Scottish Intensive Care Society
Audit Group
http://www.scottishintensivecare.org.uk

ANNUAL REPORT 2004

Audit of Intensive Care Units in Scotland.

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D. ABBREVIATIONS

ACP	Augmented Care Period
APACHE	Acute Physiology (age) and Chronic Health Evaluation, version II (III)
ARDS	Acute respiratory distress syndrome
CCDG	Critical Care Delivery Group
DGH	District General Hospital
*e*Bed Bureau	Electronic Bed Bureau
ESICM	European Society of Intensive Care Medicine
HAI	Hospital Acquired Infection
HDU	High Dependency Unit
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
ICU	Intensive Care Unit
IQR	Inter-quartile range
ISD	Information and Statistics Division
LOS	Length of stay
MPM	Mortality Probability Model
NICE	National Institute for Clinical Excellence
NMBA	Neuro-muscular blocking agents
PAFC	Pulmonary artery flotation catheter
RRT	Renal replacement therapy
SAPS	Simplified Acute Physiology Score
SCCM	Society of Critical Care Medicine
SCIEH	Scottish Centre for Infection and Environmental Health
SEHD	Scottish Executive Health Department
SICS	Scottish Intensive Care Society
SICSAG	Scottish Intensive Care Society Audit Group
SIRS	Systemic inflammatory response syndrome
SMC	Scottish Medicines Consortium
SMR	Standardised mortality ratio
SPC	Statistical process control
TISS	Therapeutic Intervention Scoring System

E. INTRODUCTION.

1. This is the 9th Annual Report of the Scottish Intensive Care Society Audit Group (SICSAG). It follows a similar format to recent years but efforts have been made to make it more contemporaneous. Reported this year are complete data on intensive care unit (ICU) activity and outcome for 2002 and activity data for 2003. Outcome data for 2003 are not yet complete and will be included in the Annual Report in 2005.

2. It is impossible to include each unit's figures and tables in this report, therefore, unit-specific graphs and tables will be given electronically to lead audit clinicians in each ICU. Data will complement those for Scotland included in this report. Locally, therefore, staff in each unit will be able to present and report on both local and national data, repeating the process established in recent years.

3. The Scottish intensive care unit audit has grown from an ICU-only system, totally reliant on the APACHE II methodology [1], into a much more comprehensive audit of critical care activity in Scotland. The audit has been a success, not just in a narrow field, but also, in its contribution to the development of intensive care services, organisation and research in Scotland. It has been a source of information for planning of services by Health Boards, the Scottish Medicines Consortium (SMC), the Scottish Executive Health Department (SEHD) and the Chairs of Critical Care Delivery Groups (CCDGs). The audit infrastructure and the collaboration between ICUs has provided a basis for the successful conduct of specific epidemiological studies; it has supported the development of both a trials group and an evidence based medicine/standards group. It has also contributed internationally to the methodologies used in audit and there is an extensive list of publications included in Appendix I. Nonetheless, the resources available to the audit are quite limited and we are never able to do everything we might wish and must prioritise. This has been particularly apparent in the last 18 months due to unavoidable staff absences, which have a very significant impact in a small team such as this.

4. A steering group supervises the audit on behalf of the Scottish Intensive Care Society (SICS). As we approach the 10th anniversary of data collection, the Audit Group would like to encourage debate about the future direction of the audit of which there are two main areas: organisation and objectives. The ICU audit and electronic (*e)*Bed Bureau are funded by central funding from Health Boards. Individual Trusts (now operating as Divisions) also pay to participate in the High Dependency Unit (HDU) audit. The present structure of the audit seems to have produced a strong feeling of clinical ownership but is dependent on piece-meal funding which makes staff recruitment, retention and development particularly challenging. The Group will seek to explore whether other arrangements would provide greater security whilst maintaining clinical ownership. It is also now possible to consider process audit, based on either evidence-based or consensus guidelines. This was not possible until recently, however the results of recent, major research have led to the introduction of recommended “bundles” of care by organisations such as the Society of Critical Care Medicine (SCCM), the European Society of Intensive Care Medicine (ESICM) and the International Sepsis Forum. We need to actively consider whether auditing at least some of these aspects should be part of future critical care audit and indeed to what extent this may replace case-mix adjustment over time.

5. Whilst the latter are issues for the future, on which we would welcome comments from participants and other health service staff, we would like to highlight certain changes that are currently taking place. Throughout the duration of the audit the dataset has continued to be reviewed and updated according to the requirements of the ICUs, the Society and, recently, HDUs. For next year we have revised the Scottish diagnosis list, removed now redundant fields from the history screen and modified the Scottish augmented care period (ACP) dataset. These changes should enhance the entry, extraction and usefulness of data, both locally and nationally.

6. The HDU audit continues to mature. There are currently 27 HDUs participating, collecting a minimum dataset on Ward Watcher (Critical Care Audit Ltd, Yorkshire). Almost all data collection is conducted by nursing staff. This year, each HDU has received local reports on its activity during the first and second halves of 2003 and for the whole of 2003. No HDU results are included in this report. Only a few HDU consultants have demonstrated any great interest in the HDU audit; the audit group and the local HDU staff greatly appreciate their continued support and advice.

7. The whole audit, including this report, is only possible as a result of the support of ***all*** participating staff in critical care in Scotland. In nearly all units, they bear the burden of data entry without any dedicated staffing. It is important that data are collected in both an accurate and timely manner and we want to pay tribute to the staff who do this.

F. RESULTS & DISCUSSION

In all graphs * identifies District General Hospitals (DGHs) and ^ identifies combined HDU/ICUs during 2002 &/or 2003, unless stated differently. Appendix II contains a list of all participating units and the acronyms used to identify these units in the workload/organ support figures.

F.1. Intensive care demand.

8. Figure 1 shows the trend in annual ICU admissions in all units which have contributed data over the period 1995-2003 and in those 20 that have participated throughout this 9-year period. A number of units joined the audit during the early months of 1995. In these units, the numbers of admissions were annualised for the year. The increase in the number of participating ICUs is reflected in the increase in admission numbers to 2001. As a reminder, Glasgow Royal Infirmary began to participate in 1997; 1998 saw ICUs at Ayr Hospital and Dumfries & Galloway Royal Infirmary become involved; after a 3-year absence Falkirk & District Royal Infirmary re-established participation once the *e*Bed Bureau came on-line in 2001; Raigmore Hospital did not participate during 1999-2000; severity data were not available from Falkirk, Queen Margaret Hospital or Raigmore during 2002.

9. Figure 2 and Table 1 demonstrate rates of admissions to the ICUs over time. Of note, in the period 2001-2003, are the admission rates to Wishaw General Hospital, Aberdeen Royal Infirmary and the Royal Infirmary of Edinburgh. There have been changes in each unit, which have increased ICU capacity (Aberdeen) or led to the inclusion of both HDU as well as ICU beds (all three units). On moving to Wishaw from Law, the new “Adult Critical Care Unit” has become a combined unit of 5 ICU beds and 7 HDU beds, resulting in a three-fold increase in admission rate since 2000.

Figure 1. Annual admission rates to Scottish ICUs, 1995 - 2003: a) in cohort of 20 units contributing throughout and b) all participating units.

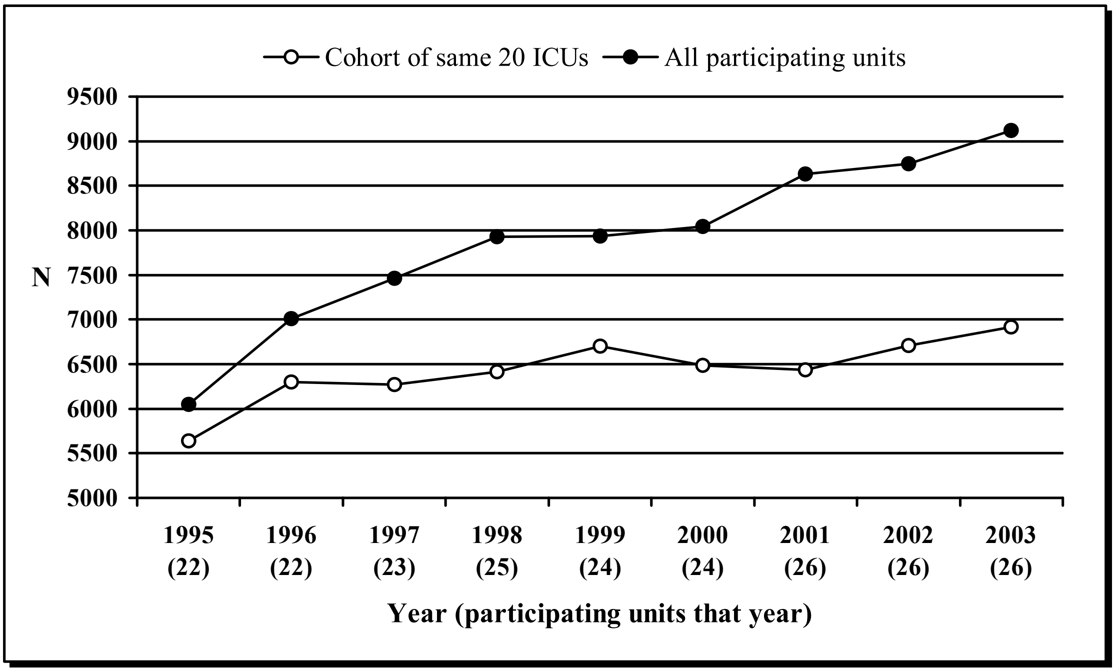


Figure 2. Trends in annual admission rates: 2001-2003.

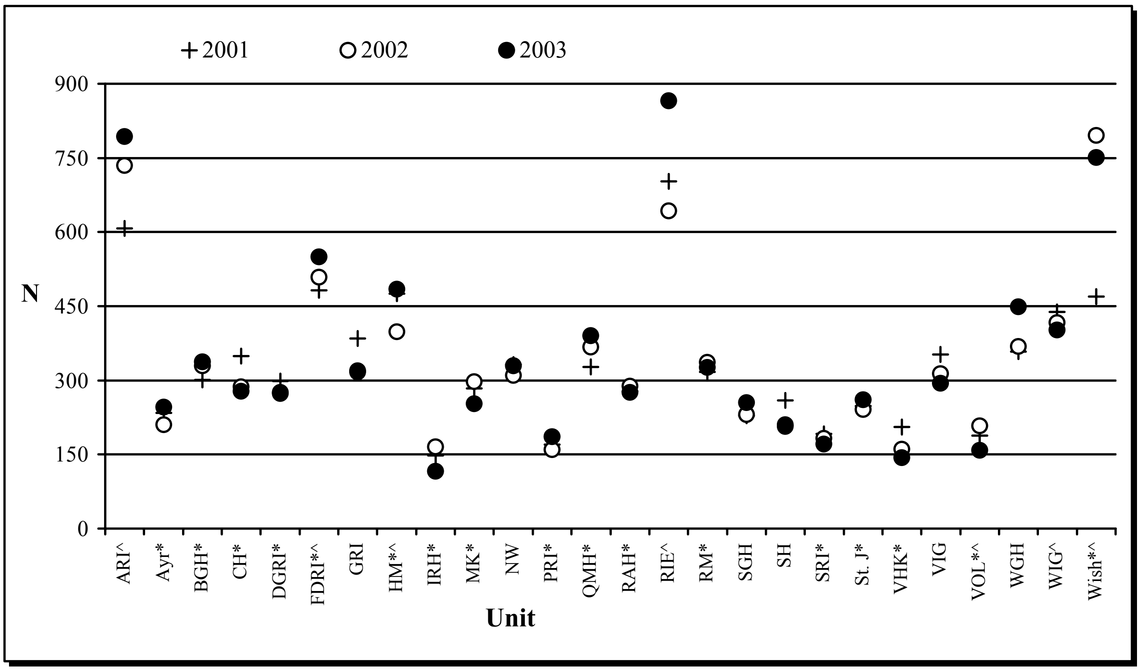


Table 1. Annual admission rates to Scottish ICUs, 1996 – 2003.

Unit	1996	1997	1998	1999	2000	2001	2002	2003
ARI^	531	564	591	606	624	607	735	793
Ayr*			335	303	268	234	210	246
BGH*	314	298	335	375	322	301	329	337
CH*	378	353	350	364	320	349	287	278
DGRI*			279	405	392	298	273	276
FDRI*^	466	530	*126*			482	508	550
GRI		*429*	436	384	387	385	317	319
HM*^				*145*	504	475	398	485
IRH*	196	212	224	188	156	148	165	116
MK*	290	268	323	331	334	284	297	252
NW	282	277	297	337	339	332	310	330
PRI*	236	222	204	190	236	170	159	186
QMH*	471	475	549	407	354	327	367	390
RAH*	320	387	372	426	359	278	288	276
RIE^	600	576	546	651	655	702	643	865
RM*	247	229	262			317	336	326
SGH	287	287	245	250	280	228	231	255
SH	255	267	225	242	236	260	207	210
SRI*	209	161	145	177	219	192	183	171
St. J*	236	201	223	260	281	248	241	261
VHK*	250	232	329	271	204	206	161	143
VIG	321	303	289	318	317	352	313	294
VOL*^	203	199	197	247	185	188	208	158
WGH	384	316	328	339	383	358	369	449
WIG^	403	466	476	456	446	439	417	402
Wish*^	183	210	239	266	239	469	796	751

FDRI 1998*: Participated January – March 1998.*
GRI 199*7: Participation began in 1997. 344 records were imported into central database, however, data were collected retrospectively on GRI's own database to complete the year's total of 429 admissions.*
HM 1999*: 145 records for participation late in 1999.*

10. Table 2 identifies the fluctuation in funded bed numbers, in some instances monthly. It also identifies the changes to the provision of the service over the last couple of years. A number of units now have both ICU (level 3) beds and HDU (level 2) beds located in the same unit. We aim to use the correct number of available funded beds to determine bed occupancy as accurately as possible. Obtaining this information reliably can be surprisingly difficult and we rely on senior staff in each ICU to keep us informed of change, particularly any increase in number over the winter months.

Table 2. Number of ICU & HDU funded beds used to calculate occupancies in 2002 & 2003.

Unit	2002	2003
ARI^	10 ICU (Jan-Mar); 12 ICU + 4HDU (Apr-Dec)	12 ICU + 4HDU
Ayr*	4	4
BGH*	3 (Jan-Sep); 4 (Oct-Dec)	4 (Jan-Mar & Oct-Dec); 3 (Apr-Sep)
CH*	5	5 (Jan-Oct); 5.5 (Nov-Dec)
DGRI*	6 (Jan-Mar); 4 (Apr-Dec)	4
FDRI*^	5 ICU + 3 HDU	5 ICU + 3 HDU
GRI	7	7
HM*^	5 ICU + 2 HDU	5 ICU + 2 HDU
IRH*	2	2 (Jan-Apr); 3 (May-Dec)
MK*	5 (Jan-Nov); 6 (Dec)	6 (Jan-Mar & Dec); 5 (Apr-Nov)
NW	7	7
PRI*	3	3
QMH*	7	7
RAH*	4	4 (Jan-Oct); 6 (Nov-Dec)
RIE^	12 (Jan-Mar); 11 (Apr-Dec)	12 ICU (Jan-Mar); 11 ICU (Apr); 11 ICU+ 6 HDU (May-Dec)
RM*	7 (Jan-Mar); 6 (Apr-Dec)	6
SGH	5	5
SH	5	6
SRI*	4	4
St. J*	4	4
VHK*	3	3
VIG	5	5
VOL*^	2 ICU + 2 HDU	2 ICU + 2 HDU (Jan-Sep); 2 ICU + 1 HDU (Oct-Dec)
WGH	8	8
WIG^	7 ICU (Jan-Mar); 7 ICU + 2 HDU (Apr-Dec)	7 ICU + 2 HDU
Wish*^	5 ICU + 7 HDU	5 ICU + 7 HDU

11. Using the number of funded ICU beds available per month, given in Table 2, the mean number of funded ICU beds per annum, per unit has been calculated for 2002 and 2003 (Table 3). There has been an increase in the number of ICU beds in Scotland, from 112 beds in 1996 to an average of 138.5 and 141.2 in 2002 and 2003 respectively.

Table 3. Mean number of funded ICU beds in Scotland during 2001 - 2003.

HEALTH BOARD	HOSPITAL	Mean number of funded ICU beds		
		2001	2002	2003
Argyll & Clyde	Inverclyde Royal Hospital	2	2	2.7
	Royal Alexandra Hospital	4	4	4.3
	Vale of Leven DGH	2	2	2
	Total for Health Board	***8***	***8***	***9***
Ayrshire & Arran	Ayr Hospital	4	4	4
	Crosshouse Hospital	5	5	5.1
	Total for Health Board	***9***	***9***	***9.1***
Borders	Borders General Hospital	3	3.3	3.5
	Total for Health Board	***3***	***3.3***	***3.5***
Dumfries & Galloway	Dumfries Royal Infirmary	4	4	4
	Total for Health Board	***4***	***4***	***4***
Fife	Victoria Hospital Kirkcaldy	3.9	3	3
	Queen Margaret Hospital	6.1	7	7
	Total for Health Board	***10***	***10***	***10***
Forth Valley	Stirling Royal Infirmary	4	4	4
	Falkirk Royal Infirmary	5	5	5
	Total for Health Board	***9***	***9***	***9***
Grampian	Aberdeen Royal Infirmary	9.3	11.5	12
	Total for Health Board	***9.3***	***11.5***	***12***
Greater Glasgow	Glasgow Royal Infirmary	7	7	7
	Southern General Hospital	5	5	5
	Stobhill Hospital	5	5	6
	Victoria Infirmary	5	5	5
	Western Infirmary	7	7	7
	Total for Health Board	***29***	***29***	***30***
Highland	Raigmore Hospital	6.1	6.3	6
	Total for Health Board	***6.1***	***6.3***	***6***
Lanarkshire	Hairmyres Hospital	5.3	5	5
	Wishaw (Law) Hospital	5	5	5
	Monklands Hospital	5.3	5.1	5.3
	Total for Health Board	***15.5***	***15.1***	***15.3***
Lothian	Royal Infirmary of Edinburgh	11.3	11.3	11.3
	Western General Hospital	8	8	8
	St. John's Hospital	4.3	4	4
	Total for Health Board	***23.6***	***23.3***	***23.3***
Tayside	Ninewells Hospital	7	7	7
	Perth Royal Infirmary	3	3	3
	Total for Health Board	***10***	***10***	***10***
	SCOTLAND	**136.5**	**138.5**	**141.2**

12. Trends in annual bed occupancies per unit are demonstrated in Figure 3. Each unit's percentage annual bed occupancy is derived from the mean of the twelve monthly occupancies for each year, based on the total number of funded beds identified to the SICSAG (Table 2) for each month. In 2002 and 2003 respectively, 80% and 75% of all units had an average occupancy greater than 70%. The average occupancy has remained consistently high, at 80%, throughout the audit, despite the increase in funded beds (Figure 4).

13. In the combined HDU/ICUs the total numbers of funded beds are used to derive bed occupancy. This methodology inevitably underestimates the 'ICU' bed occupancy in those units were an increase in ventilated patients requires a two-fold reduction in HDU beds. Historically, annual occupancies at Aberdeen have been persistently high. Following expansion, its ICU now encompasses 12 ICU (level 3) beds and 4 HDU (level 2) beds. Since April 2002, the bed occupancy for Aberdeen has been calculated based on a total of 16 funded beds. Although this unit can admit up to 12 ICU plus 4 HDU patients (16 beds), the reality is that more than 12 ICU (level 3) beds are utilised on a regular basis; rarely can a total of 16 beds ever be open. There is a resultant underestimation of bed occupancy. In Figure 3, a sharp decrease in bed occupancy can be seen in Aberdeen between 2001 & 2002, despite an increase in admission rate (Figure 2 & Table 1). A similar pattern is observed, to a lesser extent, in the Royal Infirmary of Edinburgh between 2002 and 2003. During 2003, the ICU moved to a new hospital at which point composition altered to 11 ICU (level 3) and 6 HDU (level 2) beds.

14. In Dumfries, the unit was originally an HDU/ICU until a separate HDU opened in 2001. Historically, a total of 6 beds (4 ICU and 2 HDU) were used to calculate bed occupancy in this unit, which too underestimated ICU occupancy. For the majority of 2002 and 2003, 4 funded ICU beds have been used to calculate this unit's occupancy. Hence, the apparent increase in occupancy.

Figure 3. Trends in bed occupancies (%) in Scottish ICUs, 2000 - 2003.

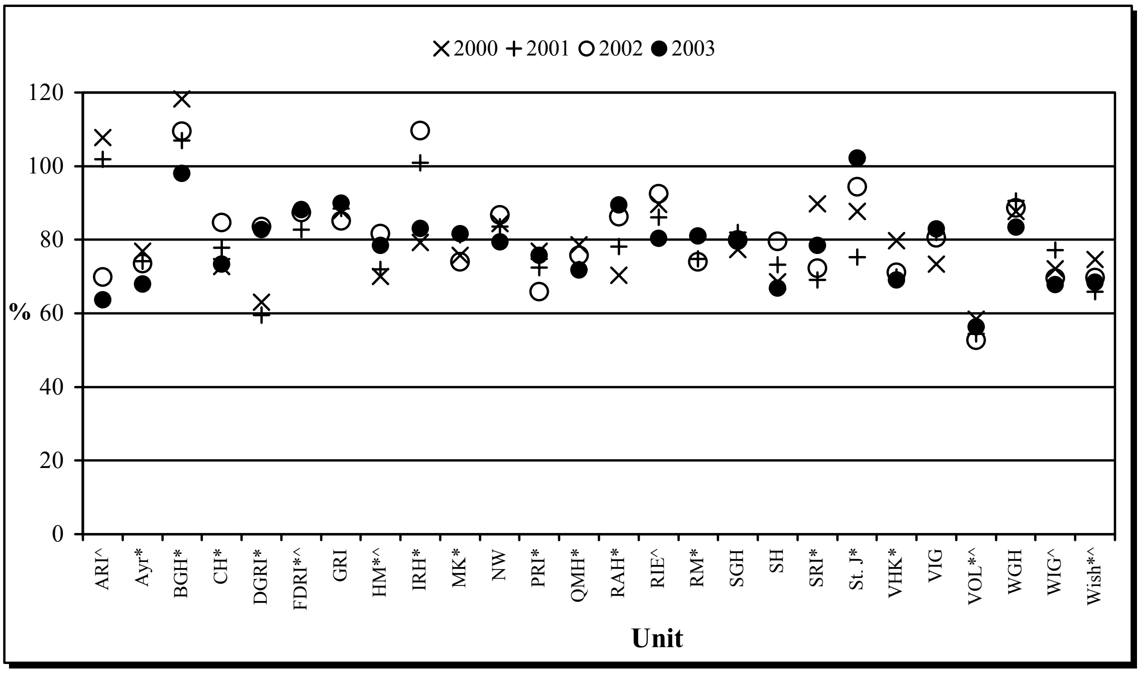
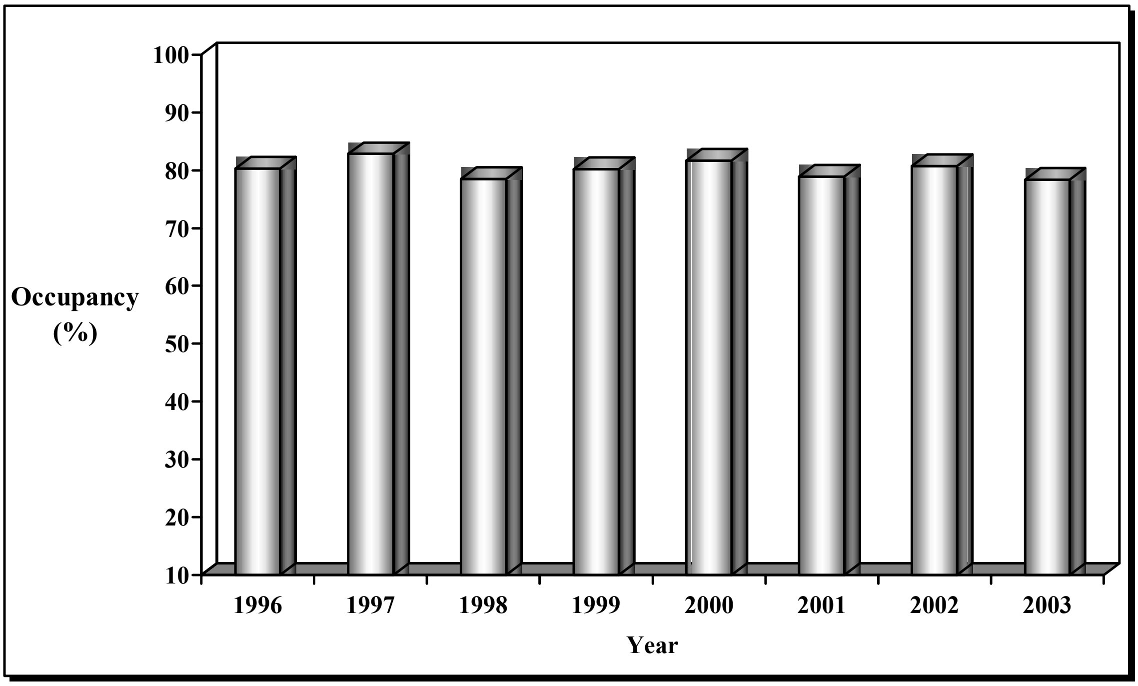


Figure 4. Scotland's annual ICU bed occupancies, 1996 - 2003.



15. The period between December and March is a time when it is thought ICUs are most consistently under pressure. Figure 5 details the trend in winter occupancy from 1996 – 2003. January 2000 remains exceptional. Figure 6, however, demonstrates the continuous pressure on ICU resources throughout the year.

Figure 5. Trends in Scottish ICU winter bed occupancies: December - March.

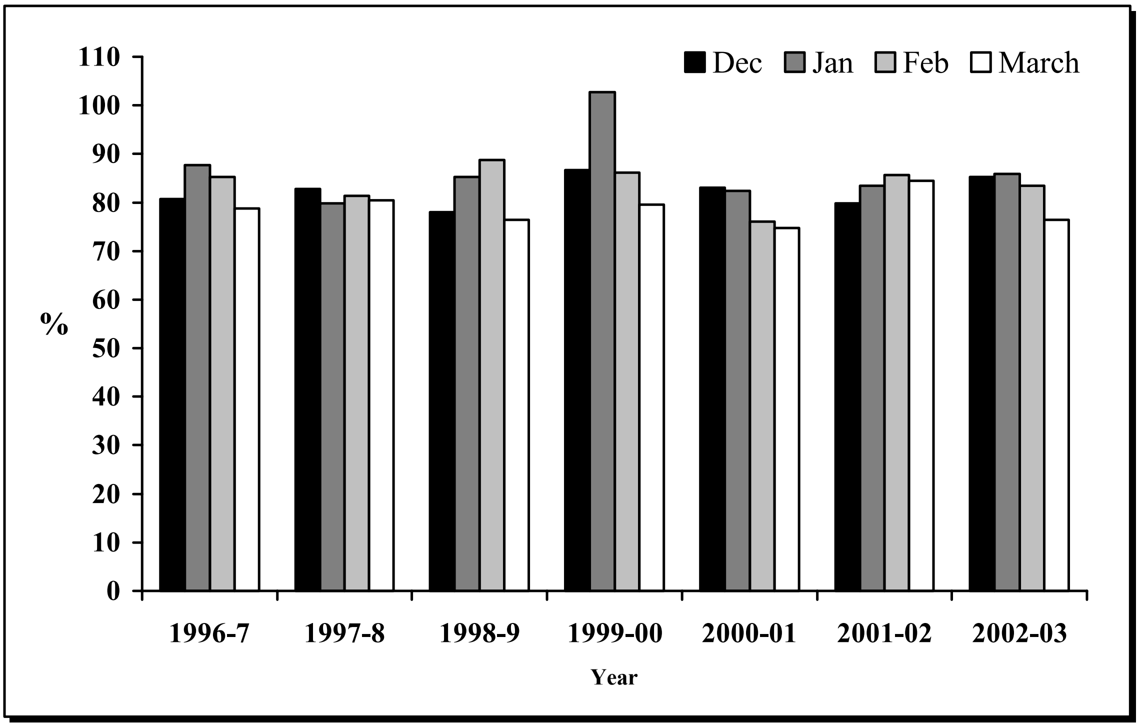
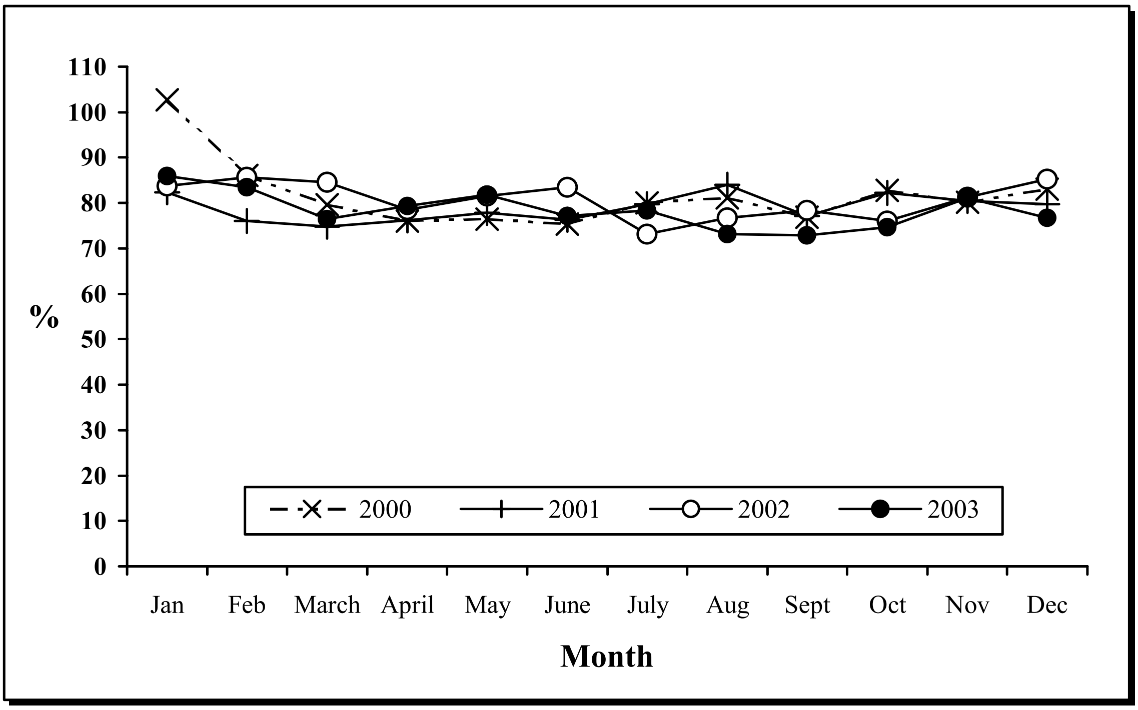


Figure 6. Trends in monthly bed occupancies (all units): 2000-2003.



16. Summary characteristics of the admissions during 2002 and 2003 are given in Table 4. The similarity between the two years is apparent and is not dissimilar to the 2001 data [2].

17. Figures 7 - 10 demonstrate ICU lengths of stay (LOS) in 2002 and 2003. Although median length of stay is the more appropriate way to describe the data (LOS is not normally distributed), both measures have value. The mean value can be heavily influenced by a small number of patients with a prolonged ICU stay. The practical consequences within a unit can be to markedly increase occupancy but reduce the number of beds available for new admissions, with potential impact on the service. The effect can be especially marked in smaller units. Mean and median lengths of stay have been stable year-on-year in Scotland, at 5.2 and 2.0 days respectively in 2002 and 5.0 and 2.0 days in 2003.

Table 4. Summary demographic characteristics of all admissions to Scottish ICUs in 2002 & 2003.

	All admissions 2002	**All admissions 2003**
N	8748	9119
Operative (%)	41.6	41.2
Non-operative (%)	58.4	58.8
Male (%)	55.8	54.5
Female (%)	44.2	45.5
Age (y) (Mean)	58.9	59.2
Age (y) (Range)	0-103	0-102
Length of ICU Stay (d) (Mean)	5.2	5.0
Length of ICU Stay (d) (Median)	2.0	2.0
Length of ICU Stay (d) (Range)	177.7	119.0
ICU Mortality (%)	21.9	not available
Hospital Mortality (%)	29.4	
Ultimate Hospital Mortality (%)	32.2	

Figure 7. Lengths of stay in Scottish ICUs, 2002 (Mean & Median).

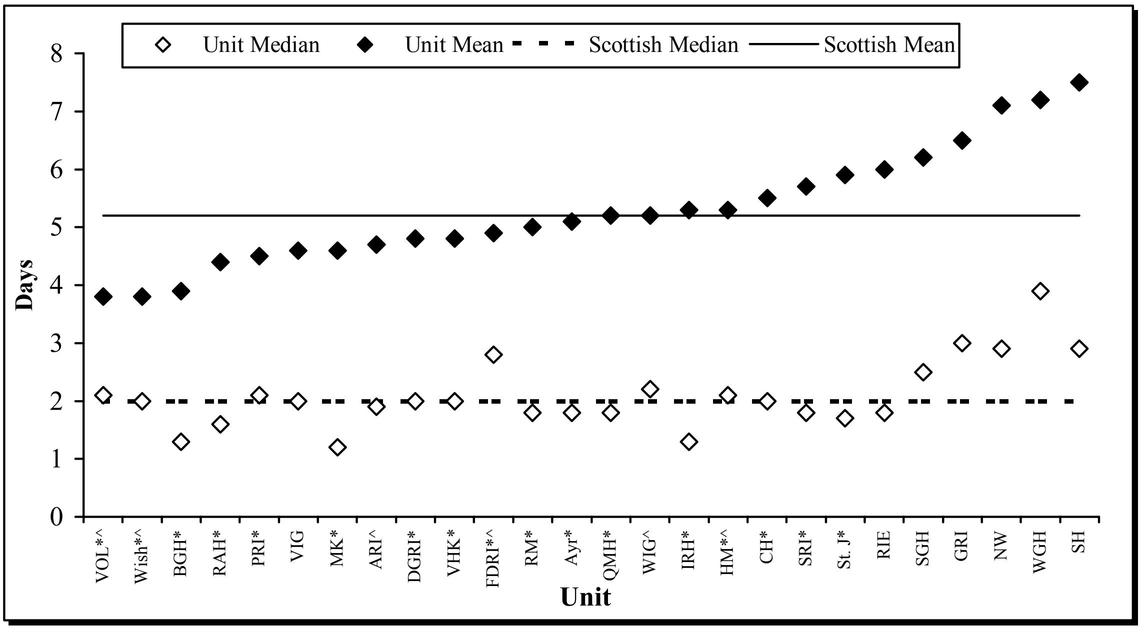


Figure 8. Lengths of stay in Scottish ICUs, 2003 (Mean & Median).

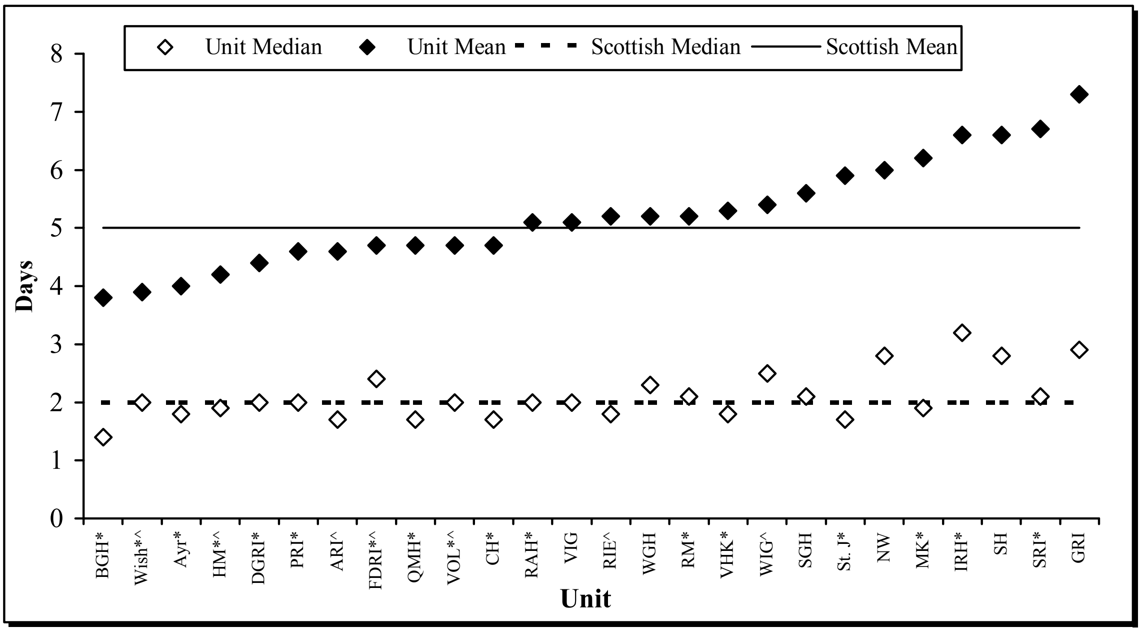


Figure 9. Length of ICU stay, 2002 (median and inter-quartile range). Scottish median = 2 days, IQR 0.9-5.6.

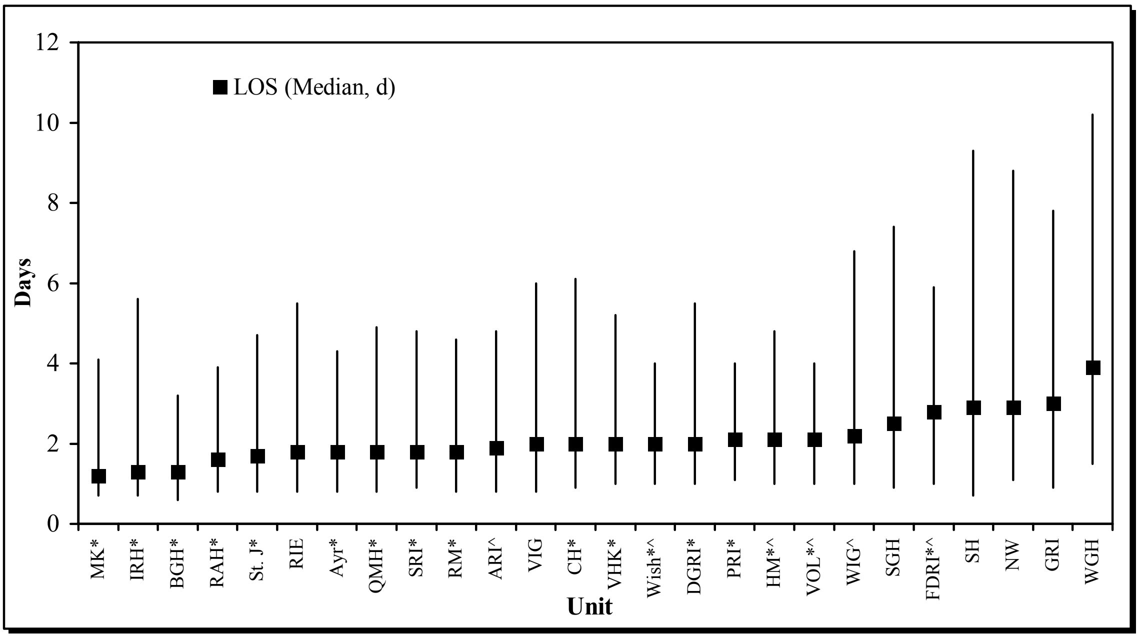
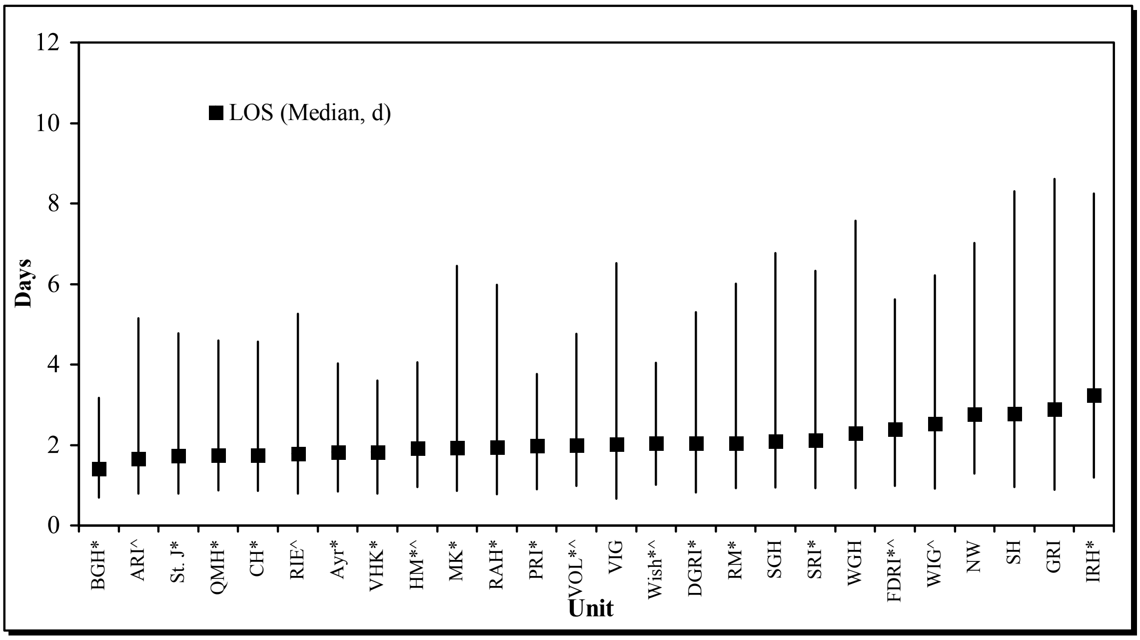


Figure 10. Length of ICU stay, 2003 (median and inter-quartile range). Scottish median = 2 days, IQR 0.9-5.4.



18. Tables 5 and 6 provide detailed information on each unit's length of stay during 2002 and 2003. In 2002 the Western General Hospital (WGH) in Edinburgh had the longest median ICU stay at 3.9 d (IQR 1.5d - 10.2d) and the second longest mean ICU LOS at 7.2d (Range 0.0d - 84.3d). This changed in 2003, when median and mean lengths of stay at the WGH fell to 2.3d (IQR 0.927d - 7.573d) and 5.2d (Range 0.0d – 47.2d) respectively. This is a mixed general and neurosurgical ICU in which greater than average lengths of ICU stay have been demonstrated previously. The reduction in the LOS between 2002 and 2003 is due to the opening of a 4-bedded level 2 HDU adjacent to the ICU. This has allowed earlier discharge of patients who do not require level 3 care but still need involvement of the critical care team. This ICU has not had any obvious decrease in bed occupancy between 2001, 2002 and 2003 (Table 3), instead, we see a 25% increase in the admissions rate of 358, 369 & 449 respectively. This is an example of a situation where the creation of level 2 beds, closely integrated with level 3 beds, has allowed an increase in level 3 admissions without an increase in level 3 beds or any detriment to patient care.

Table 5. Tabulated median and mean lengths of ICU stay, 2002.

Unit	ICU LOS(d)					
	Median	Lower IQR	Upper IQR	Mean	Minimum	Maximum
ARI^	1.9	0.8	4.8	4.7	0.0	82.6
Ayr*	1.8	0.8	4.3	5.1	0.0	48.9
BGH*	1.3	0.6	3.2	3.9	0.0	177.7
CH*	2.0	0.9	6.1	5.5	0.0	103.8
DGRI*	2.0	1.0	5.5	4.8	0.1	53.7
FDRI*^	2.8	1.0	5.9	4.9	0.0	69.2
GRI	3.0	0.9	7.8	6.5	0.0	59.7
HM*^	2.1	1.0	4.8	5.3	0.0	70.3
IRH*	1.3	0.7	5.6	5.3	0.1	80.5
MK*	1.2	0.7	4.1	4.6	0.0	75.2
NW	2.9	1.1	8.8	7.1	0.0	127.2
PRI*	2.1	1.1	4.0	4.5	0.1	52.1
QMH*	1.8	0.8	4.9	5.2	0.0	71.0
RAH*	1.6	0.8	3.9	4.4	0.1	61.0
RIE	1.8	0.8	5.5	6.0	0.0	88.9
RM*	1.8	0.8	4.6	5.0	0.0	108.0
SGH	2.5	0.9	7.4	6.2	0.0	45.0
SH	2.9	0.7	9.3	7.5	0.0	66.6
SRI*	1.8	0.9	4.8	5.7	0.1	69.9
St. J*	1.7	0.8	4.7	5.9	0.0	169.2
VHK*	2.0	1.0	5.2	4.8	0.1	33.1
VIG	2.0	0.8	6.0	4.6	0.0	45.0
VOL*^	2.1	1.0	4.0	3.8	0.1	50.1
WGH	3.9	1.5	10.2	7.2	0.0	84.3
WIG^	2.2	1.0	6.8	5.2	0.0	49.8
Wish*^	2.0	1.0	4.0	3.8	0.0	40.0
Scotland	**2.0**	**0.9**	**5.6**	**5.2**	**0.0**	**177.7**

Table 6. Tabulated median and mean lengths of ICU stay, 2003.

Unit	ICU LOS(d)					
	Median	Lower IQR	Upper IQR	Mean	Minimum	Maximum
ARI^	1.7	0.8	5.1	4.6	0.0	54.8
Ayr*	1.8	0.8	4.0	4.0	0.1	35.0
BGH*	1.4	0.7	3.2	3.8	0.0	51.6
CH*	1.7	0.9	4.6	4.7	0.0	51.5
DGRI*	2.0	0.8	5.3	4.4	0.0	44.8
FDRI*^	2.4	1.0	5.6	4.7	0.0	57.9
GRI	2.9	0.9	8.6	7.3	0.0	117.9
HM*^	1.9	1.0	4.1	4.2	0.0	101.3
IRH*	3.2	1.2	8.3	6.6	0.0	78.0
MK*	1.9	0.9	6.5	6.2	0.0	67.0
NW	2.8	1.3	7.0	6.0	0.0	59.2
PRI*	2.0	0.9	3.8	4.6	0.0	37.3
QMH*	1.7	0.9	4.6	4.7	0.0	98.9
RAH*	2.0	0.8	6.0	5.1	0.0	47.1
RM*	2.1	0.9	6.0	5.2	0.0	56.4
RIE^	1.8	0.8	5.3	5.2	0.0	111.2
SGH	2.1	0.9	6.8	5.6	0.0	62.7
SH	2.8	1.0	8.3	6.6	0.0	107.7
SRI*	2.1	0.9	6.3	6.7	0.0	52.7
St. J*	1.7	0.8	4.8	5.9	0.1	84.7
VHK*	1.8	0.8	3.6	5.3	0.0	71.5
VIG	2.0	0.7	6.5	5.1	0.0	59.2
VOL*^	2.0	1.0	4.8	4.7	0.2	119.0
WGH	2.3	0.9	7.6	5.2	0.0	47.2
WIG^	2.5	0.9	6.2	5.4	0.0	43.4
Wish*^	2.0	1.0	4.0	3.9	0.0	63.0
Scotland	**2.0**	**0.9**	**5.4**	**5.0**	**0.0**	**119.0**

F.2. Use of Augmented Care Period (ACP) data to determine levels of organ support and levels of care.

19. The level of organ support may be influenced by both the patients admitted and the approach employed by the clinical staff. It can be seen as complimentary to occupancy data when attempting to characterise workload, severity of illness and the consequent staffing requirements. The intervention results described in this section are primarily from ACP or augmented care period data recorded daily during 2002 and 2003. The daily ACP dataset incorporates Yes or No responses to the following fields for every calendar day:

- Intubated
- Connected to a ventilator
- Face Mask CPAP
- Pulmonary artery flotation catheter
- Inotropes/vasopressors
- Filtration/dialysis

The first and last ACP days may be for only a few hours in the intensive care unit during that day. Nevertheless, as the aim is to assess the greatest levels of support, if any of the categories have been utilised in that day, even if not at the time of recording the data, the response should always be Yes.

20. The Scottish ACP dataset was developed in 1998 and is similar to that used in England. The intention was primarily to characterise patients according to the interventions required. The Therapeutic Intervention Scoring System (TISS) [3] had been obligatory for the first 3-years of the audit (1995-1997) and was utilised along with APACHE III [4] to identify levels of care (low-risk monitoring, high-risk monitoring and active treatment). TISS was complex however, making it difficult to complete and almost impossible to validate. When the use of APACHE III was discontinued in 1998, we decided to replace TISS with a simple ACP dataset for routine analysis. (TISS remains available for units to use internally if they wish.)

21. With an increase in the number of combined HDU/ICUs and the audit now encompassing HDUs as well as ICUs, there is a need to modify the ACP dataset. Work has been ongoing to determine the most effective and appropriate dataset, one which will stratify patients once more by levels of care, this time based on Levels 1, 2 & 3 as identified in *Better Critical Care* [5]. Modifications to the SICSAG dataset have been consulted on to achieve this objective in a manner as user friendly as possible and it is intended that these will be implanted early in 2005.

22. An extensive database of the key ACP interventions has developed since 1999 and collection of these daily intervention data allows us to gain insights into variations in practice, both between units and with time. The following series of figures and tables attempts to convey the level of work conducted in each Scottish ICU during 2002 and 2003 and the 5-year trends of specific interventions. We would encourage units to examine their practice, not only in relation to the national norm but also in relation to that of comparable units.

Ventilation.

23. Figures 11 and 12 demonstrate the proportion of patients ventilated on the first ‘ACP day’ of ICU care in each unit during 2002 and 2003. The first ACP day is the time between ICU admission and midnight that day: this may be only a few hours during which some patients are assessed prior to instituting key interventions. Variations are entirely understandable, with larger units, predominantly in teaching hospitals, having the greater level of this key intervention. It is also important to recognise that collection of data on all admissions to the combined HDU/ICU facilities underestimates the proportion of ‘ICU’ patients who are ventilated. The Scottish mean of 63.8% in 2002 (Figure 11) is as low as a result of the inclusion of the rates of ventilation on day 1 in a number of these combined units (Falkirk Royal Infirmary, Wishaw, Vale of Leven and Hairmyres). In almost half of all units, more than 75% of patients are ventilated in their first few hours in ICU.

Figure 11. Proportion of patients ventilated on the first ACP day during 2002.

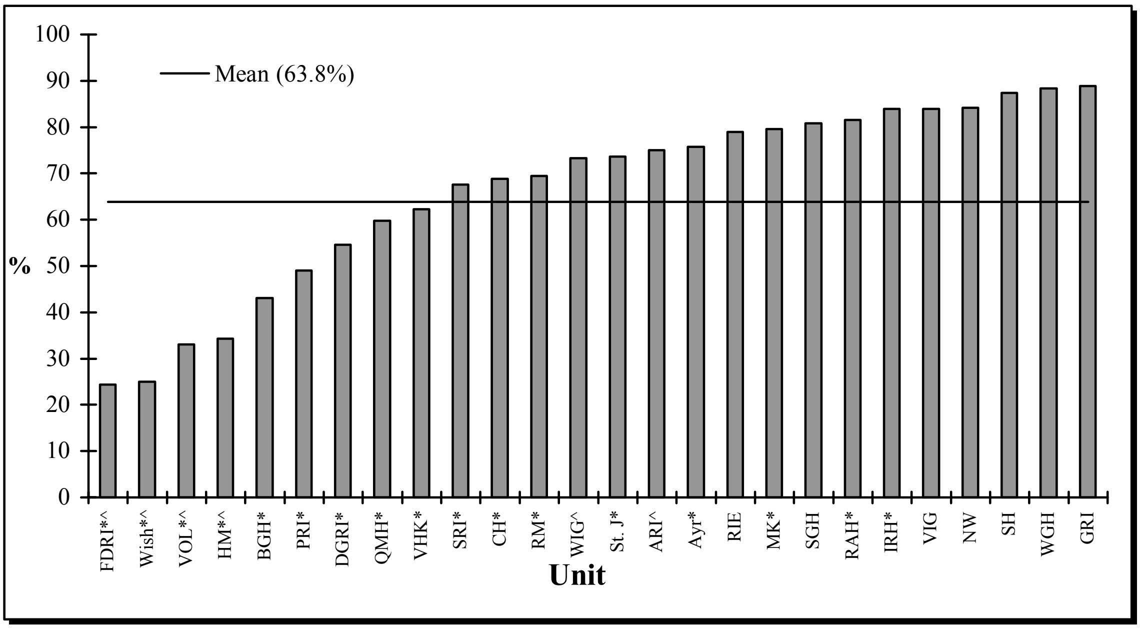
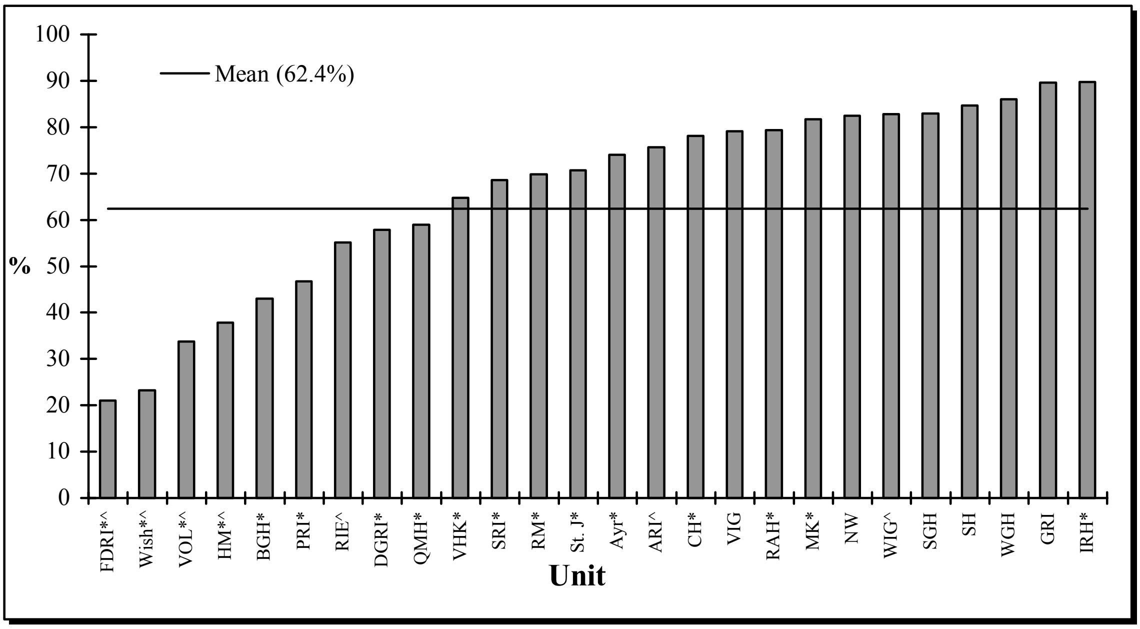


Figure 12. Proportion of patients ventilated on the first ACP day during 2003.



24. A similar pattern is seen in Figures 13 and 14, both displaying annual rates of ventilation at any time in the ICU stay. In 2003, 17 units had ventilation rates greater than the national average and in 13 units more than 75% of admissions were ventilated.

25. On average during 2002 and 2003, 94% of all patients who are ventilated during their ICU stay are ventilated on day 1 (Figures 15 and 16). There is little variation between the units.

26. One unit displaying a reduction in ventilation rates is the Royal Infirmary of Edinburgh, from 82.3% in 2002 to 60.4% in 2003 (Figures 13 and 14). This is a consequence of the co-location of 6 HDU (level 2) beds alongside the 11 ICU (level 3) beds within the new unit, which culminated in a 35.4% increase in admissions (Table 1). The service changes in both Aberdeen and the Western Infirmary, Glasgow, (co-location of 4 and 2 level 2 beds respectively) have had less profound effects. The ventilation rate in Aberdeen has decreased from 85.3% in 2001 to approximately 80% in both 2002 and 2003. After a reduction from 84.6% in 2001 to 76.1% in 2002 in the Western Infirmary, the ventilation rate has risen once more to 84.4% in 2003. These issues will prevail as more ‘critical care’ units develop. It is with this in mind that the ACP dataset and stratification of patients into levels of care is a priority for the audit group.

Figure 13. Proportion of patients ventilated at any time during 2002.

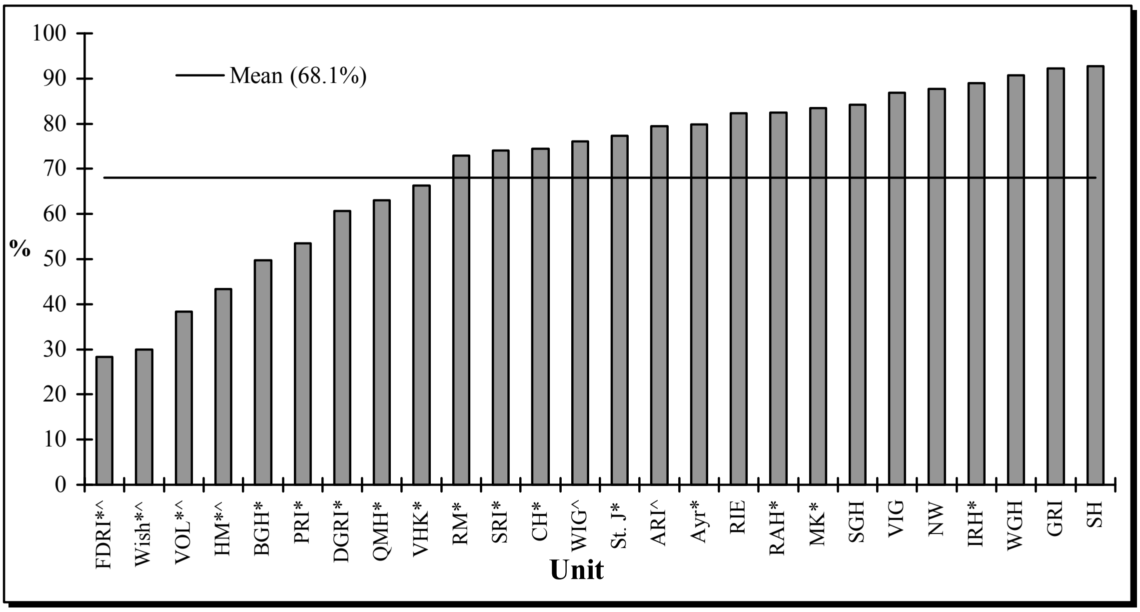


Figure 14. Proportion of patients ventilated at any time during 2003.

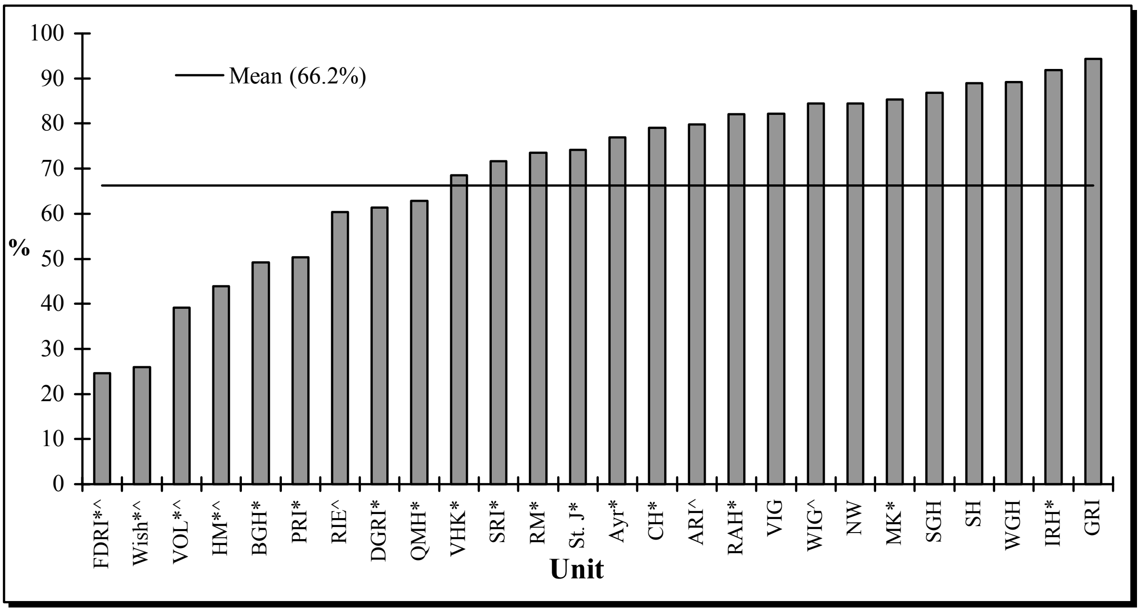


Figure 15. Proportion of ventilated patients in 2002 who are ventilated on day 1.

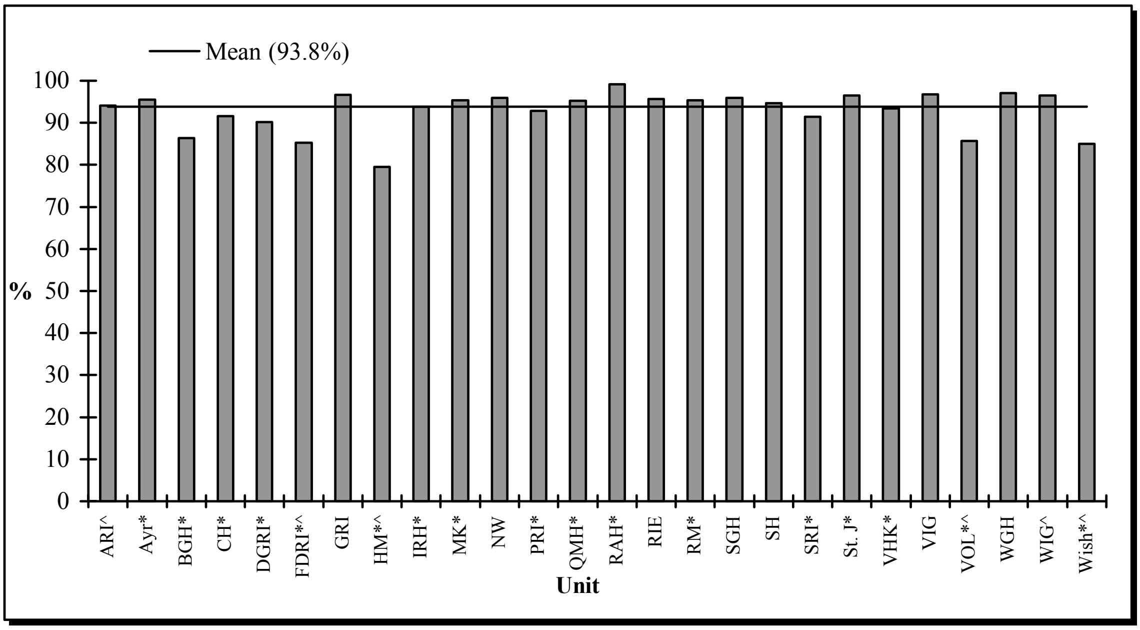
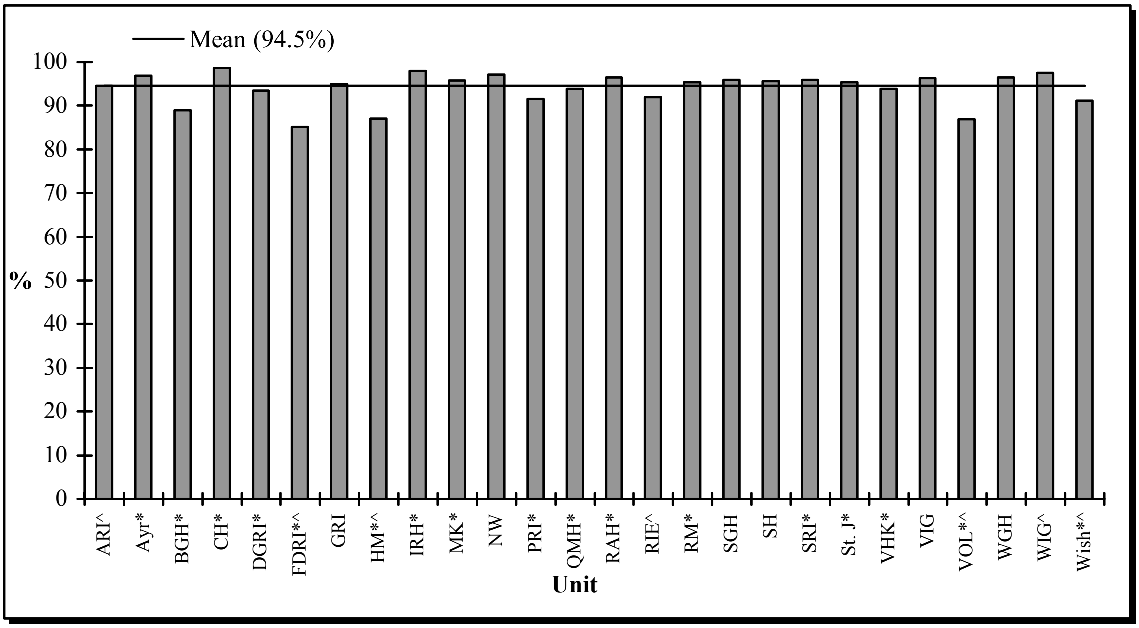


Figure 16. Proportion of ventilated patients in 2003 who are ventilated on day 1.



27. Overall, ventilation rates in Scotland have decreased over time (Table 7), with an increase in combined ICU/HDUs admitting a higher proportion of patients who are never ventilated.

Table 7. Five-year trend in ventilation rates (1999-2003).

Year	Proportion of patients ventilated on 1st ACP day (%)	Proportion of patients ventilated at any time (%)
2003	62.4	66.2
2002	63.8	68.1
2001	66.6	70.4
2000	68.2	72.2
1999	67.2	70.6

28. Figures 17 and 18 demonstrate the consistency of the ventilation rates over the first 100 days in ICU. The ACP data should be recorded in such a way as to reflect the greatest intervention in a given calendar day. For example, a patient who is ventilated for only part of the day should have ventilation recorded. There is a fall in the proportion ventilated over the first couple of days, but the great majority of long-stay patients remain ventilated. We have previously published a review of the characteristics and outcome of patients remaining in the ICU for 30 days or greater [6]. The number of patients is low, decreasing with length of stay.

29. The decrease in the proportion of patients ventilated on day 2 may be a real decrease, with patients being prepared for discharge from intensive care (the median length of ICU stay being 2 days (Table 4)). There is also a possibility that staff are recording the last ACP prior to discharge as *not* ventilated when the patient may well have been ventilated for part of that day.

Figure 17. Proportion of all patients treated in ICUs in 2002 who are ventilated, per ACP day.

Includes the ACP days in 2002 of patients admitted in 2001 whose stay continued into 2002.

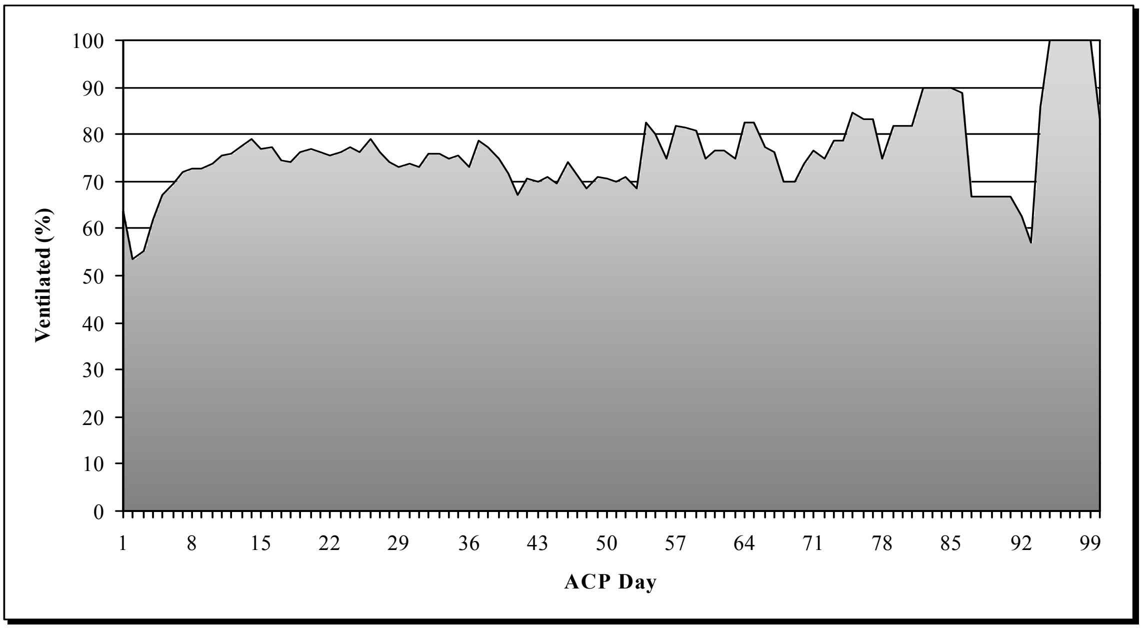
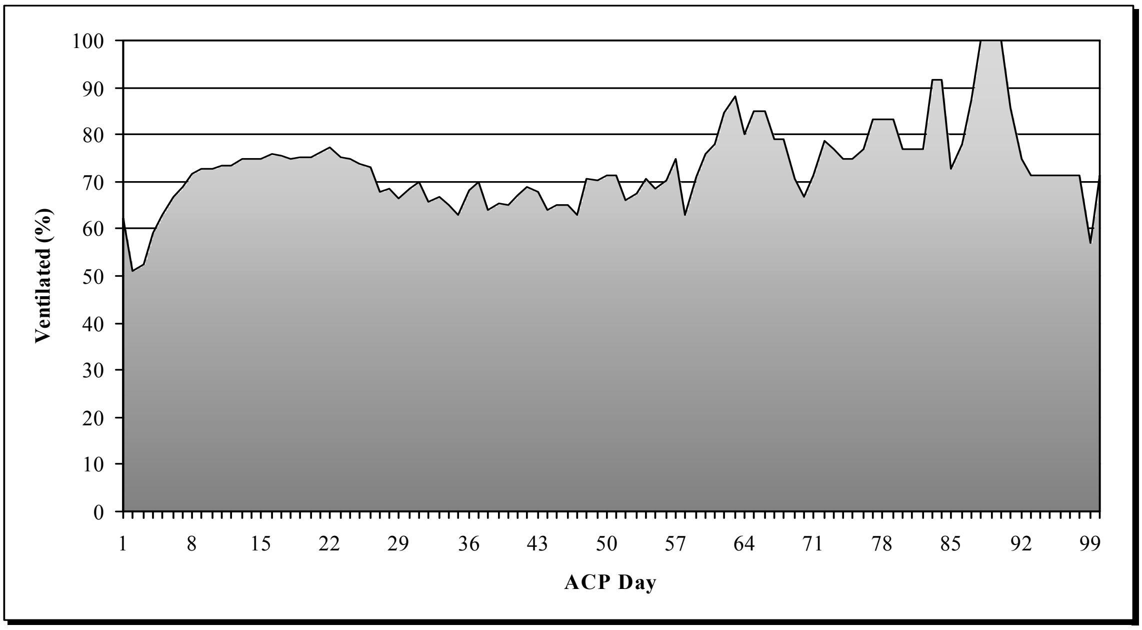


Figure 18. Proportion of all patients treated in ICUs in 2003 who are ventilated, per ACP day.

Includes the ACP days in 2003 of patients admitted in 2002 whose stay continued into 2003.



30. During 2002 and 2003, the proportion of the total number of ACP days on which ventilation was utilised in Scotland was similar (Figures 19 and 20). There was, however, year-on-year variation in some units. The effect of the changes to the resources in the Royal Infirmary of Edinburgh is evident, once again, with a 20% reduction in the proportion of days in which ventilation is utilised between the two years.

31. There appears to be continuous pressure in a number of units, with an increase from 5 to 11 providing ventilation during at least 80% of the ACP days. Of those units, both Inverclyde Royal Hospital and Glasgow Royal Infirmary were ventilating 90% of the time in 2003.

Figure 19. Proportion of ACP days in which there is ventilatory support: 2002. Mean = 66.6% of ACP days.

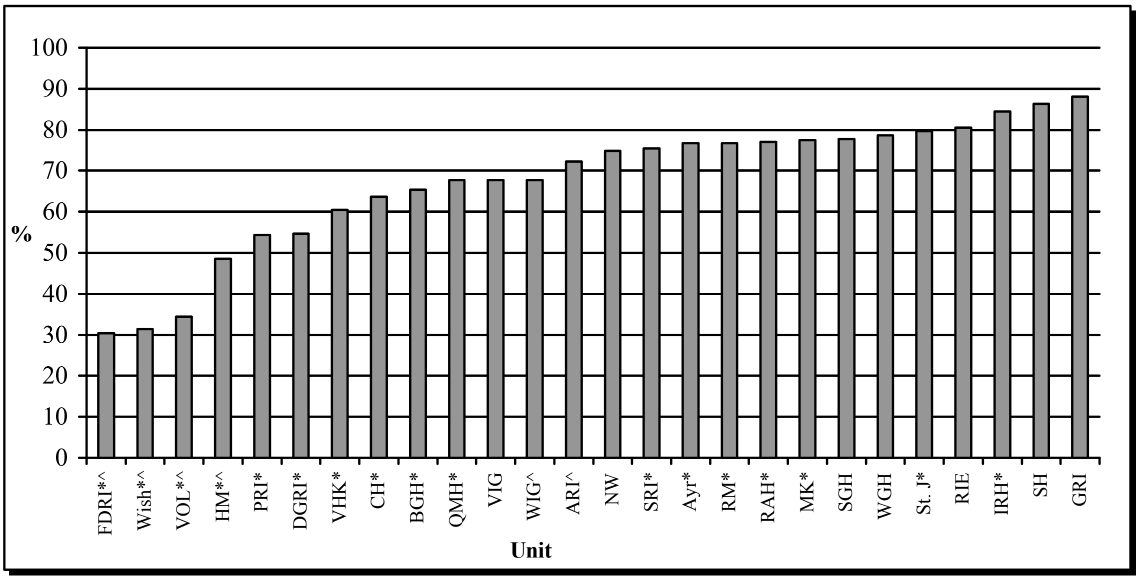
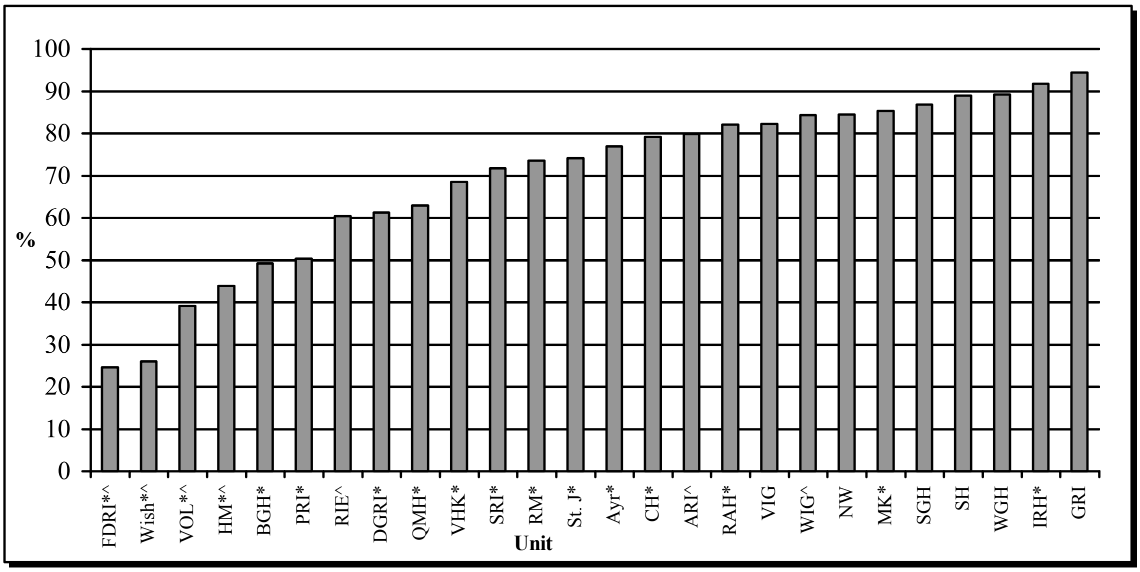


Figure 20. Proportion of ACP days in which there is ventilatory support: 2003. Mean = 66.2% of ACP days.



Renal replacement therapy.

32. As well as identifying the units in which renal replacement therapy (RRT) has been provided in 2002 and 2003, Figures 21 and 22 demonstrate the number of patients in these units who had RRT delivered and the proportion they represent of each unit's ICU admissions.

Figure 21. Provision of renal replacement therapy in 2002.

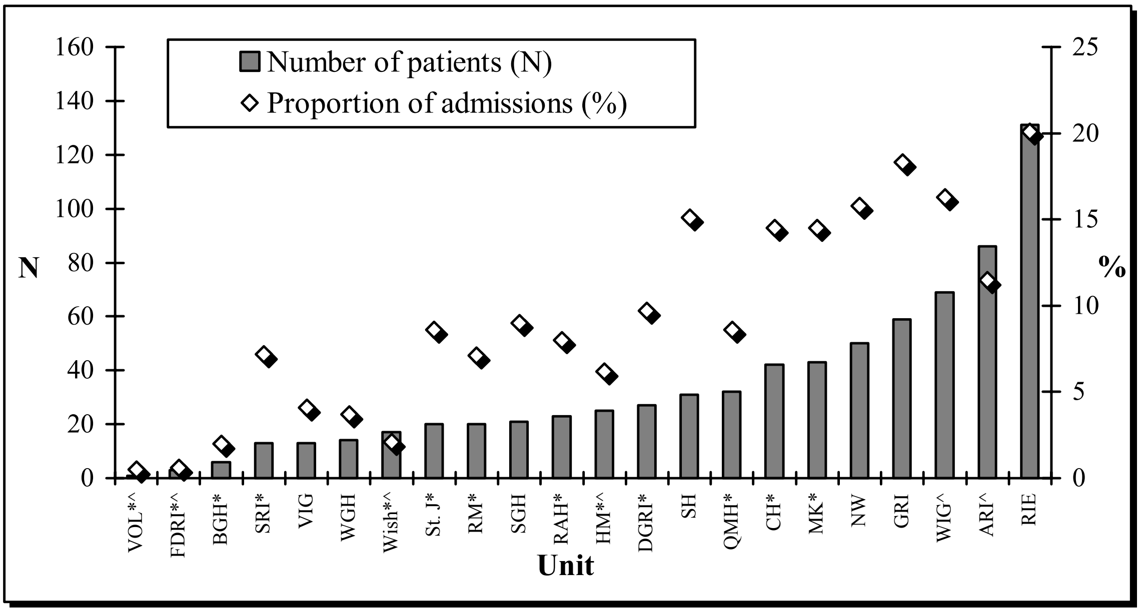
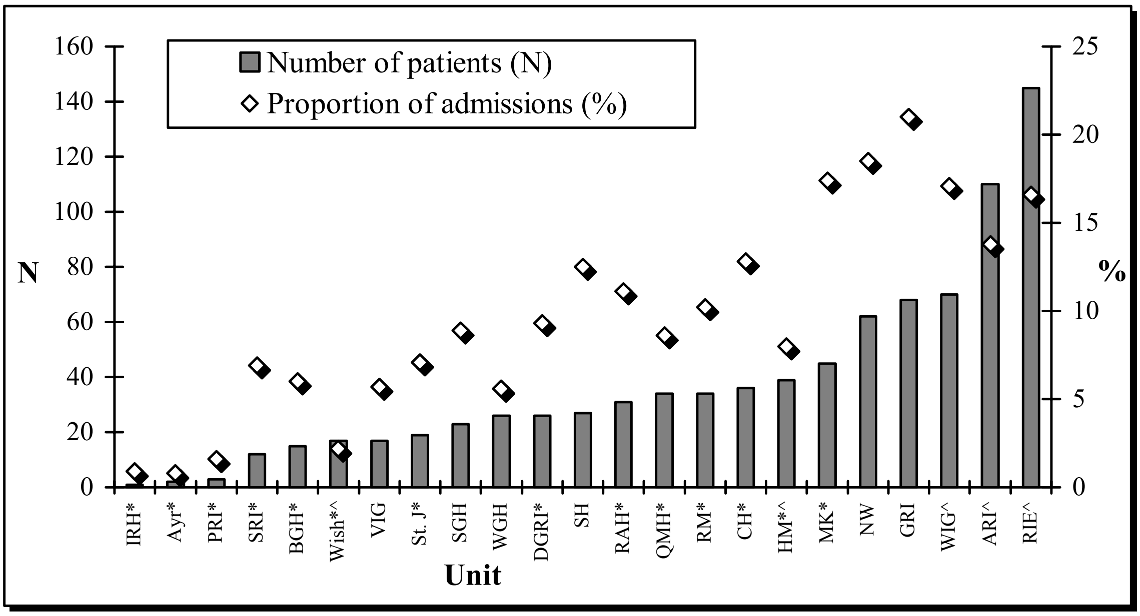


Figure 22. Provision of renal replacement therapy in 2003.



33. The proportion of patients receiving this intervention does not vary greatly within units from one year to another. Unsurprisingly, with an overall increase of 26% in its admissions, there was an increase in the number of patients in ICU at the Royal Infirmary of Edinburgh requiring this intervention, from 131 to 145. This, however, represented an overall decrease of 4% in the proportion of patients being treated with RRT between 2002 and 2003 in that unit.

34. Figures 23 and 24 complement Figures 21 and 22, demonstrating the proportion of total ACP days on which RRT was provided. Variation in the need for RRT amongst units with comparable case mix might arise from differences in the threshold for institution of RRT, the extent to which such support is instituted in patients with poor expectation of survival and the extent to which renal failure occurs during intensive care.

35. Since 1999, there has been a 2.4% increase in the proportion of patients given RRT in Scottish ICUs (Table 8).

Table 8. Five-year trend in the rates of delivering RRT (1999-2003)

Year	Proportion of patients with RRT (%)	Proportion of ACP days of RRT (%)
2003	9.4	10.3
2002	8.6	8.9
2001	8.1	8.5
2000	7.6	8.8
1999	7.0	9.1

Figure 23. Provision of renal replacement therapy in 2002. Proportion of patients in Scottish ICUs receiving RRT = 8.6%, utilising 8.9% of ACP days.

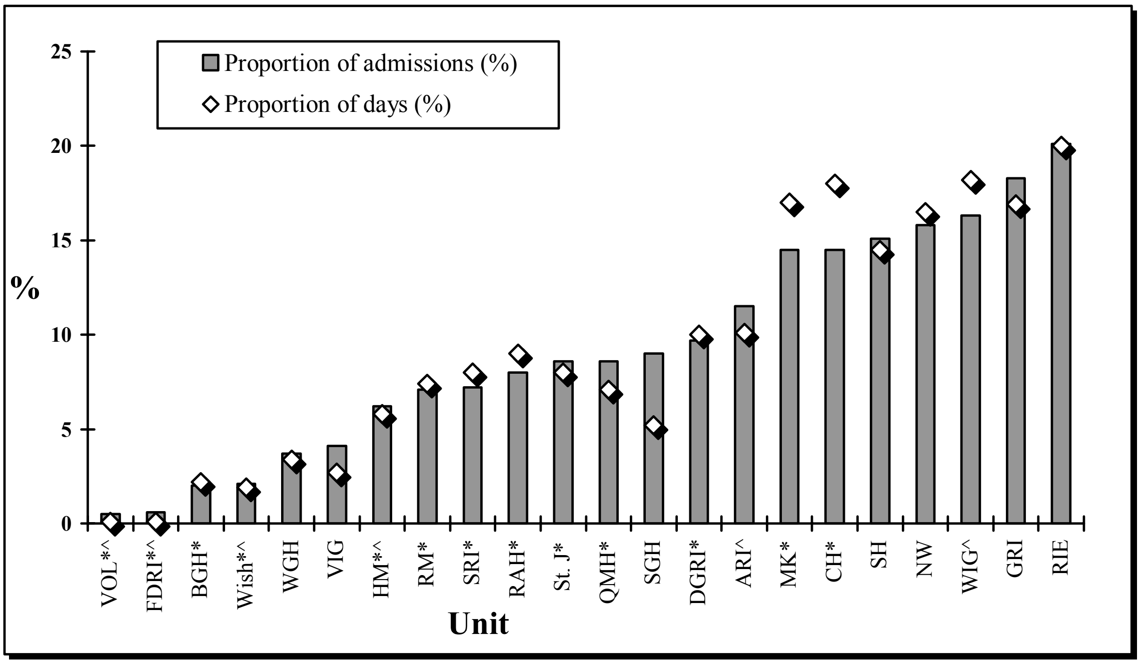
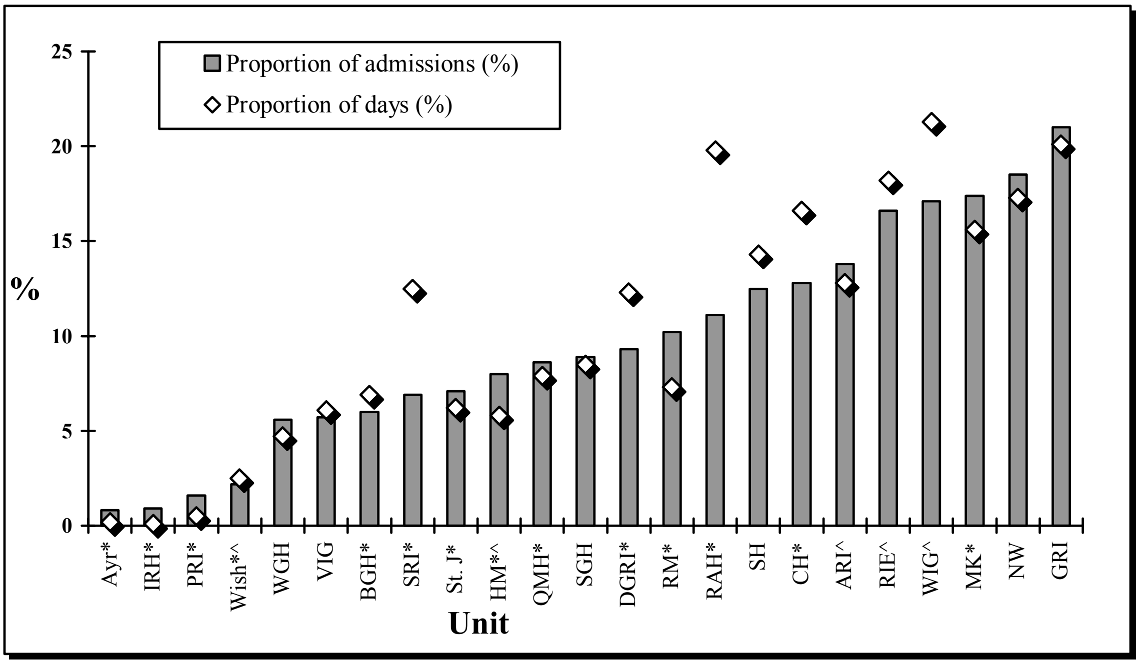


Figure 24. Provision of renal replacement therapy in 2003. Proportion of patients in Scottish ICUs receiving RRT = 9.4%, utilising 10.3% of ACP days.



Pulmonary artery flotation catheters (PAFCs).

36. Inevitably, there is variation in the approach to patient management, both within and between units. Although such variation is unlikely to affect greatly the number of patients ventilated in an ICU, we have already described how the institution of RRT may, in part, be due to such variations. This may also be true of the use of inotropes and more particularly of pulmonary artery flotation catheters (PAFCs).

37. Over the years there has been striking variation in the utilisation of PAFCs between comparable units. In Scotland in 2001, there were still 8 units which monitored over 10% of their patients using PAFCs, 5 of which utilised it in over 20%. The use of PAFCs in 2002 and 2003 is demonstrated in Figure 25 and 26. In the most recent data, 2003, only 3 units monitored between 10% and 20% of patients in this manner.

38. Table 9 confirms the diminished use of this monitoring tool. The use of PAFCs has been controversial and has been discussed previously in greater detail [7]. Results of a randomised controlled clinical trial assessing pulmonary artery catheters, conducted by the Intensive Care National Audit and Research Centre in London, are awaited. Alternative tools for assessing cardiac indices are increasingly used and alterations to the minimum ACP dataset will attempt to address this issue.

Table 9. Five-year trend in PAFC utilisation rates (1999-2003).

Year	Proportion of patients with PAFC on 1st ACP day (%)	Proportion of patients with PAFC at any time (%)
2003	3.2	5.6
2002	4.8	8.3
2001	6.7	10.9
2000	9.0	14.5
1999	10.0	15.0

Figure 25. Proportion of patients with PAFC *in situ* on 1st day of ICU (mean = 4.8%) or at any time during ICU (mean = 8.3%): 2002.

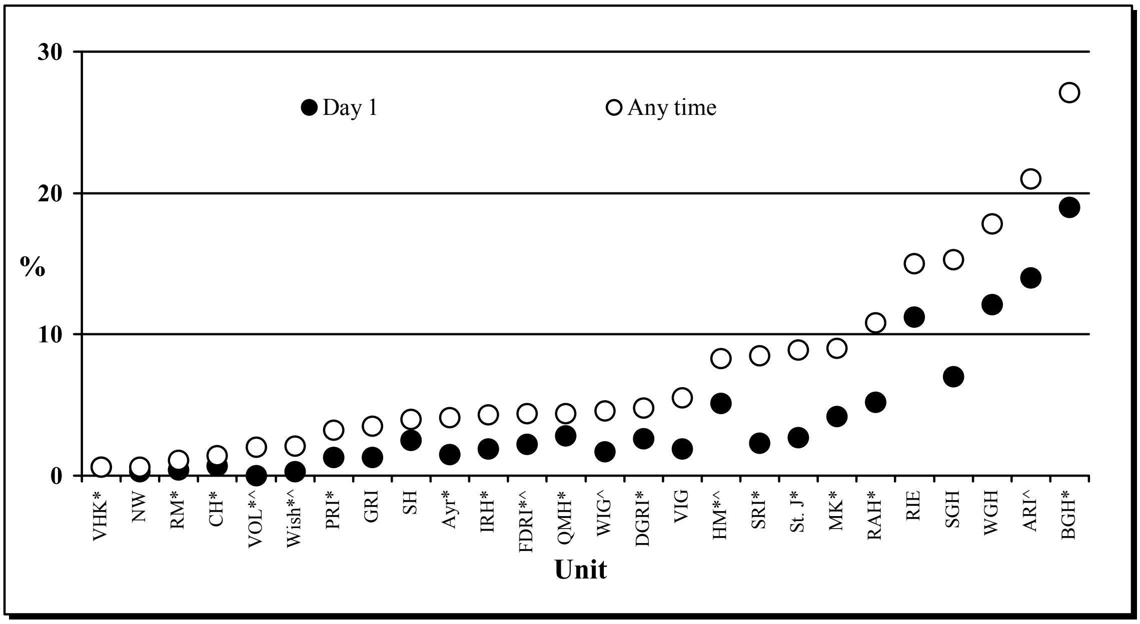
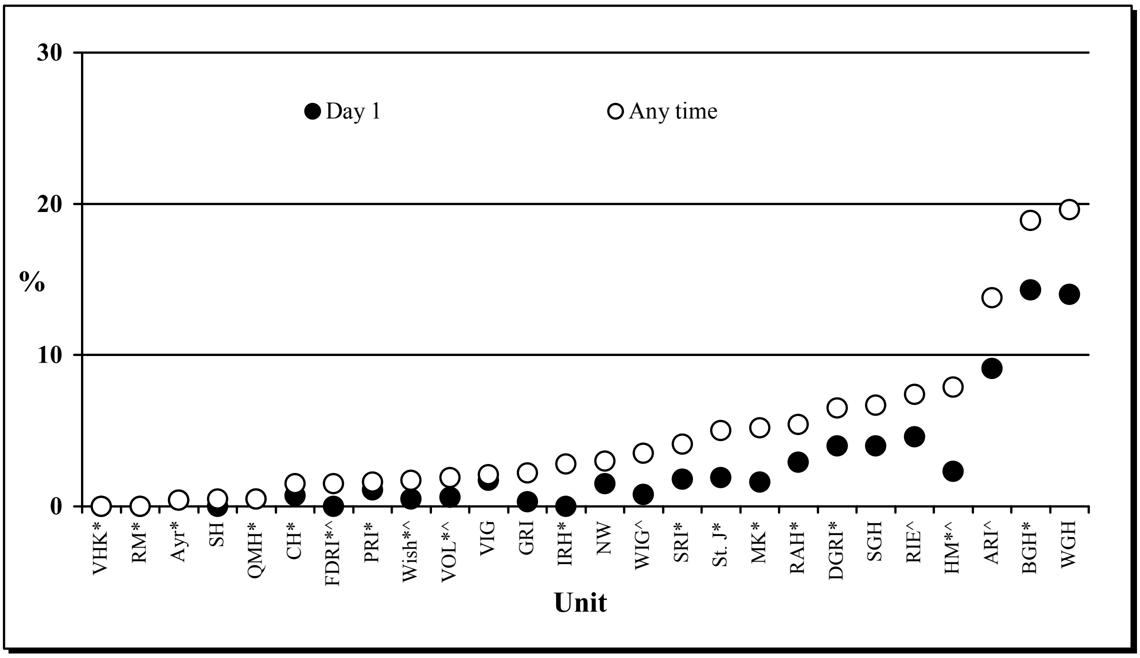


Figure 26. Proportion of patients with PAFC *in situ* on 1st day of ICU (mean = 3.2%) or at any time during ICU (mean = 5.6%): 2003.



Inotropes/vasopressors.

39. Presented in Figures 27 and 28 are data demonstrating the extent to which inotropes/vasopressors are utilised during the intensive care period. On average, approximately 37% of admissions to Scottish ICUs received this therapeutic intervention in 2002 and 2003 (38% in 2001).

40. There is wide variation in the use of inotropes/vasopressors, from 10% in Falkirk Royal Infirmary to just over 63% at the Western General Hospital in 2003. The units with the least usage are, as expected, the combined HDU/ICUs. These variations reflect the different case mix of admissions and may also reflect differing approaches to management. In the combined units, these figures reflect the proportion of inotropes/vasopressors administered to all admissions, whether HDU or ICU patients.

Number and proportion of ACP days of specific therapies or interventions.

41. Summary data of various key interventions and / or therapies that were utilised in the 26 adult, general ICUs in Scotland are tabulated in Tables 10 and 11. In 2002, data for a total of 53,110 ACP days were available for 8,748 admissions. For the 9,119 admissions in 2003, data for a total of 54,807 ACP days were available.

Figure 27. Proportion of patients receiving inotropes/vasopressors in Scottish ICUs: 2002.

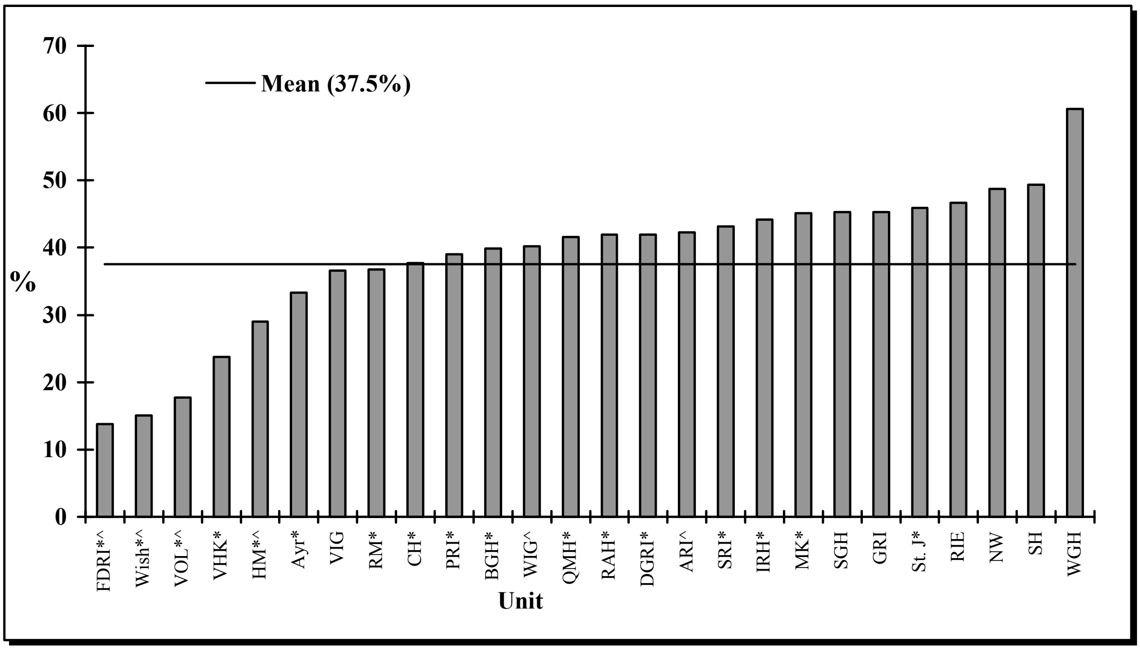


Figure 28. Proportion of patients receiving inotropes/vasopressors in Scottish ICUs: 2003.

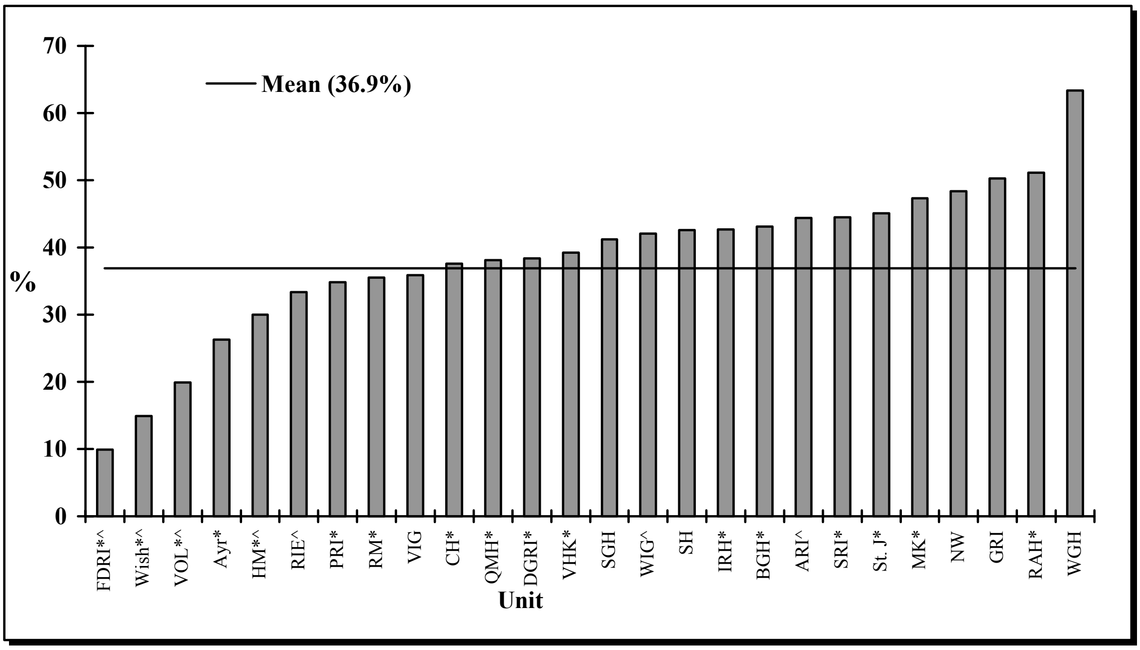


Table 10. Summary ACP data demonstrating the extent of organ support in each ICU during 2002.

Includes patients admitted to ICU in 2001, still in ICU in 2002.

	ACP Days, all admissions																		
Unit	Total days	Ventilator days		Intubation days		Tracheostomy days		Mask CPAP days		PAFC days		Inotrope days		RRT days		ICP Monitor days	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
ARI^	4143	2993	72.2	1888	45.6	1556	37.6	294	7.1	425	10.3	932	22.5	418	10.1	111	2.7
Ayr*	1229	943	76.7	583	47.4	427	34.7	47	3.8	20	1.6	182	14.8	0	0.0	1	0.1
BGH*	1513	989	65.4	520	34.4	494	32.7	50	3.3	271	17.9	438	28.9	33	2.2	1	0.1
CH*	1789	1140	63.7	806	45.1	471	26.3	56	3.1	6	0.3	441	24.7	322	18.0	2	0.1
DGRI*	1586	867	54.7	671	42.3	349	22.0	120	7.6	31	2.0	438	27.6	158	10.0	3	0.2
FDRI*^	3036	922	30.4	557	18.3	653	21.5	64	2.1	49	1.6	190	6.3	3	0.1	4	0.1
GRI	2470	2175	88.1	1941	78.6	239	9.7	17	0.7	15	0.6	509	20.6	417	16.9	24	1.0
HM*^	2485	1206	48.5	924	37.2	438	17.6	76	3.1	108	4.3	397	16.0	143	5.8	2	0.1
IRH*	982	829	84.4	673	68.5	192	19.6	49	5.0	14	1.4	206	21.0	0	0.0	2	0.2
MK*	1630	1262	77.4	1011	62.0	334	20.5	74	4.5	66	4.0	511	31.3	277	17.0	7	0.4
NW	2493	1865	74.8	1601	64.2	451	18.1	170	6.8	5	0.2	568	22.8	411	16.5	63	2.5
PRI*	865	470	54.3	395	45.7	143	16.5	62	7.2	18	2.1	214	24.7	0	0.0	0	0.0
QMH*	2268	1535	67.7	1180	52.0	481	21.2	33	1.5	36	1.6	712	31.4	162	7.1	9	0.4
RAH*	1530	1178	77.0	1084	70.8	162	10.6	23	1.5	80	5.2	419	27.4	138	9.0	11	0.7
RIE	4373	3520	80.5	2425	55.5	1240	28.4	83	1.9	161	3.7	1178	26.9	873	20.0	84	1.9
RM*	1693	1300	76.8	985	58.2	412	24.3	72	4.3	9	0.5	329	19.4	126	7.4	8	0.5
SGH	1676	1304	77.8	990	59.1	421	25.1	44	2.6	105	6.3	400	23.9	87	5.2	13	0.8
SH	1633	1409	86.3	1315	80.5	149	9.1	5	0.3	17	1.0	425	26.0	237	14.5	1	0.1
SRI*	1210	912	75.4	477	39.4	553	45.7	30	2.5	49	4.0	352	29.1	97	8.0	2	0.2
St. J*	1568	1250	79.7	623	39.7	727	46.4	44	2.8	63	4.0	480	30.6	125	8.0	1	0.1
VHK*	932	563	60.4	440	47.2	236	25.3	28	3.0	2	0.2	106	11.4	0	0.0	0	0.0
VIG	1761	1192	67.7	967	54.9	383	21.7	106	6.0	37	2.1	355	20.2	48	2.7	15	0.9
VOL*^	961	331	34.4	283	29.4	124	12.9	20	2.1	10	1.0	116	12.1	1	0.1	0	0.0
WGH	2950	2321	78.7	1627	55.2	965	32.7	119	4.0	185	6.3	1048	35.5	101	3.4	353	12.0
WIG^	2533	1718	67.8	1516	59.8	343	13.5	51	2.0	37	1.5	489	19.3	461	18.2	5	0.2
Wish*^	3810	1197	31.4	1102	28.9	313	8.2	80	2.1	46	1.2	459	12.0	72	1.9	5	0.1
Scotland	**53119**	**35391**	**66.6**	**26584**	**50.0**	**12256**	**23.1**	**1817**	**3.4**	**1865**	**3.5**	**11894**	**22.4**	**4710**	**8.9**	**727**	**1.4**

Table 11. Summary ACP data demonstrating the extent of organ support in each ICU during 2003.

Includes patients admitted to ICU in 2002, still in ICU in 2003.

	ACP Days, all admissions																		
Unit	**Total days**	**Ventilator days**		**Intubation days**		**Tracheostomy days**		**Mask CPAP days**		**PAFC days**		**Inotrope days**		**RRT days**		**ICP Monitor days**	
		N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
ARI^	4504	3247	72.1	2211	49.1	1352	30.0	364	8.1	261	5.8	1161	25.8	576	12.8	124	2.8
Ayr*	1214	833	68.6	656	54.0	221	18.2	23	1.9	2	0.2	199	16.4	2	0.2	3	0.2
BGH*	1155	694	60.1	460	39.8	234	20.3	79	6.8	162	14.0	502	43.5	80	6.9	0	0.0
CH*	1619	1138	70.3	867	53.6	404	25.0	38	2.3	5	0.3	410	25.3	269	16.6	3	0.2
DGRI*	1485	754	50.8	576	38.8	293	19.7	130	8.8	45	3.0	353	23.8	183	12.3	1	0.1
FDRI*^	3120	722	23.1	514	16.5	382	12.2	65	2.1	12	0.4	139	4.5	0	0.0	1	0.0
GRI	2603	2344	90.0	1972	75.8	359	13.8	42	1.6	21	0.8	659	25.3	523	20.1	5	0.2
HM*^	2494	1196	48.0	987	39.6	317	12.7	74	3.0	107	4.3	481	19.3	144	5.8	10	0.4
IRH*	852	706	82.9	541	63.5	195	22.9	50	5.9	5	0.6	192	22.5	1	0.1	1	0.1
MK*	1837	1491	81.2	1185	64.5	426	23.2	81	4.4	33	1.8	513	27.9	286	15.6	2	0.1
NW	2330	1595	68.5	1278	54.8	556	23.9	195	8.4	24	1.0	580	24.9	403	17.3	39	1.7
PRI*	1023	555	54.3	472	46.1	178	17.4	60	5.9	7	0.7	191	18.7	5	0.5	1	0.1
QMH*	2198	1391	63.3	1100	50.0	434	19.7	66	3.0	7	0.3	505	23.0	174	7.9	7	0.3
RAH*	1673	1241	74.2	1049	62.7	312	18.6	18	1.1	34	2.0	553	33.1	332	19.8	10	0.6
RIE^	5338	3293	61.7	2486	46.6	1007	18.9	156	2.9	101	1.9	1052	19.7	972	18.2	67	1.3
RM*	2068	1385	67.0	980	47.4	570	27.6	81	3.9	0	0.0	381	18.4	150	7.3	3	0.1
SGH	1681	1296	77.1	1012	60.2	333	19.8	66	3.9	47	2.8	420	25.0	143	8.5	5	0.3
SH	1709	1456	85.2	1127	65.9	374	21.9	18	1.1	2	0.1	350	20.5	244	14.3	2	0.1
SRI*	1293	967	74.8	532	41.1	528	40.8	37	2.9	20	1.5	375	29.0	161	12.5	2	0.2
St. J*	1739	1174	67.5	696	40.0	691	39.7	83	4.8	26	1.5	467	26.9	107	6.2	22	1.3
VHK*	889	677	76.2	432	48.6	285	32.1	30	3.4	0	0.0	172	19.3	0	0.0	8	0.9
VIG	1812	1152	63.6	955	52.7	428	23.6	81	4.5	13	0.7	310	17.1	111	6.1	11	0.6
VOL*^	936	465	49.7	282	30.1	252	26.9	22	2.4	8	0.9	135	14.4	0	0.0	1	0.1
WGH	2857	2245	78.6	1715	60.0	718	25.1	99	3.5	246	8.6	1113	39.0	134	4.7	294	10.3
WIG^	2610	1849	70.8	1595	61.1	367	14.1	92	3.5	25	1.0	459	17.6	556	21.3	25	1.0
Wish*^	3768	1237	32.8	1022	27.1	392	10.4	32	0.8	32	0.8	491	13.0	96	2.5	11	0.3
Scotland	**54807**	**35103**	**64.0**	**26702**	**48.7**	**11608**	**21.2**	**2082**	**3.8**	**1245**	**2.3**	**12163**	**22.2**	**5652**	**10.3**	**658**	**1.2**

Levels of care.

42. A more complete picture of the variation in dependency and organ support has been made in past reports, by aggregating the days on which each patient receives one or more key interventions, i.e., ventilation, renal replacement therapy or cardiovascular support. The audit group has received requests to demonstrate resource utilisation by the dependency levels: 3 (most dependent), 2 and 1 (least dependent). A modified ACP dataset, which will be in place early in 2005, will map key interventions to these levels of dependency. No such facility is available in the current dataset, however, in preparation for displaying this type of data in the future we have attempted to map the current ACP dataset to levels of care in this report. The daily ACP records for every admission were used to determine the proportions of each level of care for each unit, using the classifications:

Level 3:	- Advanced respiratory support (ventilator plus intubation or ventilator plus tracheostomy. - Any two other organs supported
Level 2:	- One organ support (other than advanced respiratory support)
Level 1:	- No organ support

43. In England, the ACP allows a patient who has had no organ support (level 1) but who cannot be safely looked after in a general ward, or is at risk of deteriorating, to be categorised as level 2. The current Scottish ACP dataset does not account for this, therefore, the results will likely overestimate the proportion of level 1 days, particularly in the combined HDU/ICUs.

44. In both Figures 29 and 30 the units are ordered from left to right by highest to lowest proportion of level 1 days. The combined HDU/ICUs generally have the lowest proportion of level of 3 days. The extent of their level 2 days is likely to be underestimated. In 2002, almost 90% of the ACP days at Stobhill Hospital and Glasgow Royal Infirmary were used to provide level 3 care. The extent of workload is even more pronounced in Glasgow Royal Infirmary in 2003. In 2003, the units with the least proportion of level 1 days (8%) were Inverclyde and Monklands Hospitals as well as Glasgow Royal Infirmary.

Figure 29. Levels of care determined from a limited ACP dataset in 2002.

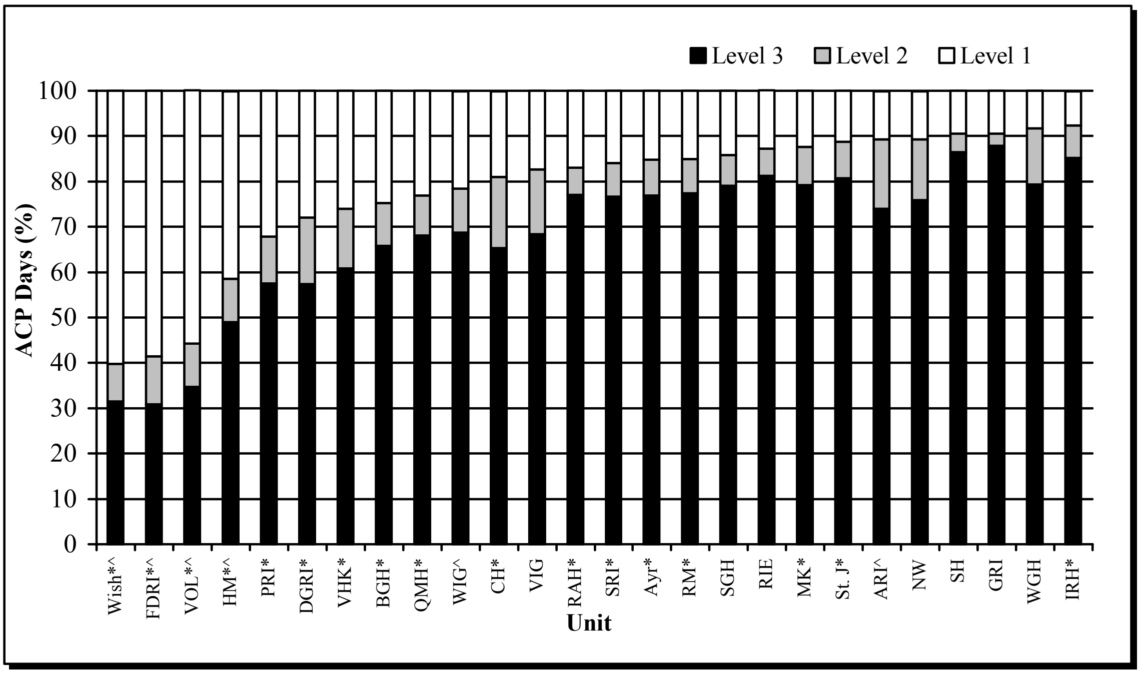
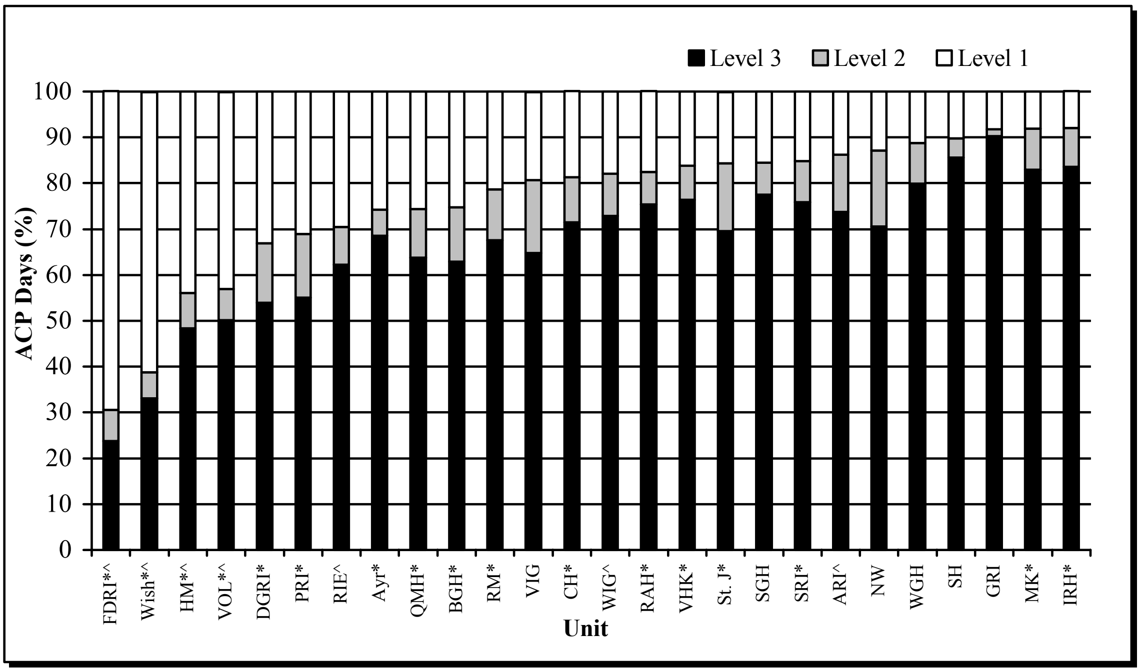


Figure 30. Levels of care determined from a limited ACP dataset in 2003.



F.3. Admission source and critical care transfers in Scotland.

46. Previous reports have demonstrated trends over time in the sources from which patients are admitted in to Scottish ICUs. The dataset requires source of admission to be recorded for every admission as follows (datafield = "Admitted from (type)"):

- A&E in this hospital
- Recovery/theatre in this hospital
- Recovery only, in this hospital
- Ward in this hospital
- ICU in this hospital
- HDU in this hospital
- Other intermediate care area (not ICU or HDU) in this hospital
- X-Ray, endoscopy suite, CT scanner or similar in this hospital
- ICU in another hospital
- HDU in another hospital
- Other area in another hospital (not ICU or HDU)
- Normal residence

As NHS Divisions in Scotland review their critical care needs, data describing the source of admissions becomes a vital part in any needs assessment. In this report we have extended the review of admissions to assess flow between hospitals, within and outwith Divisions.

47. A trend towards a diminishing contribution made by patients admitted to the ICU from theatre between 1998 and 2001, has been previously demonstrated [2]. Figure 31 demonstrates, however, that a plateau appears to have been reached in the past 3 years. Although, on average, 41% are admitted from theatre, there is great variation across the ICUs (Tables 12 and 13). Reconfiguration of services can affect this. In 2002, 59.9% of admissions to Wishaw's Adult Critical Care Unit had theatre as source. Between 1998 and 2001, this proportion has been 64%, 51.9%, 44.4% and 52.8% respectively. Until mid-2001, this unit, based in Law Hospital, had no supporting HDU. On moving to Wishaw General Hospital, it became one 12-bedded combined HDU/ICU where the proportion of post-operative admissions has remained high. In the Victoria Hospital, Fife, only 12.6% were admitted to ICU from theatre during 2003. There has been a steady reduction in post-operative admissions to this unit, from 52.3% in 1998 (41.3% in 1999, 34.8% in 2000, 24.8% in 2001, 16.1% in 2002). During these years, service changes in Fife have seen both the opening and closing of HDU beds in the Victoria Hospital and the transfer of surgical services to Queen Margaret Hospital.

Figure 31. Trend over time of admission sources (%) to Scottish ICUs.

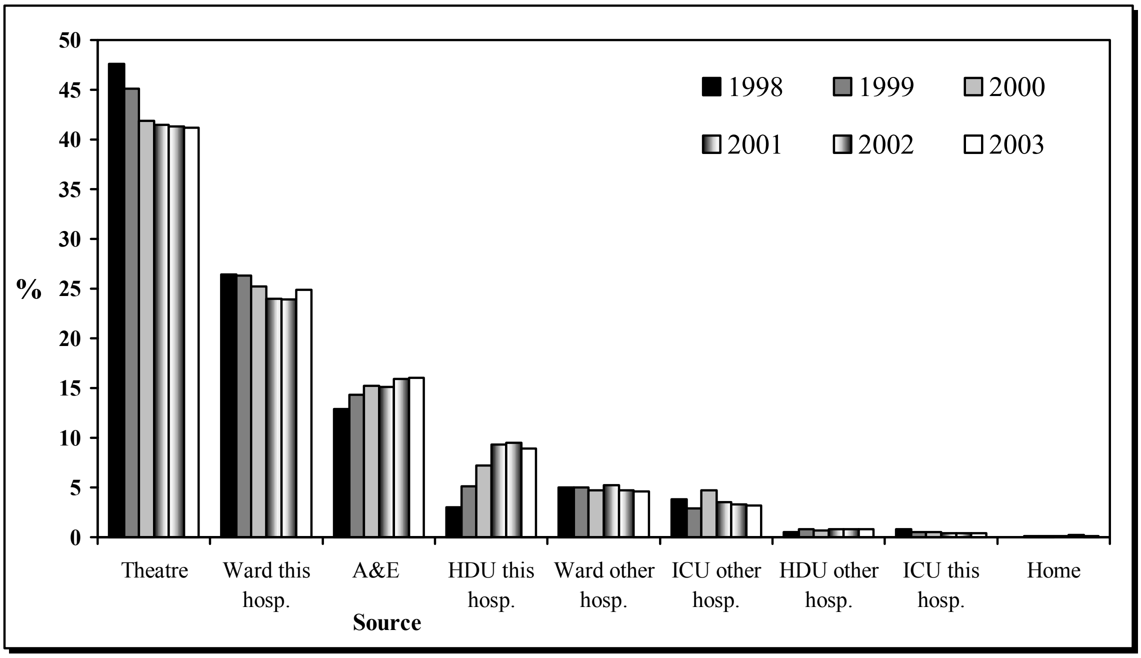


Table 12. Proportion (%) of admissions to ICUs from the sources indicated during 2002.

	Theatre	Ward this hosp.	A&E	HDU this hosp.	Ward other hosp.	ICU other hosp.	ICU this hosp.	HDU other hosp.	Home
ARI^	37.0	29.1	9.3	9.5	11.8	1.1	1.2	1.0	0.0
Ayr*	51.4	15.7	19.0	7.1	2.4	3.3	0.0	0.5	0.5
BGH*	45.0	43.5	10.3	0.0	0.0	0.6	0.0	0.6	0.0
CH*	34.8	24.0	20.6	11.8	6.3	2.4	0.0	0.0	0.0
DGRI*	59.3	10.3	8.1	18.7	2.9	0.7	0.0	0.0	0.0
FDRI*^	50.6	28.5	17.5	1.0	0.6	1.0	0.0	0.2	0.6
GRI	25.9	25.6	12.9	11.4	11.0	10.7	0.3	2.2	0.0
HM*^	49.5	30.2	10.6	6.5	1.3	1.5	0.0	0.5	0.0
IRH*	32.1	33.3	16.4	15.2	0.6	2.4	0.0	0.0	0.0
MK*	39.1	26.6	18.9	11.1	1.3	2.7	0.0	0.3	0.0
NW	47.4	25.8	15.5	8.4	1.3	1.6	0.0	0.0	0.0
PRI*	59.1	13.8	13.8	10.7	1.9	0.6	0.0	0.0	0.0
QMH*	52.9	16.3	14.7	9.8	2.7	3.3	0.0	0.3	0.0
RAH*	37.8	20.8	26.0	6.3	3.8	4.2	0.0	1.0	0.0
RM*	41.7	21.4	17.0	17.3	1.5	0.3	0.0	0.9	0.0
RIE	31.4	10.9	26.4	21.5	2.2	4.4	2.6	0.6	0.0
SGH	24.7	22.1	20.8	13.4	11.7	3.5	0.4	3.0	0.4
SH	22.2	29.0	8.7	15.5	12.6	9.2	0.0	2.9	0.0
SRI*	44.8	19.1	24.0	7.7	2.7	1.6	0.0	0.0	0.0
St. J*	35.3	23.7	19.9	10.4	2.9	7.1	0.0	0.8	0.0
VHK*	16.1	38.5	24.2	0.0	11.8	8.1	0.0	1.2	0.0
VIG	32.9	29.1	20.1	4.8	8.0	3.5	0.0	1.6	0.0
VOL*^	52.4	26.4	15.9	0.0	0.5	4.3	0.0	0.5	0.0
WGH	31.2	27.1	8.4	13.8	11.9	6.8	0.0	0.3	0.5
WIG^	30.7	22.5	15.3	9.4	11.3	7.0	1.7	2.2	0.0
Wish*^	59.9	19.0	12.7	4.6	0.0	1.9	0.0	0.4	1.5
Scotland	**41.3**	**23.9**	**15.9**	**9.5**	**4.7**	**3.3**	**0.4**	**0.8**	**0.2**

- **'Ward this hosp'** incorporates the sources '03. Recovery only, in this hospital', '04. Ward in this hospital', '07. Other intermediate care area' & '08. X-ray endoscopy suite CT' recorded on the audit software.
- **'Ward other hosp'** incorporates source '11. Other area in another hospital' recorded on the audit software.

Table 13. Proportion (%) of admissions to ICUs from the sources indicated during 2003.

	Theatre	Ward this hosp.	A&E	HDU this hosp.	Ward other hosp.	ICU other hosp.	ICU this hosp.	HDU other hosp.	Home
ARI^	30.4	37.3	8.3	9.0	10.7	1.1	1.1	2.0	0.0
Ayr*	49.2	22.0	16.3	8.5	1.6	2.4	0.0	0.0	0.0
BGH*	40.7	45.7	13.1	0.0	0.3	0.0	0.0	0.0	0.3
CH*	38.1	14.7	23.4	15.8	2.9	4.0	0.0	0.7	0.4
DGRI*	59.4	16.3	8.7	13.0	1.4	0.7	0.0	0.4	0.0
FDRI*^	58.5	23.6	13.3	1.3	0.5	0.9	1.5	0.2	0.2
GRI	31.3	27.6	12.9	13.5	4.4	7.8	0.9	1.6	0.0
HM*^	54.4	22.9	11.8	6.8	1.2	2.5	0.0	0.4	0.0
IRH*	29.3	39.7	13.8	12.9	1.7	2.6	0.0	0.0	0.0
MK*	39.7	29.0	17.1	9.9	1.2	2.8	0.0	0.4	0.0
NW	41.8	27.9	18.2	7.3	1.5	3.0	0.0	0.3	0.0
PRI*	50.0	16.1	12.9	18.3	0.5	2.2	0.0	0.0	0.0
QMH*	53.6	16.7	15.1	7.2	1.8	5.1	0.0	0.5	0.0
RAH*	37.0	23.6	19.6	11.2	5.1	2.5	0.0	1.1	0.0
RM*	44.5	22.1	17.8	12.6	1.8	0.9	0.0	0.3	0.0
RIE^	34.9	20.0	24.5	12.1	2.8	4.0	0.2	1.2	0.2
SGH	33.7	17.6	23.5	10.6	9.4	2.4	2.0	0.8	0.0
SH	22.9	19.5	12.9	11.4	22.4	7.6	0.0	3.3	0.0
SRI*	42.7	18.7	20.5	8.8	0.6	7.0	0.6	1.2	0.0
St. J*	33.0	26.4	17.6	11.9	8.4	2.3	0.0	0.4	0.0
VHK*	12.6	41.3	33.6	0.0	9.8	2.1	0.0	0.7	0.0
VIG	24.5	28.9	24.8	7.8	7.5	4.8	0.0	1.7	0.0
VOL*^	51.3	26.6	18.4	0.0	0.6	3.2	0.0	0.0	0.0
WGH	34.5	22.9	10.5	15.4	11.4	4.9	0.0	0.4	0.0
WIG^	30.3	22.4	14.2	10.9	11.4	7.7	1.5	1.5	0.0
Wish*^	58.1	22.1	13.4	3.3	0.7	2.0	0.0	0.4	0.0
Scotland	**41.2**	**24.9**	**16.0**	**8.9**	**4.6**	**3.2**	**0.4**	**0.8**	**0.1**

- **'Ward this hosp'** incorporates the sources '03. Recovery only, in this hospital', '04. Ward in this hospital', '07. Other intermediate care area' & '08. X-ray endoscopy suite CT' recorded on the audit software.
- **'Ward other hosp'** incorporates source '11. Other area in another hospital' recorded on the audit software.

48. Patients may require to be transferred from their base hospital to ICU in a second hospital for a number of reasons:

- There may be no ICU in that hospital. This may be because it is an isolated site within an acute hospital service, as in the case of isolated maternity units. Such a site will transfer routinely to a specific ICU unless that ICU is full. Alternatively it may be in a small district hospital, which has insufficient activity to justify an ICU. In such cases, there may be an identifiable ICU which routinely services this requirement. We describe these as "planned transfers" and do not regard them as indicating a lack of ICU resources; this is an appropriate centralisation of resource.
- There may be an ICU which is unable to provide a specific modality of organ support (e.g., renal support) or there may be a need to access a regional service within the receiving hospital, as in the case of neurosurgery or burns.
- By far the most common reason for transfer is where there are insufficient beds or staff at the point where a new patient is referred. In Scotland, this process is routinely facilitated by access to the national intensive care *e*Bed Bureau. These "bed space" transfers, along with data on percentage bed occupancy, offer an indication of the adequacy of critical care provision in a given hospital. However, used in this way, they must be interpreted in the context of the extent to which there is a culture of routinely transferring patients. This may be influenced by the availability of a designated critical care transfer service, as exists in the West of Scotland. It will also depend on the extent to which local arrangements exist to temporarily upgrade beds within an intermediate care facility such a high dependency unit, a coronary care unit or a theatre recovery area.

49. Figure 32 aggregates admissions recorded on the database as being admitted from another hospital (Other area in another hospital, ICU or HDU in another hospital). On average, there has been little variation in the overall rate of critical care transfers. There is considerable variation between units however, as demonstrated in Figure 33: one third of admissions to ICU at Stobhill are admitted from other hospitals.

Figure 32. Rate of admitting patients in to Scottish ICUs from other hospitals.

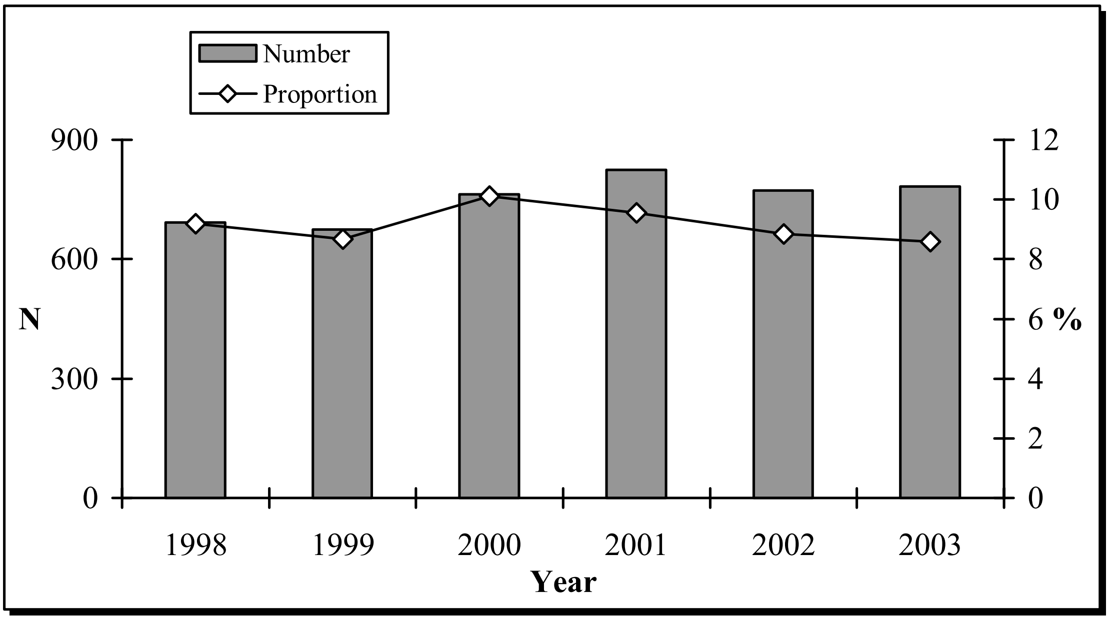
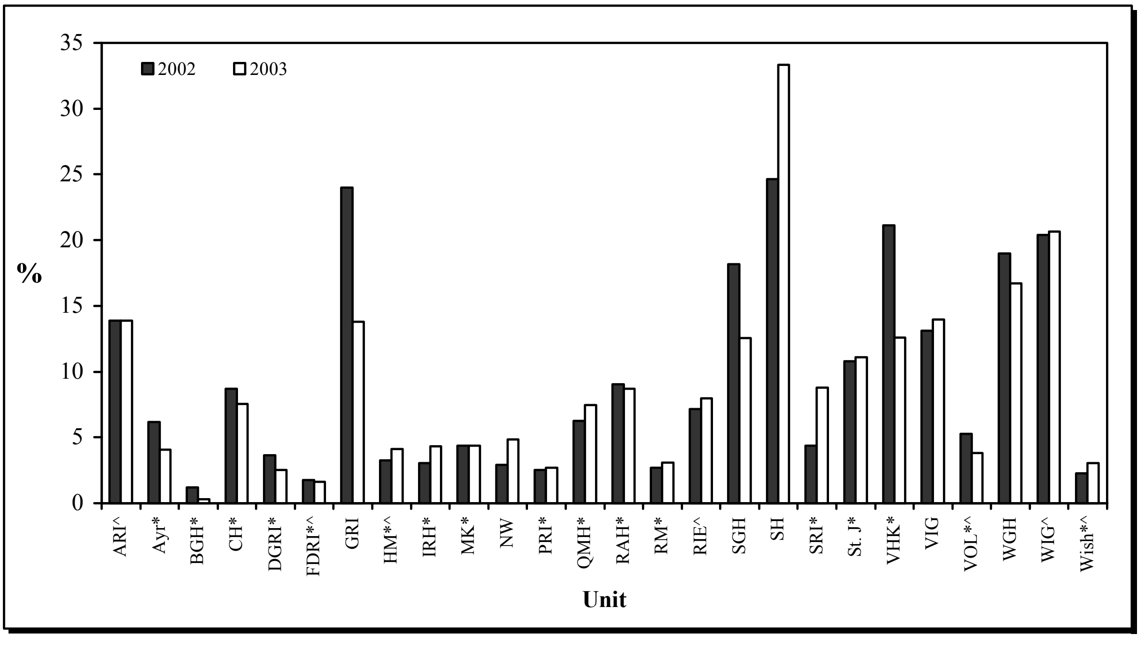


Figure 33. Proportion of admissions to Scottish ICUs from other hospitals: 2002 & 2003.



50. The current Scottish Intensive Care Society national database can be used to describe the demand for critical care transfer, however it has some limitations. Patients transferred from the base hospital for whatever reason may or may not be entered on that hospital's database. Consequently data from the receiving ICU must be mapped back to the referring hospital to describe the latter's demand for transfers. This means that certain transfers are missed. In particular, transfers to the West of Scotland regional neurosurgical service at the Southern General Hospital are not captured as that unit has yet to be recruited to the audit. Transfers out of Scotland are also missed. This is particularly relevant to hospitals near the border, such as Dumfries & Galloway Royal Infirmary.

51. Data on patient transfers were examined for the period 2001-2003 inclusive. The database for each ICU was examined to identify all transfers which were not from within the hospital ("Admitted from (type)" = "ICU in another hospital", "HDU in another hospital" or "Other area in another hospital (not ICU or HDU)"). The dataset also requires the name of the source hospital to be recorded, however, this is a locally modifiable field and less robust. Both the "Admitted from (type)" and "Admitted from (name)" datafields provided a means of data validation which, along with admission &/or discharge comments, revealed some instances of obvious error in recording the source of admission as from another hospital. These records were removed from further analyses (2001 N= 9; 2002 N = 11; 2003 N = 21).

52. The information in each admitting ICU's "Admitted from (name)" field was used to categorise each admission by the NHS Board of the transferring hospital. The admitting ICU was also categorised by its own NHS Board.

53. Table 14 shows the abbreviations and letter codes used for Health Boards in presenting the data.

Table 14. Key to NHS Boards

NHS Boards	
A	Ayrshire & Arran
B	Borders
C	Argyll & Clyde
E	England
F	Fife
G	Greater Glasgow
H	Highland
L	Lanarkshire
N	Grampian
O	Overseas
R	Orkney
S	Lothian
T	Tayside
V	Forth Valley
W	Western Isles
Y	Dumfries
Z	Shetland

54. We wished the data on transfers to provide a basis for examining patient flows at both an individual hospital level and at a Health Board level. The latter may be particularly relevant to sizing intensive care provision if there is a trend towards more centralised, acute health care provision. This has resulted in very "busy" tables; this was unavoidable in order to provide ICUs with sufficient detail on their own pattern of critical care transfer.

55. Tables 15, 16 and 17 show detailed transfer data for the three years 2001, 2002 and 2003. In using these data to generate a picture of the number of transfers in Scotland, which are due to shortage of beds or staff in the appropriate ICU, we counted transfers from a hospital without an ICU only where they were to an ICU other than that which routinely met that need. Such transfers were counted as bed space transfers from what would have been the appropriate ICU. Tables 15, 16 and 17 exclude these "planned transfers". For an individual hospital or Health Board, read horizontally, there is a description of all critical care "transfers out" showing the destination and, in parenthesis, the number of inter-ICU transfers that were described as tertiary referral. The columns at the far right aggregate all transfers by both hospital and Board with inter-ICU tertiary referral aggregates in parenthesis. Similarly, read vertically, a hospital or Board can see the source of all "transfers in" and the proportion that were inter-ICU tertiary referrals.

Table 15. 2001: Modified table of transfers. Those transfers from non-ICU hospitals have been allocated to appropriate ICUs, where possible.

			Admissions into receiving ICUs (Number with tertiary referral recorded as reason in ICU-ICU transfers)																										Total transferred out		Total transferred outwith Board	
		Board	A		B	C			F		G					H	L			N	S			T		V		Y				
	Board	Hospital	Ayr	CH	BGH	IRH	RAH	VOL	QMH	VHK	GRI	SGH	SH	VIG	WIG	RM	HM	MK	Wish	ARI	RIE	St.J	WGH	NW	PRI	FDRI	SRI	DGRI				
Transferring hospitals	A	Ayr		13 (3)							2 (2)	1		1	2 (2)		1 (1)				1 (1)								21 (9)	33 (15)	8 (6)	18 (12)
		CH	2								3 (3)				3		1 (1)				3 (2)								12 (6)		10 (6)	
	B	BGH																					1						1	1	1	1
	C	IRH	2				3	1			2 (1)		1	1	9 (4)		1												20 (5)	43 (13)	16 (5)	32 (13)
		RAH									1 (1)			1	1 (1)														3 (2)		3 (2)	
		VOL				1	5				1 (1)	1		2 (1)	4 (4)						1								15 (6)		9 (6)	
		C'town												1															1		1	
		LIDGH					1				2	1																	4		3	
	F	QMH								17											6 (2)	1	7						31 (2)	50 (9)	14 (2)	21 (4)
		VHK							12 (5)												2 (1)	1	1	3 (1)					19 (7)		7 (2)	
	G	GRI	1	2		1 (1)	3	1				11	28	11	29 (1)		1	4	4									1	97 (2)	279 (16)	18 (1)	79 (7)
		SGH		6 (1)		3	9	1			12 (2)		12	19	15 (2)		6	4	8 (1)										96 (6)		38 (2)	
		SH									3 (1)	4 (1)		4	1			1									1		14 (2)		2	
		VIG					3				5 (1)	8	11		4		4				2 (2)		1 (1)						38 (4)		10 (3)	
		WIG		2		1	4	1			4 (1)	1	12	4					1		1 (1)					1			32 (2)		11 (1)	
	H	RM									1	2								5	1 (1)			1					10 (1)	13 (1)	10 (1)	11 (1)
		Skye														2				1									3		1	
	L	HM									1				1			2	7										11	69 (8)	2	28 (5)
		Wish									3 (1)	1	1	3 (1)	2 (1)		4 (3)	4											18 (6)		10 (3)	
		MK		1							5 (2)		1	1	7		11		12								1		39 (2)		16 (2)	
	N	ARI														10								2	1				13	13	13	13
	R	BHK																		2									2	2	2	2
	S	RIE			1 (1)				1			1										8 (1)	31 (6)		2		1		45 (8)	102 (15)	6 (1)	11 (1)
		St.J																			4 (2)		8 (2)						12 (4)		0	
		WGH							2	1				1							33 (2)	5 (1)				1			43 (3)		5	
	T	NW							1																6				7	15 (6)	1	5 (3)
		PRI																			3 (3)			4 (3)					7 (6)		3 (3)	
		Arbroath																		1									1		1	
	V	FDRI									2 (1)				3 (3)						1 (1)	1	3				2		12 (5)	29 (16)	10 (5)	27 (16)
		SRI								1	4 (2)	1 (1)	1 (1)		3 (2)			3 (3)					4 (2)					17	17 (11)		17 (11)	
	W	WIH													5	1				1									7	7	7	7
	Y	DGRI	1	1											1				1		2 (2)								6 (2)	6 (2)	6 (2)	6 (2)
	Z	GBH										1								5				1					7	7	7	7
	Total transferred in:		**6**	**25** (4)	**1** (1)	**6** (1)	**28**	**4**	**16** (5)	**19**	**51** (19)	**33** (2)	**67** (1)	**49** (2)	**90** (20)	**13**	**29**(5)	**18** (3)	**33** (1)	**15**	**60** (20)	**16** (2)	**56** (11)	**11** (4)	**9**	**2**	**5**	**1**				
			31 (4)		**1** (1)	**38** (1)			**35** (5)		**290** (44)					**13**	**80** (9)			**15**	**132** (33)			**20** (4)		**7**		**1**				
	Total transferred in from outwith Board:		**16** (1)		**1** (1)	**27** (1)			**6**		**92** (35)					**11**	**40** (6)			**15**	**43** (19)			**10** (1)		**5**		**1**				

Table 16. 2002: Modified table of transfers. Those transfers from non-ICU hospitals have been allocated to appropriate ICUs, where possible.

			Admissions into receiving ICUs (Number with tertiary referral recorded as reason in ICU-ICU transfers)																										Total transferred out		Total transferred outwith Board	
		Board	A		B	C			F		G					H	L			N	S			T		V		Y				
	Board	Hospital	Ayr	CH	BGH	IRH	RAH	VOL	QMH	VHK	GRI	SGH	SH	VIG	WIG	RM	HM	MK	Wish	ARI	RIE	St.J	WGH	NW	PRI	FDRI	SRI	DGRI				
Transferring hospitals	A	Ayr		9 (2)							4 (3)		2 (1)		4 (3)													1	20 (9)	38 (12)	11 (7)	22 (10)
		CH	7				1				3 (2)			2	3				1		1 (1)								18 (3)		11(3)	
	B	BGH										1									1		4 (1)						6 (1)	6 (1)	6 (1)	6 (1)
	C	IRH					6	4			4 (1)	5 (1)	5 (3)	4	5 (1)		1	2	1										37 (6)	66 (15)	27 (6)	51 (15)
		RAH						1			2 (1)	2			4 (1)			1	1										11 (2)		10 (2)	
		VOL					4				2 (1)	2 (2)	3	1 (1)	3 (3)														15 (7)		11 (7)	
		Lochgilphead										1																	1		1	
		LIDGH									2																		2		2	
	F	QMH								12 (1)											7 (5)	1	7 (3)	1					28 (9)	49 (19)	16 (8)	22 (13)
		VHK							14 (5)												1 (1)		4 (3)	1 (1)					20 (10)		6 (5)	
		Cameron								1																			1		0	
	G	GRI		2			3					4	13	3	19 (1)		2		2 (1)								1		49 (2)	230 (15)	10 (1)	61 (5)
		SGH	1	4			4	3			12 (3)		9	15	20 (2)		3	1	1		2 (2)		1						76 (7)		20 (2)	
		SH					2				7 (1)	3		5	5			1	2		2 (1)					1			28 (2)		8 (1)	
		VIG	1	3			2				8 (2)	8	2		6 (1)		2		2								1		35 (3)		11	
		WIG	1	3			2	3 (1)			12	7	5	6				1			1					1			42 (1)		12 (1)	
	H	RM										2 (1)			1 (1)					18 (8)				1					22 (10)	24 (10)	22 (10)	23 (10)
		Skye														1				1									2		1	
	L	HM									1 (1)	2 (1)	1	3	1			3	5		1 (1)								17 (3)	53 (5)	9 (3)	28 (4)
		MK					1				3		4	1	1		2		10				1						23		11	
		Wish		1							2 (1)		3	1			1	4 (1)				1							13 (2)		8 (1)	
	N	ARI									1 (1)					1								1					3 (1)	3 (1)	3 (1)	3 (1)
	R	BHK																		6									6	6	6	6
	S	RIE			2		1		1	2 (1)												15 (5)	34 (3)	3	1 (1)				59 (10)	104 (19)	10 (2)	24 (3)
		St.J							3										1		5 (1)		11 (3)						20 (4)		3	
		WGH			2 (1)				2	4											11 (3)	4 (1)				2			25 (5)		7 (1)	
	T	NW																		1	2 (2)				2				5 (2)	10 (6)	3 (2)	7 (5)
		PRI																		1 (1)	3 (2)			1 (1)					5 (4)		4 (3)	
	V	FDRI									3 (3)		2 (2)		2 (1)						2 (1)	4 (2)	2		1		3		19 (9)	35 (15)	16 (9)	29 (15)
		SRI									3 (2)	1	1								3 (2)	1	4(2)			3			16 (6)		13 (6)	
	W	Daliburgh										2																	2	8	2	8
		WIH									1		1		3	1													6		6	
	Y	DGRI	1								2 (1)										1 (1)								4 (2)	4 (2)	4 (2)	4 (2)
	Z	GBH																		10									10	10	10	10
	Total transferred in:		11	22 (2)	4 (1)	0	26	11 (1)	20 (5)	19 (2)	72 (23)	40 (5)	51 (6)	41(1)	77 (14)	3	11	13 (1)	26 (1)	27 (9)	43 (23)	26 (8)	68 (15)	8 (2)	4 (1)	7	5	1				
			33 (2)		4 (1)	37 (1)			39 (7)		281 (49)					3	50 (2)			27 (9)	137 (46)			12 (3)		12		1				
	Total transferred in from outwith Board		17		4 (1)	22 (1)			12 (1)		112 (39)					3	25 (1)			27 (9)	57 (30)			9 (2)		8		1				

Table 17. 2003: Modified table of transfers. Those transfers from non-ICU hospitals have been allocated to appropriate ICUs, where possible.

			Admissions into receiving ICUs (Number with tertiary referral recorded as reason in ICU-ICU transfers)																										Total transferred out		Total transferred outwith Board	
		Board	A		B	C			F		G					H	L			N	S			T		V		Y				
	Board	Hospital	Ayr	CH	BGH	IRH	RAH	VOL	QMH	VHK	GRI	SGH	SH	VIG	WIG	RM	HM	MK	Wish	ARI	RIE	St.J	WGH	NW	PRI	FDRI	SRI	DGRI				
Transferring hospitals	A	Ayr		6 (2)			1 (1)				1 (1)				2 (2)						1								11 (6)	23 (8)	5 (4)	12 (6)
		CH	5				1				3				1 (1)		1				1 (1)								12 (2)		7 (2)	
	B	BGH									1 (1)										7 (5)	1	2 (1)						11 (7)	11 (7)	11 (7)	11 (7)
	C	IRH		1 (1)			2				4 (4)	2 (1)	1 (1)		6 (4)		1		1		1 (1)						1		20 (12)	59 (17)	18 (12)	51 (17)
		RAH		1				3			3 (2)	4		2	3		2				2 (1)								20 (3)		17 (3)	
		VOL					3				1 (1)			2	5 (1)												1		12 (2)		9 (2)	
		LIDGH									2		2		1												1		6		6	
		C'town										1																	1		1	
	F	QMH								9											5 (4)	10	8 (2)	1					33 (6)	54 (17)	24 (6)	28 (9)
		VHK							17 (8)												1 (1)		3 (2)						21 (11)		4 (3)	
	G	GRI	1	2			1	1				5	32	8	22		1	4	3 (1)								1		81 (1)	206 (11)	14 (1)	51 (3)
		SGH	1	2			5	1			3 (1)		6	16 (2)	8		1 (1)		2		1	1							47 (4)		14 (1)	
		SH					1				2 (2)	4		1	2			1											11 (2)		2	
		VIG		4			2				3 (1)	7	6		4		2			1 (1)									29 (2)		9 (1)	
		WIG		3			3	1			9 (1)	3 (1)	10	4			1	1			1						1	1	38 (2)		12	
	H	RM									1				2					22 (8)	1								26 (8)	26 (8)	26 (8)	26 (8)
	L	HM		1			1				2			2	3				3 (1)		1 (1)								13 (2)	64 (8)	10 (1)	38 (7)
		MK					2				3 (1)	2	6 (1)		6		3		12		2 (2)								36 (4)		21 (4)	
		Wish									1 (1)			1	1		5	3			3 (1)					1			15 (2)		7 (2)	
	N	ARI									1					3					1								5	5	5	5
	R	BHK																		7									7	7	7	7
	S	RIE							2	1												11 (3)	37 (3)	1	1 (1)				53 (7)	106 (17)	5 (1)	22 (4)
		St.J							3	2											10 (2)		8 (1)			1	1		25 (3)		7	
		WGH							4 (1)					1				1			17 (4)	1				2 (2)	1	1	28 (7)		10 (3)	
	T	NW													1										4				5	19 (10)	1	2 (1)
		PRI							1 (1)															13 (9)					14 (10)		1 (1)	
	V	FDRI									1 (1)				2		1 (1)		1		2 (1)	1	5 (2)				4 (2)		17 (7)	28 (8)	13 (5)	22 (6)
		SRI							1				1								2 (1)		5			2			11 (1)		9 (1)	
	W	WIH					1				1		4		4					1									11	11	11	11
	Y	DGRI									1										3 (2)		2 (1)						6 (3)	6 (3)	6 (3)	6
	Z	GBH																		7	1								8	8	8	8
	Total transferred in:		7	20 (3)	0	0	23 (1)	6	28 (10)	12	43 (17)	28 (2)	68 (2)	37 (2)	73 (8)	3	18 (2)	10	22 (2)	38 (9)	63 (27)	25 (3)	70 (12)	15 (9)	5 (1)	6 (2)	11 (2)	2				
			27 (3)		0	29 (1)			40 (10)		249 (31)					3	50 (4)			38 (9)	158 (42)			20 (10)		17 (4)		2				
	Total transferred in from outwith Board:		16 (1)		0	21 (1)			14 (2)		94 (23)					3	24 (3)			38 (9)	74 (29)			3 (1)		11 (2)		2				

56. Table 18 shows the trend in the number of patients being transferred, irrespective of the source or destination Board. Figures 34 and 35 present these data graphically.

57. Table 19 and Figures 36 and 37 show the trend in the number of patients whose critical care transfer required transfer to a different Health Board. The residual "bed space" transfers (non inter-ICU tertiary referral) give one indicator of the extent to which a Health Board has sufficient intensive care resources. In England, transfers across current critical care 'network' boundaries are highlighted. This cannot simply be equated with transfers across Health Board boundaries in Scotland. Rather, the electronic Bed Bureau, available in every ICU, highlights the intensive care units with the most available beds at any given point in time. The transferring consultant will examine this in conjunction with the distance involved. There is no specified priority given to attempting to restrict transfers outwith the Health Board.

58. From Tables 18 & 19, it is not surprising to determine that the largest number of admissions from other hospitals is to ICUs within Greater Glasgow. The greatest frequency of transfers out also occurs in Greater Glasgow. The decrease in the number of inter-ICU tertiary referrals to ICUs in Greater Glasgow from outwith Greater Glasgow, demonstrated in Table 19, may be a result of an increase in services provided by ICUs in other Boards, for example, renal replacement therapy.

59. There has been a year-on-year increase in admissions into Grampian (Aberdeen Royal Infirmary) from other Boards (N = 15, 27 and 38 in 2001, 2002 and 2003 respectively) (Table 19). Primarily, these admissions are from Highland, Orkney and Shetland (Tables 15 - 17).

60. ICUs in Lothian have seen an increase in admissions from other Boards from 43 in 2001 to 74 in 2003. Whilst the rise from 2001 to 2002 was due predominantly to increased tertiary referral, the rise in the subsequent year appears to have arisen predominantly from bed space transfers.

Table 18. Trend in transfers, irrespective of source or destination Health Board.

(Excludes Gartnavel to Western transfers within Greater Glasgow)

		2001		2002		2003	
Board	**Type of transfer**	**All**	**inter-ICU tertiary referral**	**All**	**inter-ICU tertiary referral**	**All**	**inter-ICU tertiary referral**
A	**Admissions in (N)**	31	4	33	2	27	3
	Transfers out (N)	33	15	38	12	23	8
B	**Admissions in (N)**	1	1	4	1	0	0
	Transfers out (N)	1	0	6	1	11	7
C	**Admissions in (N)**	38	1	37	1	29	1
	Transfers out (N)	43	13	66	15	59	17
F	**Admissions in (N)**	35	5	39	7	40	10
	Transfers out (N)	50	9	49	19	54	17
G	**Admissions in (N)**	290	44	281	49	249	31
	Transfers out (N)	279	16	230	15	206	11
H	**Admissions in (N)**	13	0	3	0	3	0
	Transfers out (N)	13	1	24	10	26	8
L	**Admissions in (N)**	80	9	50	2	50	4
	Transfers out (N)	69	8	53	5	64	8
N	**Admissions in (N)**	15	0	27	9	38	9
	Transfers out (N)	13	0	3	1	5	0
R	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	2	0	6	0	7	0
S	**Admissions in (N)**	132	33	137	46	158	42
	Transfers out (N)	102	15	104	19	106	17
T	**Admissions in (N)**	20	4	12	3	20	10
	Transfers out (N)	15	6	10	6	19	10
V	**Admissions in (N)**	7	0	12	0	17	4
	Transfers out (N)	29	16	35	15	28	8
W	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	7	0	8	0	11	0
Y	**Admissions in (N)**	1	0	1	0	2	0
	Transfers out (N)	6	2	4	2	6	3
Z	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	7	0	10	0	8	0

Figure 34. Three-year trend in the number of admissions into each Board's ICUs from other hospitals, irrespective of Board.

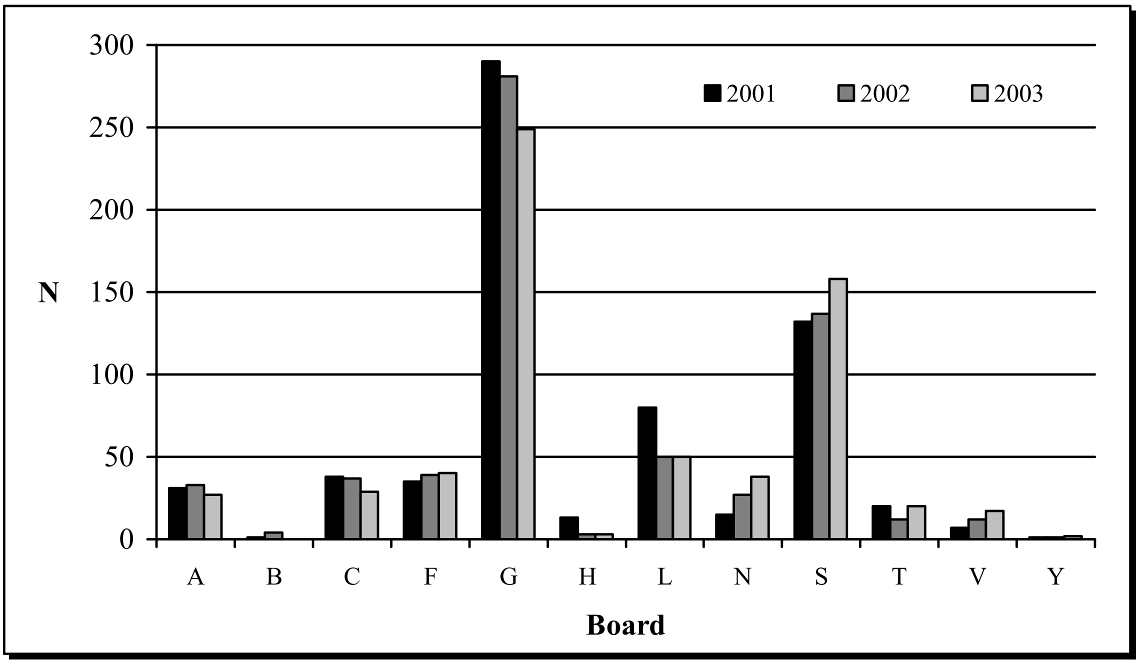


Figure 35. Three-year trend in the number of transfers from each Board to other hospitals' ICUs, irrespective of Board.

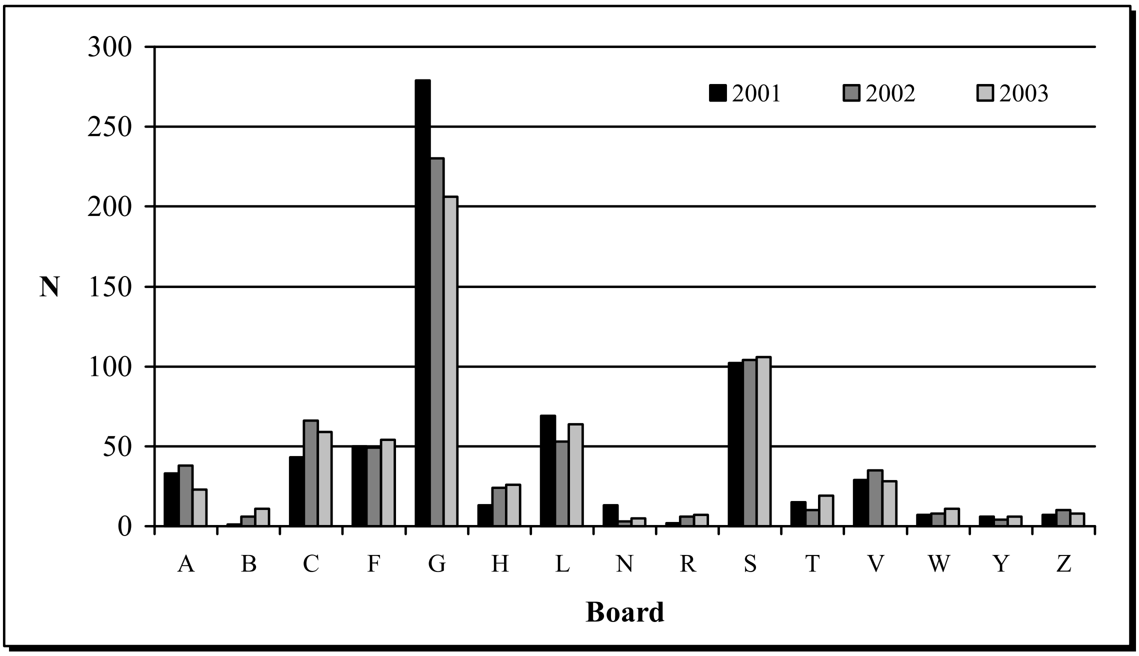


Table 19. Trend in admissions into ICUs from hospitals outwith each ICU's Health Board and transfers from hospitals in each Board to ICUs outwith the source hospital's Board.

		2001		2002		2003	
Board	**Type of transfer**	**All**	**inter-ICU tertiary referral**	**All**	**inter-ICU tertiary referral**	**All**	**inter-ICU tertiary referral**
A	**Admissions in (N)**	16	1	17	0	16	1
	Transfers out (N)	18	12	27	10	12	6
B	**Admissions in (N)**	1	1	4	1	0	0
	Transfers out (N)	1	0	6	1	11	7
C	**Admissions in (N)**	27	1	22	1	21	1
	Transfers out (N)	32	13	51	15	51	17
F	**Admissions in (N)**	6	0	12	1	14	2
	Transfers out (N)	21	4	22	13	28	9
G	**Admissions in (N)**	92	35	112	39	94	23
	Transfers out (N)	79	7	61	5	51	3
H	**Admissions in (N)**	11	0	3	0	3	0
	Transfers out (N)	11	1	23	10	26	8
L	**Admissions in (N)**	40	6	25	1	24	3
	Transfers out (N)	28	5	28	4	38	7
N	**Admissions in (N)**	15	0	27	9	38	9
	Transfers out (N)	13	0	3	1	5	0
R	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	2	0	6	0	7	0
S	**Admissions in (N)**	43	19	57	30	74	29
	Transfers out (N)	11	1	24	3	22	4
T	**Admissions in (N)**	10	1	9	2	3	1
	Transfers out (N)	5	3	7	5	2	1
V	**Admissions in (N)**	5	0	9	0	3	1
	Transfers out (N)	27	16	29	15	22	6
W	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	7	0	8	0	11	0
Y	**Admissions in (N)**	1	0	1	0	2	0
	Transfers out (N)	6	2	4	2	6	3
Z	**Admissions in (N)**	-	-	-	-	-	-
	Transfers out (N)	7	0	10	0	8	0

Figure 36. Three-year trend in the number of admissions into each Board's ICUs from outwith that Board.

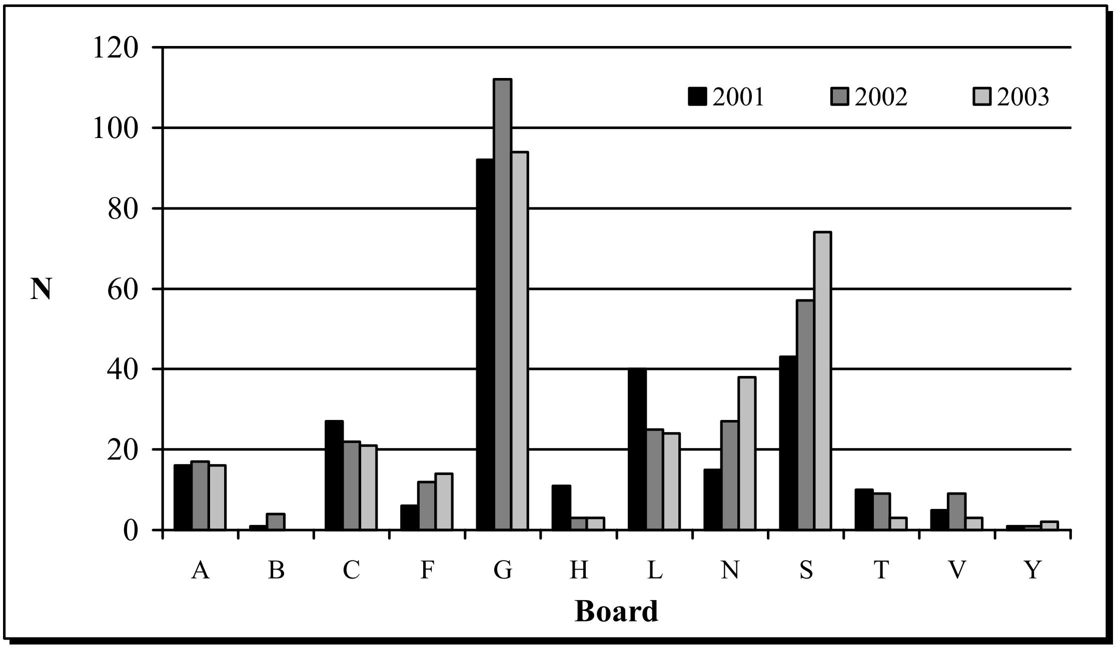
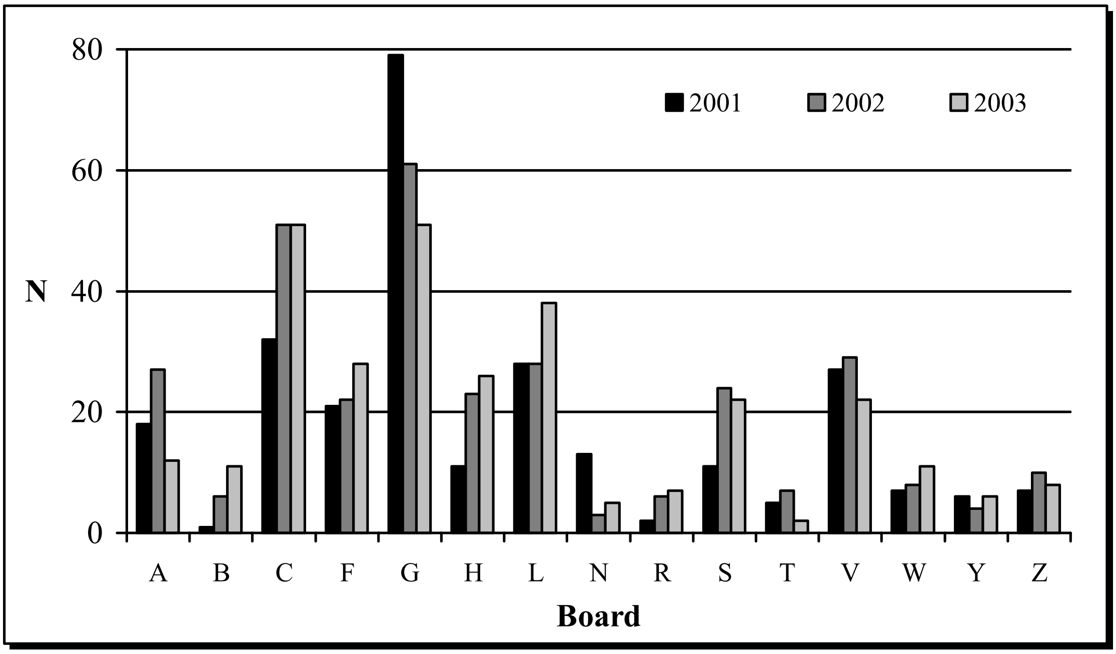


Figure 37. Three-year trend in the number of transfers from each Board to ICUs outwith that Board.



61. A more comprehensive picture of transfer data is shown for completeness in tables 20 - 22. These show all transfers including those patients having "planned transfers". As a picture of overall critical care transfers, it is incomplete to the extent that transfers between Gartnavel General Hospital and the Western Infirmary in Glasgow are not included due to the way in which that unit codes such transfers (regarded as "internal transfers"). Data from the West of Scotland critical care transfer team indicate such transfers amounted to 62, 61 and 53 in the three years from 2001 to 2003.

Table 20. 2001. Complete table of transfers before allocating transfers from non-ICU hospitals to appropriate ICUs (planned transfers).

(Excludes Gartnavel to Western transfers within Greater Glasgow)

			Admissions into receiving ICUs																										Total transferred out	
		Board	A		B	C			F		G					H	L			N	S			T		V		Y		
	Board	Hospital	Ayr	CH	BGH	IRH	RAH	VOL	QMH	VHK	GRI	SGH	SH	VIG	WIG	RM	HM	MK	Wish	ARI	RIE	St.J	WGH	NW	PRI	FDRI	SRI	DGRI		
TRANSFERRING HOSPITALS	A	Ayr		13							2	1		1	2		1				1								21	37
		CH	2								3				3		1				3								12	
		Ayr Central		3																									3	
		Arran		1																									1	
	B	BGH																					1						1	1
	C	IRH	2				3	1			2		1	1	9		1												20	43
		RAH									1			1	1														3	
		VOL				1	5				1	1		2	4						1								15	
		C'town												1															1	
		LIDGH					1				2	1																	4	
	E	Cumberland Inf																										1	1	2
		English Hosp													1														1	
	F	QMH								17											6	1	7						31	55
		VHK							12												2	1	1	3					19	
		Forth Park								5																			5	
	G	GRI	1	2		1	3	1				11	26	10	25		1	4	4									1	90	294
		SGH		6		3	9	1			12		12	19	15		6	4	8										95	
		SH									3	4		4	1			1									1		14	
		VIG					3				5	8	11		4		4				2		1						38	
		WIG		1		1	4				4	1	8	3					1		1					1			25	
		Canniesburn									5		2	1	4														12	
		GGH		1				1					4	1	2														9	
		QMMH													7														7	
		RHSC		1																									1	
		Rosshall, Private					1							1															2	
		Nuffield, Private													1														1	
	H	RM																		5	1			1					7	22
		Belford Hospital										2				5													7	
		Broadford														2				1									3	
		Caithness									1					4													5	
	L	HM									1				1			2	7										11	69
		MK		1							5		1	1	7		11		12								1		39	
		Wish									3	1	1	3	2		4	4											18	
		Bellshill																1											1	
	N	ARI														3								1	1				5	79
		ARM																		7									7	
		Dr Grays														7				45				1					53	
		RACH																		2									2	
		Woodend																		12									12	
	O	Majorca					1												1										2	13
		Malaga							1	1										1									3	
		Mexico																					1						1	
		Lisbon																		1									1	
		North Ireland									1																		1	
		Lourdes						1																					1	
		Germany																			1								1	
		Las Palmas											1																1	
		Overseas															1												1	
		Ethiopia																			1								1	
	R	BHK																		2									2	2
	S	RIE			1				1			1										8	31		2		1		45	106
		St Johns																			4		8						12	
		WGH							2	1				1							33	5				1			43	
		Murrayfield, Private																			1		2						3	
		Princess Mgt Rose																			2								2	
		Simpsons																			1								1	
	T	NW							1																6				7	22
		PRI																			3			4					7	
		Arbroath																		1									1	
		Kings Cross																						5					5	
		Stracathro																						2					2	
	V	FDRI									2				3						1	1	3				2		12	29
		SRI								1	4	1	1		3			3					4						17	
	W	WIH													5	1				1									7	7
	Y	DGRI		1															1		2								4	12
		Cresswell																										1	1	
		Garrick	1												1													5	7	
	Z	GBH										1								5				1					7	7
	Unknown	Other Hospital												1													1		2	5
		Other ICU																			2					1			3	

Table 21. 2002. Complete table of transfers before allocating transfers from non-ICU hospitals to appropriate ICUs (planned transfers).

(Excludes Gartnavel to Western transfers within Greater Glasgow)

			Admissions into receiving ICUs																										Total transferred out	
		Board	A		B	C			F		G					H	L			N	S			T		V		Y		
	Board	Hospital	Ayr	CH	BGH	IRH	RAH	VOL	QMH	VHK	GRI	SGH	SH	VIG	WIG	RM	HM	MK	Wish	ARI	RIE	St.J	WGH	NW	PRI	FDRI	SRI	DGRI		
TRANSFERRING HOSPITALS	A	Arran		2																									2	40
		Ayr		9							4		2		4													1	20	
		CH	7				1				3			2	3				1		1								18	
	B	BGH										1									1		4						6	6
	C	IRH					6	4			4	5	5	4	5		1	2	1										37	66
		RAH						1			2	2			4			1	1										11	
		VOL					4				2	2	3	1	3														15	
		Lochgilphead										1																	1	
		LIDGH									2																		2	
	E	Cumberland																										1	1	2
		Newcastle							1																				1	
	F	QMH								12											7	1	7	1					28	61
		VHK							13												1		4	1					19	
		Forth Park								12																			12	
		Cameron								1																			1	
		Whyteman's Brae								1																			1	
	G	GRI		1			3					3	13	3	17		2		2								1		45	243
		SGH	1	4			4	3			12		9	15	20		3	1	1		2		1						76	
		SH					2				7	3		5	5			1	2		2					1			28	
		VIG	1	3			2				8	8	2		6		2		2								1		35	
		WIG	1	3			2	3			10	5	3	3				1			1					1			33	
		Canniesburn		1							4	1			2														8	
		GGH									2	2	2	2	2														10	
		QMMH												1	4														5	
		Nuffield, Private													2														2	
		Rosshall, Private										1																	1	
	H	RM										1			1					12									14	28
		Belford										1				1				1									3	
		Skye														1				1									2	
		Caithness														3				5				1					9	
	L	HM									1	2	1	3	1			3	5		1								17	53
		MK					1				3		4	1	1		2		10				1						23	
		Wish		1							2		3	1			1	4				1							13	
	N	ARI									1																		1	67
		ARM																		6									6	
		Dr Grays														1				45				1					47	
		RACH																		4									4	
		Woodend																		8									8	
		Albyn, Private																		1									1	
	O	Algarve							1																				1	8
		Bulgaria								1																			1	
		Cyprus							1																				1	
		Mallorca								1																1			2	
		Palma	1																										1	
		Spain															1			1									2	
	R	BHK																		6									6	6
	S	RIE			2		1		1	2												15	34	3	1				59	107
		St. J							3										1		5		11						20	
		WGH			2				2	4											11	4				2			25	
		Murrayfield, Private																			2								2	
		Princess Mgt Rose																			1								1	
	T	NW																		1	2				2				5	11
		PRI																		1	3			1					5	
		Stracathro																						1					1	
	V	FDRI									3		2		2						2	4	2		1		3		19	35
		SRI									3	1	1								3	1	4			3			16	
	W	Daliburgh										2																	2	8
		WIH									1		1		3	1													6	
	Y	DGRI	1								1										1								3	12
		Garrick									1																	8	9	
	Z	GBH																		10									10	10
	Unknown	A&E																								1			1	6
		Other Hospital																									3		3	
		ER																	1										1	
		Recovery/theatre																	1										1	

Table 22. 2003. Complete table of transfers before allocating transfers from non-ICU hospitals to appropriate ICUs (planned transfers).

(Excludes Gartnavel to Western transfers within Greater Glasgow)

			Admissions into receiving ICUs																										Total transferred out	
		Board	**A**		**B**	**C**			**F**		**G**					**H**	**L**			**N**	**S**			**T**		**V**		**Y**		
		Hospital	**Ayr**	**CH**	**BGH**	**IRH**	**RAH**	**VOL**	**QMH**	**VHK**	**GRI**	**SGH**	**SH**	**VIG**	**WIG**	**RM**	**HM**	**MK**	**Wish**	**ARI**	**RIE**	**St.J**	**WGH**	**NW**	**PRI**	**FDRI**	**SRI**	**DGRI**		
TRANSFERRING HOSPITALS	**A**	Arran		1																									1	25
		Ayr		6			1				1				2						1								11	
		Carrick Glen, Private	1																										1	
		CH	5				1				3				1		1				1								12	
	B	BGH									1										7	1	2						11	11
	C	C'town										1																	1	59
		IRH		1			2				4	2	1		6		1		1		1						1		20	
		LIDGH									2		2		1												1		6	
		RAH		1				3			3	4		2	3		2				2								20	
		VOL					3				1			2	5												1		12	
	E	Cumberland																										1	1	2
		Glenfield, Leicester	1																										1	
	F	Forth Park								6																			6	60
		QMH								9											5	10	8	1					33	
		VHK							17												1		3						21	
	G	GRI	1	2			1	1				5	32	8	21		1	4	3								1		80	217
		SGH	1	2			5	1			3		6	16	8		1		2		1	1							47	
		SH					1				2	4		1	2			1											11	
		VIG		4			2				3	7	6		4		2			1									29	
		WIG		3			3	1			7	3	6	3			1	1			1						1	1	31	
		Canniesburn													1														1	
		GGH									2		4		1														7	
		QMMH												1	5														6	
		Nuffield, Private													1														1	
		Rosshall, Private										1		2	1														4	
	H	Belford													2	3					1								6	32
		Skye														2				3									5	
		Caithness									1					1				7									9	
		RM																		12									12	
	L	HM		1			1				2			2	3				3		1								13	64
		MK					2				3	2	6		6		3		12		2								36	
		Law/Wish									1			1	1		5	3			3					1			15	
	N	Albyn, Private																		1									1	75
		ARI														2					1								3	
		ARM																		5									5	
		Dr Grays									1					1				55									57	
		Peterhead																		1									1	
		RACH																		1									1	
		Woodend																		7									7	
	O	Cyprus											1																1	9
		Greece									1																		1	
		Majorca					1																				1		2	
		Solvenia										1																	1	
		Spain																					1			1			2	
		Tenerife	1												1														2	
	R	BHK																		8									8	8
	S	Murrayfield, Private																			1	1	1						3	110
		RIE							2	1												11	37	1	1				53	
		Simpsons																			1								1	
		St. J							3	2											10		8			1	1		25	
		WGH							4					1				1			17	1				2	1	1	28	
	T	NW													1										4				5	19
		PRI							1															13					14	
	V	FDRI									1				2		1		1		2	1	5				4		17	28
		SRI							1				1								2		5			2			11	
	W	WIH					1				1		4		4					1									11	11
	Y	DGRI									1										3		2						6	10
		Garrick																										4	4	
	Z	GBH																		7	1						1		9	9
	Unknown	Home										1																	1	7
		Other Hospital																									1		1	
		Other ICU																1			1					1			3	
		Medical Bleeding Unit																		1									1	
		Theatre or Recovery																						1					1	

F.4. Outcomes monitoring: Case mix-adjusted outcome & Statistical Process Control.

62. We continue to employ the APACHE II methodology [1] to assess severity of illness during the first 24-hours of intensive care and attempt to adjust mortality for variation in case mix. Each ICU uses identical software into which raw data values are entered and scores and mortality probabilities calculated by the software. The APACHE II score is derived from 12 acute physiological variables, age points and chronic health points. The higher the score, the greater the severity of the acute illness. A diagnostic weighting, used in conjunction with this score, enables the mean number of expected hospital deaths to be generated for each unit. Dividing the observed mortality rate by the expected mortality rate generates a standardised mortality ratio, an attempt to assess the case-mix adjusted outcome of the intensive care population.

63. Extensive collaboration between the SICSAG and the Information and Statistics Division (ISD), NHS Scotland, exists to provide record linkage to the Scottish Morbidity Records. The methodology employed is that where no ultimate hospital outcome is available for an ICU episode on a unit's database, the outcome recorded at the end of the continuous in-patient stay, gained via linkage, is used as the ultimate outcome. This helps avoid generating apparent differences in performance between units due to patient transfer. It is also clearly what matters to patients. If the linkage has failed, the hospital outcome for the ICU record is used. This is an in-depth process requiring extensive data validation during which erroneous linkages are reviewed to confirm the outcome status. This process undoubtedly improves the accuracy of the data but requires extensive work and a time delay in producing reports. The extent of this work is providing ISD with a process of external validation of the morbidity records being returned and linked.

64. As in previous years, we are publishing the outcome data for individual units on an anonymised basis. The same letter code identifies an individual unit throughout this section of the Report. The code will be given to the lead audit clinician in that unit and to relevant Trust staff on request.

65. During 2002, 23 of the 26 ICUs provided severity data. Raigmore Hospital, Falkirk Royal Infirmary and Queen Margaret Hospital were unable to participate in this aspect of the national ICU audit. Summary characteristics of those admissions with APACHE mortality probabilities are given in Table 23.

Table 23. Summary demographic characteristics of admissions with APACHE predictions in 2002.

23 SITES	**Predicted Patients**
N	5503
Operative (%)	36.7
Non-operative (%)	63.3
Length of ICU Stay (d) (Mean)	6.1
Length of ICU Stay (d) (Median)	2.4
Length of ICU Stay (d) (Range)	177.7
ICU Mortality (%)	24.8
Hospital Mortality (%)	33.1
Ultimate Hospital Mortality (%)	35.8
APACHE II Score (Mean)	19.7
APACHE II Probability (%)	34.0
SMR *(95% lower & upper CIs)*	1.052 *(1.021-1.083)*

66. The mean and median scores in Scotland are 19.7 & 19 respectively. The median APACHE II scores (plus inter-quartile ranges) are given for each ICU in Figure 38. Although these scores give some indication of severity of illness, the expected mortality is also influenced by diagnostic coefficients and is not directly proportional to the APACHE II score.

67. Figure 39 shows the expected hospital mortalities for severity scored admissions to the 23 ICUs. The expected mortality varies from 20.7% in Unit A to 45.2% in Unit J. Figure 40 demonstrates the observed mortality, ranging from 20.5% in Unit A to 44% in Unit J. On average, 11% of those severity scored patients discharged alive from ICU died prior to hospital discharge at the end of that acute episode.

Figure 38. Illness severity: Median APACHE II scores in 2002. Scottish median: 19 (Inter-quartile range: 15-26).

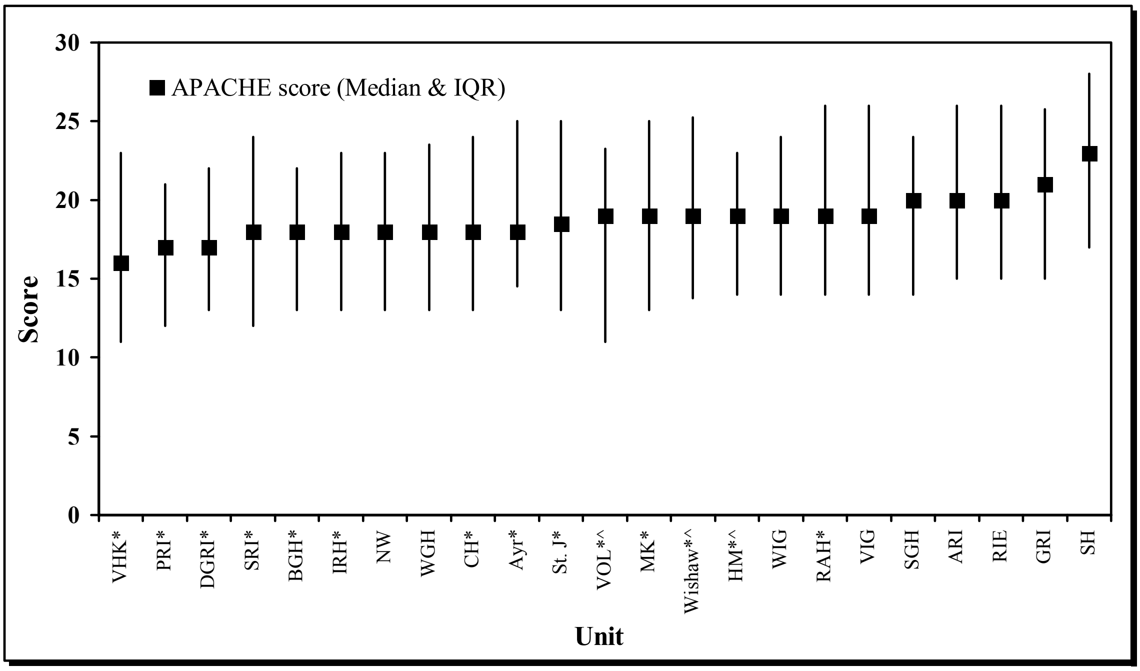


Figure 39. Median APACHE II probabilities in 23 units in 2002. Scottish median: 28.8 (Inter-quartile range: 12.5-52.2).

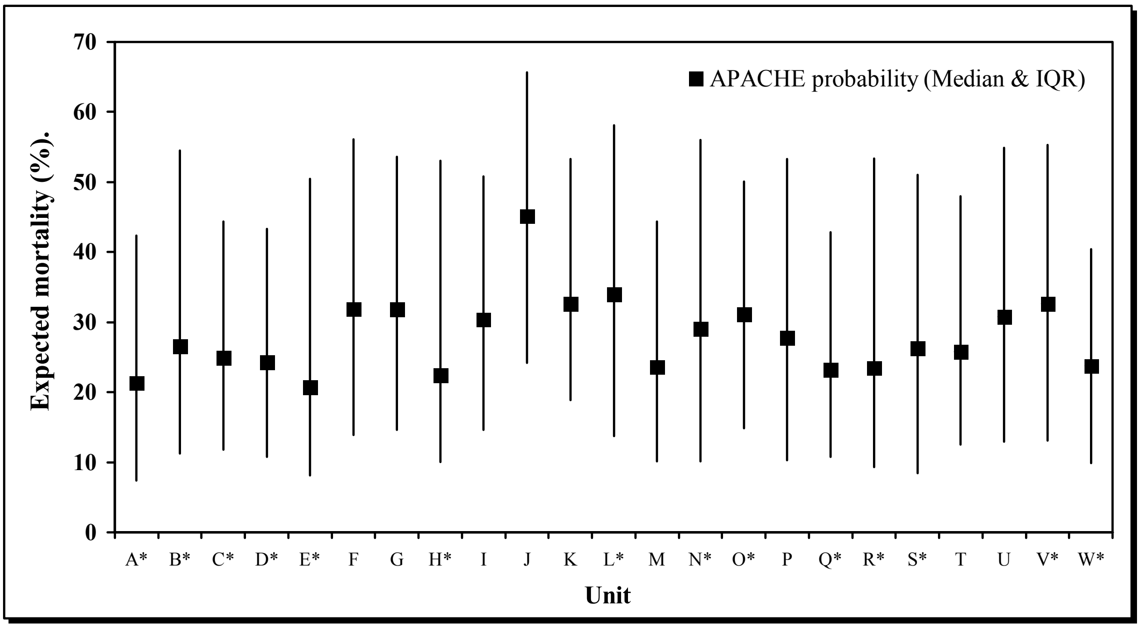
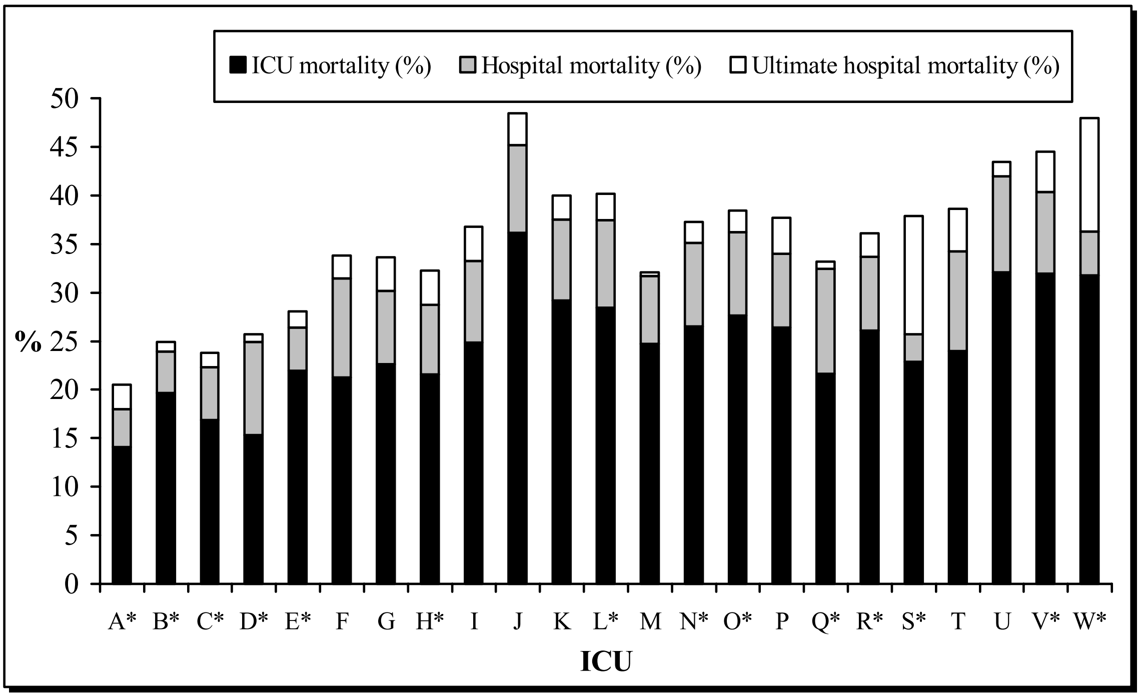


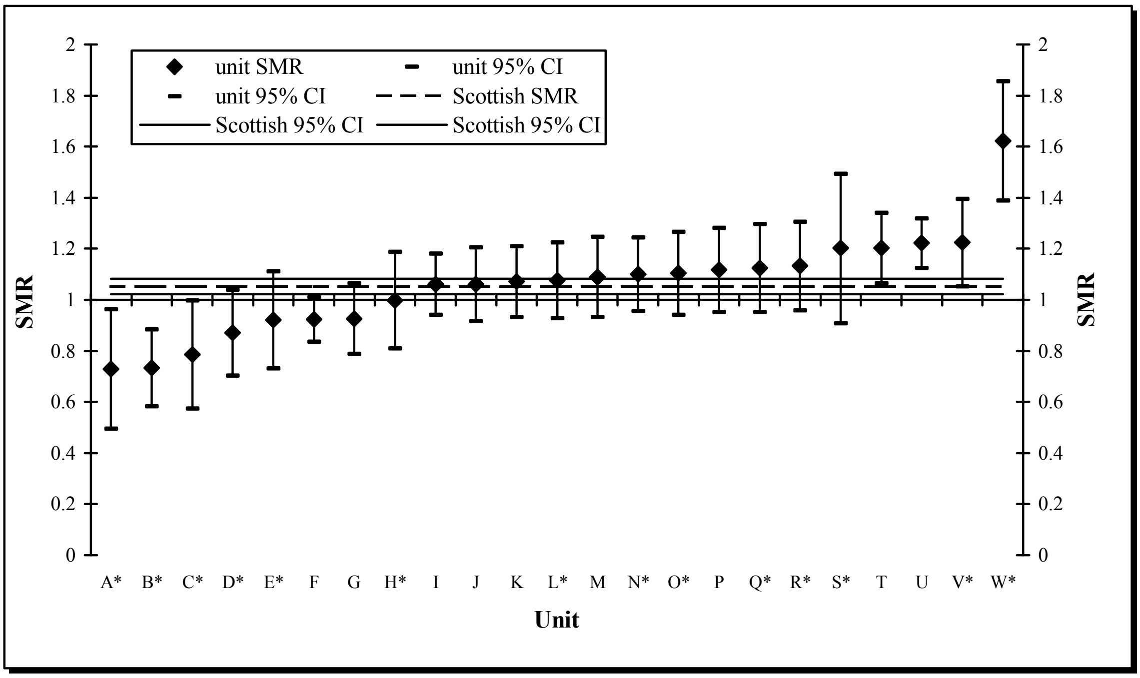
Figure 40. Mortality within subgroup of admissions in which APACHE II methodology applied: 2002.



68. Generation of case mix adjusted mortality (APACHE II model) has been our usual means of assessing variation in outcome throughout the intensive care audit. Standardised mortality ratios (SMRs) and associated lower and upper confidence intervals for Scotland and each of the 23 units are presented in Figure 41 and in Table 24. The uses and limitations of applying standardised mortality ratios in this way must be kept in mind:

- They may be biased to the system or population on which they were developed: international comparisons have been difficult to interpret.
- They do not fully adjust for case mix. As an example, we have previously demonstrated how the mortality of patients with a neurological diagnosis may be under-estimated [8].
- They were developed on what are, by present standards, relatively small data sets.
- There has been no new system since APACHE III, the Simplified Acute Physiology Score [9] (SAPS II) or the Mortality Probability Model [10] (MPM II), which were developed 10 years ago.
- They are more susceptible than is often appreciated to treatment effects. This includes, but is not limited to, 'lead time bias'- the effect of resuscitation prior to ICU admission [11]. Changes in ICU management strategies since the systems were developed may have increased this effect.

Figure 41. Scottish overall SMRs (APACHE II model) in 23 units in 2002. Mean: 1.052 (95% CIs 1.021-1.083).



69. Although the ultimate hospital mortality is used in SMR calculations, where available, comparison of Figure 40 and Figure 41 demonstrates that the ultimate hospital mortality rate and SMR do not correlate. There is much less variation in SMR than there is in a raw mortality not corrected for case mix.

70. For 2002, Figure 41 demonstrates that the upper 95% confidence intervals of units A and B fall below the lower 95% confidence interval of the Scottish SMR. The lower 95% confidence intervals of units U and W lie above the upper 95% confidence interval for the Scottish SMR. The units are ordered by the 2002 SMR in Figure 41 and in Table 24. Table 24 demonstrates changes to the rank order of each unit year-on-year.

Table 24. Annual variation in APACHE II SMRs.

	2002			2001			2000		
Unit	**SMR**	**95% LCI**	**95% UCI**	**SMR**	**95% LCI**	**95% UCI**	**SMR**	**95% LCI**	**95% UCI**
A*	0.729	0.496	0.962	0.860	0.683	1.04	1.08	0.898	1.26
B*	0.734	0.583	0.884	1.01	0.869	1.15	0.888	0.739	1.04
C*	0.786	0.575	0.998	1.13	0.931	1.33	0.746	0.573	0.919
D*	0.871	0.702	1.040	0.829	0.675	0.984	0.784	0.638	0.931
E*	0.922	0.732	1.112	0.760	0.576	0.943	0.920	0.736	1.10
F	0.924	0.837	1.012	0.941	0.852	1.03	0.992	0.891	1.09
G	0.926	0.788	1.065	0.907	0.781	1.03	0.996	0.858	1.13
H*	0.998	0.809	1.187	0.986	0.812	1.16	1.00	0.855	1.15
I	1.061	0.940	1.182	1.13	1.013	1.25	1.06	0.937	1.19
J	1.062	0.918	1.206	0.922	0.792	1.05	1.08	0.946	1.21
K	1.071	0.932	1.210	1.09	0.970	1.21	0.914	0.820	1.01
L*	1.077	0.929	1.224	1.01	0.853	1.17	0.959	0.817	1.10
M	1.089	0.932	1.247	1.19	1.05	1.33	1.41	1.26	1.56
N*	1.100	0.956	1.245	1.06	0.922	1.21	1.08	0.926	1.22
O*	1.104	0.942	1.267	0.879	0.757	1.00	0.911	0.759	1.06
P	1.118	0.953	1.282	1.11	0.936	1.27	1.08	0.907	1.25
Q*	1.124	0.952	1.297	0.895	0.718	1.07	0.829	0.681	0.977
R*	1.133	0.959	1.306	0.892	0.712	1.07	0.847	0.627	1.07
S*	1.202	0.909	1.494	1.08	0.809	1.35	0.895	0.609	1.18
T	1.204	1.066	1.341	1.18	1.05	1.30	1.16	0.998	1.31
U	1.222	1.125	1.319	1.17	1.08	1.27	1.10	1.00	1.19
V*	1.224	1.052	1.395	1.16	0.979	1.34	1.14	0.936	1.34
W*	1.622	1.389	1.855	1.01	0.785	1.24	1.14	0.916	1.36
Scotland	**1.052**	**1.021**	**1.083**	**1.02**	**0.995**	**1.05**	**1.00**	**0.971**	**1.03**

71. Figures 42 and 43 present case mix adjusted outcomes for patients admitted directly to ICU from any area other than theatre and those admitted directly to ICU post-operatively. Only units in which there were 70 or more cases within either subgroup were included in these analyses. In Scotland, 63% of scored patients are non-operative admissions (Table 23). The data continue to demonstrate a higher SMR for non-operative admissions than post-operative admissions.

Figure 42. Scottish non-operative SMRs (APACHE II model) in 20 units in 2002. Mean: 1.112 (95% CIs 1.076-1.148).

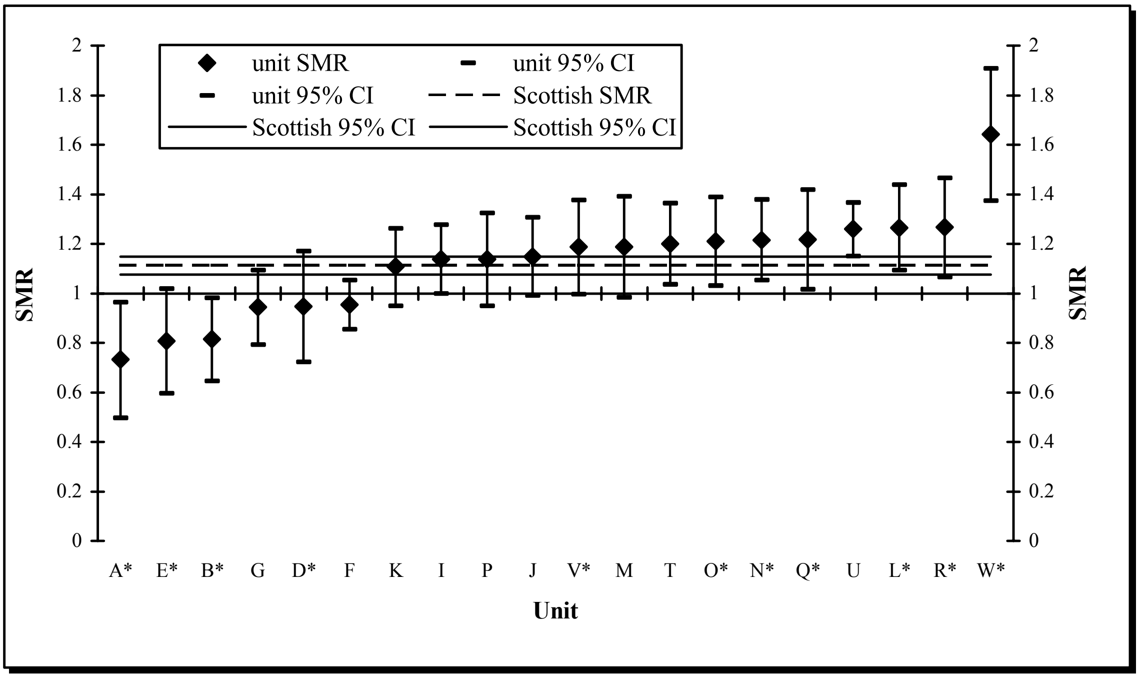
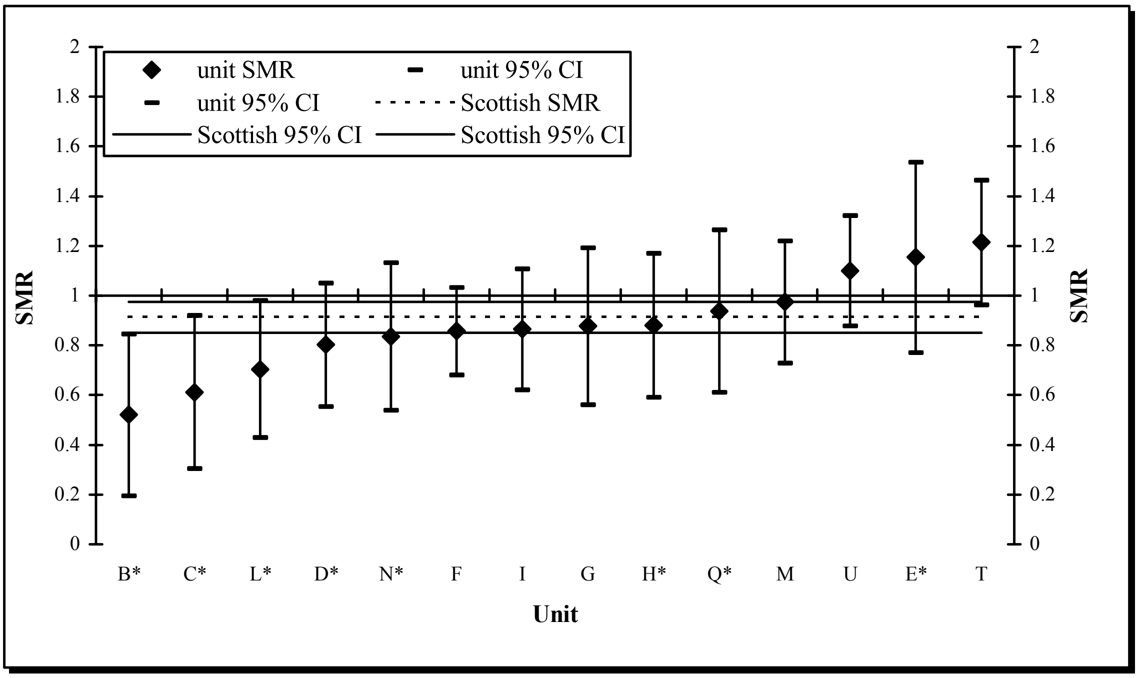


Figure 43. Scottish operative SMRs (APACHE II model) in 14 units in 2002. Mean: 0.914 (95% CIs 0.851-0.976).



72. Using the APACHE diagnostic classification, patients can be grouped according to the primary organ system failure leading to ICU admission. Table 25 illustrates the variation in the proportions of patients within these nine categories during 2002. The majority of patients (70%) fall into only three of the categories (GI, Resp & CVS). The biggest impact on length of stay is made by the respiratory subgroup. Although the lowest severity of illness score is found to exist in the trauma subgroup, this subgroup has the second longest average length of ICU stay and the highest SMR. Neither mortality probability nor SMR are given for Haematological classifications of which there were only 12 cases. Similarities are demonstrated between 2000 and 2001 data in Table 26.

Table 25. Variation in illness severity and length of ICU stay within each admission APACHE system categories in all scored patients: 2002.

APACHE Diagnostic System Category	Proportion of patients (%)	LOS (d) mean	APACHE II		Ultimate Outcome (%)	2002		
			Score	Probability (%)		SMR	95% LCI	95% UCI
Gastrointestinal (GI)	24.7	5.7	18.7	39.3	35.1	0.892	0.833	0.952
Respiratory (Resp)	24.3	8.3	20.3	33.5	37.8	1.128	1.061	1.194
Cardiovascular (CVS)	21.1	5.7	23.9	46.8	50.2	1.071	1.020	1.123
Neurological	13.9	4.6	18.0	22.6	29.3	1.293	1.188	1.398
Trauma	6.8	6.0	13.8	11.9	18.1	1.516	1.260	1.771
General	4.5	2.5	14.7	19.9	13.2	0.663	0.439	0.886
Renal	2.7	4.7	20.7	28.4	27.7	0.974	0.749	1.198
Metabolic/endocrine	1.7	5.2	23.0	29.0	32.6	1.124	0.853	1.396
Haematological	0.2	5.7	23.8	-	50.0	-	-	-

Table 26. Comparison of SMRs within each admission APACHE diagnostic category during 2002 and 2001.

	2002			2001		
Admission APACHE Diagnostic System Category	**SMR**	**95% LCI**	**95% UCI**	**SMR**	**95% LCI**	**95% UCI**
Gastrointestinal	0.892	0.833	0.952	0.852	0.799	0.905
Respiratory	1.128	1.061	1.194	1.151	1.087	1.216
Cardiovascular	1.071	1.020	1.123	1.052	1.004	1.100
Neurological	1.293	1.188	1.398	1.351	1.257	1.445
Trauma	1.516	1.260	1.771	1.248	1.037	1.458
General	0.663	0.439	0.886	0.503	0.311	0.695
Renal	0.974	0.749	1.198	0.976	0.759	1.194
Metabolic/endocrine	1.124	0.853	1.396	0.794	0.468	1.120
Haematological	-	-	-	-	-	-

73. To help assess the case mix of the non-operative and post-operative subgroups, the diagnostic classifications of each are broken down in Tables 27 and 28. Where there were less than 70 cases within a subgroup, no probability or SMR data have been presented.

74. Gastrointestinal diagnoses accounted for almost half of the post-operative admissions (N = 991) but only 10% of non-operative admissions (N = 349). The non-operative GI subgroup, however, remained in ICU on average 4 days longer. Over a third of non-operative admissions were admitted with respiratory diagnoses and remained in ICU, on average, for 9 days.

Table 27. Non-operative admissions: variation in illness severity and length of ICU stay within each diagnostic category.

APACHE Diagnostic System Category	Proportion of patients (%)	LOS (d) mean	APACHE II		2002			Ultimate Outcome (%)
			Score	Probability (%)	SMR	95% LCI	95% UCI	
Respiratory	34.6	9.0	21.0	35.4	1.148	1.080	1.216	40.6
Cardiovascular	22.3	5.7	26.0	56.6	1.071	1.017	1.125	60.7
Neurological	19.7	4.4	18.2	22.6	1.251	1.142	1.361	28.3
Gastrointestinal	10.2	8.7	21.7	51.3	0.956	0.865	1.046	49.0
Trauma	6.2	6.7	13.9	12.7	1.781	1.455	2.107	22.5
Metabolic/endocrine	2.4	5.4	24.1	30.0	1.219	0.941	1.497	36.6
Renal	2.3	6.3	24.2	33.3	1.249	0.973	1.526	41.6
General	2.0	2.1	16.1	-	-	-	-	19.4
Haematological	0.3	4.7	23.1	-	-	-	-	50.0

Table 28. Post-operative admissions: variation in illness severity and length of ICU stay within each diagnostic category.

APACHE Diagnostic System Category	Proportion of patients (%)	LOS (d) mean	APACHE II		2002			Ultimate Outcome (%)
			Score	Probability (%)	SMR	95% LCI	95% UCI	
Gastrointestinal	49.3	4.7	17.7	35.1	0.860	0.783	0.937	30.2
Cardiovascular	19.1	5.6	19.7	27.4	1.072	0.931	1.214	29.4
General	8.7	2.7	14.2	13.9	0.776	0.431	1.121	10.8
Trauma	7.9	5.1	13.5	10.9	1.101	0.691	1.512	12.0
Respiratory	6.9	2.5	15.0	17.5	0.782	0.454	1.109	13.7
Neurological	4.0	5.8	16.3	22.6	1.639	1.280	1.998	37.0
Renal	3.5	3.0	17.0	23.2	0.546	0.167	0.925	12.7
Metabolic/endocrine	0.5	3.7	14.5	-	-	-	-	0.0
Haematological	0.1	10.5	27.5	-	-	-	-	50.0

75. These results provide valuable information about the impact of specific diagnostic groups on resource utilisation and will be especially useful in service design. Individual unit's data have not been given in this report, however, each unit will receive a series of figures and tables of their data which will complement the results described in this report.

76. The results demonstrated in this section also illustrate the limitations of the APACHE system, making it an imperfect system for case mix adjustment. Apparent differences in performance between units may, in fact, be partly due to varying case mix.

Statistical Process Control.

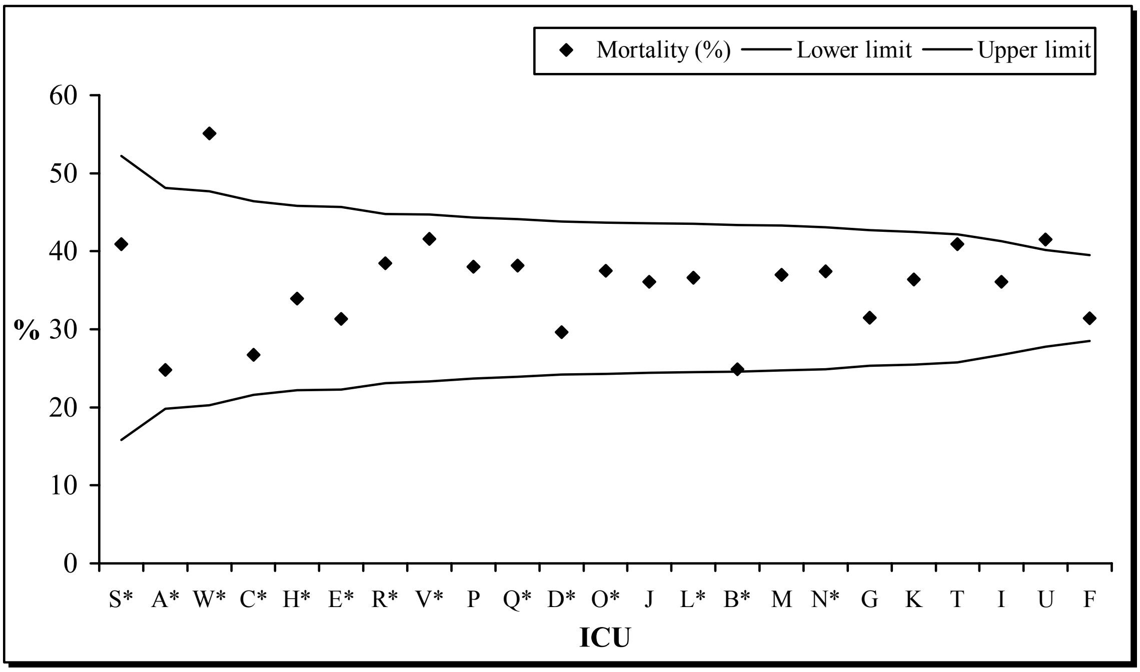
77. In our last Annual Report [2] we proposed assessing the feasibility of applying Statistical Process Control (SPC) techniques to assess quality of intensive care provision. This is a system introduced by Walter Shewhart as a quality improvement tool within the manufacturing industry many years ago; a technique that has been recently applied to healthcare processes. Indeed, it is a technique now advocated for quality improvement in the NHS [12, 13]. Shewhart recognised that there are two types of process variation: random (common) causes and assignable (special) causes. Common cause variation is ever present and does not indicate differences in the quality of a process. If there is only common cause variation present in a process, the process is “in control”. If special cause variation is present, the process is “out of control”, unstable and unpredictable.

78. The application of SPC techniques in healthcare produces outcome data in the form of ‘control charts’. The presentation of a control chart does not include ranking individual outcomes or displaying “league” or “performance” tables. Adabe *et. al.,* reason that the use of control charts as a means of displaying performance in the NHS, without ranking, avoids stigmatising “poor performers” whilst promoting a systems approach to quality improvement [13]. They argue that the NHS should be regarded as a single system (similar recruitment, similar grading, similar pay, national policies) in which this methodology can differentiate between common cause variation, which exists in all processes, and special cause variation within this single system. Performance tables, they argue, compare quality from different systems.

79. The Clinical Indicators Support Team at NHS Quality Improvement Scotland are introducing the use of Statistical Process Control in outcomes monitoring within the NHS in Scotland. The team have produced further information on the use and construction of control charts, which can be found at: http://www.show.scot.nhs.uk/indicators/tutorial/main.htm.

80. Figure 44 demonstrates a control chart for the 23 units which collected severity data in 2002. As this is the first year of using control charts we are presenting one year's data only, therefore, presenting a static process control chart. It is proposed that future reporting of control charts will provide individual unit's trends over time. Data are usually presented on control charts as the number of deaths plotted on the y-axis against the number of patients admitted. To maintain anonymity, however, the control chart in Figure 44 is presented as a 'funnel plot', by the nature of its shape. In this chart, adjusted mortality rates, on the y-axis, are plotted against the unit codes on the x-axis. Each unit's population has been adjusted for the severity of illness to give an 'effective population' (the actual unit population is multiplied by the ratio of the unit's predicted mortality to the overall Scottish predicted mortality). This effective population is then used to calculate the mortality rates presented in the chart. The upper and lower control limits are calculated to reflect +3 and –3 standard deviations from the expected number of deaths within each unit's population. The expected number of deaths in the 'funnel plot' for each unit is the same – the Scottish APACHE II mortality probability.

Figure 44. Control chart for 23 Scottish ICUs in 2002.



81. In comparison with the SMRs in Figure 41, Units A and B fall on or within the confidence levels in the funnel plot. In this instance the confidence levels encompass 99.8% rather than 95%, calculated in the SMR charts. The statistical control chart indicates that their lower mortality rates are due to common cause (random) variation. Units U and W, however, remain above the upper control limit, indicating a mortality higher than expected which is not due to common cause (random) variation.

82. The Audit Group will continue to explore the use of process control with the Clinical Indicators Support Team as a tool for monitoring outcomes.

F.5. Application of guidelines for the administration of Drotrecogin alfa (activated).

Introduction.

83. In our Annual Report 2003 [2], interim results of the audit of the use of Drotrecogin alfa (activated) were published. This audit was conducted to correspond with the introduction of the Society's guideline for this drug, prepared in anticipation of the drug becoming licensed in Autumn 2002. These guidelines are available at http://www.scottishintensivecare.org.uk.

84. The guideline suggests that patients should fulfil the following criteria for use of the drug:

1. **S.I.R.S.:** Meet 3 of the 4 criteria for Systemic Inflammatory Response Syndrome.

2. **Organ Failure:** Have at least 2 new organ failures, which are of less than 48 hours duration.

3. **Infection:** Have evidence of infection as the cause of **1** and **2.**

4. **High Risk of Death:** It is suggested that an APACHE II score of 25 or more be used to define this.

85. An important objective of the audit was to assess whether the guidelines are appropriate; whether the drug is used broadly in line with the guidelines or whether it is also used in other circumstances.

Methods.

86. Based on the Society's guidelines and its recommendations for audit, a standard electronic dataset was developed which enabled clinicians to record appropriate data and determine if a patient fulfilled recommended criteria. Consultants were requested to collect relevant data electronically and prospectively, to confirm patients' fulfilment of the guideline criteria prior to administering the drug. With the assistance of Pharmacists and ICU staff, SICSAG was kept informed whenever the drug was administered. The Audit Group produced folders containing the guidelines and data collection packs. These were taken to every ICU and discussed with consultants in every unit. Laminated information sheets detailing the audit were posted in every ICU. Participation, however, was voluntary and variable.

87. An experienced ICU nurse, Linda Patterson, assisted with this audit. She visited all the ICUs to introduce herself, helped develop data collection packs, demonstrated data collection on Ward Watcher, validated data and reported variations in data entries to ICU staff.

Results.

88. Between October 2002 and August 2003, 102 patients received the licensed drug in Scotland. Based on our prospective audit, conducted over a 5-month period in 2002 [14], we expected that in the region of 300 patients might meet the criteria in this time period.

89. Figure 45 demonstrates the frequency of administration of Drotrecogin alfa (activated) over the 11 months of the study from its first use in Scotland. Figure 46 demonstrates the pattern of prescribing across the NHS Boards. These numbers represent the number of patients treated in ICUs within these NHS Boards, irrespective of the patients' Boards of residence.

90. Attempts to review records of all patients receiving the drug in the first 10 months were made. Complete records were available for data validation in 92 (90%) of the recipients. The study's audit nurse collected data from each of these records. The average age of recipients was 54.3 years, ranging from 16 years to 90 years. Of these recipients, 90 (97.8%) fulfilled the recommended criteria for SIRS, 87 (94.6%) for infection and 81 (88%) had at least 2 organ dysfunctions (Table 29).

91. The range in APACHE II scores was wide, from 5 to 43 (Table 30). Over half (57.6%), however, had APACHE II scores greater than 24 (mean 25.5, median 26). Overall, 49 recipients (53.3%) fulfilled all the criteria as suggested in the guidelines.

Figure 45. Frequency distribution of prescribing Drotrecogin alfa (activated). N=102. October was an incomplete month.

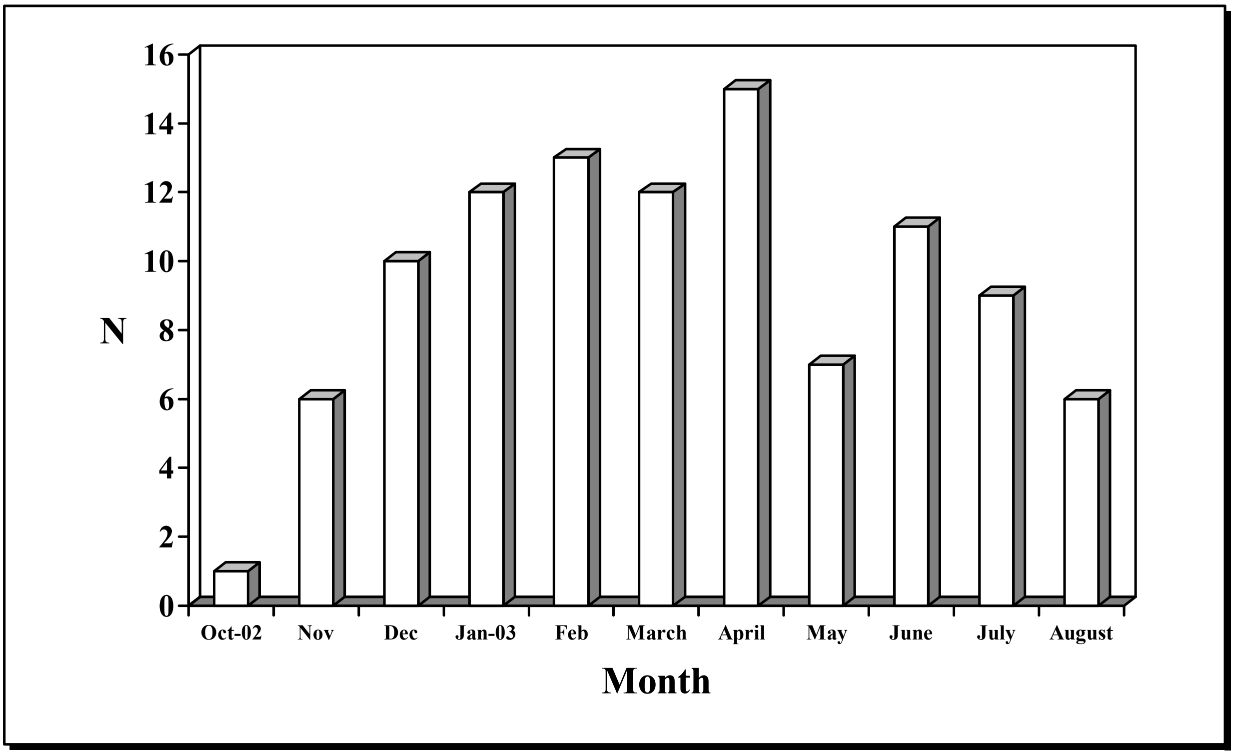


Figure 46. Use of Drotrecogin alfa (activated) within NHS Boards, N=102 until August 2003.

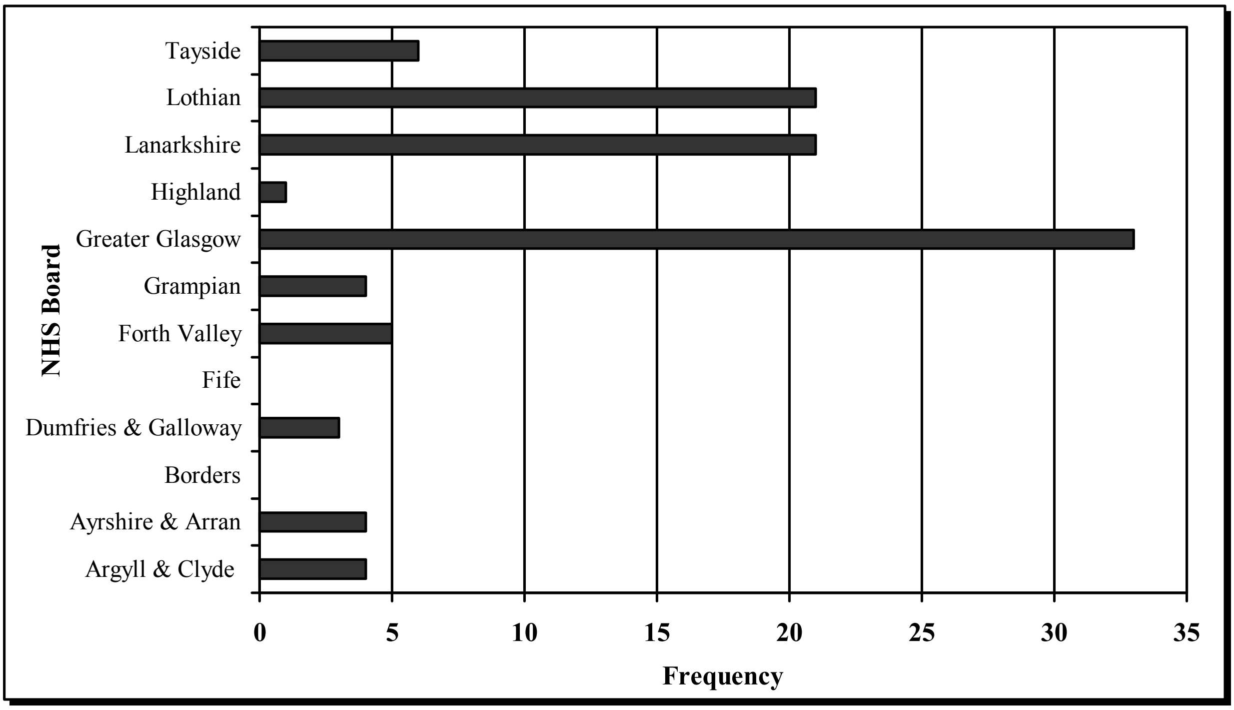


Table 29. Fulfilment of the guideline criteria in the 92 recipients (90%) for whom complete data validation was possible.

	Recipients	SIRS	Infection	Organ failure	APACHE II	All criteria
N	**92**	90	87	81	53	***49***
%	**100**	97.8	94.6	88	57.6	***53.3***

Table 30. Severity scores of recipients of Drotrecogin alfa (activated).

	APACHE score
Mean	25.5
Median	26
Range	5 - 43

Conclusions.

92. As mentioned previously, participation in this audit was voluntary and proved to be variable. Overall use has been less than anticipated but has shown marked variation between units. Validated data collected by an experienced ICU nurse demonstrate that consultants generally follow those aspects of the guidelines relating to SIRS criteria and organ dysfunction but seem reluctant to base prescribing decisions on APACHE score.

93. To date the guidelines and the results from the audit have been used by the Scottish Medicines Consortium and the National Institute for Clinical Excellence (NICE). The Society will review its guideline for Drotrecogin alfa (activated) in the coming months.

94. A standard electronic tool to assess a patient's suitability for Drotrecogin alfa (activated), based on the Society's guideline, continues to be available on the ICU audit software. The Society recommends staff use this facility.

F.6. Data validation.

95. During the data validation conducted by Linda Patterson as part of the audit of Drotrecogin alfa (activated) an error was identified in the allocation of chronic health points by the audit software, which affects the APACHE II score. This error has been traced to an earlier upgrade and affected scores during 2001. In the derivation of an APACHE II score, points are generated and added to the acute physiology score for chronic health problems of defined severity. When patients who meet these chronic health criteria are admitted from theatre, following elective or scheduled surgery, 2 points are awarded; those admitted from theatre following emergency or urgent surgery are awarded 5 points. Those non-operative admissions with chronic health confirmed are also awarded 5 points. The error resulted in 5 points being generated to those admitted from theatre following elective/scheduled procedures who also had chronic health problems confirmed, rather than 2 as is correct.

96. Validation of the APACHE data in previous years had led to software changes in order to reduce inappropriate recording of chronic health in those patients who do not meet the criteria. Although definitions were already available on the software for each co-morbidity, for many years now both cardiovascular and respiratory co-morbidities must be re-confirmed following display of the definition.

97. Case mix adjusted mortality figures for 2001 have already been published in the Annual Report in 2003, when this error had not been recognised. It was necessary, therefore, to assess the impact this error had on the data, both in the post-operative SMRs and the overall SMRs. In order to do this, we have compared the original values with those produced when the scores were recalculated correctly. For practical reasons, we used the hospital outcome data available rather than ultimate hospital outcome and for this reason the overall SMRs in Table 31 do not exactly match those for 2001 in Table 24, which were presented last year's report.

98. Table 31 shows the SMRs using the original and the re-scored data. Once more, where there were less than 70 cases in a subgroup, no outcomes are given. Although the SMRs are slightly increased, as would be expected, the confidence intervals show that there were no significant differences between the original 2001 data and those re-scored to remove the error in chronic health score allocation. We have decided, therefore, not to change the data presented for 2001. (It should be noted that record linkage year-on-year increases the number of patients for whom we have ultimate hospital outcome, and any recalculation would inevitably produce slightly different SMRs.)

Table 31. Comparison of original 2001 SMRs and those corrected for chronic health points.

		Original			Rescored		
Unit		**SMR**	**95% LCI**	**95% UCI**	**SMR**	**95% LCI**	**95% UCI**
A*	**Overall**	0.751	0.573	0.928	0.759	0.581	0.937
	Post-op	-	-	-	-	-	-
B*	**Overall**	0.972	0.832	1.111	0.983	0.842	1.123
	Post-op	0.761	0.508	1.015	0.784	0.525	1.042
C*	**Overall**	1.001	0.801	1.201	1.010	0.809	1.211
	Post-op	1.010	0.643	1.378	1.038	0.664	1.412
D*	**Overall**	0.765	0.611	0.920	0.769	0.614	0.923
	Post-op	0.747	0.493	1.000	0.753	0.498	1.008
E*	**Overall**	0.686	0.502	0.869	0.693	0.508	0.877
	Post-op	0.504	0.140	0.869	0.521	0.148	0.894
F	**Overall**	0.874	0.785	0.963	0.878	0.789	0.967
	Post-op	0.678	0.453	0.903	0.693	0.466	0.921
G	**Overall**	0.870	0.744	0.995	0.872	0.746	0.998
	Post-op	0.361	0.067	0.655	0.365	0.070	0.660
H*	**Overall**	0.907	0.733	1.082	0.907	0.733	1.082
	Post-op	0.694	0.395	0.992	0.694	0.395	0.992
I	**Overall**	1.014	0.898	1.131	1.016	0.900	1.132
	Post-op	1.001	0.760	1.242	1.007	0.765	1.249
J	**Overall**	0.855	0.726	0.985	0.857	0.727	0.987
	Post-op	0.814	0.570	1.058	0.819	0.573	1.064
K	**Overall**	1.069	0.948	1.190	1.070	0.949	1.190
	Post-op	1.038	0.766	1.310	1.042	0.769	1.314
L*	**Overall**	0.916	0.760	1.072	0.921	0.764	1.077
	Post-op	0.629	0.390	0.868	0.637	0.396	0.877
M	**Overall**	1.176	1.036	1.317	1.182	1.041	1.323
	Post-op	1.273	1.030	1.517	1.290	1.044	1.535
N*	**Overall**	1.015	0.873	1.156	1.021	0.879	1.162
	Post-op	0.850	0.579	1.121	0.864	0.591	1.138
O*	**Overall**	0.851	0.729	0.974	0.853	0.730	0.976
	Post-op	0.543	0.217	0.869	0.548	0.220	0.876
P	**Overall**	1.063	0.888	1.238	1.071	0.896	1.246
	Post-op	0.968	0.582	1.354	0.986	0.594	1.378
Q*	**Overall**	0.906	0.729	1.083	0.933	0.754	1.113
	Post-op	0.840	0.582	1.098	0.890	0.623	1.156
R*	**Overall**	0.842	0.663	1.022	0.847	0.667	1.027
	Post-op	0.524	0.194	0.854	0.532	0.199	0.865
S*	**Overall**	1.039	0.769	1.308	1.048	0.776	1.320
	Post-op	-	-	-	-	-	-
T	**Overall**	1.047	0.924	1.171	1.050	0.926	1.174
	Post-op	1.084	0.850	1.318	1.092	0.857	1.328
U	**Overall**	1.111	1.021	1.201	1.113	1.023	1.203
	Post-op	1.139	0.949	1.330	1.148	0.956	1.339
V*	**Overall**	1.045	0.865	1.226	1.047	0.867	1.227
	Post-op	0.755	0.440	1.070	0.757	0.442	1.072
W*	**Overall**	0.985	0.756	1.214	0.988	0.759	1.217
	Post-op	-	-	-	-	-	-
All	**Overall**	0.962	0.933	0.991	0.966	0.937	0.995
	Post-op	0.828	0.771	0.886	0.836	0.778	0.804

F.7. Audit of sedative use in Scottish ICUs.

99. Two years ago a pilot survey of expenditure on sedatives in 8 Scottish ICUs was carried out. It produced some interesting findings, which, in turn, generated some debate on practices [2]. The survey was, therefore, repeated for the period April 2002 – March 2003, this time with a further 8 units participating, though 2 of the initial cohort were unable to contribute during the second period of the audit (units 6 & 8).

100. Information was obtained from 11 ICUs and 3 combined ICU/HDUs. Expenditure figures were collected from each unit for sedatives, analgesics and neuromuscular blocking agents (NMBAs) for the financial year 2002/2003. In practice, this covered morphine, alfentanil, remifentanil, midazolam, propofol and haloperidol. Since these are all purchased on national agreements, expenditure can be compared between units in the knowledge that this relates directly to usage. The annual number of ventilated patient days and the total number of augmented care period days for each unit for the same period was obtained from the SICSAG database.

101. The total annual expenditure on analgesics, sedatives and NMBAs is shown in Figure 47, while Figure 48 shows this figure as a percentage of total ICU drug expenditure for all participating units in the second audit and, where available, in the first audit. There was considerable variation between the units in expenditure on sedative drugs. This is not unexpected as the units are of different sizes with different activity levels. However, there was also a considerable variation in the proportion of each unit's total drug expenditure that was spent on sedatives. This was not the case in the previous audit of 2001/02 (Figure 48, units 1, 5, 6, 7 & 8), and it might be reasonably expected that most ICUs would use sedatives, antibiotics, fluids, *etc.*, in similar amounts. In the original audit, the exception to this was unit 3 who, at the time, were using pre-filled syringes of Propofol rather than the much less expensive vials. Figure 49 demonstrates a reduction in Unit 3's sedative costs, from £44,631 in the first audit cycle to £30,754 in the second.

Figure 47. Annual expenditure on sedatives and NMBAs: 2002/03.

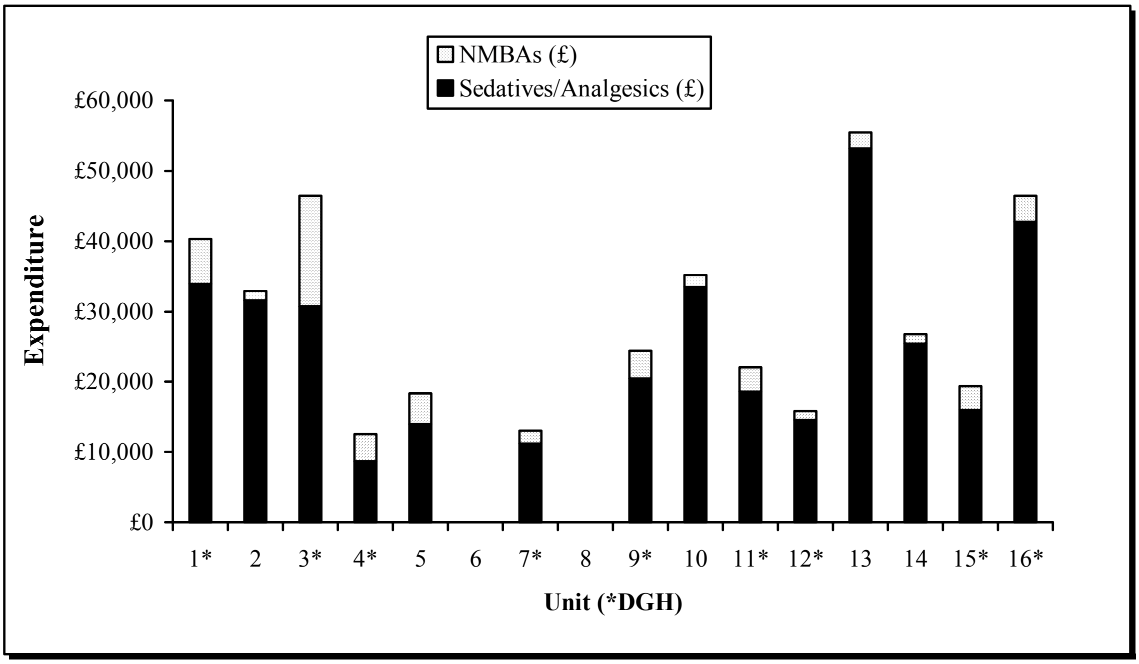


Figure 48. Sedatives and NMBAs as a percentage of ICU drug expenditure.

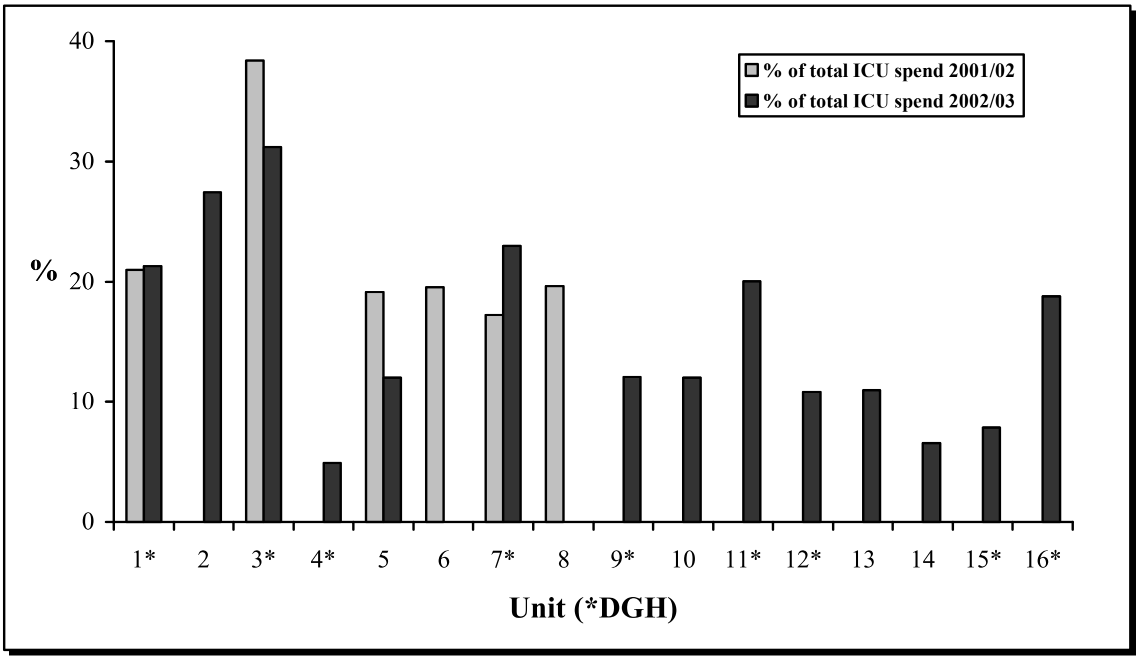
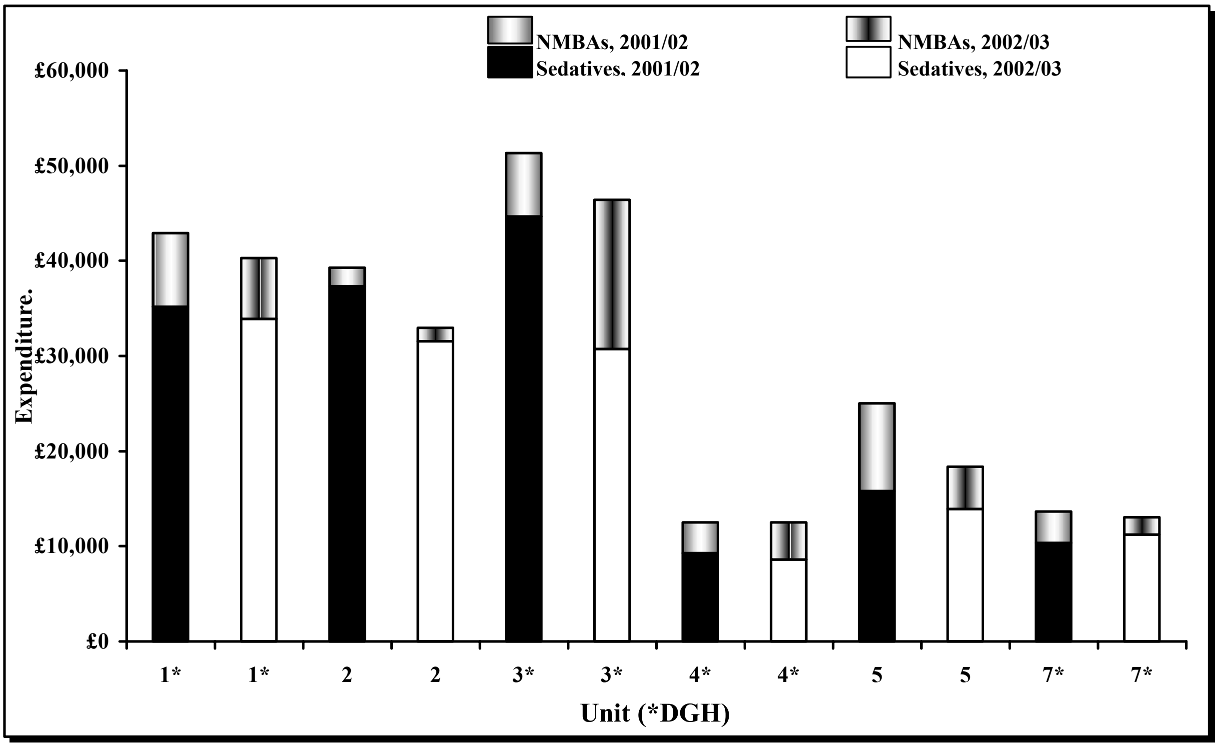
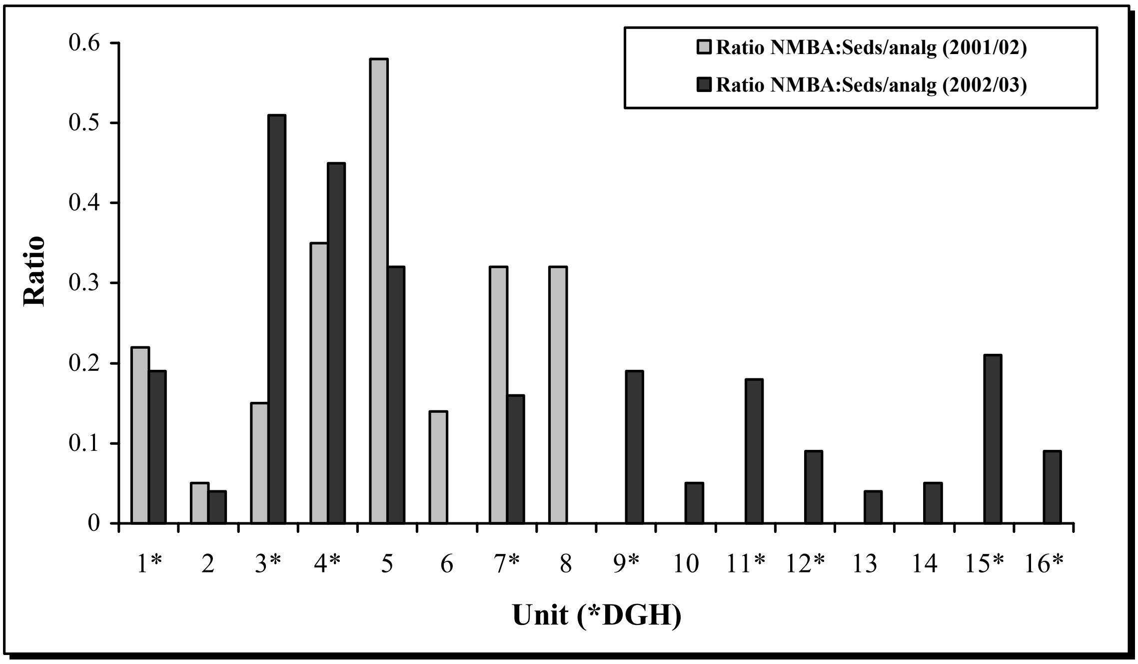


Figure 49. Two-year trend in annual expenditure on sedatives and NMBAs in 6 ICUs.



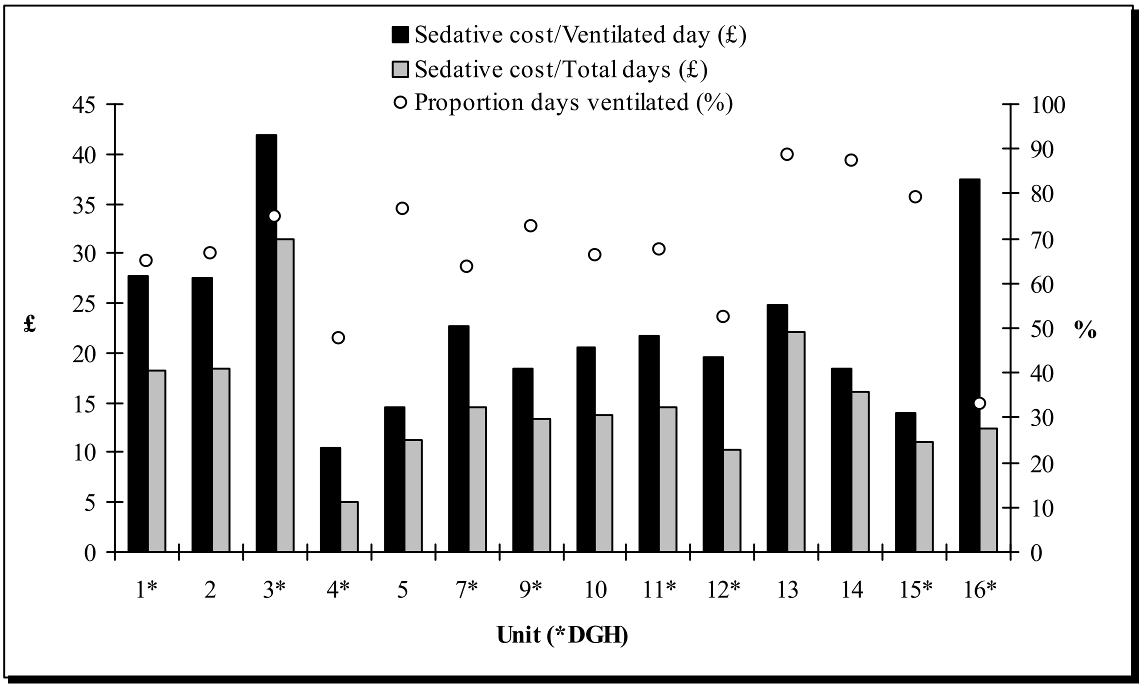
102. Figure 50 shows the ratios of expenditure on NMBAs to expenditure on sedatives for each unit. Again, there is a wide variation between units, with six units showing quite a low ratio (<0.10) in 2002/03. This suggests that their use of NMBAs is minimal compared to those that have a ratio that is relatively high, and again points to considerable differences in practice between units. Of note is the increase in ratio of expenditure in Unit 3 between 2001/02-2002/03, a result of a decrease in the expenditure in sedatives. Units 5 and 7 demonstrate a decrease in ratio, as the expenditure on NMBAs approximately halves between 2001/02 and 2002/03 in each unit.

Figure 50. Ratio of expenditure of NMBAs:Sedatives.



103. Figure 51 shows the cost of sedative drugs per occupied bed day and per ventilated day, as well as the proportion of sedative drugs to total days for each unit. Considerable variation between units is demonstrated, which does not always appear to be explained by differences in the proportion of ventilated days. Unit 16, however, is a combined HDU/ICU with two thirds of its admissions HDU-type patients, who are never ventilated. The low proportion of ventilated/total days is expected in a unit of this nature. Sedative agents are still prescribed for this unit's HDU patients, therefore, it is surprising that the sedative cost per ventilated day for this unit is only second highest amongst the 14 ICUs. Units 4 and 10 are also combined units, the majority of their patients, however, are ICU admissions.

Figure 51. Ventilation rate & sedative costs, 2002-03.



104. Figures [52](#) & [53](#) demonstrate the 2-year trends in sedative costs in the 6 units for which data were available. In almost every unit, there was a reduction in sedative costs per ventilated day and per total days.

Figure 52. Two-year trend in sedative costs per ventilated day in 6 ICUs.

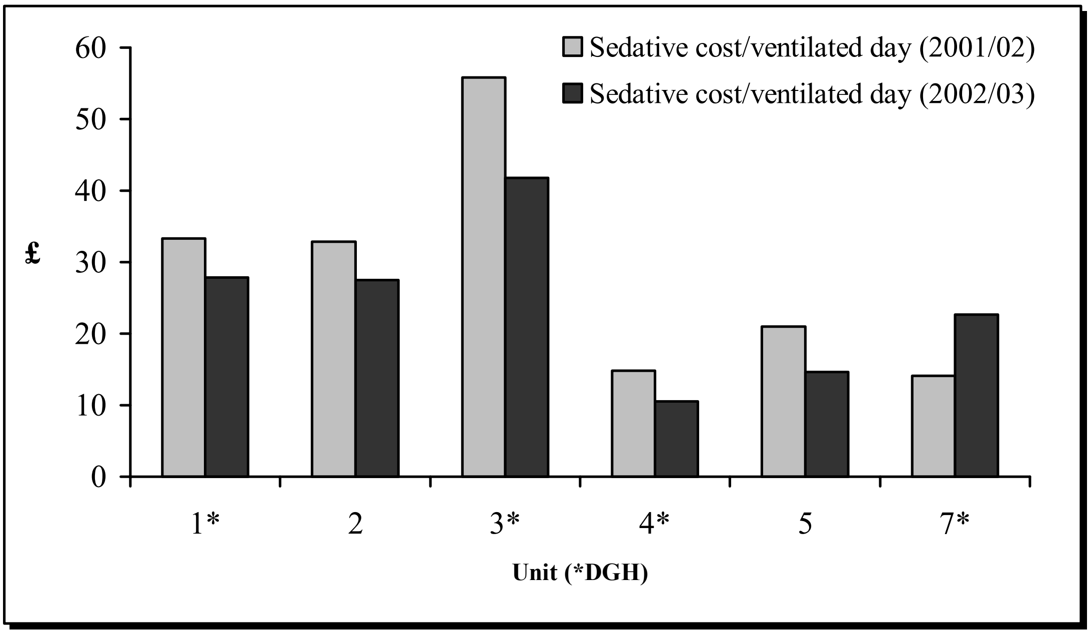
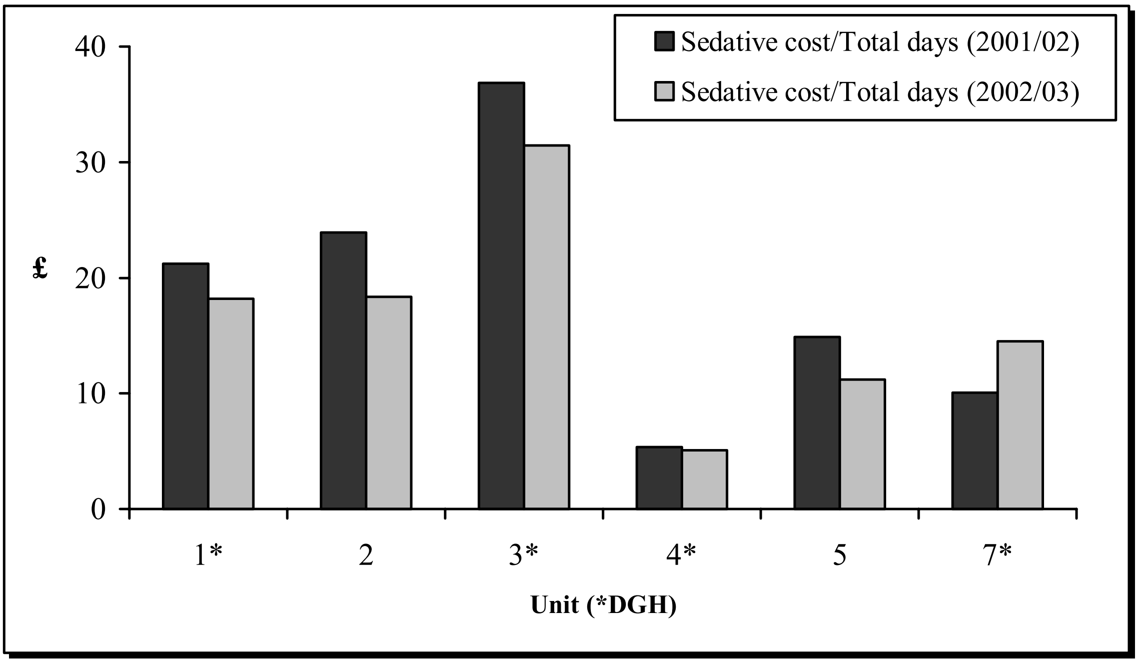


Figure 53. Two-year trend in sedative costs per total days in 6 ICUs.



105. It appears that those units producing a high cost per day for sedatives are generally those that use large amounts of alfentanil. Firm evidence for superiority of alfentanil over morphine in ICU sedation is lacking, and in the meantime it may be that considerable sums could be saved annually, without compromising patient care, by reviewing sedation policies. There is also scope here for an examination of the outcome of these policies.

F.8. Dermatology admissions to Scottish ICUs.

Introduction.

106. A review of dermatology admissions to ICU in Monklands Hospital was conducted jointly by dermatologists and ICU staff in that hospital. Their work initiated a request from dermatologists to review such admissions to ICUs in Scotland.

Methods.

107. Searching for dermatology patients in the ICU database was not straight forward due to limited dermatology diagnoses (APACHE). For the period 01/01/1995 to 31/12/2001, the audit group was provided with a list of dermatology wards in each hospital, a list of dermatology consultants and the hospital to which they would admit patients. An in-depth search of the intensive care database was conducted. Where the diagnosis or admission comments recorded on the database were inconsistent with a dermatology admission, confirmation was requested from the lead ICU audit consultant.

Results.

108. The search revealed, as expected, a very small number of admissions. Between 1/1/1995 & 31/12/2001, only 13 patients were identified from the database as having been admitted to ICU from a dermatology ward, or having had one of the dermatology consultants listed in the database. This accounts for less than 0.1% of ICU admissions. Illness severity was high, as was mortality. Summary characteristics are given in Table 32.

Table 32. Summary data of dermatology admissions.

Mean Age (y) ***(range)***	58 *(23-78)*
Mean ICU LOS (d)	3.64
ICU Mortality (%)	69.2
Hospital Mortality (%)	84.6
APACHE II score	25.9

Conclusion.

109. Few dermatology patients are admitted into the ICU. Those who are, are gravely ill and have low survival rates. The dermatologists are keen to review their ICU admissions further and have contacted individual units for assistance.

G. ADDITIONAL ASPECTS OF THE AUDIT.

G.1. Progress of surveillance of hospital acquired infections, antimicotic prescribing and resistance in ICUs in Scotland.

110. There follows a brief background to this surveillance and the progress to date.

111. In June 2002 a subgroup of the Advisory Group on Infection, set up by the Scottish Executive Health Department to advise it on surveillance of hospital acquired infection and antibiotic resistance, recommended that surveillance of hospital acquired infection (HAI), antibiotic resistance and prescribing be piloted in ICUs in Scotland [15]. Since then, there has been extensive collaboration between SICSAG, the Scottish Centre for Infection and Environmental Health (SCIEH), microbiologists, infection control nurses and clinicians in Scottish hospitals to work towards the development of an electronic surveillance system, maximising the data already collected routinely on the national ICU audit software. It was recommended that the model for this surveillance should be the work done in the United States jointly by the Centers for Disease Control's National Nosocomial Infection Surveillance (NNINS) and Emory University [16,17].

112. Data from a paper-based pilot undertaken in early 2003 were presented at the Annual Audit Meeting in 2003. The overall consensus was that data collection would be labour-intensive and may not be of the best quality.

113. In the interim, staff from SCIEH and SICSAG had held discussions with key members of a collaborative group, Hospitals in Europe Link for Infection Control through Surveillance (HELICS). At the Annual Audit Meeting 2003, Dr Carl Suetens from the Scientific Institute of Public Health in Brussels presented the HELICS dataset. There is considerable overlap between the ICU audit data that are already collected routinely and the HELICS dataset. Currently, several European countries contribute data on HAI in ICUs.

114. It was proposed that the pilot surveillance of hospital-acquired infection in Scottish ICUs, recommended by the Advisory Group on Infection, be conducted utilising the HELICS model rather than the American one, that it be facilitated by SICSAG and that the dataset be incorporated into the audit software.

115. A provisional dataset was presented to all interested parties at a meeting in the Victoria Infirmary on 28th April 2004. Following discussion several changes were suggested. This dataset is to be incorporated into the forthcoming upgrade of Ward Watcher and is expected to be available in the New Year.

116. Once the program is ready to collect HAI surveillance data, a pilot will be needed to ensure it works as well as expected. A request for volunteer sites was made and several intimated an interest in being involved. These will be confirmed once a pilot can be organised.

G.2. SICS Diagnosis list update.

117. Until 1998/99, the only diagnosis that was required to be recorded for an ICU admission was the admission diagnoses for the APACHE scoring system. Each unit could have used an individual list in a separate diagnosis section, currently located on the "Local" screen. Few units only used this. The APACHE diagnoses were felt to be too limiting and only reflected admission diagnosis and only enabled one diagnosis to be recorded. The current SICS diagnosis list was produced in 1998/99 by a small group within the Society to address this. By using a more comprehensive, common diagnosis list it was hoped that a clearer picture of problems requiring intensive care would be available. A comprehensive list of all possible diagnoses, such as ICD 10, was not possible because of space limitations.

118. The diagnosis list has been reasonably successful although it has not been modified since then. Over this period it has become increasingly obvious that there were missing diagnoses, which forced the use of an "Other" selection more often than had been hoped. This causes problems when searching the database as multiple variations of the same diagnosis appear and can be easily missed. The list has, therefore, been updated to make it more inclusive.

119. Missing diagnoses sent in to the audit group and all "Other" diagnoses entered into the database have been reviewed recently. This process showed four main problem areas:

1) **The diagnosis/operation was present in the list but missed**: possibly because the section in which it was placed was not obvious (e.g., breast problems are in the metabolic/endocrine section). We are considering placing terms in more than 1 section to avoid this.
2) **The diagnosis/operation was covered by a more general term:** a few of these have been added, but the majority have not. Each individual diagnosis only appeared a few times and adding them all would have made the list too unwieldy. Please use the more general term rather than adding diagnoses. It is easier to search for the general term then look in the

admission comments to identify specific problems than search the "Other" fields.

3) **It was impossible to use the existing list to categorise the diagnosis:** in this case, if the diagnosis appeared frequently it was added to the list. Some non-specific complaints have been added to help with the "Reason for hospital admission field" (e.g., Abdominal pain). It will still be possible to use the "Other" diagnosis for rare events.
4) **Multiple Trauma:** in many cases the "Other" selection had been used to list the injuries. Searching for "multiple trauma" then misses these cases. The best solution suggested so far is to enter "Multiple trauma" in the diagnosis section and enter the individual injuries in the "Other significant diagnosis" section.

120. A draft of the new list of diagnoses has been sent by email to the contacts in all units asking for feedback. It is intended that the new list will be incorporated into the next Ward Watcher upgrade.

121. After the new list is released it is important that, where possible, a diagnosis on the list is used even if it is very general. Use of the "Other Diagnosis" choice makes it very difficult to classify the patient in a large database so any improved diagnostic precision attempted effectively loses the patient from analysis.

122. It is appreciated that specialised units may wish to record more detailed information but it is not practical to do this without making the list very unwieldy. For these units, which wish a more comprehensive list of their own common diagnosis, it is suggested that they maintain their own list in the "Diagnosis" or "Surgical interventions" fields in the "Local" section of Ward Watcher **in addition** to completing the SICSAG diagnosis section. Individual units can modify the list in this section.

123. Hopefully, the new list will make patient categorisation easier.

G.3. Dataset changes.

124. The dataset is regularly reviewed to ensure that it meets the needs of participants, whilst avoiding the collection of unnecessary data. An early example of this was our removal of fields only required for APACHE III after we had shown that it was not valid for the Scottish population [18]. Other fields have been introduced and removed for short-term projects (*e.g*., ARDS and sepsis studies). The group also seeks to provide optional fields within the software to aid projects that individual units or groups wish to undertake. There are already optional research screens ("Research" and "Daily"), optional intervention fields (ACP data) and local fields available in the unit discharge screen. These avoid the need for duplicate entry or systems in such units.

125. The main changes to be introduced at the end of this year are:

- **ACP dataset and underlying software**: alterations to provide a common system usable in ICUs, HDUs and combined units; to meet the frequent request for the software to categorise patients as level 1, 2 or 3 as defined in *Better Critical Care;* redundant variables have been removed.
- **Diagnosis list:** the SICS diagnosis list will be improved. Further information available in section G.2.
- **Error checking**: changes will force confirmation of date of birth when age is very low; will also force confirmation of date of hospital admission if there has been a prolonged stay in hospital prior to ICU admission. (There are few admissions of less than a year old, however, recording the current year in the "Date of Birth" field is an error which does arise. When an earlier year is recorded in the "Date admitted this hospital" field, the length of time in hospital can appear exceedingly lengthy. This is an error that occurs generally around the New Year.)
- **Hospital Acquired Infection:** a dataset will be available to enable participation in the HAI surveillance by units that have chosen to do so.
- **Mortality Probability Model:** removal of fields associated only with MPM.
- **POSSUM:** a dataset will be available which will enable POSSUM scores to be calculated. This is of interest to HDUs.

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J. APPENDICES.

Appendix I. Publications, Reports and Abstracts.

PUBLICATIONS

Hughes M, MacKirdy FN, Ross J, Norrie J, Grant IS. Acute respiratory distress syndrome: an audit of incidence and outcome in Scottish intensive care units. *Anaesthesia* 2003; **58**(9):838.

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Appendix II. List of Scottish adult ICUs and the lead audit consultants during the period of reporting.

Unit ID	Intensive Care Unit	Lead Audit Consultant
ARI	Aberdeen Royal Infirmary	Dr G Adey
Ayr	Ayr Hospital	Dr I Taylor
BGH	Borders General Hospital, Melrose	Dr NP Leary
CH	Crosshouse Hospital	Dr R White
DGRI	Dumfries & Galloway Royal Infirmary	Dr D Williams
FDRI	Falkirk & District Royal Infirmary	Dr H Robb
GRI	Glasgow Royal Infirmary	Dr MG Booth
HM	Hairmyres Hospital, East Kilbride	Dr D Allen / Dr V Watson
IRH	Inverclyde Royal Hospital, Greenock	Dr F Munro
MK	Monklands Hospital, Airdrie	Dr R MacKenzie
NW	Ninewells Hospital, Dundee	Dr AJ Shearer
PRI	Perth Royal Infirmary	Dr S Winship
QMH	Queen Margaret Hospital, Dunfermline	Dr R Savage / Dr P Nicholas
RM	Raigmore Hospital, Inverness	Dr I Skipsey / Dr S Hunter
RAH	Royal Alexandra Hospital, Paisley	Dr S Madsen
RIE	Royal Infirmary of Edinburgh	Dr SJ Mackenzie
St. J	St. John's Hospital, Livingston	Dr M Fried
SRI	Stirling Royal Infirmary	Dr M Worsley
SH	Stobhill Hospital	Dr C Miller / D Ure
SGH	General ICU, Southern General Hospital	Dr G Imrie
VOL	Vale of Leven DGH, Alexandria	Dr WR Easy
VHK	Victoria Hospital, Kirkcaldy	Dr C Wilson
VIG	Victoria Infirmary, Glasgow	Dr JC Howie
WGH	Western General Hospital, Edinburgh	Dr IS Grant
WIG	Western Infirmary, Glasgow	Dr L Plenderleith
Wish	Wishaw General Hospital (Law Hospital until mid 2001)	Dr N Willis

Appendix III. Additional hospitals in the critical care transfer tables.

Additional Hospitals in Cross-boundary Analyses	
Arbroath	Arbroath Infirmary
ARM	Aberdeen Maternity Hospital
Arran	Arran Hospital
Ayr Central	Ayrshire Central Hospital, Irvine
Belford	Belford Hospital, Fort William
Bellshill	Bellshill Hospital
BHK	Balfour Hospital, Kirkwall
Broadford	Mackinnon Memorial Hospital, Skye
Caithness	Caithness Hospitals
Cameron	Cameron Hospital, Leven
Canniesburn	Canniesburn Hospital, Glasgow
Cresswell	Cresswell Maternity Hospital, Dumfries
C'town	Campbeltown Hospital
Cumberland	Cumberland Royal Infirmary
Daliburgh	Daliburgh Hospital, South Uist
Dr Grays	Dr. Gray's Hospital, Elgin
Forth Park	Forth Park Hospital, Kirkcaldy
Garrick	Garrick Hospital, Stranraer
GBH	Gilbert Bain Hospital, Lerwick
GGH	Gartnavel General Hospital, Glasgow
Kings Cross	Kings Cross Hospital, Dundee
LIDGH	Lorn & Islands District General Hospital, Oban
Peterhead	Peterhead Cottage Hospital
Princess Mgt Rose	Princess Margaret Rose Orthopaedic Hospital, Edinburgh
QMMH	Queen Mother's Maternity Hospital
RACH	Royal Aberdeen Children's Hospital
RHSC	Royal Hospital for Sick Children, Glasgow
Simpsons	Simpson Memorial Maternity Pavilion, Edinburgh
Skye	Skye Hospitals
Stracathro	Stracathro Hospital, Brechin
Whyteman's Brae	Whyteman's Brae Hospital, Kirkcaldy
WIH	Western Isles Hospitals
Woodend	Woodend Hospital, Aberdeen