NHS National Services Scotland

Scottish Intensive Care Society Audit Group

Audit of Critical Care in Scotland 2013
Reporting on 2012

ISD SCOTLAND

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Foreword

It has been my privilege to chair this audit for the last 6 years and this will be my final annual report as I hand over to my successor. It has been an enjoyable and productive time and all involved can be proud of the developments we have achieved. Scottish Intensive Care Society Audit Group (SICSAG) is a national audit funded through Information Services Division (ISD). We exist to improve the quality of care delivered to Critical Care patients by monitoring and comparing activities and outcomes across Scottish Critical Care.

The audit has moved on from a focus on mortality to include other outcomes such as Healthcare Associated Infection and we have established a national system with Health Protection Scotland (HPS) which is reporting for the third year in tandem with this report. We are now measuring unit performance against a suite of Quality Indicators and publish these for the first time this year. Process audit is firmly embedded with our care bundles and engagement with the Scottish Patient Safety Programme (SPSP) since it started in 2008. At the same time, we have developed rapid feedback with monthly reports to units with quality indicator, HAI and mortality data. This includes an early warning system CUSUM graph of unit mortality. The SICSAG database has been linked to a number of others in ISD adding enormously to the potential for research.

In short, the last 5 years have seen SICSAG move on from an anonymised audit focusing on mortality to a co-ordinated quality improvement programme examining structure, process and outcome to inform quality of care in an open publicly accountable structure. Health service managers will be interested to see how their services perform against Quality Indicators which may serve as pointers for development (Section 1).

The 2013 report includes data from all general ICUs in Scotland and specialist cardiothoracic and neurological ICUs and all except a handful of HDUs, some of which will be joining in 2013. This encompasses 40,000 patient admissions to Critical Care in Scotland for which we have detailed information and measures.

Our annual conference in conjunction with the Scottish Critical Care Trials Group and SICS Evidence Based Medicine Group in Stirling will take place this year on 5th and 6th September. Details of this and further information are available at www.sicsag.scot.nhs.uk.

I would like to thank everyone who has contributed to the audit over the years and they are too numerous to mention individually: Scottish Critical Care clinical staff, the SICSAG steering group and staff at ISD.

At time of writing, I do not know who my successor will be, but I wish him/her well and know that the audit remains in safe hands with the support available to them from all involved.

Dr Brian Cook

Chairman

Introduction

Scottish Intensive Care Society Audit Group (SICSAG) will continue to improve its methodology, ensuring its quality assurance of data and analysis is aligned with the aim to improve the care of ICU and HDU patients by systematic, comprehensive audit of their management and outcomes. We 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 NHSScotland 2010[1].

This year, we are reporting on the management of 13,103 patients admitted to ICU and Combined Units (units with a combination of ICU and HDU beds) and 26,877 patients admitted to HDU during 2012. This report summarises data that have been collected via a bespoke electronic database (WardWatcher), within critical care units in Scotland. The format continues to follow the patient's journey through four sections: quality indicators, activity, interventions and outcomes with data presented in tables, charts and 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 3.3.1 explains how to interpret the control charts (funnel plots) used in this report and suggests some reasons 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.

Quality Indicators

For the first time (Section 1) we report on 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.

Recalibration of APACHE II

During 2012 SICSAG recalibrated the APACHE II model that the SMR is based on; this had the effect of increasing the SMR and is more accurately predicting outcomes for Scotland. See the website for more details on this work www.sicsag.scot.nhs.uk.

Development of CUSUM charts

The CUSUM chart (CUmulative SUMmation), is a method for quickly identifying unusual patterns of hospital outcome. This information is provided on a monthly basis on the predicted outcomes of the last 300 patients. See the website for more details on this work www.sicsag.scot.nhs.uk.

Nurse User Group

This Group was set up to support and enable critical care nurses to access and utilise their own local audit data to drive and support quality improvement. It has evolved into a forum where nurses share and promote quality improvement initiatives and programmes which have improved patient care in their unit.

Meetings are held every six months, and free to those attending. Places are limited so early booking is advised. Next meeting is 4th November 2013; further details will be published on the website.

Health Protection Scotland (HPS)

SICSAG continue to work collaboratively with HPS to report on the incidence of Healthcare Associated Infections in ICUs. Many units have received no additional resource to collect these data so the continuation of this programme, once again, demonstrates the dedication and commitment of critical care staff.

Information Requests

From January 2013, ISD has operated the eData, Research and Innovation Service (eDRIS) - a one stop shop for health informatics research. This facility provides expert services for specific research, complex and commercial customer information requests.

SICSAG respond to information requests to support local and national audit and research projects, ensuring the vast amount of data held is utilised for maximum benefit. A new section on the website will detail the results from these bespoke analyses. Regretfully due to limited analyst resource there has been a delay in processing some of these requests and we will endeavour to reduce the turnaround time in the future.

New units

SICSAG continues to expand with the addition of more specialist units and medical HDUs in 2012/13:

Cardiothoracic ICU and HDU, Golden Jubilee National Hospital (2012)

Medical HDU Wishaw General Hospital (2012)

Cardiothoracic ICU and HDU, Aberdeen Royal Infirmary (2012/13)

Obstetrics HDU, Ninewells Hospital , Dundee (2013)

Obstetrics HDU, Royal Infirmary of Edinburgh (planned late 2013)

New Chairperson

SICSAG will welcome a new Chairperson in 2013, as Dr Brian Cook steps down. We would like to take this opportunity to thank Brian for his expert guidance and leadership over the past six years. He has helped to drive the audit forward and leaves SICSAG in a strong position to embark upon its next phase.

Anita Pritchard

National Clinical Coordinator

Summary and Key Findings

SICSAG collects high quality data on all general intensive care patients as well as the majority of high dependency patients in Scotland. Coverage of units has further expanded in 2012 with the addition of three new High Dependency Units (HDUs), and one Combined Unit.

SICSAG continues to be the only national audit to publish case-mix adjusted mortality rates for individual units.

SICSAG does not limit itself to collecting data but actively works to improve patient outcomes. Quality Indicators for Critical Care have been developed and for the first time are included in the annual report (Section 1). Collaboration continues with Health Protection Scotland to produce reports of Healthcare Associated Infection.

The quality of data collected is regularly reviewed and this report accurately reflects Critical Care activity in Scotland.

Key findings

39,980 admissions to Critical Care were included in the audit in 2012. This is higher than in any previous year, and reflects an increase in the number of participating units. The like for like HDU admissions decreased slightly probably due to the addition of more Combined Units.

In 2012, the bed occupancy rate for Scotland remained stable, at around 71% in ICU and Combined Units and 77% in HDUs. However, there was considerable variation between units, particularly in HDU.

For the first time data from each of the units on the Quality Indicators for Critical Care in Scotland 2012[2] are published. It is encouraging to see that the majority of units are meeting the indicators.

This year SICSAG has recalibrated the APACHE II model and used this model in addition to the standard APACHE model to adjust for case mix differences in outcomes. As in previous years no unit is significantly different from the others. One unit may be different from the Scottish mean and while this could be due to chance, the unit had been contacted before publication of this report and is currently reviewing practice and data collection.

Out of hours discharges decreased in ICUs from 13% in 2011 to 11% in 2012, out of hours remained stable for HDUs at 15%. One ICU and three HDUs had significantly higher rates of out of hours discharges, this may reflect capacity issues.

There continue to be issues with discharging patients from Critical Care due to difficulty in finding ward beds.

Early discharges from Critical Care are those that happen before the patient is deemed medically ready, because of pressure on beds or staffing. They can be used as a marker of insufficient resources. In 2012 this ranged from 0-8.9% in ICUs and 0-6.7% in HDUs.

The definition of Level 3 care has changed in the SICSAG report this year to be brought in line with the Intensive Care Society Standards 2009[3]. This should be taken into account when comparing with previous years data. The intensity of treatment remains high with 61% of patients treated in ICU and Combined Units receiving level 3 care.

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.

The percentage of patients in ICU and Combined Units requiring invasive ventilation fell from to 66% in 2011 to 62% in 2012. This is partly due to the increased number of Combined Units.

20% of patients admitted to ICU and Combined Units in 2012 died before hospital discharge, reflecting the severity of illness in this population. Case-mix adjusted mortality fell again this year and is at its lowest since the audit began. The adjusted mortality rate has been reducing for the last ten years but it is impossible to attribute to any one change. It may be in part due to the introduction of care bundles as well as other quality improvement initiatives.

Section 1 Quality Indicators

The SICS Quality Improvement Group produced an agreed list of 10 Quality Indicators (QIs) in 2012. We started collection of information from 1st January 2012 to report unit performance and present these for the first time in this report. 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 QIs 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) and no (red) delivery of each QI.

Part 1 Structure

1.1 Units participate in a national audit which examines activity and outcomes

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, all general ICUs and the vast majority of HDUs in Scotland submit data, and support is being provided to remaining HDUs to begin submitting information. Some units such as Obstetric HDUs are new developments.

Units joining the audit in 2013 are; Aberdeen Royal Infirmary Cardiothoracic ICU & HDU, Ninewells Obstetrics HDU, Royal Infirmary of Edinburgh Obstetrics HDU.

Known units who do not currently submit information are; Ninewells Neurological HDU, Crosshouse Renal HDU, Caithness HDU, Lorne & Islands HDU.

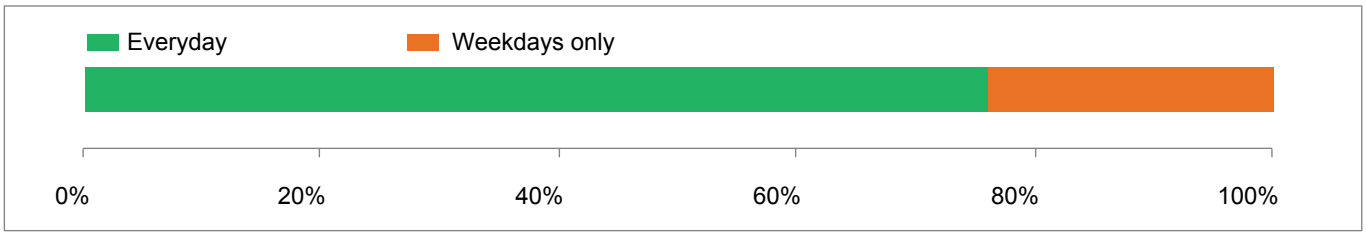
One unit has not been able to submit data of sufficient quality to be included in analysis:
Aberdeen Royal Infirmary Neurological HDU.

1.2 Daily review and written management plan by an appropriately trained consultant

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 SPSP and is consistent with Intensive Care Society (ICS) recommendations which recognise the importance of staffing patterns on outcome. Some evidence exists mainly from the USA where extremes of staffing models show that "closed" ICUs have better outcomes.

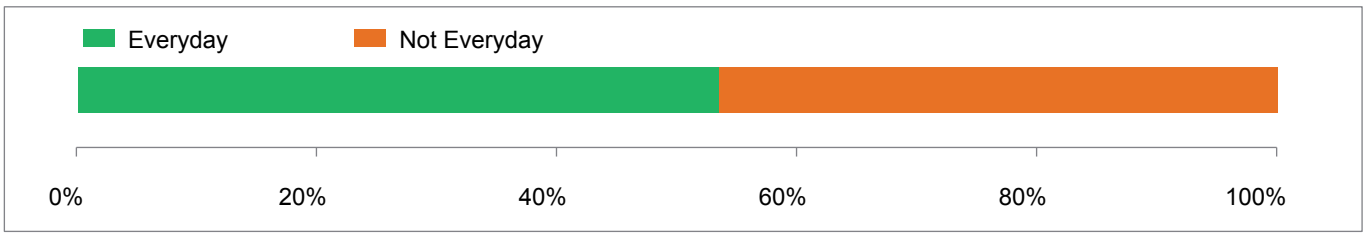
Figure 1 Percentage of ICU and Combined Units with a daily review and written management plan



76.0% of ICUs and Combined Units are achieving QI 1.2

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



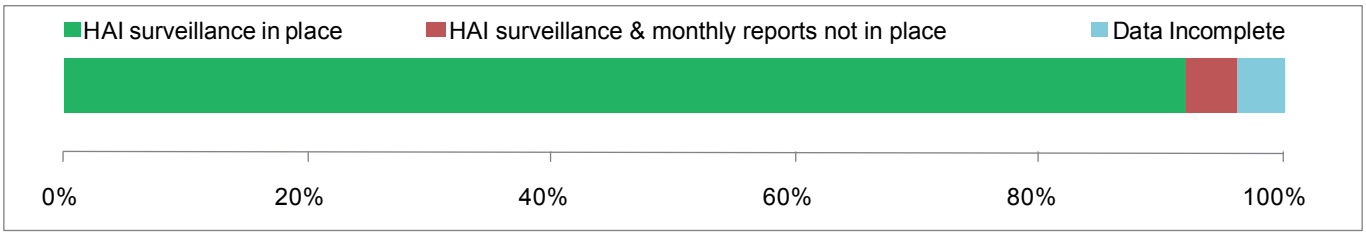
52.3% of HDUs are achieving QI 1.2

See Table 2 on page 11 for individual units.

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.

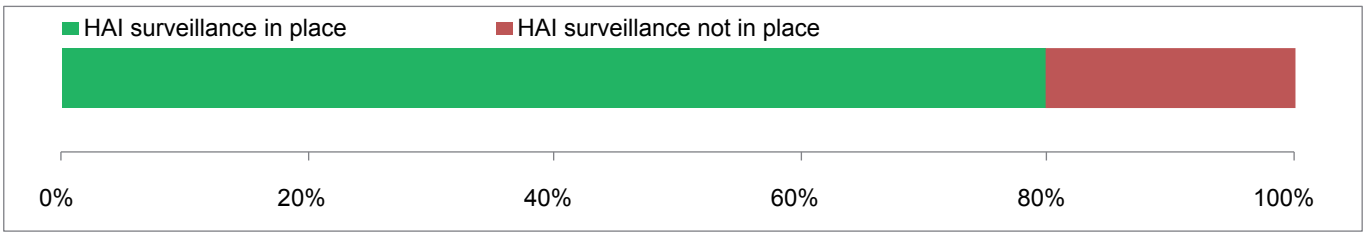
Figure 3 Percentage of ICU and Combined Units with HAI surveillance system



92.0% of ICUs met this minimum standard in 2012 with a HAI surveillance system reporting data to staff and SICSAG/HPS.

See Table 1, page 10: Cardiothoracic ICU, Royal Infirmary, Edinburgh are not reporting HAI incidence and Forth Valley Royal Hospital Units were unable to collect sufficient data to be included in this year's HAI surveillance national annual report.

Figure 4 Percentage of HDUs with HAI surveillance system



80.0% of HDUs have a HAI surveillance system.

Table 2 has detailed information by unit and Health Board.

Part 2 Process

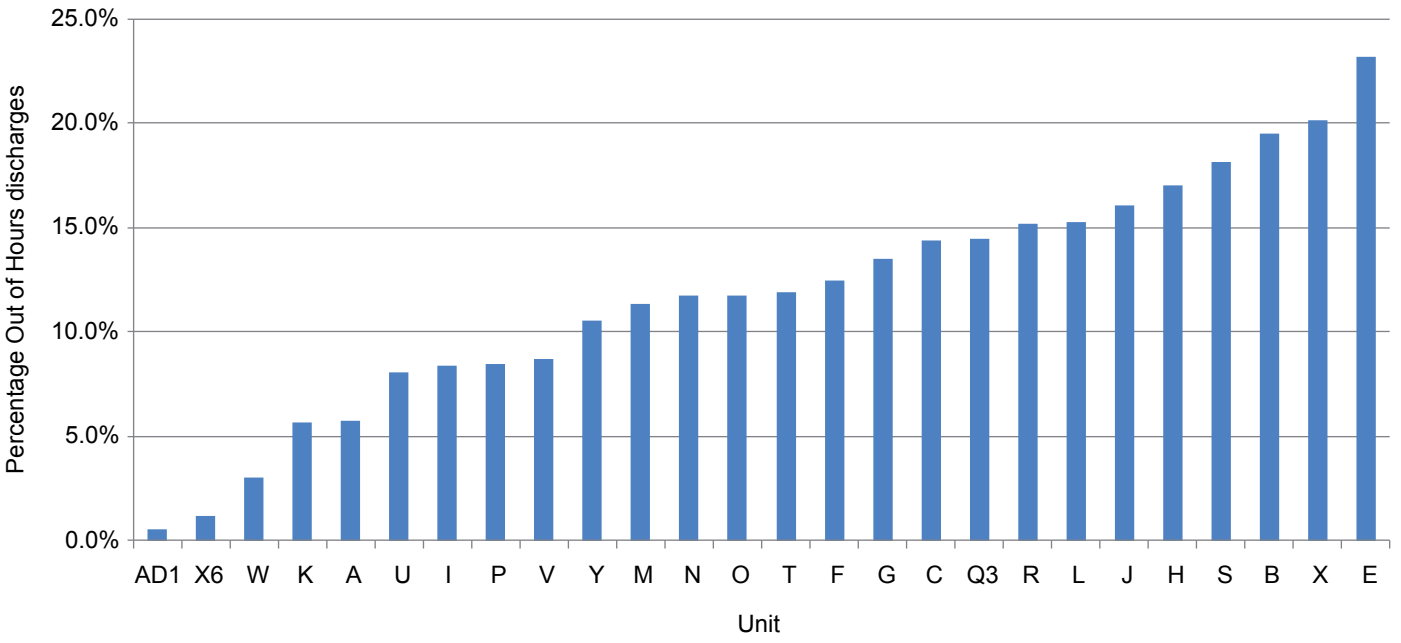
2.1 Proportion of night time discharges from Critical Care between 20.01 and 07.59

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 intensive care units are associated with worse outcomes.[4, 5] 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.

The charts in this section show percentages of live patient discharges out of hours, these percentages do not include self-discharges, discharges to specialist care and discharges for palliative care.

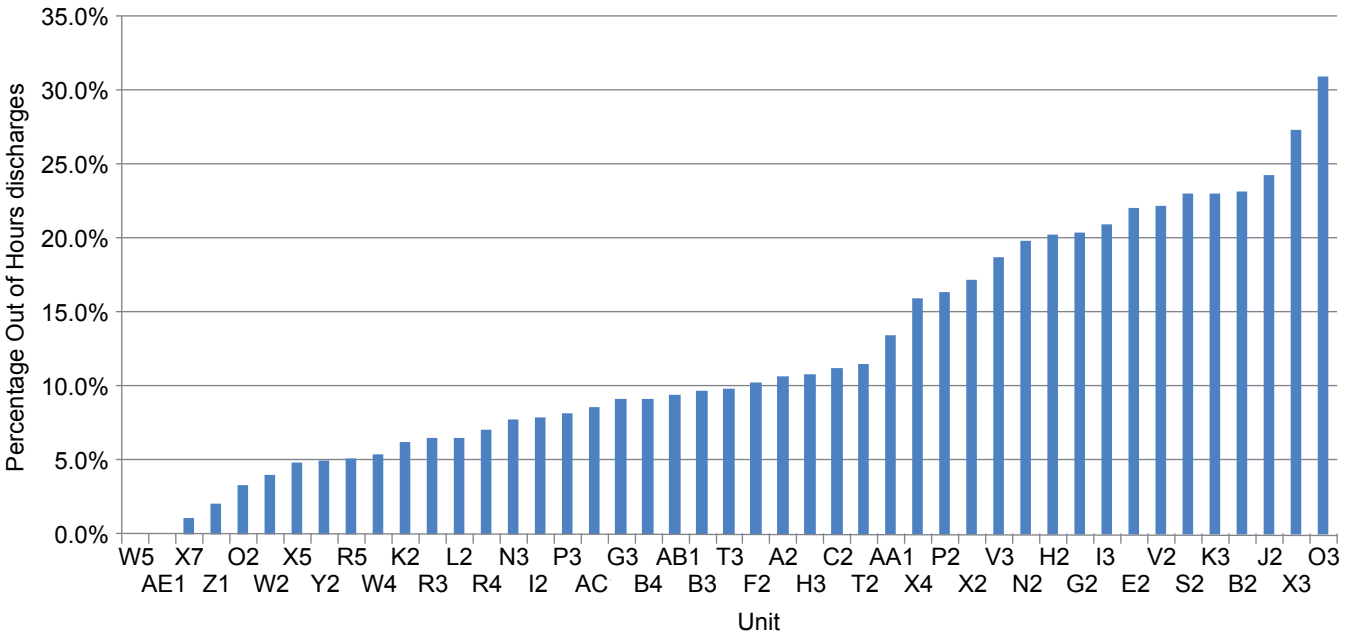
Units with high numbers of night discharges should examine locally why this is occurring to target solutions or resources: delayed discharges (figures 27, 28 page 22) and/or early discharges (figures 11, 12 pages 7 and 8).

Figure 5 Out of Hours discharges from ICU and Combined Units (2012)



Note: Out of hours is defined as discharges between 8pm and 8am.

Figure 6 Out of Hours discharges from HDU (2012)



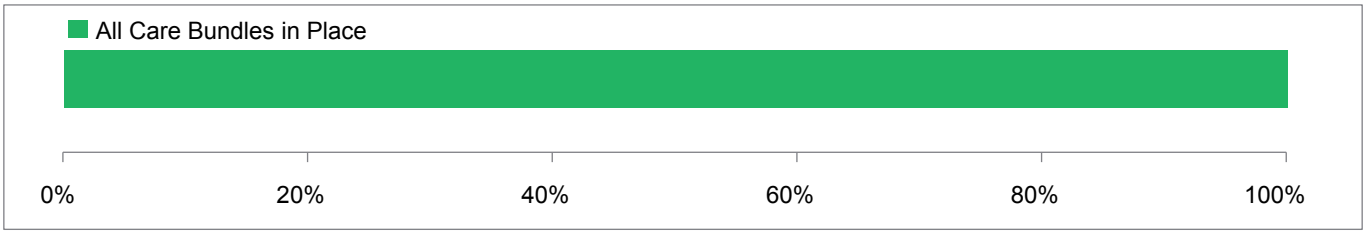
Note: Out of hours is defined as discharges between 8pm and 8am.

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.

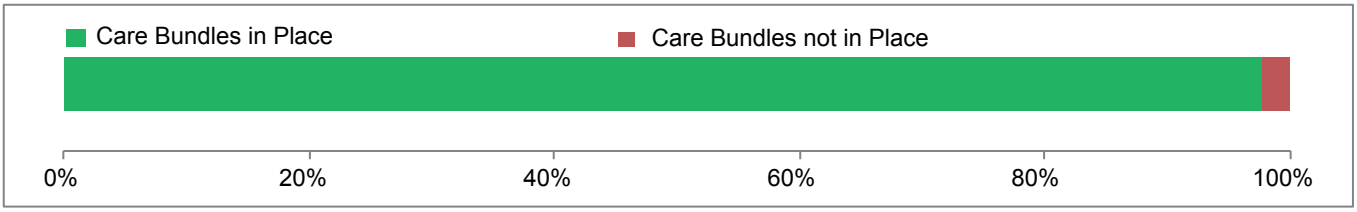
All ICUs and HDUs should measure and submit data to SPSP and feedback to unit staff on delivery of VAP prevention bundle [6, 7] (ICU or Combined Units only), CVC insertion and maintenance bundle[8] and PVC insertion and maintenance bundle.

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

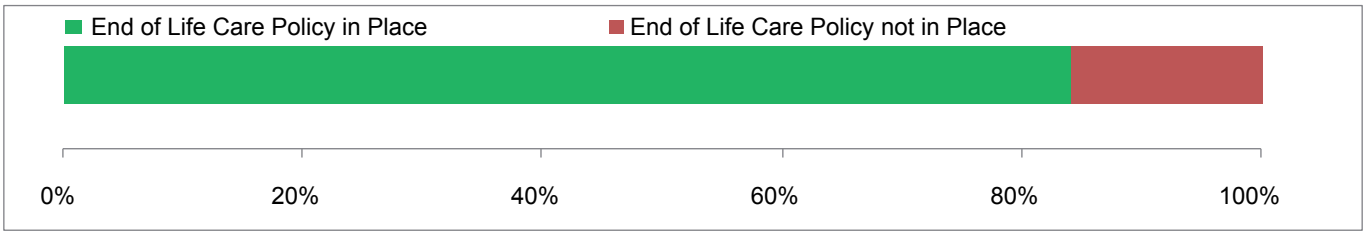


97.7% of HDUs meet the minimum standard with all care bundles in place reporting data to SPSP and feedback to staff.

2.3 End of Life Care

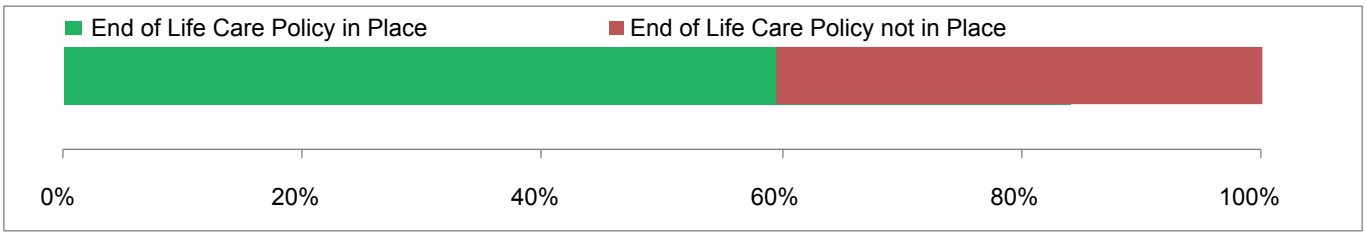
All ICUs and HDUs have a written end of life care policy. The two important elements are to ensure that patients are both identified and then cared for appropriately.

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



84.0% 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



59.1% of HDUs have an end of life care policy. Please see Table 2 on page 11 for individual units.

Part 3: Outcomes

3.1 Standardised Mortality Ratio (SMR)

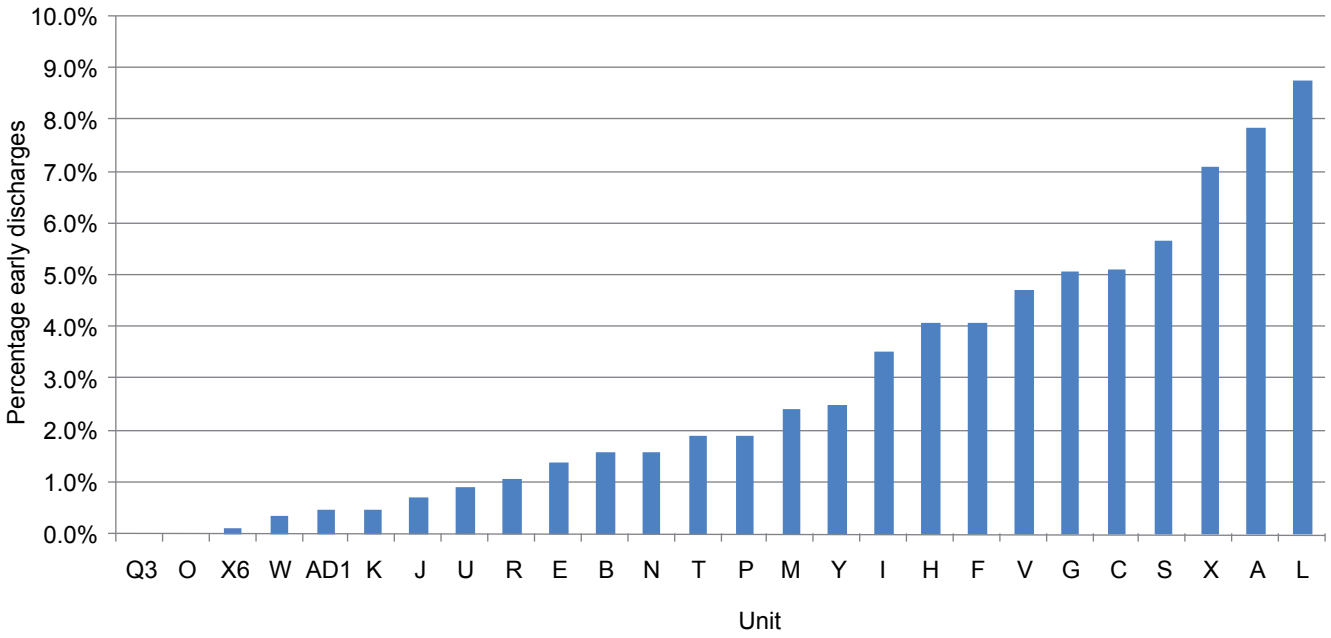
Please refer to Section 4, page 31 for further information on SMR Outcomes.

3.2 Number (%) of early discharges from Critical Care

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

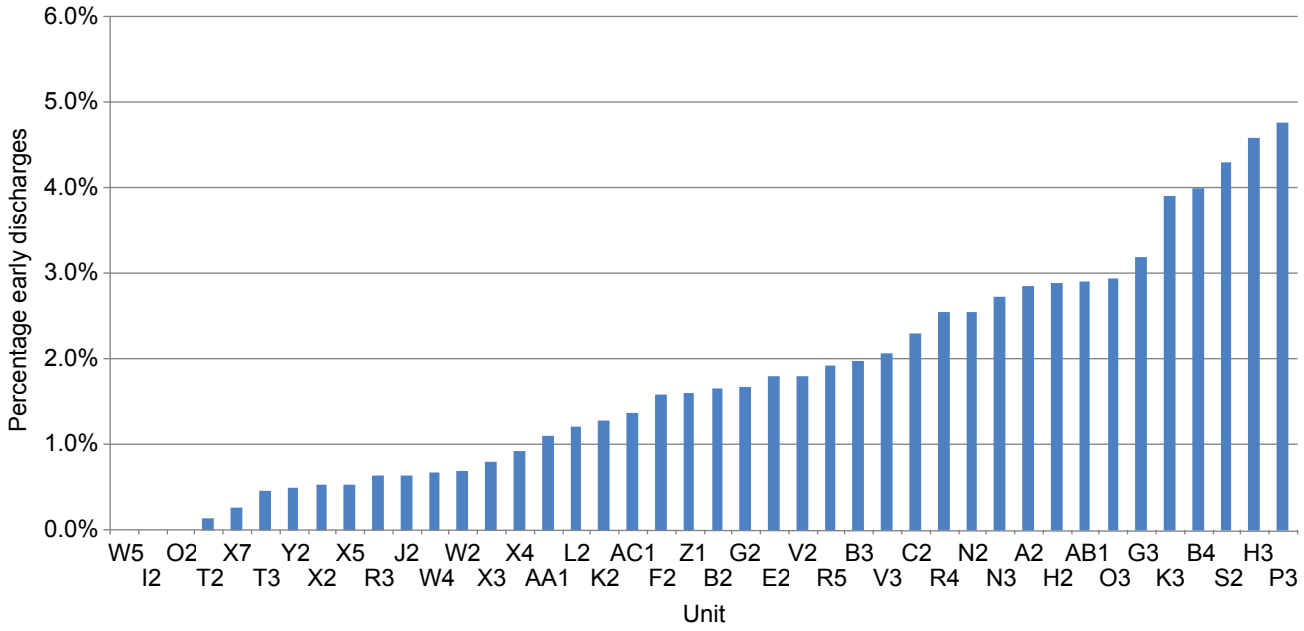
Early discharge is by definition unplanned, and usually forced by the need to admit another acutely ill patient. Patients who are discharged early are at risk of deterioration and adverse outcomes. This requires local interpretation as to where these patients have been transferred and adequacy of care after Critical Care discharge. It is helpful to examine this in conjunction with Critical Care readmission rates. (Section 2 Activity, Figures 29 and 30).

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



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.

Figure 12 Early discharges from HDU (2012)

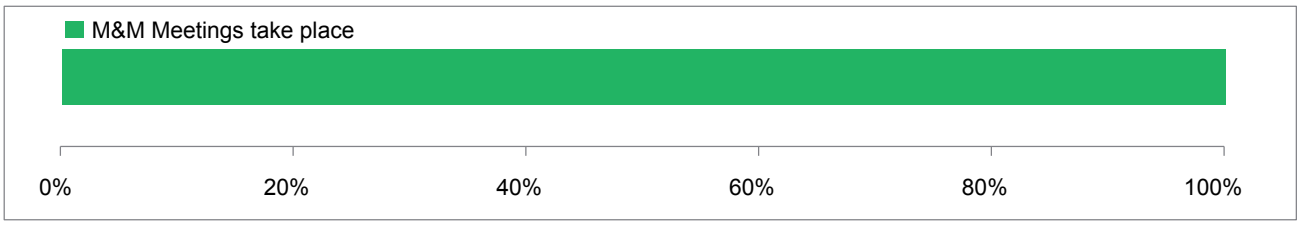


Note: Early discharge is defined as a transfer that is not in the best interest of a patient but necessary due to pressure on beds or staffing.

3.3 All unit deaths are discussed at a Morbidity and Mortality meeting

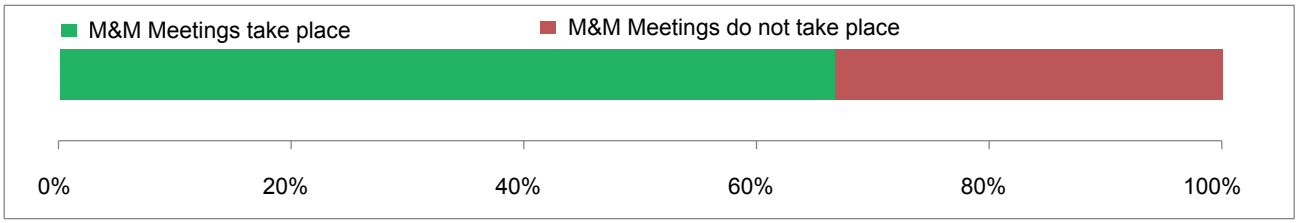
Every unit should discuss in open forum significant critical incidents and the care of all patients who die in a Critical Care ward.

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

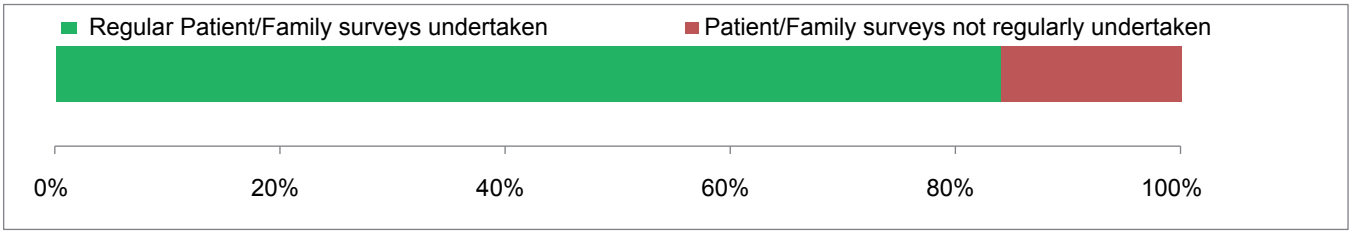


65.9% of HDUs meet this minimum standard to discuss and learn from all unit deaths. Unit level information can be found in Table 2, page 11.

3.4 Units should undertake regular patient/family experience surveys

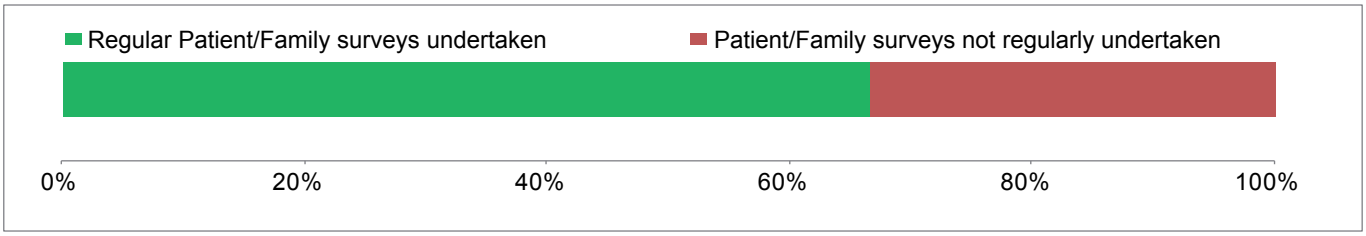
Critical Care units should undertake patient/relative satisfaction surveys on an annual (or more frequent) basis.

Figure 15 Percentage of ICU and Combined Units undertaking regular patient/family experience surveys.



84.0% 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



63.6% of HDUs undertake patient/family surveys. Unit level information can be found in Table 2, page 11.

Table 1 Responses from ICU and Combined Units to Quality Indicators (2012)

	1.1 Unit participate in a national comparative audit	1.2 Daily review and written management plan by an appropriately trained consultant	1.3 HAI Surveillance system	2.2 VAP/ CVC/ PVC Care bundles	2.3 End of life care	3.3 All unit deaths are discussed at M & M meeting	3.4 Units should undertake regular patient/ family experience surveys
NHS Ayrshire and Arran							
Ayr ICU	Yes	Weekdays Only	Yes	Yes	Yes	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	No
NHS Fife							
VHK ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Forth Valley							
FVRH ICU/HDU	Yes	Yes	Data Incomplete	Yes	Yes	Yes	Yes
NHS Grampian							
ARI ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARI Cardiothoracic ICU	Joining 2013						
NHS Greater Glasgow and Clyde							
GRI ICU / HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IRH ICU	Yes	Weekdays Only	Yes	Yes	No	Yes	Yes
RAH ICU	Yes	Yes	Yes	Yes	No	Yes	Yes
SGH ICU	Yes	Yes	Yes	Yes	Yes	Yes	No
SGH Neurological ICU	Yes	Weekdays Only	Yes	Yes	Yes	Yes	Yes
VI ICU	Yes	Yes	Yes	Yes	Yes	Yes	No
WIG ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NHS Highland							
Raigmore ICU	Yes	Weekdays Only	Yes	Yes	Yes	Yes	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	Yes	Yes	Yes	Yes	Yes	Yes
NHS Lothian							
RIE ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE Cardiothoracic ICU	Yes	Yes	No	Yes	Yes	Yes	No
SJH ICU/HDU	Yes	Weekdays Only	Yes	Yes	No	Yes	Yes
WGH ICU/HDU	Yes	Yes	Yes	Yes	No	Yes	Yes
NHS Tayside							
Ninewells ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PRI ICU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Special Health Board							
Golden Jubilee National Hospital ICU/HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Fully complies with indicator
Partly complies with indicator
Does not comply with indicator/No Information Provided
Data Incomplete
Joining 2013

Table 2 Responses from HDUs to Quality Indicators (2012)

	1.1 Unit participate in a national comparative audit	1.2 Daily review and written management plan by an appropriately trained consultant	1.3 HAI Surveillance system	2.2 VAP/ CVC/ PVC Care bundles	2.3 End of life care	3.3 All unit deaths are discussed at M & M meeting	3.4 Units should undertake regular patient/ family experience surveys
NHS Ayrshire and Arran							
Ayr HDU	Yes	Partly	Yes	Yes	Yes	Yes	Yes
Crosshouse Medical HDU	Yes	Partly	Yes	Yes	Yes	No	Yes
Crosshouse Surgical HDU	Yes	Partly	Yes	Yes	Yes	No	Yes
Crosshouse Renal HDU							
NHS Dumfries and Galloway							
DGRI Medical HDU	Yes	Yes	Yes	Yes	No	Yes	No
DGRI Surgical HDU	Yes	Yes	No	Yes	Yes	No	Yes
NHS Fife							
VHK Surgical HDU	Yes	Yes	No	Yes	No	No	Yes
VHK Medical HDU	Yes	Yes	No	Yes	No	Yes	Yes
VHK Renal HDU	Yes	Yes	No	Yes	No	Yes	Yes
NHS Grampian							
ARI Surgical HDU (Ward 31/32)	Yes	Yes	Yes	Yes	No	Yes	Yes
ARI Neurological HDU	Data Incomplete	Partly	Yes	Yes	No	No	No
ARI Surgical HDU (Ward 35)	Yes	Yes	Yes	Yes	Yes	Yes	No
ARI Cardiothoracic HDU	Yes	Yes	Yes	Yes	No	Yes	No
Dr Gray's HDU	Yes	Yes	Yes	Yes	No	No	No
NHS Greater Glasgow and Clyde							
GRI Surgical HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GRI Medical HDU	Yes	Partly	Yes	Yes	Yes	Yes	No
IRH Surgical HDU	Yes	Partly	Yes	Yes	No	Yes	No
RAH Surgical HDU	Yes	Partly	No	Yes	No	Yes	Yes
SGH Surgical HDU	Yes	Partly	Yes	Yes	Yes	Yes	Yes
SGH Neurological HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VI Surgical HDU	Yes	Yes	No	Yes	Yes	Yes	Yes
GGH HDU	Yes	Partly	Yes	Yes	Yes	Yes	No
WIG HDU	Yes	Yes	Yes	Yes	Yes	No	No
NHS Highland							
Raigmore Medical HDU	Yes	Partly	Yes	Yes	Yes	No	Yes
Raigmore Surgical HDU	Yes	Partly	Yes	Yes	Yes	No	Yes
Caithness HDU							
Lorne & Islands HDU							
Belford HDU	Yes	Yes	Yes	Yes	Yes	Yes	No
NHS Lanarkshire							
Hairmyres Medical HDU	Yes	Yes	Yes	Yes	Yes	No	Yes
MDGH Surgical HDU	Yes	Yes	Yes	Yes	Yes	Yes	No
MDGH Medical HDU	Yes	Partly	Yes	Yes	No	Yes	Yes
Wishaw Surgical HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wishaw Medical HDU	Yes	Partly	Yes	Yes	Yes	No	Yes

Table 2 Responses from HDUs to Quality Indicators (2012)

	1.1 Unit participate in a national comparative audit	1.2 Daily review and written management plan by an appropriately trained consultant	1.3 HAI Surveillance system	2.2 VAP/ CVC/ PVC Care bundles	2.3 End of life care	3.3 All unit deaths are discussed at M & M meeting	3.4 Units should undertake regular patient/ family experience surveys
NHS Lothian							
RIE HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RIE Renal HDU	Yes	Partly	Yes	Yes	Yes	Yes	Yes
RIE Transplant HDU	Yes	Yes	Yes	Yes	Yes	Yes	No
RIE Vascular (Level 1)	Yes	Partly	Yes	Yes	Yes	Yes	Yes
RIE Cardiothoracic HDU	Yes	Yes	No	Yes	Yes	Yes	No
RIE Obstetric HDU	Joining 2013						
WGH Surgical HDU	Yes	Partly	Yes	Yes	No	Yes	Yes
WGH Neurological HDU	Yes	Partly	Yes	Yes	No	Yes	Yes
WGH Neurological (Level 1)	Yes	Partly	Yes	Yes	No	Yes	Yes
NHS Orkney							
Balfour Hospital HDU	Yes	Partly	No	No	No	No	No
NHS Shetland							
GBH HDU	Yes	Yes	Yes	Yes	Yes	Yes	No
NHS Tayside							
Ninewells Surgical HDU	Yes	Partly	Yes	Yes	No	No	Yes
Ninewells Medical HDU	Yes	Yes	Yes	Yes	No	No	No
Ninewells Obstetric HDU	Joining 2013						
Ninewells Neurological HDU							
Perth HDU	Yes	Partly	Yes	Yes	No	No	Yes
NHS Western Isles							
WIH HDU	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Fully complies with indicator
Partly complies with indicator
Does not comply with indicator/No Information Provided
Data Incomplete
Joining 2013
Not part of Audit

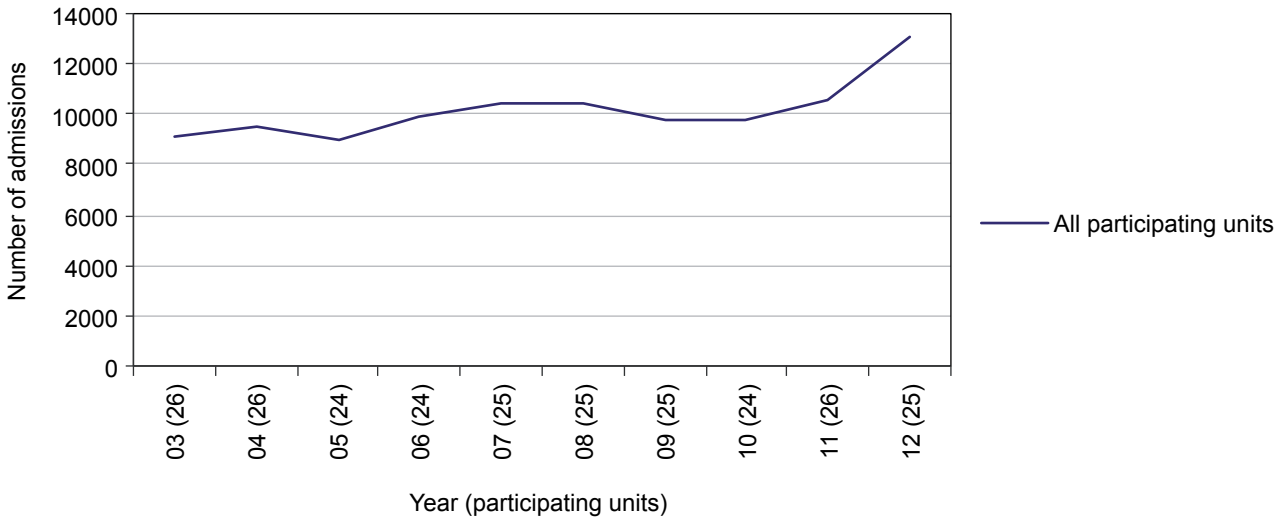
Section 2 Activity

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 3.3.1.

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.

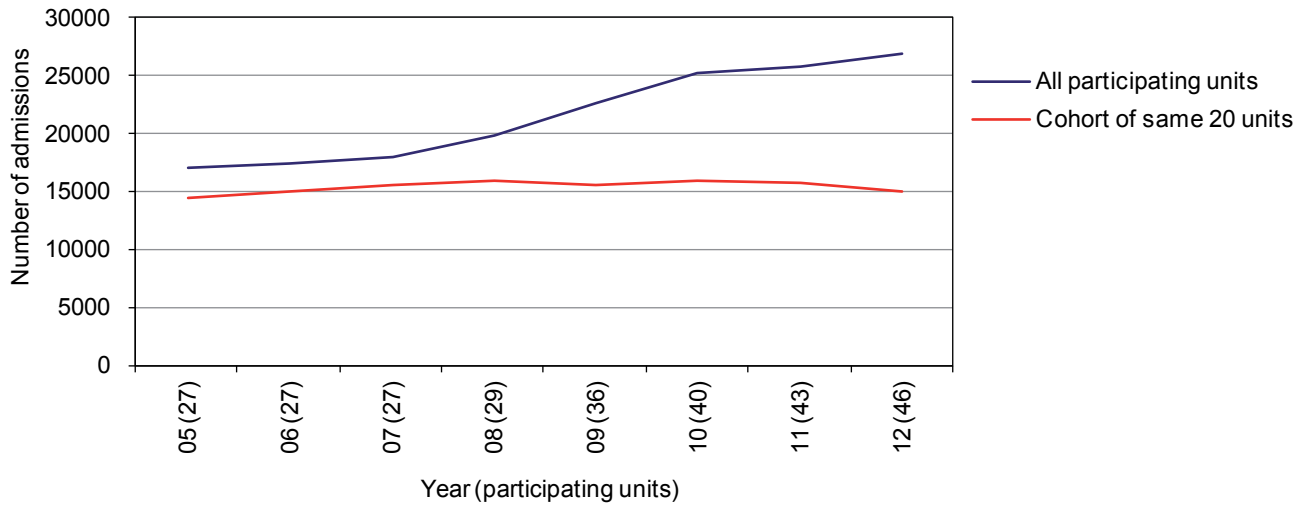
2.1 Number of admissions

Figure 17 Annual admissions to ICU and Combined Units (2003-2012)



There was an increase in admissions across Scotland in 2012. The increase of around 2500 admissions was in part due to the Golden Jubilee National Hospital joining the audit, also Forth Valley Royal Hospital ICU/HDU and the cardiothoracic ICU at the Royal Infirmary of Edinburgh completed their first full year of data collection. Queen Margaret Hospital closed in January 2012 and relocated to the new Victoria Hospital Kirkcaldy.

Figure 18 Annual admissions to HDU (2005-2012)



The number of admissions to HDU continued to rise in 2012. Queen Margaret Hospital relocated to the Victoria Hospital. Glasgow Medical HDU joined in April, and Wishaw Medical HDU joined in November. The cohort line refers to units that had complete data for the last eight years.

Table 3 Number of annual admissions to ICU and Combined Units (2003-2012)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
NHS Ayrshire and Arran										
Ayr ICU	246	242	271	266	307	330	330	292	252	268
Crosshouse ICU	278	267	290	285	302	304	294	305	319	302
NHS Borders										
BGH ICU/HDU	340	407	398	709	691	406	397	429	506	600
NHS Dumfries and Galloway										
DGRI ICU	276	334	331	304	324	316	285	298	293	314
NHS Fife										
QMH ICU[2]	390	374	406	377	373	382	437	439	449	22
VHK ICU[1]										394
VHK ICU/HDU	143	123	152	145	179	124	38			
NHS Forth Valley										
FVRH ICU/HDU									577	1189
SRI ICU	171	215	267	480	471	443	378	411	214	
FDRI ICU	549	560								
NHS Grampian										
ARI ICU	793	806	746	781	778	762	717	748	665	676
NHS Greater Glasgow and Clyde										
GRI ICU / HDU	319	310	320	321	348	395	426	461	793	948
IRH ICU	116	114	155	122	104	104	82	120	150	138
RAH ICU	276	316	310	318	367	359	360	433	402	374
SGH ICU	255	302	287	279	296	299	289	278	282	264
SGH Neurological ICU					76	454	461	451	395	347
Stobhill ICU	210	218	199	220	201	233	202	155	40	
VI ICU	294	313	314	340	391	284	317	298	281	284
Vale of Leven ICU	158	128								
WIG ICU	402	433	460	532	512	554	495	485	475	393
NHS Highland										
Raigmore ICU	326	374	359	389	436	391	429	433	384	423
NHS Lanarkshire										
Hairmyres ICU/HDU	485	411	506	531	522	505	560	562	583	558
MDGH ICU	252	265	264	307	301	278	252	225	273	267
Wishaw ICU	750	739	744	756	829	619	222	229	237	212
NHS Lothian										
RIE ICU/HDU	865	1123	1032	1059	1041	1092	968	1110	1177	1230
RIE Cardiothoracic ICU									188	926
SJH ICU/HDU	261	218	225	352	367	443	465	424	444	452
WGH ICU/HDU	449	453	497	504	714	772	831	735	705	647
NHS Tayside										
Ninewells ICU	330	327	339	352	370	404	386	357	349	417
PRI ICU	186	150	119	163	151	156	136	122	119	140
Special Health Board										
Golden Jubilee National Hospital ICU/HDU[3]										1318
Total	**9120**	**9522**	**8991**	**9892**	**10451**	**10409**	**9757**	**9800**	**10552**	**13103**

Notes:
1 Unit opened January 2012
2 Unit closed January 2012
3 Unit joined May 2012

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

Table 4 Number of annual admissions to HDU (2005-2012)

	2005	2006	2007	2008	2009	2010	2011	2012
NHS Ayrshire and Arran								
Ayr HDU			413	542	527	498	487	469
Crosshouse Medical HDU	880	966	992	997	974	1033	1103	1193
Crosshouse Surgical HDU	667	657	696	728	711	644	641	644
NHS Borders								
BGH Surgical (Level 1)				310	339	254		
NHS Dumfries and Galloway								
DGRI Medical HDU	841	783	793	823	804	854	731	788
DGRI Surgical HDU	313	336	360	393	392	431	418	437
NHS Fife								
QMH Surgical HDU[1]	827	821	853	849	840	816	813	34
QMH Medical HDU[1]						525	724	37
QMH Renal HDU[1]							155	
VHK Medical HDU[1]						429	444	
VHK Surgical HDU[2]								817
VHK Medical HDU[2]								937
VHK Renal HDU[2]								160
NHS Forth Valley								
Stirling HDU				1089	963	992	558	
NHS Grampian								
ARI Surgical HDU (Ward 31/32)	684	654	587	582	623	714	631	575
ARI Neurological HDU	90	170	251	237	235	241	243	215
ARI Surgical HDU (Ward 35)					780	814	868	892
ARI Cardiothoracic HDU								42
Dr Gray's HDU					797	1083	1169	1069
NHS Greater Glasgow and Clyde								
GRI Surgical HDU	899	693	1028	1051	1053	1026	765	631
GRI Medical HDU[3]								533
IRH Surgical HDU					266	432	469	440
RAH HDU	905	1188	1201	1291	1289	1339	1459	1497
SGH Surgical HDU	691	796	809	861	870	807	693	711
SGH Neurological HDU	591	642	703	675	660	647	621	594
Stobhill Surgical HDU	353	317	327	327	338	287	58	
VI Surgical HDU	608	605	702	692	636	700	812	847
GGH HDU	796	771	849	885	882	904	755	755
WIG HDU						75	413	438
NHS Highland								
Raigmore Medical HDU	588	651	732	718	730	811	803	743
Raigmore Surgical HDU	685	672	714	620	677	669	669	653
Belford HDU							74	78
NHS Lanarkshire								
Hairmyres Thoracic HDU	354	340						
Hairmyres Medical HDU							274	375
MDGH Surgical HDU	443	632	628	601	593	569	565	589
MDGH Medical HDU					56	278	288	377
Wishaw Surgical HDU				154	602	532	546	571
Wishaw Medical HDU[4]								265
NHS Lothian								
RIE HDU	1531	1530	1517	1541	1390	1369	1366	1377
RIE Renal HDU	596	607	683	667	632	674	675	634
RIE Transplant HDU	305	269	330	338	306	345	298	325
RIE Vascular (Level 1)					112	452	378	372
RIE Cardiothoracic HDU							214	1118

Table 4 Number of annual admissions to HDU (2005-2012)

	2005	2006	2007	2008	2009	2010	2011	2012
WGH HDU	491	502	117					
WGH Surgical HDU	1198	1229	1139	1192	1126	1119	1136	1112
WGH Neurological HDU	577	450	362	230	285	404	476	431
WGH Neurological (Level 1)						52	418	364
NHS Orkney								
Balfour Hospital HDU								78
NHS Shetland								
GBH HDU	54	72	64	63	49	58	74	65
NHS Tayside								
Ninewells Surgical HDU	703	652	723	832	742	754	794	784
Ninewells Medical HDU					558	641	673	743
Perth HDU	499	536	569	623	644	618	625	659
NHS Western Isles								
WIH HDU					145	414	448	409
Total	**17169**	**17541**	**18142**	**19911**	**22626**	**25304**	**25824**	**26877**
Total (20 units)	**14405**	**15069**	**15644**	**15971**	**15570**	**15875**	**15682**	**14982**

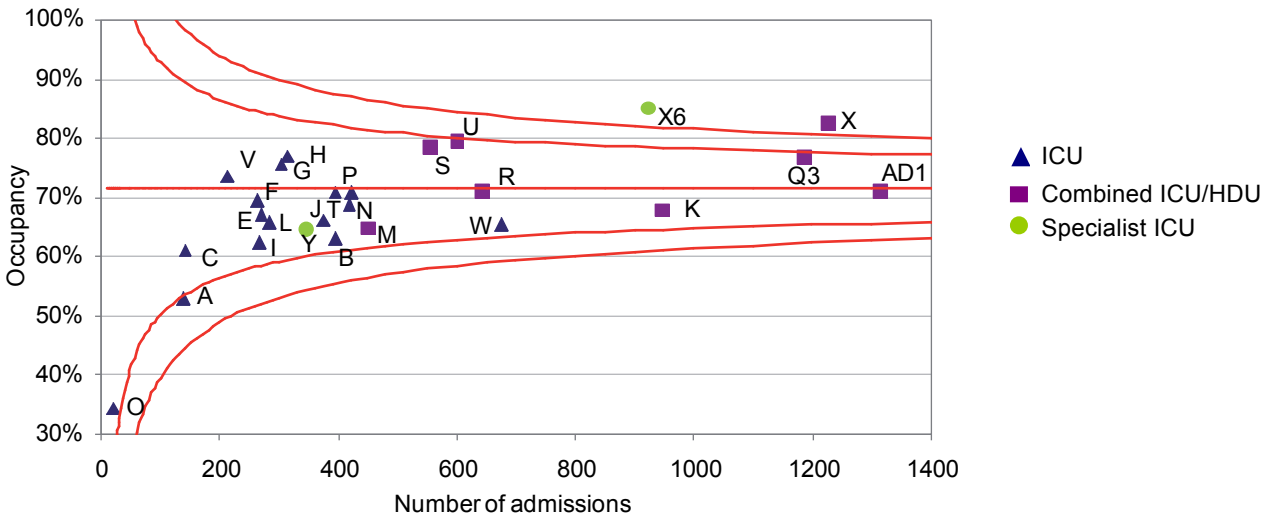
Notes:
1 Unit closed January 2012
2 Unit opened January 2012
3 Unit joined February 2012
4 Unit joined October 2012

NHS Health Boards

Shaded areas refer to periods with incomplete data collection

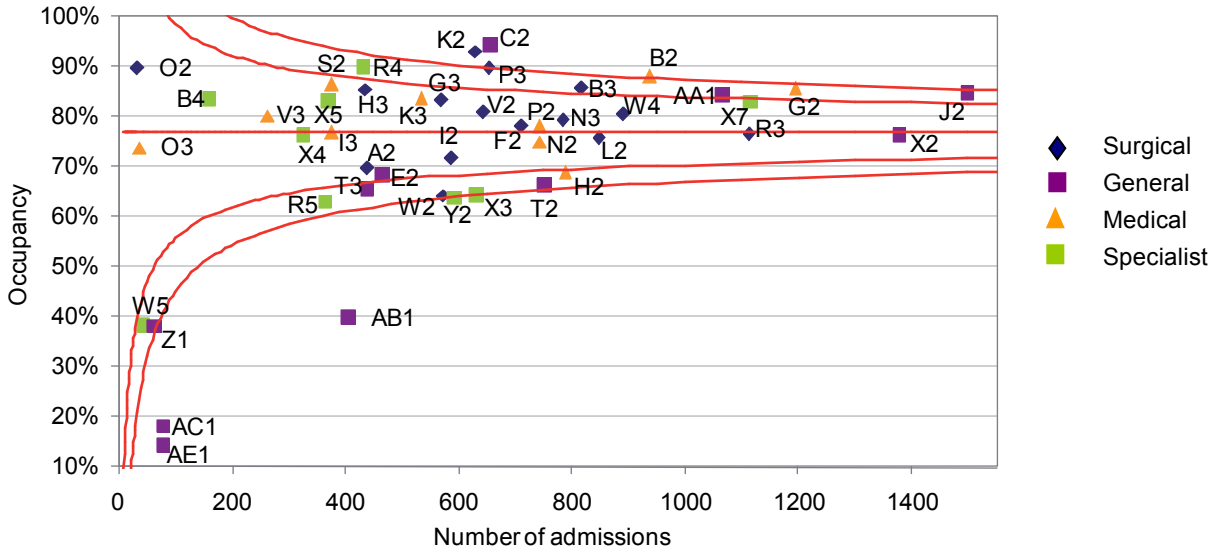
2.2 Bed occupancy

Figure 19 Bed occupancy rates for ICU and Combined Units (2012)



Mean bed occupancy was slightly less than 2011 at 71.4%. As in 2012 Units X and X6 were above 3 Standard Deviations (SD) from the Scottish mean, showing they had significantly higher bed occupancy rates of 82.3% and 85.1% respectively.

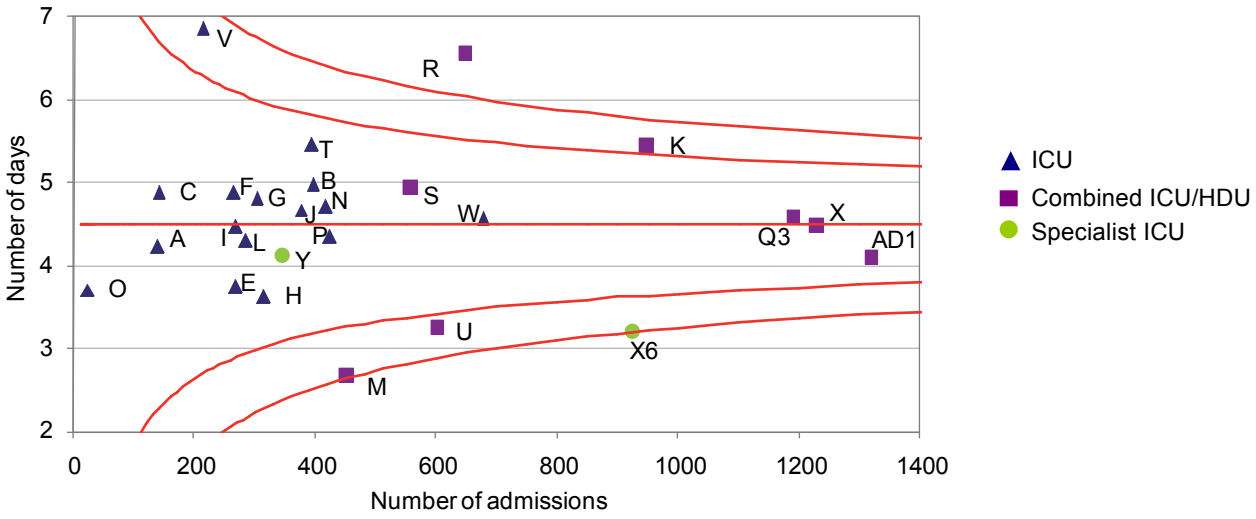
Figure 20 Bed occupancy rates for HDU (2012)



Mean bed occupancy remains stable at 77.2%. Three units were above the 3 SD line (K2, C2, B2), and five units below the 3 SD line (AC1, AE1, AB1, Y2, X3).

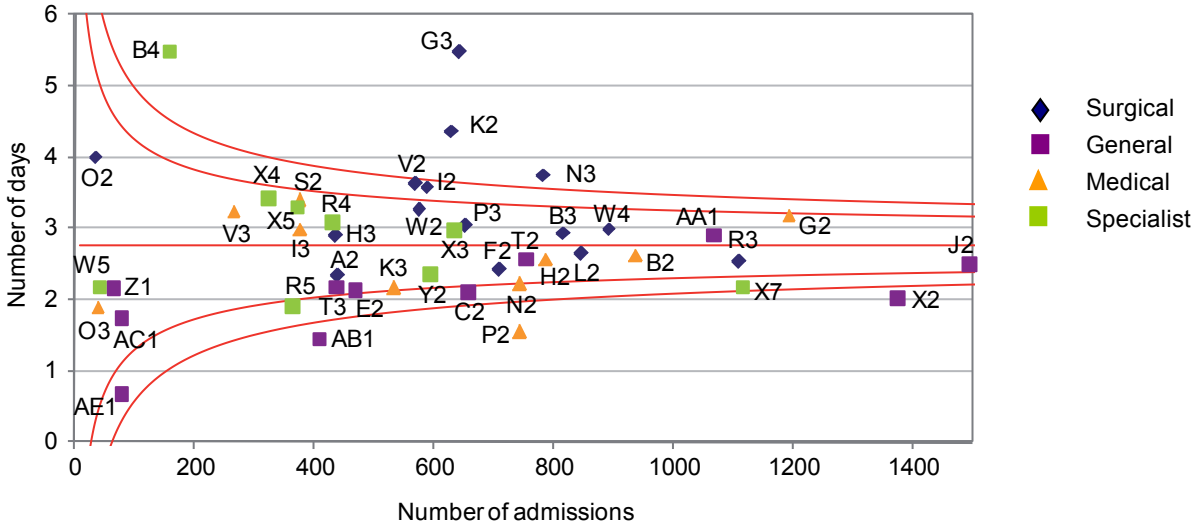
2.3 Length of stay

Figure 21 Mean length of stay in ICU and Combined Units (2012)



The mean length of stay was similar to 2011 at 4.5 days. Unit R had a significantly longer length of stay, and Unit X6 had a significantly shorter length of stay than the Scottish mean.

Figure 22 Mean length of stay in HDU (2012)

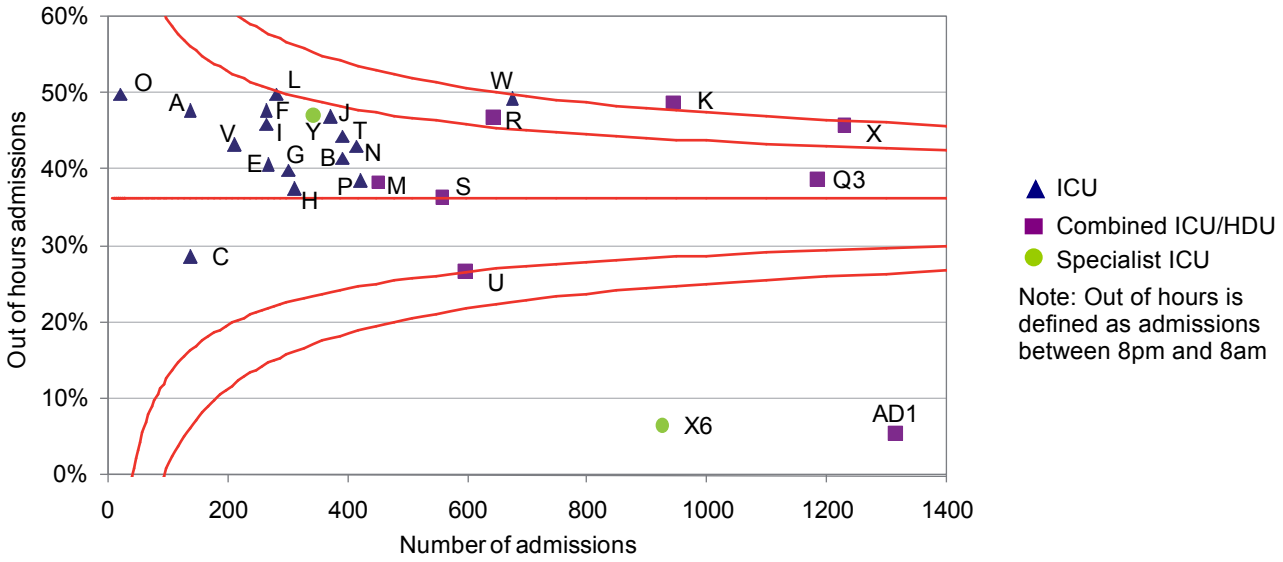


The mean length of stay was similar to previous years at 2.8 days.

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

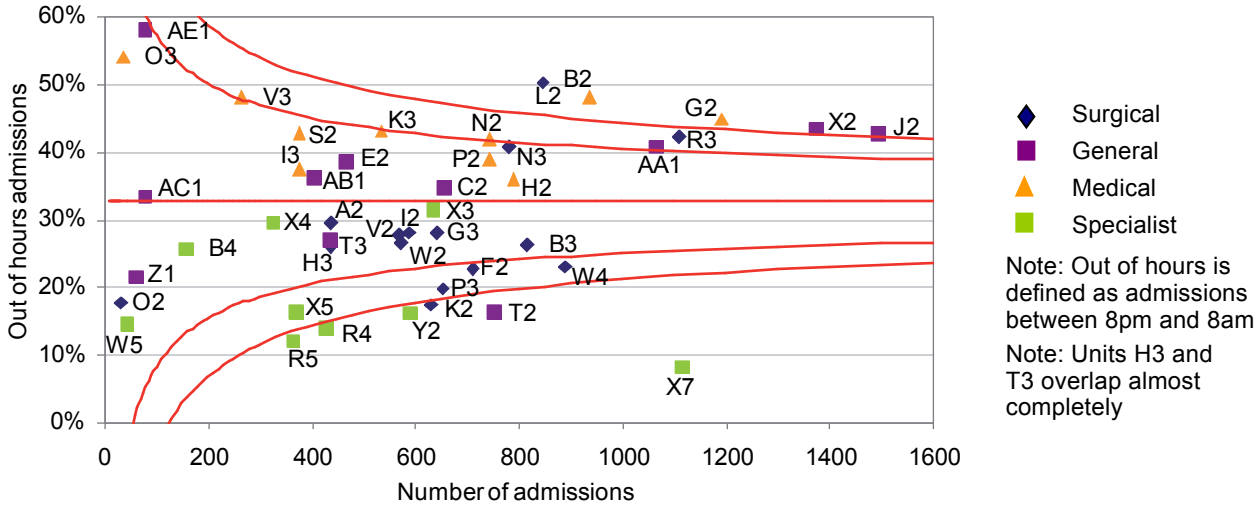
2.4 Timing of Critical Care admissions and discharges

Figure 23 Out of hours admissions to ICU and Combined Units (2012)



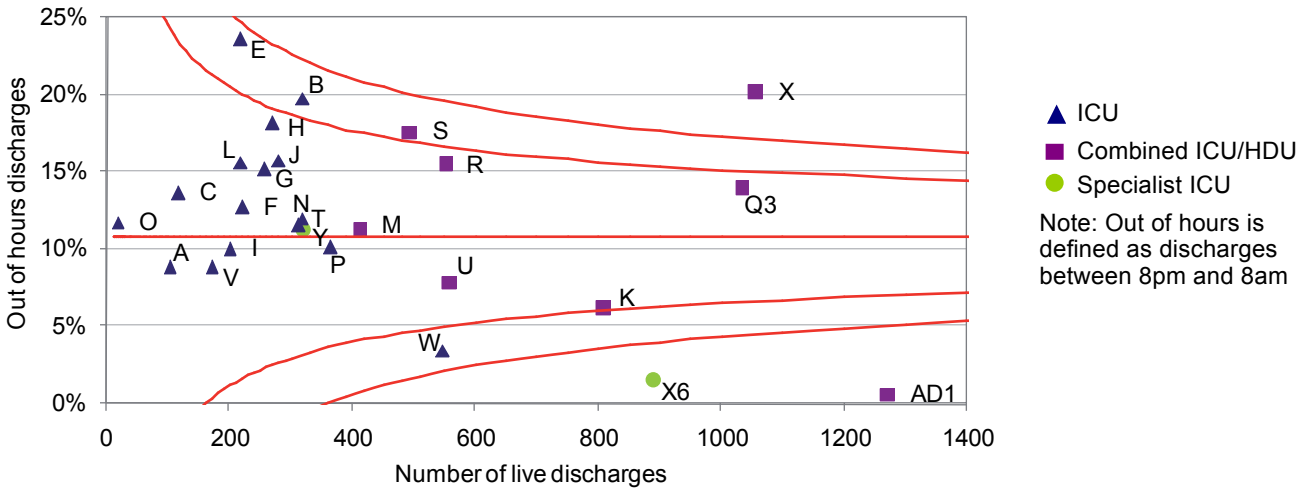
Unit K had significantly more out of hours admissions to the other units in Scotland. Unit X6 (as in 2011) and Unit AD1 admitted significantly fewer patients out of hours reflecting their predominantly elective workloads.

Figure 24 Out of hours admissions to HDU (2012)



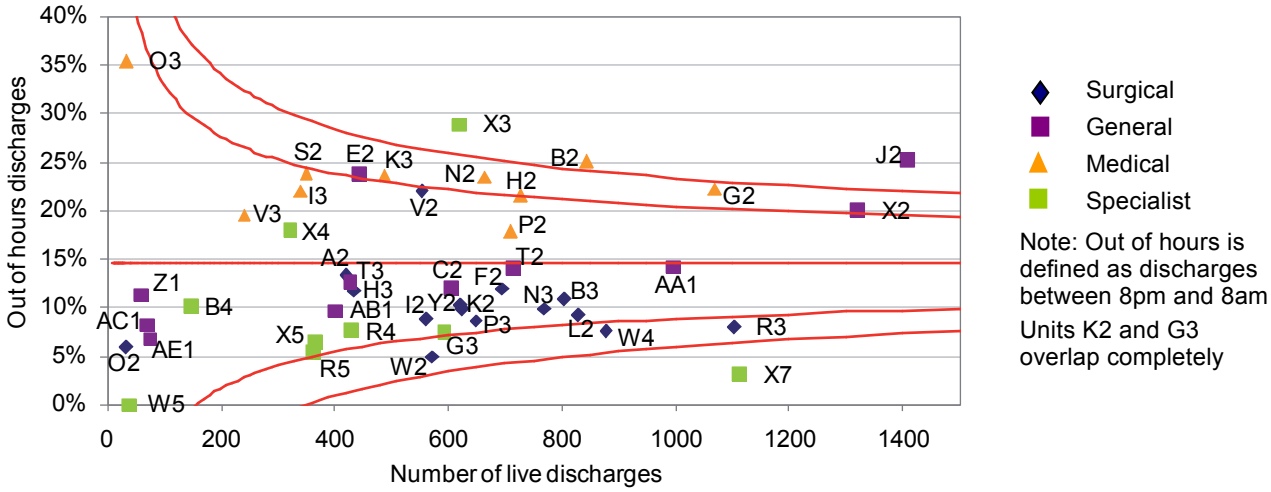
Five units were above 3 SD from the mean (B2, L2, G2, X2, J2). Six units were below the 3SD line (R5, R4, Y2, T2, X7, K2).

Figure 25 Out of hours discharges in ICU and Combined Units (2012)



In 2012 Unit X had a significantly higher rate of out of hours discharges than the rest of the Scottish units. This may reflect capacity issues.

Figure 26 Out of hours discharges in HDU (2012)

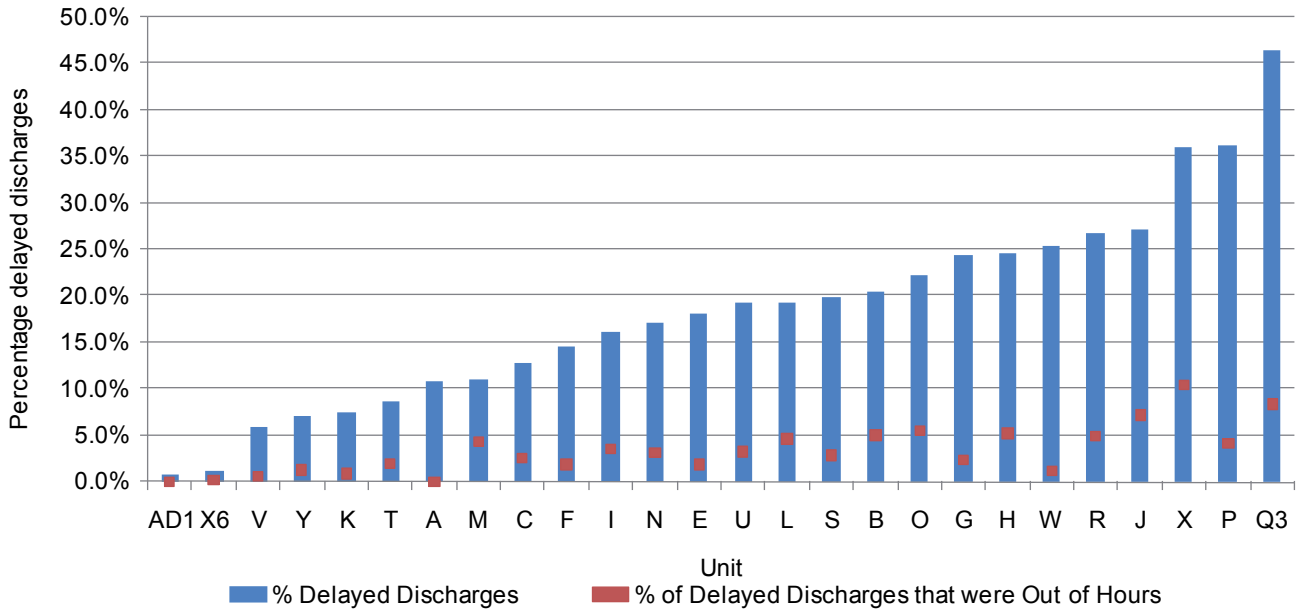


Units X3 (as in 2011), B2 and J2 were different from the rest of Scotland. This may reflect a capacity issue.

These funnel plots include all out of hours discharges. Graphs of out of hours discharges are also included as bar charts in ‘Section 1 Quality Indicators’, which exclude out of hours discharges due to; ‘self-discharge’, ‘discharge to palliative care’ and ‘discharge to specialist care’.

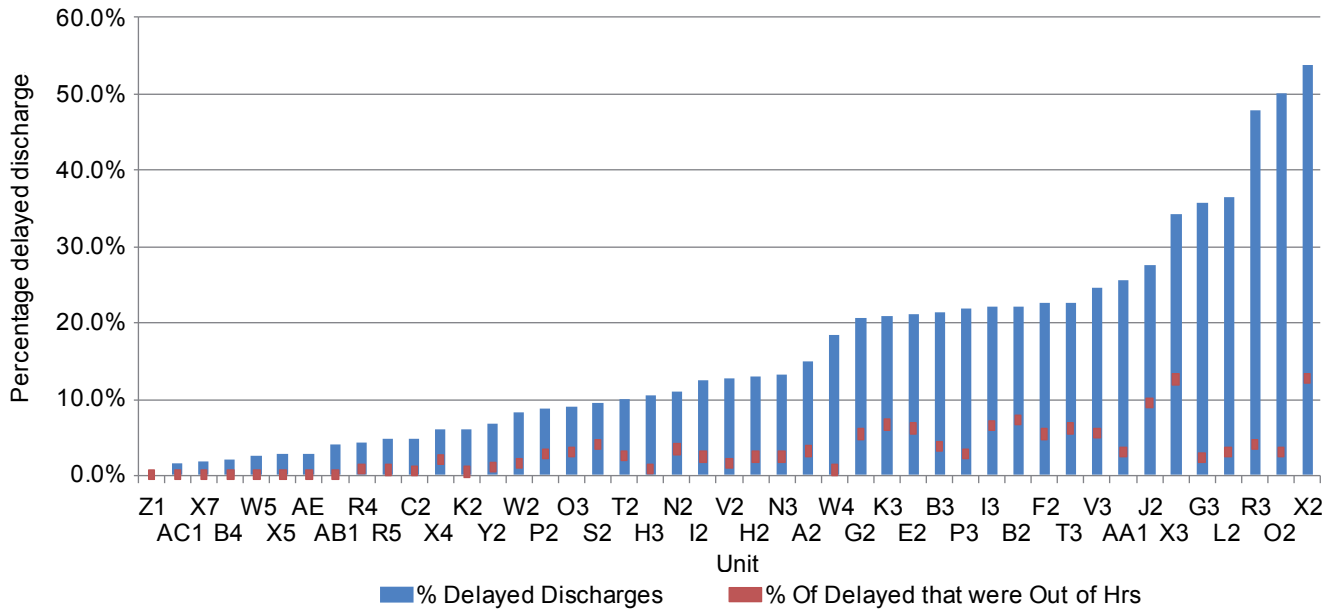
2.5 Delayed discharges

Figure 27 Delayed Discharges in ICU and Combined Units (2012)*



Unit Q3 had the most delayed discharges at 46.5%, with almost 10% of these delayed discharges being out of hours. The main reason for discharges being delayed was a shortage of available ward or HDU beds.

Figure 28 Delayed Discharges in HDU (2012)*



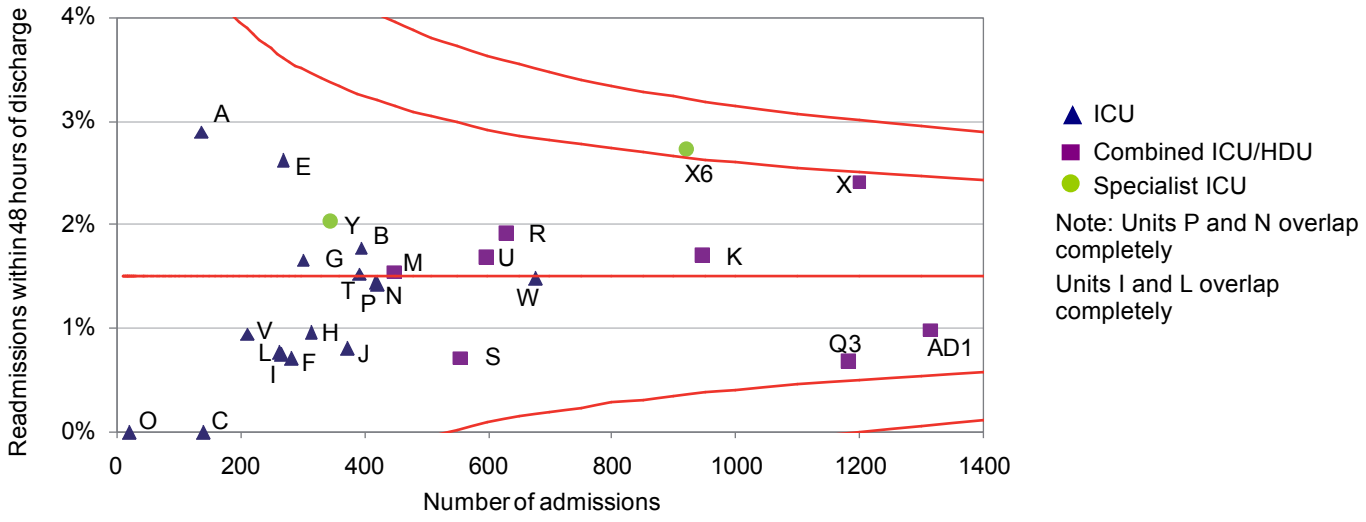
The main reason for discharges being delayed was a shortage of available ward beds. X2 had the most delayed discharges at 53.8%.

* The analysis includes delayed discharges where the delay recorded was greater than six hours.

2.6 Readmissions to critical care

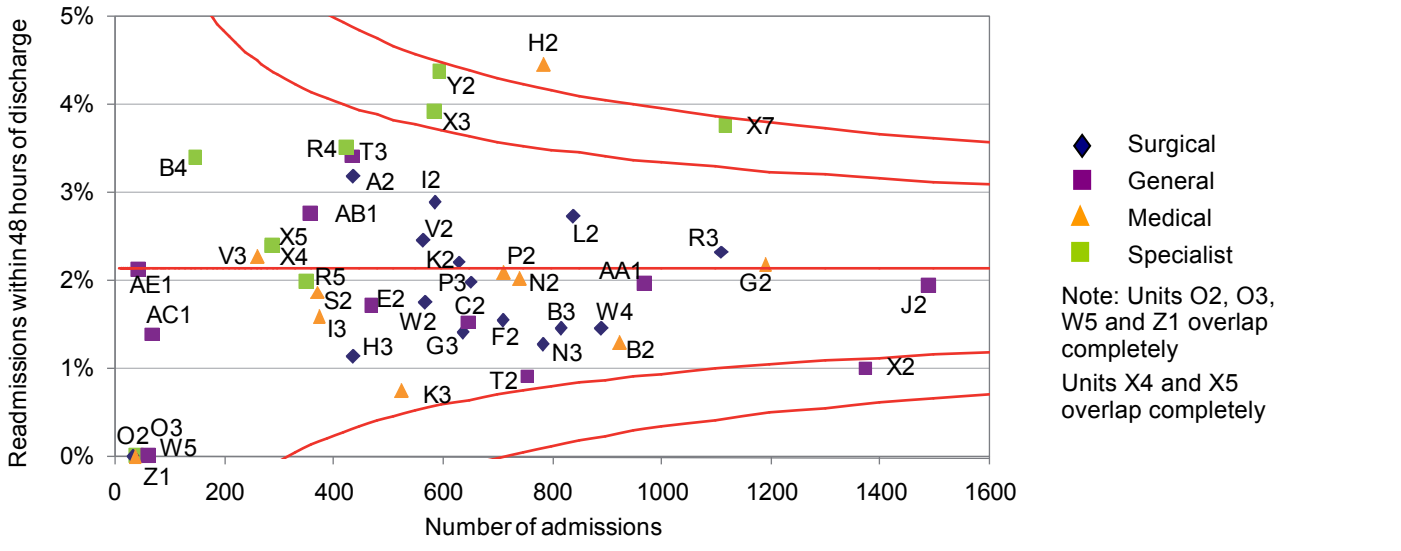
Readmissions to critical care may be an indicator that discharge was too early, or that downstream care was not of a sufficient standard. From 2011 readmissions were derived using records linked together by the CHI number. Previous analyses used the readmission field in WardWatcher. The historic method was found to underestimate readmissions; therefore comparison with previous years should be treated with caution.

Figure 29 Readmissions within 48 hours of discharge to ICU and Combined Units (2012)



The mean readmission rate in ICUs and Combined Units in Scotland was slightly lower from 2011 at 1.5%.

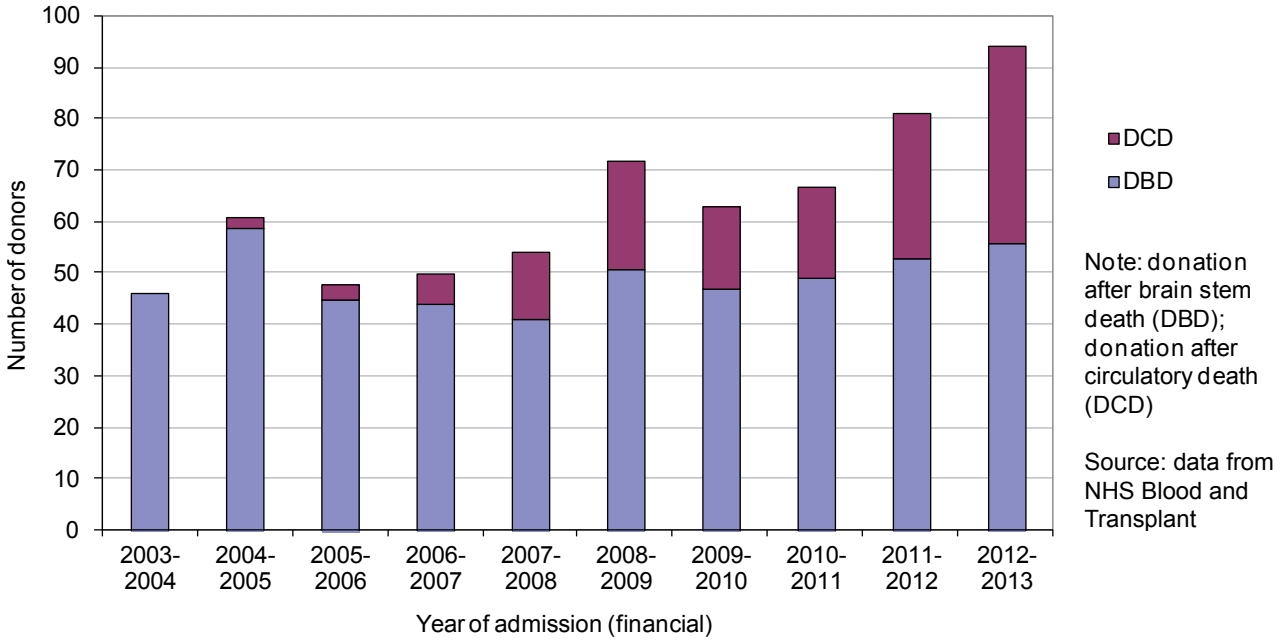
Figure 30 Readmissions within 48 hours of discharge to HDU (2012)



Unit H2 had significantly more readmissions than the rest of the Scotland units.

2.7 Organ donation

Figure 31 Scottish deceased organ donors (2002-2012)



Note: donation after brain stem death (DBD); donation after circulatory death (DCD)

Source: data from NHS Blood and Transplant

There has been a steady increase in the number of deceased organ donors in Scotland over the last five years. In 2008 the Organ Donor Task Force set an ambitious target of a 50% increase in deceased donors by 2013. In the year 2007/8 there were 54 donors rising to 94 in 2012/13, an increase of 74%, well ahead of the target. Much of this increase has been due to donation after circulatory death (DCD) while donation after brain death (DBD) has remained relatively constant.

It is important to acknowledge that currently all deceased organ donors come from Intensive Care Units. This increase in donation activity is a positive reflection of the engagement that ICU staff have with the organ donation process across Scotland.

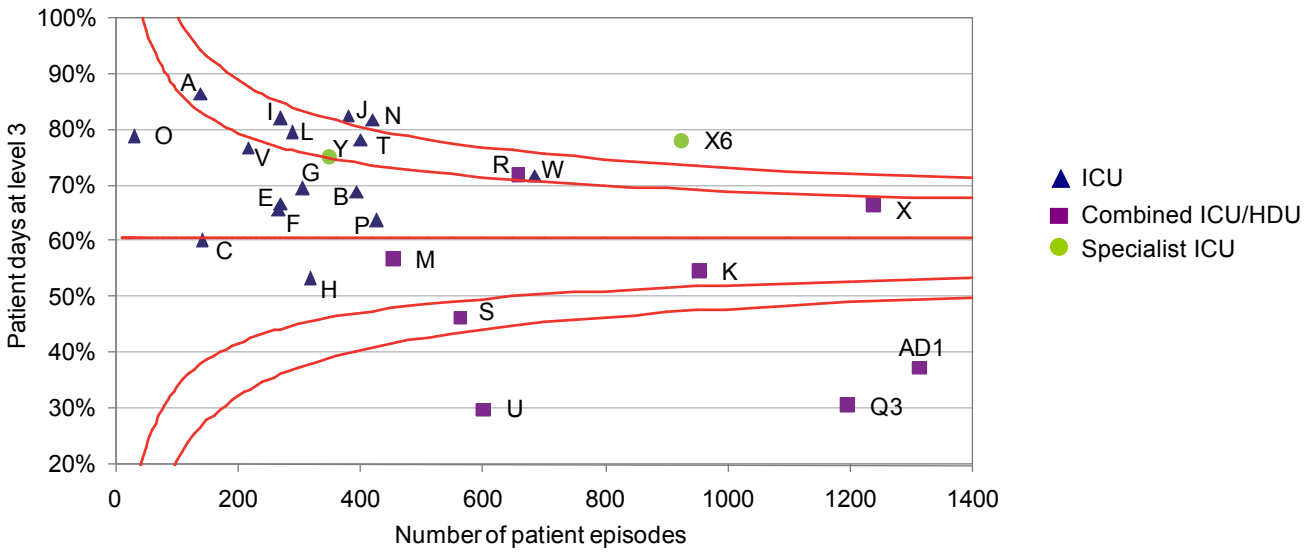
Section 3 Interventions in Critical Care

3.1 Level of care

These 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 2011 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.

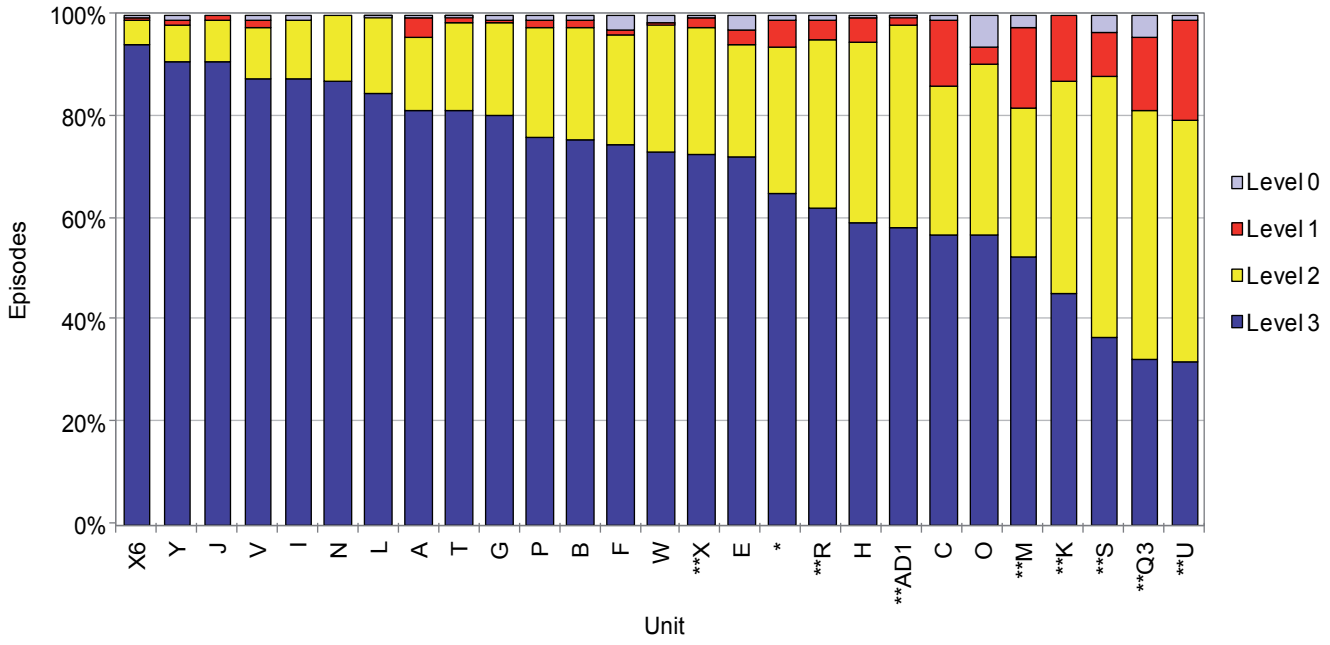
Figure 32 Level 3 days in ICU and Combined Units (2012)



The definition of a level 3 patient was changed in 2012 to bring it in line with the Intensive Care Society Standards 2009[3].

61% of patient days in ICU and Combined Units were recorded as level 3. This is reduced from 70% last year in part due to the change in definition described above, but also due to the addition of two large Combined Units. The lower portion of this graph is dominated by Combined Units as would be expected.

Figure 33 Highest level of care in ICU and Combined Units (2012)

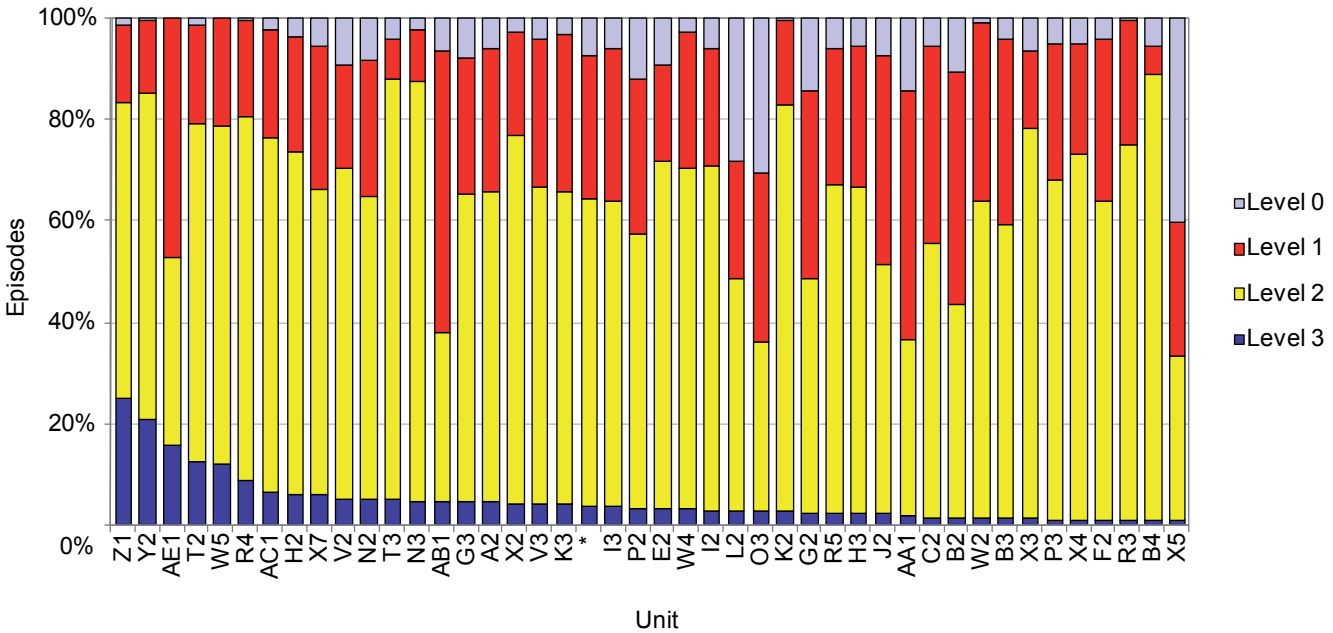


* Scottish Mean
**Combined Unit

As in last year's report the data is presented in order of descending proportion of level 3 care. In 2012 the highest level of care, level 3, was required in 65% of patient episodes in ICU and Combined Units, and indicates the significant resource and skill-mix implications required by each unit in Scotland.

This represents a fall of 10% compared to last year.

Figure 34 Highest level of care in HDU (2012)

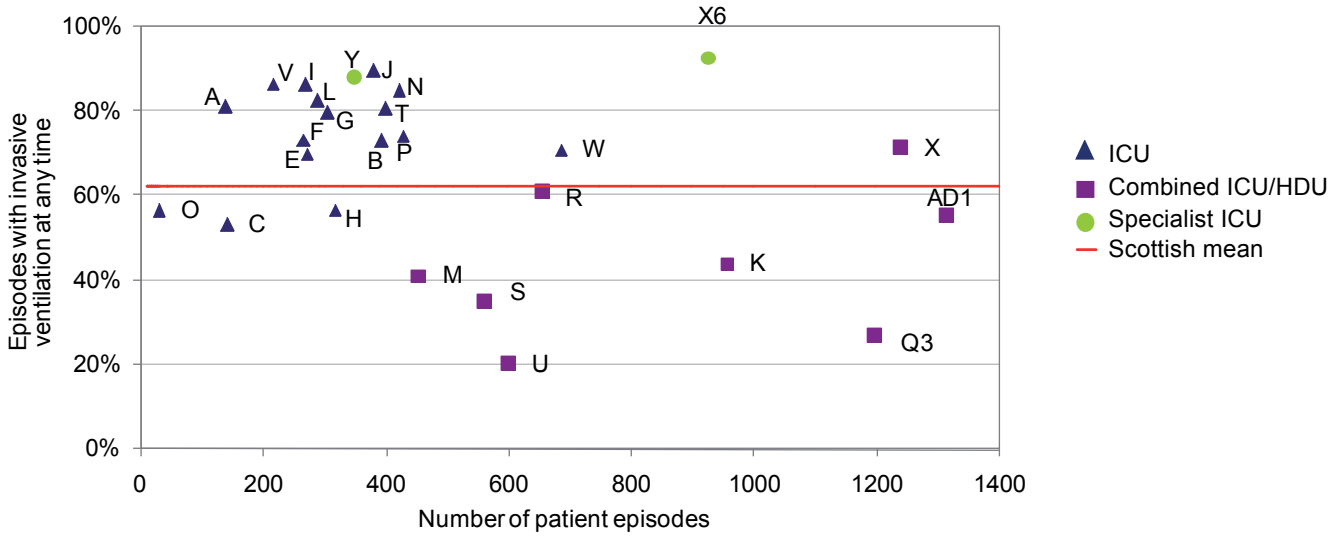


It is reassuring that this graph shows that the highest level of care required for the majority of HDU episodes is at the appropriate level (level 2). There is variation in the pattern of the highest level of care demonstrating the heterogeneous nature of HDUs.

The proportion of HDU episodes requiring only level 0 care has decreased from 8 to 7% from 2011 and likely represents downstream bed issues that remain an issue in Critical Care. Unit Z1 has the highest proportion of patients requiring level 3 care.

3.2 Respiratory support

Figure 35 Invasive ventilation at any time in ICU and Combined Units (2012)

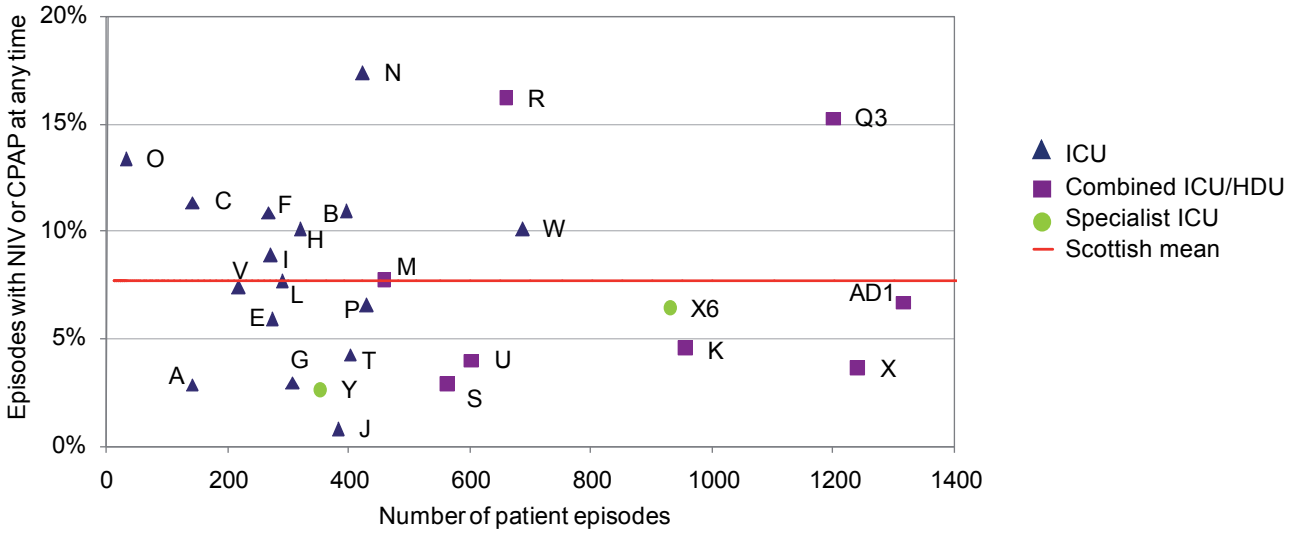


There was a reduction in the percentage of patients requiring invasive ventilation from 66% to 62%. This was in part due to more units changing from ICUs to Combined Units.

The same units year on year continue to have significant percentage of invasively ventilated patients.

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

Figure 36 NIV and CPAP rates in ICU and Combined Units (2012)

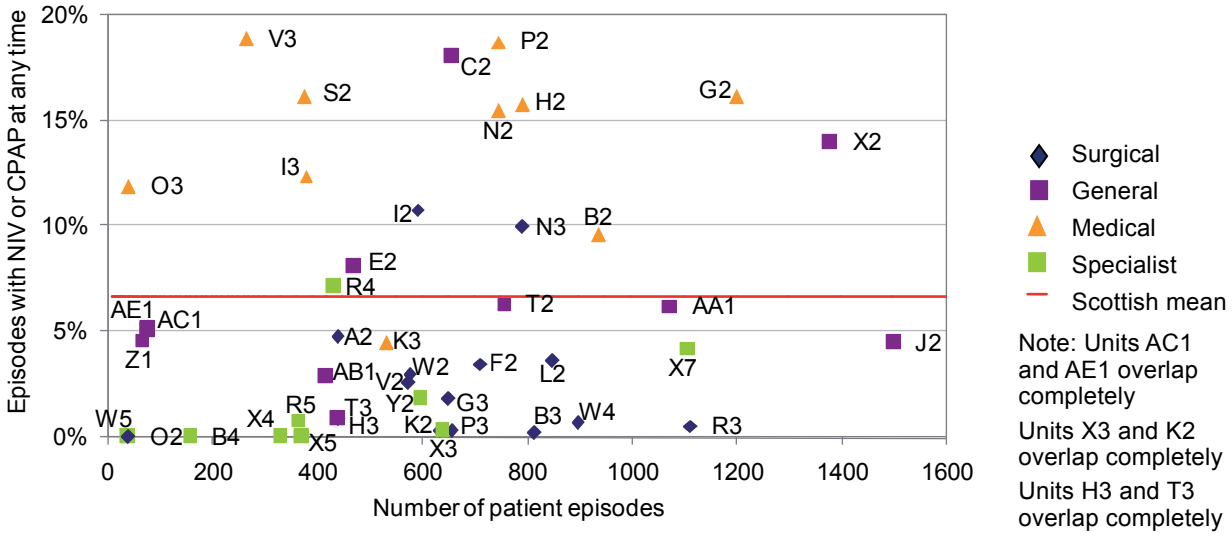


The incidence of this method of respiratory support remains low in ICU and Combined Units.

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

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

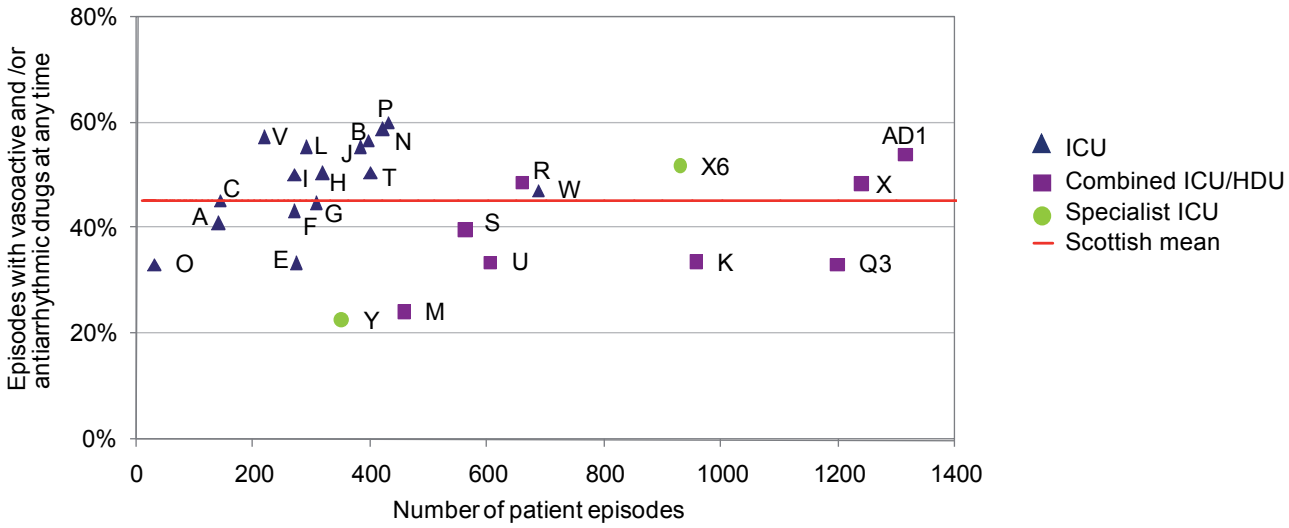
Figure 37 NIV and CPAP rates in HDU (2012)



The proportion of admissions to HDU with NIV/CPAP was increased slightly from 6 to 7%. The top of the chart is dominated by medical HDUs as would be expected.

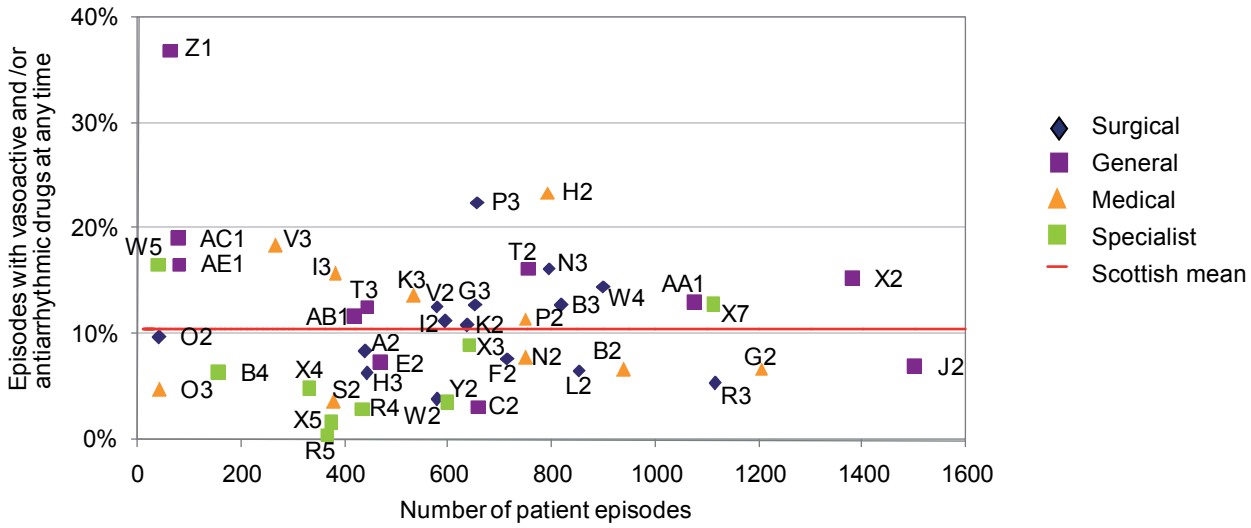
3.3 Cardiovascular support

Figure 38 Use of vasoactive and/or antiarrhythmic drugs in ICU and Combined Units (2012)



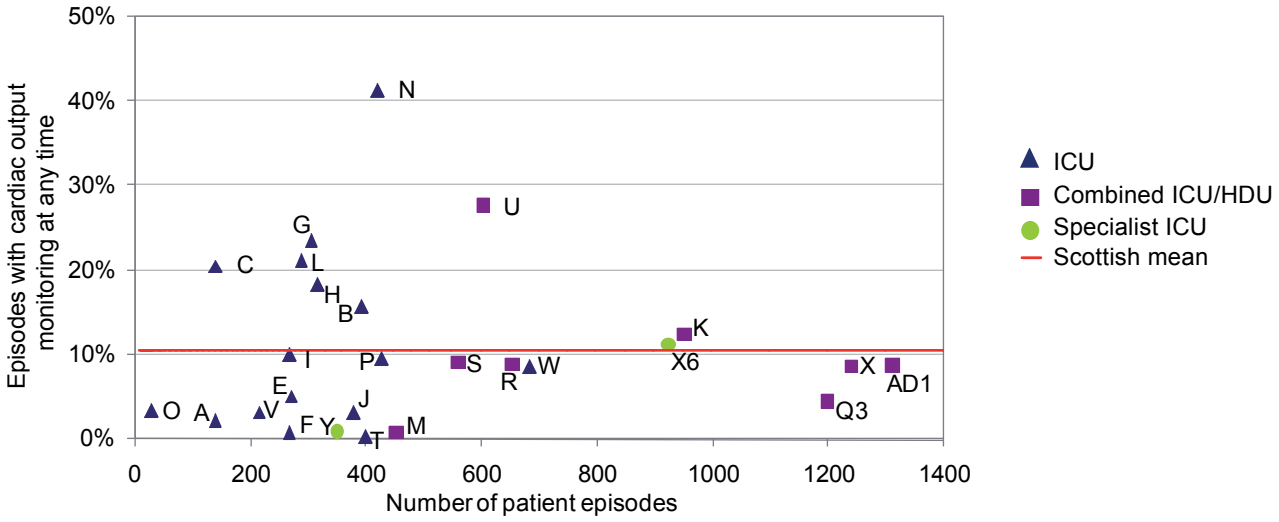
The proportion of patient episodes with vasoactive and/or antiarrhythmic drugs in ICU and Combined Units remained stable at 45%.

Figure 39 Use of vasoactive and/or antiarrhythmic drugs in HDU (2012)



Use of vasoactive and/or antiarrhythmic drugs in HDU has remained stable at 10%.

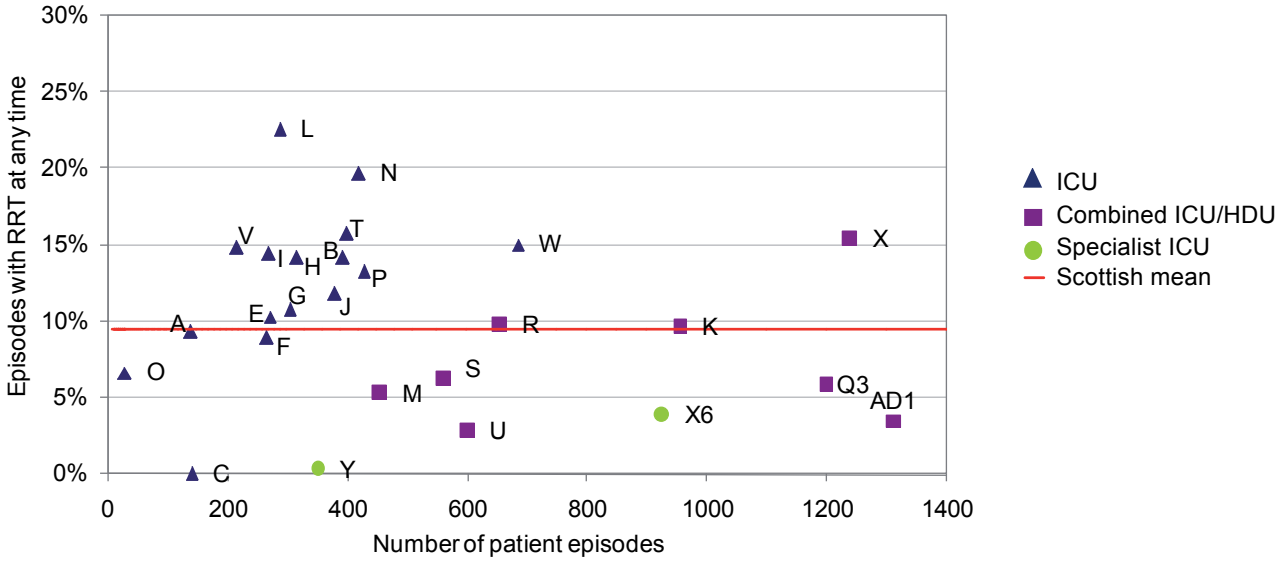
Figure 40 Cardiac output monitoring in ICU and Combined Units (2012)



There has been a fall in cardiac output monitoring over the last four years from 18% to 11%.

3.4 Renal support

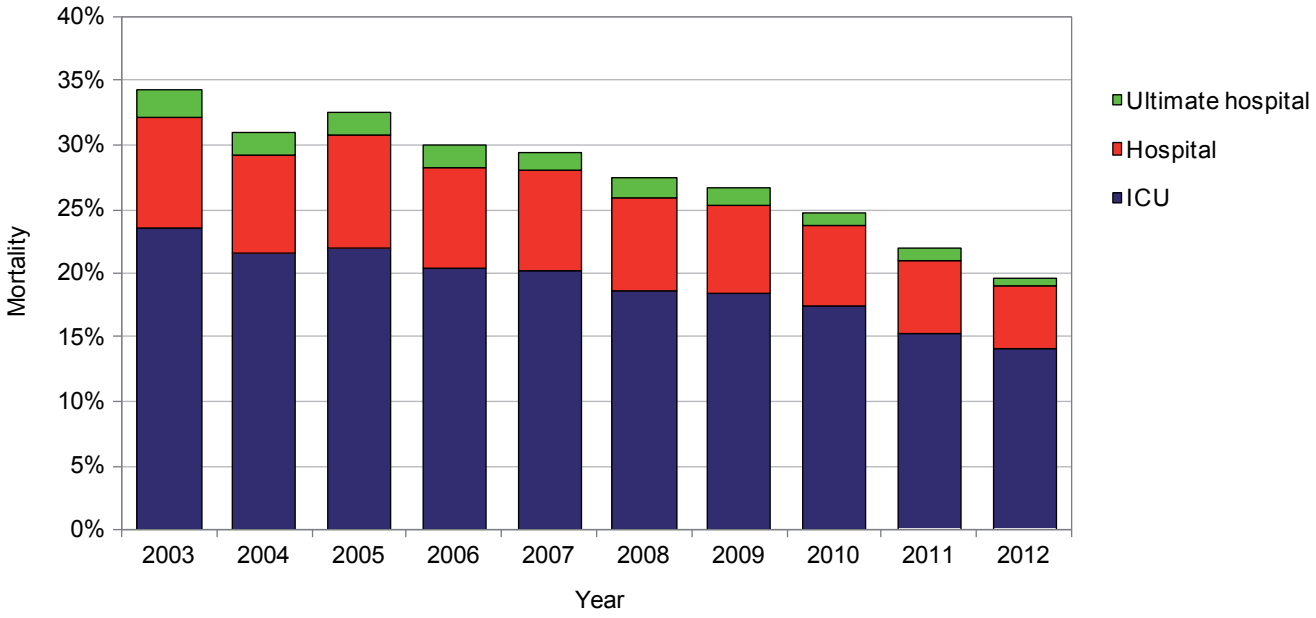
Figure 41 Renal Replacement Therapy in ICU and Combined Units (2012)



The provision of Renal Replacement Therapy (RRT) across Scotland decreased from 12% to 10%.

Section 4 Outcomes

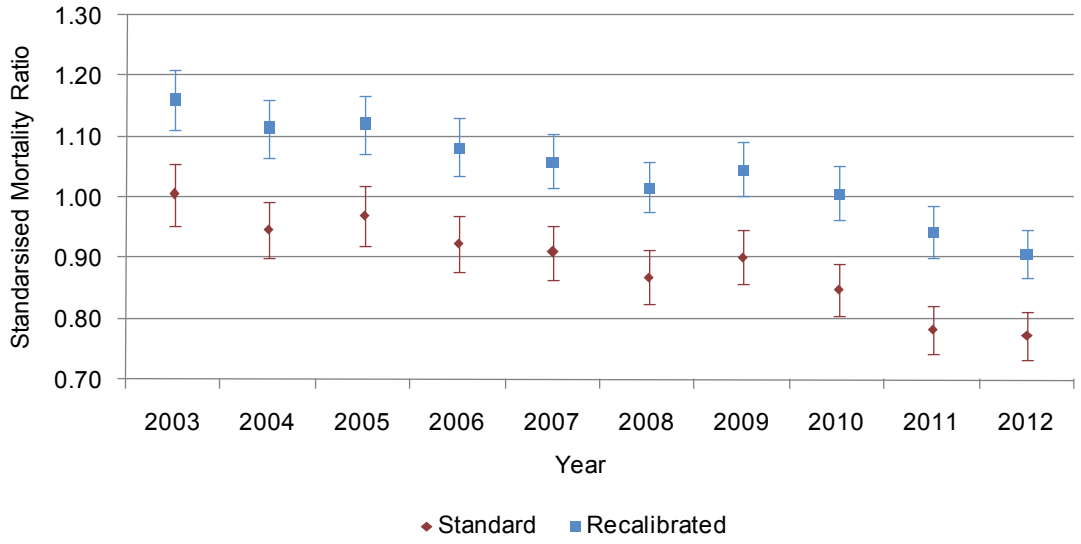
Figure 42 Scottish crude mortality of patients in ICU and Combined Units (2003-2012)



Crude mortality in patients admitted to ICU continues to improve year on year in Scotland. This year a total of 19.6% of patients died before their ultimate discharge from hospital. Conversely 80.4% of patients survived critical illness and intensive care admission and were discharged from acute hospital care.

A continued improvement has been seen in intensive care mortality. In 2012 unit mortality was 14.1% down by 1.1 percentage points on 2011's figure. This result is based on 9855 records and 1389 deaths in ICUs across Scotland. This continues a year on year trend; there have also been smaller improvements in both hospital and ultimate hospital mortality.

Figure 43 Scottish Standardised Mortality Ratios in ICU and Combined Units (2003-2012), using the Standard and Recalibrated APACHE models



There has been a decrease in crude mortality from 2009, however it is not possible to determine whether this decrease is a result of a real change in outcomes across Scotland in 2012 or simply a difference in case-mix compared with that seen in previous years.

Adjustment for case-mix removes this uncertainty. It is clear from Figure 43 that (with the exception of 2009) year on year Standardised Mortality Ratios (SMR) across Scotland continue to fall. SMR is the observed mortality divided by the expected mortality as predicted on a population basis from the APACHE II scoring that is carried out on patients admitted to ICUs and Combined Units. A small number of patients are excluded from the APACHE calculations (please refer to Appendix 3.4 for details). It can be seen from the error bars that the recalibrated SMR in 2012 is now statistically different from any year before 2011 as the error bars do not overlap

During 2012 SICSAG recalibrated the APACHE II model that the SMR is based on; this had the effect of increasing the SMR and is more accurately predicting outcomes for Scotland. See the website for more details on this work at www.sicsag.scot.nhs.uk.

Comment on funnel plots for Standardised Mortality Ratios

SICSAG will, through its agreed governance process, continue to highlight units outside 2 Standard Deviation (SD) from the mean as “might be different” and outside 3 SD 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.

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[9] produced for the Scottish Patient Safety Programme by Information Services Division and also the Intensive Care National Audit & Research Centre (ICNARC) will use 3 SD level to identify outliers.

Figure 44 Standard Mortality Ratios using standard APACHE model in ICU and Combined Units (2012)

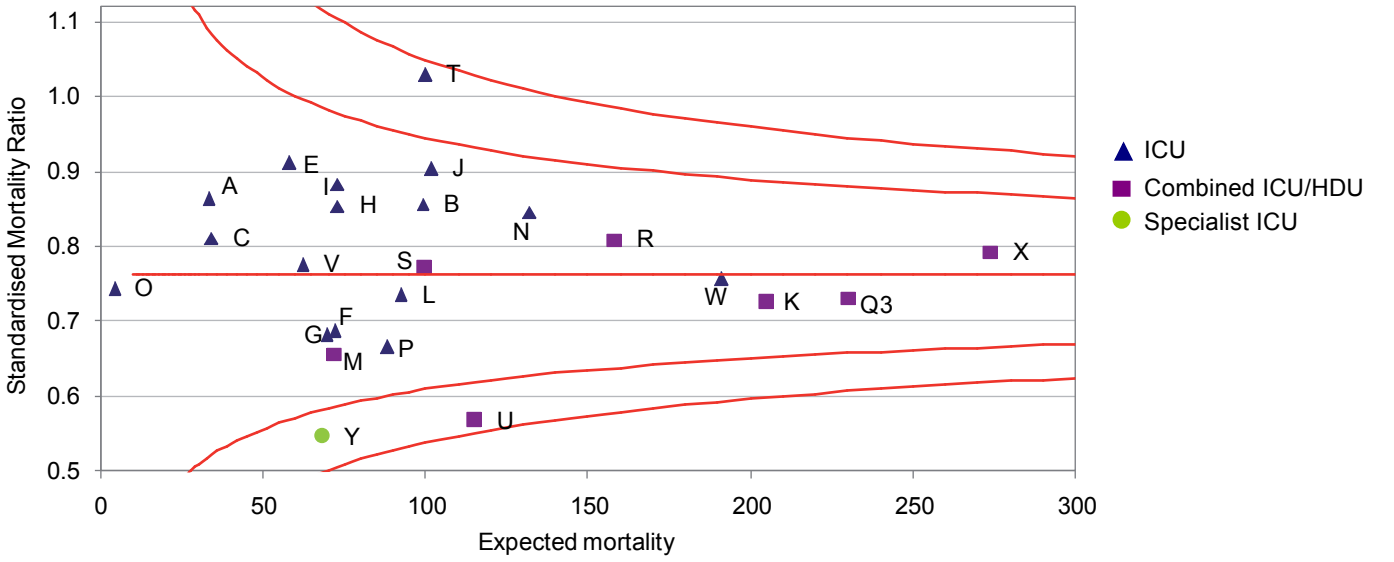
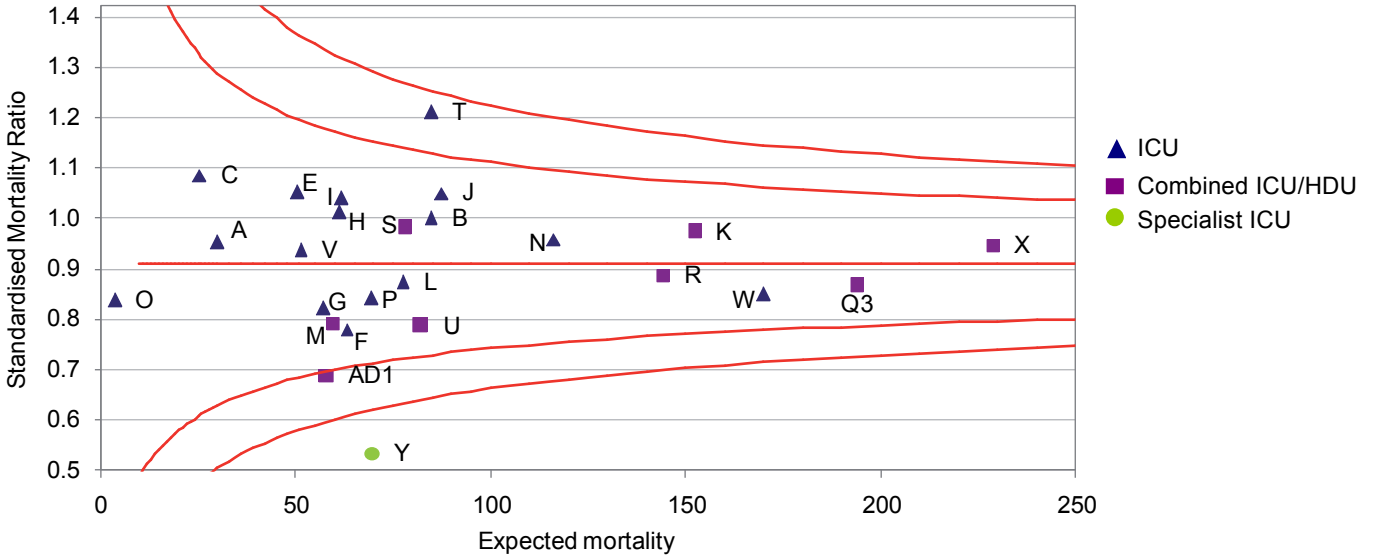


Figure 45 Standard Mortality Ratios using recalibrated APACHE model in ICU and Combined Units (2012)



Figures 44 and 45 shows the SMR for ICU and Combined Units (excluding X6), Figure 44 is calculated using the standard APACHE model, and Figure 45 is calculated using the recalibrated model.

Unit T is above the 2SD mean line in both graphs and hence may be statistically different from the rest of Scotland. While this could be due to chance, the unit had been informed before publication of this report and is currently commissioning an external review of this result.

It is pleasing to note this year all other units have an SMR below the upper confidence limit (the 2 SD above the mean line).

On Figure 45 Unit Y was below the lower 3 SD line and hence, using the recalibrated model its SMR is statistically different from other units in Scotland.

Conclusions

The SICSAG audit remains a comprehensive report of activity and outcome from Critical Care across the entire Scottish population.

Detailed information by unit 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 and most of the small number of non-participating units are in the process of doing so. Managers should question why any unit in their remit has not joined SICSAG.

Crude and adjusted mortality rates in patients admitted to Scottish ICUs continue to fall year on year. 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.

Critical Care Capacity (Funded Beds) 2012

Hospital	ICU/Combined Units Level 3/2	HDU Level 2/1	Specialist ICU Level 3/2	Specialist HDU Level 2/1
NHS Ayrshire and Arran				
AYR	4	4 HDU		
Crosshouse	5	8/4 SHDU[1] 8/4 MHDU		
NHS Borders				
BGH	3/2	2 Level 1 beds from March 2012		
NHS Dumfries and Galloway				
DGRI	4	4 SHDU 8 MHDU/CCU		
NHS Fife				
QMH	All units moved to VHK in January 2012			
VHK	9 (opened 20/1/2012)	↑8 MHDU on 20/1/2012 8 SHDU (opened 20/1/2012)		3 Renal (opened 20/1/2012)**
NHS Forth Valley				
FVRH	7/12			
NHS Grampian				
ARI	13	8 SHDU (31/32) 9 SHDU (35)		4 Neuro 6/2 Cardiac/ specialist (joined Dec 2012)
Dr Gray's		10 HDU		
NHS Greater Glasgow and Clyde				
GRI	12/8	8 SHDU 5 MHDU (joined 1/4/2012)		
IRH	3	4 SHDU[2]		
RAH	7	12 HDU		
SGH	5	6 SHDU	6 Neuro	6 Neuro
VI	5	8 SHDU		
WIG/ GGH	8	4 HDU 8 HDU		
NHS Highland				
Raigmore	7	6 SHDU 4 MHDU		
Belford		2 HDU		

Hospital	ICU/Combined Units Level 3/2	HDU Level 2/1	Specialist ICU Level 3/2	Specialist HDU Level 2/1
NHS Lanarkshire				
Hairmyres	5.25/4	4 MHDU		
MDGH	5.2	8 SHDU 4 MHDU		
Wishaw	5.3	6.7 SHDU 12 MHDU/CCU (joined Nov 12)		
NHS Lothian				
RIE	16/2	10 HDU	9 Cardiotho-racic**	6 + 2 Renal/ HDU 4 Transplant 0/4 Vascular 8 Cardiothoracic **
SJH	3/2			
WGH	10/6	6/4 SHDU		4 Neuro 0/3 Neuro
NHS National Waiting Times Centre				
Golden Jubilee			21/16 Cardio-thoracic ICU/ HDU joined June 2012	
NHS Orkney				
Balfour Hospital		2 HDU (reporting from June 2012)		
NHS Shetland				
GBH		2 HDU[4]		
NHS Tayside				
Ninewells	7.5	10 SHDU 6 MHDU		
PRI	3	4 HDU		
NHS Western Isles				
WIH		4 HDU		

Key:
MHDU - Medical HDU
SHDU - Surgical HDU
Neuro - Neurological
Cardio – Cardiothoracic
CCU – Coronary Care Unit
Notes
1 Funded beds reduced temporarily in Nov 2012
2 Predominantly surgical but admits medical patients
3 GJ has 2 ICUs and 2 HDUs but for the purpose of this audit is reported as one Combined ICU/HDU
4 no allocated funding
5 totals are based on funded beds at the end of 2012 and figures are rounded
** missing data for some of the year (noted on Tables/graphs affected by this)

Appendix 1 ICU profiles 2013

Capacity and Multi-disciplinary Team Information							
Hospital	Actual beds	Funded beds (Level 3/2)	Trained nursing WTE/level 3 bed	ICU pharmacist	Daily contact from microbiologist	Daily physiotherapy review	Dietetic review for all patients
ARI	16	13	6.5	Yes	Yes	Yes	Yes
AYR	5	4	6	Yes	No	Yes	Yes
Crosshouse	7	5	6.5	Yes	Yes	Yes	Yes
BGH	9	3/2	6.4	Yes	No	Yes	No
DGRI	6	4	8.1	Yes	Yes	Yes	Yes
VHK	10	9	6.6	No	Yes	Yes	Yes
FVRH	19	7/12	6.1	Yes	Yes	Yes	Yes
GRI	20	12/8	5	Yes	Yes	Yes	Yes
IRH	4	3	5.5	Yes	Yes	Yes	Yes
RAH	8	7	6	Yes	Yes	Yes	Yes
SGH General	6	5	6.6	Yes	Yes	Yes	Yes
SGH Neuro	9	6	5.8	Yes	Yes	Yes	Yes
VI	5	5	5.8	Yes	Yes	Yes	Yes
WIG	9	8	6	Yes	Yes	Yes	Yes
Raigmore	8	7	6.5	Yes	Yes	Yes	Weekdays only
Hairmyres	10	6/2	4.5	Yes	Yes	Yes	Yes
MDGH	6	5.2	5.4	Yes	Yes	Yes	Yes
Wishaw	12	5.3	5.2	Yes	No	Yes	Weekdays only
RIE	19	16/2	5.9	Yes	Yes	Yes	Yes
RIE Cardiothoracic	12	9	6.7	Yes	Weekdays only	Yes	When requested
SJH	7	3/2	6.1	Yes	Yes	Yes	Yes
WGH	16	10/6	6.3	Yes	Yes	Yes	Yes
Ninewells	9	7.3	5.5	Yes	Yes	Yes	Yes
PRI	4	3	7	Yes	Yes	Yes	Yes
GJNH	38	21/16	5.5	Yes	Yes	Yes	Yes

Appendix 2 HDU profiles 2013

Capacity and Multi-disciplinary Team Information							
Hospital	Funded Level 2/1 beds	Nursing WTE/ Level 2 bed	Dedicated HDU Consultant - days/ week	Dedicated HDU pharmacist	Microbiologist - daily contact	Physiotherapy - daily review	Dietetic review for all patients
Ayr HDU	4	3.1	None	Yes	No	Yes	Yes
Crosshouse Surgical HDU	8/4	2.4	None	Yes	No	Yes	Yes
Crosshouse Medical HDU	8/4	2.6	None	Yes	No	Not weekends unless requested	Only if referred
DGRI Medical HDU	8	3.1	None	No	No		Only if referred
DGRI Surgical HDU	4	4.2	None	Yes	No	Yes	Only if referred
VHK Surgical HDU	8	3.1	Designated intensivist Mon-Fri 8.30-16.30	Yes	No	Yes	Only if referred
VHK Medical HDU	8	2.6	None	Yes	No	Yes	Yes
VHK Renal HDU	3	4.7	None	No	Yes	Yes	Yes
ARI Surgical HDU (31/32)	8	1.8	None	No	No	Not weekends unless requested	Only if referred
ARI Surgical HDU (35)	9	2	None	No	No	Not weekends unless requested	Not by dietician
ARI Neurological HDU	4	2	None	No	Yes, but only if contacted by ward medical staff	Not weekends unless requested	Yes
ARI Cardiothoracic HDU	8	1.9	None	No	No	Not weekends unless requested	No
Dr Gray's HDU	10	2.1	None	Yes	No	Yes	No
GRI Surgical HDU	8	2.7	None	Yes	Yes	Yes	Yes
GRI Medical HDU	6	2.6	5/7	Yes	No	Yes	No

Capacity and Multi-disciplinary Team Information

Hospital	Funded Level 2/1 beds	Nursing WTE/ Level 2 bed	Dedicated HDU Consultant - days/ week	Dedicated HDU pharmacist	Microbiologist - daily contact	Physiotherapy - daily review	Dietetic review for all patients
IRH Surgical HDU	4	4.2	None	Yes	No	Yes	Yes
RAH Surgical HDU	12	2.9	None	Yes	No	Yes	Yes
SGH Surgical HDU	6	1.7	None	Yes	No	Not weekends unless requested	Only if referred
SGH Neurological HDU	4	4.5	Yes	No	Yes	Yes	Yes
VI Surgical HDU	8	3	None	Yes	No	Not weekends unless requested	Only if referred
WIG HDU	4	3	7/7	Yes	Yes	Yes	Yes
GGH HDU	8	2.7	0-4 Depending on A/L , study and sick leave	Yes	No	Yes	Only if referred
Raigmore Surgical HDU	6	2.9	None	Yes	No	Not weekends unless requested	Only if referred
Raigmore Medical HDU	4	4.2	None	No	No	Not weekends unless requested	Only if referred
Belford HDU	2	0.3	None	No	No	Yes	Only if referred
Hairmyres MHDU	4	1.9	None	Yes	No	Not weekends unless requested	Only if referred
MDGH Surgical HDU	8	2.6	None	Yes	No	Yes	Yes
MDGH Medical HDU	4	2.4	5/7	Yes	No	No	No
Wishaw Surgical HDU	7	2.3	None	Yes	Yes	Yes	Only if referred
Wishaw Medical HDU	6/6	2.4	None	Yes	Yes	Yes	Only if referred
RIE HDU	10	3	7	Yes	No	Yes	Only if referred
RIE Renal HDU	8	3.5	None	Yes	No	Yes	Yes

Capacity and Multi-disciplinary Team Information

Hospital	Funded Level 2/1 beds	Nursing WTE/ Level 2 bed	Dedicated HDU Consultant - days/ week	Dedicated HDU pharmacist	Microbiologist - daily contact	Physiotherapy - daily review	Dietetic review for all patients
RIE Transplant HDU	4	Established within a wider budget	None	No	Yes	Not weekends unless requested	Yes
RIE Vascular (Level 1)	0/4	Shared with vascular ward	None	No	No	Yes	Only if referred
RIE Cardiothoracic HDU	8	3.8	7/7	No	No	Yes	Only if referred
WGH Surgical HDU	6/4	3.1	None	Yes	No	Only if referred	Only if referred
WGH Neurological/ Level 1 HDU	4/3	3.4	5 sessions/ week	No	No	Yes	No
Balfour Hospital	2	Resourced from Acute Ward	5/7	No.	Yes	Yes.	Yes.
GBH HDU	2 beds, part of general surgical ward funding	From surgical ward as required	5/7	No	No	Not weekends unless requested	Only if referred
Ninewells Surgical HDU	10	3.5	5/7	Yes	Yes	Yes	Yes
Ninewells Medical HDU	6	3.3	None	No	No	Yes	Only if referred
PRI HDU	4	3.3	None	Yes.	No	Yes.	Only if referred
WIH HDU	4	1.4	None	No	No	No weekend cover	Only if referred

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 2012, an initial extract of 2011 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 2012, 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 2011, 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 2012 have been through a linkage process that aims to match SICSAG Critical Care episodes to ISD's 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, and 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 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 outwith 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". 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[10].

3.4 APACHE II

The outcome measure used by SICSAG is the patients' survival status (alive or dead) when they finally leave 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[11]. This is a validated scoring system[12], 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

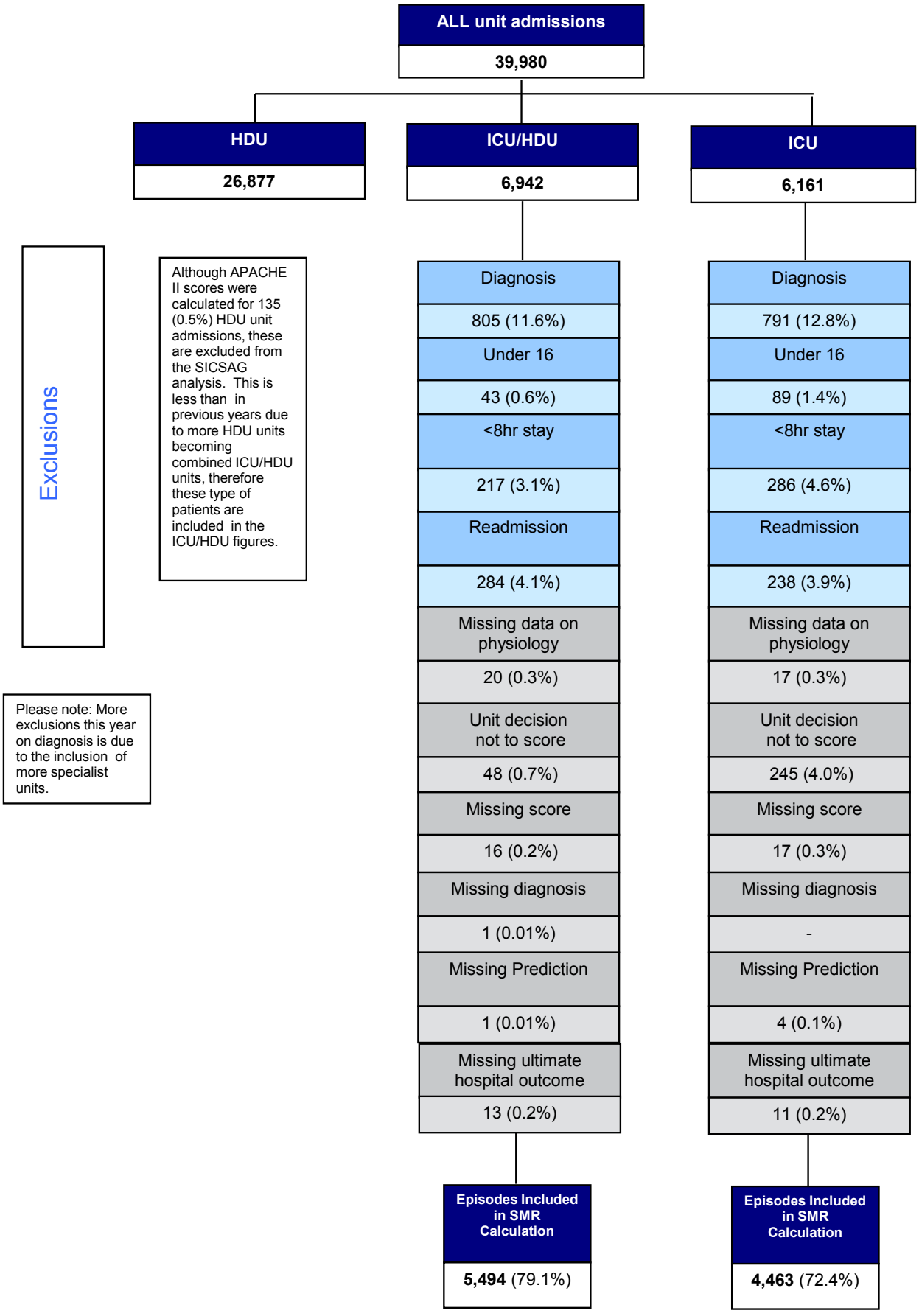
APACHE II scoring. Taking into account non-response, these were re-coded to reflect the hierarchy of decision-making within units. Automatic exclusions such as 'diagnosis', 'patient under 16' and 'patient stayed for less than eight hours' were excluded first and existing codes changed to reflect this 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 inappropriate diagnoses (eg liver transplant) are shown schematically in the decision tree on page 44.

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 (1990)[13].

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.

Figure A1: Eligibility for APACHE II scores and selection for analysis



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)

Appendix 4 List of abbreviations

ACP	Augmented Care Period
CPAP	Continuous Positive Airway Pressure
CRBSI	Catheter Related Blood Stream Infection
CVC	Central Venous Catheter
HAI	Healthcare Associated Infection
HAN	Hospital at Night
HDU	High Dependency Unit
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HPS	Health Protection Scotland
ICM	Intensive Care Medicine
ICS	Intensive Care Society
ICU	Intensive Care Unit
ISD	Information Services Division
M & M	Morbidity and Mortality
MUST	Malnutrition Universal Screening Tool
NIV	Non Invasive Ventilation
OOH	Out of hours
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
ST	Specialist Trainee (medical)
VAP	Ventilator Associated Pneumonia
WTE	Whole Time Equivalent
WW	WardWatcher

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Hospital	Abbreviation	Unit	Letter
Inverclyde Royal Hospital	IRH	ICU	A
		Surgical HDU	A2
Victoria Hospital, Kirkcaldy	VHK	ICU	B
		Medical HDU	B2
		Surgical HDU	B3
		Renal HDU	B4
Perth Royal Infirmary	PRI	ICU	C
		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
		HDU	J2
Glasgow Royal Infirmary	GRI	ICU/HDU	K
		Surgical HDU	K2
		Medical HDU	K3
Victoria Infirmary, Glasgow	VI	ICU	L
		Surgical HDU	L2
St John's Hospital, Livingston	SJH	ICU/HDU	M
Ninewells Hospital, Dundee	Ninewells	ICU	N
		Medical HDU	N2
		Surgical HDU	N3
Queen Margaret Hospital, Dunfermline	QMH	ICU	O
		Surgical HDU	O2
		Medical HDU	O3
		Renal HDU	O4
Raigmore Hospital, Inverness	Raigmore	ICU	P
		Medical HDU	P2
		Surgical HDU	P3
Forth Valley Royal Hospital	FVRH	ICU/HDU	Q3
Western General Hospital, Edinburgh	WGH	ICU/HDU	R
		Surgical HDU	R3
		Neurological HDU	R4
		Neurological (Level 1)	R5
Hairmyres Hospital, East Kilbride	Hairmyres	ICU/HDU	S
		Medical HDU	S2
Western Infirmary, Glasgow	WIG	ICU	T
		HDU	T3
Gartnavel General Hospital, Glasgow	GGH	HDU	T2
Borders General Hospital	BGH	ICU/HDU	U
Wishaw General Hospital	Wishaw	ICU	V
		Surgical HDU	V2
		Medical HDU	V3
Aberdeen Royal Infirmary	ARI	ICU	W
		Surgical HDU (31/32)	W2
		Neurological HDU	W3
		Surgical HDU (35)	W4
		Cardiothoracic HDU	W5
Royal Infirmary of Edinburgh	RIE	ICU/HDU	X
		HDU	X2
		Renal HDU	X3
		Transplant HDU	X4
		Vascular (Level 1)	X5
		Cardiothoracic ICU	X6
		Cardiothoracic HDU	X7
Southern General Hospital, Glasgow	SGH	Neurological ICU	Y
		Neurological HDU	Y2
Gilbert Bain Hospital, Shetland	GBH	HDU	Z1
Dr Gray's Hospital, Elgin	Dr Gray's	HDU	AA1
Western Isles Hospital, Stornoway	WIH	HDU	AB1
Belford Hospital, Fort William	Belford	HDU	AC1
Golden Jubilee Hospital	GJNH	ICU/HDU	AD1
Balfour Hospital,Orkney	Balfour	HDU	AE1

Hospital	Abbreviation	Unit	Letter
Ayr Hospital	AYR	ICU	E
		HDU	E2
Crosshouse Hospital, Kilmarnock	Crosshouse	ICU	G
		Medical HDU	G2
		Surgical HDU	G3
Borders General Hospital	BGH	ICU/HDU	U
Dumfries & Galloway Royal Infirmary	DGRI	ICU	H
		Medical HDU	H2
		Surgical HDU	H3
Queen Margaret Hospital, Dunfermline	QMH	ICU	O
		Surgical HDU	O2
		Medical HDU	O3
		Renal HDU	O4
Victoria Hospital, Kirkcaldy	VHK	ICU	B
		Medical HDU	B2
		Surgical HDU	B3
		Renal HDU	B4
Forth Valley Royal Hospital	FVRH	ICU/HDU	Q3
Aberdeen Royal Infirmary	ARI	ICU	W
		Surgical HDU (31/32)	W2
		Neurological HDU	W3
		Surgical HDU (35)	W4
		Cardiothoracic HDU	W5
Dr Gray's Hospital, Elgin	Dr Gray's	HDU	AA1
Glasgow Royal Infirmary	GRI	ICU/HDU	K
		Surgical ICU/HDU	K2
		Medical HDU	K3
Inverclyde Royal Hospital	IRH	ICU	A
		Surgical HDU	A2
Royal Alexandra Hospital, Paisley	RAH	ICU	J
		HDU	J2
Southern General Hospital, Glasgow	SGH	ICU	F
		Surgical HDU	F2
		Neurological ICU	Y
		Neurological HDU	Y2
Victoria Infirmary, Glasgow	VI	ICU	L
		Surgical HDU	L2
Western Infirmary, Glasgow	WIG	ICU	T
		HDU	T3
Gartnavel General Hospital, Glasgow	GGH	HDU	T2
Golden Jubilee Hospital	GJNH	ICU/HDU	AD1
Belford Hospital, Fort William	Belford	HDU	AC1
Raigmore Hospital, Inverness	Raigmore	ICU	P
		Medical HDU	P2
		Surgical HDU	P3
Hairmyres Hospital, East Kilbride	Hairmyres	ICU/HDU	S
		Medical HDU	S2
Monklands DGH, Airdrie	MDGH	ICU	I
		Surgical HDU	I2
		Medical HDU	I3
Wishaw General Hospital	Wishaw	ICU	V
		Surgical HDU	V2
		Medical HDU	V3
Royal Infirmary of Edinburgh	RIE	ICU/HDU	X
		HDU	X2
		Renal HDU	X3
		Transplant HDU	X4
		Vascular (Level 1)	X5
		Cardiothoracic ICU	X6
		Cardiothoracic HDU	X7
St John's Hospital, Livingston	SJH	ICU/HDU	M
Western General Hospital, Edinburgh	WGH	ICU/HDU	R
		Surgical HDU	R3
		Neurological HDU	R4
		Neurological (Level 1)	R5
Balfour Hospital, Orkney	BAL	HDU	AE1
Gilbert Bain Hospital, Shetland	GBH	HDU	Z1
Ninewells Hospital, Dundee	Ninewells	ICU	N
		Medical HDU	N2
		Surgical HDU	N3
Perth Royal Infirmary	PRI	ICU	C
		HDU	C2
Western Isles Hospital, Stornoway	WIH	HDU	AB1

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