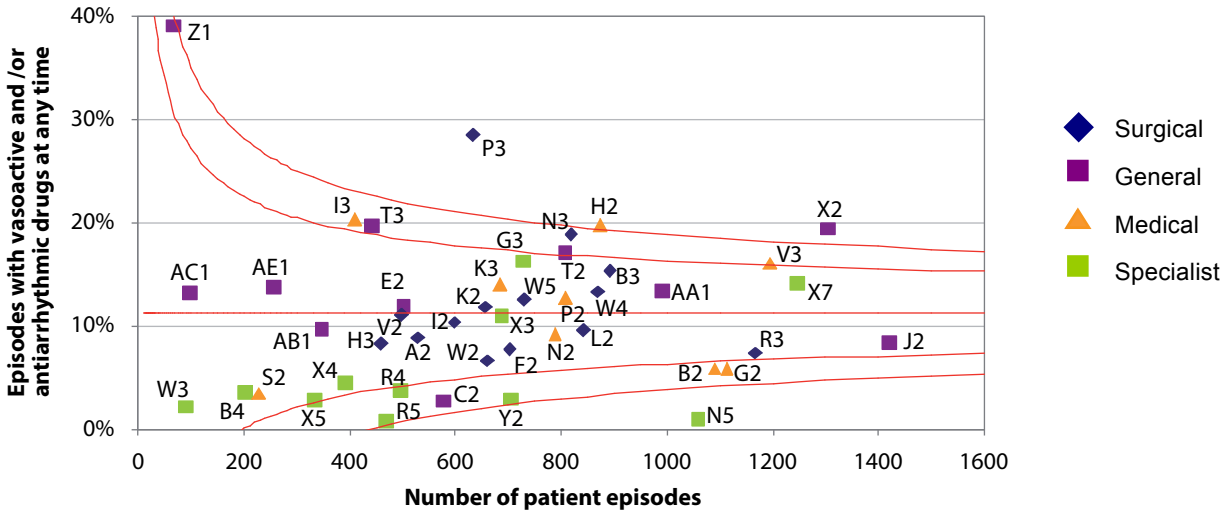
3.3 Cardiovascular support

Figure 34 Use of vasoactive and/or antiarrhythmic drugs in ICU and Combined Units (2014)



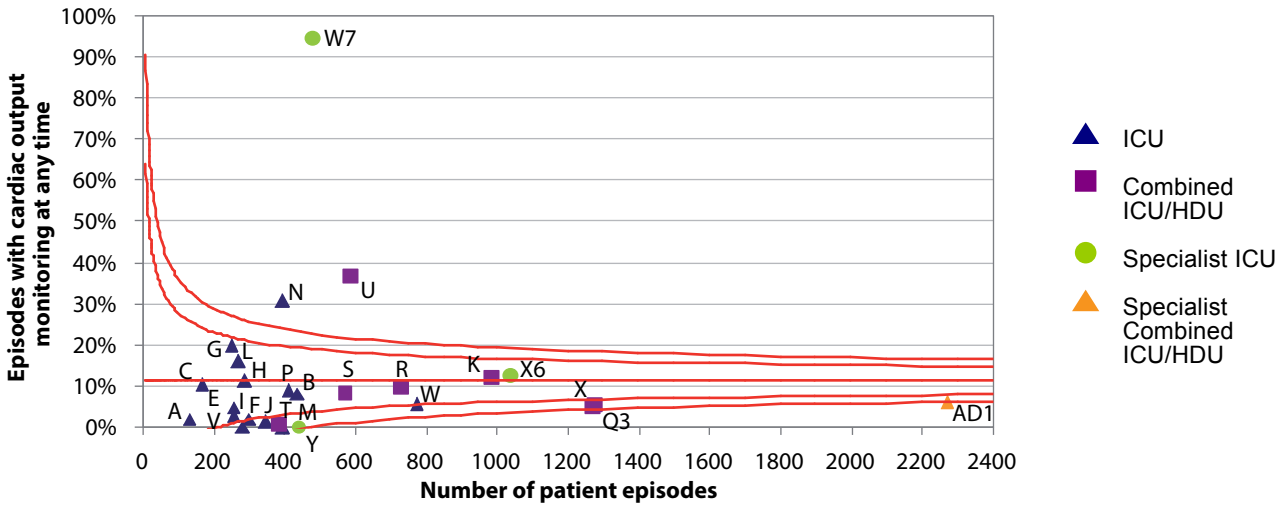
The proportion of patient episodes with vasoactive and/or antiarrhythmic drugs in ICU and Combined Units in 2014 is 48%, similar to the percentage reported in 2013.

Figure 35 Use of vasoactive and/or antiarrhythmic drugs in HDU (2014)



Use of vasoactive and/or antiarrhythmic drugs in HDU has remained the same as last year at 11%.

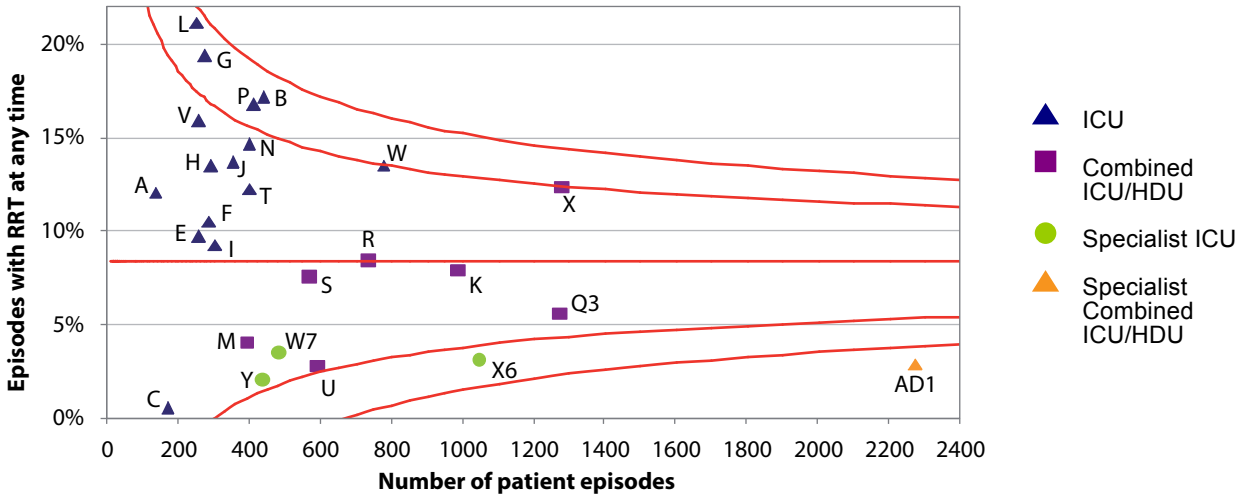
Figure 36 Cardiac output monitoring in ICU and Combined Units (2014)



In 2014 12% of episodes of care had cardiac output monitoring at some time during the patient stay – this is a fall of 6% since 2008. W7 is a cardiothoracic ICU who routinely uses non-invasive cardiac output monitoring.

3.4 Renal support

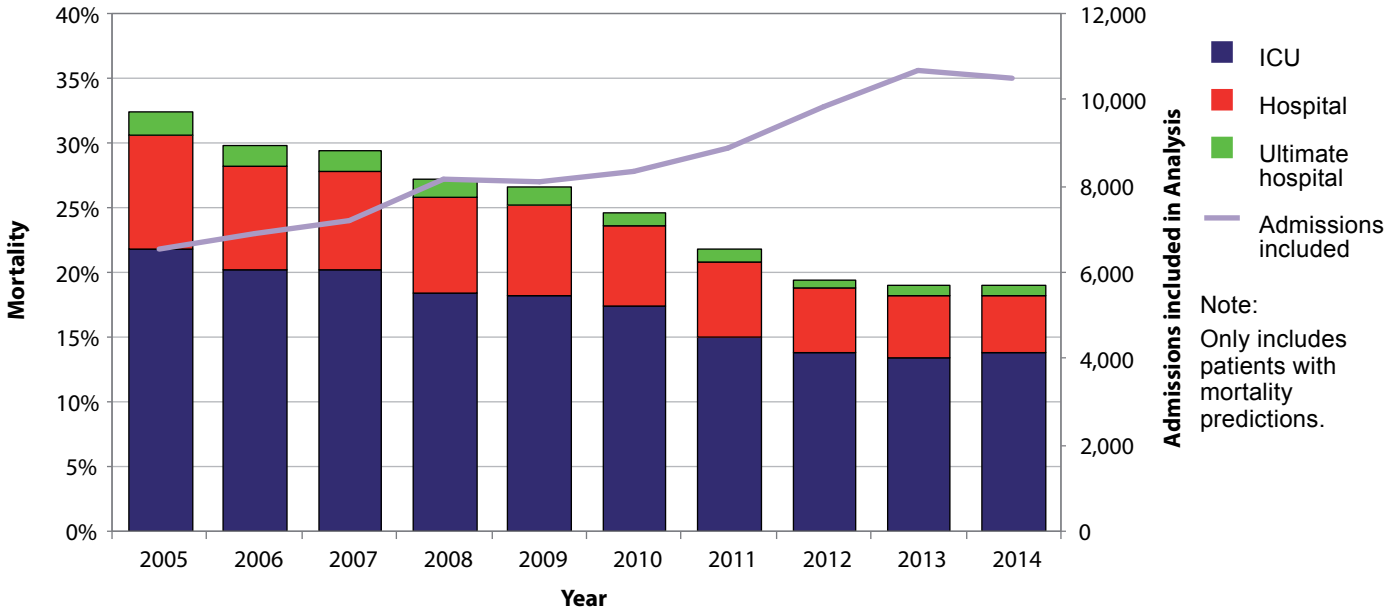
Figure 37 Renal Replacement Therapy in ICU and Combined Units (2014)



The provision of Renal Replacement Therapy (RRT) across Scotland decreased in the last few years from 12% in 2011 to 8% in 2014.

Section 4 Outcomes

Figure 38 Scottish crude mortality of patients in ICU and Combined Units (2005-2014)



Crude mortality in patients admitted to ICU has improved year on year in Scotland. Since 2010 the crude mortality trend has decreased, and plateaued despite the trend of admissions increasing. In 2014 19% of patients died before their ultimate discharge from hospital, this figure has not changed since 2013.

It should be remembered that the above figures are not adjusted for illness severity or case-mix, which can change over time.

Figure 39 Scottish Standardised Mortality Ratios in ICU and Combined Units, using the Standard APACHE II model (2005-2014) and Recalibrated APACHE II model (2007-2014)

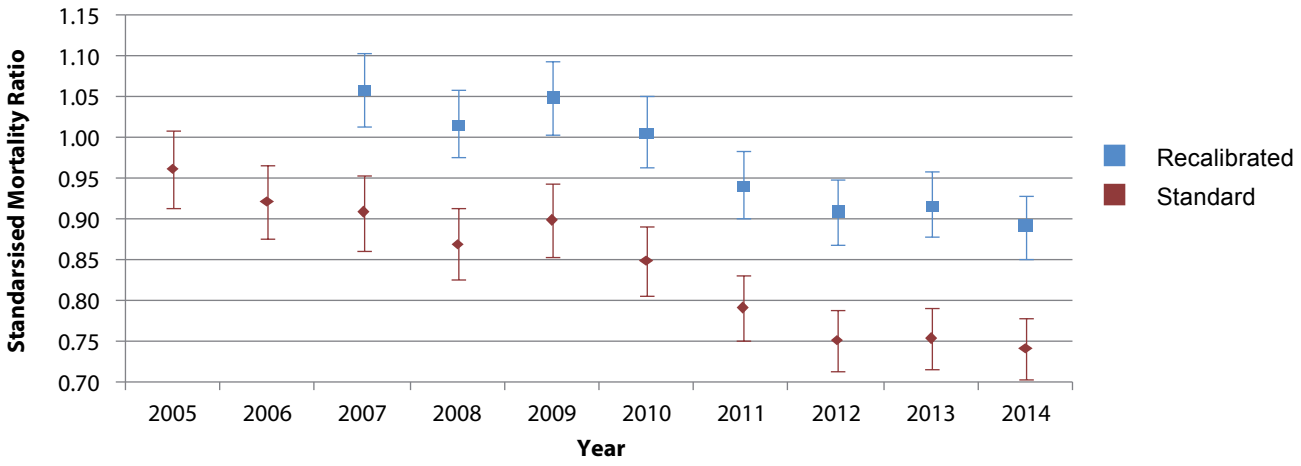


Figure 39 shows the Standardised Mortality Ratio (SMR) where the actual mortality is compared with expected mortality, using APACHE II methodology (see SICSAG website).This allows a better comparison of mortality over time and between different units, as illness severity and case-mix are adjusted for.

The APACHE II scoring system is over 30 years old and may not reflect current ICU practice and case-mix. For this reason APACHE II was recalibrated in 2012 using Scottish data from 2009-2011, then tested on Scottish data from 2007-2008.

SMR has fallen overall in the ten year period in both the standard and recalibrated APACHE models in 2014 scoring 0.74 and 0.89 respectively.

Figure 40 Standard Mortality Ratios using recalibrated APACHE model in ICU and Combined Units (2014)

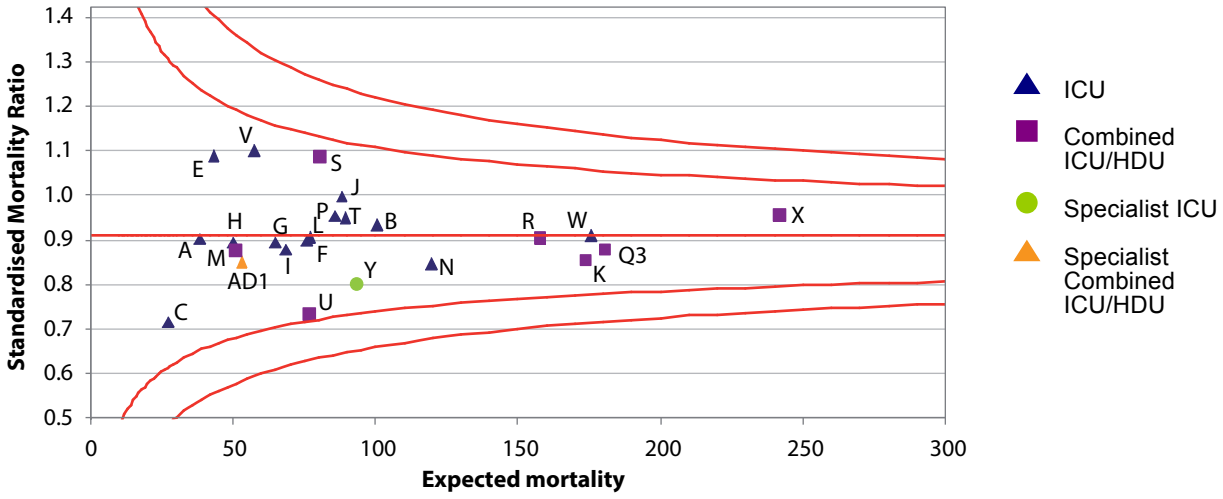


Figure 40 shows the SMR for ICU and Combined Units (excluding X6 and W7), and is calculated using the recalibrated model. It is pleasing to note that no units are significantly higher than the Scottish mean.

Section 5 Surveillance of HAI in Scottish ICUs

5.1 Introduction

In previous years the HAI surveillance in ICUs and SICSAG annual reports were published separately. For the first time the reports have been merged, and the HAI information is now included as Section 5 in the SICSAG annual report. Data were collected from adult patients (ages 16 years or over) admitted to participating ICUs between 01/01/2014 and 31/12/2014, with a stay of more than two days in ICU.[9]

Surveillance of Healthcare Associated Infection in Scottish Intensive Care Units

Patients admitted to intensive care are critically ill and often have chronic underlying illnesses that may in some cases result in immunosuppression or immunodeficiency. Patients in intensive care are subject to invasive procedures as part of their routine care and are therefore vulnerable to infection. In 2011, the Scottish Point Prevalence Survey[10] reported that a quarter of patients in intensive care had a healthcare associated infection (HAI) at the time of survey. The most recent European Point Prevalence survey of HAI and antimicrobial use for 2010 and 2011 indicated that ICUs remained the area in hospitals with the highest HAI prevalence and an at risk group of patients.[11] Therefore, it is important that we continue to work towards reducing HAI and improving outcomes for this patient group.

Data from the 'Healthcare Associated Infection in Scottish Intensive Care Units Surveillance Programme' are reported collaboratively by SICSAG and Health Protection Scotland (HPS). Surveillance and reduction of HAI in ICU is supported by a set of Quality Indicators for Critical Care in Scotland that were implemented in 2012.[12] Within this set of Quality Indicators, two indicators relate to HAI; intensive care and high dependency units are required to have an HAI surveillance system in place and to report on a monthly basis to staff and to the Scottish Patient Safety Programme (SPSP). ICUs are also required to submit data to SPSP on the delivery of the ventilator associated pneumonia (VAP) prevention bundle and the central venous catheter (CVC) insertion and maintenance bundle.

The HAI surveillance programme includes monitoring of data relating to pneumonia (including VAP), bloodstream infections (BSI) and CVC related infections.

Aims and Objectives of HAI surveillance in Scottish ICUs

- To support local feedback of surveillance data for improvement and reduction of HAI.
- To monitor the incidence of HAI in ICU and contribute to a national database of HAI surveillance data for the ICU setting in Scotland. This will allow the epidemiology to be described and the impact of interventions to improve patient safety to be evaluated.
- To provide standardised surveillance definitions and methods to Scottish ICUs in order that data can be benchmarked with Europe.

5.2 Data collection

Healthcare Associated Infections

BSI	Bloodstream Infection
CLABSI	Central Line Associated Bloodstream Infection
CRI	Catheter-related Infection
CR-BSI	Catheter-related Bloodstream Infection
PN	Pneumonia

Data collection methods and definitions

Demographic, invasive device exposure (CVC and invasive respiratory device use) and HAI data were collected in accordance with the methods and data definitions set out in the European Centre for Disease Prevention and Control (ECDC) HAIICU protocol for the surveillance of HAI in ICUs.[13] This protocol is based on the surveillance protocol developed by the HELICS (Hospitals in Europe Link for Infection Control through Surveillance) network.[14] The HELICS-ICU surveillance protocol was developed by national experts in the surveillance of ICU-acquired infections in collaboration with several members of the Infection Section of the European Society of Intensive Care Medicine. Since only minor changes were applied to the protocol by the national HAI-Net surveillance contact points before its integration in The European Surveillance System, data collected using the HELICS-ICU protocol are fully compatible with the ECDC HAIICU protocol.

It should be noted that the collection of BSI-B have been removed from the ECDC protocol and subsequently from the WardWatcher data collection software. From 2014, they are no longer included in the output from the surveillance programme. The numbers of BSI-B previously reported were extremely small and therefore this has a minimal impact on the national dataset. However, data from 2013 will be adjusted to account for this change when making 2013/2014 comparisons of infection rates.

There are two versions of the ECDC HAIICU protocol: (i) Patient-based (or 'standard') protocol: patient-level data are collected for each patient whether there is an infection or not. The data includes risk factors that could allow for risk-adjusted, inter-hospital comparisons and (ii) Unit-based (or 'light') protocol: selected patient-level data are only collected for infected patients. Denominator data (patient-days) are collected each day for the entire ICU. In Scotland, patient-based data are collected.

All surveillance data were collected either via WardWatcher or HELICSwin data collection software. Data were collected by a wide range of clinical staff and the methods for data collection varied between units and in one unit a dedicated data collector was employed. In 2014, a number of updates were made to the HAI pages in WardWatcher with the software being updated in all ICUs on a rolling basis during 2014. The updated changes included the addition of a field to the HAI dataset, which allows the collection of data related to the presence of another infection site where the causative organism is the same as that reported for a BSI. This facilitates the reporting of Central Line Associated BSI (CLASBI), in addition to the ECDC definition for CR-BSI.

A CLABSI was defined as a BSI (according to the ECDC definition) where a CVC was *in situ* on the day of onset or in the 48 hours prior to the day of onset and where there was no infection

with the same organism at another site. Patients meeting these criteria were identified at the data analysis stage of the reporting. Units using HELICSwin applied the definition and reported CLABSI separately. It is anticipated that the collection of these data will provide a measure of how many BSI are associated with CVC use where the microbiology required for the ECDC CR-BSI definition are not available.

Infections included in the surveillance programme

Data relating to central venous catheter-related infection (CRI) which includes local CRI (CRI-1), general CRI (CRI-2) and central venous catheter-related bloodstream infection (CR-BSI), pneumonia (PN), bloodstream infections (BSI) and central line associated BSI (CLABSI) were collected. All infections reported were identified in accordance with the HELICS surveillance methodology.[13]

Antimicrobial resistance data

Antimicrobial resistance (AMR) data were collected for:

Staphylococcus aureus isolates as determined by the organism/antibiotic resistance combinations detailed in the HELICS protocol.[13]

Exclusion criteria and data cleansing

The process followed for exclusion and data cleansing was as follows:

i. Records with essential data missing, such as discharge dates were removed.

ii. Duplicate records were identified and removed.

iii. Duplicate infections were excluded. Criteria for determining possible duplicates were based on those specified by HELICS. Infection episodes were defined by a minimum of a four day interval between PN episodes and a seven day interval for BSI and CRI.[14]

iv. Any patients not discharged at the time of data transfer were arbitrarily discharged (censored) on the last day for which the daily device data had been collected for the patient.

Data analysis methods

Data analyses were carried out using STATA version 13. The Wilson method[15] was used to calculate 95% confidence intervals (CI) for proportions and the Byar method was used to calculate CI for rates.[16]

5.3 Results

NOTE: All the data reported here are provisional. Data submitted by the Royal Infirmary, Edinburgh were incomplete at the time of data transfer, several infections were missing from the dataset and the device data were incomplete. The HAI dataset from the Victoria Infirmary, Glasgow were also incomplete for 2014.

Participating ICUs

A total of 23 adult ICUs in Scotland contributed HAI surveillance data for the period 1st January to 31st December 2014. Of the units contributing data 15 (65.2%) were solely ICUs, seven (30.4%) were combined ICU/ High Dependency Units (HDU) and one (4.3%) was a neurological ICU. The size of the contributing units ranged from three to 18 beds. For the purpose of this report all units including the combined ICU/HDU will be referred to as ICUs.

Patient population

Data from 7041 patients (aged 16 years or over) admitted to the participating ICUs between 01/01/2014 and 31/12/2014 with a stay of more than two days in the ICU were included in the data analysis.

A total of 4.7% admissions had no HAI surveillance data collected via the WardWatcher system. Data from these admissions contribute to the denominator and these admissions are included in the non-infected group for analysis, however the infection status of this group cannot be accurately defined.

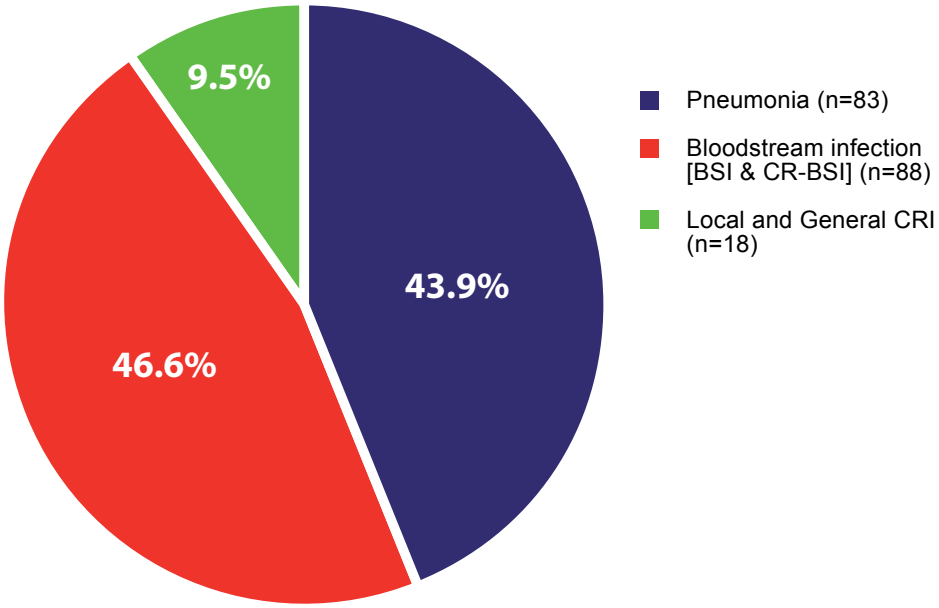
Of the 7041 admissions, 3953 (56.1%) and were male and 3088 (43.9%) were female. The median length of stay (LOS) was five days (interquartile range [IQR] 3,9), the mean Acute Physiology and Chronic Health Evaluation II (APACHE II)[17] score performed within the first 24 hours of the patient stay was 16.9 (95% CI: 16.7-17.1) and the median age was 62 (IQR: 49,72). Central venous catheters (CVCs) were present for 59.3% of patient days and invasive respiratory devices were present for 56.3% of patient days.

HAI epidemiology

In total 189 HAIs (PN, CRI and BSI) were reported from 173 (2.5%, 95% CI: 2.1-2.8) patients and met the criteria for inclusion in the analysis (six duplicate infections were removed from the database).

Of the 189 HAIs, 83 (43.9%) were PN, 88 (46.6%) were BSI (including CR-BSI) and 18 (9.5%) were CRI-1 and CRI-2. Figure 15 shows the percentage of each HAI type reported.

Figure 41 Percentage of each HAI type (n=189)



Patient Characteristics

Table 5 shows patient characteristics for admissions to ICU for more than two days.

Table 5 Characteristics of patients admitted to ICU

Patient Characteristic		Number (n=7041)	Percentage
Gender	Male	3953	56.1
	Female	3088	43.9
Patient Origin (Another area of the hospital)	Ward in hospital	4808	68.3
	Other ICU	238	3.4
	Community	1986	28.2
	Long term care	3	0.04
	Not recorded	6	0.1
Admission Type	Medical	3514	49.9
	Surgical	2796	39.7
	Not recorded	731	10.4
Trauma Admission	No	5676	80.6
	Yes	421	6.0
	Not recorded	944	13.4
Antimicrobials in the 48 hours prior to and/or after admission to ICU	No	1867	26.5
	Yes	4862	69.0
	Not recorded	312	4.4

Comparison of age, APACHE II[17] score (performed within the first 24 hours of the patient stay) and LOS for patients with an HAI and patients without an HAI is shown in Tables 6a and 6b. The median age of patients with and without an HAI was 56 years and 63 years respectively, this was significantly different ($p<0.001$, Mann Whitney U test). Preliminary analysis suggests that there may be a relationship between younger age, trauma and HAI. A detailed analysis of risk factors would be required to determine the nature of this relationship, this will be investigated.

The mean APACHE II[17] score for patients with and without an HAI was 19.8 and 17.8 respectively (19.8 versus 17.8, $p<0.001$ Student T-test). The median LOS for patients with an HAI was 17 days and patients without an HAI was five days, this was significantly different ($p< 0.001$, Mann Whitney U test).

Table 6a Comparison of age and length of stay for patients with HAI (n=173) and without HAI (n=6868)

	No HAI Median	No HAI IQR	HAI	HAI IQR	p value (Mann Whitney U test)
Length of Stay (days)	5	3,8	17	11, 30.5	p <0.001
Age (years)	63	50, 73	56	43, 67.5	p <0.001

Table 6b Comparison of APACHE II score for patients with HAI (n=173) and patients without HAI (n=6363)

	No HAI Mean	No HAI 95% CI	HAI Mean	HAI 95% CI	p value (Student T-Test)
APACHE II score	17.8	17.6 - 18.0	19.8	16.7 - 20.9	p <0.001

Pneumonia

A total of 83 pneumonia were reported from 82 (1.2%, 95% CI: 0.9-1.4) patients. Of these infections 66 (79.5%) infections were considered to be ventilator-associated pneumonia (VAP)§. Eight (9.6%) of the remaining pneumonia were not considered to be VAP and nine were unable to be classified due to missing data. Incidence density rates for pneumonia are shown in Table 7.

Table 7 Incidence density for pneumonia

Invasive respiratory device present‖	Number of Pneumonia	Incidence Rate (95% CI)
Yes (VAP)	66	2.2 per 1000 invasive respiratory device days¶ (1.7-2.8)
No (non-VAP)	8	0.1 per 1000 patient days (0.1-0.3)
Not classified	9	-
All	83	1.5 per 1000 patient days (1.2-1.9)

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

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

¶ VAP incidence- Total number of VAP as a proportion of the sum of the invasive respiratory device days (days that a patient required intubation) contributed by each patient in the study population. The proportion is expressed as the number VAP per 1000 invasive respiratory device days.

Diagnostic categories of pneumonia

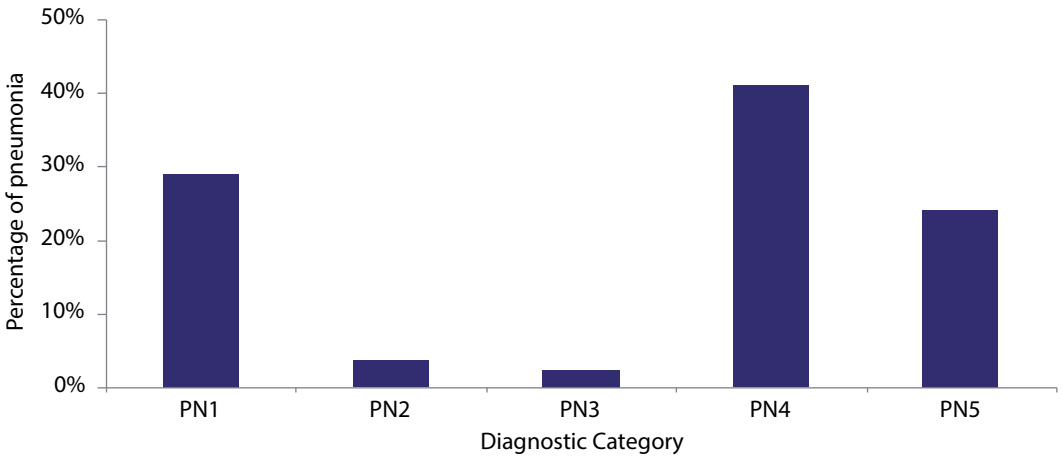
Pneumonia is categorised (for surveillance purposes) according to the microbiology methods (and clinical signs) used to identify the infection[9],details are given in Table 8. Microbiology methods used across Scotland are not standardised and therefore there is variation across units within Scotland.

Table 8 Diagnostic categories and microbiology method for pneumonia

Diagnosis category	Microbiology Method
PN1	Positive quantitative culture from minimally contaminated lower respiratory tract (LRT) specimen e.g. broncho-alveolar lavage.
PN2	Positive quantitative culture from possibly contaminated LRT specimen e.g. endotracheal aspirate.
PN3	Alternative microbiology methods
PN4	Positive sputum culture or non-quantitative LRT specimen culture
PN5	No positive microbiology (Clinical diagnosis only)
UC	*Unclassified- This category covers discrepant data where the pneumonia was reported as PN5 however a microbiology result was recorded for that patient.*

The distribution of pneumonia reported by diagnostic category is shown in Figure 42.

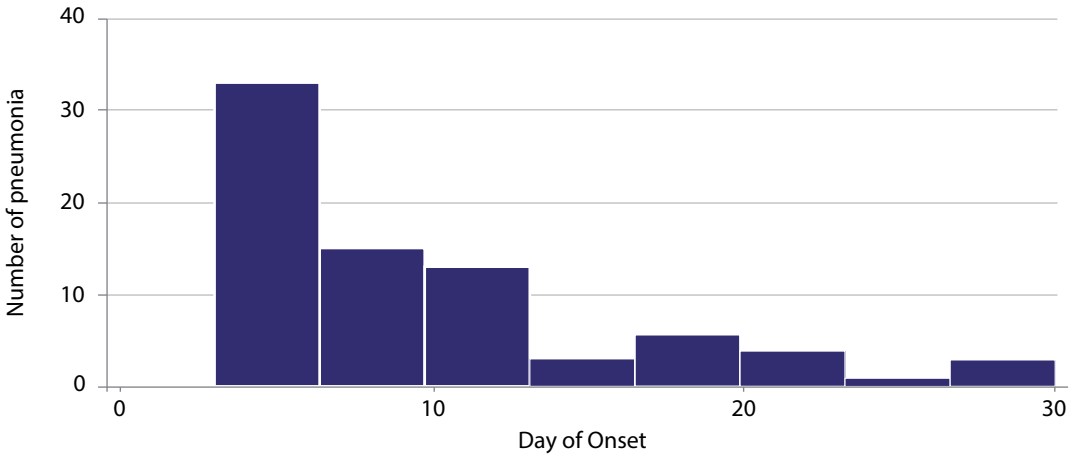
Figure 42 The distribution of diagnostic categories of all pneumonia reported



Day of onset of pneumonia

The median day of onset of pneumonia was eight days (IQR 4, 15), the distribution of the day of onset of pneumonia (from day three of ICU stay onwards) is shown in Figure 43. Note that five data points larger than 30 days were excluded to compress the graph. The median day of onset of VAP was nine days (IQR 5, 17).

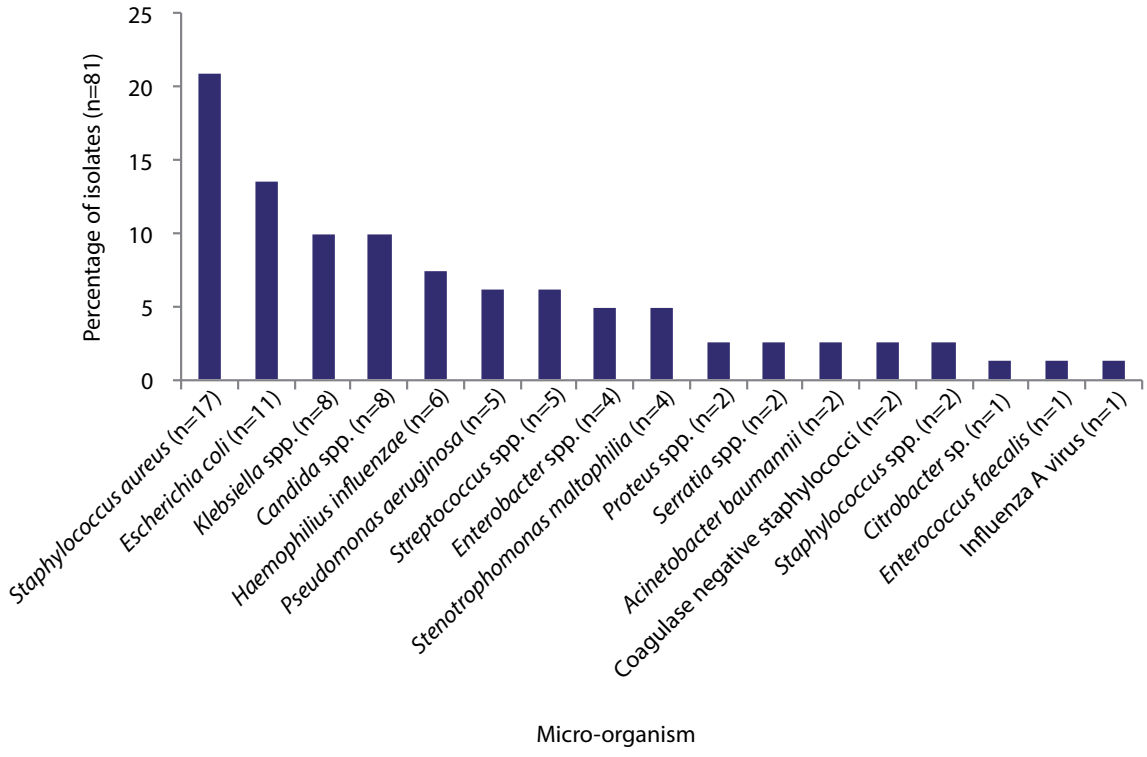
Figure 43 Frequency of all pneumonia by the day of onset



Distribution of micro-organisms isolated from pneumonia

Data for a total of 81 micro-organisms isolated from patients with pneumonia were reported. Figure 44 shows the distribution of micro-organisms isolated from pneumonia. The most frequently isolated micro-organisms were *Staphylococcus aureus* (21.0%), *Escherichia coli* (13.6%), *Klebsiella* spp. (9.9%) and *Candida* spp. (9.9%). Of the 17 *S. aureus* isolated, resistance data were available for 10 isolates and of these none were meticillin resistant *Staphylococcus aureus* (MRSA).

Figure 44 The distribution of micro-organisms isolated from pneumonia



Bloodstream Infections

A total of 88 BSI were reported from 85 (1.2, 95% CI: 1.0-1.5) patients and the median day of onset was day eight (IQR: 5, 14.5). The incidence of all BSI was 1.6 per 1000 patient days (95% CI: 1.3-2.0). Of the BSI, ten (11.4%) were CR-BSI, the incidence density of CR-BSI was 0.3 per 1000 central venous catheter (CVC) days (95% CI: 0.2-0.6). The incidence density of BSI (not including CR-BSI) was 1.4 per 1000 patient days, (95% CI: 1.1-1.8). A summary of BSI incidence rates is shown in Table 9.

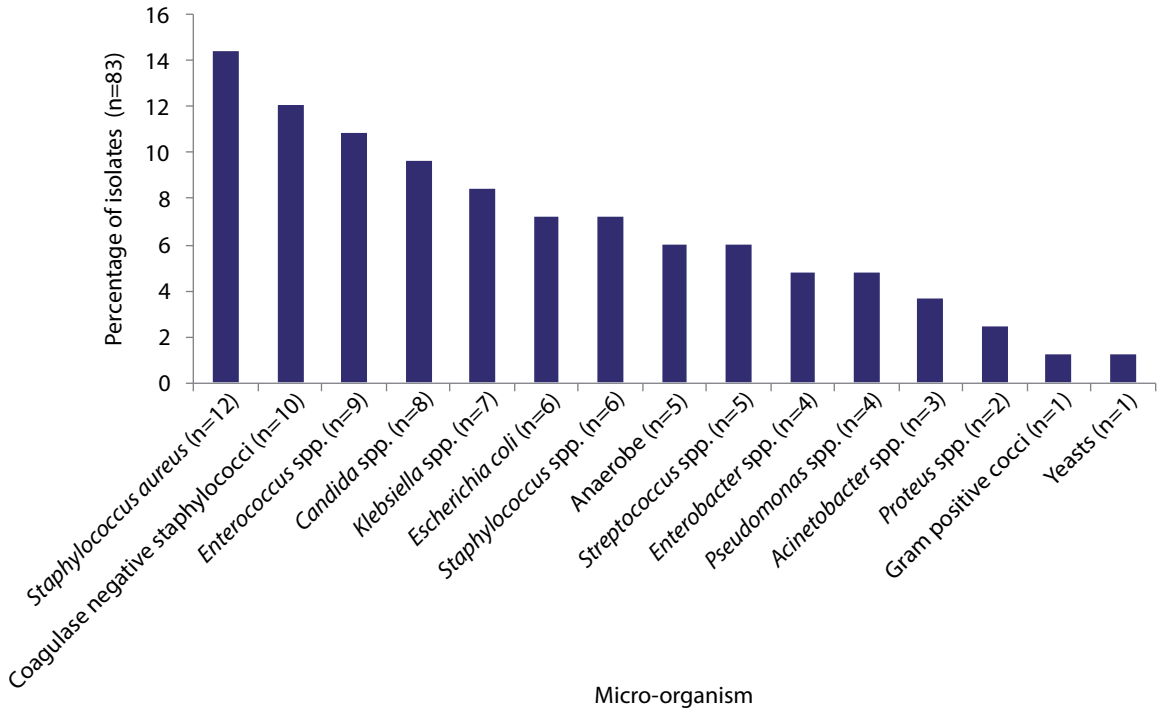
Table 9 Summary of BSI incidence rates

Infection Type	Number of infections	Incidence rate (95% CI)
BSI (not CRI)	78	1.4 per 1000 patient days (1.1-1.8)
CR-BSI	10	0.3 per 1000 CVC days (0.2-0.6)
BSI (All)	88	1.6 per 1000 patient days (1.3-2.0)
All	83	1.5 per 1000 patient days (1.2-1.9)

Distribution of micro-organisms isolated from BSI.

The distribution of micro-organisms from all BSI (CR-BSI and non CR-BSI) is shown in Figure 45. A total of 83 organisms were reported from all BSI. A total of 12 *S. aureus* were isolated and of these, seven isolates had resistance data reported, of these isolates none were MRSA.

Figure 45 The distribution of micro-organisms isolated from bloodstream infections



Presence of CVCs in patients with BSI

Of the 78 BSIs reported (not including CR-BSI), 65 (83.3%) had a CVC *in situ* on the day of onset, or in the 48 hours prior to the date of onset, however microbiological tip culture criteria were not available.

Summarised in Table 10 are the BSI data relative to (i) those confirmed as CR-BSI (reported as CRI3), (ii) those where a CVC was *in situ* around the time of onset and classified as 'Probable CR-BSI' and (iii) those where there was no evidence of CVC use around the time of onset. When the 'Probable and confirmed CR-BSI data were combined, the 'Probable and Confirmed BSI' incidence rate was 2.4 per 1000 CVC days (95% CI: 1.8, 2.9).

Table 10 Summary of Bloodstream infections

Infection Type	Number of infections	Incidence rate (95% CI)
BSI with no evidence of CVC	13	0.2 per 1000 patient days (0.1 -0.4)
BSI with evidence of CVC	65	2.0 per 1000 CVC day (1.6- 2.6)
CR-BSI (confirmed CR-BSI)	10	0.3 per 1000 CVC days (0.2-0.6)
'Probable and confirmed CR-BSI'	75	2.4 per 1000 CVC days (1.8-2.9)

Central Line Associated Bloodstream Infections (CLABSI)

Following the changes to WardWatcher, CLABSI were reported in accordance with the definition described in section 5.2. CLABSI data were reported from 22 units only, one unit did not report these data, BSI data from this unit were excluded from the analysis. It is also important to note that the changes to WardWatcher that facilitated reporting of the data for CLABSI were rolled out over the period February to September 2014. Therefore, the data required to meet the criteria for a CLABSI were not available for all BSIs reported for the whole time period. It is therefore likely that the proportion of BSI meeting the criteria for a CLABSI are an underestimate for this time period.

In total eight BSI were excluded from the analysis, as there was no CLABSI data for these infections. Of the 80 BSI reported, where CLABSI criteria were applied 53.8% (43) met the criteria for CLABSI, 35.0% (28) were BSI and 11.3% (9) were CR-BSI. When the CR-BSI were excluded, 60.5% of BSI were CLABSI, a breakdown of these data are shown in Table 11.

Table 11 Summary of CLABSI data

	CLABSI	Non CLABSI	CLABSI Rate (95% CI)
BSI (n=71)	43 (60.5%)	28 (39.4%)	1.3 per 1000 CVC days (1.0-1.8)
CR-BSI (n=9)	4 (44.4%)	5 (55.6%)	0.3 per 1000 CVC days (0.1-0.5)
Total (n=80)	47 (58.7%)	33 (41.3%)	1.5 per 1000 CVC days (2.0-3.1)

CVC related infection (not including CR-BSI)

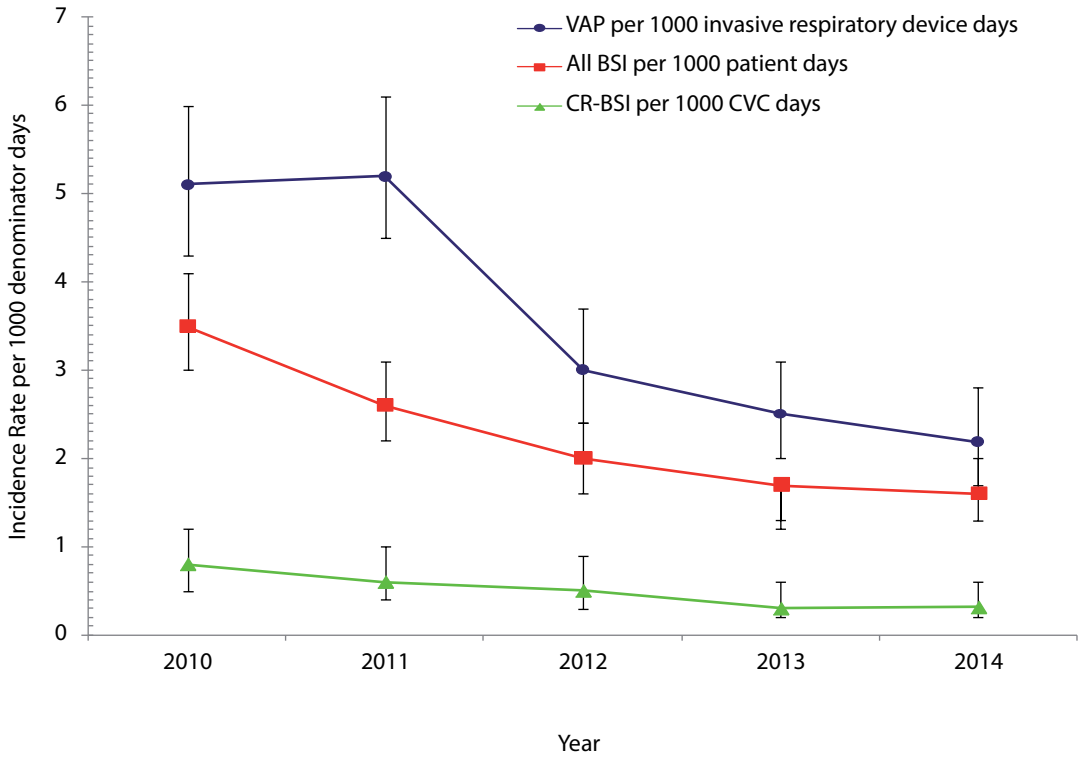
In total, seven CRI-1 and 11 CRI-2 were reported, the incidence density of CRI-1 and CRI-2 was 0.6 per 1000 CVC days, (95% CI: 0.3-0.9). Table 12 shows the distribution of micro-organisms isolated from CRI-1 and CRI-2.

Table 12 The distribution of micro-organisms isolated from CVC related infection (not including CR-BSI)	
Micro-organism	**Number of isolates**
Coagulase negative staphylococci	8
Candida spp.	2
Staphylococcus aureus	1
Serratia marcescens	1
Enterococcus sp.	1
Enterobacter sp.	1
Total	**14**

Year on Year Comparison of Incidence Rates

HAI data collected in 2014 showed that 2.5% (95% CI: 2.1–2.8) of patients admitted to ICU with a stay of more than two days developed one or more HAI this compares with 3.0% of patients in 2013 (Ratio of Rates, p=0.05). Incidence rates for VAP, BSI and CR-BSI for 2010 to 2014 are shown in Figure 46. The HAI data collected from 2014 showed that there have been no significant reduction or increase in incidence rates during this time period.

Figure 46 Incidence rates of BSI, VAP and CR-BSI for 2010 to 2014



Year on year comparison of micro-organisms isolated from HAI

The distribution of the top ten organisms from pneumonia and BSI in 2013 and 2014 are shown in Figures 47 and 48. The number of organisms is small and therefore should be interpreted with caution.

Figure 47 The distribution of the top ten micro-organisms isolated from pneumonia in 2014 and the corresponding distribution of these organisms on 2013

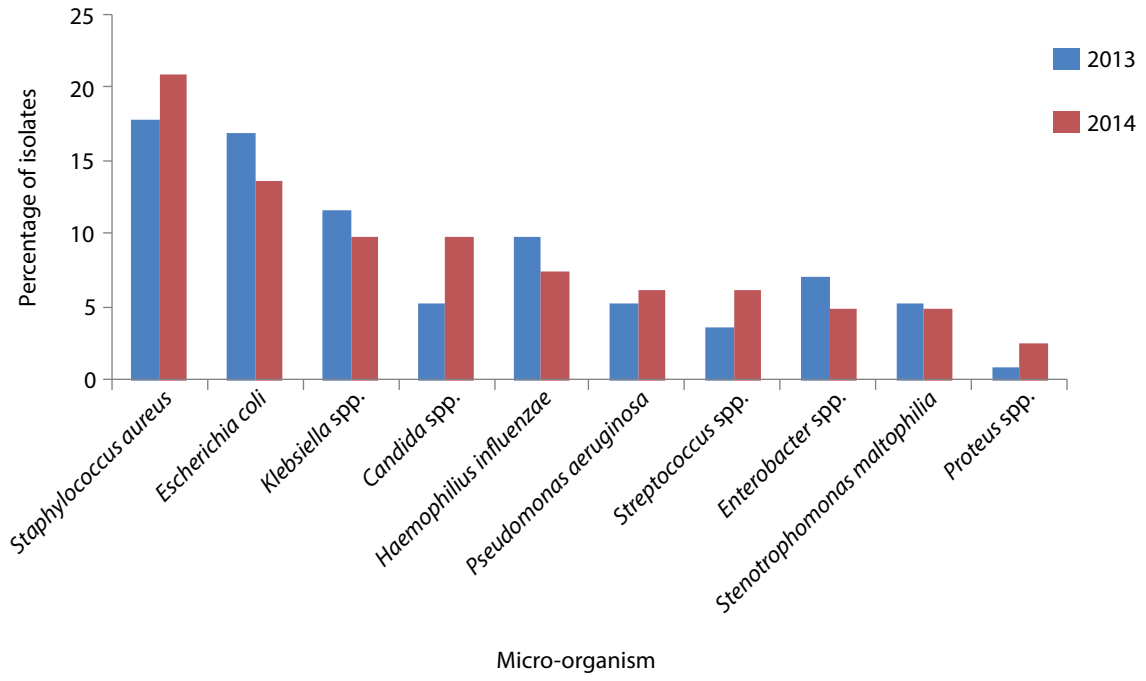
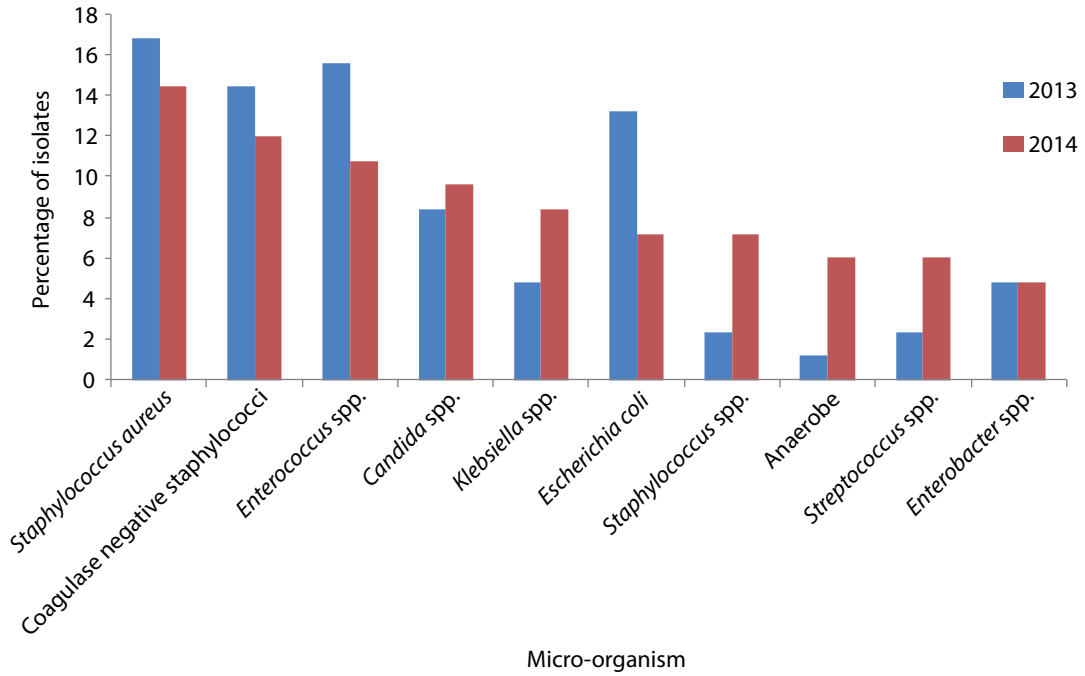


Figure 48 The distribution of the top ten micro-organisms isolated from BSI in 2014 and the corresponding distribution of these organisms in 2013



Benchmarking of incidence rates in Scotland and Europe for 2010 to 2012

Aggregated data from 14 European countries for pneumonia and BSI are shown in Table 13 and are compared to equivalent data from Scotland for the same time period. There is no published European data available beyond 2012 for comparison.

Table 13 Incidence Rates and percentage of patients with pneumonia and BSI for Scotland and Europe, 2010 to 2012

	Europe 2010[18]	Scotland 2010[19]	Europe 2011[20]	Scotland 2011[21]	Europe 2012[22]	Scotland 2012[23]
Percentage of patients who developed a pneumonia	5.9	3.1	5.6	2.8	5.3	2.0
All pneumonia per 1000 patient days	6.9	4.3	6.5	3.9	6.4	2.4
Ventilator associated pneumonia per 1000 intubation days	10.8	5.1	9.9	5.2	10.1	3.0
Percentage of patients who developed a BSI	3.1	2.6	3.0	2.0	3.0	1.5
Incidence rate of all BSI per 1000 patient days	3.5	3.5	3.5	2.6	3.3	2.0

5.4 Discussion

This HAI section is a report of data collected from 23 adult ICUs across Scotland during January to December 2014. Data collected from ICUs are collated by SICSAG and HPS to the Scottish national database for HAI surveillance in ICU. The surveillance programme has been running since 2009 and units contribute their data on a voluntary basis, the programme runs alongside the Scottish Patient Safety Programme (SPSP) and the Quality Indicators for Critical Care in Scotland [3].

It should be noted that data from the Royal Infirmary, Edinburgh were incomplete at the time of data transfer and that data from the Victoria Infirmary, Glasgow were also not complete.

The overall findings presented here indicate that HAI in the intensive care setting during 2014 has remained at a similar level to that reported in for 2013. A total of 2.5% of admissions in participating units developed an HAI in 2014, compared to 3.0% in 2013.[24]

The data showed that 1.2% of patients developed pneumonia and of the 83 pneumonia, 79.5% were VAP. The incidence density of VAP was 2.2 per 1000 intubation days; these rates were unchanged from 2013. A total of 1.2% of patients developed a BSI and the incidence density was 1.6 per 1000 patient days, the CR-BSI rate was 0.3 per 1000 CVC days, again these rates were similar to 2013.[24]

Analyses to produce rates for 'Confirmed and Probable CR-BSI' were carried out. 'Probable CR-BSI' were defined as BSI where there was evidence of a central line *in situ* at the time of onset or having been *in situ* in the 48 hours prior to the date of onset of the BSI and 'Confirmed BSI' were defined as BSI reported as 'CRI3'. Of the BSI (not CR-BSI) that were reported 86.7% were defined as 'Probable CR-BSI', the incidence rate for 'Probable and Confirmed CR-BSI' was 2.4 per 1000 CVC days, this rate compares to that from 2013 data.[24] While this analysis provides a measure of BSI where a CVC was *in situ* around the time of infection, it does not account for other infections that may be present at the time and may be the source of the BSI. Therefore, the role of the CVC in BSI may be over-estimated by this proxy measure.

In order to provide an alternative measure which did not require additional microbiology testing to be carried out, the data collection system (WardWatcher) was updated to provide additional data and facilitate the reporting of CLABSI. Bloodstream infections were classified as a CLABSI if there was a CVC *in situ* in the 48 hours prior to the date of onset, or on the day of infection and if there was no other infection site from which the same organism was isolated.

Analyses of these data showed that 60.5% of BSI (not CR-BSI) reported were CLABSI. The incidence rate for CLABSI was 1.5 per 1000 CVC days, it is important to note that the facility to collect data relative to other infection sites was not available at all units for the full time period covered in this report and therefore a no meaningful comparison can be made with the 'Probable and Confirmed CR-BSI' rates, previously used as a proxy for CLABSI at this time.

Micro-organisms most frequently isolated from pneumonia were *S. aureus* (21.0%), *E. coli* (13.6%), *Klebsiella* spp. (9.9%) and *Candida* spp. (9.9%). The most frequently isolated micro-organisms from BSI were *S. aureus* (14.5%), coagulase negative staphylococci (12.0%) and *Enterococci* spp., (10.8%) accounting for 37.3% of all isolates. The distribution of organisms was similar to previous years and to data published from Europe.[22,24] The number of micro-organisms reported here are relatively small and therefore data should be interpreted with caution. However, it is important to monitor these data and evaluate them in the context of similar data from the wider hospital setting.

BENCHMARKING WITH EUROPE

Scottish data from 2010 to 2012 were compared with the most recently published European data from the same period. The data indicate that incidence rates for VAP and BSI are within the lower end of the range seen across the rest of Europe. Scottish data for this period reflects the significant reductions in VAP and BSI that were seen during this time period, which have subsequently been seen to plateau.[24] The incidence of VAP in Scotland in 2012 was 2.0 per 1000 invasive respiratory device days and the European pooled mean incidence for the same year was 5.3 per 1000 respiratory device days.[22,23] The Scottish incidence rates for VAP seem relatively low, however it is important to note that there are variations across Europe in terms of case-mix, clinical practice, diagnostics and surveillance methods. Scottish BSI rates appear similar to data published from the aggregated European dataset. In 2012, the incidence of BSI in Scotland was 2.0 BSI per 1000 patient days and the European incidence rate was 3.3 BSI per 1000 patient days.[22,23] European data for 2013 and 2014 have not yet been published for comparison. Future plans to validate data across Europe will facilitate benchmarking between countries with more confidence.

LIMITATIONS OF THE DATA

The variation in laboratory practice and data collection methods across Scotland's ICUs is recognised and has previously been noted as limitation of the data.[21] It has been documented in previous reports that there are variations in tip culturing and microbiology methods used to diagnose pneumonia across Scotland. There is no evidence of any significant changes to this microbiology practice during 2014 and therefore the data remain reliable as a national measure of HAI for comparison year on year.

Previous reports highlighted issues around fulfilling the microbiology criteria for CR-BSI, including the lack of routine tip culturing.[21] In response to this, the data collection software has been updated to provide data that makes possible the reporting of CLABSI, the findings from this have already been discussed but due to the way in which the updates were rolled out, a more detailed analysis of the results will not be possible until next year.

As previously mentioned, data from the Royal Infirmary Edinburgh were incomplete at the time of data transfer and data were not collected for the whole time period at the Victoria Infirmary, Glasgow. It is anticipated that the small number of omissions from these units will not impact on the overall outcomes of these data. The missing data will be fully assessed and an update of data will be published if necessary.

FUTURE WORK

UPDATES TO THE ECDC PROTOCOL FOR SURVEILLANCE

In May 2015, ECDC produced a new pilot protocol for surveillance of HAI in ICU. The new protocol includes the collection of ward level data relative to structure and process indicators for HAI; data required would include alcohol hand rub consumption, information relating to staffing levels and audit of patients for indicators relative to clinical care and antimicrobial stewardship. These data would be collected over a two week period each year. Changes relative to the collection of antimicrobial resistance data and the addition of data relative to the relationship of death to HAI have also been included in the protocol.[25] A pilot study will be carried out across Europe to inform further development of a new ECDC protocol for member countries to adopt. SICSAG and HPS will work together to determine the feasibility of and process required to adopting this new protocol in Scotland.

As discussed in previous reports from this surveillance programme, identifying VAP for surveillance purposes remains a challenge and issues around subjectivity of definitions are well recognised. Work has been funded by the Scottish Government to compare the ECDC definitions for VAP and CDC definitions for Ventilator Associated Events.[26] This work is currently being carried out with a volunteer ICU to compare the sets of definitions and it will be reported on in late 2016.

It is clear from the data reported from 2013 and 2014 that rates have reached a plateau and the reductions seen in 2011 and 2012 have not continued.[19,21] This period saw the introduction of Quality Indicators across ICU. While it is encouraging that HAI rates have remained stable for the past two years, it is important that surveillance continues and that all units remain engaged with the surveillance programme. SICSAG and HPS will continue to support units in establishing and maintaining ownership of data, ensuring regular local feedback to staff and fully utilising the approaches to infection prevention that currently exist in the intensive care setting.

With antimicrobial resistance a key focus of health protection, work is in progress to investigate a number of options around record linkage between databases to produce an antimicrobial resistance dataset for the ICU setting. Linkage of data from the national database for HAI in ICU to data from the Electronic Communication of Surveillance in Scotland (ECOSS) database is being investigated. The ECOSS database held at HPS contains details of positive microbiology reports from all laboratories across Scotland. This work is still in its early stages but is hoped that options and feasibility around utilising these data to produce a more comprehensive dataset for microbiology and antimicrobial resistance for ICU surveillance will be produced in the near future.

VALIDATION OF DATA

The validation of surveillance data is essential to ensure that data are robust and can be used to make valid comparisons. As previously mentioned, ECDC are developing a methodology to validate the surveillance data collected across Europe's ICUs. Once developed, HPS and SICSAG will plan a validation study in line with this European method at unit level. This will allow benchmarking to be more accurate as rates can be adjusted depending on the validity of the data being compared.

Conclusion

The SICSAG audit remains a comprehensive report of the activity, interventions and outcome of 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 uniformly high standard. There are challenges, particularly around discharge from critical care taking place out of hours. There is also evidence that some areas of the country lack adequate critical care capacity.

The number of units participating in the audit continues to grow as Critical Care expands to encompass more patients and many of the small number of non-participating units are in the process of doing so. Managers and Health Boards should seek to question why any critical care unit within their remit has not joined SICSAG and provide resource to ensure accurate and timely data collection.

The audit has developed into a highly co-ordinated quality improvement programme which 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 engagement and enthusiasm for the audit among the clinical staff who care for the critically ill in Scotland.

Appendix 1 ICU profiles 2014

Capacity and Multi-disciplinary Team Information

Hospital	Actual beds	Funded beds (Level 3/2)[1]	Trained Nurse WTE*	ICU pharma-cist	Microbiolo-gist	Physi-otherapy	Dietetic review available
ARI General	16	10	7	everyday	6 days a week Telephone service on Sunday	everyday and on call service on Sunday	weekdays
ARI Cardio	6	5	5.1	weekdays	On call as needed	everyday	On referral
AYR	5	4	6.2	weekdays	On call as needed	On call as needed	weekdays
Crosshouse	6	5	7	weekdays	everyday	everyday	weekdays
BGH	5	5	5.8	weekdays	weekdays	everyday	weekdays
DGRI	5	4	6.9	weekdays	Phone service at weekends	everyday	weekdays
VHK	10	9	6.7	everyday	everyday	everyday	everyday
FVRH	19	7/12	5.5	weekdays	everyday	everyday	weekdays
GRI	20	12/8	4.7	weekdays	everyday	everyday	As required
IRH	3	2	4.5	weekdays	other	everyday	weekdays
RAH	8	7	5.9	weekdays	everyday	everyday	weekdays
SGH General	5	5	6.1	weekdays	everyday	everyday	weekdays
SGH Neuro	9	6	7.3	everyday	everyday	everyday	weekdays
VI	5	5	7	weekdays	everyday	everyday	weekdays
WIG	9	8	7.2	weekdays	everyday	everyday	other
Raigmore	7	8	5.97	weekdays	other	everyday	weekdays
Hairmyres	10	7.25[1]	5.3	weekdays	weekdays	weekdays	weekdays
MDGH	6	5.2[1]	5.4	everyday	other	other	weekdays
Wishaw	6	5.3[1]	5.2	weekdays	weekdays	everyday	weekdays
RIE General	18	16/2	6.2/3.1	weekdays	weekdays	everyday	weekdays
RIE Cardio	11	9	6.6	weekdays	weekdays	everyday	weekdays
SJH	7	3/2	6.4	weekdays	weekdays	everyday	other
WGH	16	10/6	6.3	weekdays	everyday	everyday	weekdays
Ninewells	9	8	5.5	weekdays	everyday	everyday	everyday
PRI	4	3	6.3	everyday	everyday	everyday	weekdays
GJNH Critcare	22 ICU	33[2]	6.2 for ITU beds only	weekdays	everyday	everyday	weekdays

Notes

1 Funded beds increase in winter months.

2 Available beds vary daily from Friday to Tuesday.

* Whole Time Equivalent per level 3 bed.

Appendix 2 HDU profiles 2014

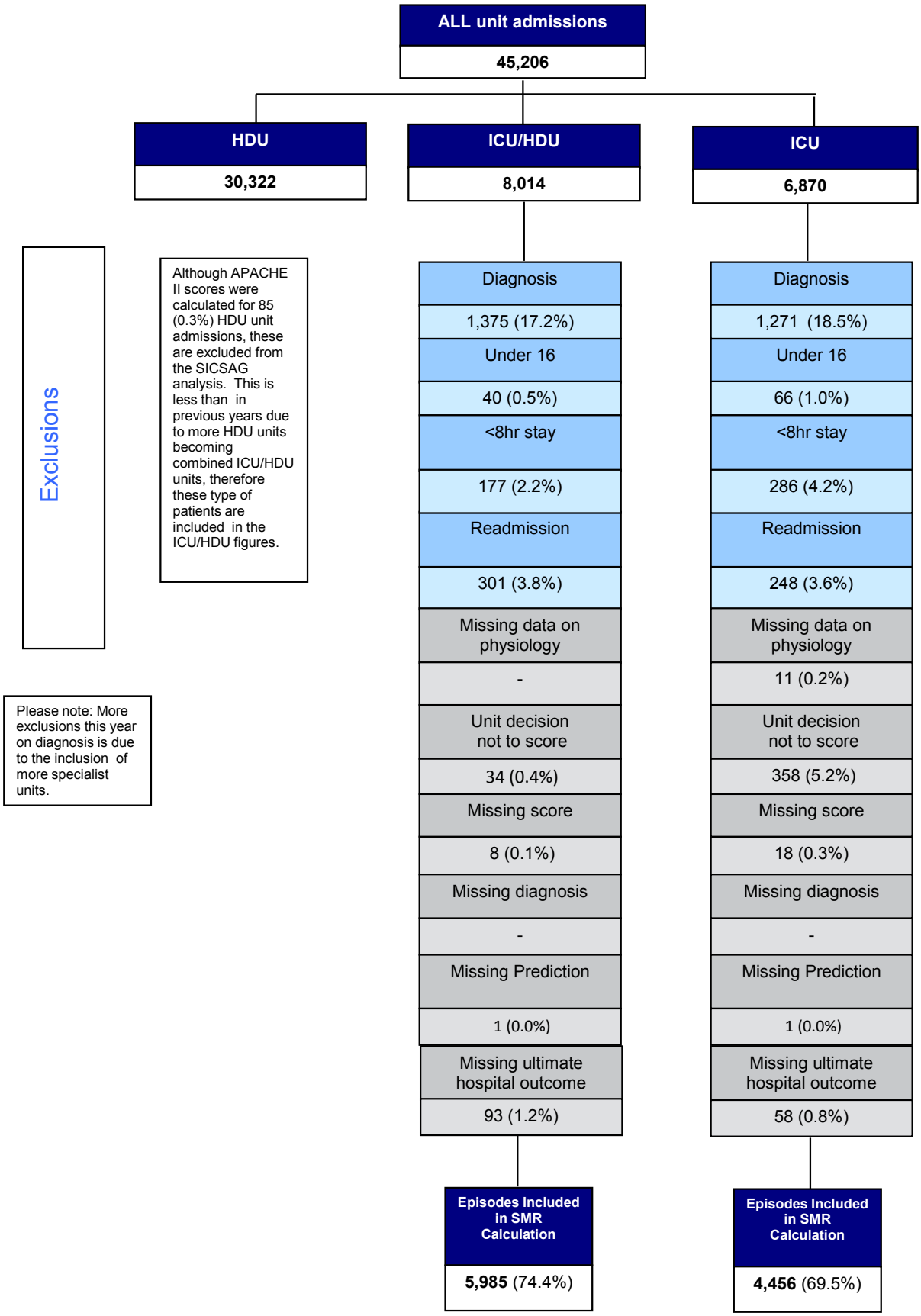
Capacity and Multi-disciplinary Team Information								
Hospital	**Actual beds**	**Funded Level 2/1 beds[1]**	**Trained Nursing WTE***	**Dedicated HDU Consultant**	**HDU pharmacist**	**Microbiologist**	**Physiotherapy**	**Dietetic review**
Ayr HDU	4	4	3	no	weekdays	other	weekdays	weekdays
Crosshouse SHDU	12	8	3	no	weekdays	everyday	weekdays	weekdays
Crosshouse MHDU	12	12	1.8	everyday	weekdays	other	weekdays	weekdays
DGRI MHDU	8	8	3.2	no	weekdays	other	weekdays	weekdays
DGRI SHDU	4	4	3.6	no	other	other	everyday	weekdays
VHK SHDU	10	8	3.2	weekdays	weekdays	other	everyday	other
VHK MHDU	8	8	3.4	no	weekdays	other	everyday	other
VHK RHDU	3	3	3	yes	weekdays	weekdays	weekdays	weekdays
ARI SHDU (31/32) Ward 503	8	7	2.8	no	weekdays	other	everyday	weekdays
ARI SHDU (35) Ward 506	8	8	2.7	no	other	other	everyday	weekdays
ARI CHDU	10	7 (Jan-Jun), 6 (Jul-Dec)	2.2	no	weekdays	everyday	everyday	weekdays
ARI NHDU	-	2	No separate funding	yes	weekdays	other	everyday	weekdays
Dr Gray's HDU	10	10	2.1	no	other	other	other	other
GRI SHDU	8	8	2.9	everyday	everyday	everyday	weekdays	everyday
GRI MHDU	6	6	2.6	weekdays	weekdays	everyday	weekdays	weekdays
IRH SHDU	4	4	4.5[1]	no	weekdays	other	everyday	weekdays
RAH HDU	12	12	2.9	no	weekdays	other	weekdays	other
SGH SHDU	6	6	3.5	no	weekdays	other	weekdays	weekdays
SGH NHDU	6	4	2.7	no	everyday	everyday	everyday	weekdays
VI SHDU	8	8	2.7	no	weekdays	other	weekdays	other
WIG HDU	4	4	3.2	everyday	weekdays	everyday	everyday	other
GGH HDU	9	8	2.7	no	weekdays	everyday	everyday	other
Raigmore SHDU	6	6	3.0	no	weekdays	other	everyday	weekdays
Raigmore MHDU	4	4	2	weekdays	weekdays	other	weekdays	weekdays
Belford HDU	2	2	1.5	no	weekdays	other	other	weekdays
Hairmyres MHDU	4	4	2 nurses per shift[2]	weekdays	weekdays	everyday	everyday	weekdays
MDGH SHDU	8	8	2.6	no	weekdays	other	everyday	weekdays
MDGH MHDU	4	4	0.5	weekdays	everyday	other	weekdays	weekdays
Wishaw SHDU	6	6.3	2.3	everyday	everyday	weekdays	weekdays	weekdays

Capacity and Multi-disciplinary Team Information								
Hospital	**Actual beds**	**Funded Level 2/1 beds[1]**	**Trained Nursing WTE***	**Dedicated HDU Consultant**	**HDU pharmacist**	**Microbiologist**	**Physiotherapy**	**Dietetic review**
Wishaw MHDU	12	6/6	0.5	no	weekdays	everyday	everyday	weekdays
RIE HDU	10	10	3.1	everyday	weekdays	other	everyday	weekdays
RIE RHDU	8	8	0.5	everyday	weekdays	other	everyday	weekdays
RIE Transplant HDU	4	4	4.25	no	weekdays	weekdays	weekdays	weekdays
RIE Vascular (Level 1)	4	0/4	Shared with Vascular ward	no	other	On referral only	other	On referral only
RIE CHDU	10	8	3.8	everyday	weekdays	weekdays	everyday	other
WGH SHDU	10	6/4	2.9	no	weekdays	everyday	weekdays	weekdays
WGH NHDU/ Level 1	7	4/3	3.4	other	weekdays	other	everyday	weekdays
Balfour Hospital HDU	3	2.5[3]	3.7	everyday	weekdays	other	everyday	weekdays
GBH HDU	2	No separate funding[4]	3.7	everyday	weekdays	other	weekdays	weekdays
Ninewells SHDU	10	10	3.7	weekdays	other	everyday	everyday	weekdays
Ninewells MHDU	6	6	3.1	weekdays	weekdays	everyday	everyday	weekdays
Ninewells OHDU	2	2[5]	0.5	no	other	other	other	weekdays
PRI HDU	4	4	2.7	no	weekdays	other	everyday	weekdays
WIH HDU	4	4	1.0	no	weekdays	everyday	weekdays	weekdays

Key:
SHDU – Surgical HDU
MHDU – Medical HDU
NHDU – Neurological HDU
CHDU – Cardiothoracic HDU
RHDU – Renal HDU

Notes
1 Nursing staff cover ICU, SHDU and CCU beds therefore this figure is approximate.
2 Staff rotate from the general ward; two trained nurses are allocated to HDU every shift.
3 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on two beds in this unit.
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.
* Whole time equivalent per level 2 bed.

Appendix 3 Eligibility for APACHE II score



Appendix 4 Level of care

Level of care is calculated on a daily basis from the Augmented Care Period (ACP) page of WardWatcher.

WardWatcher scores levels of care based on support of five organ systems: respiratory, cardiovascular, renal, neurological and dermatological.

Level 3

Advanced respiratory support (connected to a ventilator via ETT or tracheostomy) OR

Two or more organ systems are being supported (except basic respiratory and basic cardiac)

Level 2

One organ supported

Level 1

Epidural or/and

General observations requiring more monitoring than can be provided on a general ward

Level 0

A patient is assessed as level 0 if not assessed as level 1, 2 or 3 (e.g. no organ support and adequate monitoring could be provided on a general ward)

Level of care is based on the Intensive Care Society guidelines[5].

Appendix 5 HAI Reader's Notes

Confidence Intervals

A range of values within which we are fairly confident the true population value lies. A 95% CI means that we can be 95% confident that the population value lies within the lower and higher confidence limits.

Incidence Density for BSI and PN

Total number of BSI/PN as a proportion of the sum of the ICU in-patient days contributed by each patient in the study population. The proportion is expressed as the number of BSI/PN per 1000 patient days.

Incidence Density for CRI and CR-BSI

Total number of CRI/CR-BSI as a proportion of the sum of the CVC days (days that a patient had a CVC *in situ*) contributed by each patient in the study population. The proportion is expressed as the number CRI/CR-BSI per 1000 CVC days

Incidence density for VAP

Total number of VAP as a proportion of the sum of the invasive respiratory device days (days that a patient required intubation) contributed by each patient in the study population. The proportion is expressed as the number VAP per 1000 invasive respiratory device days.

Interquartile range

The inter quartile range for a distribution is the distance between the first and third quartiles.

The quartiles split the distribution into four equal parts with the median being the second quartile. Consequently the inter quartile range is the range containing the middle 50% of the data.

Mean

The mean value is obtained by adding all the values in a population or sample and dividing the total by the number of samples that are added.

Median

The median of a finite set of values is that value which divides the set into two equal parts such that the number of values equal to or greater than the median is equal to the number of values equal to or less then the median. If the number of observations is odd, the median will be the middle value when all values have been arranged in order of magnitude, when the number of observations is even, the median is the mean of the two middle observations.

Standard Deviation

A measure of how close the sample mean is to the population mean.

A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.

Device Utilisation

Total number of days that a patient had a CVC or invasive respiratory device *in situ* as a proportion of the sum of the patient days contributed by each patient in the study population. The proportion is expressed as the number of CVC or invasive respiratory device per 100 patient days.

Appendix 6 List of abbreviations

ACP	Augmented Care Period
CLABSI	Central Line Associated Bloodstream Infection
COMQI	Clinical Outcome Measures for Quality Improvement
CPAP	Continuous Positive Airway Pressure
CRBSI	Catheter Related Bloodstream Infection
CVC	Central Venous Catheter
ECDC	European Centre for Disease Prevention and Control
HAI	Healthcare Associated Infection
HAN	Hospital at Night
HDU	High Dependency Unit
HPS	Health Protection Scotland
ICS	Intensive Care Society
ICU	Intensive Care Unit
ISD	Information Services Division
LCP	Liverpool Care Pathway
M & M	Morbidity and Mortality
NIV	Non Invasive Ventilation
PHI	Public Health and Intelligence (formerly ISD and HPS)
QI	Quality Indicator
RRT	Renal Replacement Therapy
SCCTG	Scottish Critical Care Trials Group
SD	Standard Deviation
SICS	Scottish Intensive Care Society
SICSAG	Scottish Intensive Care Society Audit Group
SMR	Standardised Mortality Ratio
SPSP	Scottish Patient Safety Programme
VAP	Ventilator Associated Pneumonia
WTE	Whole Time Equivalent
WW	WardWatcher

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Report Writing Subgroup 2014		
Name	**Title**	**Address**
Dr Stephen Cole	Chairman	Consultant in Critical Care, Ninewells Hospital, Dundee
Dr Charles Wallis	Vice Chairman	Consultant in Critical Care, Western General Hospital, Edinburgh
Professer Jacqui Reilly	Consultant Lead HAI, AMR, Infection Prevention and Control and Decontamination	Health Protection Scotland, NHS National Services Scotland
Mr Paul Smith	National Clinical Coordinator	SICSAG, Information Services Division, NHS National Services Scotland
Ms Lorraine Smyth	Senior Information Analyst	SICSAG, Information Services Division, NHS National Services Scotland
Dr Jodie McCoubrey	Epidemiologist, Surveillance of Scottish HAI Programme	Health Protection Scotland, NHS National Services Scotland
Dr Ian Mellor	Consultant in Anaesthesia and Intensive Care	Consultant in Critical Care, Ninewells Hospital, Dundee
Dr Jim Ruddy	Consultant	Consultant in Critical Care, Monklands District General Hospital, Airdrie

Hospital	Unit	Letter
Inverclyde Royal Hospital	ICU	A
	SHDU	A2
Victoria Hospital, Kirkcaldy	ICU	B
	MHDU	B2
	SHDU	B3
	RHDU	B4
Perth Royal Infirmary	ICU	C
	HDU	C2
Ayr Hospital	ICU	E
	HDU	E2
Southern General Hospital, Glasgow	ICU	F
	SHDU	F2
Crosshouse Hospital, Kilmarnock	ICU	G
	MHDU	G2
	SHDU	G3
Dumfries & Galloway Royal Infirmary	ICU	H
	MHDU	H2
	SHDU	H3
Monklands DGH, Airdrie	ICU	I
	SHDU	I2
	MHDU	I3
Royal Alexandra Hospital, Paisley	ICU	J
	HDU	J2
Glasgow Royal Infirmary	ICU/HDU	K
	SHDU	K2
	MHDU	K3
Victoria Infirmary, Glasgow	ICU	L
	SHDU	L2
St John's Hospital, Livingston	ICU/HDU	M
Ninewells Hospital, Dundee	ICU	N
	MHDU	N2
	SHDU	N3
	OHDU	N5
Raigmore Hospital, Inverness	ICU	P
	MHDU	P2
	SHDU	P3
Forth Valley Royal Hospital	ICU/HDU	Q3
Western General Hospital, Edinburgh	ICU/HDU	R
	SHDU	R3
	NHDU	R4
	Neurological (Level 1)	R5
Hairmyres Hospital, East Kilbride	ICU/HDU	S
	MHDU	S2
Western Infirmary, Glasgow	ICU	T
	HDU	T3
Gartnavel General Hospital, Glasgow	HDU	T2
Borders General Hospital	ICU/HDU	U
Wishaw General Hospital	ICU	V
	SHDU	V2
	MHDU	V3
Aberdeen Royal Infirmary	ICU	W
	SHDU (ward 503)	W2
	SHDU (ward 506)	W4
	CHDU	W5
	CICU	W7
Royal Infirmary of Edinburgh	ICU/HDU	X
	HDU	X2
	RHDU	X3
	Transplant HDU	X4
	Vascular (Level 1)	X5
	CICU	X6
	CHDU	X7
Southern General Hospital, Glasgow	NICU	Y
	NHDU	Y2
Gilbert Bain Hospital, Shetland	HDU	Z1
Dr Gray's Hospital, Elgin	HDU	AA1
Western Isles Hospital, Stornoway	HDU	AB1
Belford Hospital, Fort William	HDU	AC1
Golden Jubilee National Hospital, Clydebank	ICU/HDU	AD1
Balfour Hospital, Orkney	HDU	AE1

Hospital	Abbreviation	Unit	Letter
Inverclyde Royal Hospital	IRH	ICU	A
		Surgical HDU	A2
Dr Gray's Hospital, Elgin		General HDU	AA1
Western Isles Hospital, Stornoway	WIH	General HDU	AB1
Belford Hospital, Fort William	Belford	General HDU	AC1
Golden Jubilee Hospital	GJH	Combined	AD1
Balfour Hospital, Orkney	Balfour	General HDU	AE1
Victoria Hospital, Kirkcaldy	VHK	ICU	B
		Medical HDU	B2
		Surgical HDU	B3
		Renal HDU	B4
Perth Royal Infirmary	PRI	ICU	C
		General HDU	C2
Ayr Hospital	AYR	ICU	E
		HDU	E2
Southern General Hospital, Glasgow	SGH	ICU	F
		Surgical HDU	F2
Crosshouse Hospital, Kilmarnock	Crosshouse	ICU	G
		Medical HDU	G2
		Surgical HDU	G3
Dumfries & Galloway Royal Infirmary	DGRI	ICU	H
		Medical HDU	H2
		Surgical HDU	H3
Monklands DGH, Airdrie	MDGH	ICU	I
		Surgical HDU	I2
		Medical HDU	I3
Royal Alexandra Hospital, Paisley	RAH	ICU	J
		General HDU	J2
Glasgow Royal Infirmary	GRI	Combined	K
		Surgical HDU	K2
		Medical HDU	K3
Victoria Infirmary, Glasgow	VI	ICU	L
		Surgical HDU	L2
St John's Hospital, Livingston	SJH	Combined	M
Ninewells Hospital, Dundee	Ninewells	ICU	N
		Medical HDU	N2
		Surgical HDU	N3
		Obstetrics HDU	N5
Raigmore Hospital, Inverness	Raigmore	ICU	P
		Medical HDU	P2
		Surgical HDU	P3
Forth Valley Royal Infirmary	FVRH	Combined	Q3
Western General Hospital, Edinburgh	WGH	Combined	R
		Surgical HDU	R3
		Neuro HDU	R4
		Neuro HDU	R5
Hairmyres Hospital, East Kilbride	Hairmyres	Combined	S
		Medical HDU	S2
Western Infirmary, Glasgow	WIG	ICU	T
		General HDU	T3
Gartnavel General Hospital, Glasgow	GGH	General HDU	T2
Borders General Hospital	BGH	Combined	U
Wishaw General Hospital	Wishaw	ICU	V
		Surgical HDU	V2
		Medical HDU	V3
Aberdeen Royal infirmary	ARI	ICU	W
		Surgical HDU (503)	W2
		Neuro HDU	W3
		Surgical HDU (506)	W4
		Cardiothoracic HDU	W5
		Cardiothoracic ICU	W7
Royal Infirmary of Edinburgh	RIE	Combined	X
		General HDU	X2
		Renal HDU	X3
		Transplant HDU	X4
		Vascular HDU (Level 1)	X5
		Cardiothoracic ICU	X6
		Cardiothoracic HDU	X7
	SGH	Neurological ICU	Y
		Neuro HDU	Y2
Gilbert Bain Hospital, Shetland	GBH	General HDU	Z1

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