NHS National Services Scotland

Scottish Intensive Care Society Audit Group

Audit of Critical Care in Scotland 2014
Reporting on 2013

ISD SCOTLAND

First published October 2009

ISBN: 978-1-84134-014-2

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Foreword

This report describes the activities and outcomes for Scottish Intensive Care Units (ICU) and High Dependency Units (HDU) in 2013. It is a continuation of work which has produced an ever expanding dataset since 1995.

The Scottish Intensive Care Society Audit Group (SICSAG) is a national Critical Care audit, funded through Public Health and Intelligence (formerly Information Services Division), 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.

One of the signs of a successful programme is that other Critical Care areas seek to join and become part of the Critical Care Audit in Scotland. I am pleased to report that this continues to be the case this year and that we have had representation from colleagues working in Obstetric Critical Care who wish to join the SICSAG programme.

The continued expansion of the audit together with the increasing number of units now participating means that in 2013 we report on over 43,000 of our hospitals sickest patients.

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

We are continuing our established collaboration with Health Protection Scotland (HPS) to collect, analyse and report on Healthcare Associated Infection (HAI) Surveillance across Scottish ICU. A separate report is published in tandem with this report on an annual basis and we hope to move to joint publication in future years.

Measures of success include the reporting of professionally agreed Standards and Quality Indicators across Critical Care in Scotland. We report for the second 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.

The popular annual conference held in conjunction with the Scottish Critical Care Trials Group will take place this year at the Stirling Management Centre on 4th and 5th September 2014, details of this and further information are available at www.sicsag.scot.nhs.uk.

This is my first year as Chair of SICSAG and my sincere thanks go to my predecessor Dr Brian Cook who has recently stepped down from this role but remains closely involved in the audit.

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

Particular thanks go to the SICSAG steering group, Angela Khan (National Clinical Coordinator), Claire McGeogh (Quality Assurance Manager), Deborah Murphy (Regional Coordinator), Lorraine Smyth, (Senior Information Analyst), Gerry O'Neill (Information Analyst) and the network of Local Audit Team Coordinators.

Dr Stephen Cole

Chairman

Introduction

SICSAG continue to work with the Scottish Critical Care community and other NHS bodies to promote patient safety and improve quality of patient care and outcomes as set out in the Healthcare Quality Strategy for NHS Scotland 2010[1].

This year, we are reporting on the management of 14,705 patients admitted to ICU and Combined Units (units with a combination of ICU and HDU beds) and 28,975 patients admitted to HDU during 2013. 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 (section 1) and then follows the patient's journey through sections 2 to 4 (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 and is not intended as a judgement of what is 'correct' but to highlight differences and inform quality improvement. We recommend units who are outliers (above or below 3 standard deviations) examine the reason for this. Appendix 3.3.2 explains how to interpret the control charts (funnel plots) used in this report and suggests 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 second year (Section 1), ten Quality Indicators (QIs) for Critical Care in Scotland[2], developed and published by The Scottish Intensive Care Society Quality Improvement Group. Figures 5, 6, 11 and 12 are also reported monthly to unit leads. This year we are able to show whether there has been local improvement, the primary aim of these indicators.

National Clinical Data Advisory Group (NCDAG)

NCDAG are a collaboration between Public Health and Intelligence, Healthcare Improvement Scotland and the Scottish Government. Their purpose is to ensure that national audits are 'having a beneficial impact on patient care while providing value for money'. Each audit has been asked to:

1. *Review and where necessary refresh its aim to ensure alignments with the Healthcare Quality Strategy for Scotland*[1]. SICSAG's aims and objectives were updated in March 2014 and are available on the website.
2. *Review its methodology, ensuring its approach is aligned with the aim and leads to demonstrable improvements in patient care. This also includes ensuring that it is as efficient as possible.* SICSAG have improved its efficiency over the last four years and are currently reviewing its methodology. The Steering Group have agreed that from 2015 all Quality Indicators will be part of the governance process, which means that units who do not meet these standards will be highlighted at Health Board level. We are aware that many units have struggled to make any improvements to the indicators with interdependent relationships

and/or resource related (eg early and night time discharges) and are reviewing ways of supporting them with this in the future.

Obstetric HDU involvement

A business case has been submitted to provide the necessary support to expand the audit to include all Obstetric HDUs. An Obstetric working group, which includes representatives from most hospitals in Scotland, are now meeting regularly to progress this Critical Care specialty. Being involved in SICSAG is one element of this. A member of this group has joined the SICSAG Steering Group.

WardWatcher upgrade

WardWatcher will have a minor upgrade in summer 2014 with the primary aim of ensuring that the HAI methodology is aligned with European Centre for Disease Prevention and Control (ECDC) definition[3] and information governance standards are adhered to. Other changes have been made to the core dataset and can be found on the SICSAG website www.sicsag.scot.nhs.uk.

New units

SICSAG continues to expand with the addition of more units in 2014, which includes:

- Obstetric HDU, Ninewells Hospital, Dundee (April 2014)
- Obstetric HDU, Royal Infirmary of Edinburgh (2014)
- Medical HDU, Aberdeen Royal Infirmary (2014)

As mentioned earlier, the ever increasing number of units participating in the audit (currently 70 units) has put unsustainable strain on the resource allocated to it and we are therefore currently seeking additional funding to allow for further expansion into all Obstetric HDUs.

Angela Khan

National Clinical Coordinator

Key Findings

43,680 admissions to Critical Care were included in the audit in 2013. 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[2] are published for the second time:

- All ICUs in Scotland now participate in the audit and only four HDUs (excluding Obstetric HDUs) do not participate at this time.
- 85% of ICUs and 66% of HDUs have a daily review and written management plan by an appropriately trained consultant, an increase from 2012 figures of 76% and 52% respectively.
- Quality Indicators that are interdependent and/or resource dependant (eg night time and early discharges), remain relatively unchanged from 2012.
- More units now have an end of life care policy in place (96% of ICUs and 64% of HDUs).
- Crude mortality in ICU and Combined Units continues to improve year on year and in 2013 has fallen to just over 13%.
- Case-mix adjusted mortality remained stable following a consistent reduction over the last ten years. This is the second year SICSAG has used the recalibrated APACHE II model to adjust for case-mix differences. This year, there are no outliers.
- All ICUs continue to have Mortality and Morbidity meetings regularly, and only six HDUs have no meetings.
- More units are undertaking patient/relative experience surveys.

In 2013, the bed occupancy rate for Scotland remained stable, at around 72% in ICU and Combined Units and 78% in HDUs. However, there was considerable variation between units, particularly in HDU.

Night time admissions to ICU and HDU are 34% and 33% respectively highlighting the unpredictability of this service.

17% of discharges from ICU and 19% of discharges from HDU are delayed for more than six hours. There is wide variation between units.

The intensity of treatment remains high with 68% of patients treated in ICU and Combined Units receiving level 3 care and 65% of patients treated in HDU receiving level 2 or 3 care. Level of care definitions are based on the Intensive Care Society Standards 2009[4] (Appendix 3.5).

The pattern of interventions is essentially unchanged from last year 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 differing 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 reports. Managers 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.

Quality Indicator (QI): This is a measure of a structure, process or outcome that could be used by local teams to improve care. The reason this is viewed as an indicator (not a minimum standard) is that experience in using this as a measure for driving improvement is less well established, because those areas with interdependent relationships (e.g. discharges) are more difficult to change or experience and acceptance in Scotland is limited. 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

The layout of the QI section has descriptions of each indicator. QIs 2.1, 3.1 and 3.2 are presented in graph format of all units. For the rest of the QIs, responses from each unit are in Tables 1 and 2 grouped by Health Board.

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

Part 1 Structure

QI 1.1 Units participate in a national audit

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. The number of non-participating units is now just a handful of HDUs. This is a nationally accepted governance standard and managers of non-participating units should question this. Known units who do not currently submit information are; Ninewells Neurological HDU, Crosshouse Renal HDU, Caithness HDU and Lorn & Islands HDU.

Units joining the audit in 2014 are; Aberdeen Royal Infirmary Medical HDU, Ninewells Obstetric HDU and Royal Infirmary of Edinburgh Obstetric HDU.

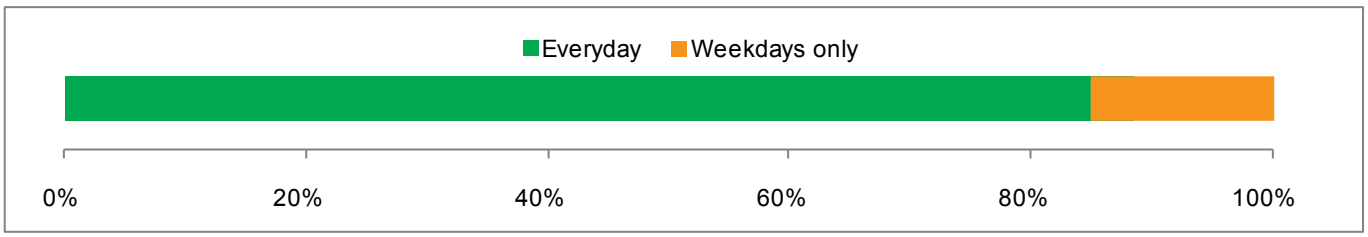
Last year Aberdeen Royal Infirmary Neurological HDU closed, and currently these patients are admitted to their ICU.

QI 1.2 Daily review and written management plan

All patients in ICU or Combined Units are 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 are 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. We recognise that continuity of care and setting management goals are important. This reinforces the setting of daily goals driven by the Scottish Patient Safety Programme (SPSP). Core Standards for Intensive Care Units published by the Faculty of Intensive Care Medicine and Intensive Care Society in 2013[5] have reinforced and stretched this to include all level 2 and 3 patients being seen by a consultant who has regular intensive care weekday commitments on twice daily ward rounds every day. Those consultants should not have any other commitments while on call (eg theatre anaesthetics). Due to staffing numbers in many units, these more stringent standards are not immediately achievable. However this QI will require to be reviewed for future years.

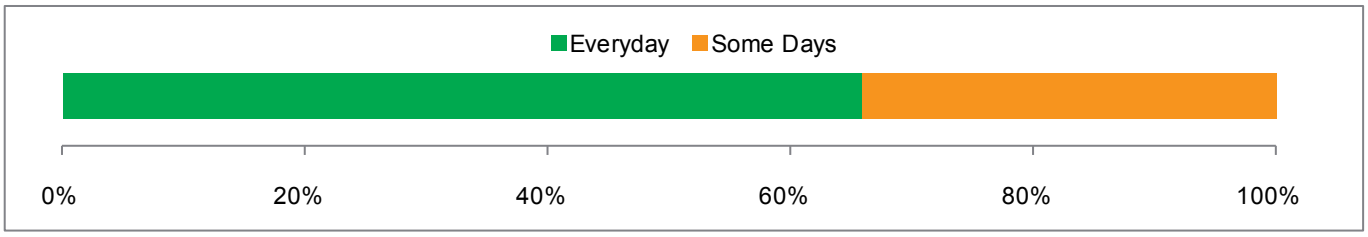
Figure 1 Percentage of ICU and Combined Units with a daily review and written management plan



85% of ICUs and Combined Units are achieving QI 1.2; this is an increase from 76% reported in 2012.

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



66% of HDUs are achieving QI 1.2, compared to 52% in 2012.

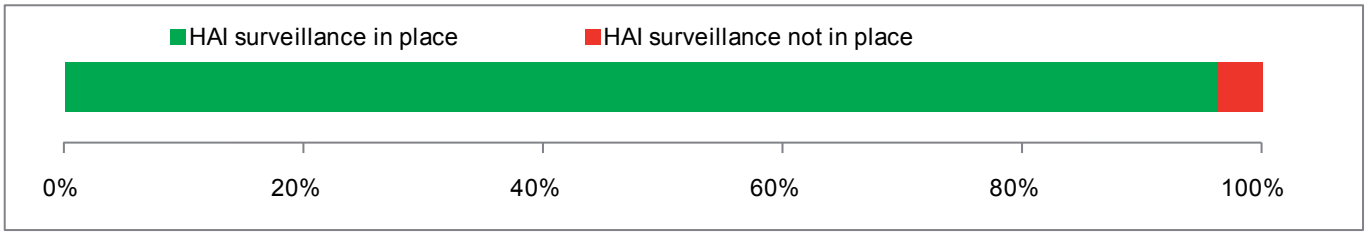
See Table 2 on page 11 for individual units.

QI 1.3 Healthcare Associated Infection (HAI) surveillance system

ICU and HDUs have an HAI surveillance system in place which reports incidence of important infections on a monthly basis to unit staff and 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. These HAIs are important, measurable and with an effective quality improvement programme can be reduced. The SPSP and SICSAG have introduced these nationally in conjunction with care bundles to reduce infection rates since 2008.

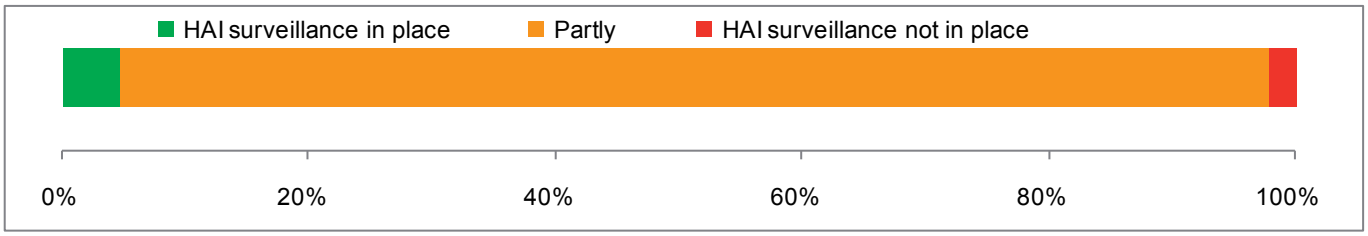
Where units do not or cannot collect this data, Health Boards should question why and ensure appropriate resource is in place to do so.

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



96% of ICUs met this minimum standard in 2013 with a HAI surveillance system reporting data to staff and SPSP. See Table 1, page 10.

Figure 4 Percentage of HDUs with HAI surveillance system



93% of HDUs have a HAI surveillance system which monitors Staphylococcus aureus bacteraemia (SAB) only, therefore partly complying with the quality 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.

These data are not comparable with 2012 as we have changed how we collect and report this information.

Part 2 Process

QI 2.1 Night time discharges

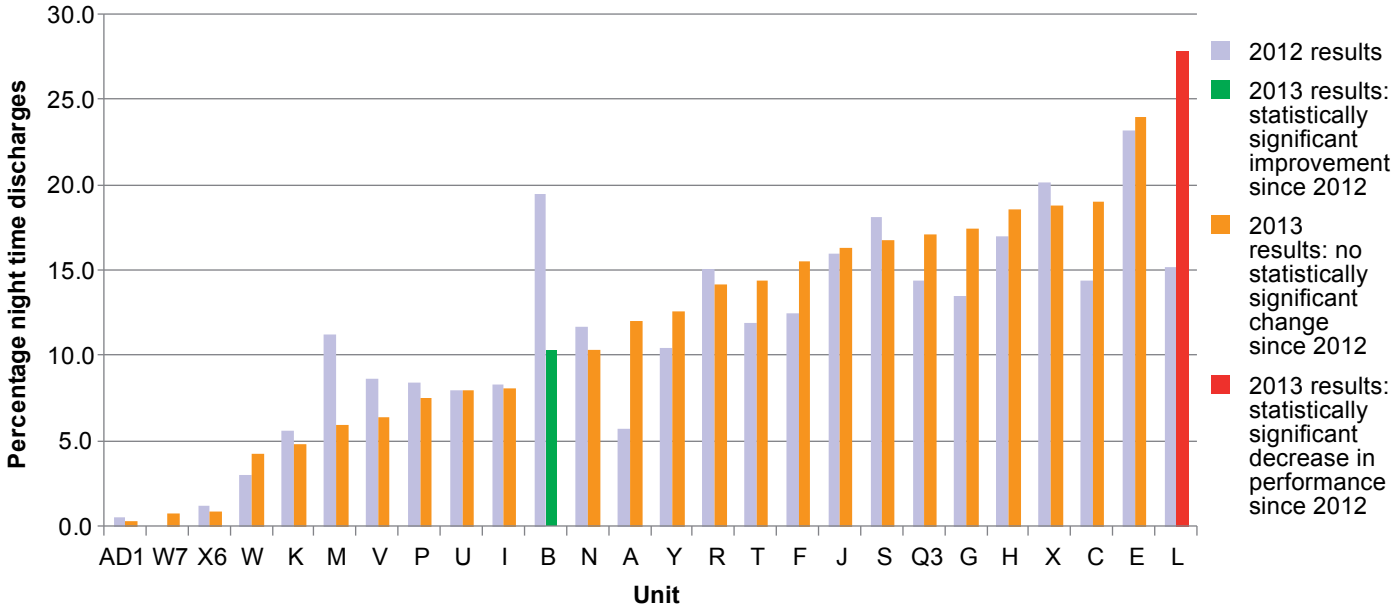
All Scottish ICUs and HDUs should participate in, and submit data to, the Scottish Intensive Care Society Audit Group to measure night time discharges. The aim is to encourage and support local improvement to reduce night time Critical Care discharges. Night time discharges from ICU are associated with worse outcomes[6,7]. Discharge from Critical Care to a ward is most safely performed during the day when parent ward teams are still accessible and before transfer of care to a "Hospital at Night" team. Night time discharges are forced early discharges to accommodate another patient or delayed from earlier in the day due to inadequate ward beds. They may be poorly planned and/or communicated. Patients perceive discharge at night as extremely unpleasant[8].

The charts in this section show percentages of live patient discharges at night time. These percentages do not include self-discharges, discharges to specialist care and discharges for palliative care.

Units with high numbers of night time discharges should examine locally why this is occurring to target solutions or resources: delayed discharges (figures 25, 26 page 21) and/or early discharges (figures 11, 12 pages 7 and 8).

Where there are significant changes from 2012, this should also trigger local discussion and explanation to inform any necessary actions. Funnel plots with this data are available on the SICSAG website www.sicsag.scot.nhs.uk.

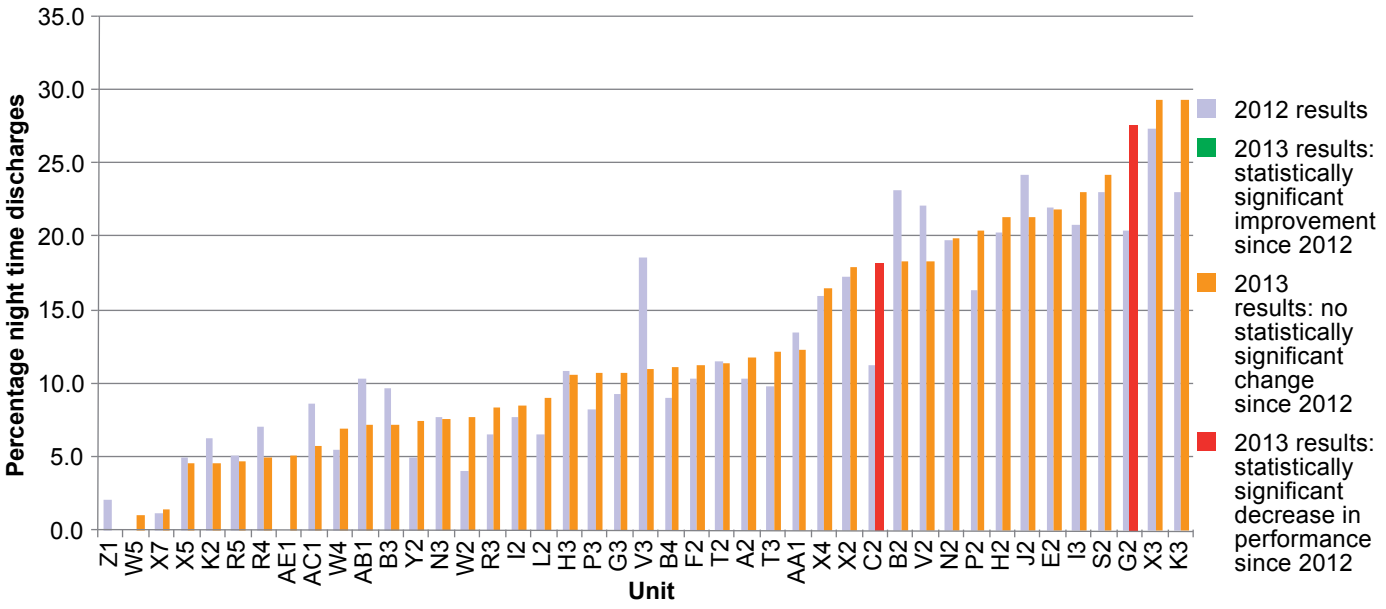
Figure 5 Night time discharges from ICU and Combined Units (2012-2013)



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

Unit B showed a statistically significant reduction in night time discharges from almost 20% in 2012 to 10% in 2013. Unit L had the highest percentage of night time discharges in 2013 at 28%, for this unit this is a statistically significant increase from the figure 15% reported in 2012.

Figure 6 Night time discharges from HDU (2012-2013)



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

Units K3 and X3 had the highest percentage night time discharges for HDUs in 2013 both at 29%. Units C2 and G2 showed a statistically significant increase in night time discharges from 2012. Unit V3 decreased by 8% from 19% in 2012 to 11% in 2013.

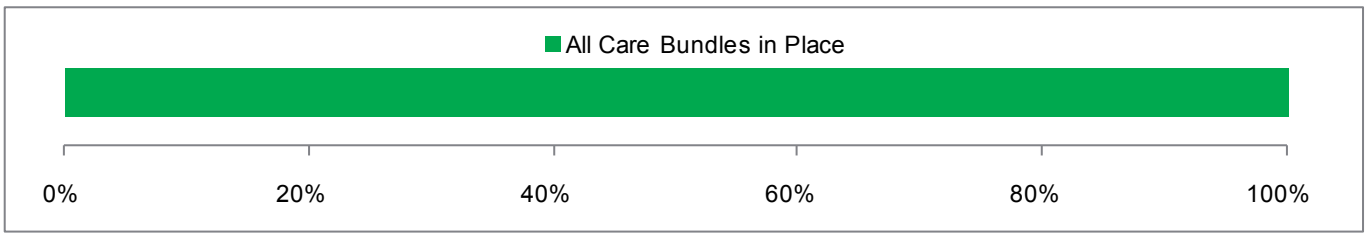
QI 2.2 Care Bundles

Units should have 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 ICUs and HDUs should measure and submit data to SPSP and feedback to unit staff on delivery of VAP prevention bundle[9,10] (ICU or Combined Units only), CVC insertion and maintenance bundle[11] and PVC insertion and maintenance bundle.

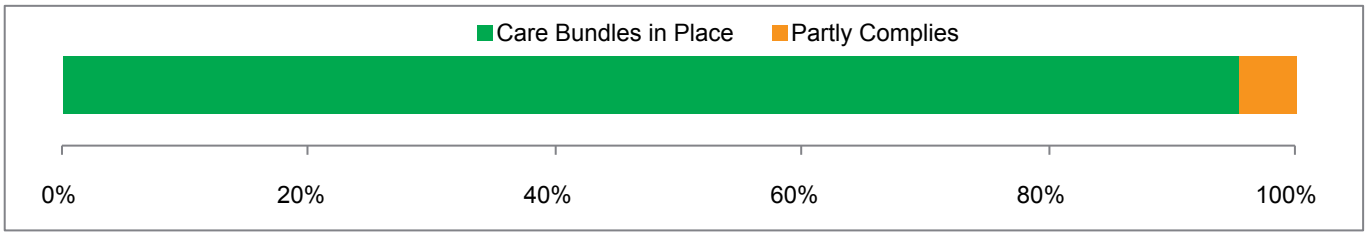
These care bundles have been in place since 2008 and in 2013 were mandated as part of the ten safety essentials by the Scottish Government Health Department[12].

Figure 7 Percentage of ICU and Combined Units with care bundles in place



100% of ICUs meet the minimum standard with all care bundles in place reporting data to SPSP and feedback to staff.

Figure 8 Percentage of HDUs with care bundles in place



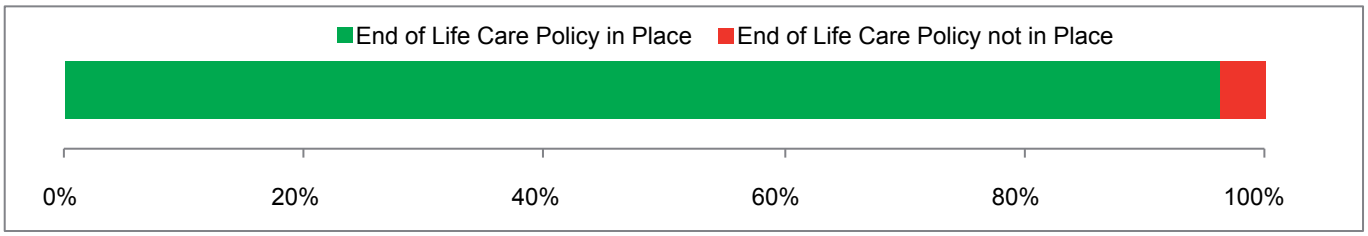
96% of HDUs meet the minimum standard with all care bundles in place reporting data to SPSP and feedback to staff.

The two units in Aberdeen and Glasgow (Table 2, page 11) who do not have these fully in place should examine why.

QI 2.3 End of Life Care

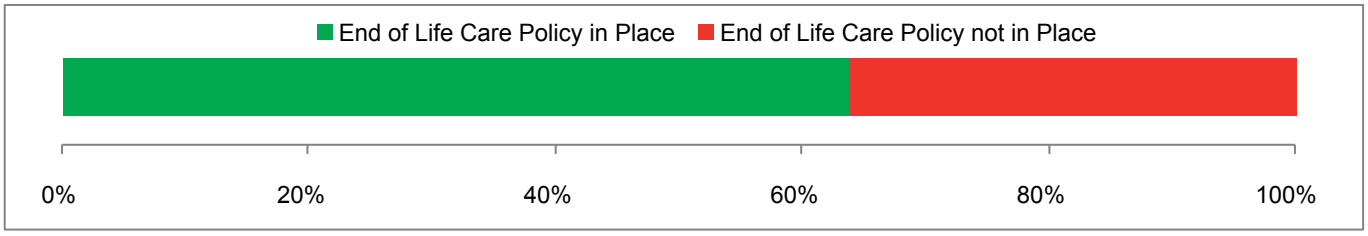
All ICUs and HDUs have a written end of life care policy. The two important elements are to ensure that patients are both identified and then cared for appropriately.

Figure 9 Percentage of ICU and Combined Units with an end of life care policy



96% of ICUs have an end of life care policy. Please see Table 1 on page 10 for individual units.

Figure 10 Percentage of HDUs with an end of life care policy



64% of HDUs have an end of life care policy. Please see Table 2 on page 11 for individual units.

Part 3: Outcomes

QI 3.1 Standardised Mortality Ratio (SMR)

Please refer to Section 4, page 31 for further information on SMR Outcomes.

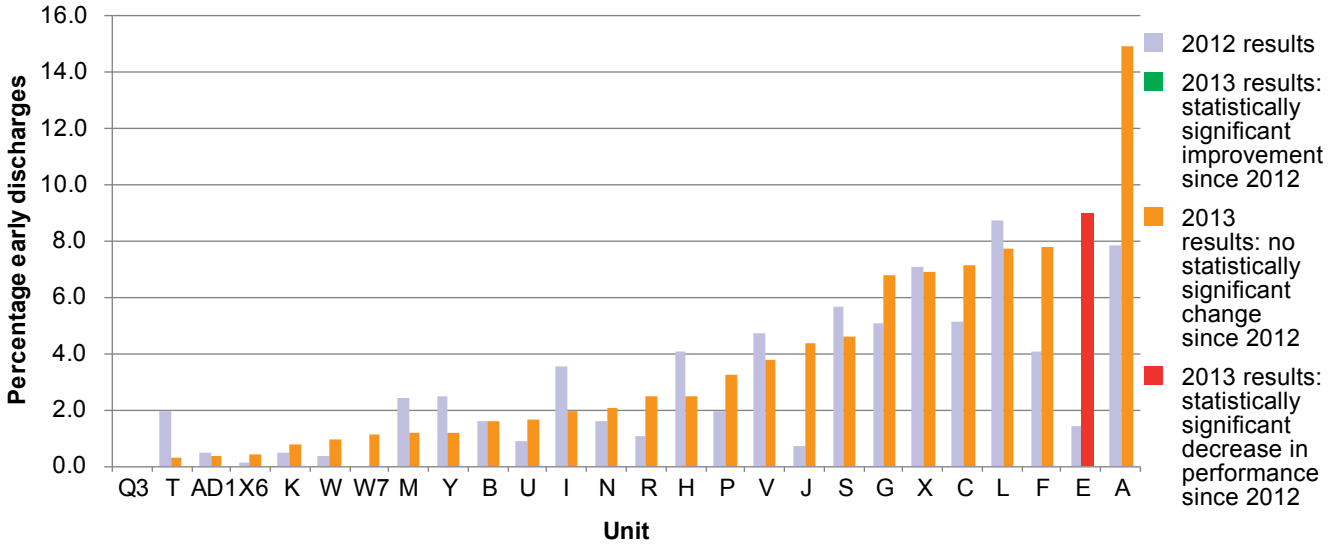
QI 3.2 Early discharges

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

Early discharge is by definition unplanned, and usually forced by the need to admit another acutely ill patient. Patients who are discharged early are at risk of deterioration and adverse outcomes. This requires local interpretation as to where these patients have been transferred and adequacy of care after Critical Care discharge. It is helpful to examine this in conjunction with Critical Care readmission rates. (Figures 27 and 28, page 22).

Where there are significant changes from previous year, this should also trigger local discussion and explanation to inform any necessary actions.

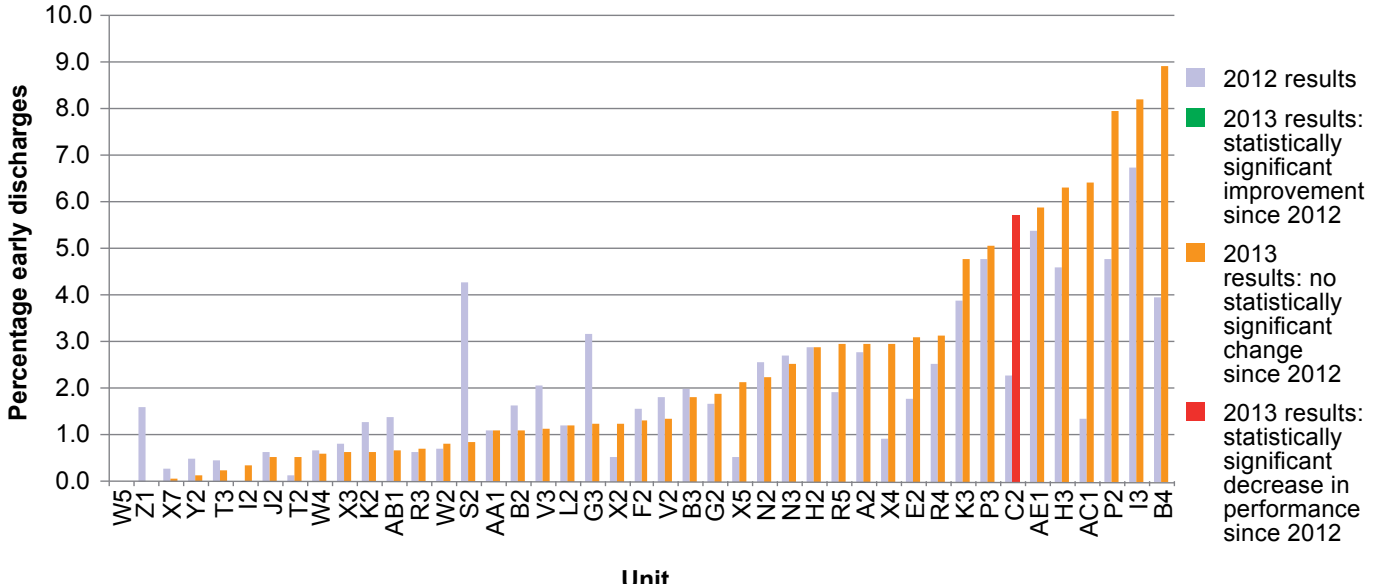
Figure 11 Early discharges from ICU and Combined Units (2012-2013)



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 T had the lowest reported early discharges at 0.3%; this was a reduction for this unit from 1.9% in 2012. Unit Q3 had no early discharges in 2012 or 2013. The highest percentage of early discharges was in unit A at 15%, while for unit E, 9% of discharges were early in 2013 and this was a statistically significant increase from 1.4% reported in 2012.

Figure 12 Early discharges from HDU (2012-2013)



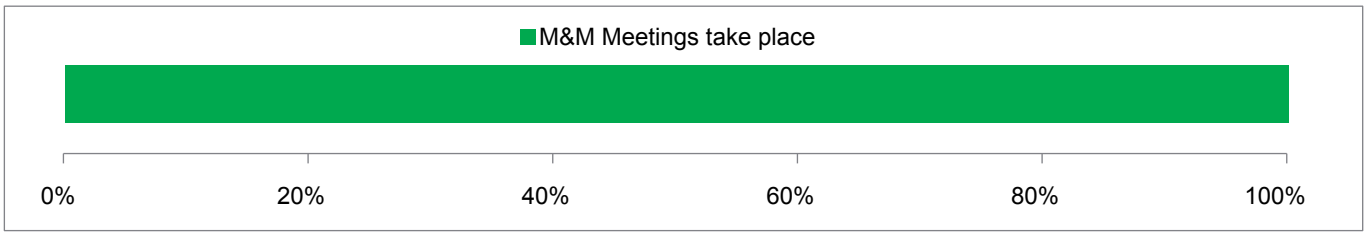
Note: Early discharge is defined as a transfer that is not in the best interest of a patient but necessary due to pressure on beds or staffing.

Unit B4 showed the highest percentage of early discharges from HDUs in 2013 at 8.9%. Unit C2 had a statistically significant increase in early discharges from 2.3% in 2012 to 5.7% in 2013.

QI 3.3 Morbidity and Mortality meetings

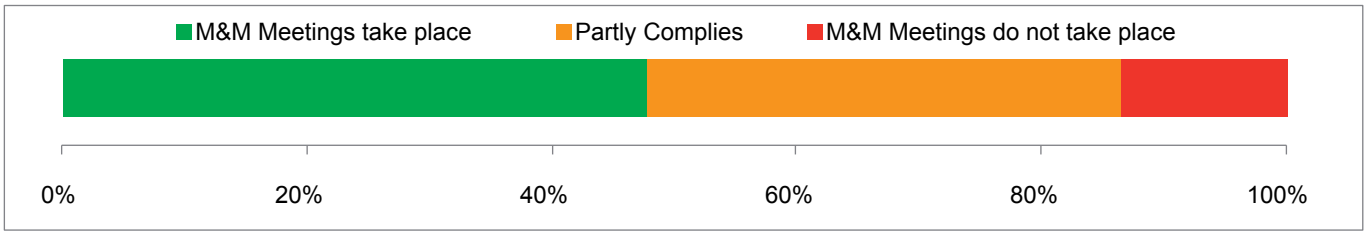
Every unit should discuss in open forum significant critical incidents and the care of all patients who die in a Critical Care ward.

Figure 13 Percentage of ICU and Combined Units with Morbidity & Mortality Meetings



100% of ICUs meet this minimum standard to discuss and learn from all unit deaths.

Figure 14 Percentage of HDUs with Morbidity & Mortality Meetings

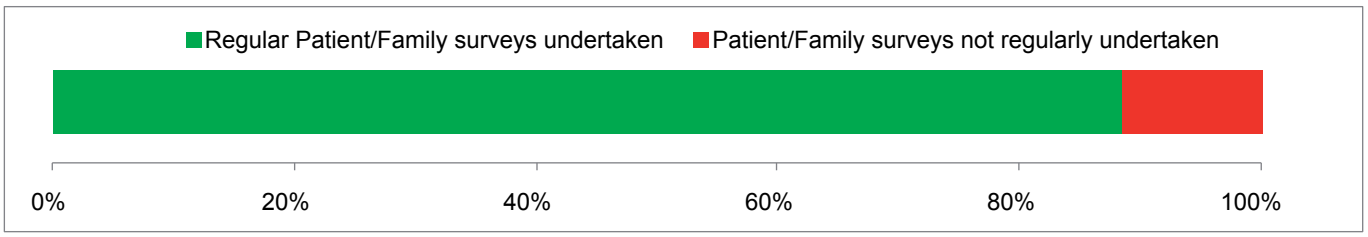


48% of HDUs meet this minimum standard to discuss and learn from all unit deaths. However, only six HDUs have no M&M in place. They should reflect on this standard of governance which is widely practised by the majority of clinicians in similar units. Unit level information can be found in Table 2, page 11.

QI 3.4 Patient/family experience surveys

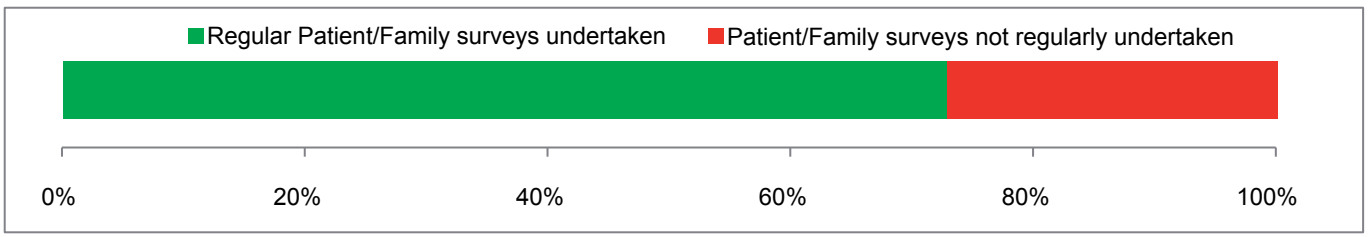
Critical Care units should undertake patient/relative satisfaction surveys on an annual (or more frequent) basis.

Figure 15 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 16 Percentage of HDUs undertaking regular patient/family experience surveys



73% of HDUs undertake patient/family surveys. Unit level information can be found in Table 2, page 11.

Table 1 Responses of ICU and Combined Units to Quality Indicators (2013)

	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	Yes	Yes	Yes	Yes	Yes
Crosshouse ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Borders							
BGH ICU/HDU	Yes	Weekdays[1]	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[2]	Yes	Yes
NHS Greater Glasgow and Clyde							
GRI ICU / HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IRH ICU	Yes	Weekdays	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[2]	Yes	Yes	Yes	Yes
WIG ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Highland							
Raigmore ICU	Yes	Weekdays	Yes	Yes	Yes	Yes	Yes
NHS Lanarkshire							
Hairmyres ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MDGH ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wishaw ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Lothian							
RIE ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE CICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SJH ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	No[2]
WGH ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	No[2]
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
Partly complies with indicator	Weekdays
Does not comply with indicator/No Information Provided	No

Key:
NICU – Neurological ICU
CICU – Cardiothoracic ICU

Notes

1 Approximately 80% of weekends have an appropriately trained consultant.

2 Under review.

Table 2 Responses of HDU to Quality Indicators (2013)

	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 HDU	Yes	Yes	Partly	Yes	Yes	Specialty	Yes
Crosshouse MHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
Crosshouse SHDU	Yes	Somedays	Partly	Yes	No	Specialty	Yes
Crosshouse RHDU	Currently not part of audit						
NHS Dumfries and Galloway							
DGRI MHDU	Yes	Yes	Partly	Yes	No	No	No
DGRI SHDU	Yes	Yes	Partly	Yes	Yes	Specialty	No
NHS Fife							
VHK SHDU	Yes	Somedays	Partly	Yes	No	Medical staff only	Yes
VHK MHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
VHK RHDU	Yes	Yes	Partly	Yes	No	Yes	No
NHS Grampian							
ARI SHDU (Ward 503)	Yes	Somedays	Partly	Yes	No	Medical staff only	No
ARI SHDU (Ward 506)	Yes	Somedays	Partly	Yes	Yes	Yes	No
ARI CHDU	Yes	Somedays	Partly	Partly	No	Specialty	Yes
ARI MHDU	Joining 2014						
Dr Gray's HDU	Yes	Yes	Partly	Yes	No	Medical staff only	Yes
NHS Greater Glasgow and Clyde							
GRI SHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
GRI MHDU	Yes	Yes	Partly	Partly	Yes	No	No
IRH SHDU	Yes	Somedays	Partly	Yes	No	Specialty	No
RAH HDU	Yes	Somedays	No	Yes	No	Yes	Yes
SGH SHDU	Yes	Yes	Partly	Yes	Yes	Medical staff only	Yes
SGH NHDU	Yes	Yes	Partly	Yes	No	Specialty	Yes
VI SHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
GGH HDU	Yes	Somedays	Partly	Yes	Yes	Specialty	Yes
WIG HDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
NHS Highland							
Raigmore MHDU	Yes	Yes	Partly	Yes	Yes	No	Yes
Raigmore SHDU	Yes	Somedays	Partly	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	Partly	Yes	Yes	Medical staff only	Yes
NHS Lanarkshire							
Hairmyres MHDU	Yes	Yes	Partly	Yes	Yes	Medical staff only	Yes
MDGH SHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
MDGH MHDU	Yes	Somedays	Partly	Yes	Yes	Yes	Yes
Wishaw SHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
Wishaw MHDU	Yes	Yes	Partly	Yes	Yes	No	Yes

Table 2 Responses of HDU to Quality Indicators (2013)

	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 Lothian							
RIE HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE RHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
RIE Transplant HDU	Yes	Yes	Partly	Yes	No	Yes	No
RIE Vascular (Level 1)	Yes	Somedays	Partly	Yes	Yes	Yes	No
RIE CHDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes
RIE Obstetric HDU	Joining 2014						
WGH SHDU	Yes	Yes	Partly	Yes	No	Yes	Yes
WGH NHDU	Yes	Somedays	Partly	Yes	No	Medical staff only	Yes
WGH Neurological (Level 1)	Yes	Somedays	Partly	Yes	No	Medical staff only	Yes
NHS National Waiting Times Centre							
Golden Jubilee National Hospital HDU	Yes	Somedays	Partly	Yes	Yes	Yes	Yes
NHS Orkney							
Balfour HDU	Yes	Yes	Partly	Yes	Yes	Yes	No
NHS Shetland							
GBH HDU	Yes	Yes	Partly	Yes	Yes	Yes	No
NHS Tayside							
Ninewells SHDU	Yes	Yes	Yes	Yes	Yes	No	Yes
Ninewells MHDU	Yes	Yes	Partly	Yes	No	Specialty	No
Ninewells Obstetric HDU	Joining 2014						
Ninewells NHDU	Currently not part of audit						
Perth HDU	Yes	Somedays	Partly	Yes	No	No	Yes
NHS Western Isles							
WIH HDU	Yes	Yes	Partly	Yes	Yes	Yes	Yes

Fully complies with indicator	Yes
Partly complies with indicator	Somedays/Specialty/Medical staff only/Partly
Does not comply with indicator/ No Information Provided	No/Currently not part of audit
Data not yet available	Joining 2014

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

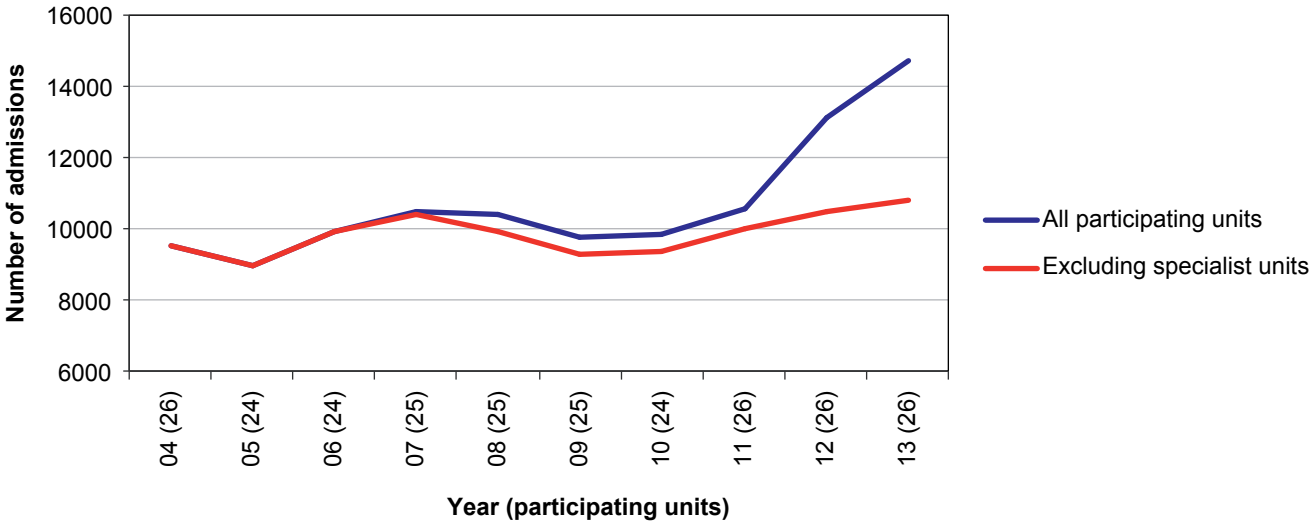
Section 2 Activity

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 Appendix 3.3.2.

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.

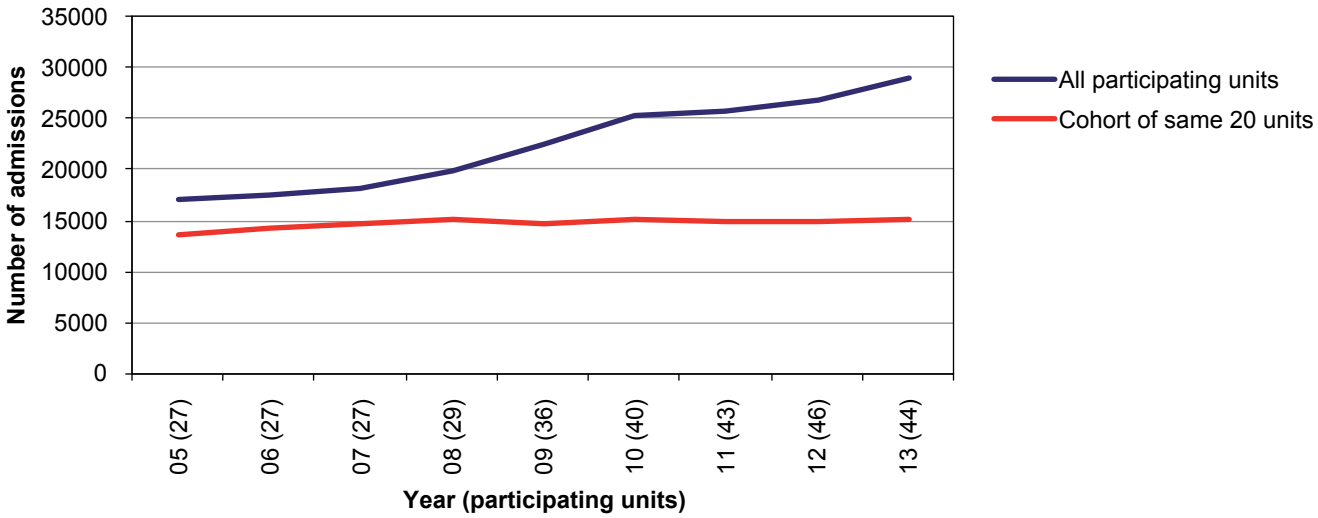
2.1 Number of admissions

Figure 17 Annual admissions to ICU and Combined Units (2004-2013)



There was an increase in admissions to ICU and Combined units across Scotland in 2013. This increase of 1602 admissions was primarily due to the Cardiothoracic ICUs and HDUs at the Golden Jubilee National Hospital submitting data for a full year, and the Cardiothoracic ICU at Aberdeen Royal Infirmary joining the audit in 2013. Excluding the specialist ICUs (three cardiothoracic units and one neurological unit) we can still see an increase in admissions from 2010.

Figure 18 Annual admissions to HDU (2005-2013)



The number of admissions to HDU increased by over 2000 episodes in the last year, mostly due to Aberdeen Royal Infirmary Cardiothoracic HDU and Wishaw Medical HDU submitting data for a full year. The cohort line refers to units that had complete data for the last nine years.

Table 3 Number of annual admissions to ICU and Combined Units (2004-2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
NHS Ayrshire and Arran										
Ayr ICU	242	271	266	307	330	330	292	252	268	244
Crosshouse ICU	267	290	285	302	304	294	305	319	302	276
NHS Borders										
BGH ICU/HDU	407	398	709	691	406	397	429	506	600	579
NHS Dumfries and Galloway										
DGRI ICU	334	331	304	324	316	285	298	293	314	323
NHS Fife										
QMH ICU	374	406	377	373	382	437	439	449	22	
VHK ICU									394	453
VHK ICU/HDU	123	152	145	179	124	38				
NHS Forth Valley										
FVRH ICU/HDU								577	1189	1159
SRI ICU	215	267	480	471	443	378	411	214		
FDRI ICU	560									
NHS Grampian										
ARI ICU	806	746	781	778	762	717	748	665	676	821
ARI CICU[1]										279
NHS Greater Glasgow and Clyde										
GRI ICU / HDU	310	320	321	348	395	426	461	793	948	1060
IRH ICU	114	155	122	104	104	82	120	150	138	137
RAH ICU	316	310	318	367	359	360	433	402	374	359
SGH ICU	302	287	279	296	299	289	278	282	264	232
SGH NICU				76	454	461	451	395	347	377
Stobhill ICU	218	199	220	201	233	202	155	40		
VI ICU	313	314	340	391	284	317	298	280	284	289
Vale of Leven ICU	128									
WIG ICU	433	460	532	512	554	495	485	475	393	421
NHS Highland										
Raigmore ICU	374	359	389	436	391	429	433	384	423	433
NHS Lanarkshire										
Hairmyres ICU/HDU	411	506	531	522	505	560	562	583	558	615
MDGH ICU	265	264	307	301	278	252	225	273	267	307
Wishaw ICU	739	744	756	829	619	222	229	237	212	235
NHS Lothian										
RIE ICU/HDU	1123	1032	1059	1041	1092	968	1110	1177	1230	1236
RIE CICU								188	926	1011
SJH ICU/HDU	218	225	352	367	443	465	424	444	452	458
WGH ICU/HDU	453	497	504	714	772	831	735	705	647	676
NHS National Waiting Times Centre										
Golden Jubilee National Hospital ICU/HDU[2]									1318	2223
NHS Tayside										
Ninewells ICU	327	339	352	370	404	386	357	349	417	378
PRI ICU	150	119	163	151	156	136	122	119	140	124
Total	**9522**	**8991**	**9892**	**10451**	**10409**	**9757**	**9800**	**10551**	**13103**	**14705**
Total (excluding specialist units)	**9522**	**8991**	**9892**	**10375**	**9955**	**9296**	**9349**	**9968**	**10512**	**10815**

Notes:

1 Aberdeen CICU joined in May 2013.

2 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 (2005-2013)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
NHS Ayrshire and Arran									
Ayr HDU			413	542	527	498	487	469	474
Crosshouse MHDU	880	966	992	997	974	1033	1103	1193	1201
Crosshouse SHDU	667	657	696	728	711	644	641	644	669
NHS Borders									
BGH Surgical (Level 1)				310	339	254			
NHS Dumfries and Galloway									
DGRI MHDU	841	783	793	823	804	854	731	788	824
DGRI SHDU	313	336	360	393	392	431	418	437	431
NHS Fife									
QMH SHDU	827	821	853	849	840	816	813	34	
QMH MHDU						525	724	37	
QMH RHDU							155		
VHK SHDU								817	903
VHK MHDU[1]						429	444	937	1088
VHK RHDU								159	210
NHS Forth Valley									
Stirling HDU				1089	963	992	558		
NHS Grampian									
ARI SHDU (Ward 503)	684	654	587	582	623	714	630	575	609
ARI NHDU[2]	90	170	251	237	235	241	240	202	86
ARI SHDU (Ward 506)					780	814	868	892	856
ARI CHDU								42	703
Dr Gray's HDU					797	1083	1169	1069	1068
NHS Greater Glasgow and Clyde									
GRI SHDU	899	693	1028	1051	1053	1026	765	629	625
GRI MHDU								533	671
IRH SHDU					266	432	469	439	486
RAH HDU	905	1188	1201	1291	1289	1339	1459	1497	1418
SGH SHDU	691	796	809	861	870	807	693	711	692
SGH NHDU	591	642	703	675	660	647	621	594	637
Stobhill SHDU	353	317	327	327	337	287	58		
VI SHDU	608	605	702	692	636	700	812	847	873
GGH HDU	796	771	849	885	882	904	755	755	761
WIG HDU						75	413	438	427
NHS Highland									
Raigmore MHDU	588	651	732	718	730	811	803	743	774
Raigmore SHDU	685	672	714	620	677	669	669	653	657
Belford HDU							74	78	114
NHS Lanarkshire									
Hairmyres Thoracic HDU	354	340							
Hairmyres MHDU							274	375	254
MDGH SHDU	443	632	628	601	593	569	565	588	618
MDGH MHDU					56	278	283	377	444
Wishaw SHDU				154	602	532	546	571	526
Wishaw MHDU								265	1245
NHS Lothian									
RIE HDU	1531	1530	1517	1541	1390	1369	1366	1377	1329

Table 4 Number of annual admissions to HDU (2005-2013)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
RIE RHDU	596	607	683	667	632	674	675	634	650
RIE Transplant HDU	305	269	330	338	306	345	296	325	375
RIE Vascular (Level 1)					112	452	378	372	330
RIE CHDU							214	1118	1223
WGH HDU	491	502	117						
WGH SHDU	1198	1229	1139	1192	1126	1119	1136	1112	1115
WGH NHDU	577	450	362	230	285	404	476	431	481
WGH Neurological (Level 1)						52	418	364	475
NHS Orkney									
Balfour Hospital HDU								78	138
NHS Shetland									
GBH HDU	54	72	64	63	49	58	74	65	77
NHS Tayside									
Ninewells SHDU	703	652	723	832	742	754	794	784	816
Ninewells MHDU					558	641	673	743	709
Perth HDU	499	536	569	623	644	618	625	659	612
NHS Western Isles									
WIH HDU					145	414	448	409	301
Total	**17169**	**17541**	**18142**	**19911**	**22625**	**25304**	**25813**	**26859**	**28975**
Total (20 units)	**14405**	**15069**	**15644**	**15971**	**15570**	**15875**	**15682**	**15683**	**15684**

Notes:
1 This unit changed in 2012 to incorporate the closed beds from QMH MHDU
2 ARI Neurological HDU closed during 2013 and patients now admitted to ICU. This units data are only included in figure 18 and table 4.

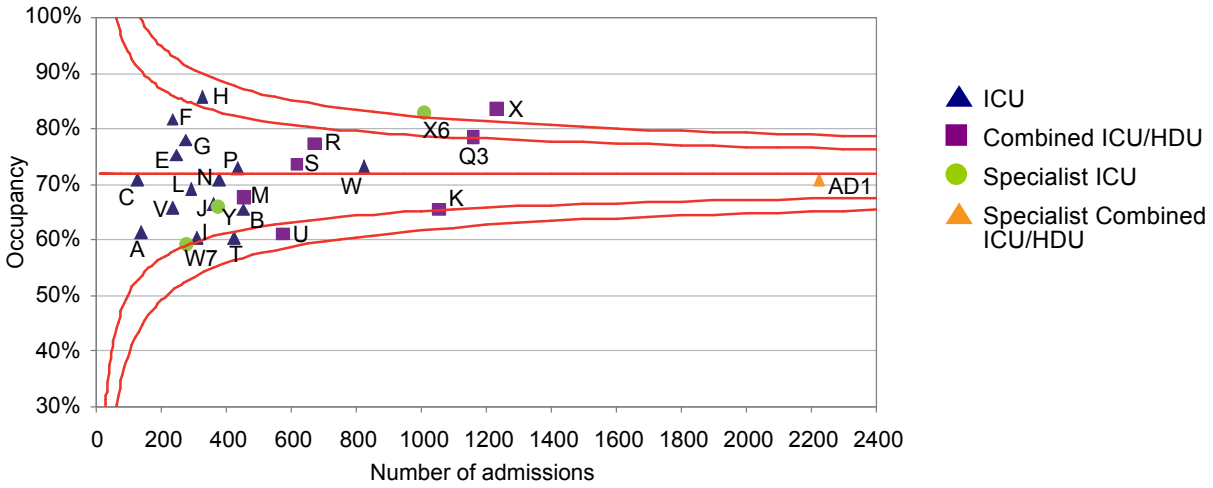
NHS Boards

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

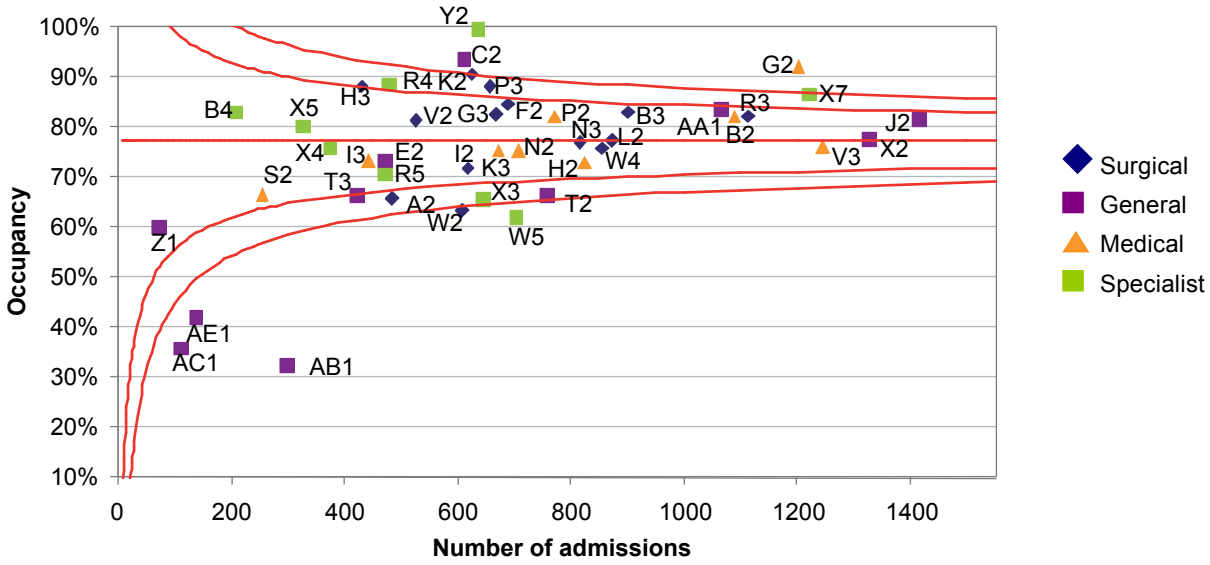
Figure 19 Bed occupancy rates for ICU and Combined Units (2013)



Mean bed occupancy was similar to 2012 at 72%. As in previous years unit X 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.

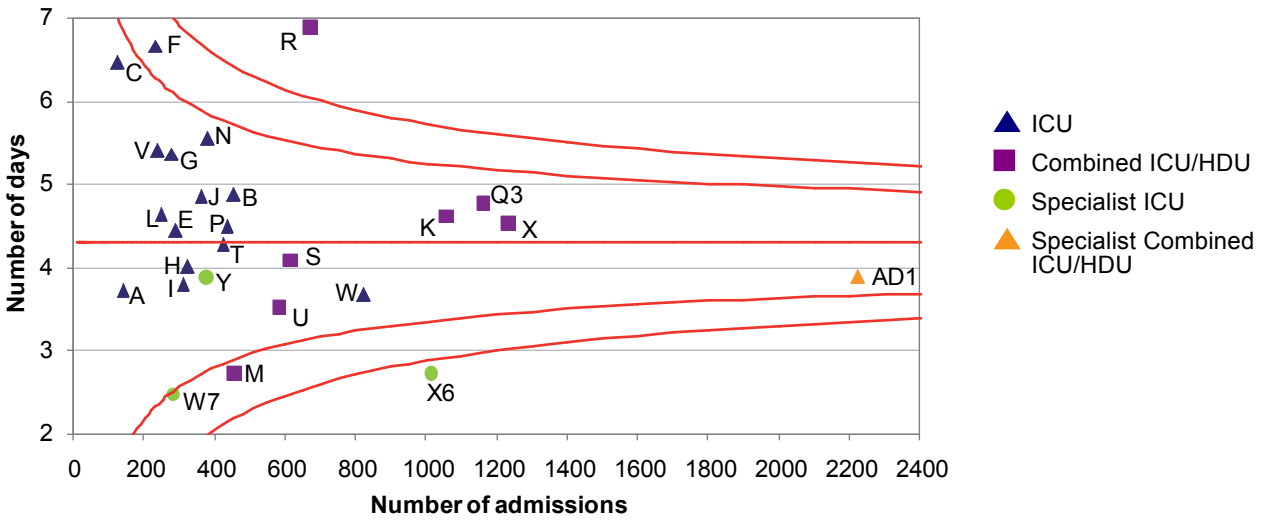
Figure 20 Bed occupancy rates for HDU (2013)



Mean bed occupancy remains stable at 78%. Four units were above the 3 SD line (C2, Y2, K2, G2), and five units below the 3 SD line (AC1, AE1, AB1, W2, W5). 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.

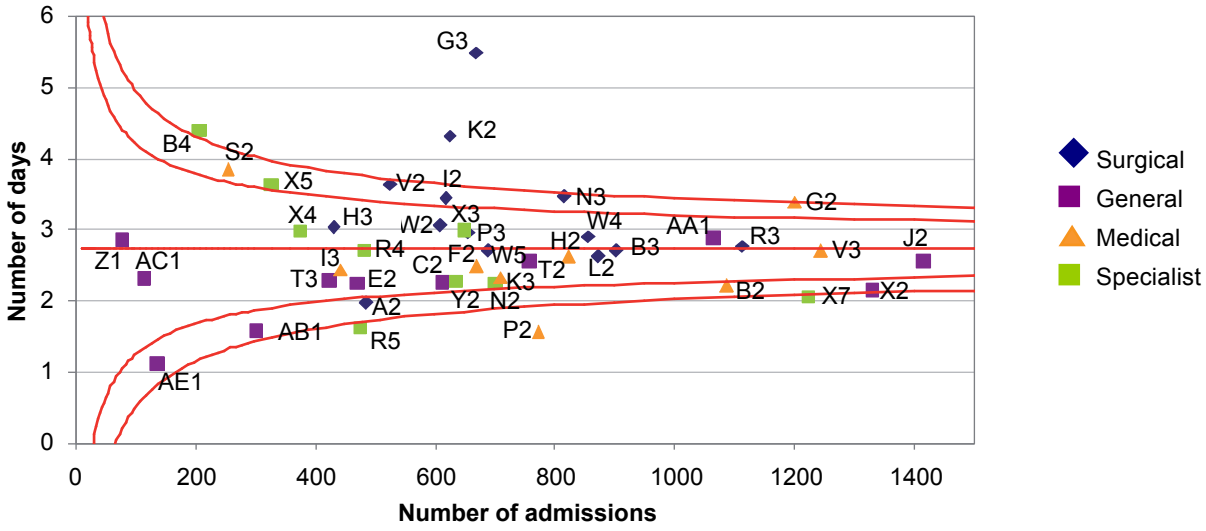
2.3 Length of stay

Figure 21 Mean length of stay in ICU and Combined Units (2013)



The mean length of stay was similar to 2012 at 4.3 days. 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 22 Mean length of stay in HDU (2013)

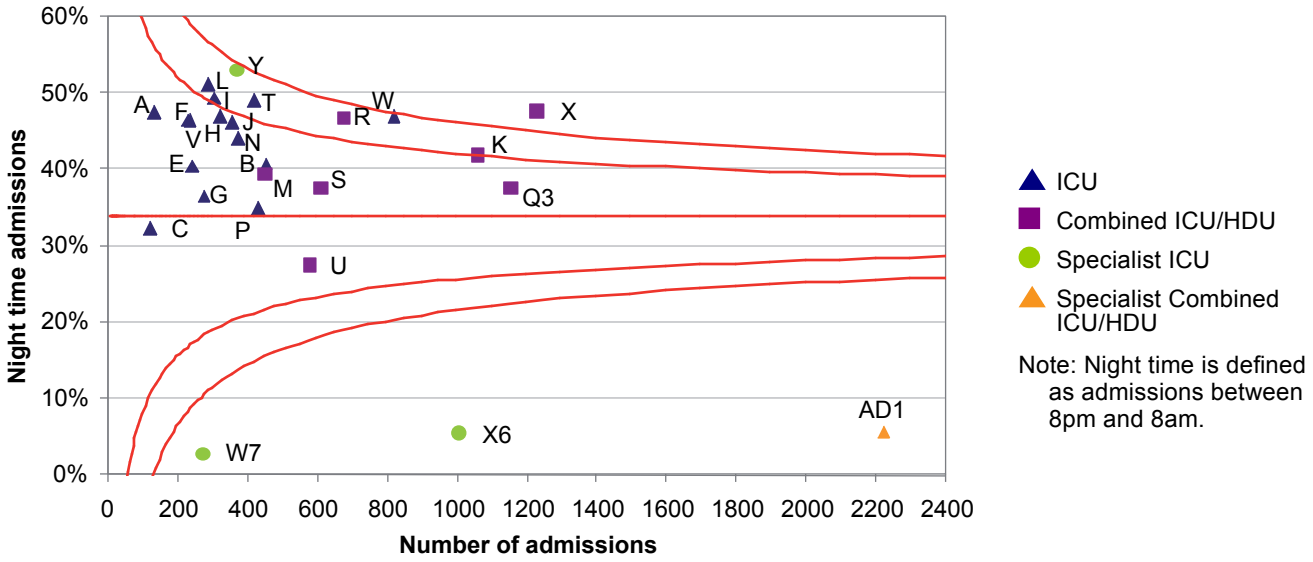


The mean length of stay was similar to previous years at 2.7 days. Two surgical units (K2 and G3), one specialist unit (B4) and one medical unit (G2) had significantly longer lengths of stay than the Scottish mean for HDUs.

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

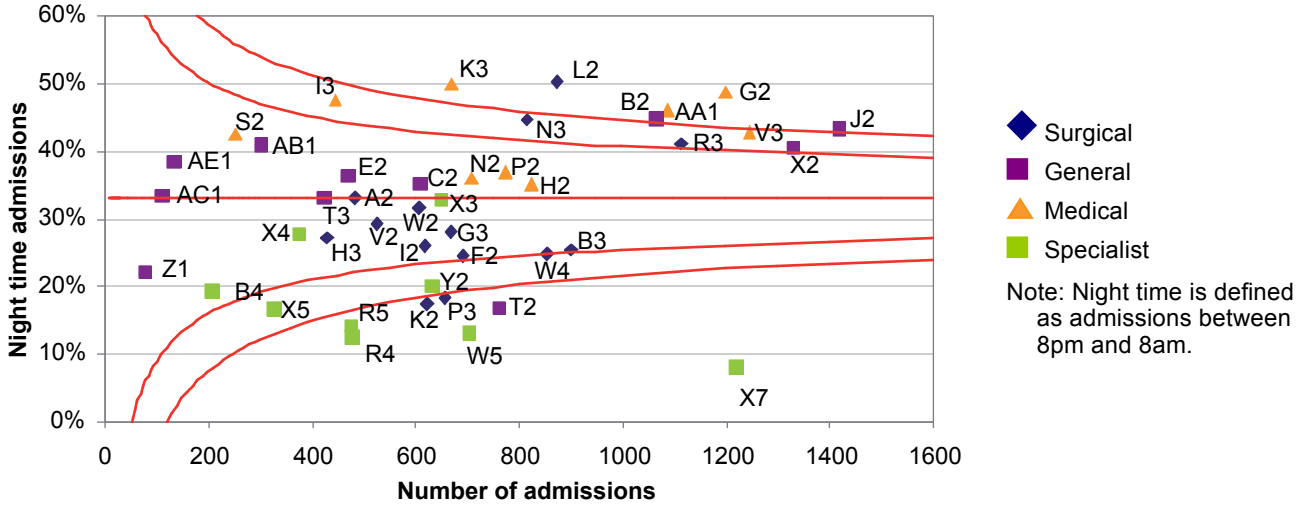
2.4 Night time admissions

Figure 23 Night time admissions to ICU and Combined Units (2013)



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

Figure 24 Night time admissions to HDU (2013)

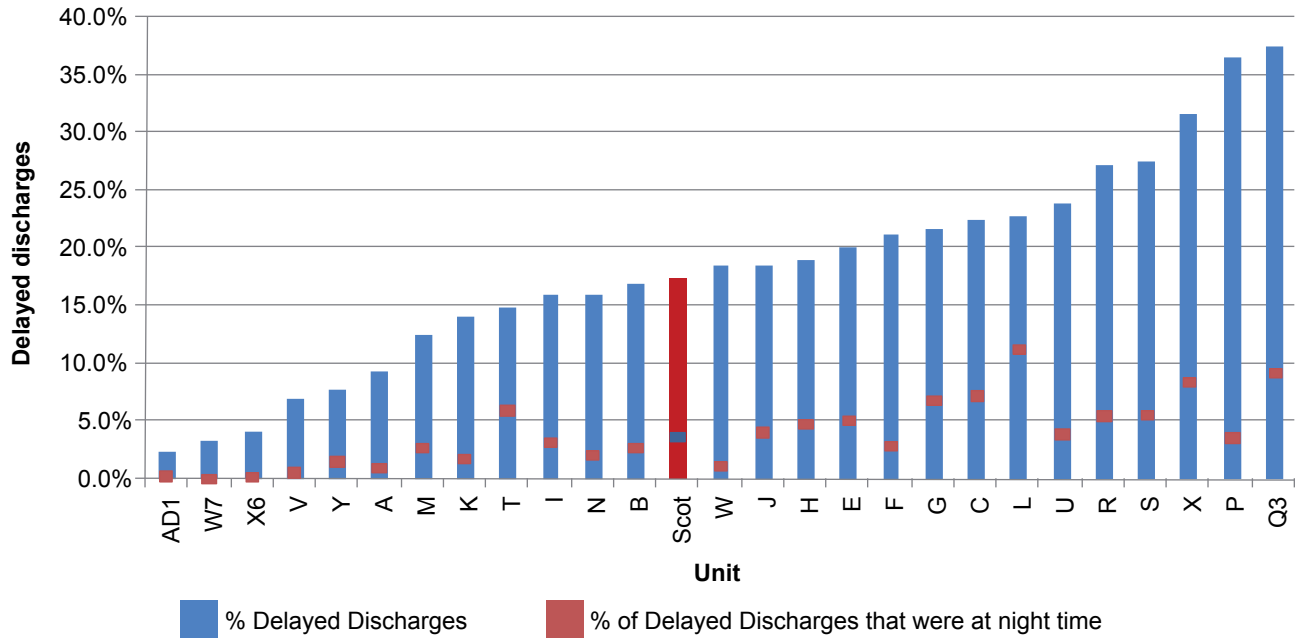


Five units were above 3 SD from the mean (K3, L2, AA1, B2, G2). Seven units were below the 3 SD line (R4, R5, W5, K2, P3, T2, X7).

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

2.5 Delayed discharges

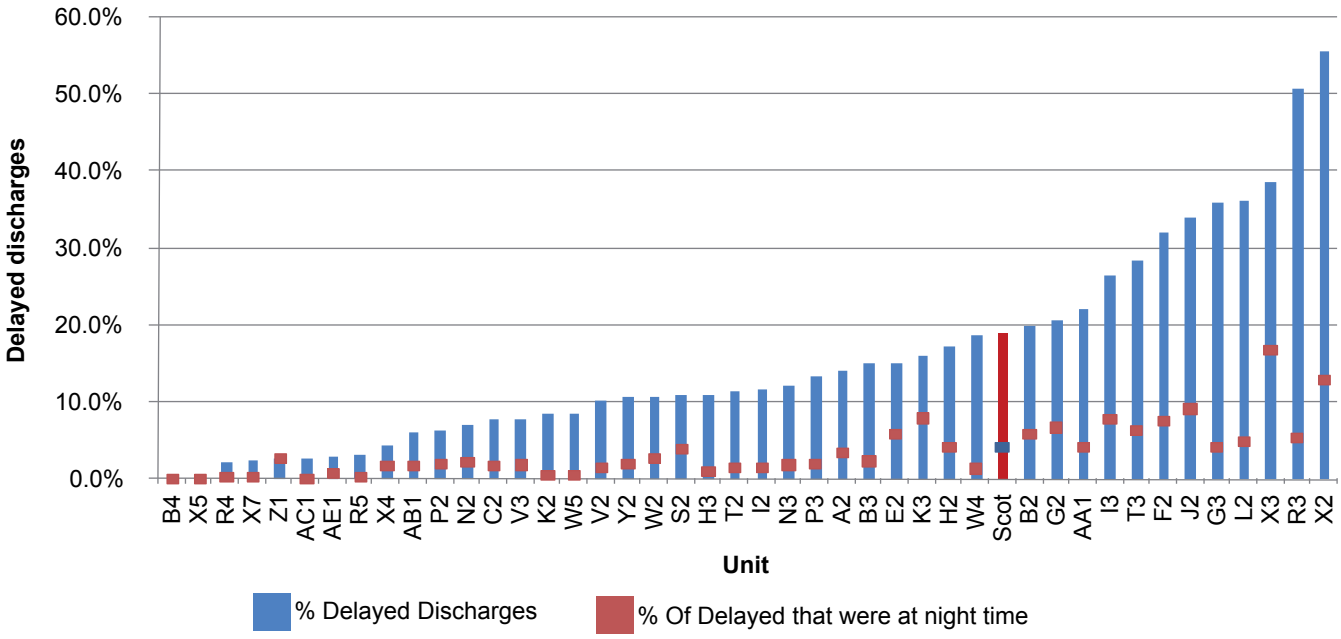
Figure 25 Delayed Discharges in ICU and Combined Units (2013)



Note: These analysis only include delayed discharges where the delay recorded was greater than 6 hours.

Unit Q3 had the most delayed discharges at 37% although this is a reduction of 9% since 2012. As in 2012 almost 10% of the delayed discharges for this unit are at night time. The main reason for discharges being delayed was a shortage of available ward or HDU beds.

Figure 26 Delayed Discharges in HDU (2013)



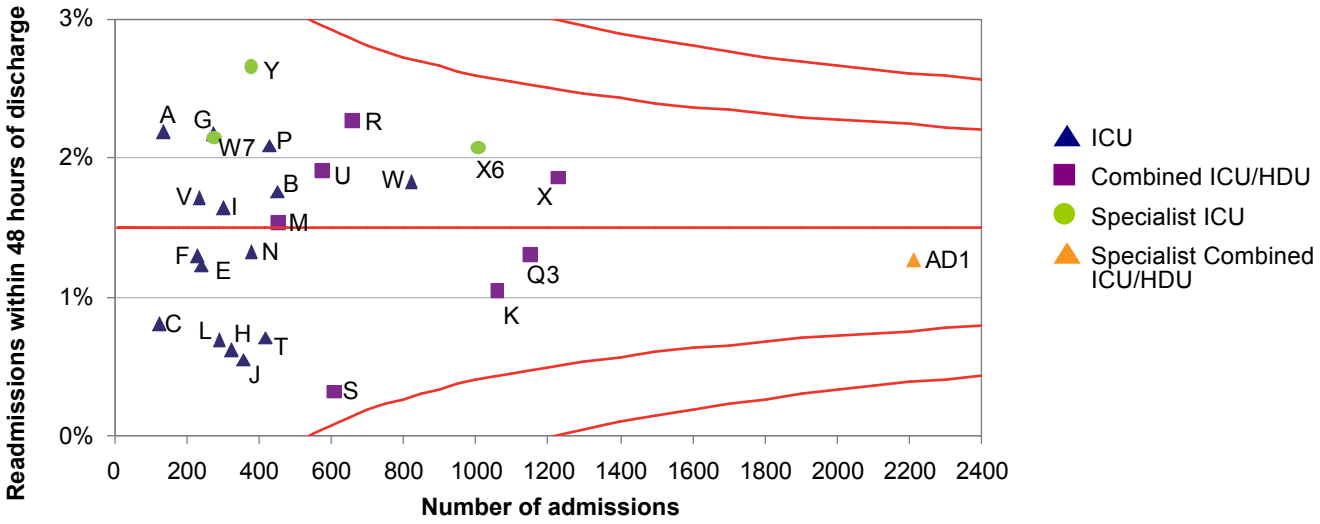
Note: These analysis only include delayed discharges where the delay recorded was greater than 6 hours.

Unit X2 had the most delayed discharges at 56%; 13% of these patients were discharged at night time. The main reason for discharges being delayed from HDU was a shortage of ward beds.

2.6 Readmissions to Critical Care

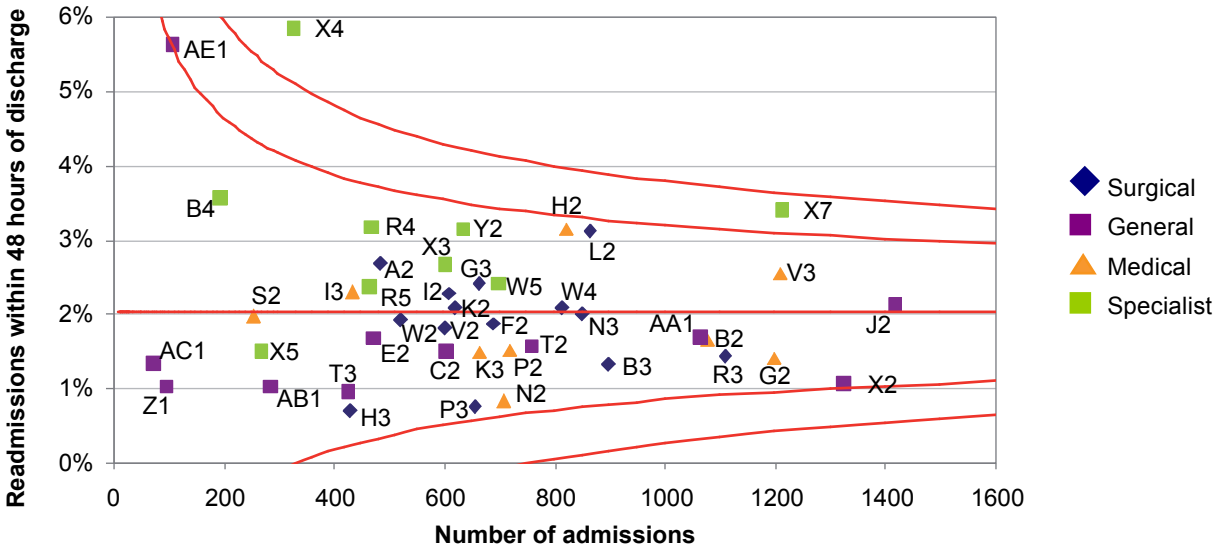
High readmission rates to Critical Care may be an indicator that discharge was too early, or that downstream care was not of a sufficient standard.

Figure 27 Readmissions within 48 hours of discharge to ICU and Combined Units (2013)



The mean readmission rate in ICUs and Combined Units in Scotland was the same as in 2012 at 1.5%, with no units significantly different from the mean.

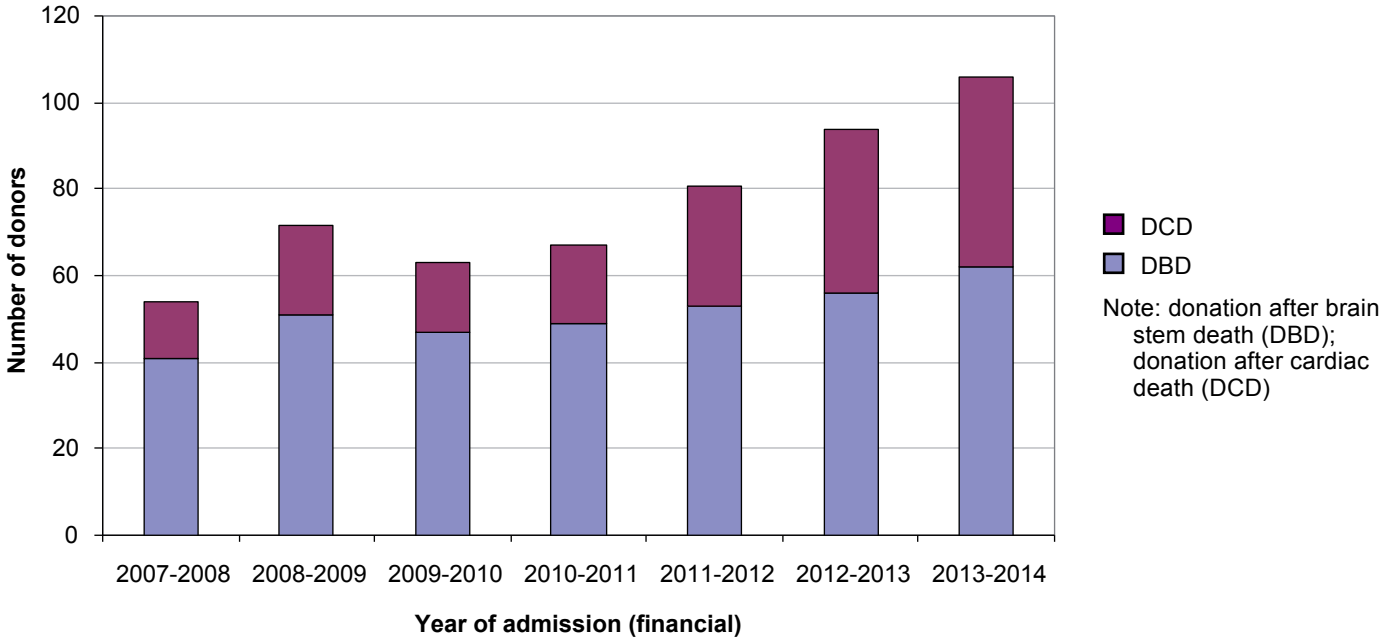
Figure 28 Readmissions within 48 hours of discharge to HDU (2013)



Unit X4 had significantly more readmissions than other HDUs.

2.7 Organ donation

Figure 29 Scottish deceased organ donors (2007-2014)



The numbers of deceased organ donors continues to rise year on year thanks to the continued recognition and referral from ICU and Emergency medicine with an increase of almost 100% over the past six years.

This year has seen the introduction of cardiac scouts to assist in the management and optimisation of the 'brain stem death' potential donor in ICU.

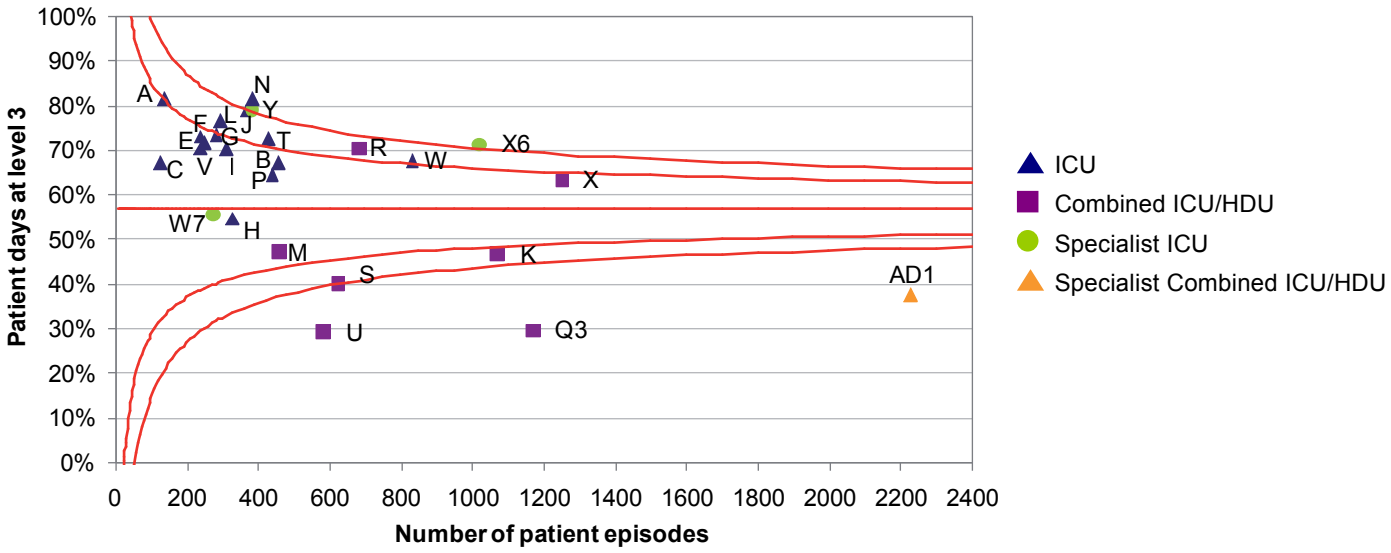
Section 3 Level of care and Interventions

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 Appendix 3.5.

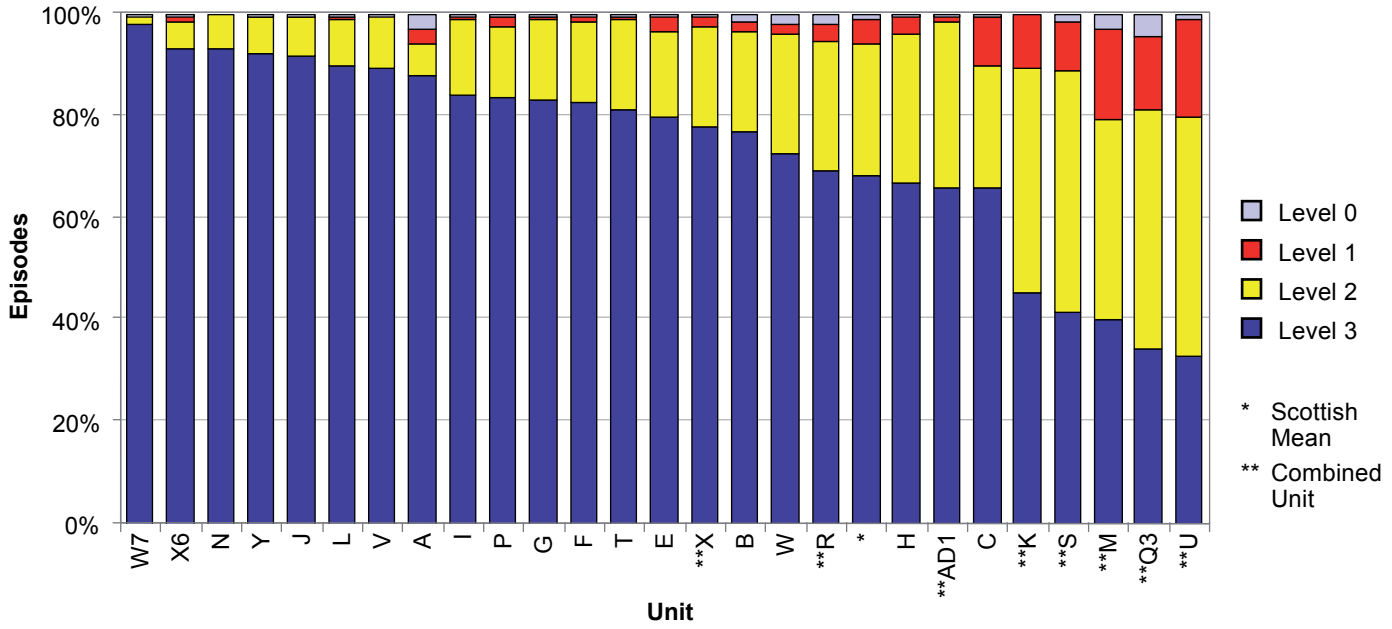
The pattern of interventions is essentially unchanged from 2012 and continues to show the heterogeneity of units. It is important to realise that units are not identical, as they admit patients with a different range of problems, reflecting the differing specialty mix between hospitals.

Figure 30 Level 3 days in ICU and Combined Units (2013)



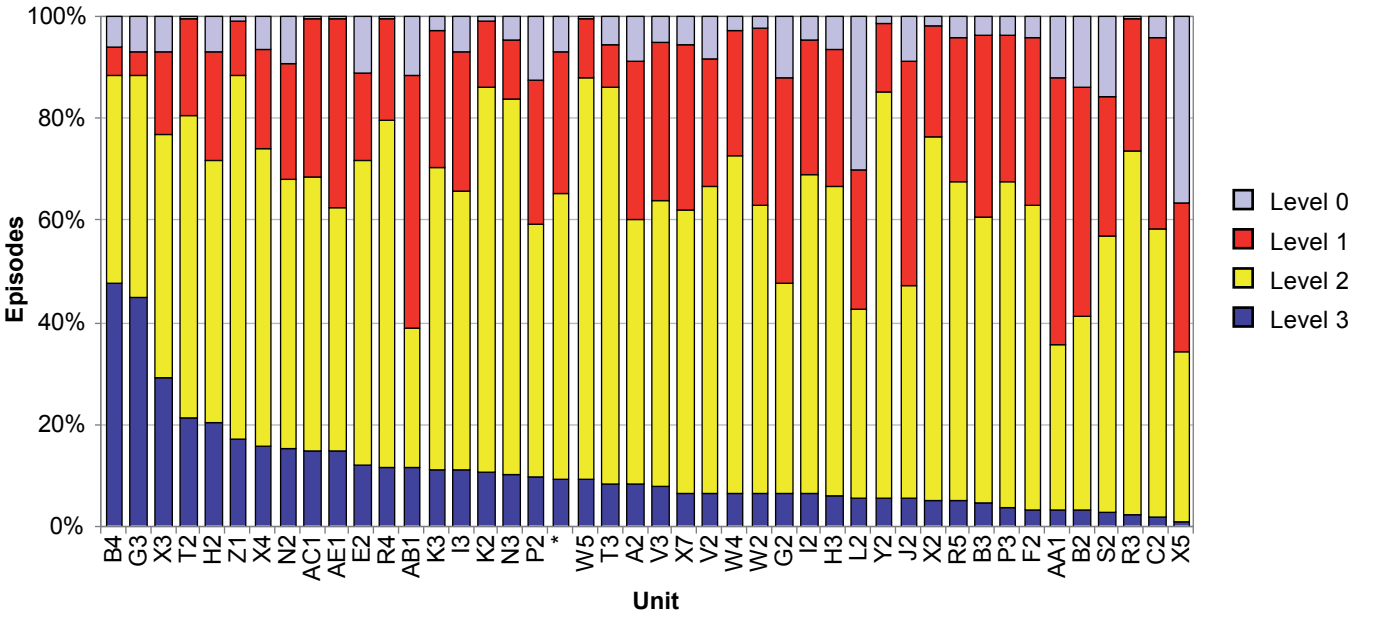
57% of patient days in ICU and Combined Units were recorded as level 3. This is reduced from last year which in part will be due to unit AD1, a large combined ICU/HDU submitting a full year of data for the first time. The lower portion of this graph is again dominated by Combined Units as would be expected.

Figure 31 Highest level of care in ICU and Combined Units (2013)



As in last year's report the data are presented in order of descending proportion of level 3 care. In 2013 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. Cardiothoracic ICUs (W7 and X6) have the highest percentage of patient episodes requiring level 3 care.

Figure 32 Highest level of care in HDU (2013)

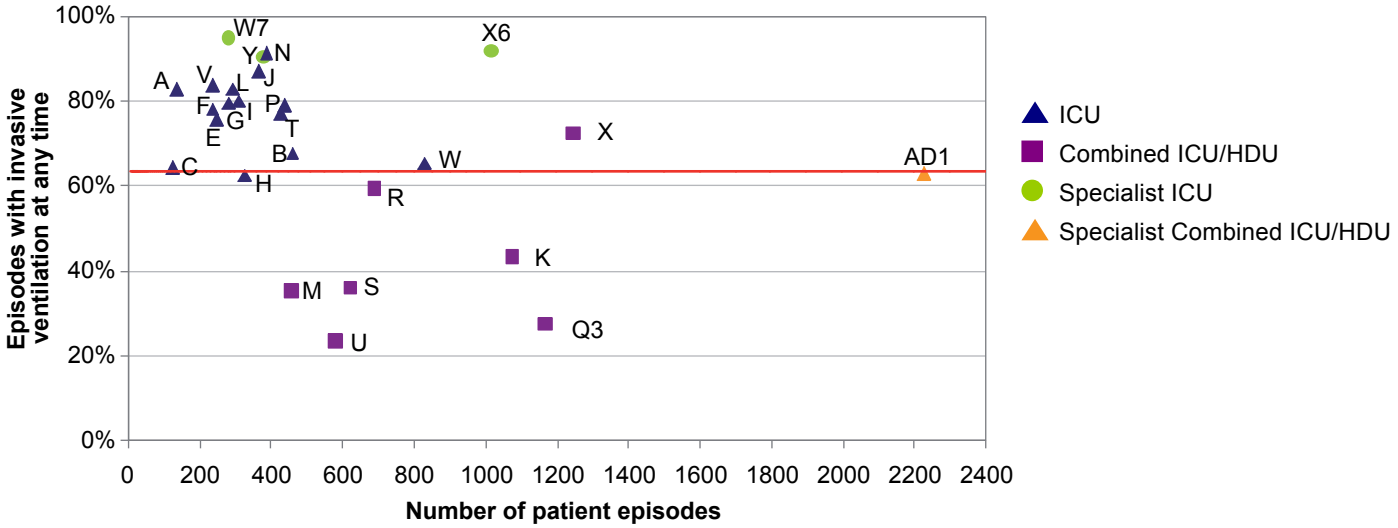


It is reassuring that this graph shows that the highest level of care required for the majority of HDU episodes is at the appropriate level (level 2). There is variation in the pattern of the highest level of care demonstrating the heterogeneous nature of HDUs.

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

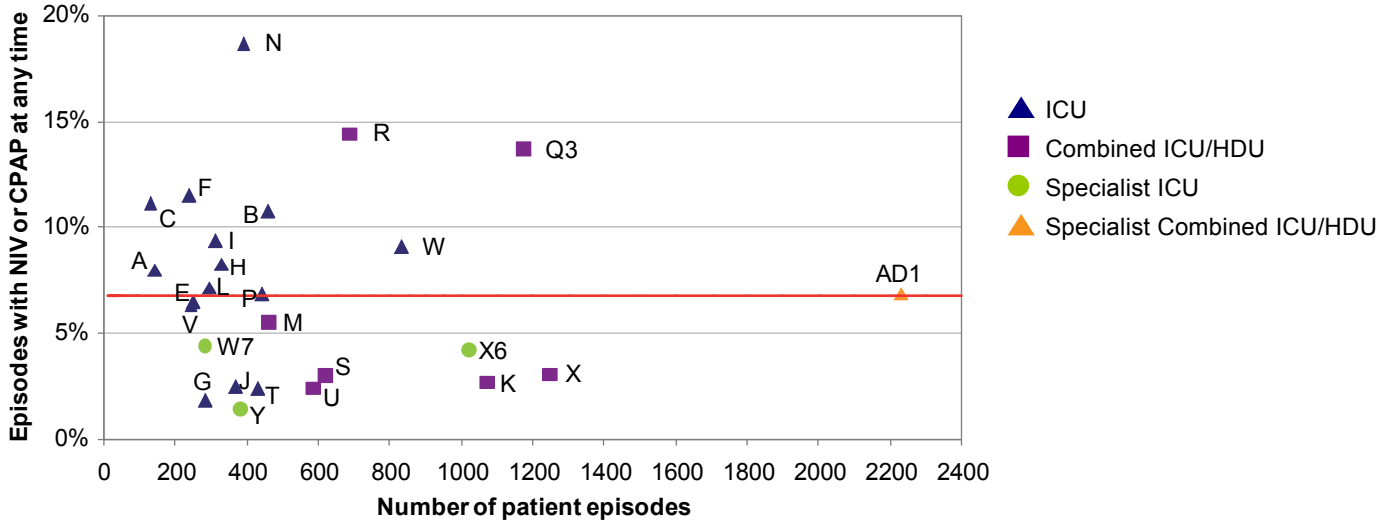
Figure 33 Invasive ventilation at any time in ICU and Combined Units (2013)



There was a slight increase in the percentage of patients requiring invasive ventilation from 62% in 2012 to 64% in 2013.

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

Figure 34 NIV and CPAP rates in ICU and Combined Units (2013)

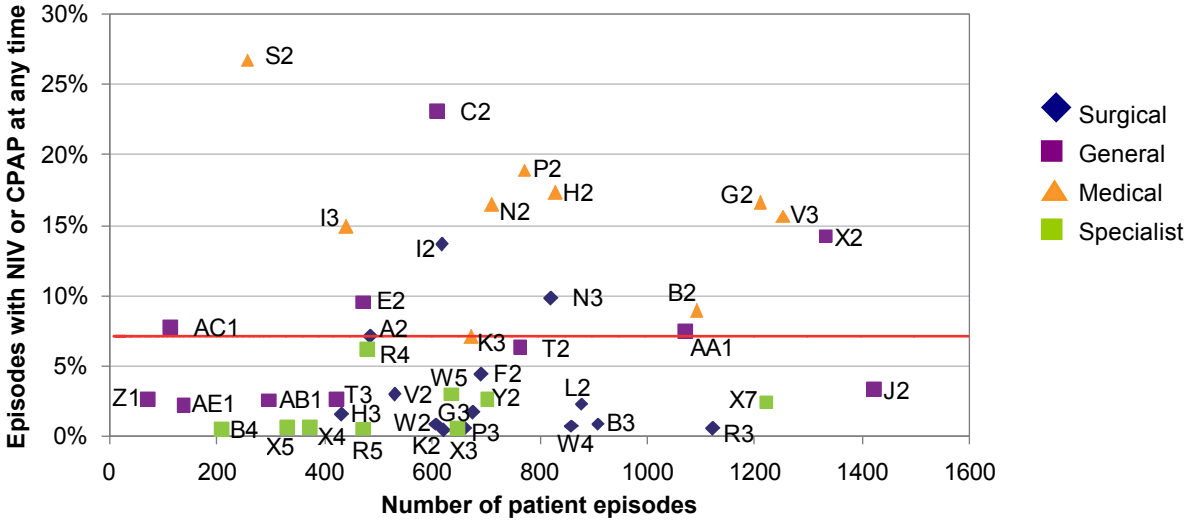


The incidence of this method of respiratory support remains low in ICU and Combined Units.

The percentage of admissions to ICU and Combined Units receiving Non-Invasive Ventilation (NIV) or/and Continuous Positive Airway Pressure (CPAP) reduced from 8% in 2012 to 7% in 2013, but has fallen from 13% in 2008.

As in previous years Units R and N had a higher proportion of patients receiving NIV/CPAP.

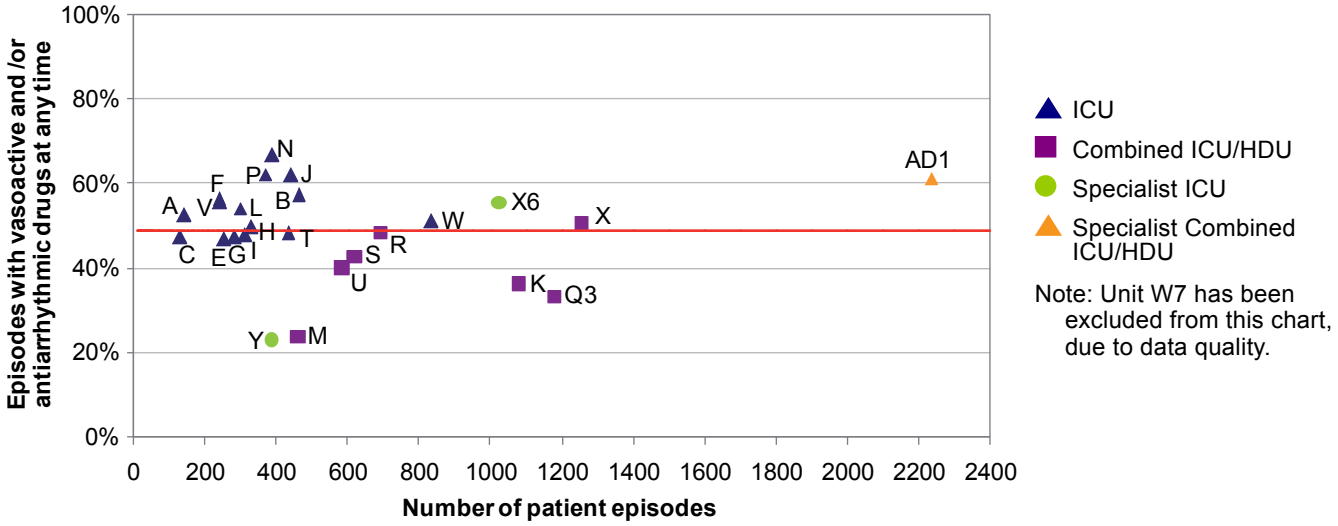
Figure 35 NIV and CPAP rates in HDU (2013)



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

3.3 Cardiovascular support

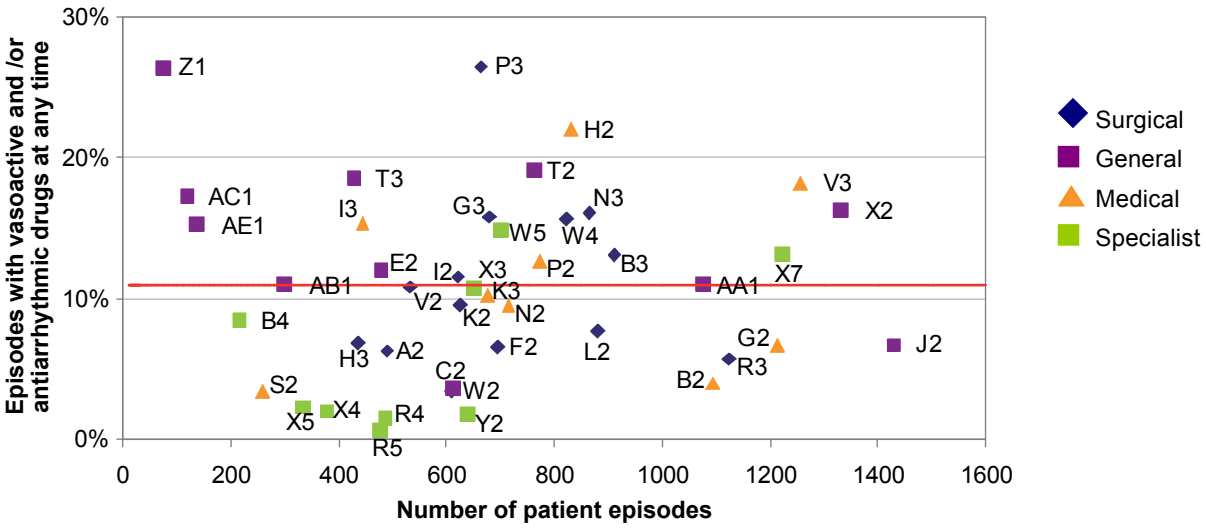
Figure 36 Use of vasoactive and/or antiarrhythmic drugs in ICU and Combined Units (2013)



Note: Unit W7 has been excluded from this chart, due to data quality.

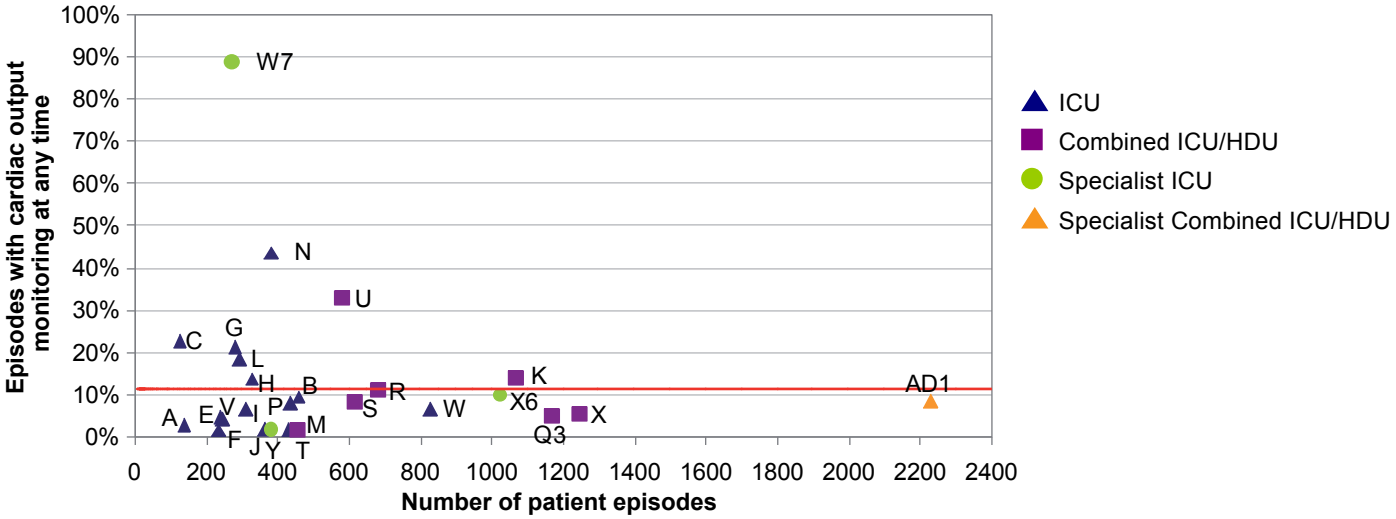
The proportion of patient episodes with vasoactive and/or antiarrhythmic drugs in ICU and Combined Units increased from the 42% reported in 2008 to 49% in 2013. This is likely due to cardiothoracic units joining the audit over the last few years.

Figure 37 Use of vasoactive and/or antiarrhythmic drugs in HDU (2013)



Use of vasoactive and/or antiarrhythmic drugs in HDU has increased slightly since 2012 to 11% from 10%.

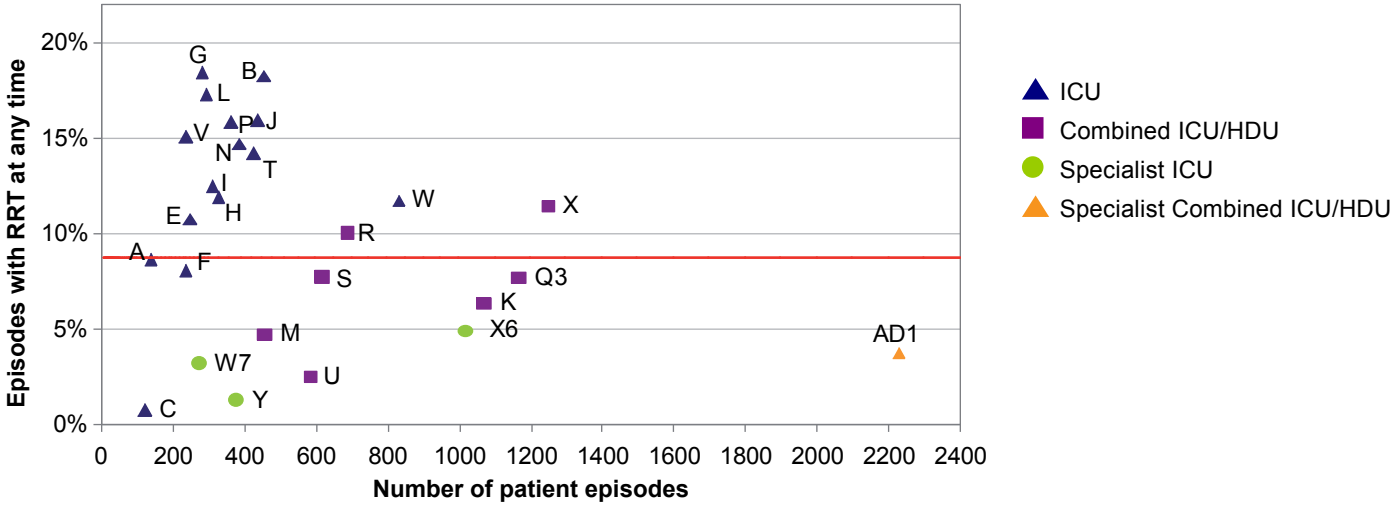
Figure 38 Cardiac output monitoring in ICU and Combined Units (2013)



There has been a fall in cardiac output monitoring over the last five years from 18% to 11%. W7 is a cardiothoracic ICU who routinely uses non-invasive cardiac output monitoring.

3.4 Renal support

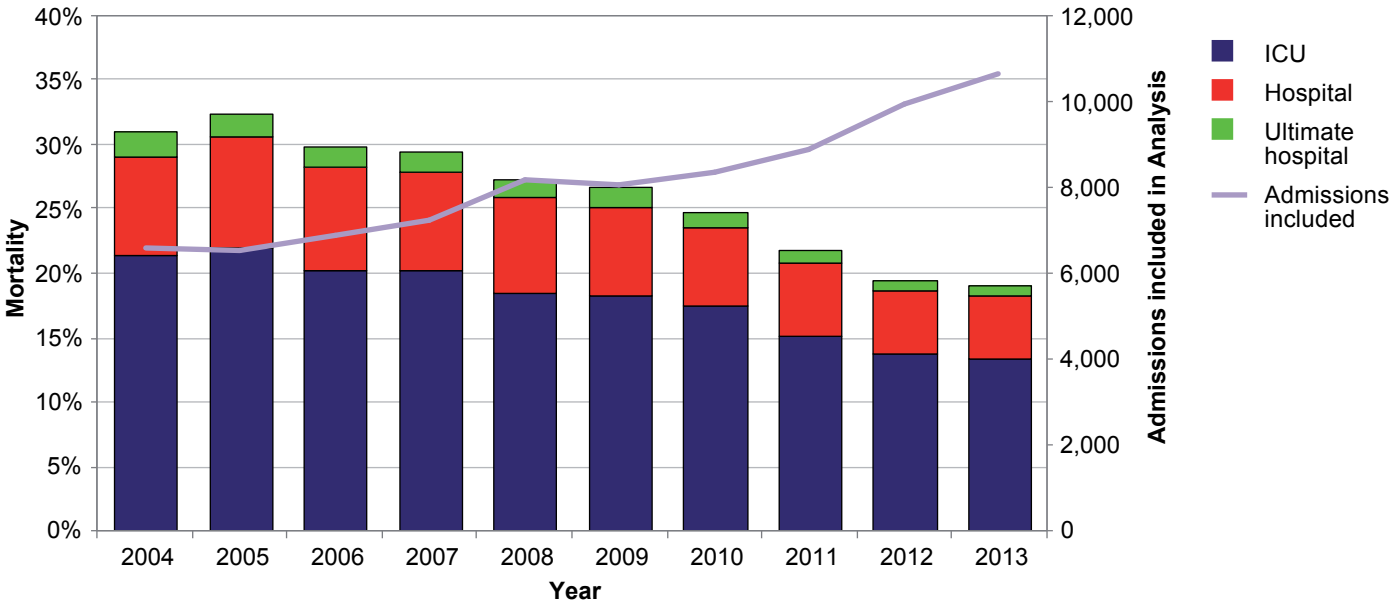
Figure 39 Renal Replacement Therapy in ICU and Combined Units (2013)



The provision of Renal Replacement Therapy (RRT) across Scotland decreased in the last few years from 12% in 2011 to 9% in 2013.

Section 4 Outcomes

Figure 40 Scottish crude mortality of patients in ICU and Combined Units (2004-2013)



Notes:

1 Only includes patients with mortality predictions.
2 Hospital discharge is discharge from hospital where the ICU admission occurred.
3 Ultimate hospital is discharge from final acute hospital.

Crude mortality in patients admitted to ICU continues to improve year on year in Scotland. This year a total of 19% of patients died before their ultimate discharge from hospital. Conversely 81% of patients survived critical illness and intensive care admission and were discharged from acute hospital care.

A continued improvement has been seen in ICU/Combined Unit mortality, with it reducing to just over 13% in 2013 (based on 10,685 records). There have also been smaller improvements in both hospital and ultimate hospital mortality. It should be remembered that the above figures are not adjusted for illness severity or case-mix, which can change over time.

Figure 41 Scottish Standardised Mortality Ratios in ICU and Combined Units, using the Standard APACHE II model (2004-2013) and Recalibrated APACHE II model (2007-2013)

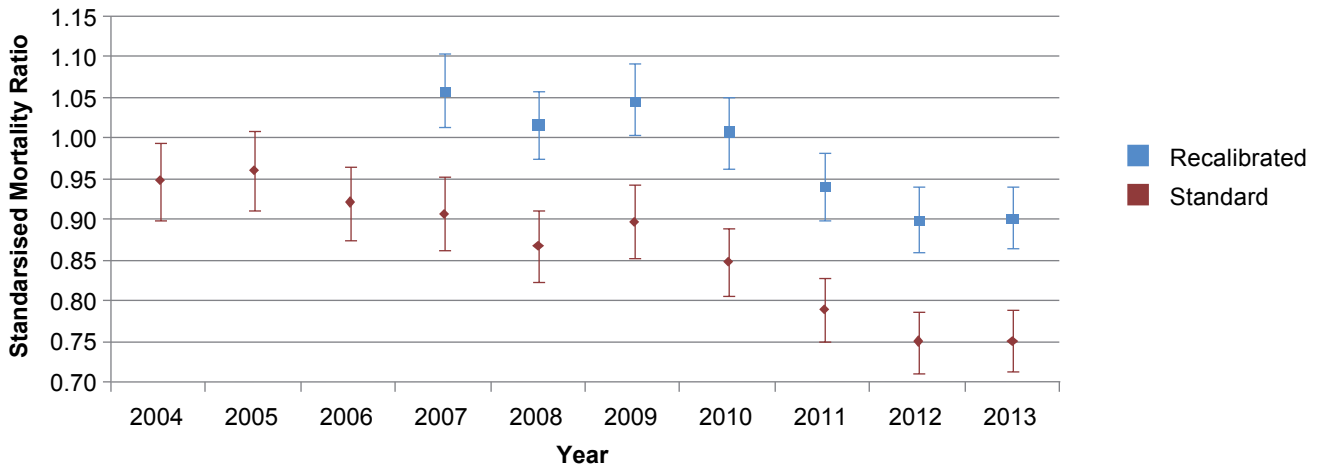


Figure 41 shows the Standardised Mortality Ratio (SMR) where the actual mortality is compared with expected mortality, using APACHE II methodology(Appendix 3).This allows a better comparison of mortality over time and between different units, as illness severity and case-mix are adjusted for.

The graph shows that, with the exception of 2009, the SMR across Scotland has fallen during the period 2004-2012. 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.

From 2012 to 2013 the standard and recalibrated SMR remained the same at 0.75 and 0.90 respectively.

Figure 42 Standard Mortality Ratios using recalibrated APACHE model in ICU and Combined Units (2013)

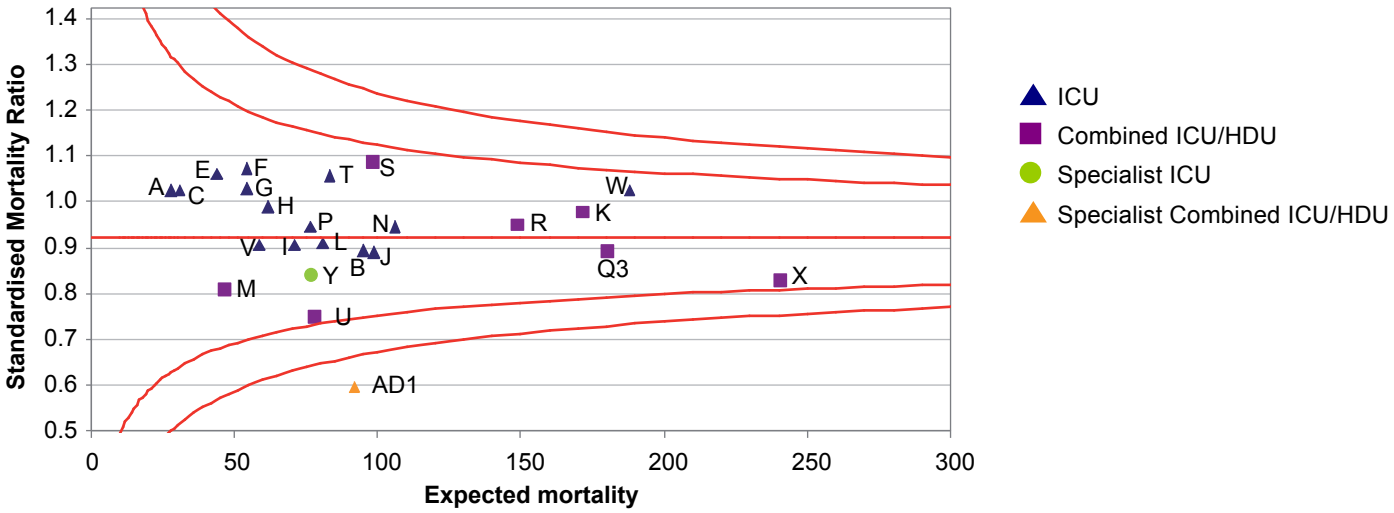


Figure 42 shows the SMR for ICU and Combined Units (excluding X6 and W7), and is calculated using the recalibrated model. No units are significantly higher than the Scottish mean.

The Golden Jubilee cardiothoracic ICU/HDU (AD1) has 58% of its admissions excluded from the SMR as coronary artery bypass grafts are not included in APACHE II methodology, hence caution should be applied when interpreting this unit as statistically different from other units in Scotland.

Conclusion

The SICSAG audit remains a comprehensive report of the activity, interventions and outcome of Critical Care in Scotland.

Detailed unit level information is presented for scrutiny and to inform health care providers, managers and the public about the quality of Scottish Critical Care.

The number of units participating in the audit continues to grow as Critical Care expands to encompass more patients. Managers should seek to question why any Critical Care unit within their remit has not joined SICSAG.

The audit has developed into a co-ordinated quality improvement programme which provides data, analysis and feedback which aims to raise standards and 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	Physiother-apy	Dietetic review
AYR	5	4	6.2	weekdays	Weekdays	everyday	weekdays
Crosshouse	7	5	6.2	weekdays	Weekdays	everyday	other
BGH	9	3/2 (and 4 level 1 beds)	6.1	weekdays	weekdays	everyday	weekdays
DGRI	4	4	6.9	weekdays	everyday	everyday	weekdays
VHK	10	9	5.7	weekdays	weekdays	everyday	everyday
FVRH	19	7/12	5.9	weekdays	everyday	weekdays	weekdays
ARI General	16	11	7	everyday	weekdays	everyday	weekdays
ARI Cardio	6	5	5.1	weekdays	weekdays	everyday	weekdays
GRI	20	12/8	5.9	weekdays	everyday	everyday	weekdays
IRH	3	3 (Jan-Mar) 2 (Apr-Dec)	5.5	weekdays	other	everyday	weekdays
RAH	8	7	6	weekdays	everyday	everyday	weekdays
SGH General	6	5	6.6	weekdays	weekdays	weekdays	weekdays
SGH Neuro	9	6	7.3	everyday	everyday	everyday	weekdays
VI	5	5	5.8	weekdays	everyday	everyday	other
WIG	9	8	6.2	weekdays	everyday	everyday	other
Raigmore	7	7	6.7	weekdays	weekdays	everyday	weekdays
Hairmyres	10	5.25/4[2]	5.6	weekdays	weekdays	everyday	weekdays
MDGH	6	5.2[2]	5.4	everyday	everyday	everyday	everyday
Wishaw	6	5.3[2]	5.2	weekdays	everyday	everyday	weekdays
RIE General	18	16/2	6.2	weekdays	weekdays	everyday	weekdays
RIE Cardio	12	9	6.7	everyday	weekdays	everyday	other
SJH	5	3/2	6.4	weekdays	weekdays	everyday	other
WGH	16	10/6	6.2	weekdays	everyday	everyday	other
GJNH Critcare	38 (20 ICU)	33[3]	6.0 (ICU beds only)	weekdays	everyday	everyday	weekdays
Ninewells	9	8	5.5	weekdays	everyday	everyday	everyday
PRI	4	3	6.3	everyday	everyday	everyday	weekdays

Notes

1 Funded beds are for 2013.

2 Funded beds increase in winter months.

3 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	3.1	no	weekdays	other	everyday	weekdays
Crosshouse SHDU	12	8/4	2.4	no	weekdays	other	everyday	weekdays
Crosshouse MHDU	12	8/4	2.5	everyday	weekdays	other	everyday	other
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	3.1	weekdays	weekdays	other	everyday	weekdays
VHK MHDU	8	8	2.9	everyday	weekdays	weekdays	weekdays	everyday
VHK RHDU	3	3	4.7	yes	everyday	weekdays	everyday	everyday
ARI SHDU (31/32) Ward 503	7	8	2.4	no	other	other	weekdays	other
ARI SHDU (35) Ward 506	9	9	2.4	no	weekdays	other	weekdays	weekdays
ARI CHDU	10	8 (Jan-Jun), 6 (Jul-Dec)	2.2	no	weekdays	other	weekdays	other
Dr Gray's HDU	10	10	1.9	no	weekdays	other	weekdays	weekdays
GRI SHDU	8	8	2.5	no	weekdays	everyday	everyday	weekdays
GRI MHDU	6	6	2.4	weekdays	weekdays	other	weekdays	weekdays
IRH SHDU	4	4	2.3[2]	no	weekdays	other	everyday	weekdays
RAH HDU	12	12	2.8	no	weekdays	other	weekdays	other
SGH SHDU	6	6	2.8	no	weekdays	other	weekdays	weekdays
SGH NHDU	6	4	3.7	no	everyday	everyday	everyday	weekdays
VI SHDU	8	8	2.5	no	weekdays	other	weekdays	other
WIG HDU	4	4	3.1	everyday	weekdays	everyday	everyday	other
GGH HDU	9	8	2.6	no	weekdays	everyday	everyday	weekdays
Raigmore SHDU	6	6	3.2	no	weekdays	other	everyday	weekdays
Raigmore MHDU	4	4	2	weekdays	weekdays	other	weekdays	Only
Belford HDU	2	2	Staffed as required with 1:2 ratio	no	weekdays	other	everyday	other
Hairmyres MHDU	4	4	2 nurses per shift[3]	no	weekdays	other	weekdays	weekdays
MDGH SHDU	8	8	2.3	no	weekdays	other	everyday	weekdays
MDGH MHDU	4	4	2	weekdays	weekdays	other	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 SHDU	6	6.3	2.3	everyday	everyday	weekdays	weekdays	weekdays
Wishaw MHDU	12	6/6	2.3	no	weekdays	everyday	everyday	weekdays
RIE HDU	10	10	3.1	everyday	weekdays	other	everyday	weekdays
RIE RHDU	8	8	3.4	everyday	weekdays	other	everyday	weekdays
RIE Transplant HDU	4	4	4.1	no	weekdays	other	other	weekdays
RIE Vascular (Level 1)	4	0/4	Shared with Vascular ward	no	other	weekdays	other	weekdays
RIE CHDU	8	8	3.8	everyday	weekdays	weekdays	everyday	other
WGH SHDU	10	6/4	2.7	no	weekdays	other	everyday	other
WGH NHDU/Level 1	7	4/3	3.4	weekdays	weekdays	other	everyday	weekdays
Balfour Hospital HDU	3	No separate funding[4]	3.7	everyday	weekdays	other	everyday	weekdays
GBH HDU	2	No separate funding[4]	Staffed as required	everyday	weekdays	other	weekdays	weekdays
Ninewells SHDU	10	10	3.5	weekdays	weekdays	everyday	everyday	weekdays
Ninewells MHDU	6	6	3.1	yes	weekdays	other	everyday	weekdays
PRI HDU	4	4	3.3	no	weekdays	other	everyday	other
WIH HDU	4	4	1.4	no	other	other	weekdays	other

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

Notes
1 Funded beds are for 2013.
2 Nursing staff cover ICU, SHDU and CCU beds therefore this figure is approximate.
3 Staff rotate from the general ward; two trained nurses are allocated to HDU every shift.
4 HDUs are open when necessary and staffed by ward nurses (with HDU training). Occupancy is calculated on one bed in these units.
* Whole Time Equivalent per level 2 bed.

Appendix 3 Methodology

3.1 Data collection

Data were collected prospectively from all general adult ICUs, Combined Units and the majority of HDUs using the WardWatcher system developed for this purpose. In March 2014, an initial extract of 2013 data was sent to ISD servers. Validation queries relating to discharges, outcomes, ages and missing treatment information were then issued and fed back to individual units for checking by local and regional audit coordinators. A final validated extract was submitted to ISD in April 2014, which has been used for this report.

Along with the measures taken to ensure data validity, the comprehensiveness of the data, incorporating data on all patients receiving care in participating units during 2013, ensures that the findings included in this report have a high degree of reliability at the national, health board and individual unit level.

3.2 Data management

SICSAG data has undergone an extensive review. All SICSAG data from 1995 onwards is now stored within a rationalised set of databases, and variables and values have been made consistent. SICSAG are constantly striving to improve data quality through ongoing validation and therefore the SICSAG database should be regarded as dynamic and the data may be subject to change.

All SICSAG data from 1998 to 2013 have been through a linkage process that aims to match SICSAG Critical Care episodes to Public Health and Intelligence (PHI), (formerly Information Services Division) SMR01 data scheme which collects data on all general / acute inpatient and day case admissions. All patients recorded in the SICSAG database should have SMR01 records relating to the same hospital stay. 96% of all SICSAG episodes have been matched to an SMR01 stay. This provides an alternative source of information on hospital, ultimate hospital, discharge dates and outcomes. Where the value of these fields is not documented in SICSAG, it has been overwritten with the value derived from linkage to SMR01.

3.3 Presentation of the data

The analysis of the data and the presentation of the findings are based on that adopted in previous annual reports.

Additional Tables, along with more detailed data on subject areas that are not included in this report, are available on the SICSAG website www.sicsag.scot.nhs.uk. Further information on the interpretation of funnel plots is also published on this website.

WardWatcher was upgraded in all units during 2008/2009 and some changes to the data set were made. 2010 was the first complete year of data based on the upgraded version of WardWatcher. Changes that will affect trend data have been referred to in the text. Please refer to the SICSAG website www.sicsag.scot.nhs.uk for information on when hospitals were upgraded.

3.3.1 Bar Charts

Quality Indicators 2.1 (Night time discharges) and 3.2 (Early Discharges) are represented on a bar chart as a percentage of discharges from each unit for 2012 and 2013. The difference between the years is calculated, and if the confidence limit for the difference does not include zero then we have concluded that the difference between the years is statistically significant. Units that performed significantly better in the QI since last year are represented in green, while units that performed significantly worse since last year are in red.

3.3.2 Funnel plots

A number of the clinical indicators within this report are presented in graphs called control charts. A control chart is a simple way of presenting data that can help guide quality improvement activities, by flagging up areas where there appears to be marked variation and where further local investigation might be beneficial. Control charts have been used widely in the manufacturing industry, and have more recently been applied in healthcare settings. While the presentation of clinical indicators as league Tables is advised against, the use of control charts has become increasingly popular.

Within this report funnel plots (a type of control chart) have been used to allow comparisons to be made between different services providers, in this case Critical Care Units.

A performance indicator is shown on the y-axis, while generally the number of admissions is shown on the x-axis. There is a data point for every unit in the funnel plot. There are five key lines in the funnel plots used in this report. The first is the average for the type of Critical

Care Unit (either 'ICU or Combined Units' or 'HDU'). Plotted on either side of the average are two sets of warning limits. Warning limits are plotted at 2 and 3 standard deviations from the mean. Each of the five key lines is depicted in red on the charts.

Data points within the control limits (the red lines) are said to exhibit common cause variation or to be 'in control'. Data points out with the control limits are said to exhibit something called 'special cause variation' (sometimes referred to as 'outliers').

SICSAG will always highlight units outside 2 standard deviations from the mean as "might be different" and outside 3 standard deviations as "are different". It should be recognised that in a comparison of 25 units there is a considerable chance of an outlier at the 2 SD (5% or 1 in 20) level. Differences may arise from many sources: differences in data accuracy, case-mix, service provision or practice. Sometimes a difference will be just a random difference caused by chance alone. SICSAG would encourage readers to use the data to examine practice in the context of the factors listed.

For some performance indicators, more than a few units are outside the outer control limits. This typically arises when the units are heterogeneous, for instance ICU versus Combined Units, or Surgical versus Medical HDUs. Then small institutional factors contribute to more variability than would be expected by chance alone. These differences may not be particularly important nor point to real differences in the performance indicators. Although the positions of the units differ in the statistical sense, they might not be of any clinical significance.

To account for excess variability the control limits can be adjusted in several ways. In this report they are calculated with a procedure derived from Spiegelhalter[13].

3.3.3 Funnel plots for Standardised Mortality Ratios

Over the time that the audit has been in existence, various units have been outliers at 2 SD level. We have sought reasons as to why they might be different and informed and supported individual units in seeking an explanation. Being an outlier at this level may be explained by

data quality, questions over standards of care, different referral patterns, admission policies or resources but it also may be due to random variation. Therefore, we are using a very stringent definition of variance. For comparison, Hospital SMRs[14] produced for the SPSP by PHI and also the Intensive Care National Audit & Research Centre (ICNARC) will use 3 SD to identify outliers.

3.4 APACHE II

The outcome measure used by SICSAG is the patients' survival status (alive or dead) when they finally leave an acute hospital (even if this is not the original hospital). Patients admitted to ICU are at significant, but varied, risk of death. Simply comparing the proportion of patients who die in each unit can give a misleading impression because the severity of their illnesses is different. To overcome this, we use the APACHE II system to adjust for case-mix[15]. This is a validated scoring system[16], which takes account of both the patients' acute condition and their chronic health.

Certain groups of patients are excluded:

- Less than 16 years of age
- Unit stay less than 8 hours
- Readmitted to unit during the same hospital admission
- Primary diagnosis for which the system was not developed: burns, coronary artery bypass graft, and liver transplant.

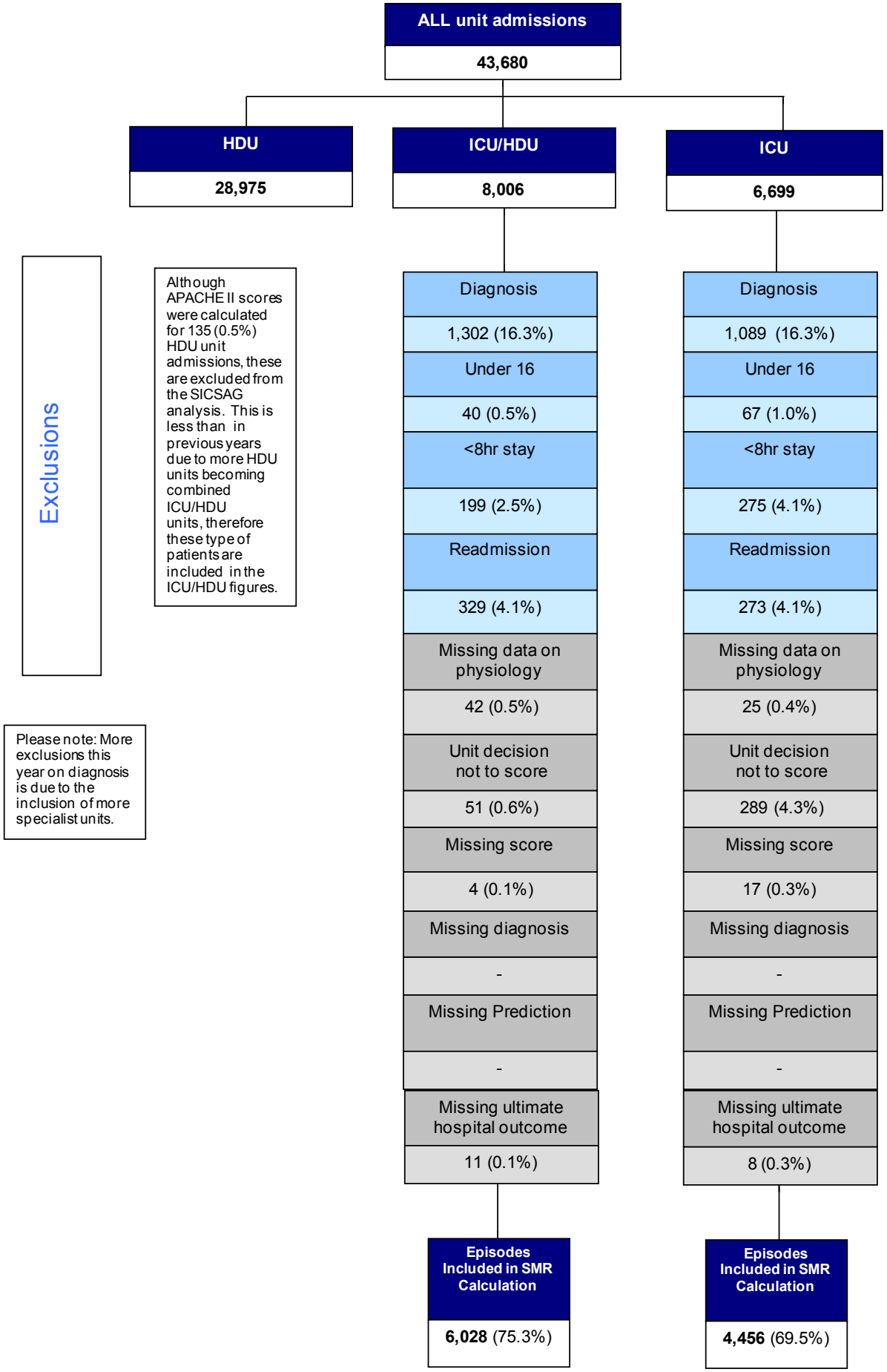
WardWatcher provides similar codes as reasons for excluding unit admissions from APACHE II scoring. Taking into account non-response, these were re-coded to reflect the hierarchy of decision-making within units. Automatic exclusions such as 'diagnosis', 'patient under 16' and 'patient stayed for less than eight hours' were excluded first and existing codes changed to reflect this prioritisation. Readmissions were excluded next, followed by 'other' cases where no rationale for automatic exclusion was provided. The remaining exclusions were optional, where it was possible to generate a score but this was not done (eg HDU patients).

If unit admissions are scored, case-mix adjusted mortality estimates may only be calculated in cases where an appropriate diagnosis is available. All exclusions and cases with missing or excluded diagnoses (eg liver transplant) are shown schematically in the decision tree on page 39.

APACHE II produces an expected mortality rate for a unit, which can be compared to the actual observed mortality rate to give a standardised mortality ratio (SMR). An SMR significantly greater than 1 suggests that mortality is higher than expected, and a value of less than 1 that it is lower than expected. It is important to interpret SMRs with caution. It should be appreciated that whilst the APACHE II scoring system adjusts for case-mix, it does not do so perfectly. This scoring system is now nearly 30 years old. Many units admit a relatively small number of patients each year and the confidence intervals around the SMR are therefore wide. Exact confidence intervals for SMR are calculated by the method described by Ulm[17].

The standard APACHE II model has been recalibrated based on data from Scottish ICU and Combined Units between 2009 and 2011. The standard APACHE II model has been consistently over predicting mortality for patients admitted to Scottish ICU and Combined Units. This has meant that the old model was not as useful for calculating SMR for the Scottish population. The standard APACHE II model will continue to be available, and could be used to produce trend information and for international comparison. WardWatcher will continue to calculate predicted mortality based on the standard APACHE II model at this time.

Figure A1: Eligibility for APACHE II scores and selection for analysis (2013)



3.5 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 (eg no organ support and adequate monitoring could be provided on a general ward)

Level of care is based on the Intensive Care Society guidelines[3].

Appendix 4 List of abbreviations

ACP	Augmented Care Period
CICU	Cardiothoracic Intensive Care Unit
CHDU	Cardiothoracic High Dependency Unit
CPAP	Continuous Positive Airway Pressure
CRBSI	Catheter Related Blood Stream 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
M & M	Morbidity and Mortality
MHDU	Medical High Dependency Unit
NHDU	Neurological High Dependency Unit
NICU	Neurological Intensive Care Unit
NIV	Non Invasive Ventilation
PHI	Public Health and Intelligence (formerly ISD and HPS)
RHDU	Renal High Dependency Unit
RRT	Renal Replacement Therapy
SCCTG	Scottish Critical Care Trials Group
SD	Standard Deviation
SHDU	Surgical High Dependency Unit
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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Acknowledgements

This report was written by the Report Writing Subgroup of the SICSAG Steering Group.

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

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