



***Scottish Intensive Care Society
Audit Group***

ANNUAL REPORT 2002

An Audit of Intensive Care Units in Scotland.

Clinical Effectiveness Programme 99/50

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B. ABBREVIATIONS

ACP	Augment Care Period
AGI	Advisory Group on Infection
APACHE	Acute Physiology and Chronic Health Evaluation
ARDS	Adult Respiratory Distress Syndrome
ATICS	Audit of Transfusion in Intensive Care in Scotland
CCDG	Critical Care Delivery Group
CRAG	Clinical Resource and Audit Group
DGH	District General Hospital
eBed Bureau	Electronic Bed Bureau
HAI	Hospital Acquired Infection
HDU	High Dependency Unit
ICNARC	Intensive Care National Audit and Research Centre
ICU	Intensive Care Unit
ISD	Information and Statistics Division
NPAT	National Patient Access Team
PAFC	Pulmonary artery flotation catheter
RRT	Renal replacement therapy
SAPS	Simplified Acute Physiology Score
SASM	Scottish Audit of Surgical Mortality
SCIEH	Scottish Centre for Infection and Environmental Health
SICS	Scottish Intensive Care Society
SICSAG	Scottish Intensive Care Society Audit Group
SMR	Standardised mortality ratio



C. INTRODUCTION & SUMMARY

1. Once again the Annual Report is being published on the Scottish Intensive Care Society's (SICS) web site. The web site is a means of communication, which saves publication costs and allows a considerable volume of information to be conveyed. More importantly, it offers improved access for health care professionals and the capacity to provide relevant links to other web-based publications. It also allows downloading of graphical data in a form which facilitates local presentation and discussion. For this year's report we have offered the option of downloading only national data, or combining that with unit-specific data for any specified hospital. This should encourage critical appraisal of local data. While the Annual Report represents an important mechanism of data feedback, many of the important issues were discussed at the Annual Audit Meeting in Stirling in October 2001.

2. Our use of the web, as a means of communication, remains in its infancy. It offers a medium for debate which, as a group, we have yet to take up with any conviction. Suggestions on how we can improve the report in particular, and the web site in general, will be very welcome. One suggestion which we have not incorporated this year is that one consultant at each site should undertake to write a commentary on that unit's data. We would welcome views on this proposal.

3. Funding of the Scottish Intensive Care Society Audit Group (SICSAG) has now been agreed with Scottish Health Boards. At the time of last submission, the "exit strategy" from the Clinical Resource and Audit Group (CRAG) funding was expected to be one in which SICSAG followed other national audits into the Information and Statistics Division (ISD). However, a pragmatic decision was made to generate top-sliced funding built around the very positive response to the creation of an *electronic* (e)Bed Bureau. As a result, funding has been assured for one further year (to March 2003) and it is anticipated that this level of funding will be ongoing.

4. Funding of high dependency unit (HDU) audit is not included in the above package. As proposed in our last Annual Report, the Audit Group organised a national



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meeting in 2001 specifically to discuss implementation of a National HDU Audit, recommended in *Better Critical Care* [1]. This has led to the development of an agreed minimum dataset and establishment of audit systems in 23 HDUs across Scotland. This was established without additional resources, through a combination of savings from the software costs for the intensive care unit (ICU) audit and a contribution from the SICS, generated by collaborative work with a number of pharmaceutical companies. Ongoing support for HDU audit was sought by “selling” the system to individual Trusts. This is the way in which funding of intensive care audit is provided in England. The annual cost will be £2,500 per annum for each HDU site.

5. The ICU audit budget provides salaries for two full-time employees, the Project Director plus one other, for the period of funding. The response, thus far, from Trusts towards the development of the HDU audit will allow us to appoint one further full-time member of staff to support our “Critical Care” audit.

6. It remains our intention to work closely with ISD, taking advantage of their expertise in record linkage and data analyses. In the current year a proportion of the data analyses has been undertaken by ISD. While this has contributed to the later than expected publication of this Report, it has had the benefit of familiarising ISD staff with the structure of our database. At present we have made an informal approach to ISD to employ a member of ISD staff, seconded annually, whose role will include database management and data analyses. With the SICSAG being responsible for software support and maintenance of audit in up to 60 critical care units spread throughout Scotland, the establishment of IT links remotely between each unit and the office is paramount. It is anticipated that this employee will also help forge such links via the NHSnet.

7. Once again we provide comparative data on ICU occupancy and levels of organ support derived from daily Augmented Care Period (ACP) data. These data are of particular value to the Trusts’ Critical Care Delivery Groups (CCDGs), which have the responsibility for ongoing assessment of the adequacy of provision of critical care



beds. The ACP data have also been examined to characterise variations in the process of care in relation to the utilisation of pulmonary artery flotation catheters and the utilisation and timing of tracheostomy. The variation in practice, which we have observed, was not surprising given the lack of evidence currently available to guide practice in this area.

8. Further development of the *e*Bed Bureau will involve providing a real-time display of *national* ICU bed occupancy and availability direct from the *e*Bed Bureau menu. Modification of the software enabling units to designate each patient, daily, as ICU or HDU, will provide a more accurate occupancy figure for combined ICU/HDUs whose maximum functional bed complement depends on the ICU/HDU mix. The presumption will be that 1 ICU patient equates to 2 HDU patients.

9. Case mix adjusted mortality is presented both in terms of 6-year trends and variation across individual ICUs. Once again the most striking feature is the very narrow range of case mix adjusted (standardised) mortality ratios (SMRs). For the first time we have divided SMR data for each unit according to the primary system failure. This allows each unit to evaluate performance in discreet areas of practice. These data are provided in an anonymised form, with an ICU's identity made available to its own staff and at the request of relevant Trust staff. We would appreciate views on whether this level of anonymity should be sustained, given a political climate which encourages making this type of information available to the public.

10. The ability to compare case mix adjusted ICU lengths of stay is complimentary to comparisons of standardised mortality ratios, in providing an insight into variations in effectiveness of ICU care. Plots of the relationship between length of ICU stay and severity of illness, as measured by the Acute Physiology and Chronic Health Evaluation model (APACHE II) [2] mortality probability, have been updated. Understanding variation in length of stay requires local knowledge of issues such as availability of step down beds and peculiarities of case mix. This is an area of performance evaluation the audit continues to refine in subsequent analyses. Once



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again these data are anonymised, using the same unit identifier as that used for SMR data.

11. Multidisciplinary, retrospective analyses of outcomes in certain groups of ICU admissions are underway. A review of haemato-oncology outcomes is being supported by Haematologists in Scotland, interim analyses of which were presented at the UK ICS Spring Meeting in May 2002. A summary of these results has been included in this Report. We have also conducted retrospective analyses of patients with ruptured aortic abdominal aneurysm. A summary of this study is also included.

12. Having previously adapted the database to undertake an audit of incidence, process and outcomes for the Adult Respiratory Distress Syndrome (ARDS), in 2001-2 we have undertaken a similar prospective audit of Sepsis, in conjunction with a pharmaceutical company (Eli Lilly). This has been very demanding in terms of the augmented data collection. We are particularly grateful to the nursing staff who have shouldered much of the additional workload. This work was critical, given the anticipated availability of Drotrecogin alfa (Activated) (recombinant human activated protein C) for the treatment of sepsis. Interim results of this study were presented at the UK Intensive Care Society Spring Meeting in Edinburgh in May 2002. A summary is included in this Report.

13. Consistent with the instruction of our last AGM in January 2002, a group has met to take forward production of a guideline for use of Drotrecogin alfa (Activated), based not only on the published randomised study [3] but also on the sub-group analyses available on the FDA web site (<http://www.fda.gov>). The potential financial impact of this drug on ICU pharmacy budgets has been highlighted to both the Chief Medical Officer and to the Scottish Medicines Consortium. It is likely that the guideline group will recommend further modification of the database to monitor both guideline compliance and outcomes in treated patients.

14. We are about to undertake a pilot project on Hospital Acquired Infection (HAI) in ICU in conjunction with the Scottish Centre for Infection and Environmental Health



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(SCIEH). This will involve approximately 4 units in the first instance. Funding of £40,000 has been identified which will be used to develop links between local laboratories, local ICUs and SCIEH. The audit database will also be updated to present microbiology information to the clinician at the bedside, in a format which facilitates clinical management. We hope this approach will encourage compliance with the additional data entry required when the project moves beyond the pilot stage. The background to this project is discussed in a review by Dr Ahilya Noone.

15. Following September 11th there is a wish to have in place systems which rapidly recognise unusual and unexplained illnesses. Intensive care has been identified as one area in which these may present. Dr Ian Grant has represented the Society in these discussions. A proposed protocol for this surveillance is given in Appendix I.

16. As the audit has developed it has encouraged the creation of groups which rely, to a variable extent, on its structure and available data. This Report, therefore, includes reviews from these groups (Research Group, Standards Group).

17. Invited reports have also been contributed on key issues. An assessment of progress in Scotland compared with England following the Critical Care reports, published both in Scotland [1] and England [4] in 2000, has been contributed by Ian Grant. Given the escalating requirement for critical care transfer, Peter Wallace provides suggestions on how safe transfer systems might be developed. New legislation on consent in Scotland has significant implications for intensive care, which are discussed by Malcolm Booth.

18. In an attempt to improve organ donor rates, UK Transplant has allocated funding for a limited number of liaison nurses (two in Scotland). The nurse appointed to the South Glasgow Trust will, in addition to local audit, work with the Audit Group to investigate the variation in organ donation rates which we have observed from our current limited data-set. A review of the Scottish Transplant Group by Jim Dougall is included in this Report.



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19. Dr Simon Mackenzie has now taken over as Lead Consultant for the Audit. During the next 6 months a steering group will be established, chaired by Dr Mackenzie. It will be responsible for setting priorities for ongoing audit and will be accountable for responding to any performance issues raised by anonymised outcome data.



D. RESULTS & DISCUSSION

In all graphs asterisks identify District General Hospitals (DGHs), unless stated differently.

D.1. Intensive care demand.

20. Figure 1 shows the trend in annual ICU admissions in all units who have contributed data over the period 1995-2000. The trend in the subgroup of 20 units who contributed data throughout that period is more informative, demonstrating an increase of approximately 15% over 6 years.

21. Figure 2 shows the annual occupancy for each ICU in 2000 compared with its mean occupancy for the preceding 2 years. In spite of an increase in the number of ICU beds in Scotland (from 112 beds in 1996 to 133 beds in 2000), average occupancy has remained consistently high, at 80%, throughout the audit (Figure 3). In individual unit reports Figure 3.1 shows the trend in occupancy for that unit over the same period of time. The period between January and March is the time when ICUs in Scotland are most consistently under pressure. Figure 4 shows the annual occupancy for this period from 1995–2001. January 2000 remains exceptional. In an individual unit's figures, located on the website, Figure 4.1. demonstrates monthly bed occupancies (<http://scottishintensivecare.org.uk>).



Figure 1. Annual admission rate to Scottish ICUs, 1995 - 2000: a) in cohort of 20 units contributing throughout and b) total admissions.

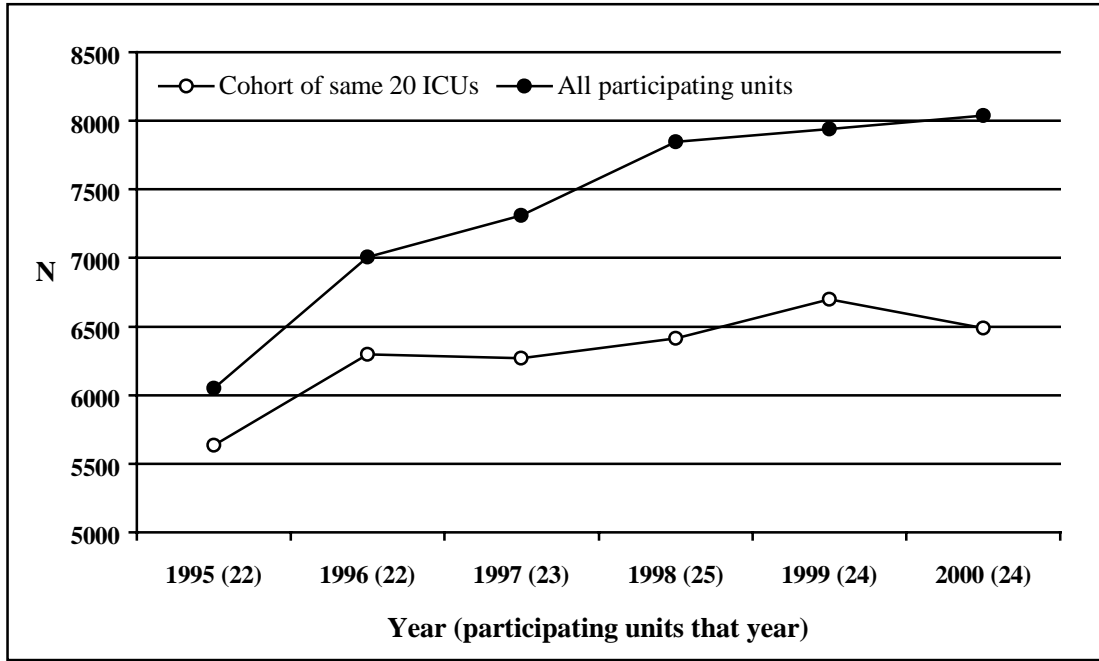


Figure 2. Trends in bed occupancies (%) in Scottish ICUs. (*indicates ICU/HDU during these years). Excludes Raigmore & FRI.

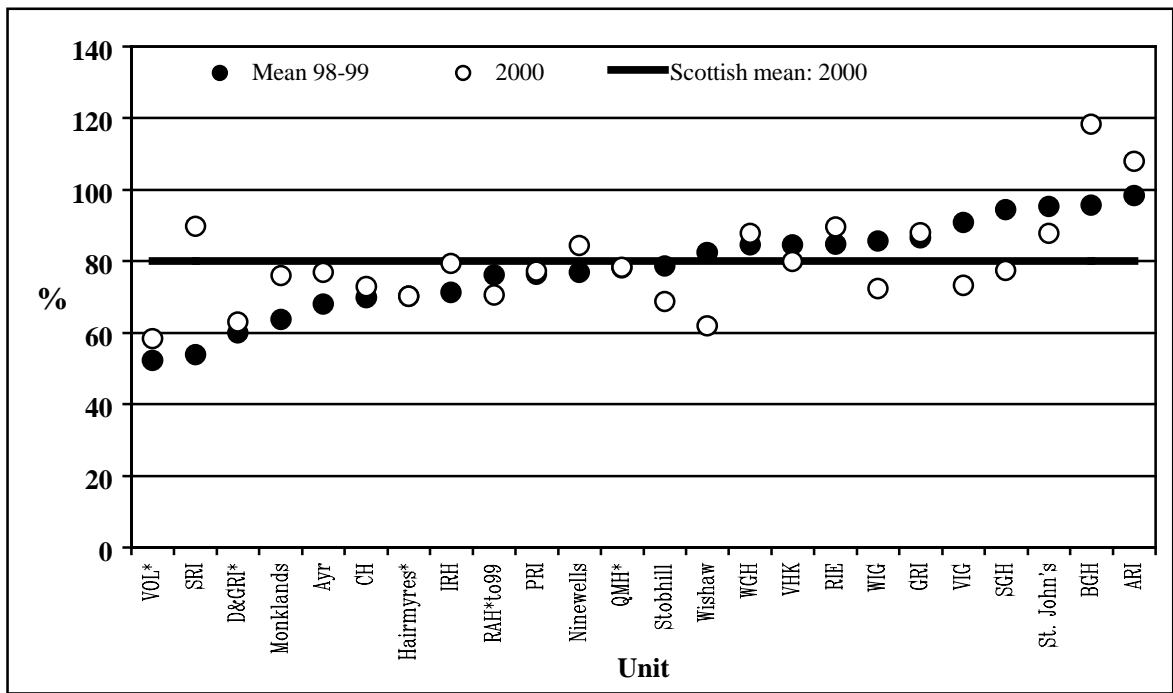




Figure 3. Scotland: ICU bed occupancy 1996-2000.

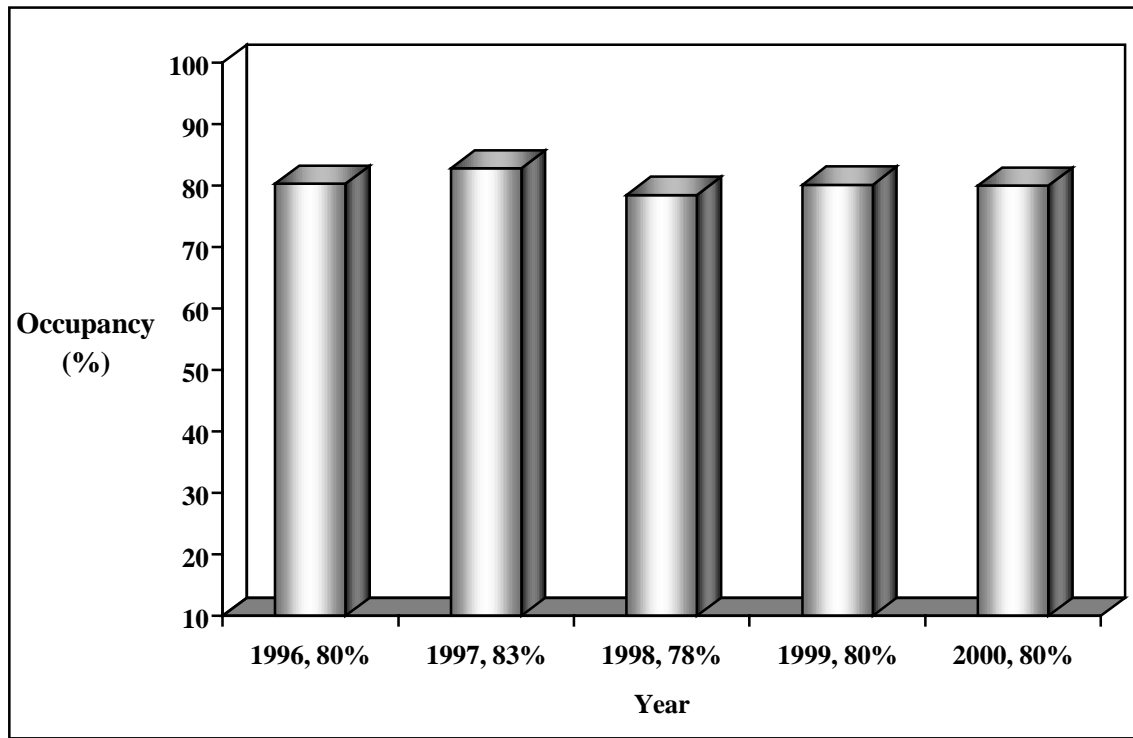
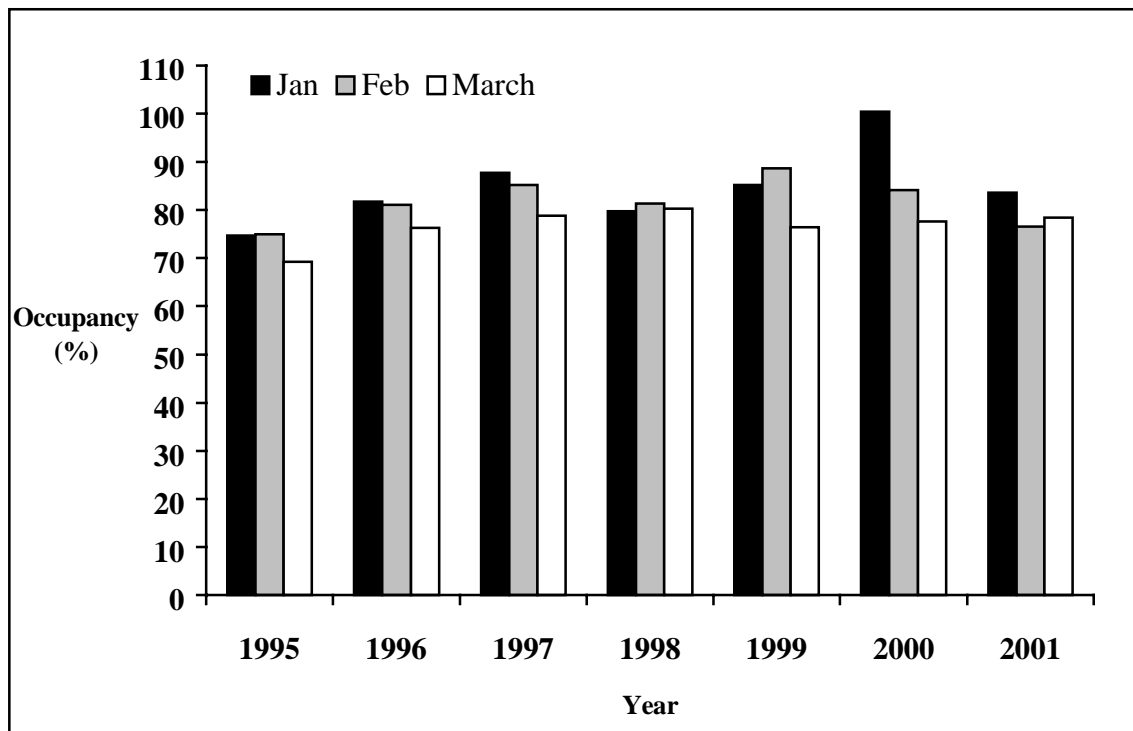


Figure 4. Trends in Scottish ICU bed occupancy: January - March.





D.2. Organ support as a measure of workload.

22. Level of organ support routinely used in an ICU is complimentary to occupancy data when attempting to characterise workload and the consequent staffing requirements. The intervention results described in this section are from daily recording of ACP data during 1999 & 2000. Limited intervention data were available for Hairmyres Hospital, no such data were available for Falkirk Royal, Ninewells or Raigmore hospitals during this period of time.

23. Figures 5 and 6 show the proportion of patients ventilated on the first day of ICU care in 1999 and 2000 respectively. Figures 7 and 8 show the proportion of patients ventilated at any time during their ICU care in 1999 and 2000 respectively. These data continue to demonstrate an entirely understandable variation in the dependency of patients, with larger units, predominantly in teaching hospitals, having patients with higher levels of dependency. This further emphasises a theme, which runs through the report, of comparing “like-with-like”. Figures 9 & 10 extract the data for comparison of teaching hospitals alone. Figure 11 supplements the proportion of patients ventilated in each unit with the level of severity of the acute illness, using APACHE II. This figure demonstrates the ability of staff, in the combined ICU/HDUs in particular, to stratify patients as ICU or HDU during this 3-year time period. In these combined units (D&GRI, Hairmyres, QMH, RAH & VOL) the APACHE scores are derived only for patients categorised as ICU. The mean and median APACHE II scores for the Scottish ICU population for 1998-2000 were 19.1 and 18 respectively. The median APACHE II scores (plus inter-quartile ranges) are given for each ICU in Figure 12.

24. A more complete picture of the variation in dependency can be gained by aggregating the days on which each patient receives one or more key interventions i.e., ventilation, renal replacement therapy and cardiovascular support (inotropes &/or pulmonary artery flotation catheters). Figures 13 & 14 demonstrate the proportion of days on which ventilation was used in each unit’s population of patients. A broadly similar pattern is observed in relation to dependency. Figures 15 & 16 depict the



proportion of ventilation days in which cardiovascular or renal support or both were concurrently delivered. In analysing these data it is important to recognise that 5 units were combined HDU/ICUs for the majority of time of data collection (D&GRI, Hairmyres, QMH, RAH & VOL). It follows that their far lower proportion of days in which vital organ support is administered is entirely to be expected.

25. Although we have not chosen to depict days on which vital organ support was provided exclusive of ventilation we have examined the provision of renal replacement therapy (RRT) in patients whether ventilated or not. We have previously documented the variation in dialysis activity across the Scottish ICUs, and a lack of correlation with outcome [5]. Figures 17 - 19 show the number of patients who had RRT delivered and the proportion which they represent of all ICU admissions for the 1999, 2000 and the 2-year period 1999-2000. Figures 20 - 22 again describe the proportion of each ICU's admissions receiving RRT but complement this by adding the proportion of total patient days on which renal support was being provided. Variation in the correlation between these 2 values will be dependent on the average time for which patients receive RRT whilst in ICU. Variation in the need for dialysis amongst units with comparable case mix might arise from differences in the threshold for institution of dialysis, 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.



Figure 5. Proportion of patients ventilated on the first ACP day, during 1999.

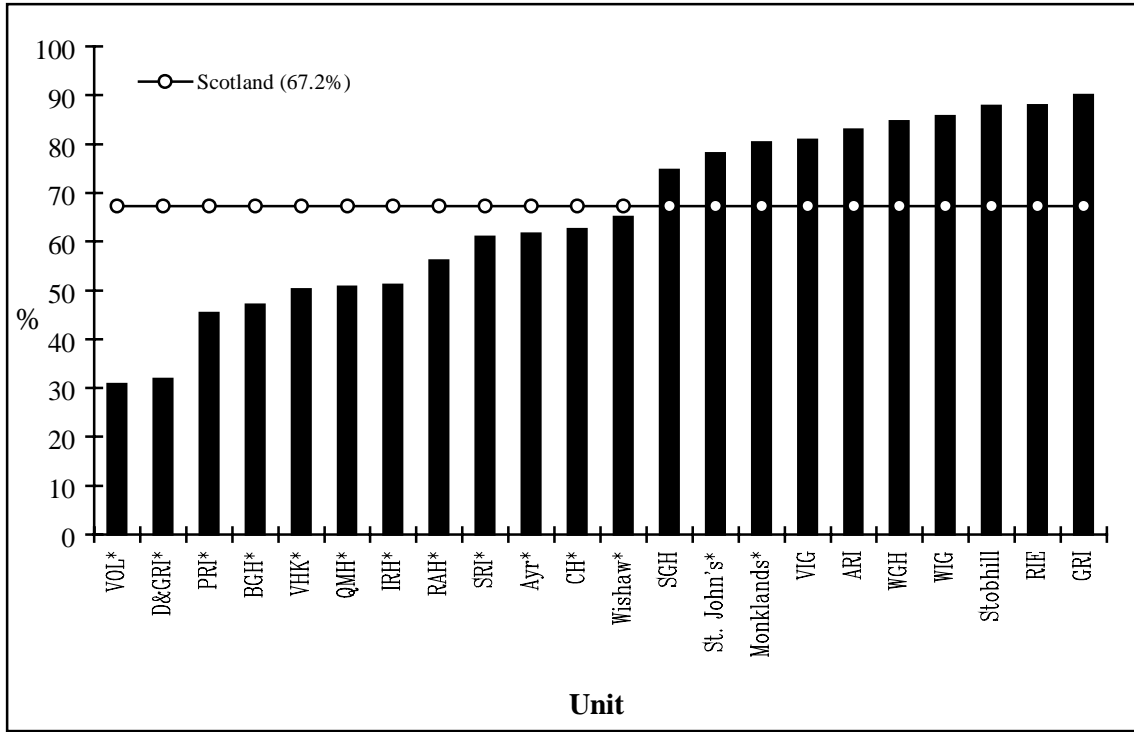


Figure 6. Proportion of patients ventilated on the first ACP day during 2000.

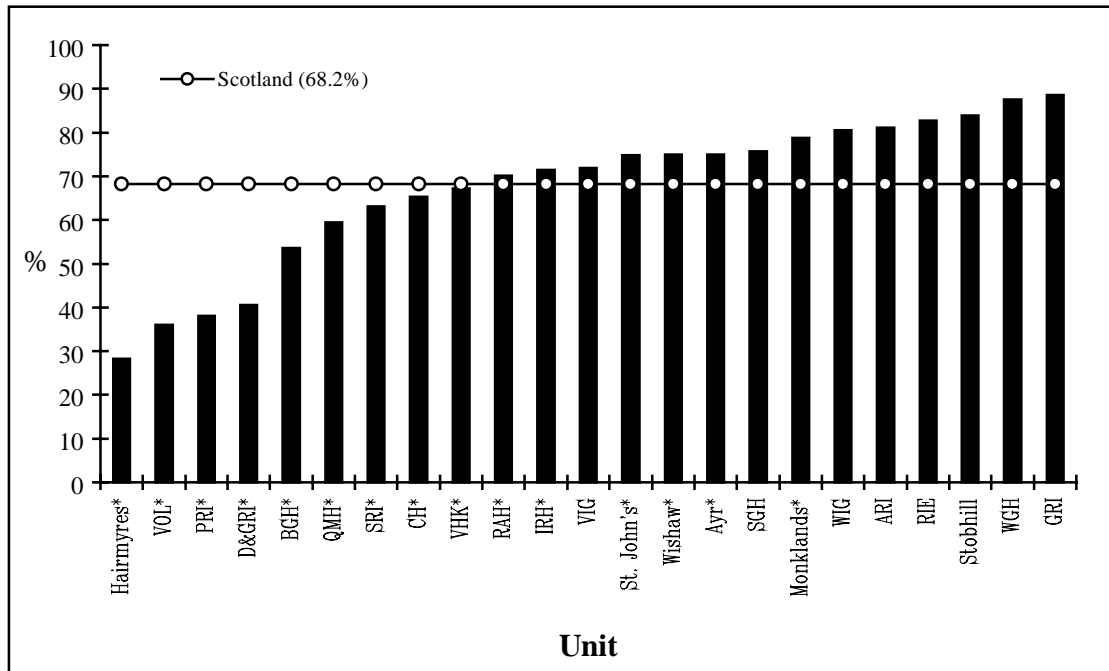




Figure 7. Proportion of patients ventilated at any time in ICU during 1999.

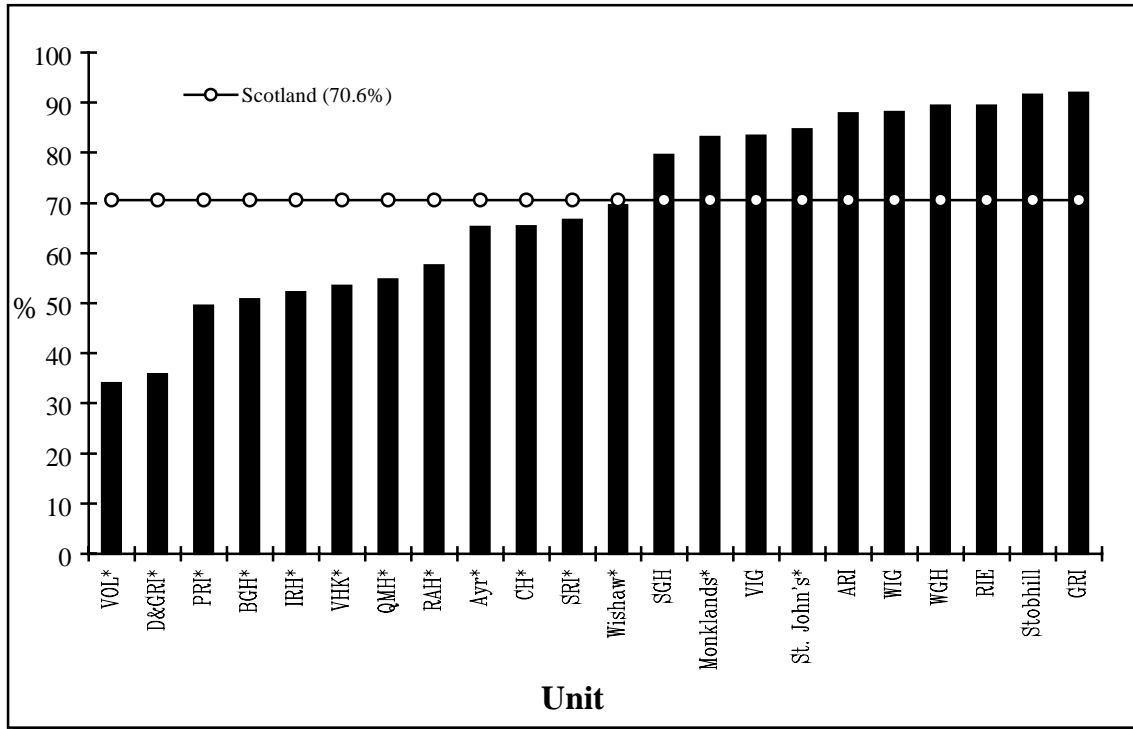


Figure 8. Proportion of patients ventilated at any time during 2000.

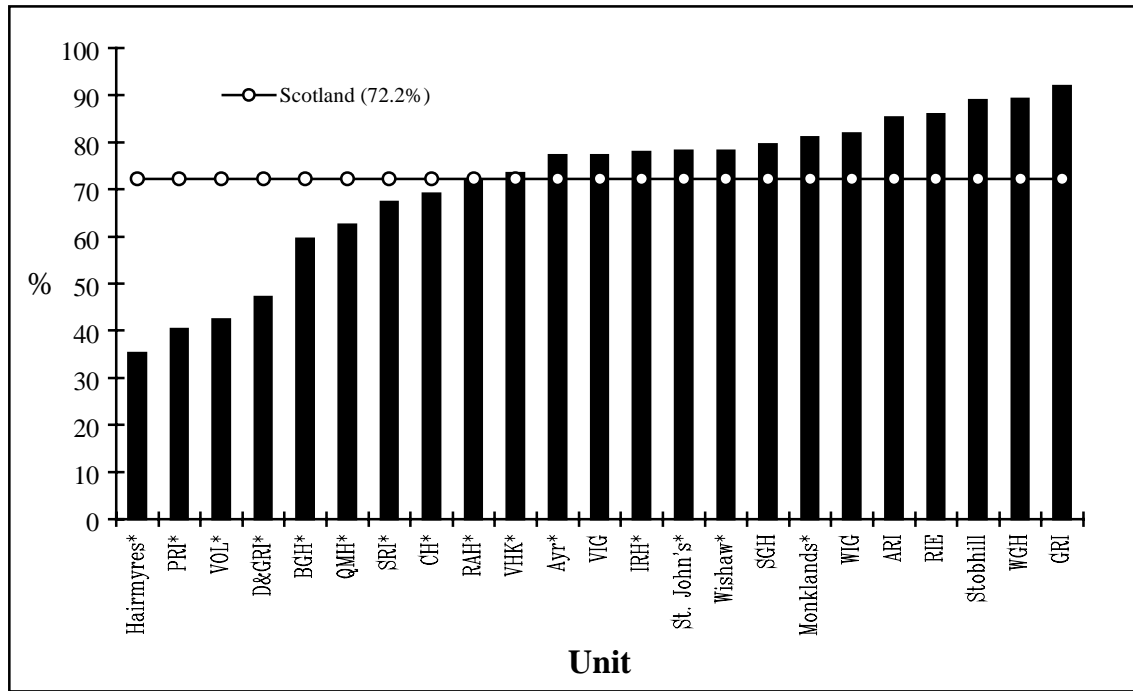




Figure 9. Proportion of patients ventilated at any time in teaching hospital ICUs during 1999.

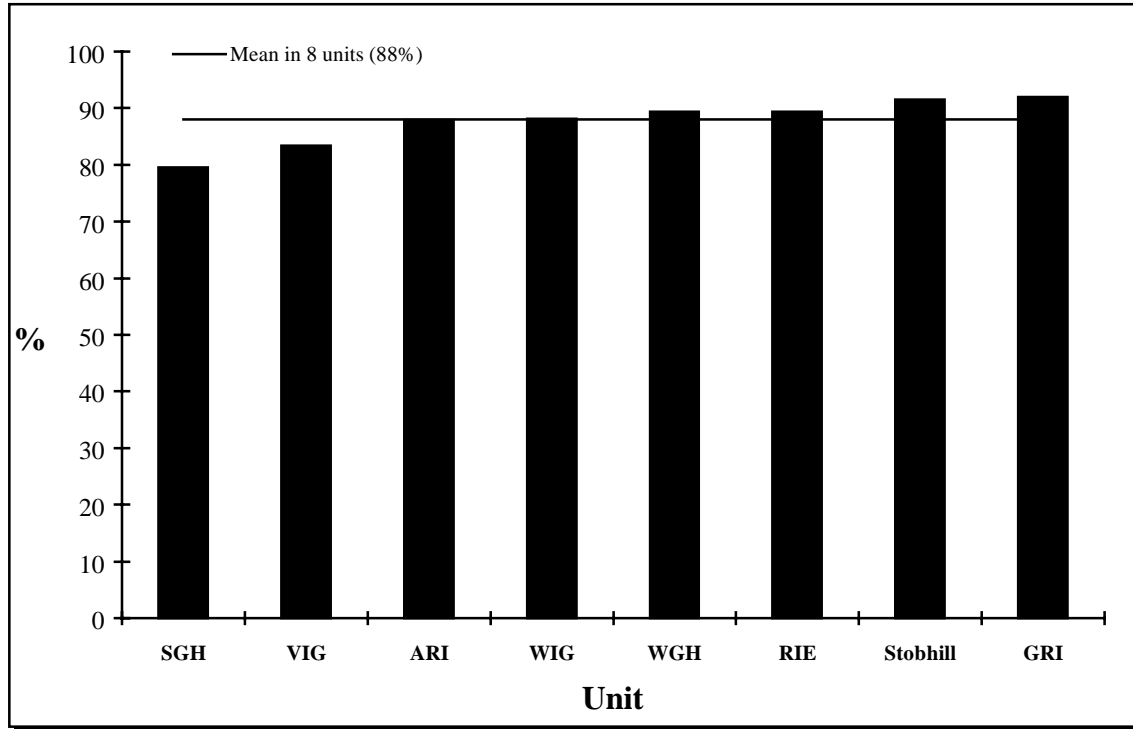


Figure 10. Proportion of patients ventilated at any time in 8 teaching hospital ICUs during 2000.

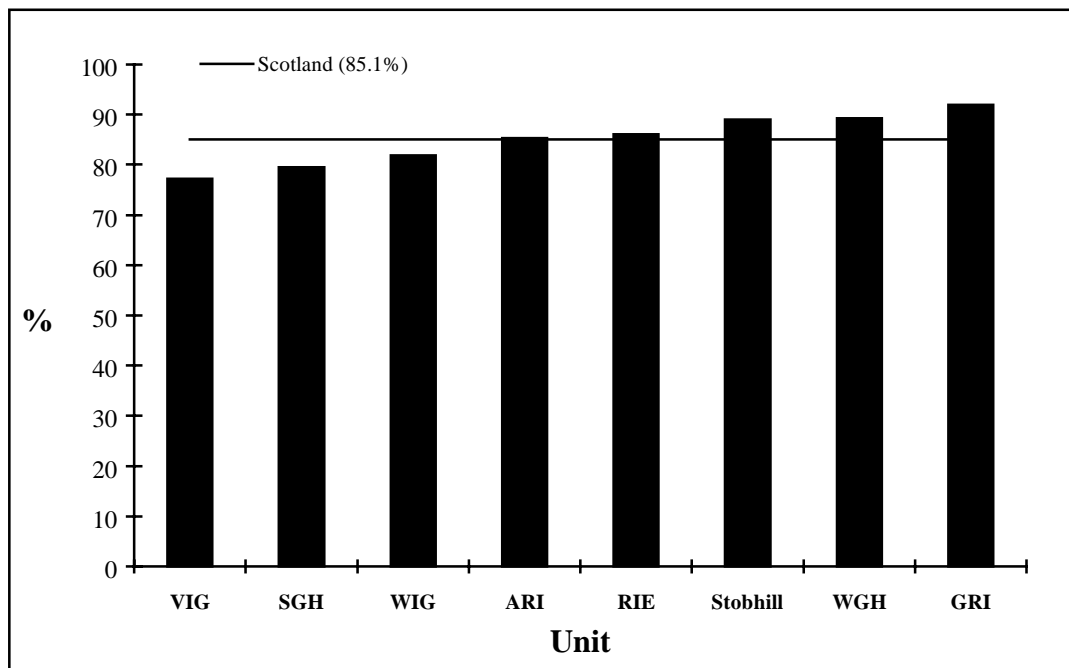




Figure 11. Illness severity and level of ventilation requirements.

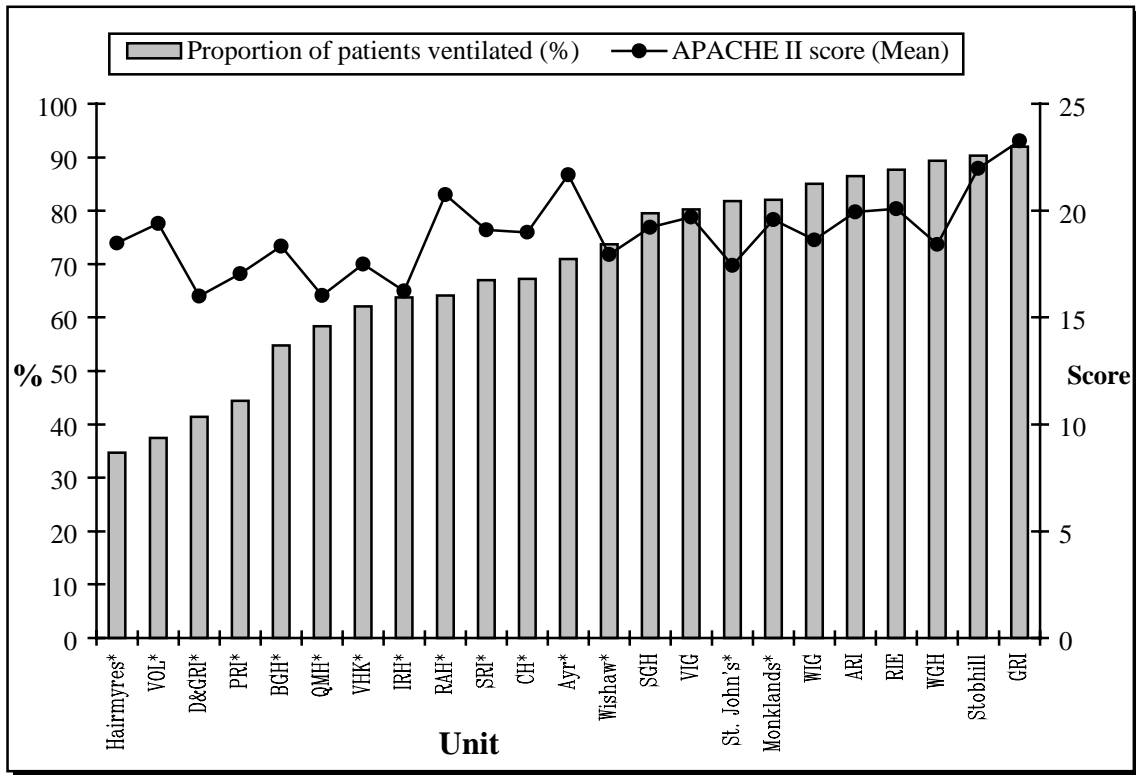


Figure 12. Illness severity: Median APACHE II scores (inter-quartile range) 1998-2000.

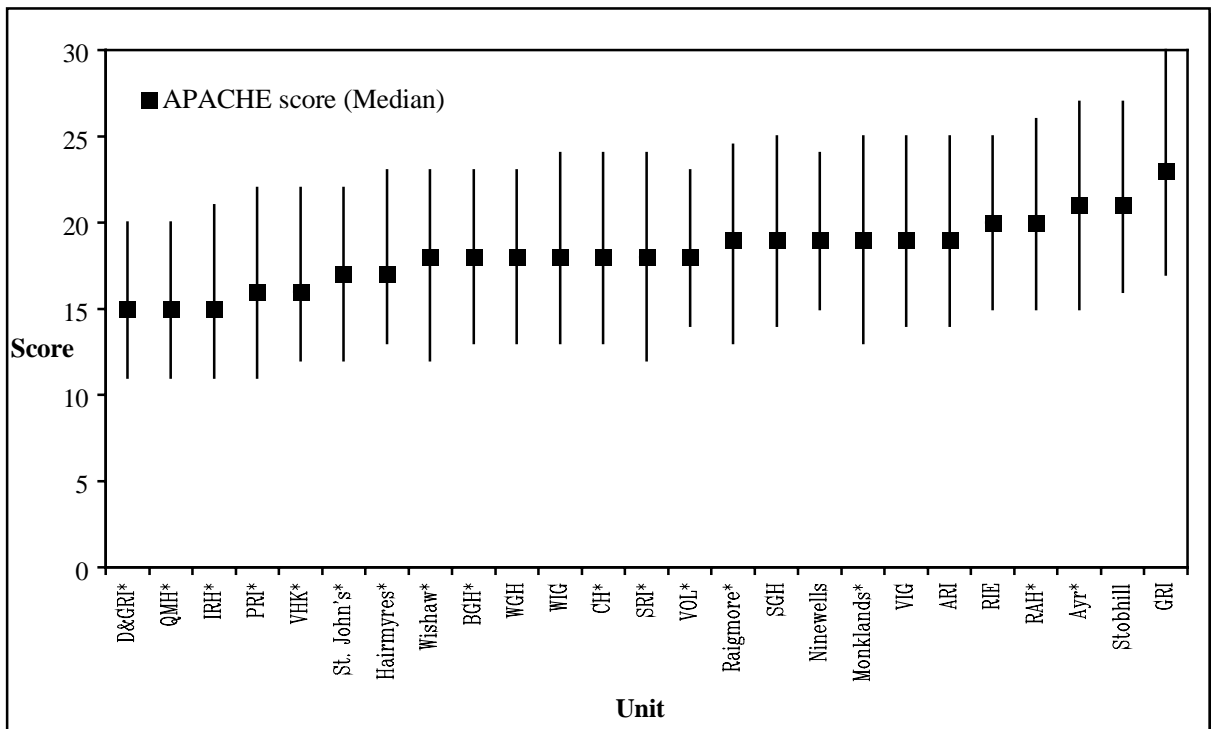




Figure 13. Proportion of ACP days in which there is ventilatory support: 1999.

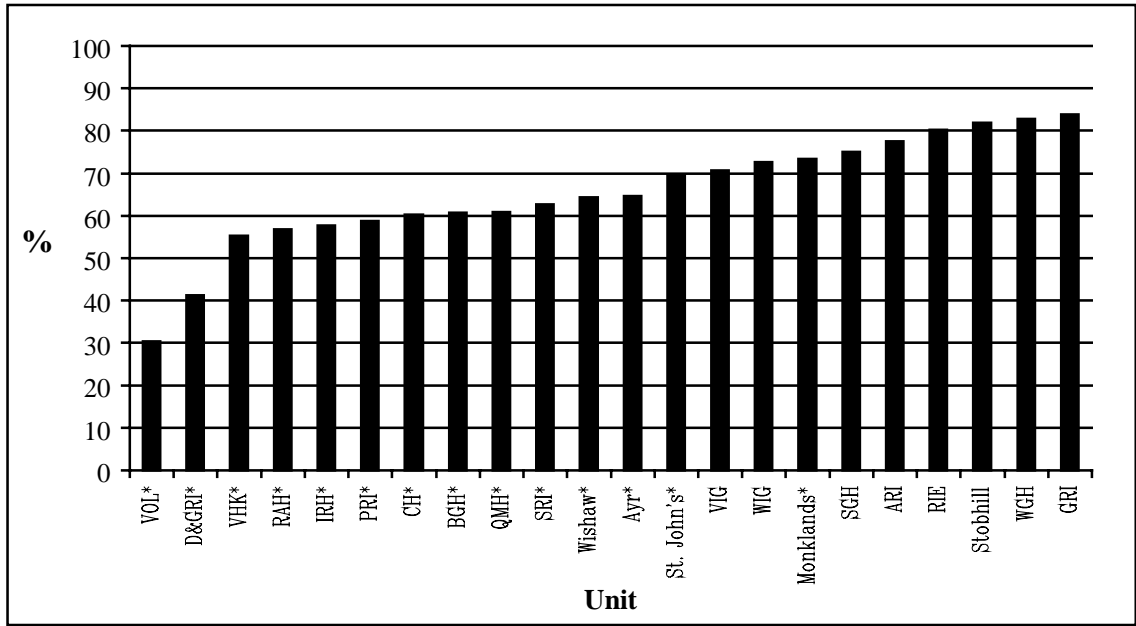


Figure 14. Proportion ACP days in which there is ventilatory support: 2000.

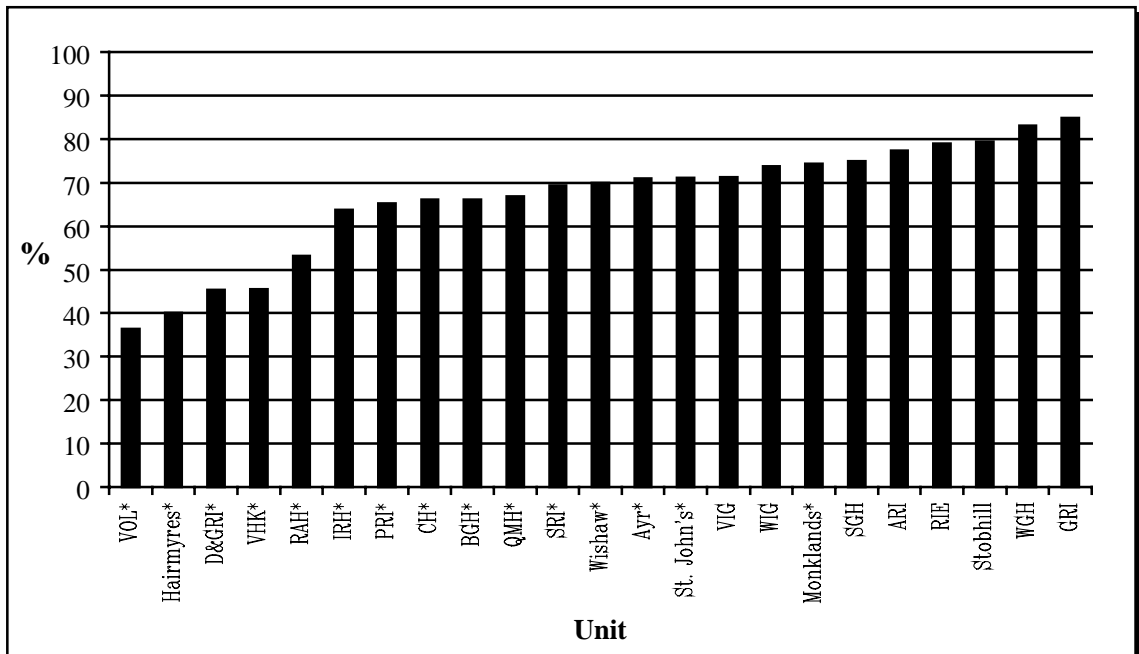




Figure 15. Proportion of ACP days in which there is ventilatory support alone, with either cardiovascular or renal support, or with both: 1999.

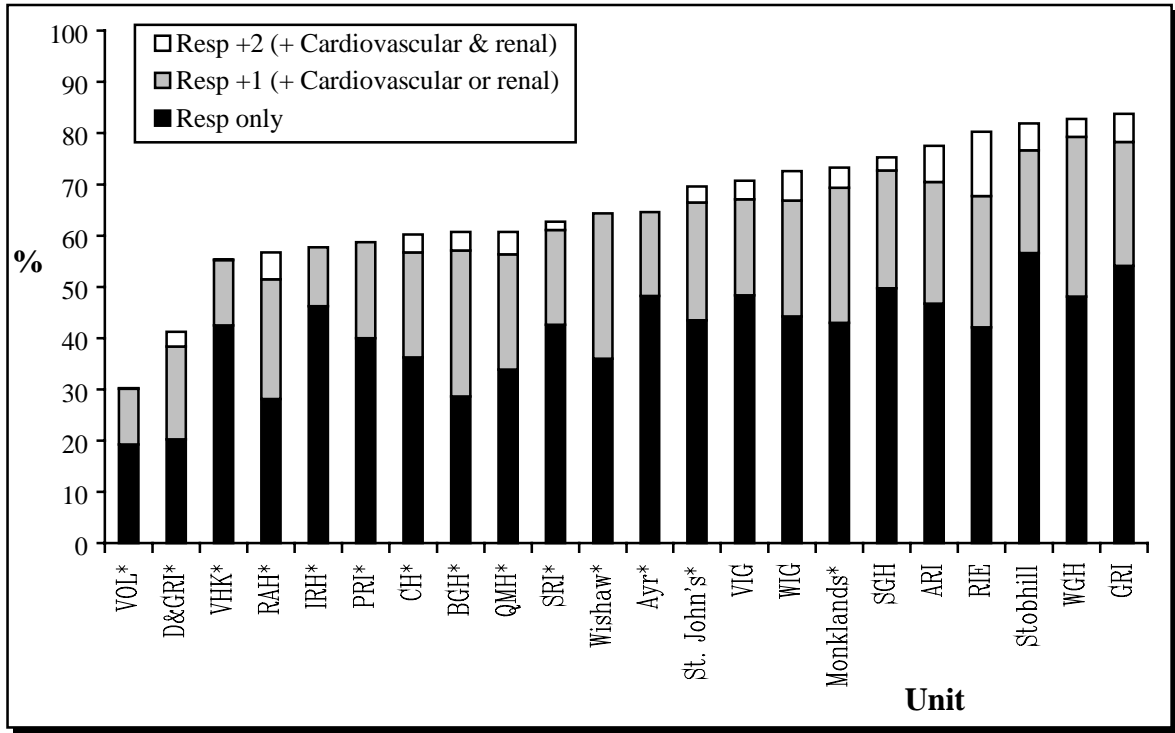


Figure 16. Proportion of ACP days days in which there is ventilatory support alone, with either cardiovascular or renal support, or with both: 2000.

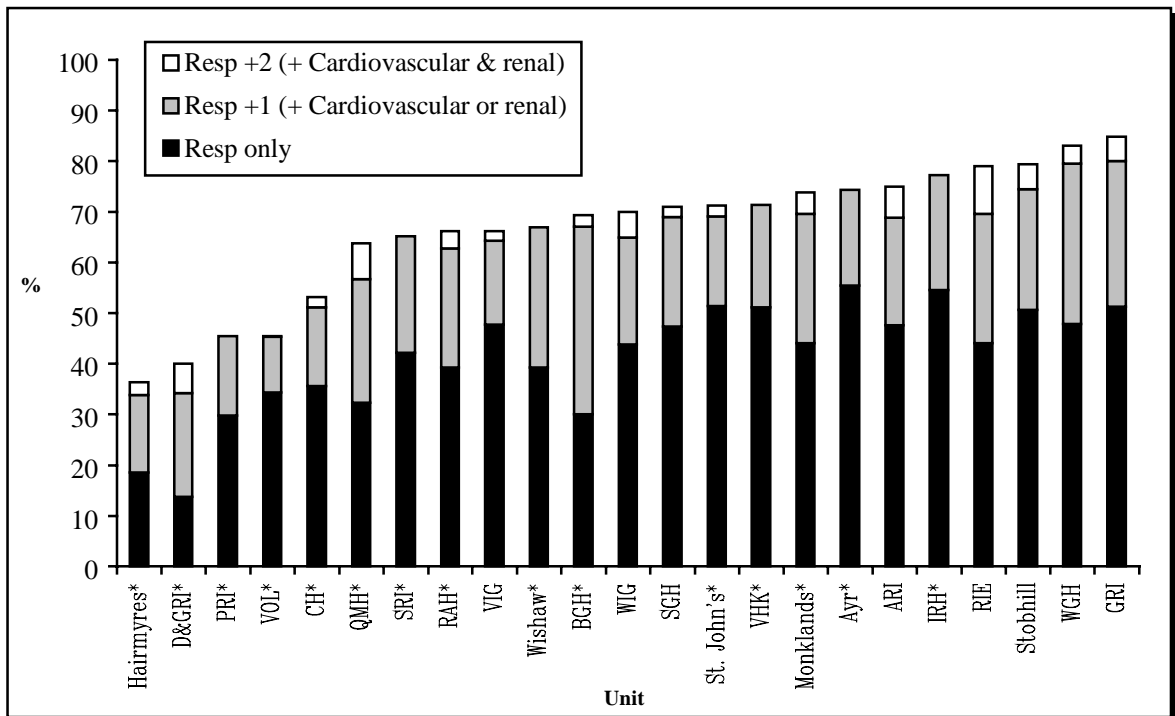




Figure 17. Provision of renal replacement therapy: 1999.

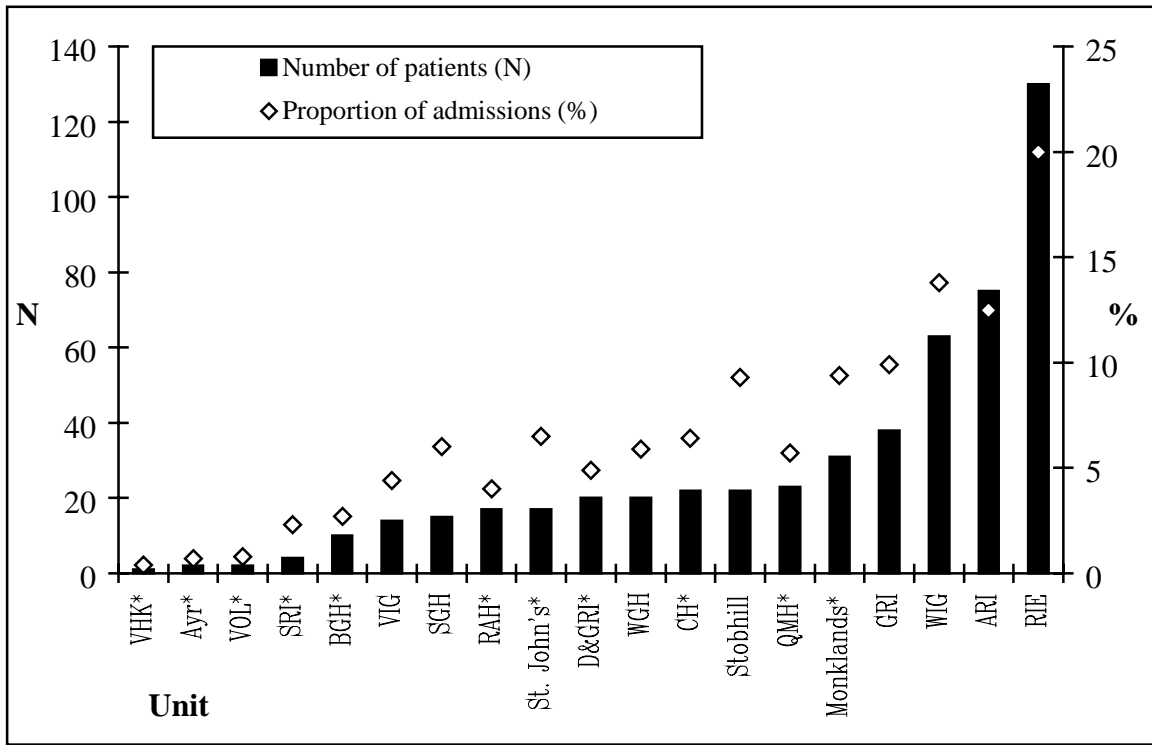


Figure 18. Provision of renal replacement therapy: 2000.

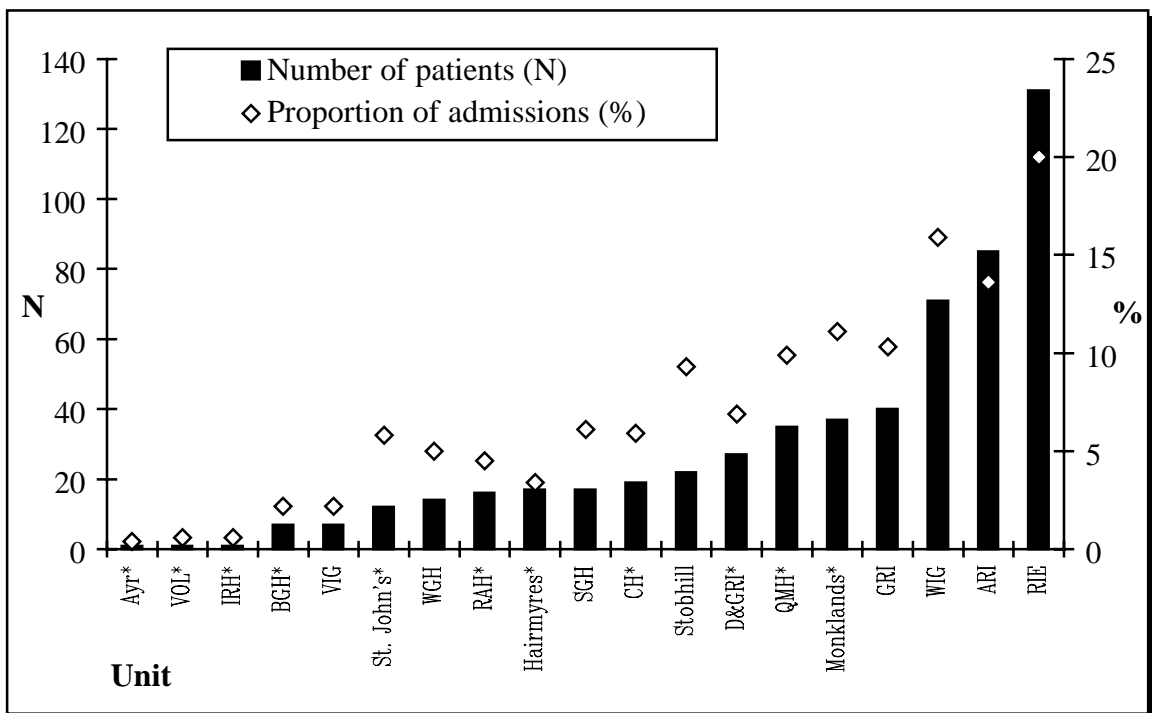




Figure 19. Provision of renal replacement therapy: 1999-2000.

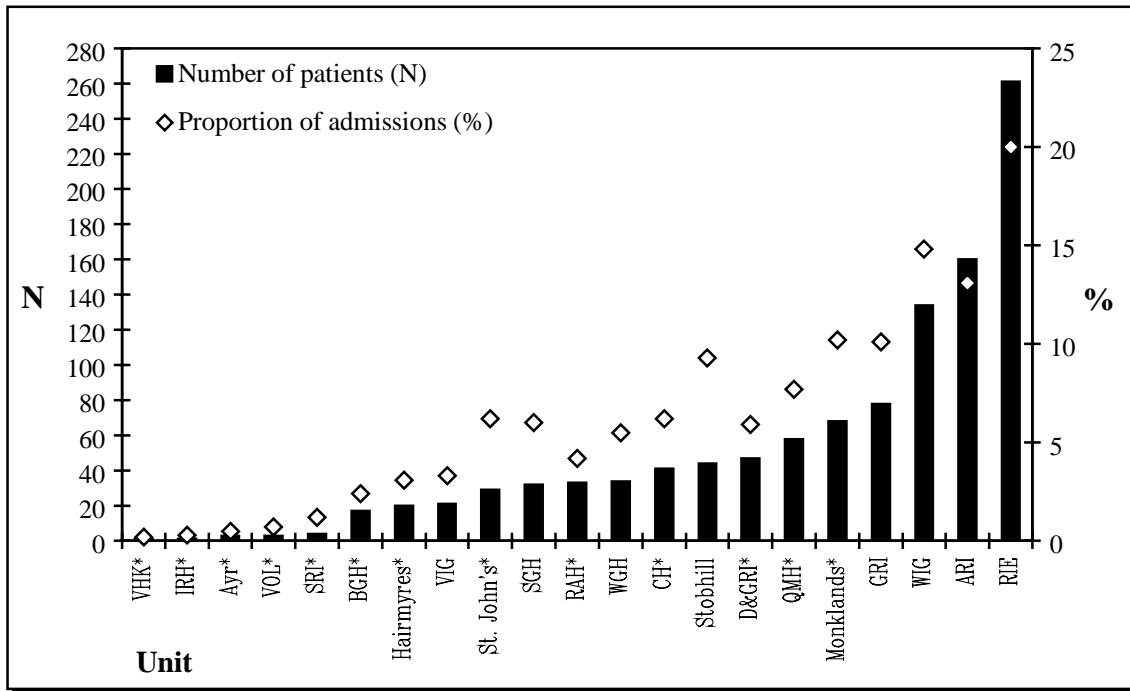


Figure 20. Provision of renal replacement therapy in 1999. 7% of patients in Scottish ICUs received RRT, utilising 9.1% of ACP days.

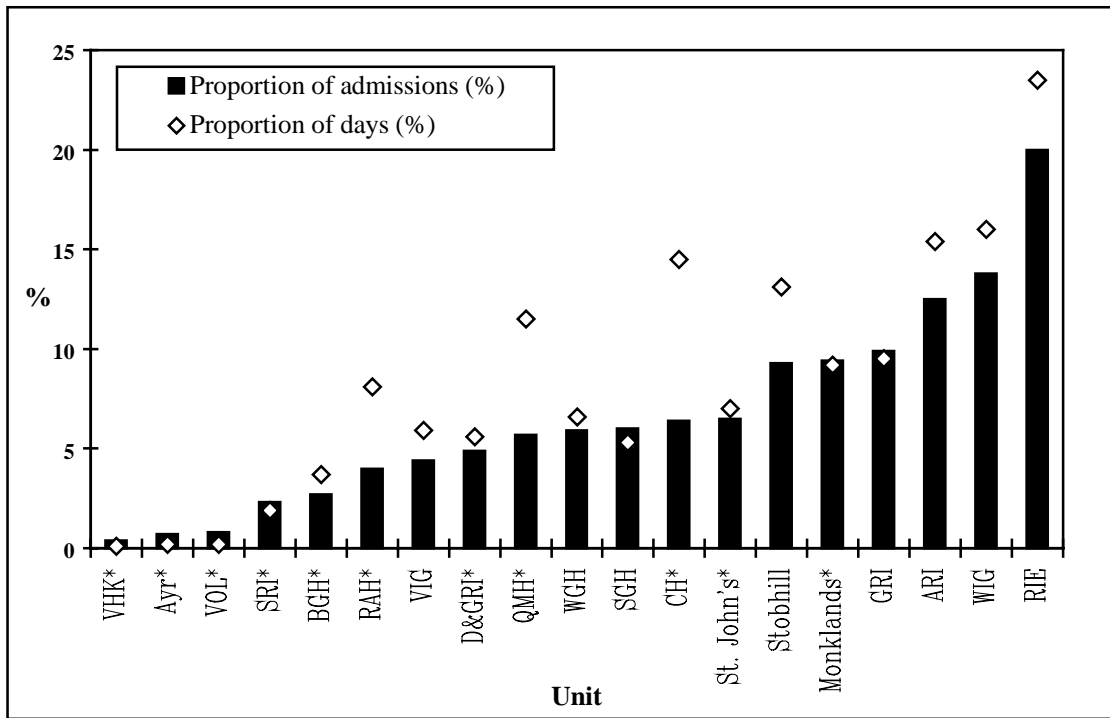




Figure 21. Provision of renal replacement therapy in 2000. 7.6% of patients in Scottish ICUs received RRT, utilising 8.8% of ACP days.

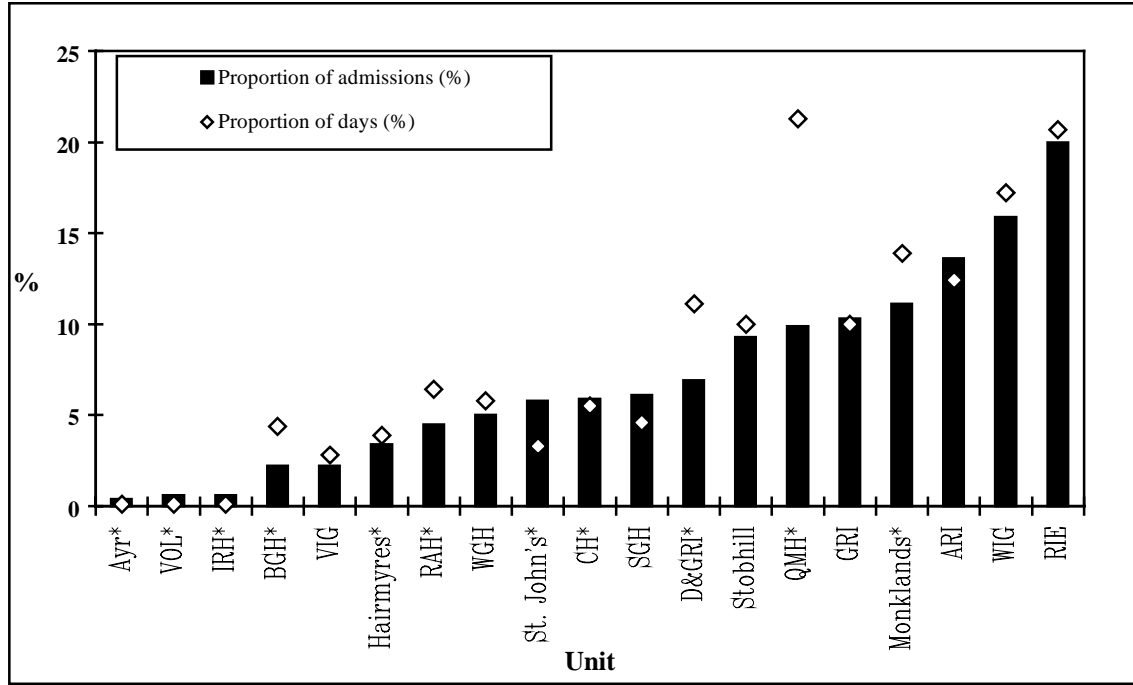
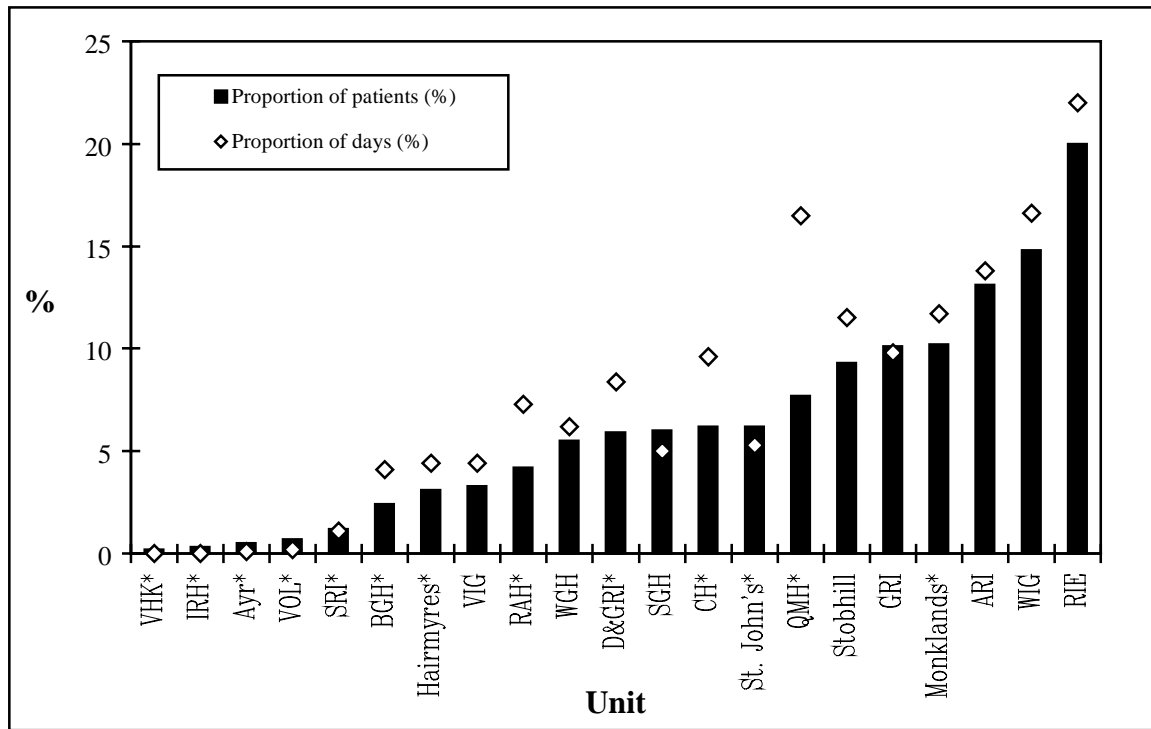


Figure 22. Provision of renal replacement therapy in 1999-2000. Proportion of patients in Scottish ICUs receiving RRT = 7.3%, utilising 8.9% of ACP days.





D.3. Organ support as a measure of variation in process of care

26. Collection of daily intervention data allows us to gain insights into variations in practice both between units and with time. 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.

27. We have previously reported the frequency of use of pulmonary artery flotation catheters (PAFCs) during the first 24 hours of ICU care [6], which fell from 17% to 13% following publication of the paper by Connors *et al.*, in 1996 [7]. At that time we recorded intervention data only during the first 24 hours. Figures 23, 24 and 25 show the variation in the use of the PAFC during both the first day and the entire duration of intensive care. This demonstrates a further fall in utilisation during the first day, this being the time when the majority of catheters are inserted. More striking is the variation in utilisation, with comparable units differing in their use by a factor of 100%. Unusually high utilisation in Borders relates to pre-optimisation of high-risk surgical patients. There is clearly a real difference in the value which should be placed on this methodology which may be better informed by the current randomised study in the UK.



Figure 23. Proportion of patients with PAFC *in situ* on 1st day of ICU (mean = 10%) or at any time during ICU (mean = 15%): 1999.

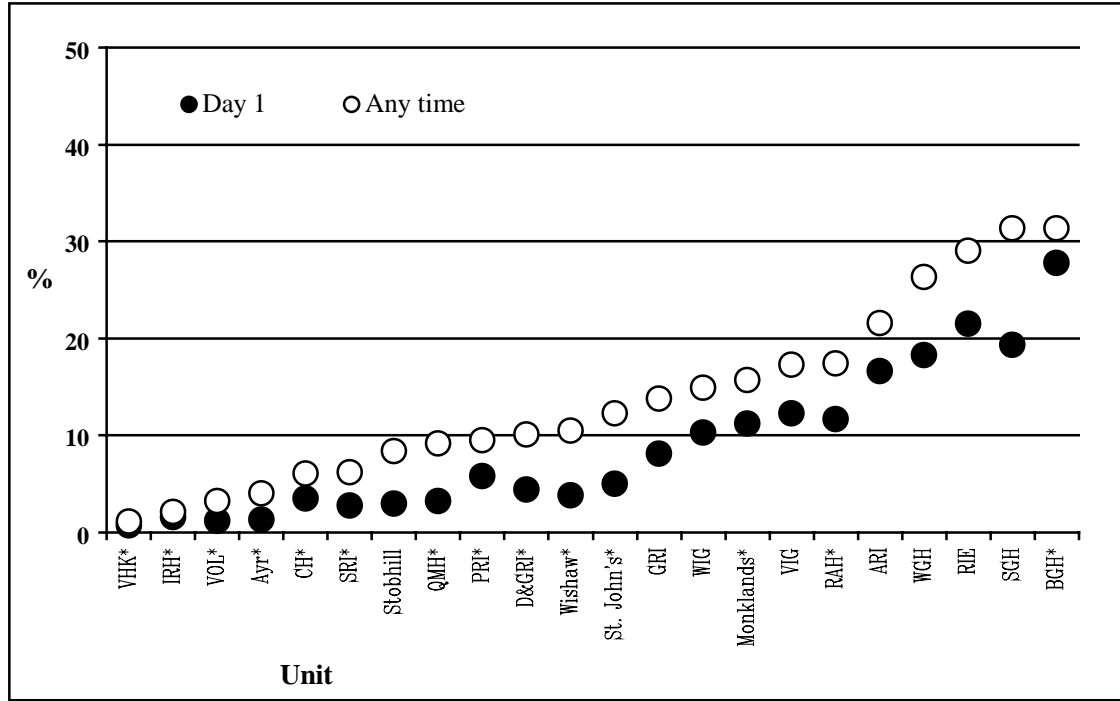


Figure 24. Proportion of patients with PAFC *in situ* in 1st day of ICU (mean = 9%) or at any time during ICU (mean = 14.5%): 2000.

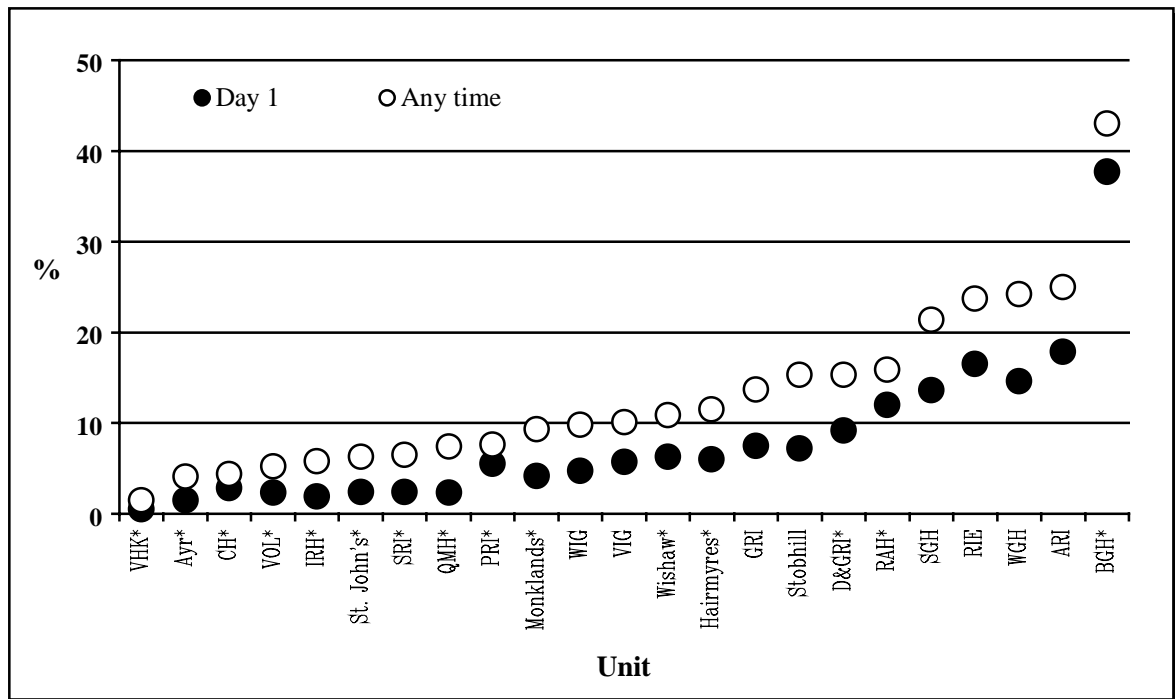
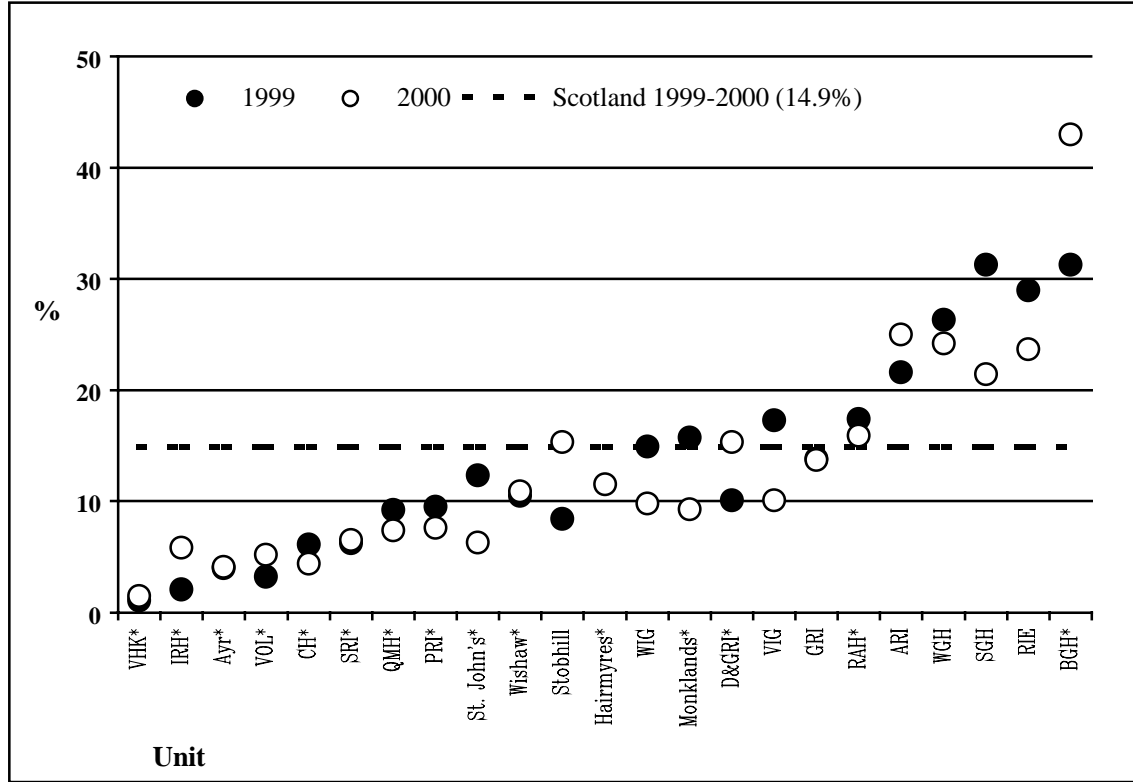




Figure 25. Proportion of patients with PAFC *in situ* at any time in ICU: 1999 & 2000.



28. There are no clear guidelines on when tracheostomy should be undertaken. Informal discussions on this topic suggested there is a real difference in the readiness with which units undertake this procedure. We analysed data on the presence of tracheostomy, in particular examining the group in whom a tracheostomy was *in situ* for the first time after day 2. We presumed this would identify patients in whom a tracheostomy was performed to facilitate ventilation rather than as part of head and neck surgical management. Figure 26 shows the percentage of patients with tracheostomies *in situ* both in the first 2 days of intensive care and from day 3 onwards. The variation in the latter group reflects both case mix variation and variation in practice. Figures 27, 28 and 29 show the variation in the time at which tracheostomy is first performed in this group of patients. Variation in practice is not as great as we had expected with peak time for undertaking this procedure being during



the second week of ICU care. However it is sufficient to result in a 100% difference in the use of this procedure in units with comparable case mix.

29. Once performed, tracheostomies are used for an average of 11 days with a skewed distribution (Table 1). These data do not include the time during which tracheostomies were subsequently managed in a general ward setting.

Figure 26. Proportion of patients with tracheostomies present in days 1 or 2 of ICU, or performed from day 3 onwards: 1999 & 2000.

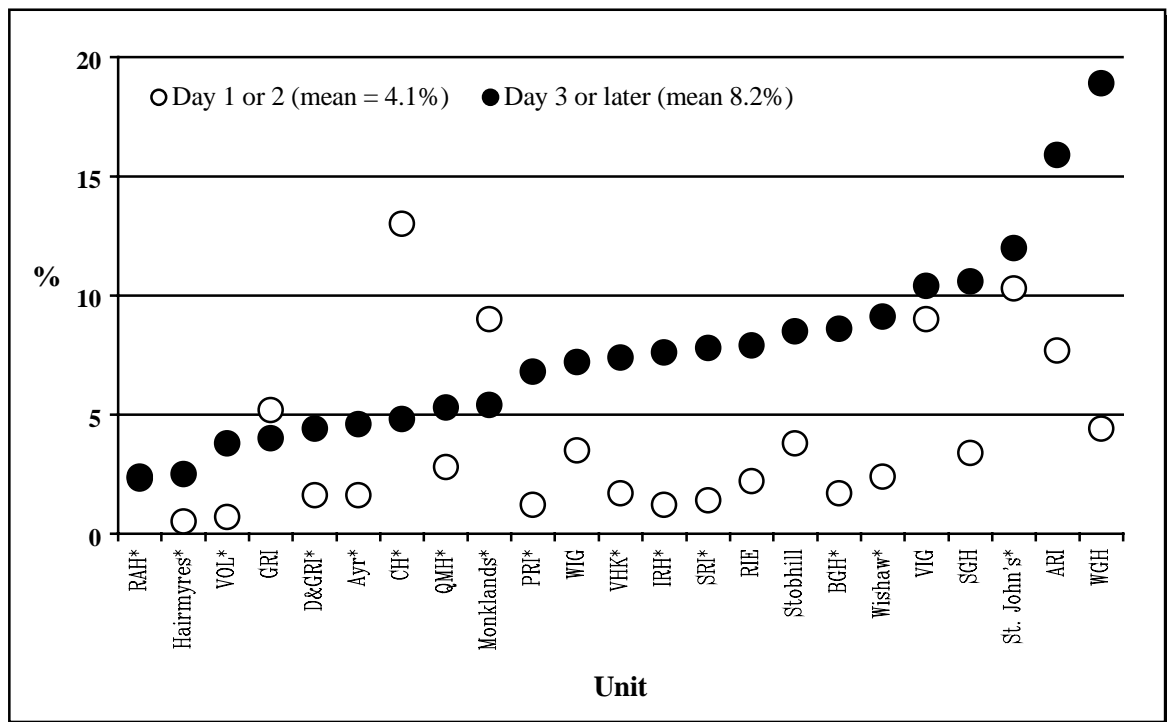




Figure 27. Practice of performing tracheostomies from day 3 onwards in Scottish ICUs: 1999. Mean & median days of procedure in Scotland are 10.4 and 9 respectively.

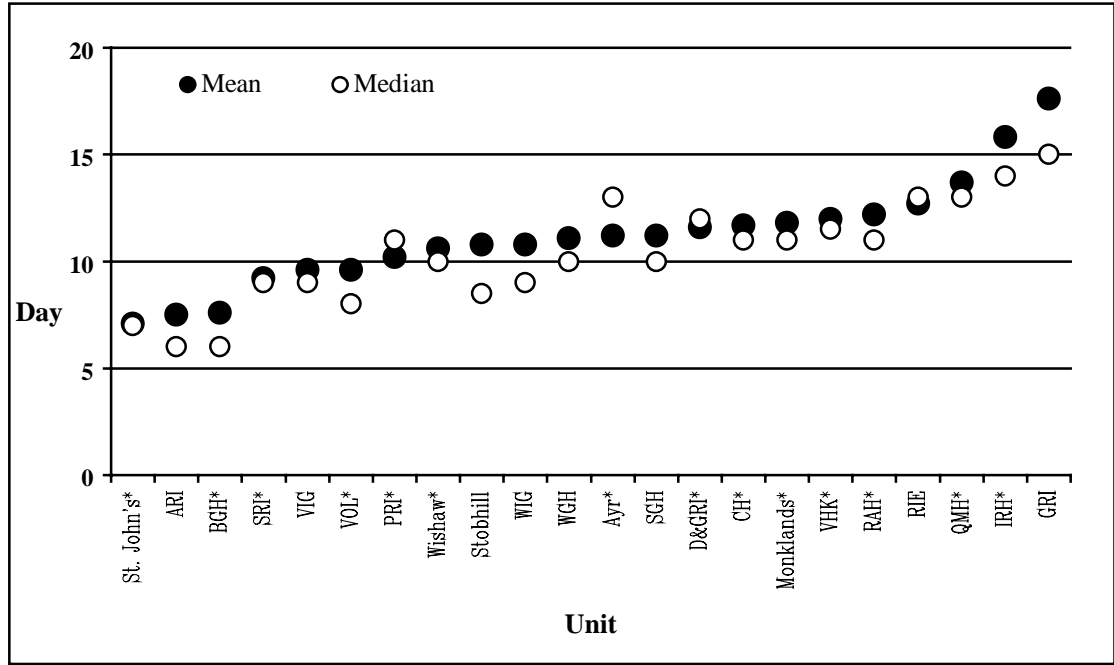


Figure 28. Practice of performing tracheostomies from day 3 onwards in Scottish ICUs: 2000. Mean & median days of procedure in Scotland are 10.8 and 10 respectively.

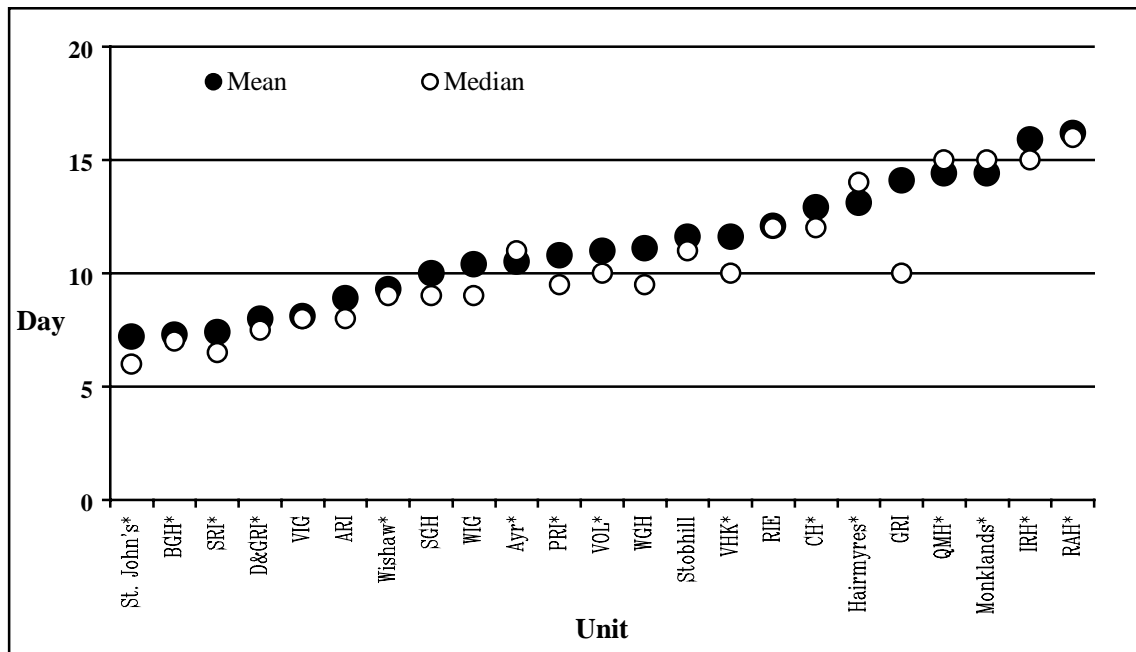




Figure 29. Practice of performing tracheostomies from day 3 onwards in Scottish ICUs: 1999-2000. Mean & median days of procedure in Scotland are 10.6 and 9 respectively.

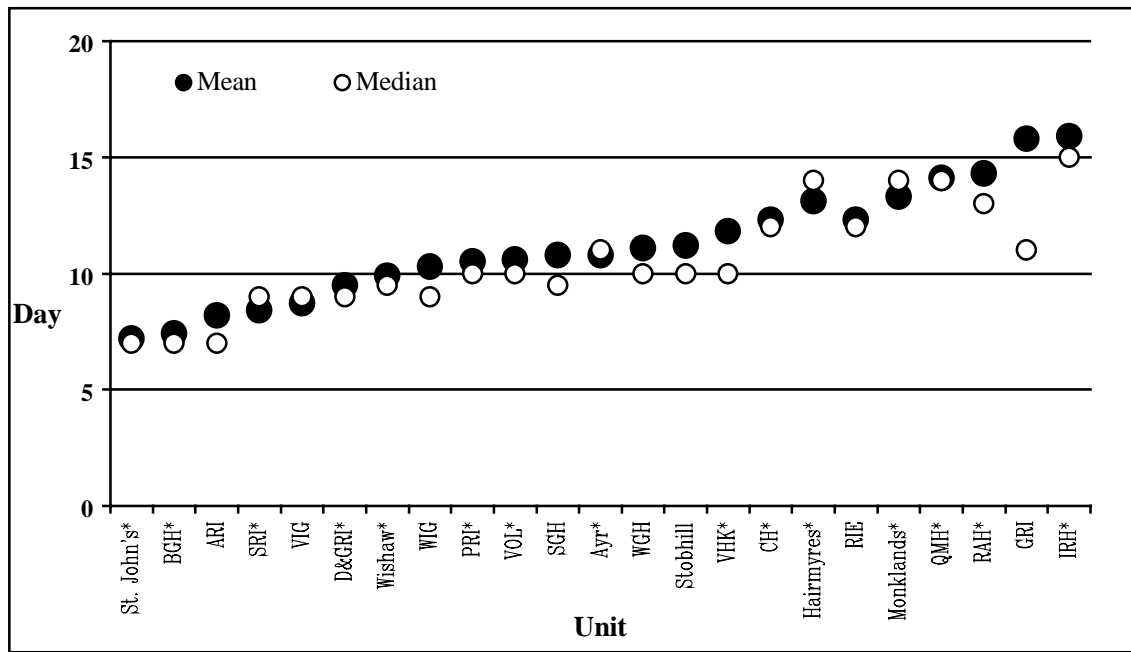


Table 1. Cumulated data identifying the proportion of patients with tracheostomies in situ only from ACP day 3 onwards.

	Patients (%)	Number of ACP days in situ.			
		Mean	Min	Max	Median
1999	7.9	11.3	1	87	8.0
2000	8.4	11.1	1	107	8.0
1999-2000	8.2	11.2	1	107	8.0



D.4. Admission source.

30. A trend has previously been demonstrated towards a diminishing contribution by patients coming from theatre and an increasing proportion coming from the ward, particularly when measured by bed days. Figures 30, 31, 32 & 33 show the variation among Scottish ICUs in admissions from Theatre, Ward, A&E and HDU respectively for the period 1998-2000.

31. Patients may require to be transferred from their base hospital to another hospital's ICU for a variety of reasons: the referring hospital may have no ICU or lack ICU beds (bed-space transfer), specific expertise may exist within the receiving ICU (e.g., renal support) or hospital (e.g., burns care). The current audit database does not allow adequate differentiation of these categories except when the patient is transferred from the ICU at the base hospital. A mechanism is required to capture data on the reason for all inter-hospital transfers to ICU including patients who are held in temporary ICU facilities at the transferring hospital whilst awaiting transfer. Bed-space transfers are a powerful marker of inadequate ICU provision at the referring site.

32. Figures 34, 35 & 36 demonstrate the variation in admission from wards, ICUs and HDUs in other hospitals. Figure 37 demonstrates the breakdown by source, cumulated for Scotland for the 3-year period and Figure 38 demonstrates the variation over time. Individual unit data are given in Figures 37.1 and 38.1 respectively. Figure 39 aggregates admissions from another hospital. The increase in number of admissions from HDU and reduction in admissions from theatre may be a result of the growth of HDUs in recent years.



Figure 30. Proportion of admissions to Scottish ICUs from Theatre/recovery, 1998-2000.

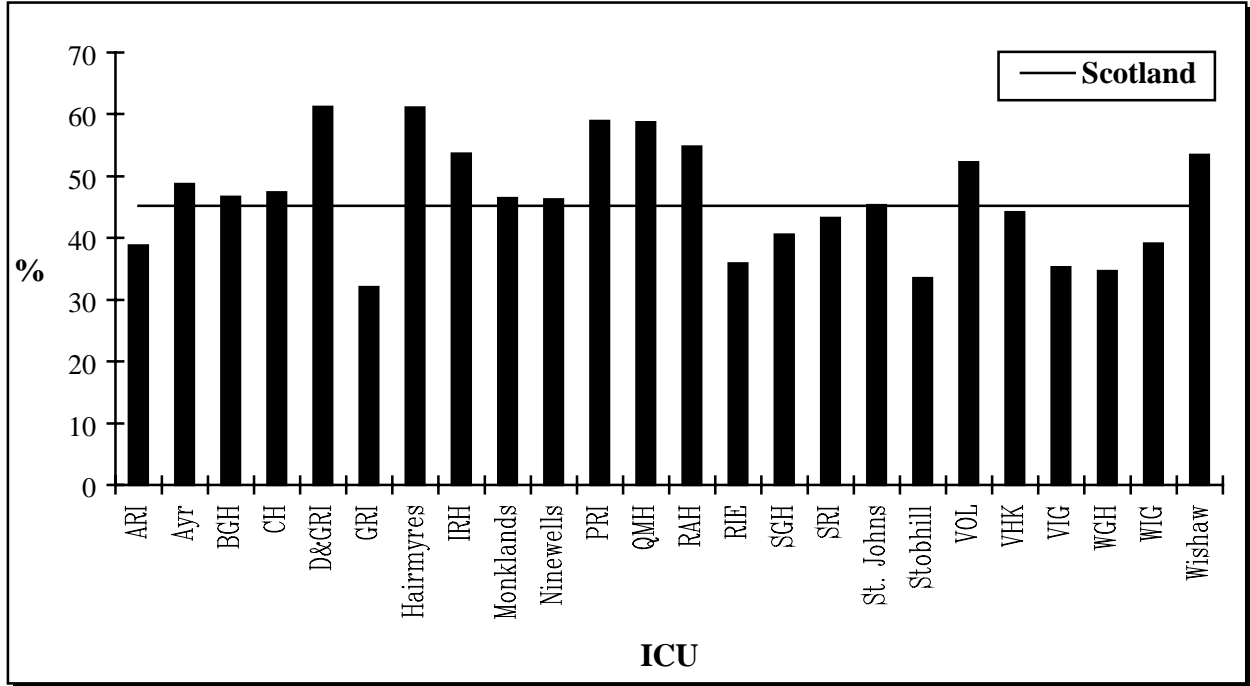


Figure 31. Proportion of admissions to Scottish ICUs from ward in same hospital, 1998-2000.

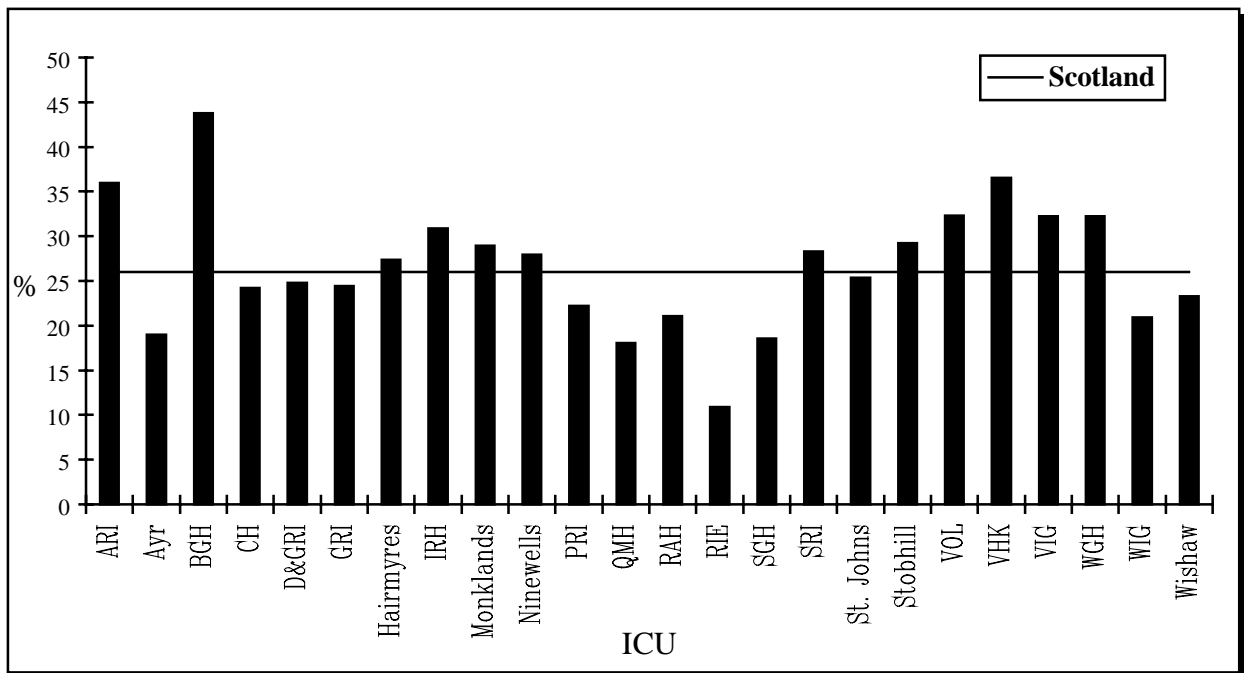




Figure 32. Proportion of admissions to Scottish ICUs from A&E, 1998-2000.

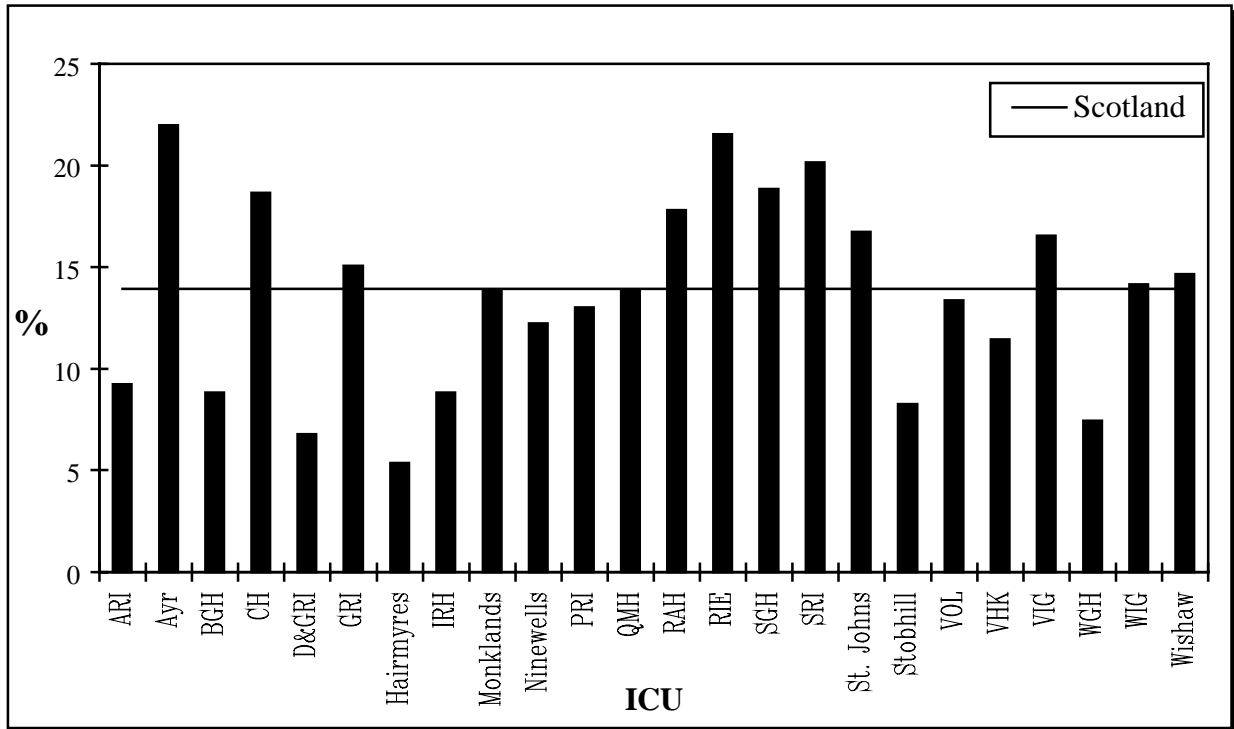


Figure 33. Proportion of admissions to Scottish ICUs from HDU that hospital, 1998-2000.

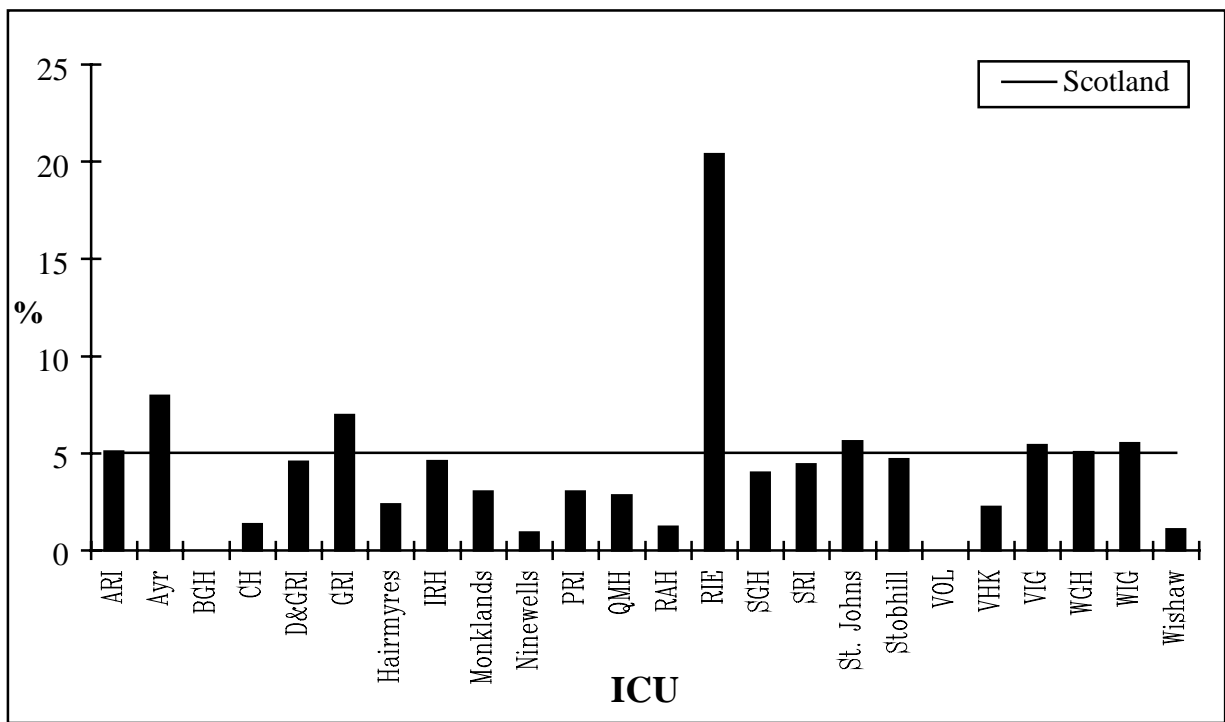




Figure 34. Proportion of admissions to Scottish ICUs from wards in other hospitals, 1998-2000.

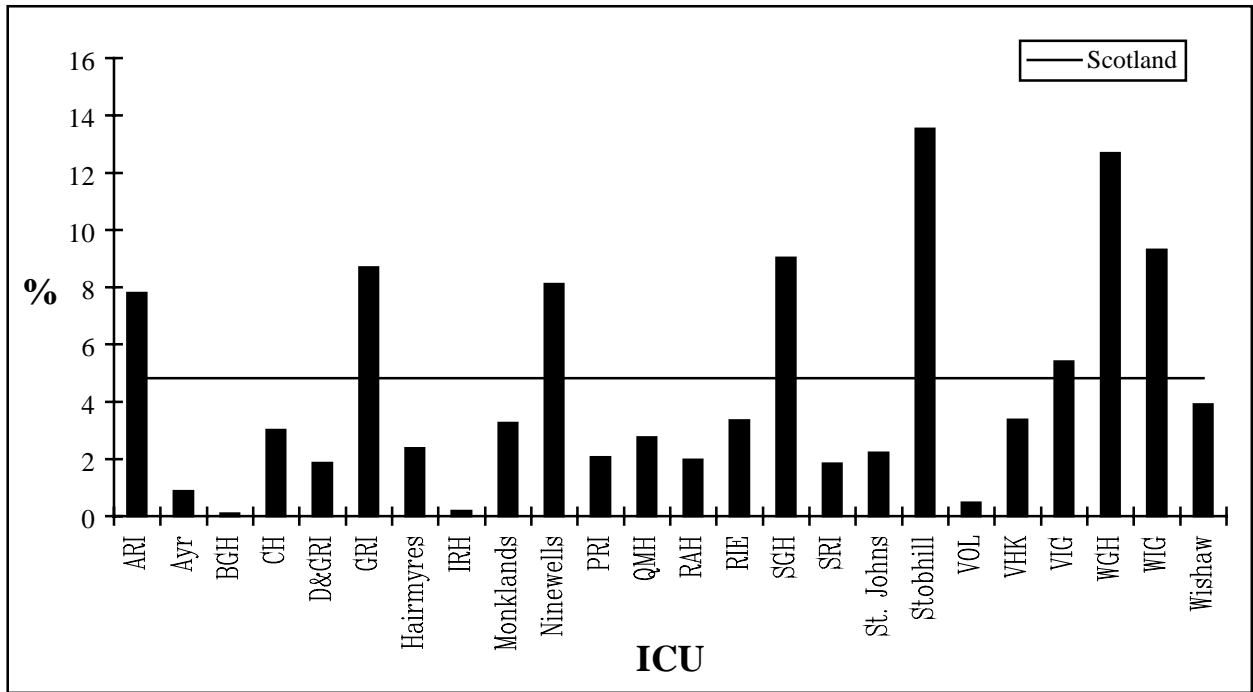


Figure 35. Proportion of admissions to Scottish ICUs from ICUs in other hospitals, 1998-2000.

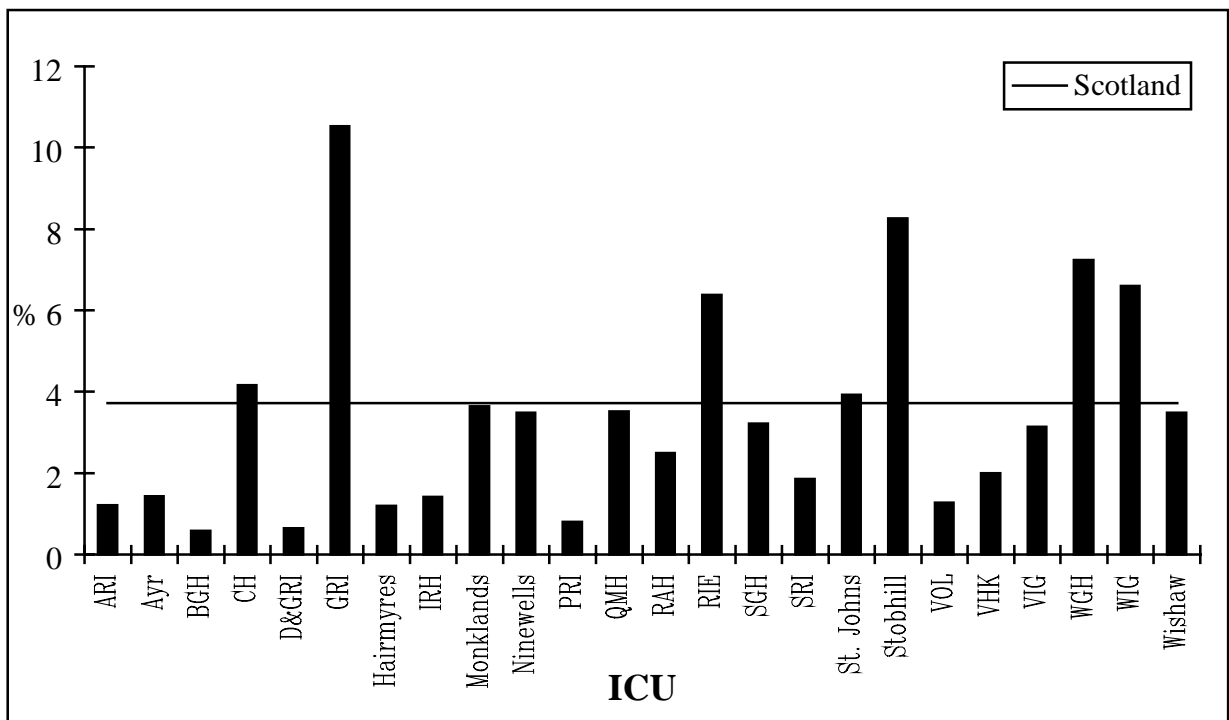




Figure 36. Proportion of admissions to Scottish ICUs from HDUs in other hospitals, 1998-2000.

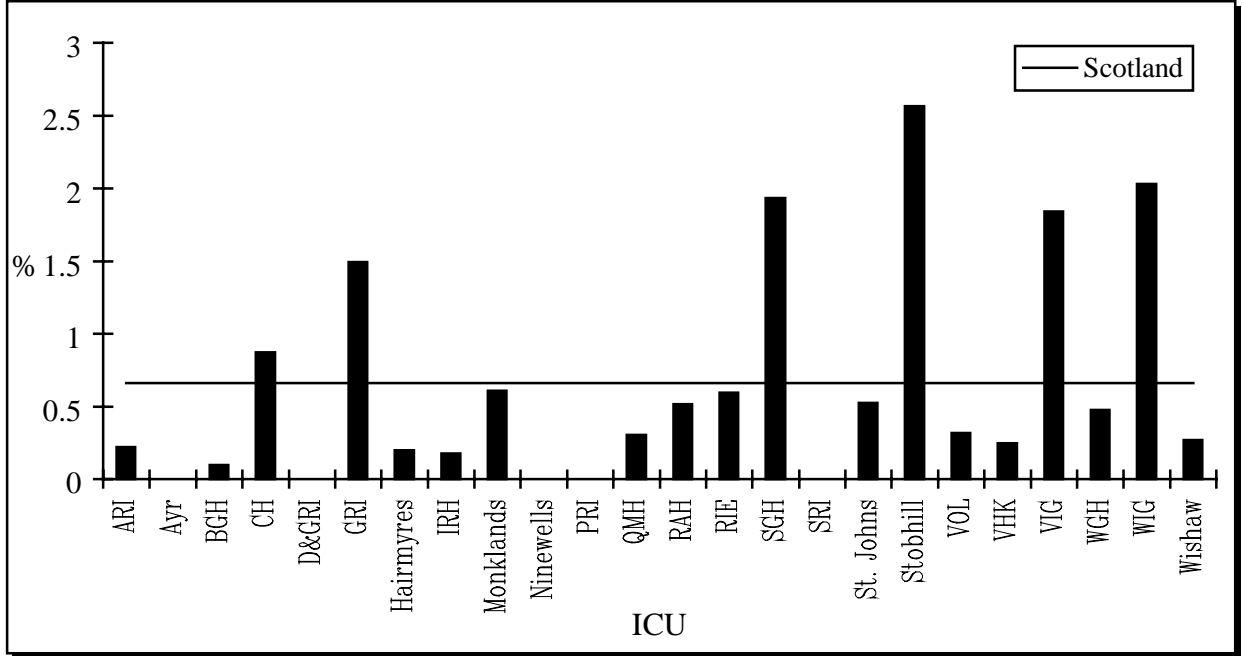


Figure 37. Source of admissions to 23 Scottish ICUs during 1998 - 2000. Excludes FRI, Hairmyres & Raigmore.

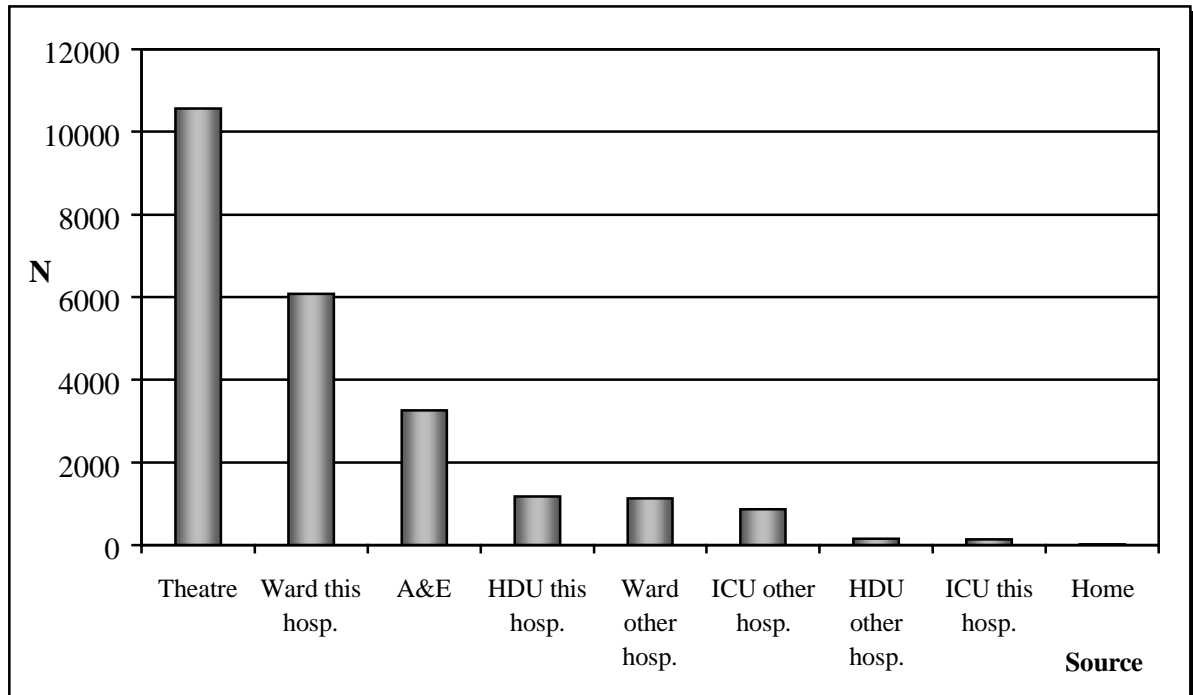




Figure 38. Trend over time of admission sources to Scottish ICUs.

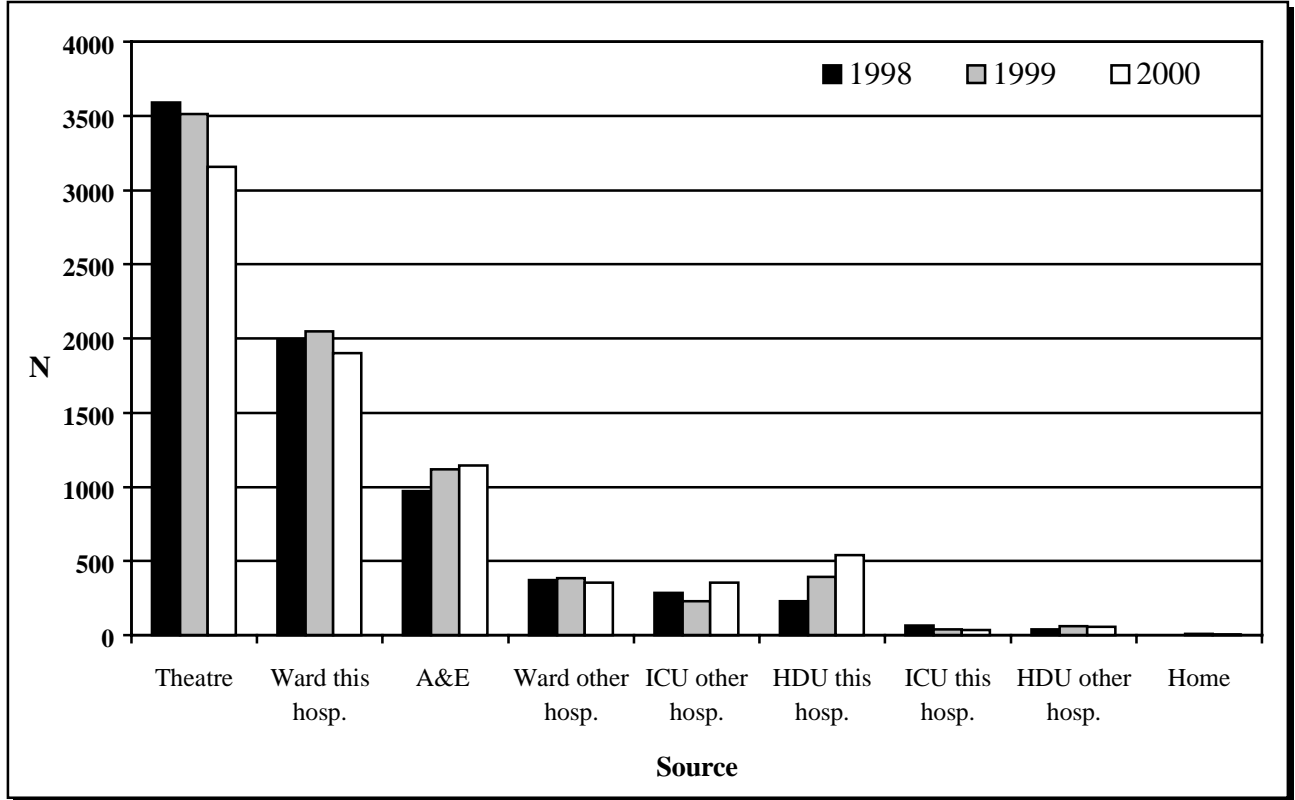
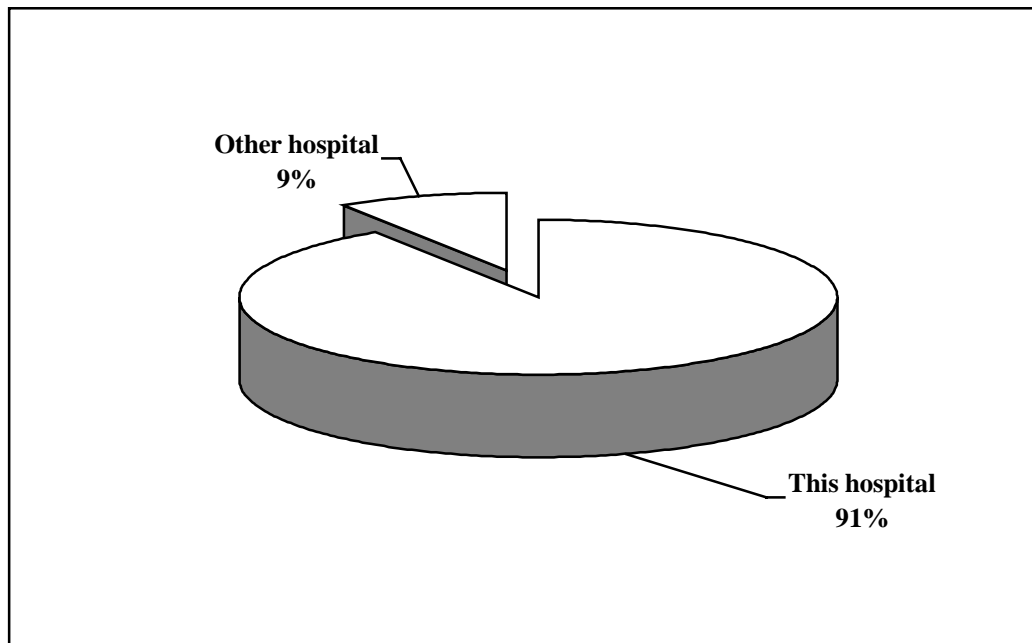


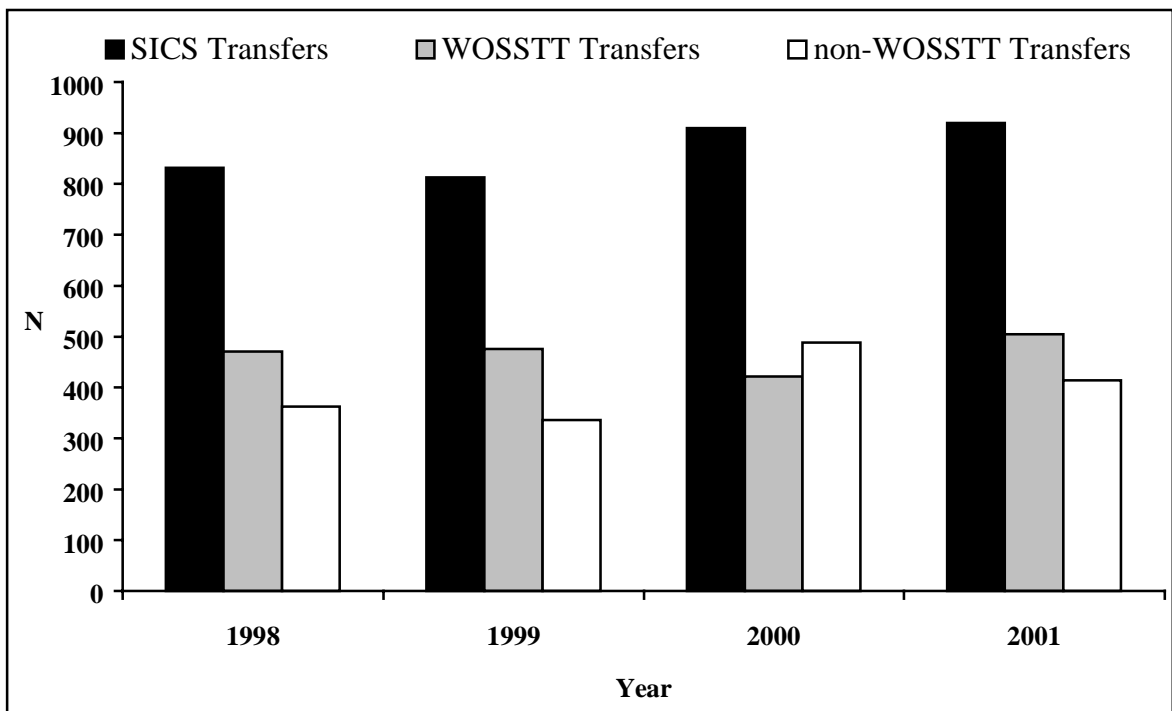
Figure 39. Source of ICU admissions.





33. Given that ICU transfers are a powerful indicator of national adequacy of ICU provision, transfer data have been used to examine the trend in national ICU transfers. Figure 40 shows an increase in annual ICU transfers. The West of Scotland Shock Transport Team (WOSSTT), based at the Western Infirmary, transports the vast majority of patients transferred to an ICU in the West of Scotland. Transfers outwith the West of Scotland have been estimated in Figure 40 by subtracting Shock Team transfers from the Scottish total. This shows a substantial number of patients being transported in Scotland, only half of whom are transported by a specialist team. Issues around transport of the critically ill are discussed by Peter Wallace, drawing on the more detailed information available from the Shock Team.

Figure 40. Trend in number of transfers within the SICS database and number carried out by the West of Scotland Shock Transfer Team (WOSSTT).





D.5. Transferring critically ill patients

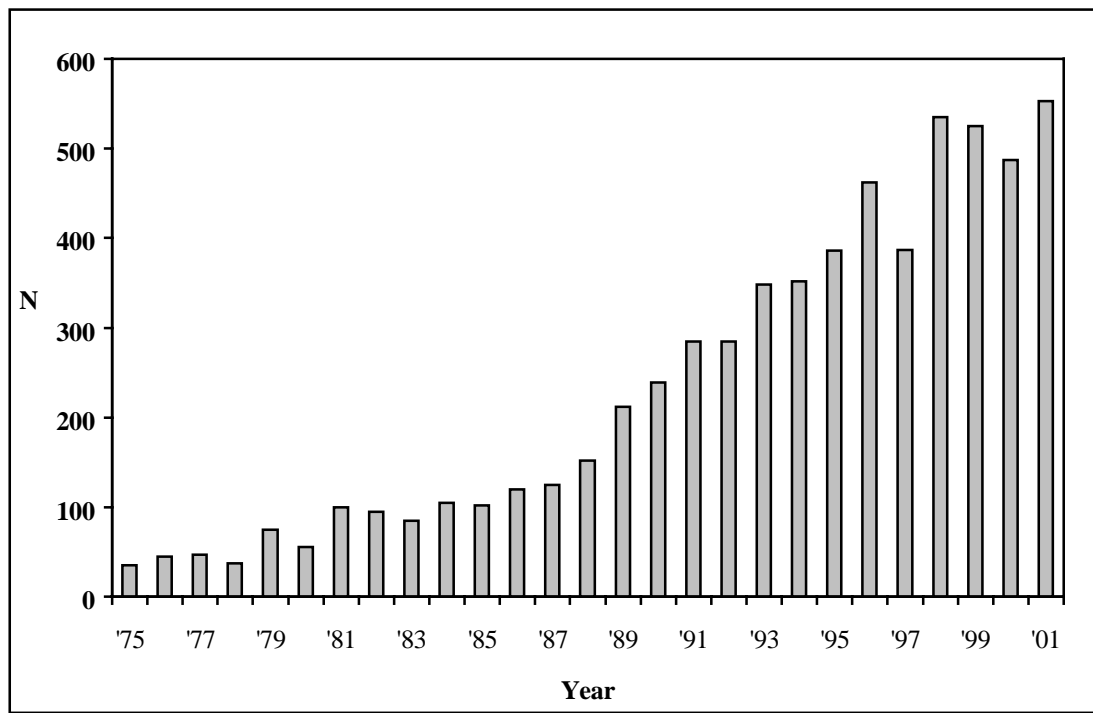
34. The transfer of ICU patients between hospitals is an essential and unavoidable component of a comprehensive critical care service. As indicated above these transfers may be required for clinical reason to “upgrade” treatment with skills or specific services unavailable in the initial hospital but also for non-clinical “bed space” reasons, when there are insufficient ICU beds or trained staff in the first hospital. No Trust can be expected to provide sufficient intensive care facilities for all peak emergency demands and it is a sensible use of resources that spare capacity in adjacent ICUs is utilised as a functional network.

35. Transferring these patients, however, is not without risk to the patients or concern to relatives. The need for transfers must be kept to a minimum and the process undertaken as safely as possible. In Continental Europe, North America and Australia dedicated transfer teams are common [8]. In the UK, despite guidelines recommending that retrieval teams be established [9,10] and evidence of their contribution to increase patient safety [11], 90% of patients are transferred by inexperienced staff drawn from the anaesthetic on-call team in the referring hospital.

36. In contrast to this UK pattern over the last quarter of a century the activities of the West of Scotland Shock Transfer Team have had a major role in identifying and safely managing the problems implicit in transferring the critically ill. The “Shock Team” was the first and remains one of the few dedicated intensive care transfer services in the UK. The increasing workload since its inception in 1975 is shown in Figure 41. In conjunction with the Scottish Ambulance Service the team provides two experienced anaesthetic registrars to accompany ICU transfers between any hospital in the West of Scotland, extending from Stornoway to Stranraer. The team provides a high level of care and saves the on-call resources of the referring hospital. The accumulated experience has led to a large number of publications and an international reputation for excellence.



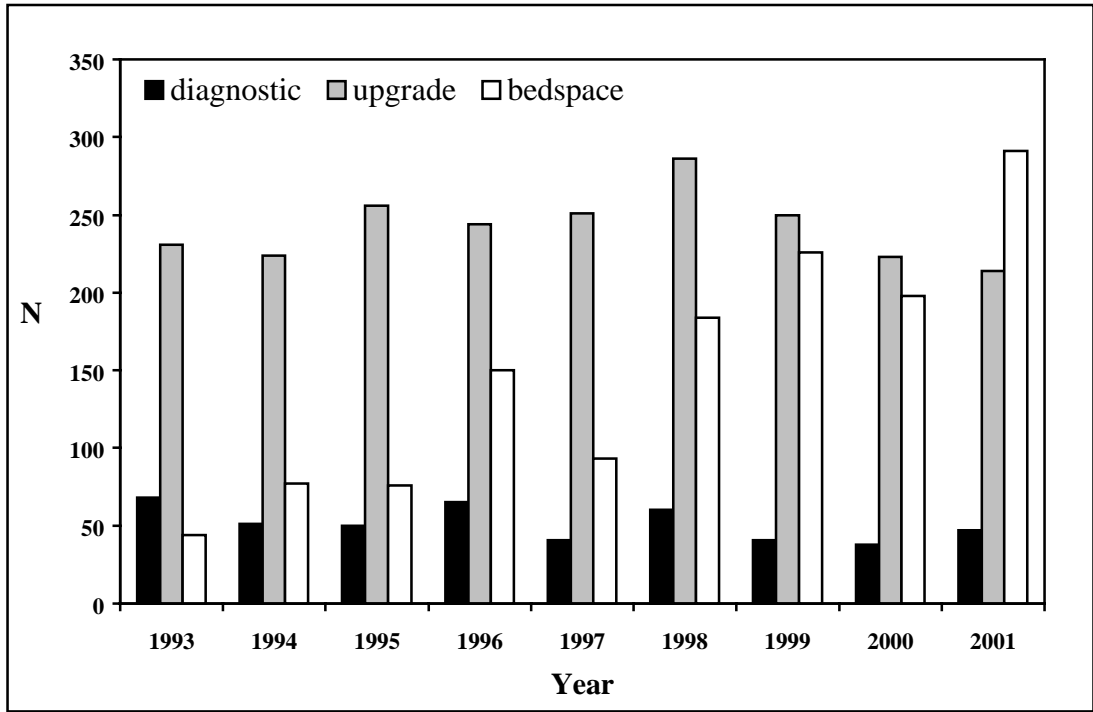
Figure 41. Extent of transfers by WOSSTT from 1995-2001.



37. The basic reasons for transfer are shown in Figure 42. It is of interest to note that despite additional critical care facilities in the West of Scotland, particularly in the DGHs whose provision of renal support has also increased, there remains a persistent requirement for “upgrade” transfers to provide clinical services available at larger tertiary referral centres. It is more concerning to note the marked increase in “bed space” transfers over the last few years indicating an acutely stretched service. Detailed analysis of these transfers has defined Trusts with significant shortfall in critical care provision versus the demand, and such evidence is essential in targeting expansion of the service.



Figure 42. Reasons for transfer by the WOSSTT.



38. Figure 40 shows a rising number of transfers in Scotland, approximately half of which are handled by the West of Scotland team. Changing workload, working hours and training considerations require review of the West of Scotland service. There are current proposals to seek additional resources to maintain the long-term future of the service; amended working patterns to reflect the increasing clinical load include introduction of a nursing component to the staffing. This is, therefore, a most opportune time to examine initiatives to provide a specialist service for the substantial number of patients identified during their transfer by an anxious junior doctor with no specific training or experience in transport medicine. The workload and geography of critical care services in East and North Scotland may require different approaches to that which has been effective in the conurbation of the West. The successful establishment of a national paediatric retrieval service with an East and West limb, however, demands that high priority should be given to ensuring that adult patients in all regions of Scotland experience similar high quality care.



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39. While a carefully planned expansion of critical care services in Trusts under most pressure will reduce the number of “bed space” transfers there is little doubt that for the foreseeable future many hundreds of Scots suffering critical illness and requiring complex organ support will, each year, require transfer between hospitals. To ensure similar standards of high quality care for these patients, whether on the mainland or islands of Scotland, a national initiative is required to extend the pioneering example of the West of Scotland Transport Team throughout the nation.

Peter Wallace

Consultant Anaesthetist

Western Infirmary, Glasgow



D.6. Standardised mortality ratios

The letter code for an individual ICU can be obtained from the local ICU audit co-ordinator.

As an Outcome Measure.

40. As in previous years, we are publishing the data for individual units on an anonymised basis. The code identifying a unit will be given to the lead audit clinician in that unit and to relevant Trust staff on request.

41. Record linkage, via ISD, enables us to generate ultimate hospital outcome data for patients discharged to other hospitals. The outcomes presented are for ultimate hospital outcome, rather than outcome from the individual hospital. This helps avoid generating apparent differences in performance between units due to patient transfer. It is also clearly what matters to patients. This form of reporting is only possible because of the existence of a national audit and collaboration with ISD to provide linkage to Scottish Morbidity Record returns. We hope that increasing automation of this linkage may allow faster turnaround of information in future.

Uses and Limitations.

42. Standardised mortality ratios compare actual outcome against that 'expected' on the basis of a model. This approach is necessary because the varying case mix of different units means that a comparison of simple mortality rates gives no indication of quality. The approach is widely used and accepted, but several points require emphasis:

- All of these systems have limitations
- 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 [12]. We have also highlighted that it is necessary to report operative and non-operative patients separately, something we do again this year.



- They were developed on what are, by present standards, relatively small data sets
- There has been no new system since APACHE III [13], the Simplified Acute Physiology Score [14] (SAPS II) or the Mortality Probability Model [15] (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 [16]. Changes in ICU management strategies since the systems were developed may have increased this effect.

43. The Audit Commission, in their report *Critical to Success* [17], found much wider differences in case mix adjusted mortality between units in the Intensive Care National Audit and Research Centre’s (ICNARC) Case Mix Programme than we have reported from Scotland; the mean case mix adjusted mortality ratios being predominantly above 1. It was inferred from this that there was a need to customise the model but it was stated that this would not alter the relative positions of units. Our own work suggests that the latter assumption is not the case, but we have yet to achieve a successful customised model.

44. Following our careful evaluation of the available systems [18], we have used APACHE II as our standard reporting tool. We have also continued to calculate SAPS II probabilities, however, since this model performed almost as well. In this report we include summary data using both systems and this highlights firstly that these models are indicative, not a gold standard, and secondly that the ‘ranking’ of units may be significantly altered by the choice of system.



Results.

45. Clinicians, managers and commissioners should use the data included in this section as a source of information and to identify areas requiring further study, but not as a basis for judgement. These systems can be used as a valuable tool to improve care, but this requires a sophisticated understanding of the potential and limitations which is often lacking

46. This information can be used to compare different units, to compare Scottish intensive care with other countries and to assess trends over time. The latter is relatively difficult to do for individual units because of the wide confidence intervals associated with small patient numbers, but is feasible on a national basis.

47. The data for the 24 units participating in the audit between 1998 and 2000 are shown in Figures 43 - 51. Those units annotated with an * are District General Hospitals. Figures 43 - 48 use the APACHE II system, 49 - 51 use SAPS II. The data in Figures 43 - 45 are for the most recent year, 2000, those in Figures 46 - 48 & 49 - 51 pool the data for the three years 1998-2000. For most units, but not all, the 95% confidence intervals overlap with the Scottish mean. Nonetheless, it appears that some units are 'outliers' in terms of performance. It is of interest that those, which appear to be doing better than expected, are predominantly DGH units and those which appear to be doing less well are larger teaching hospitals. These units will certainly wish to study this information closely, but we would stress (see above) that no immediate conclusions can be drawn. The apparent differences may be due to chance, may actually reflect quality of care, may be due to resource constraints or may reflect limitations in the methodology failing to adjust fully for case mix. One of these units is known to be disadvantaged by the failure of APACHE II to work well with its high neurological workload.

48. In Figures 49 - 51 the SAPS II system is used and it can be seen that this makes a marked difference to the 'rankings'.



Figure 43. Scottish operative SMRs in 24 units in 2000. Mean: 0.871, 0.816-0.926.

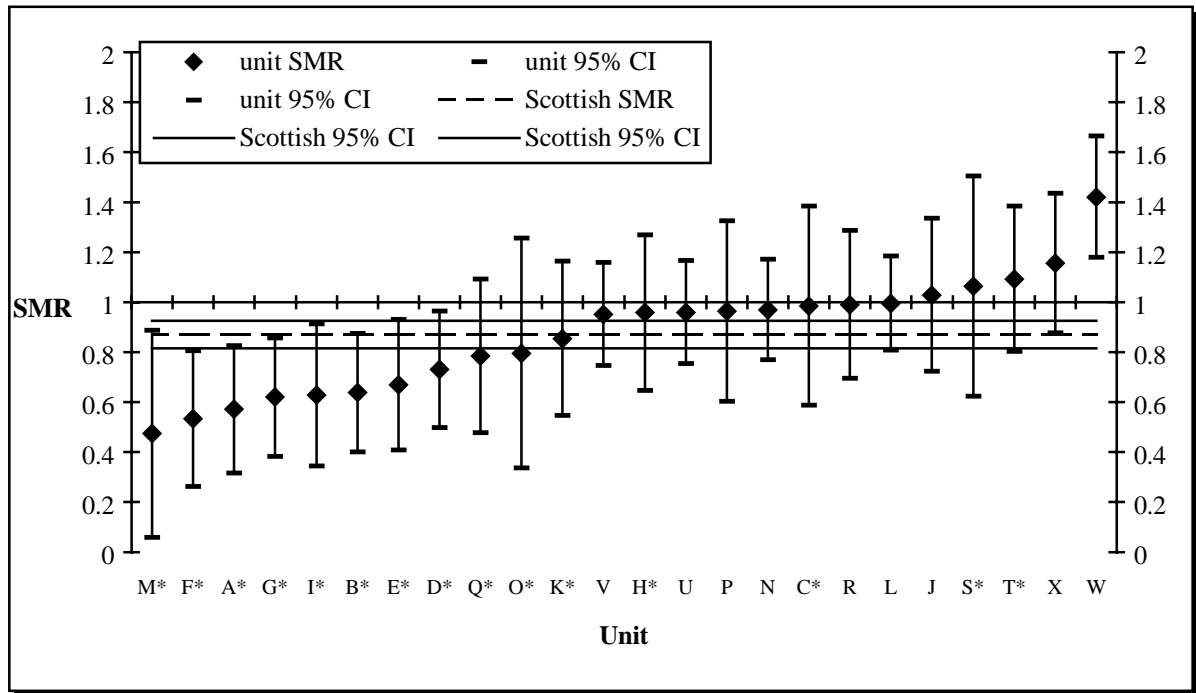


Figure 44. Scottish non-operative SMRs in 24 units in 2000. Mean: 1.07, 1.04-1.11.

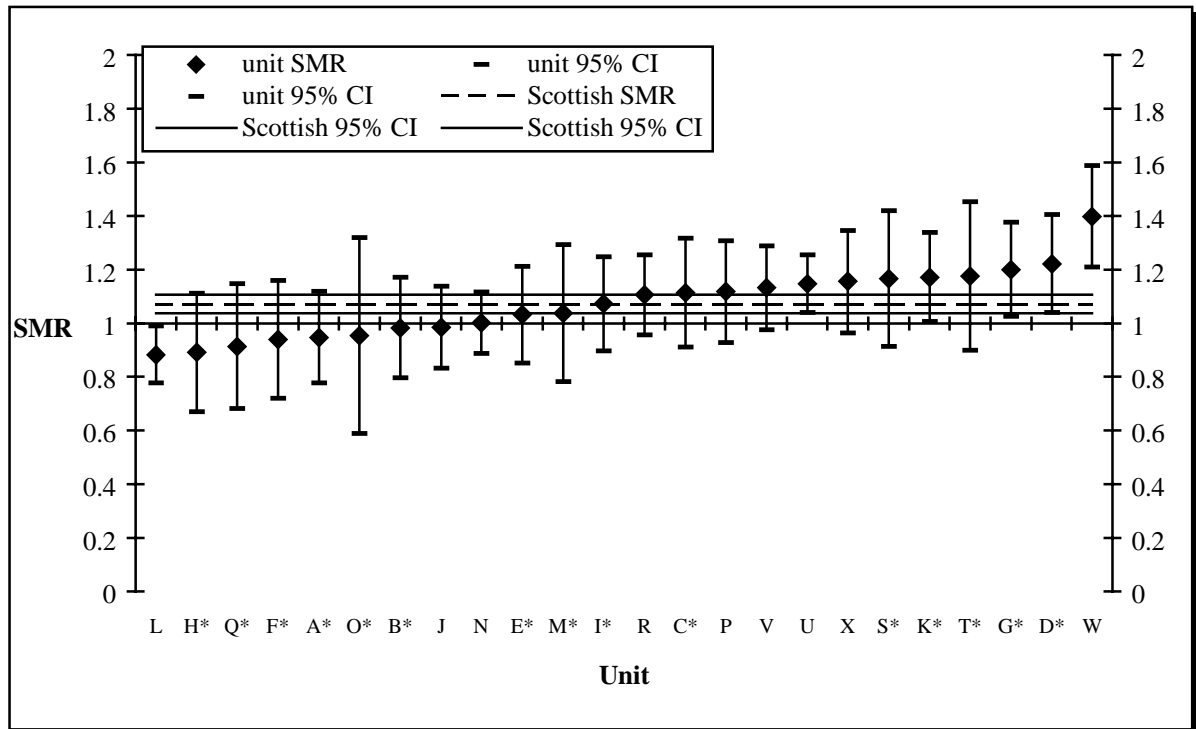




Figure 45. Scottish overall SMRs in 24 units in 2000. Mean: 1.00, 0.971-1.03.

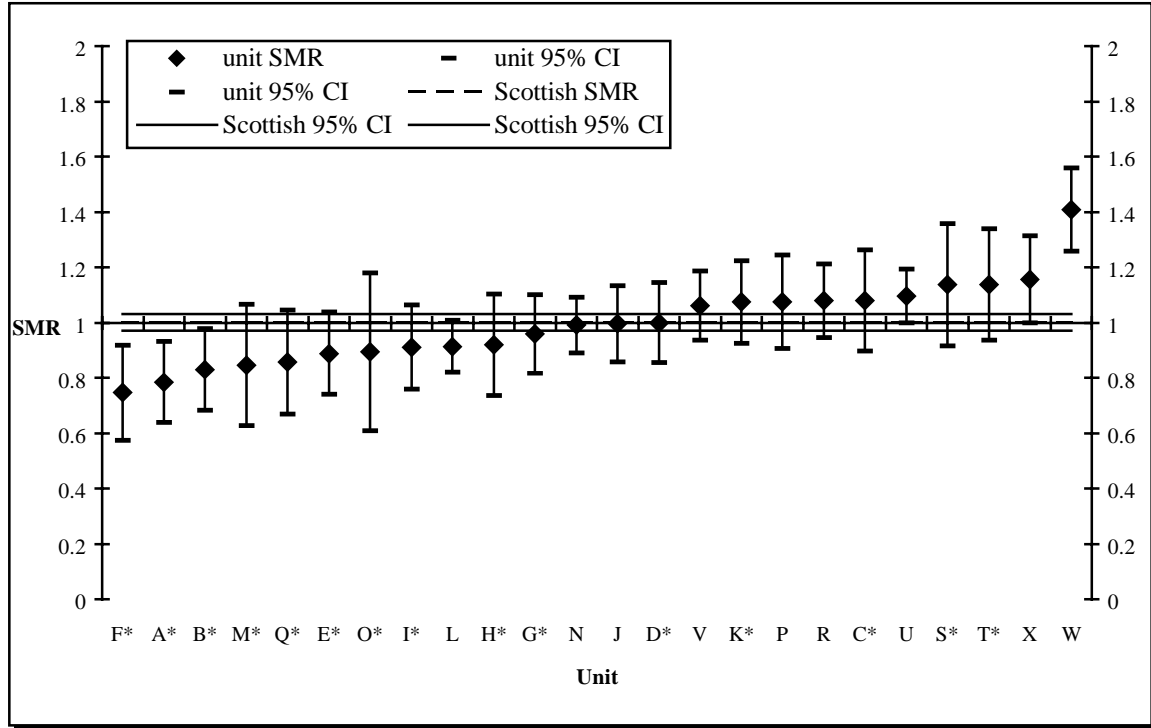




Figure 46. Scottish ICU operative SMRs in 24 units: 1998-2000. Mean: 0.796, 0.764-0.828.

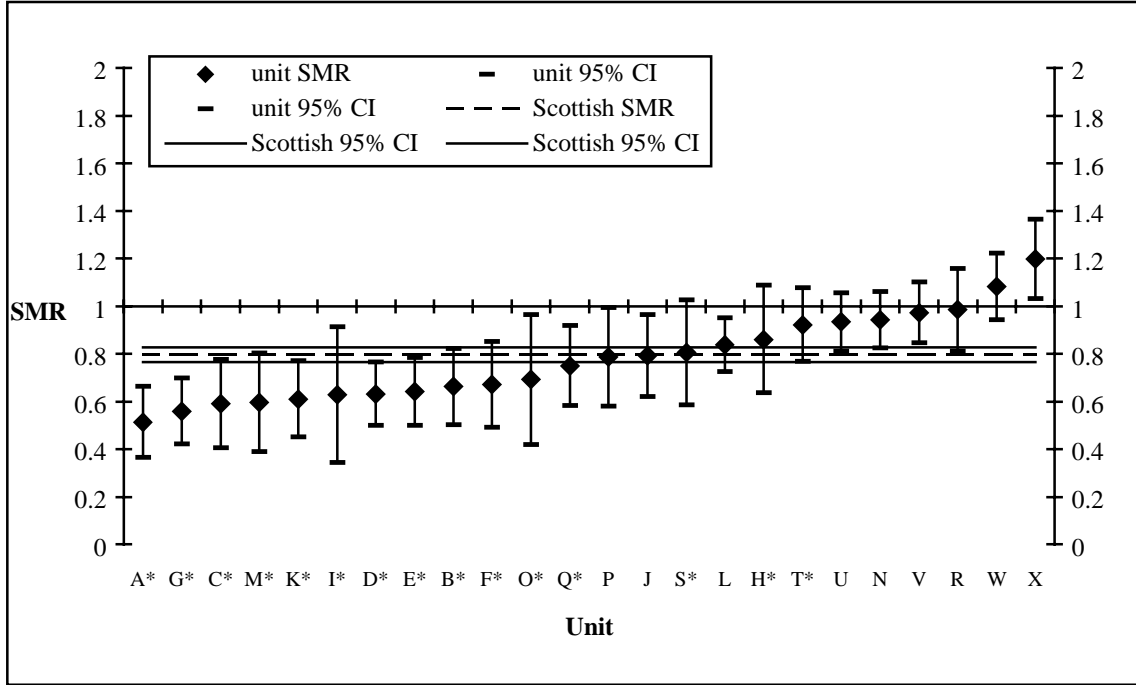


Figure 47. Scottish ICU non-operative SMRs in 24 units: 1998-2000. Mean: 1.06, 1.04-1.08.

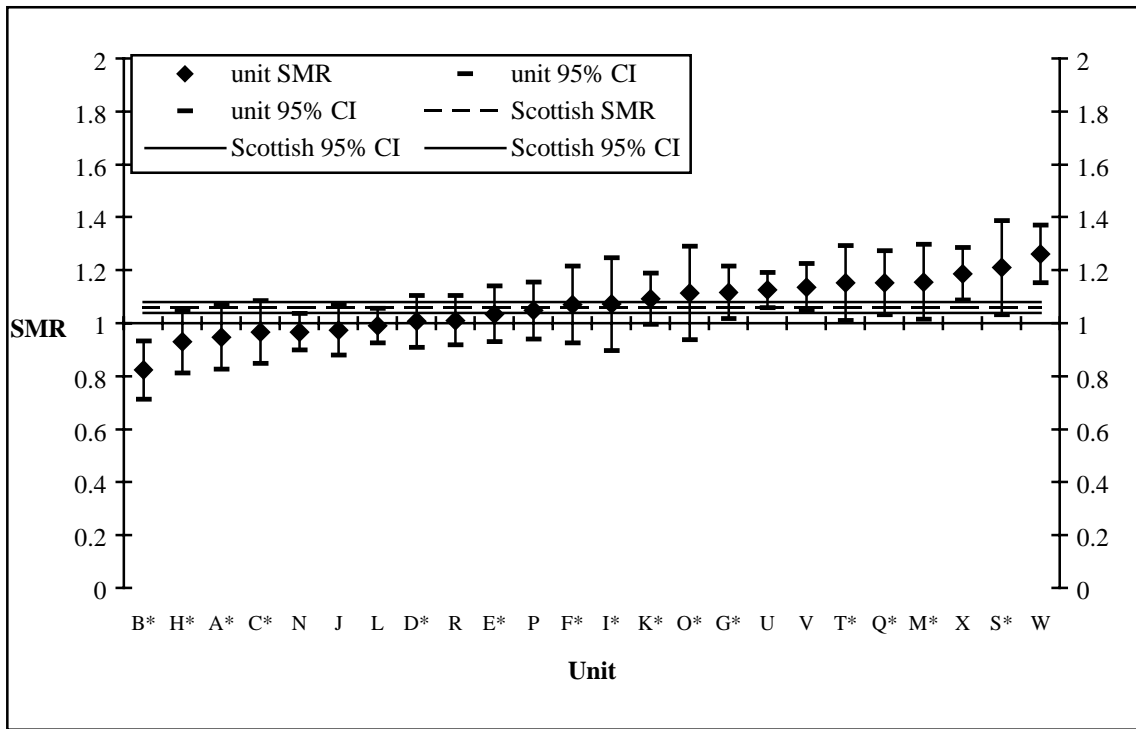




Figure 48. Scottish overall SMRs in 24 units: 1998-2000. Mean: 0.965, 0.947-0.982.

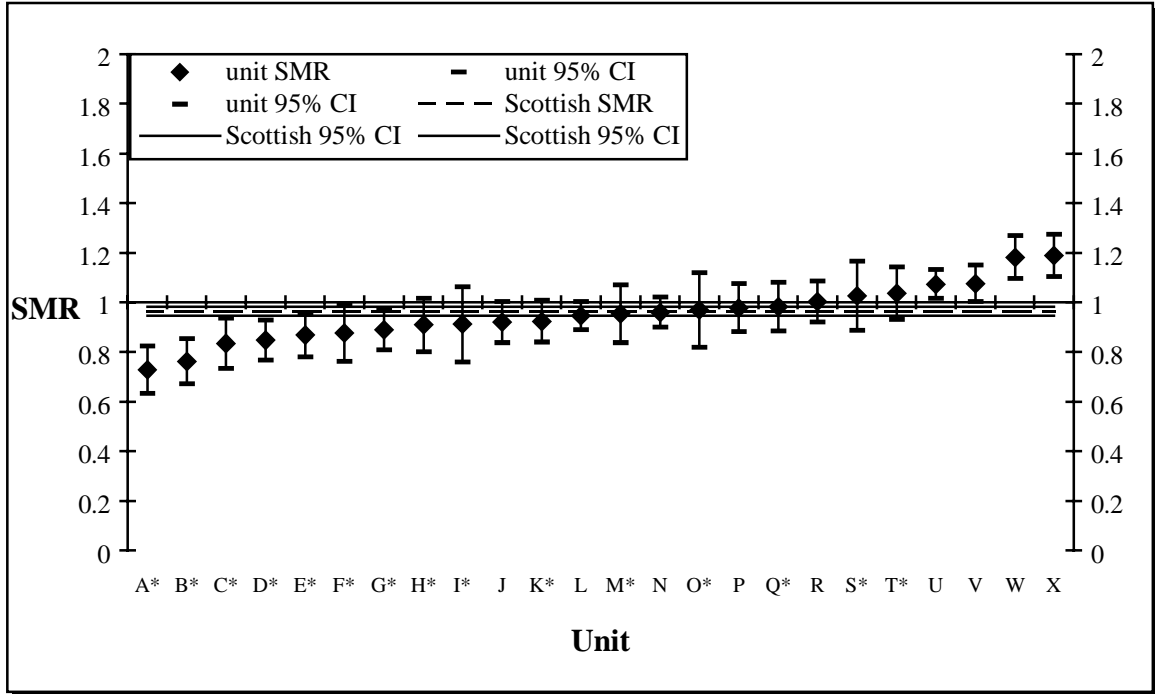


Figure 49. Scottish SAPS operative SMRs in 24 units, 1998-2000. Mean: 1.06, 1.03-1.10.

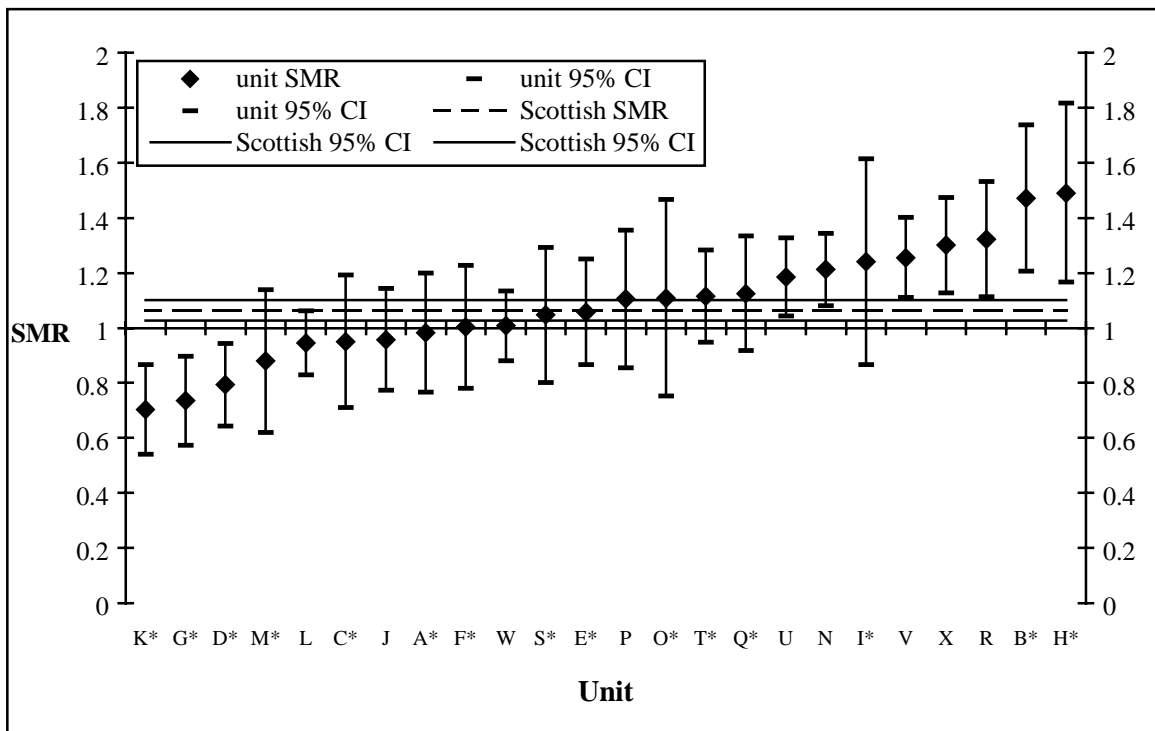




Figure 50. Scottish SAPS non-operative SMRs in 24 units, 1998-2000. Mean: 1.20, 1.17-1.22.

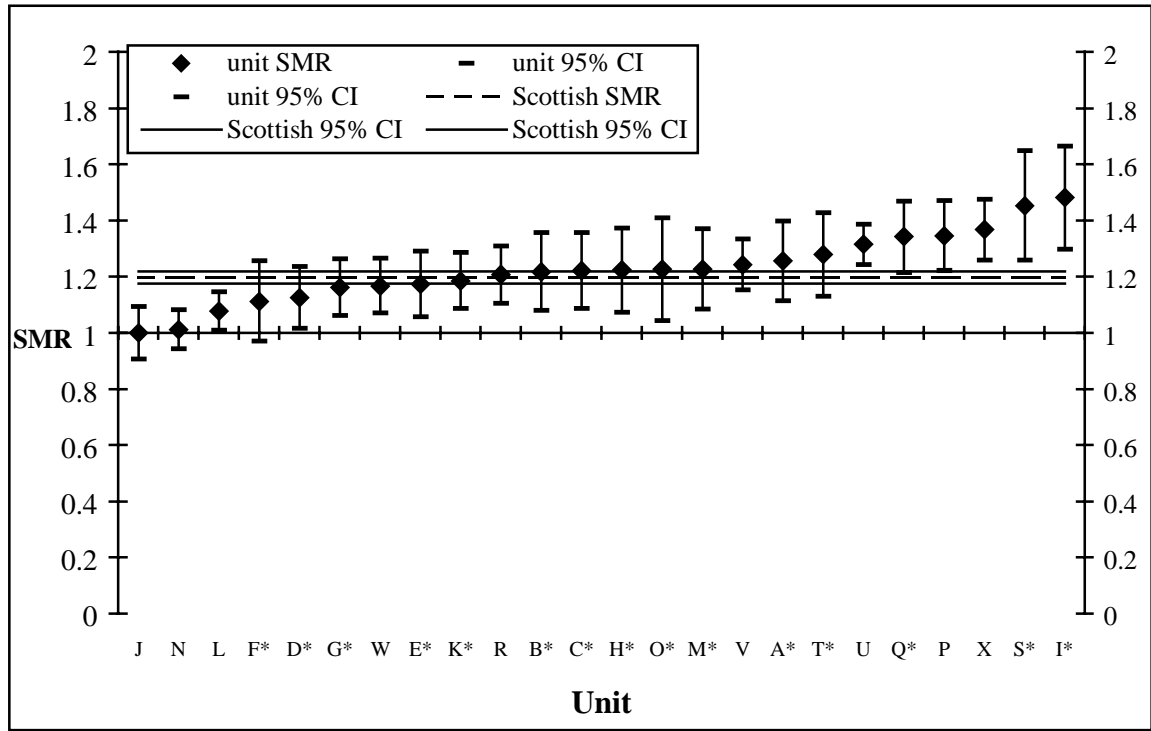
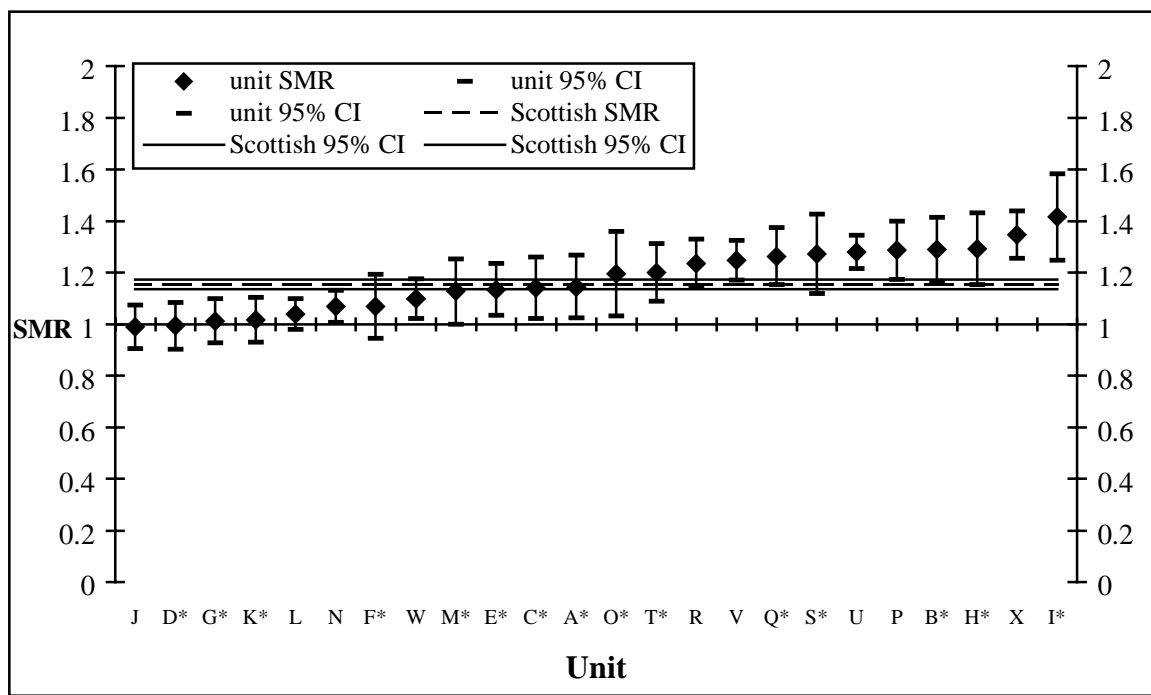


Figure 51. Scottish SAPS overall SMRs in 24 units, 1998-2000. Mean: 1.15, 1.13-1.17.





International Comparisons.

49. There is considerable academic debate about how useful SMRs are in comparing different countries, because it is well recognised that different health care systems may affect the suitability of the model. Differences between countries may, therefore, relate to genuine differences in performance or to the fit of the model. The fact that the Scottish SMR using APACHE II is around 1 is reassuring, as this model has been seen as the most appropriate but the SMR of 1.15 using SAPS II must be seen as a caution.

Scottish Trends Over Time.

50. Twenty units have participated continuously from 1995 – 2000. The SMRs for this cohort of ICUs are given for 2000, in Figures 52 - 54, and for the 6-year period, in Figures 55 - 57.

51. Given the number of units studied we might expect at least one unit to be significantly different, as indicated by 95% confidence intervals not overlapping the “national” SMR. The SMR for Unit W (Figures 45 & 54) has not been consistently significantly higher throughout the period of the audit and, more importantly, this unit’s overall SMR in 2001 has fallen back to the 1999 result. As in UK neonatal ICUs [19] we have observed considerable variation in “league table” positions year-on-year. Table 2 demonstrates this movement in rank order for 20 ICUs participating in the audit between 1995 & 2000.



Figure 52. Scottish operative SMRs in 20 units in 2000. Mean: 0.904, 0.842-0.966.

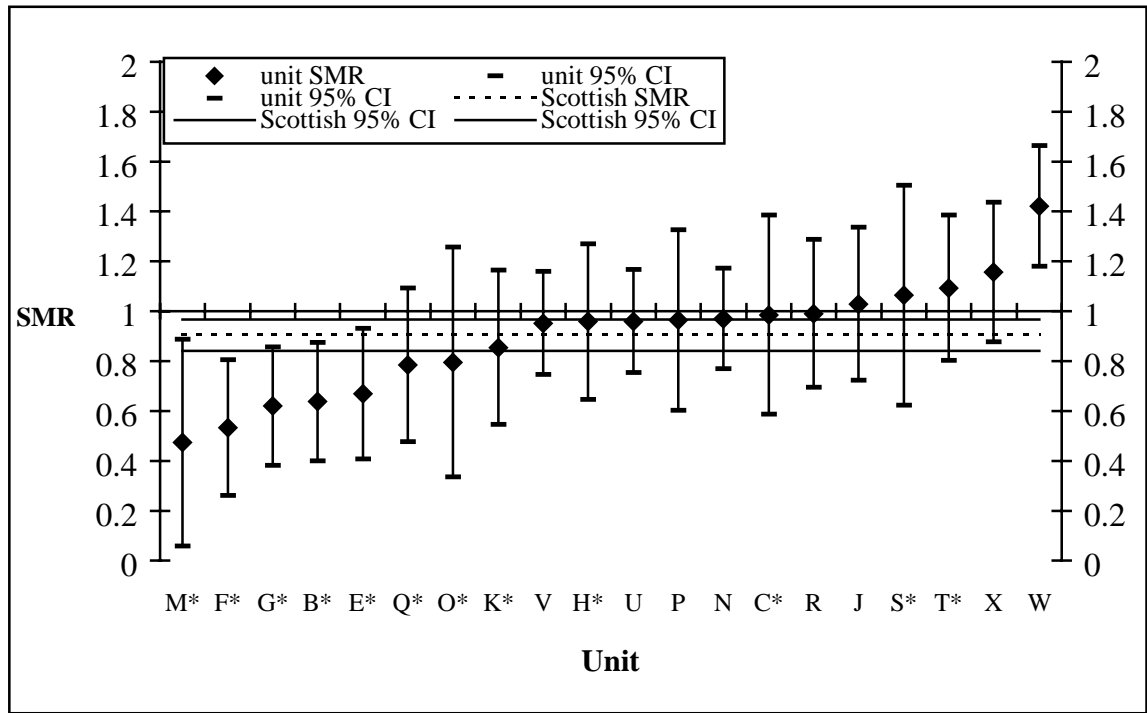


Figure 53. Scottish non-operative SMRs in 20 units in 2000. Mean: 1.09, 1.05-1.13.

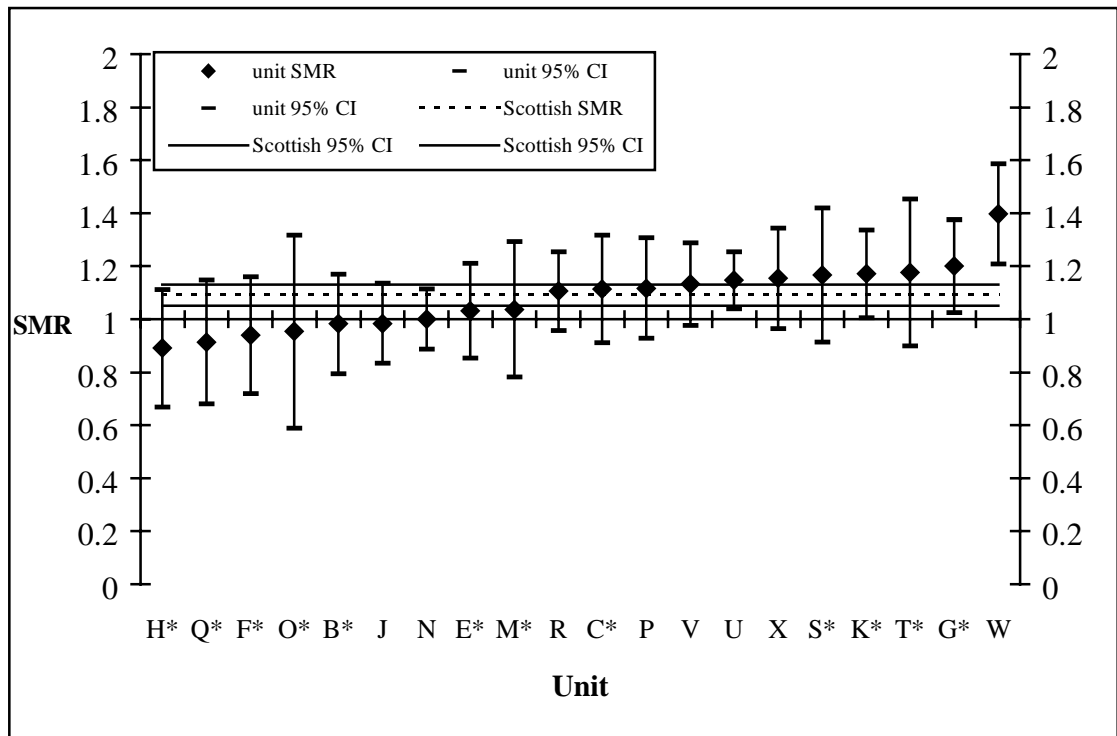




Figure 54. Scottish overall SMRs in 20 units in 2000. Mean: 1.03, 0.993-1.06.

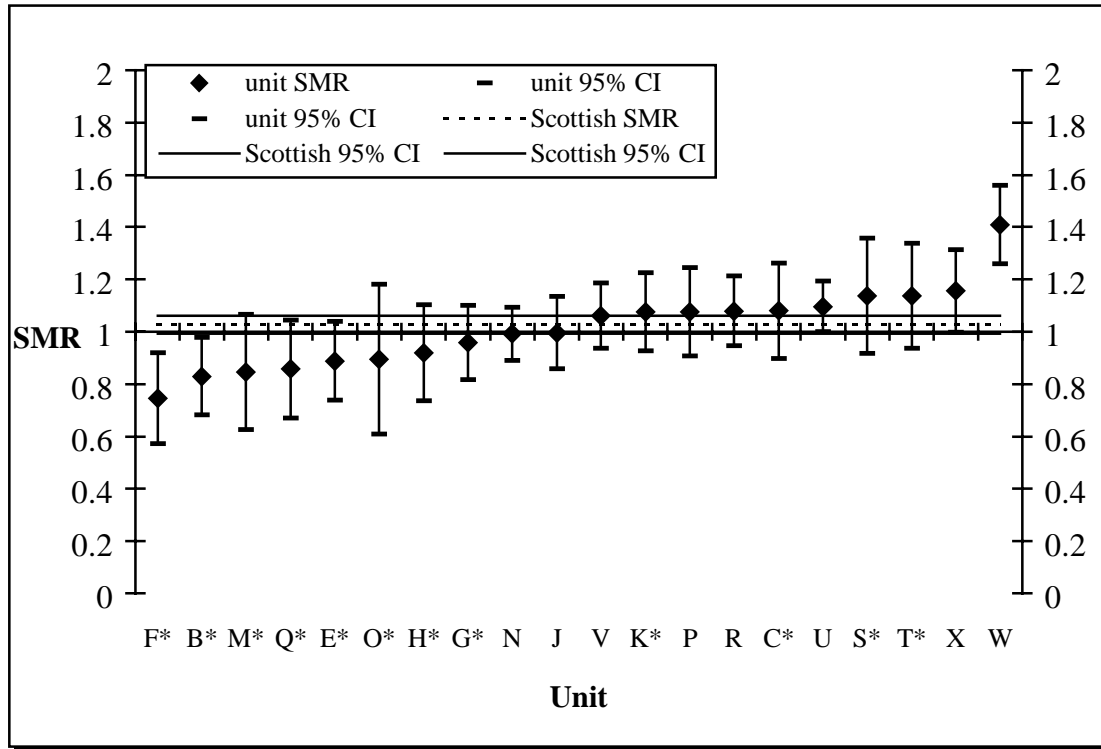




Figure 55. Scottish operative SMRs in 20 units in 1995-2000. Mean: 0.821, 0.795-0.847.

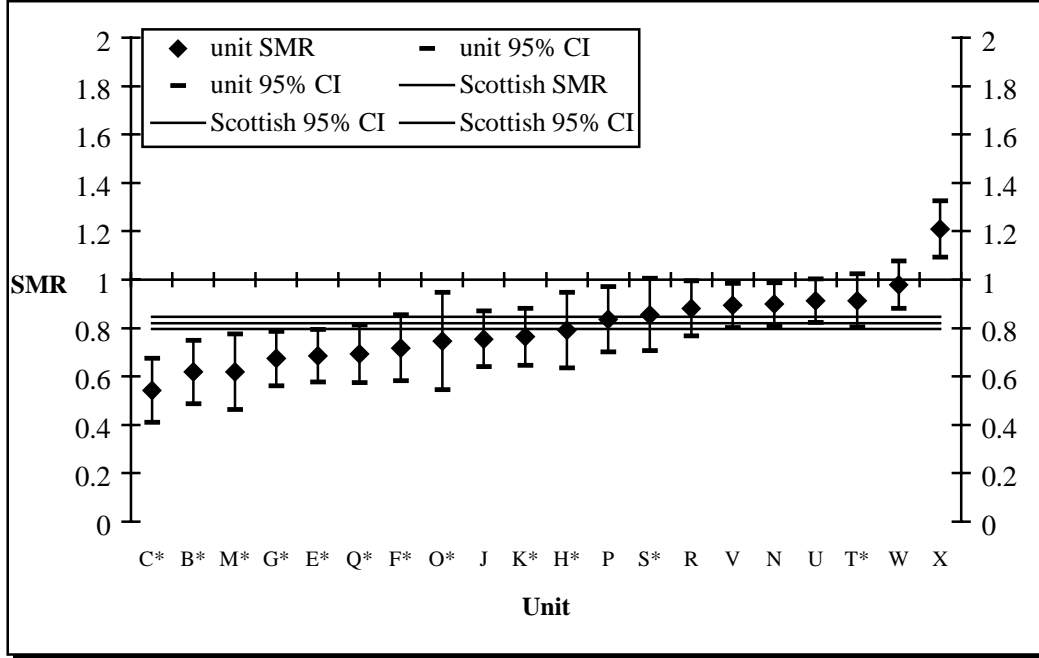


Figure 56. Scottish non-operative SMRs in 20 units in 1995-2000. Mean: 1.10, 1.08-1.12.

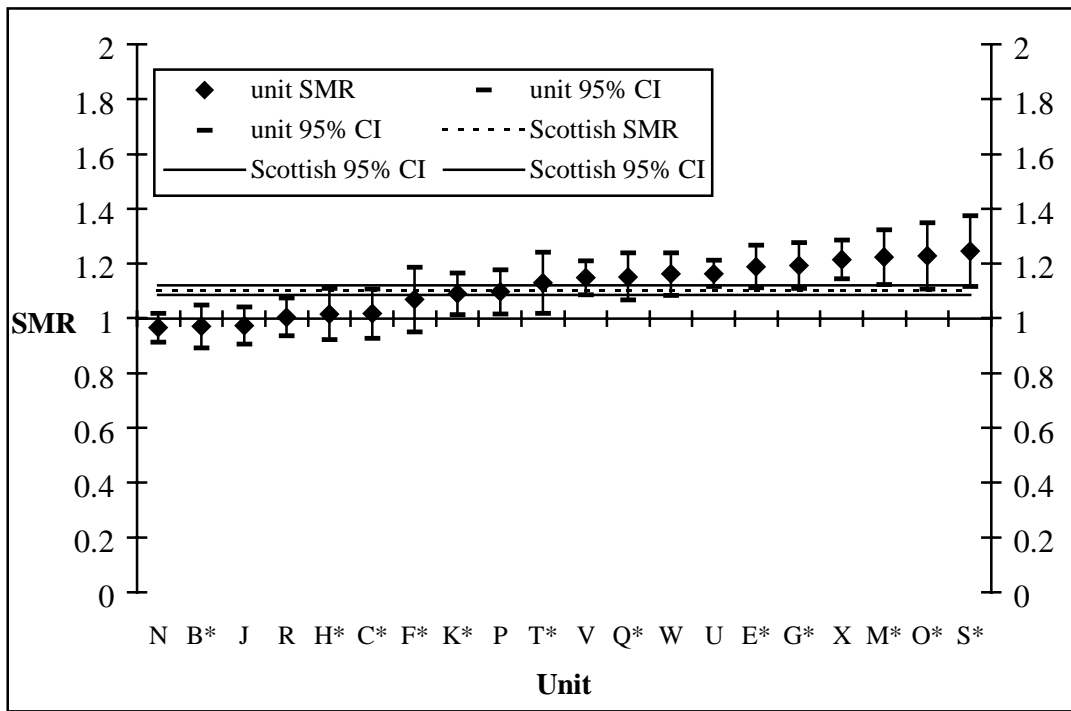




Figure 57. Scottish overall SMRs in 20 units in 1995-2000. Mean: 0.999, 0.984-1.01.

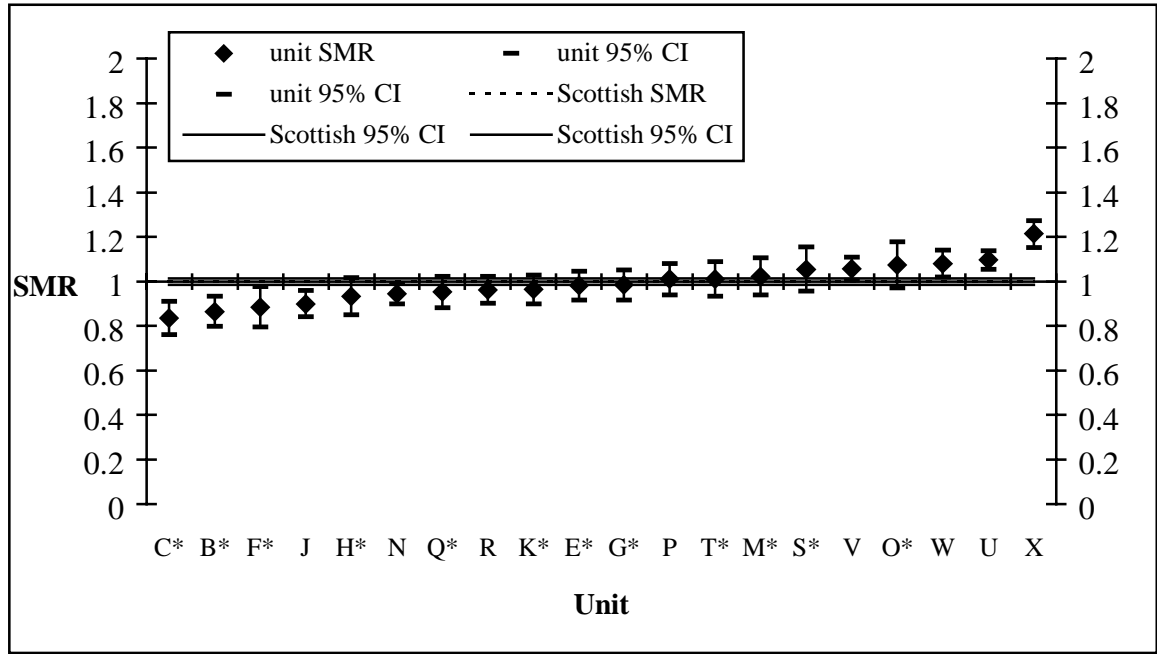


Table 2. Annual variation in rank order of APACHE II SMRs (lowest to highest) in 20 ICUs participating throughout 1995 - 2000.

1995	1996	1997	1998	1999	2000	Overall
Q*	J	C*	B*	H*	F*	C*
H*	F*	F*	C*	C*	B*	B*
O*	C*	N	K*	G*	M*	F*
W	Q*	H*	E*	B*	Q*	J
J	N	B*	P	J	E*	H*
C*	R	R	G*	R	O*	N
R	B*	J	T*	E*	H*	Q*
T*	W	V	S*	N	G*	R
K*	T*	T*	J	K*	N	K*
N	P	S*	F*	V	J	E*
F*	M*	U	N	F*	V	G*
G*	K*	M*	W	M*	K*	P
V	V	Q*	O*	P	P	T*
P	E*	K*	Q*	O*	R	M*
B*	S*	E*	M*	S*	C*	S*
U	U	P	U	U	U	V
S*	H*	W	R	T*	S*	O*
X	G*	G*	H*	Q*	T*	W
E*	X	X	V	W	X	U
M*	O*	O*	X	X	W	X

Lowest SMR
 ↓
 Highest SMR



52. The particular value of these data lies in Figures 58, 59 & 60 which show the Scottish SMR for non-operative patients, for operative and overall for 1995-2000 using APACHE II. It is clear that there has been little, if any, change over this time.

Figure 58. Scottish annual operative SMRs: 1995-2000 (in 20 units). Mean: 0.821, 0.795 – 0.847

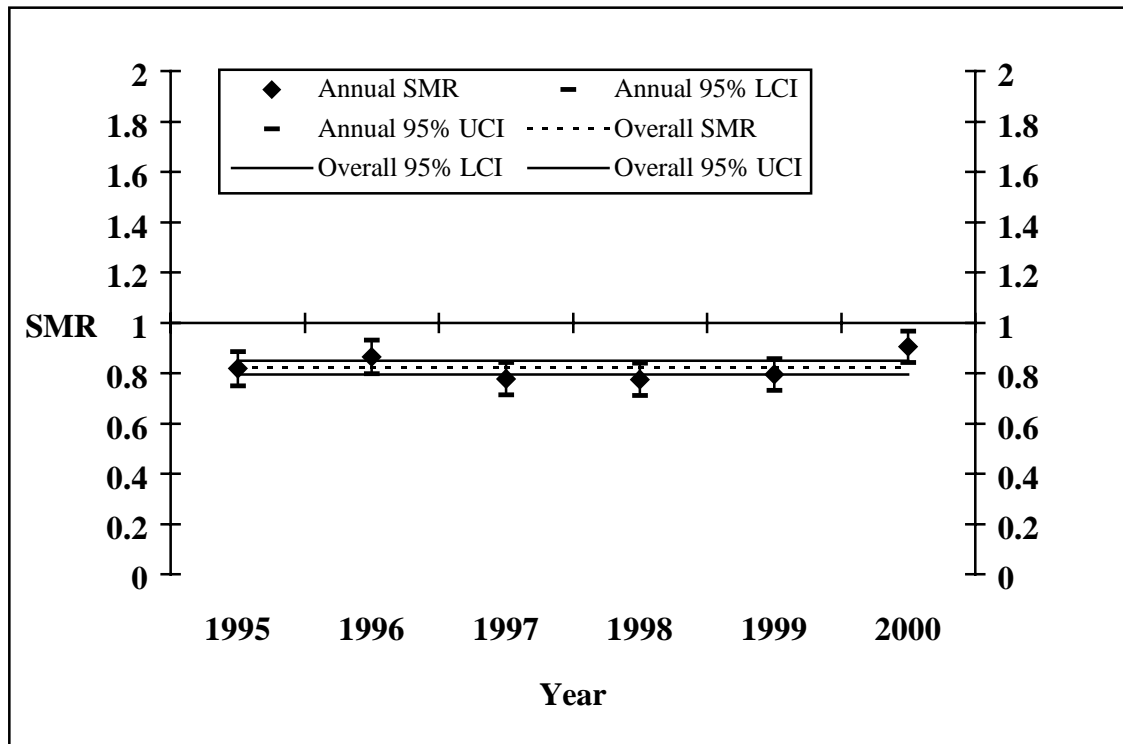




Figure 59. Scottish annual non-operative SMRs during 1995–2000 (in 20 units).
Mean: 1.10, 1.08-1.12.

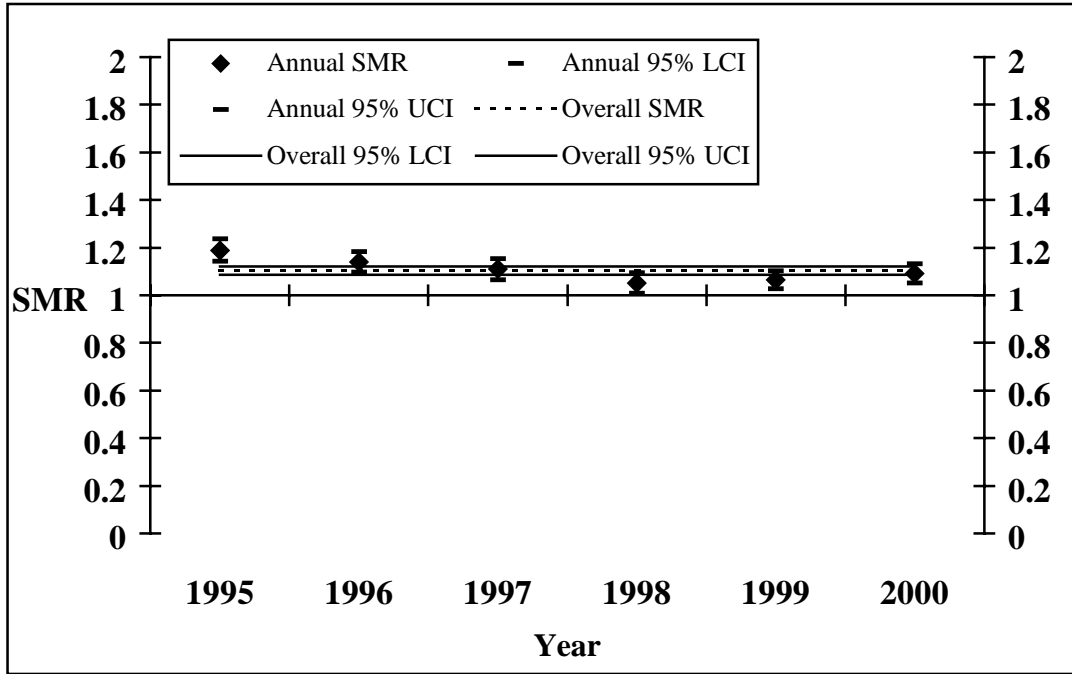
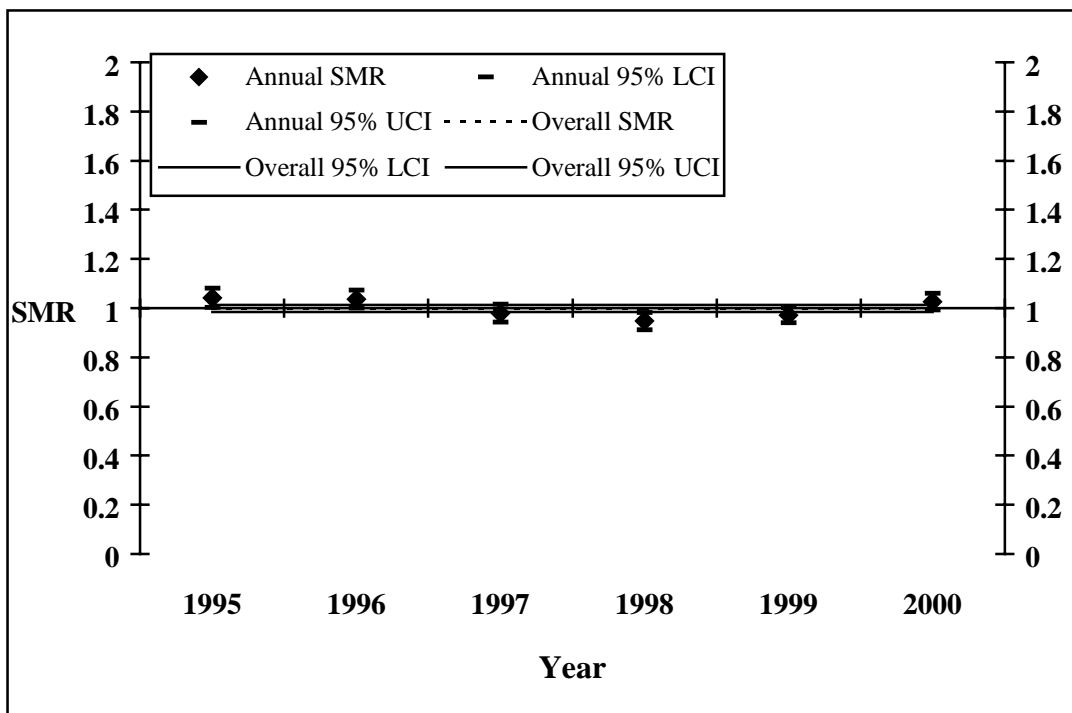


Figure 60. Scottish annual SMRs during 1995 – 2000 (in 20 units). Mean: 0.999,
0.984 – 1.01.





D.7. System classification.

53. Using the APACHE diagnostic classification, patients can be grouped according to the primary organ system failure causing ICU admission. Table 3 illustrates the variations in the proportions of all admissions to Scottish ICUs falling within these categories: from less than 1% with a haematology diagnosis to 30.7% gastrointestinal. The majority (58%) of non-operative admissions either have a respiratory (34%) or cardiovascular disorder (24%), compared to 54% of all operative patients admitted following gastrointestinal surgery. Variation in the duration of intensive care is marked, from 2 days in the general category to 7 days in respiratory.

54. Table 4 illustrates the ranges of illness severity and expected hospital outcome between each system category in those patients with APACHE II mortality probabilities. Individual unit data are tabulated in Table 4.1. of the individual unit graphs. The SMRs for these data, for 1998-2000, are given in Figure 61, confirming the point made previously, that APACHE is an imperfect system for case mix adjustment. The SMRs for several groups, particularly neurological and trauma patients, are clearly greater than 1 whilst those for gastrointestinal and general are lower. This is due to limitations of the model. It illustrates the danger that apparent differences in performance between units may, in fact, be partly due to varying case mix.

55. It is, nonetheless, of some interest that when we examine the figures for individual units within each system some differences are statistically significant (Figures 62 - 70). We would not wish to make any judgement about unit performance on the basis of these figures but hope that providing them may be of help to individual units in targeting their local Clinical Governance initiatives.



56. Specific diagnostic sub-groups have been looked at in more depth and are discussed in sections D.8. Ruptured Abdominal Aortic Aneurysms and D.9. Haematology admissions. Interim results from a prospective study of the incidence and outcome from sepsis is discussed in section D.10.

Table 3. Admission APACHE diagnostic system categories in all patients: 1998-2000.

Admission APACHE Diagnostic System Category	LOS (d) mean	Proportion (%) of patients		
		Overall	Non-operative	Operative
Gastrointestinal (GI)	4.24	30.7	12.2	54.4
Respiratory (Resp)	7.17	21.7	34.2	5.7
Cardiovascular (CVS)	4.45	20.4	24.4	15.3
Neurological (Neuro)	2.98	9.9	15.9	2.2
Trauma	4.85	7.3	7.2	7.5
General	1.94	5.5	2.4	9.5
Renal	3.83	3.0	2.0	4.1
Metabolic/endocrine (Metabolic)	2.97	1.2	1.4	0.9
Haematological (Haem)	3.39	0.4	0.5	0.2
Total	4.68	100.0	100.0	100.0

Table 4. Admission APACHE diagnostic system categories in predicted patients: 1998-2000.

Admission APACHE Diagnostic System Category	Proportion (%) of patients	LOS (d) mean	APACHE II	
			Score	Probability (%)
Gastrointestinal (GI)	31	4.6	18.1	36.92
Respiratory (Resp)	22	7.6	20.21	33.08
Cardiovascular (CVS)	21	4.9	22.96	43.33
Neurological (Neuro)	10	3.3	17.62	21.22
Trauma	7	5.7	13.46	12.15
General	5	2.2	15.13	21.09
Renal	3	4.4	19.55	25.98
Metabolic/endocrine (Metabolic)	1	3.4	19.50	24.40
Haematological (Haem)	0	3.8	22.33	50.21



Figure 61. Scottish SMRs by APACHE system: 1998-2000.

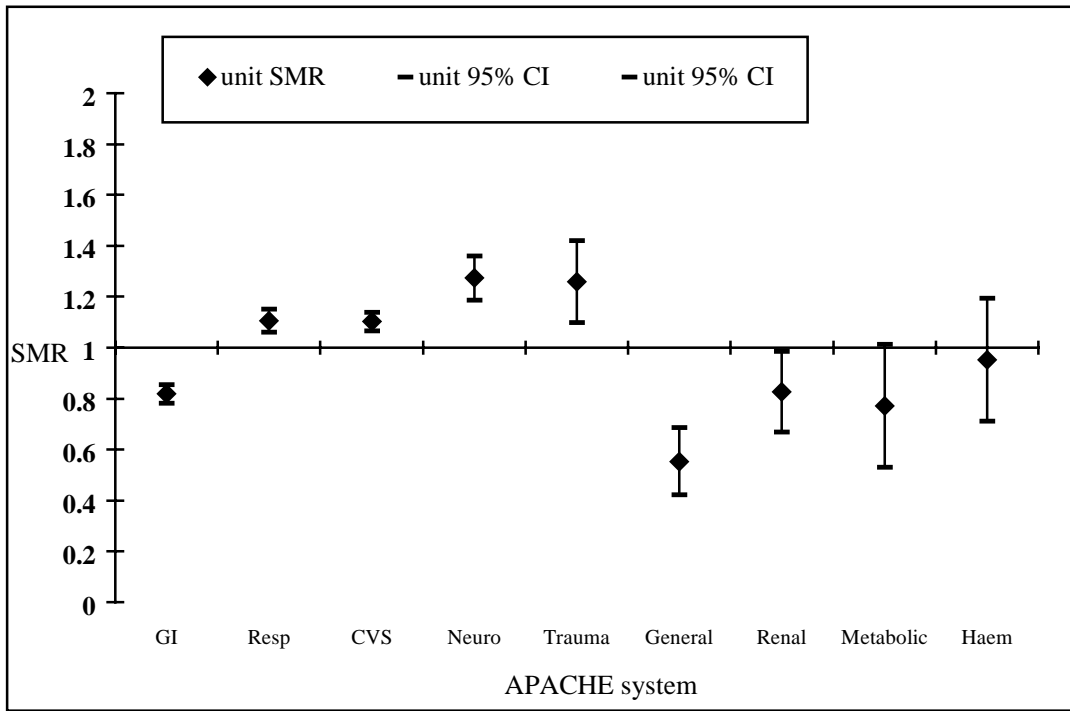


Figure 62. SMRs by gastrointestinal system (1998-2000). Mean: 0.818, 0.781-0.855.

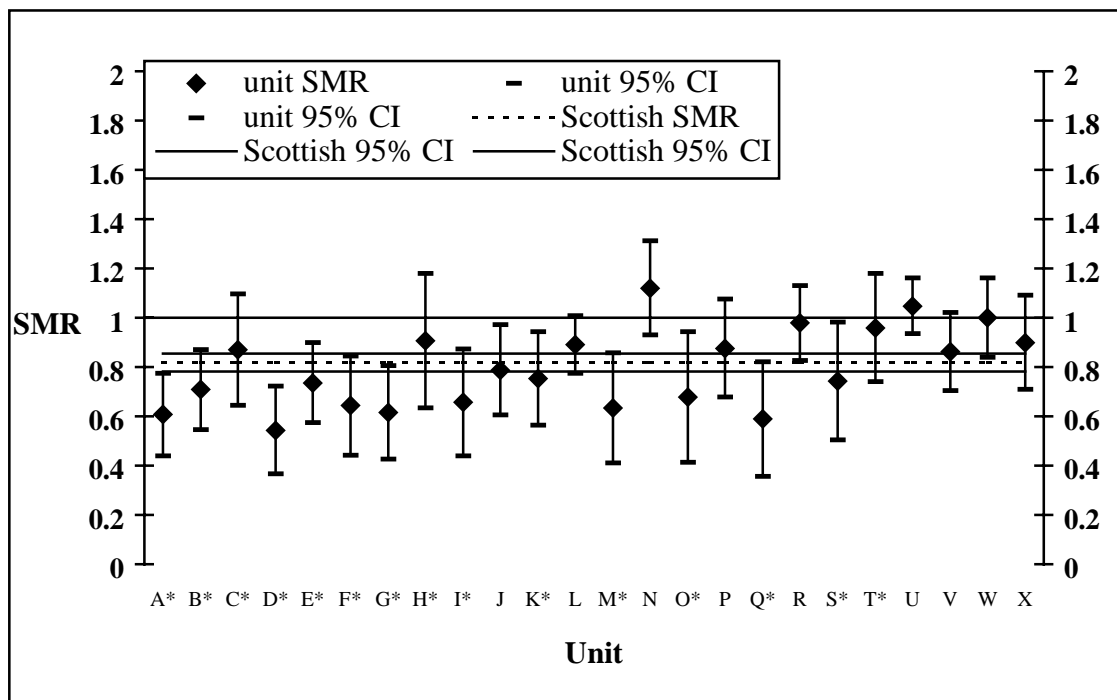




Figure 63. SMRs by respiratory system (1998-2000). Mean: 1.11, 1.06-1.15.

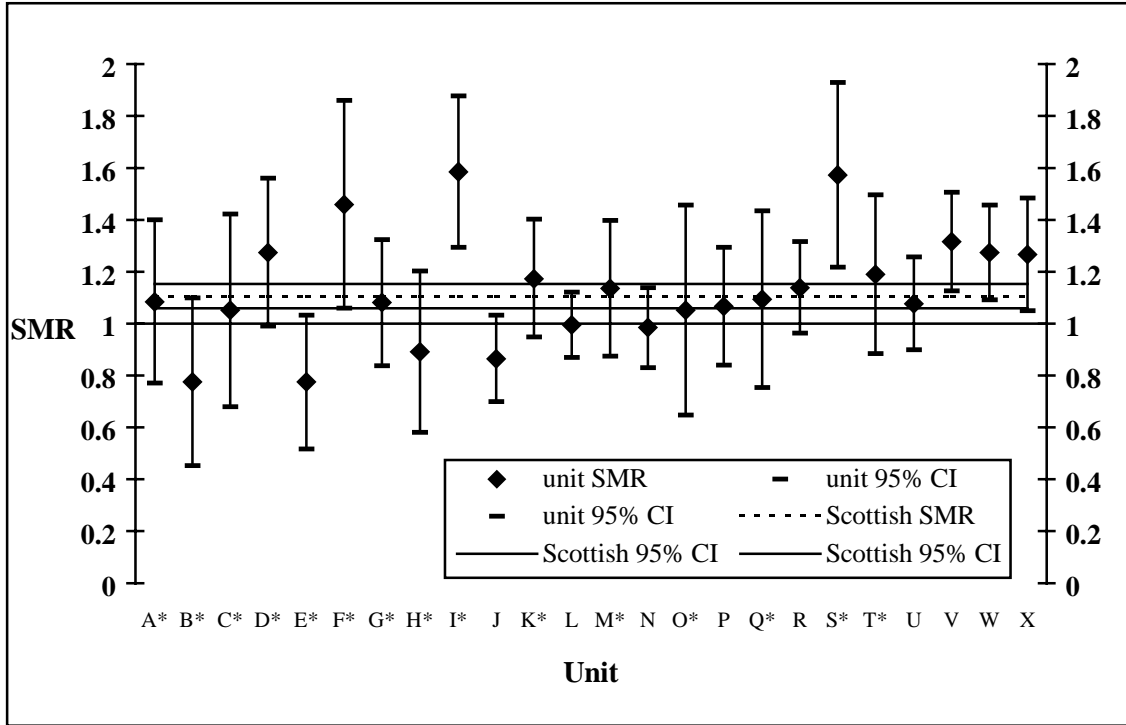


Figure 64. SMRs by cardiovascular system (1998-2000). Mean: 1.10, 1.07-1.14.

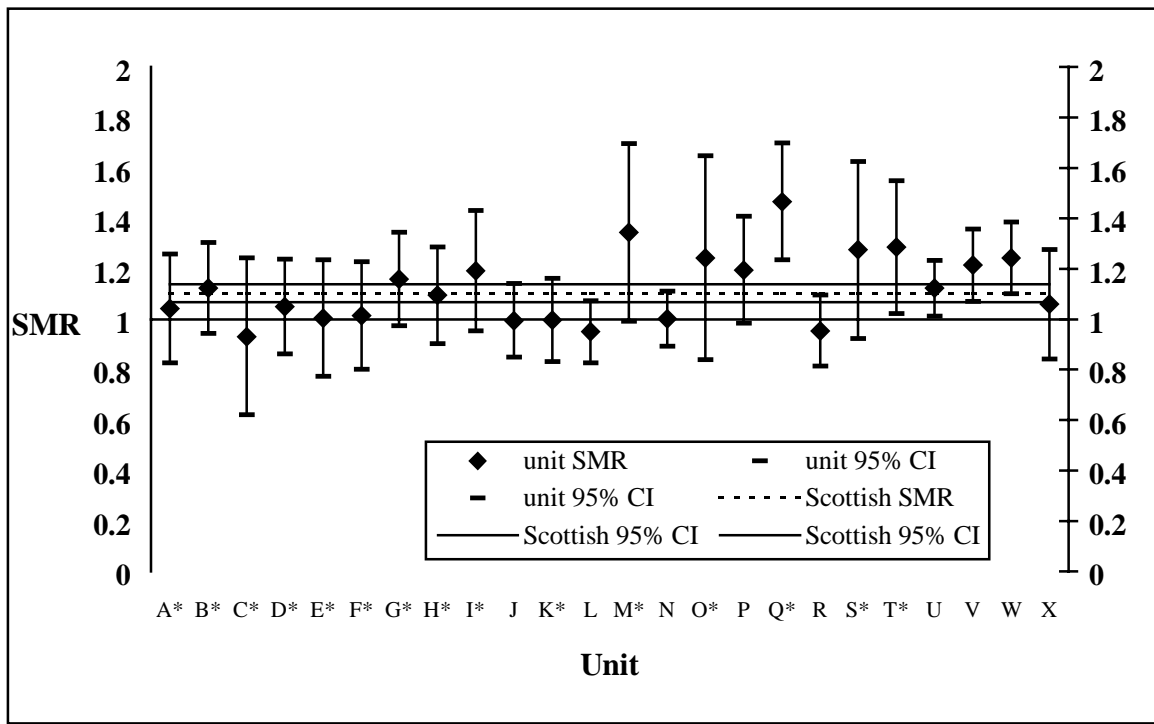




Figure 65. SMRs by neurological system (1998-2000). Mean: 1.27, 1.19-1.36

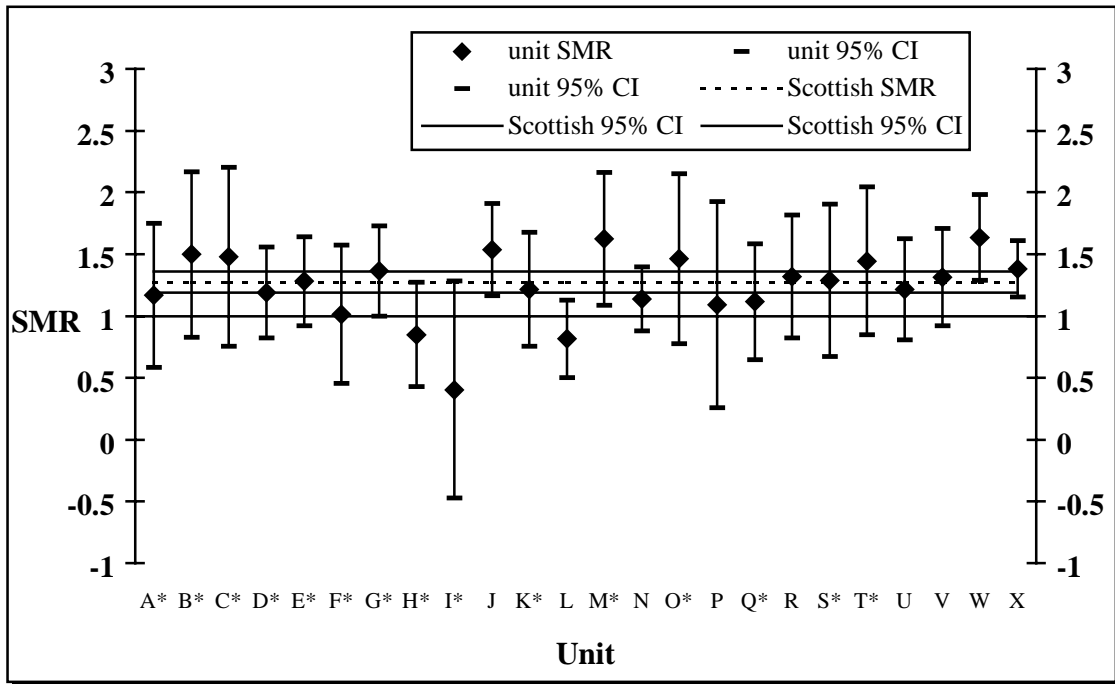


Figure 66. SMRs by trauma system (1998-2000). Mean: 1.26, 1.10-1.42.

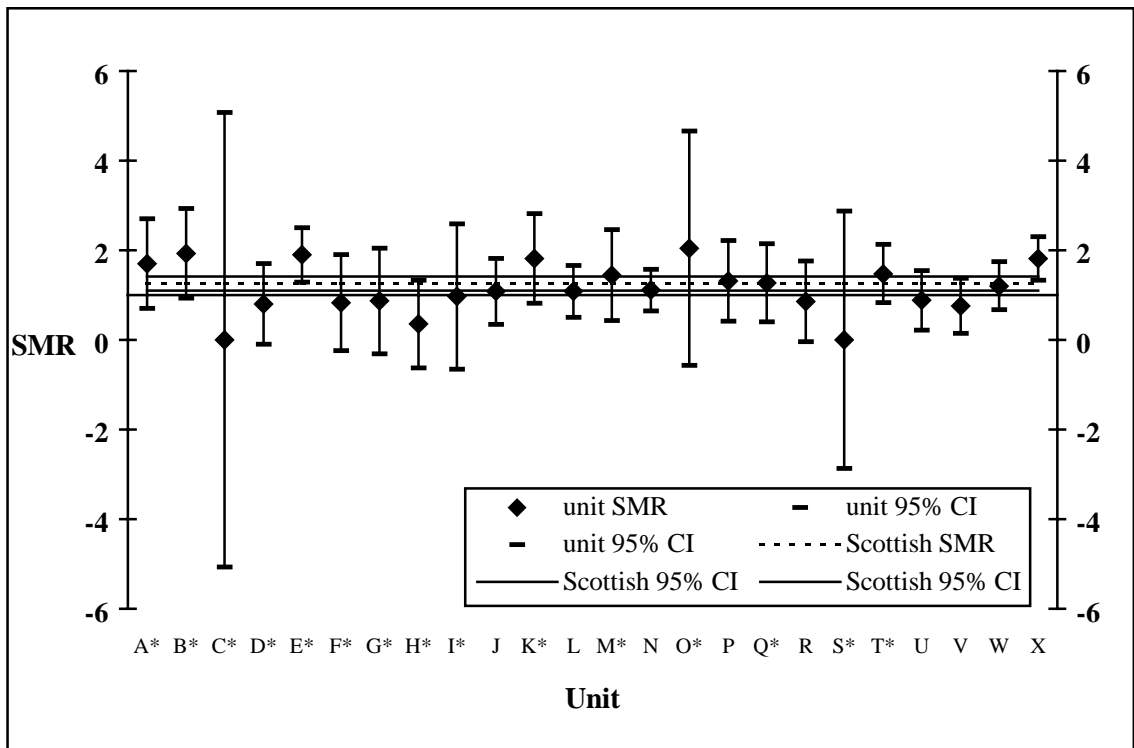




Figure 67. SMRs by general system (1998-2000). Mean: 0.553, 0.421-0.685.

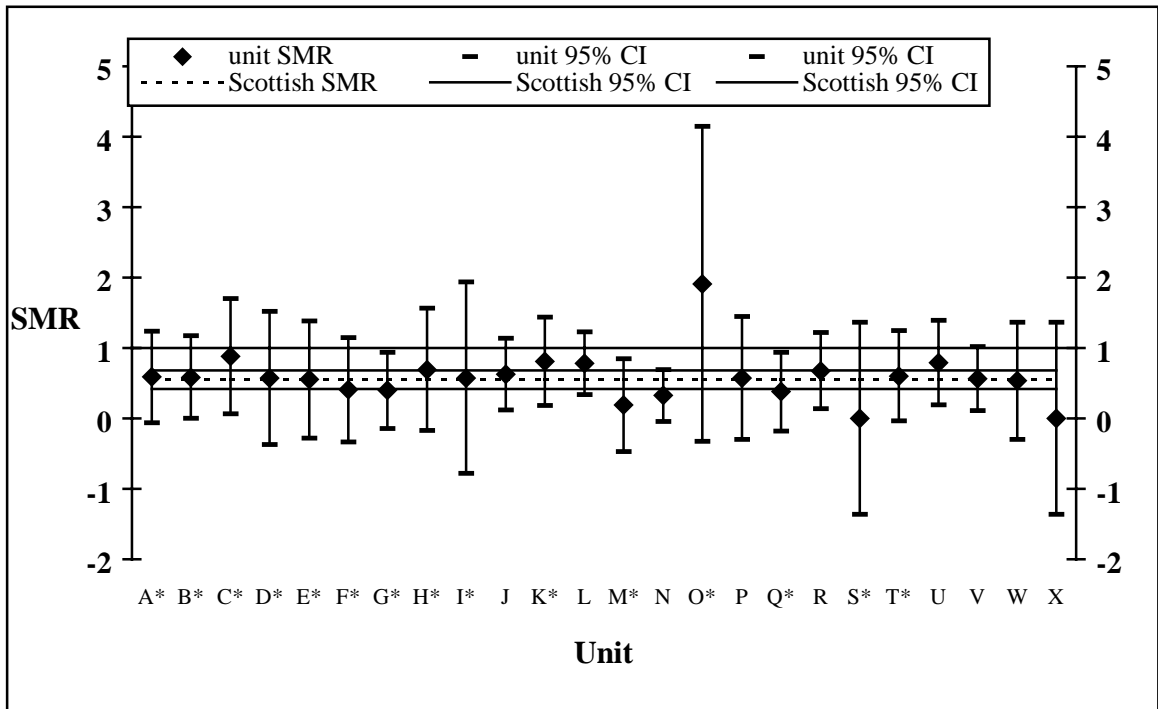


Figure 68. SMRs by renal system (1998-2000). Mean: 0.826, 0.669-0.984.

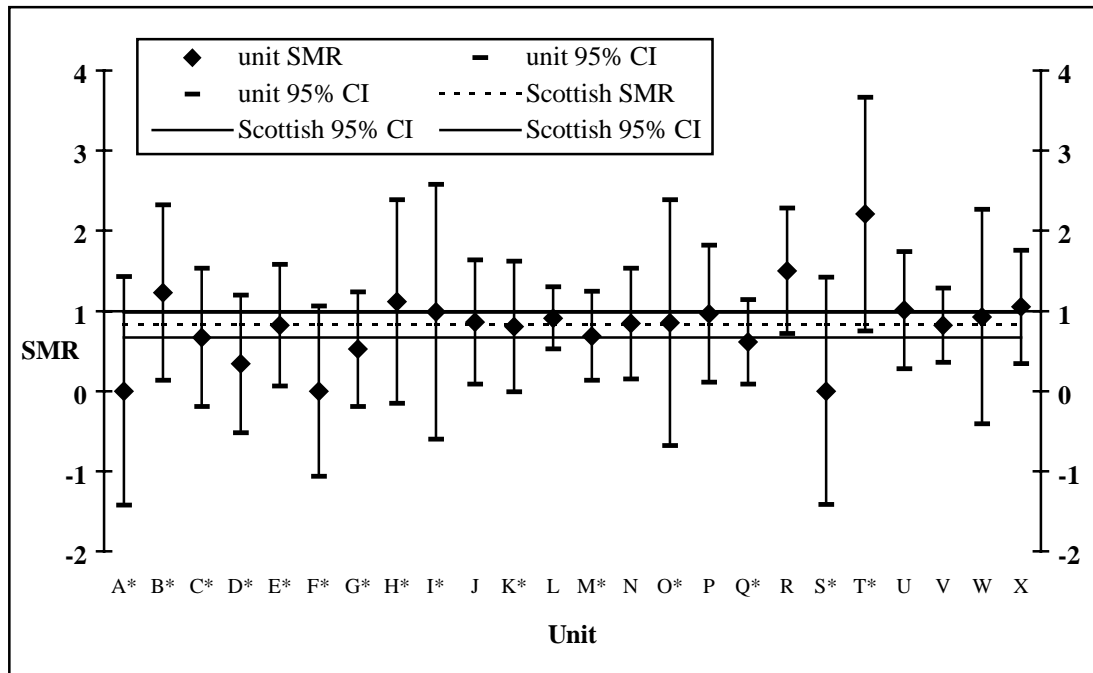




Figure 69. SMRs by metabolic system (1998-2000). Mean: 0.772, 0.531-1.01.

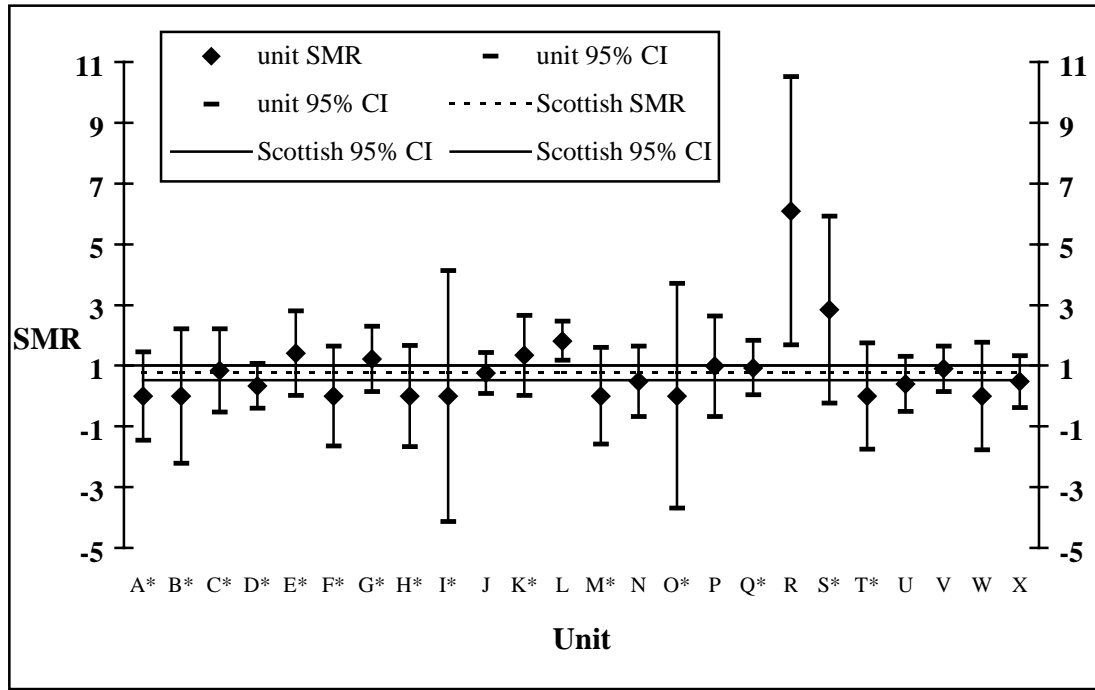
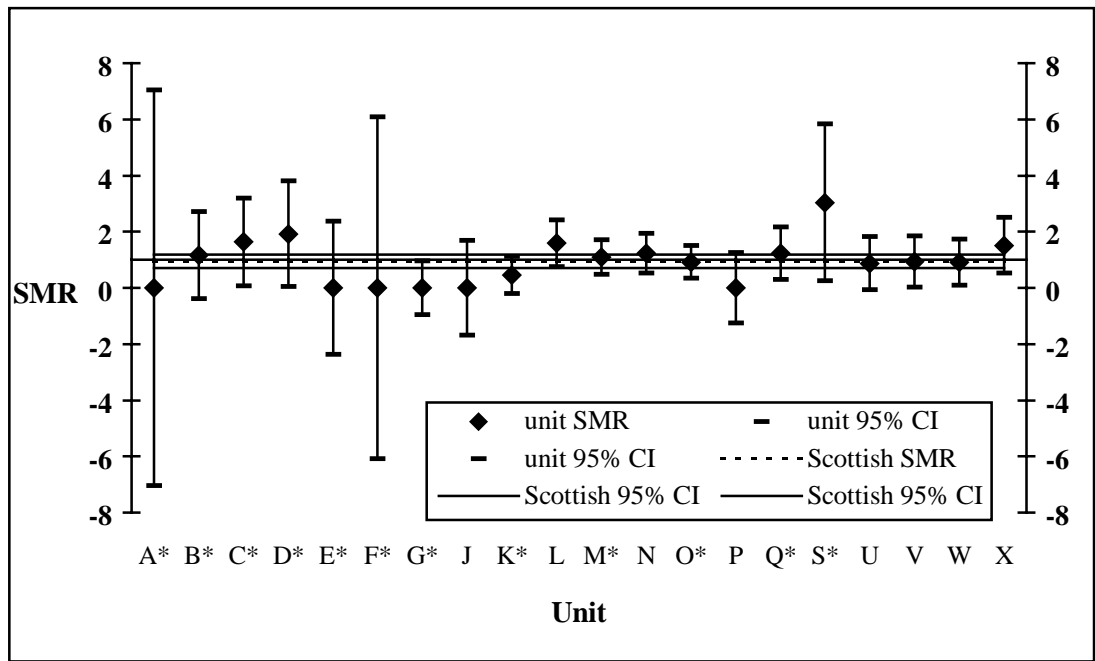


Figure 70. SMRs by haematological system (1998-2000). Mean: 0.953, 0.711-1.19.





D.8. Outcome after ruptured abdominal aortic aneurysms.

57. An analysis of the SICS data was suggested to determine whether there was any objective data to confirm the anecdotal impression that the outcome for patients with ruptured abdominal aortic aneurysms varied between ICUs.

58. A retrospective search of the SICS database was undertaken, looking for all patients with a surgical APACHE diagnosis of 'Abdominal aortic aneurysm – rupture/leak' between 1/1/1995 and 31/12/2000. Patients with a diagnosis of 'Aneurysm – pre leak or dissection' were not included. Patients were excluded if they were readmitted in the same hospital episode (1), had a length of stay less than 8 hours (13), had some other exclusion from APACHE scoring (14) or had incomplete outcome information (42). The information collected included age, sex, APACHE II scores and expected mortality where available, length of ICU stay, ICU and hospital mortality.

59. After the application of the exclusion criteria, 629 patients who had undergone emergency surgery for ruptured abdominal aortic aneurysms were identified in 21 different intensive care units. The majority were male (79.6%) with a mean age of 72 years and little variation across units. Table 5 shows results for individual units in comparison with the Scottish benchmark.

60. Clearly some units rarely admit patients with this diagnosis and it is probably inappropriate to consider further those units with fewer than 20 admissions. Even using this cut off it is clear that there are enormous differences in the number of patients admitted but it does not appear that this relates to outcome. There are greater differences between units in median length of ICU stay than in mean.

61. The ICU mortality ranges from 17.2% in unit 17 to 37% in unit 21. Hospital mortality also varies from 27% to 47%. Using APACHE II, the SMR varies from 1.06 to 1.65. Although this appears to be a large range, it can be seen that the 95% confidence intervals all overlap with those for the group as a whole.



Table 5. Abdominal aortic aneurysm repairs

The identifying code for an individual ICU can be obtained from the local ICU audit co-ordinator.

Unit	N	LOS (d)		APACHE II		Mortality (%)		SMR	95% LCI	95% UCI
		Mean	Median	Score	Probability (%)	ICU	Hospital			
1	1	6.90	6.9	20.0	21.3	0.00	0.00	0.000	-3.768	3.768
2	1	8.20	8.2	20.0	21.3	100	100	4.695	0.927	8.462
3	3	6.47	7.9	32.3	59.4	33.3	33.3	0.561	-0.307	1.428
4	3	2.40	2.4	25.0	37.9	100	100	2.639	1.315	3.962
5	4	2.43	0.7	24.7	36.9	75.0	75.0	2.031	0.818	3.244
6	5	12.0	8.7	21.0	24.3	60.0	60.0	2.467	0.936	3.998
7	8	10.9	5.3	28.5	49.5	75.0	87.5	1.769	1.150	2.388
8	9	15.0	4.5	18.8	21.1	33.3	44.4	2.111	0.887	3.335
9	12	6.63	3	16.0	14.5	0.00	0.00	0.000	-1.392	1.392
10	14	10.6	2.15	20.4	25.4	35.7	42.9	1.686	0.850	2.522
11	14	7.77	5.7	21.0	27.1	35.7	35.7	1.316	0.526	2.107
12	17	9.15	5.5	18.6	20.2	35.3	41.2	2.038	1.129	2.948
13	17	6.54	3.7	19.9	23.8	29.4	35.3	1.481	0.668	2.294
14	20	9.65	4.35	18.4	20.1	35.0	40.0	1.988	1.151	2.825
15	26	7.31	3.35	21.2	26.3	32.0	36.0	1.369	0.760	1.978
16	26	7.81	5	25.4	39.7	26.9	42.3	1.064	0.630	1.499
17	29	6.93	4.6	21.0	26.0	17.2	27.6	1.061	0.479	1.644
18	33	5.63	3.9	22.9	32.4	24.2	39.4	1.216	0.777	1.654
19	55	6.03	3.8	21.5	27.2	30.9	41.8	1.539	1.128	1.950
20	80	5.85	1.85	19.5	22.1	17.5	27.5	1.243	0.852	1.633
21	81	6.38	2.8	22.0	28.4	37.0	46.9	1.649	1.318	1.980
22	171	4.39	1.5	19.3	22.7	18.7	29.2	1.288	1.030	1.546
SICS	629	6.32	2.7	20.7	25.9	26.9	36.4	1.402	1.278	1.525



62. Although at first sight there appear to be differences in both actual and case mix adjusted mortalities, these are not statistically significant. The relatively small number of patients, even in the larger units, means that the 95% confidence intervals around the SMRs are wide. It should not be inferred from these data that there is a real difference, which would be confirmed with larger numbers. It does mean, however, that it will be very difficult to answer the question as to whether there are real differences in outcome using this methodology.

63. There are other limitations worth noting. The first is technical: it can be seen that there are differences in mean APACHE II scores between units (18.5-25.4), and that the effect on the expected mortality is considerable (20% to 40%). Any errors in scoring could, therefore, have a marked effect on SMR and these specific records have not all been validated. Earlier data validation, however, identified no significant over or under scoring in the APACHE II model in these units [18]. A second limitation is that ICU is only one part of the patients' care. There may be differences in selection policy for surgery, in the quality of surgery, and in approach to the unstable patient at the end of surgery that are not detected here but which affect outcome or the likelihood of even being admitted to ICU. There are some apparent differences in mortality after ICU discharge, which might merit further study. Such differences may reflect the quality of ICU care, but can also be due to the quality of subsequent care, or pressure on resources leading to early discharge.

64. We have shown that the differences in mortality for patients admitted to intensive care after surgery for ruptured abdominal aortic aneurysm are not statistically significant. The apparent differences may seem to require further investigation, but in view of the small numbers of patients, as well as the importance of pre-ICU care and triage, this would require a detailed and prospective study of patients from the time of initial presentation.



D.9. The outcome of haematological malignancy in Scottish ICUs.

65. The admission of patients with haematological malignancies into the ICU is usually enough to make the heart of even the most battle-hardened intensivist sink. It is perceived wisdom that these patients have a poor prognosis once they have been admitted to the ICU. This is thought to be due to their underlying malignancy and the immunosuppression that is almost always present in these patients. In contrast, outwith the confines of intensive care, there is a clear improvement in overall mortality for this group of patients over the last 30 years.

66. Factors that have been associated with a poor outcome in these patients include neutropenia, shock and multi-organ failure. However, many of these patients present to ICU with a primary diagnosis unrelated to the underlying haematological malignancy and may represent a quite different patient group.

67. We have studied the outcome of haematological malignancy in all Scottish ICUs taking part in the SICS Audit over the period of 1995 to 2000 and found 712 patients who presented to ICU with a haematological malignancy as either their primary or secondary diagnosis. For the entire cohort, the ICU and hospital mortalities were 40% and 52% respectively, the median APACHE II score was 24 and the SMR only 1.05 (0.98 to 1.13).

68. Factors seen to be associated with a poor outcome include the length of hospital stay before ICU admission, CPR before admission, admission diagnosis related to underlying malignancy or treatment, neutropenia and multi-organ failure. The presence of neutropenic septic shock and multi-organ failure was not universally fatal and was not predictive of death.



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69. In conclusion, the outcome from haematological malignancy is improving and the outcome from intensive care in these patients is not as dismal as it may be perceived. Perhaps we should be bringing this young group of patients to ICU earlier and offering aggressive organ support in an attempt to further improve outcome.

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Senior Lecturer in Anaesthesia and Intensive Care,
University of Aberdeen



D.10. Audit of sepsis in Scottish ICU admissions.

70. Sepsis has long been recognised as a major cause of morbidity and mortality in ICU, but data on its epidemiology is surprisingly sparse. Treatment has been based around eradication of infection with antimicrobials, surgery (when appropriate) and organ support. Attempts at specific treatment for sepsis have been disappointing but Drotrecogin alpha (Activated) does appear, from the PROWESS [3] trial, to be an effective, though expensive, treatment when used in addition to best current practice.

71. It became clear that there was a need for better epidemiological information in order to assess the number of patients who might benefit from the above drug (and the financial consequences) and the present impact of severe sepsis in the UK. It is often observed that mortality is greater in unselected patients when compared to those meeting entry criteria for a trial, and this could be particularly important as no patients from the UK were included in the PROWESS trial.

72. We initially performed a retrospective analysis of data from 01/01/1999 to 31/12/2000. This was presented at the 22nd International Symposium on Emergency and Intensive Care Medicine in Brussels, March 2001 [20]. We were concerned that, because of the way in which it was necessary to analyse the data, we were only identifying patients with septic shock rather than those with severe sepsis as well. We therefore suspected that the incidence (18%) we reported might be low and the mortality rate (59%) high. We were also conscious that we were only able to detect a septic episode if it occurred within the first 24 hours in ICU. We, therefore, undertook a prospective audit with financial support from Eli Lilly. Funding provided 1 WTE nurse salary for the duration of the study. Gill Harris, seconded from ICU at Raigmore Hospital for 7 months and Lynn Gillies from HDU at Royal Infirmary of Edinburgh assisted in the implementation of the study and data validation.



73. The study commenced in January 2002 and is still in progress. Recording of daily data by ICU staff allows the first episode of sepsis at any point in a patient's ICU stay to be detected. Supplementary information is recorded on site of infection, type of infection and organ failures. The daily progression of patients is then noted. All these data are entered onto a modified version of the Ward Watcher database (Critical Care Audit Ltd., Yorkshire) and a proportion of patient records independently validated.

74. Discussed here are interim results which were presented at the Spring Scientific meeting of the UK Intensive Care Society. It is important to emphasise that these are based on analysis of an incomplete dataset and that only ICU mortality data are available at present.

75. Almost half, 47%, of ICU admissions have, or develop, sepsis during ICU admission. In the great majority of cases it occurs on day 1. There is a noticeable difference in this incidence between units. It is, however, the figures for severe sepsis and septic shock which are of most interest (Table 6).

Table 6. Interim results from an audit of sepsis in Scottish ICUs: Incidence & outcome.

	Incidence	ICU mortality
Severe sepsis	20%	21%
Septic shock	18%	52%
Combined	38%	35%

76. It is clear (Table 7) that there is an association between severity of sepsis, the Sepsis-related Organ Failure Assessment (SOFA) score [21], APACHE II score and mortality. It is not obvious on initial analysis that there is a strong relationship between site, or type, of infection and severity or outcome. The majority, 58%, of infections were in the respiratory system.



Table 7. Interim results from an audit of sepsis in Scottish ICUs. Illness severity.

	SOFA score Mean	APACHE II score Mean	ICU mortality
Sepsis	1.8	17.8	9.25%
Severe sepsis	5.2	19.8	21.4%
Septic shock	10.7	24.3	52%

77. These preliminary results suggest that, although the population incidence is lower than that indicated in a study of administrative data in the USA [22], it is common. Angus *et al.* [22] reported 3 cases of severe sepsis/septic shock per 1000 as opposed to 0.5 per 1000 in our ICU-based study. The SICS figures also indicate that the ICU mortality is similar to that seen in the 28-day mortality in the control arm of the PROWESS trial [3]. It should be noted, however, that this study did not set out to exactly replicate the entry criteria for that trial. Further analyses are required in order to characterise progression of the disease and prognostic factors.

Note on definitions.

Sepsis: 2 or more SIRS criteria in response to infection

Severe sepsis: sepsis associated with organ dysfunction/hypoperfusion/hypotension

Septic shock: sepsis induced hypotension (systolic BP <90mmHg or fall >40 mmHg in absence of other causes) along with perfusion abnormalities. Patients who are on inotropes/vasopressors may not actually be hypotensive and still qualify.



D.11. The use of ICU length of stay as an outcome measure.

The letter code for an individual ICU can be obtained from the local ICU audit co-ordinator. A list of these valued individuals, who are responsible for organising the real work, is given in Appendix II.

78. We have previously published [23] an evaluation of the APACHE III prediction [13] of ICU length of stay. This was found to be of limited value and is no longer available for use in Scotland, as our access was limited to the period of our APACHE III evaluation. Nevertheless, there is a complex but entirely understandable relationship between severity of illness and ICU length of stay. The relationship is parabolic, with ICU length of stay being shortest in the most severely ill patients and in the least severely ill patients (Figure 71). The basis for this becomes clearer when ICU survivors (hashed line) and ICU non-survivors (solid line) are examined separately (Figure 72). For ICU non-survivors there is a progressive decrease in the ICU length of stay with increasing predicted mortality. For ICU survivors there is a progressive increase in ICU length of stay with increasing predicted mortality. Linear regression analysis produced r^2 of 0.96 and 0.94 for survivor and non-survivor plots respectively (mean length of stay versus mean mortality probability). Figure 72 includes a frequency distribution of survivors (grey histogram) and non-survivors (white histogram), indicating where patient numbers are sufficiently high for the relationship to be expected to be consistent. This is particularly relevant to subsequent plots for individual ICUs where numbers are much smaller. Apparent deviation of unit plots from the national norm is only likely to be significant in survivors in the lower range of predicted mortality and in non-survivors in the higher range of predicted mortality (i.e., where patient numbers are adequate).

79. Variations in ICU length of stay may arise for a variety of reasons. An example of a unit with apparently longer length of stay in both categories of patients is shown in Figure 73. (As in Figure 72, the hashed line with circles shows the national relationship between length of stay and predicted mortality for survivors, the solid line with circles represents the non-survivors. The length of stay in that unit's



survivors is represented by a hashed line with crosses, its non-survivors by a solid line with crosses. This scheme continues in Figure 74). Figure 74 demonstrates data from a unit in which there is a perfect agreement for survivors but longer length of stay in non-survivors. It remains our intention to further refine this analysis in future reports.

80. We have provided a set of plots (Figures 74.A. - W) as Appendix III, which allow each unit contributing data in 2000 to compare its pattern of length of stay, in relation to severity of illness and survivor status, with the Scottish norm. These graphs incorporate all ICU episodes with APACHE II mortality probabilities, throughout each unit's participation in the audit. The validity of this approach remains uncertain and so we have retained unit anonymity as with SMR data. The letter code for an individual ICU can be obtained from the local ICU audit co-ordinator and is the same as that used to identify units in SMR plots. Variation between unit and national data is inevitable where patient numbers are relatively low (evident from the histogram). The overwhelming impression, however, is that where a unit's patient numbers are large there is remarkably close agreement with the plots derived from the complete database. It follows that the most useful part of the plot to examine is at the lower predicted mortality range for survivors and higher predicted mortality range for non-survivors.



Figure 71. The relationship between mean length of ICU stay (days) and mortality probability.

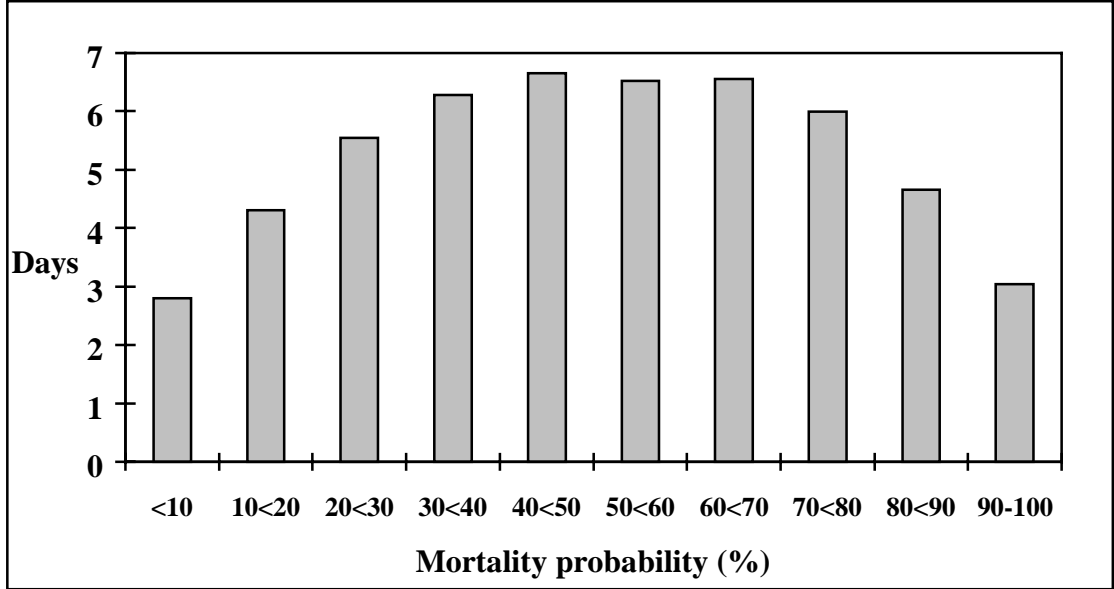


Figure 72. The relationship between mean length of ICU stay (days) and mortality probability in Scottish ICU survivors (S) and non-survivors (NS).

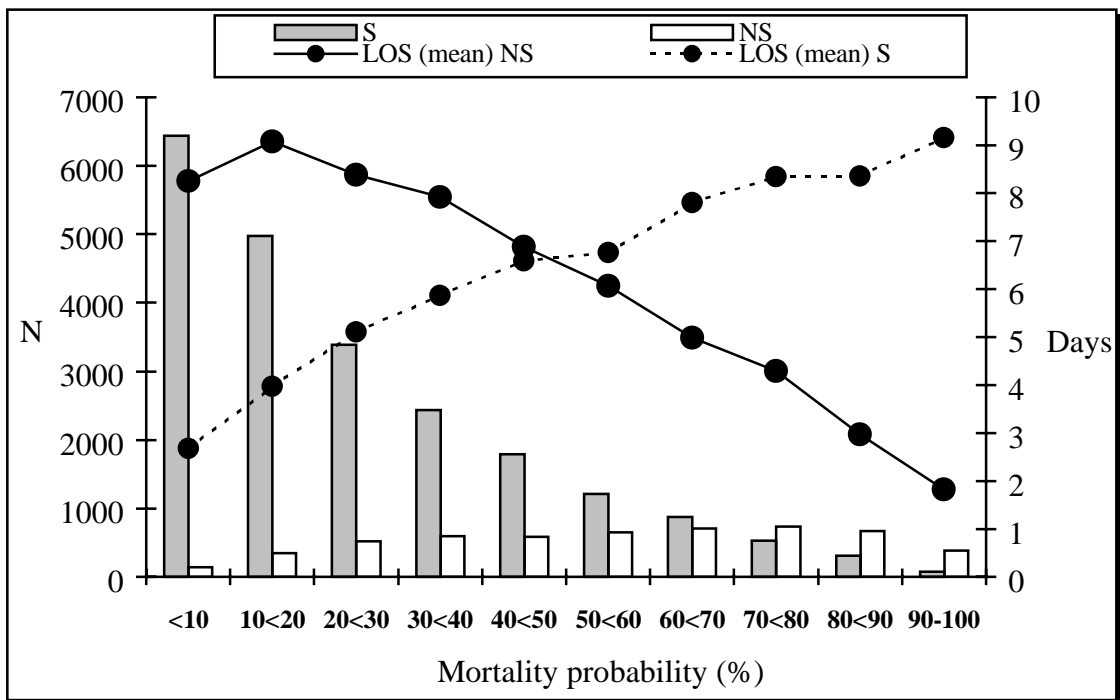




Figure 73. The relationship between mean length of ICU stay (days) and mortality probability in Scottish ICU survivors (S) and non-survivors (NS) in ICU W.

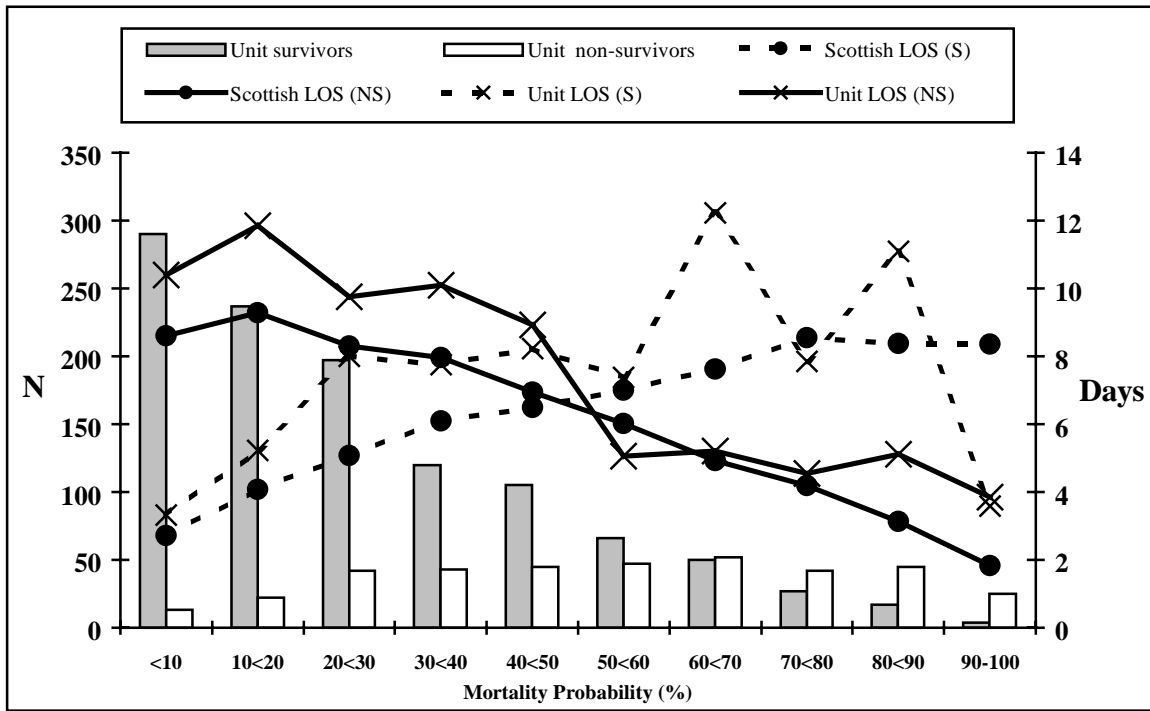
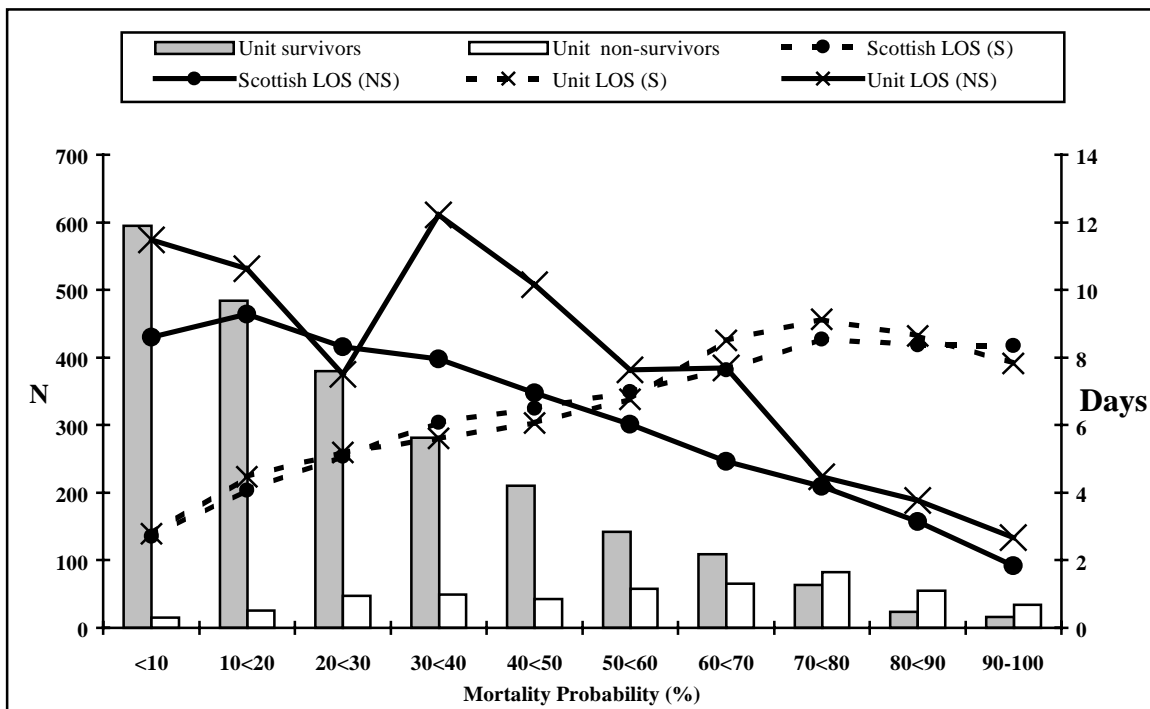


Figure 74. The relationship between mean length of ICU stay (days) and mortality probability in Scottish ICU survivors (S) and non-survivors (NS) in ICU N.





D.12. Age and outcome.

81. Age is an important component of severity of illness scores such as APACHE. Consequently, it follows that increasing age is associated with an increased risk of mortality. Without correction for severity of illness there is an increase in hospital mortality with increasing age. As demonstrated in Figures 75 to 78, the increase in mortality above 50 years is almost entirely due to an increase in mortality following ICU discharge. These graphs also display the consistent age profile of patients over the last 3 years as seen in Figure 79. Similar plots are shown separately for individual units (Figure 75.1 - 79.1).

Figure 75. Scotland: Age & Outcome, 1998.

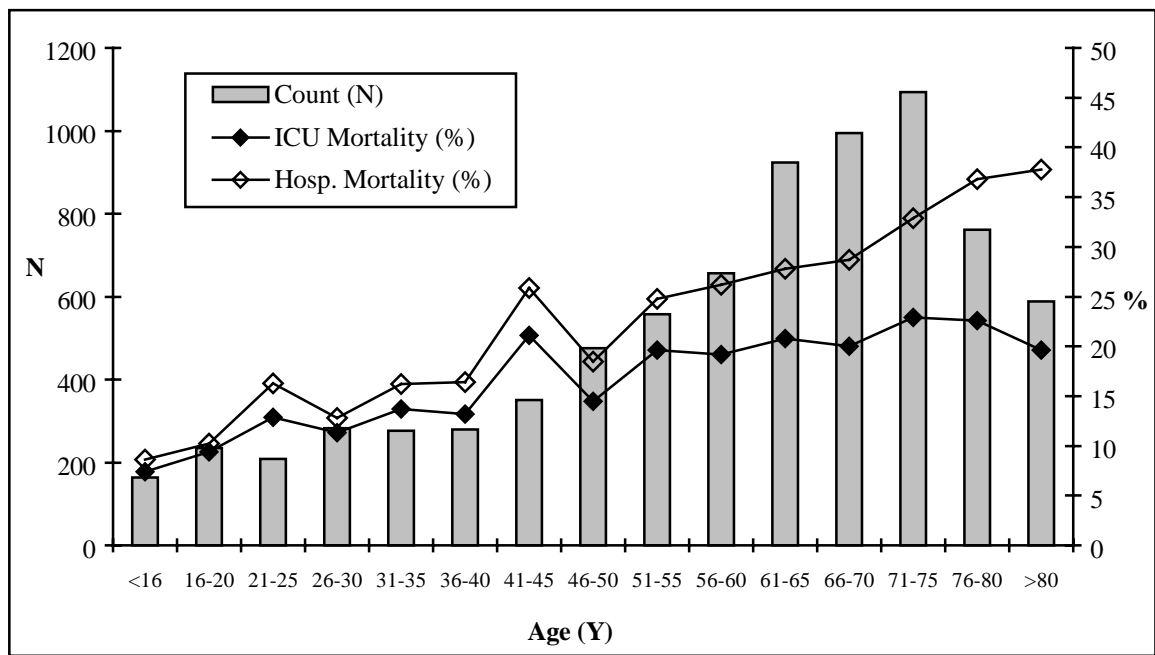




Figure 76. Scotland: Age & Outcome, 1999.

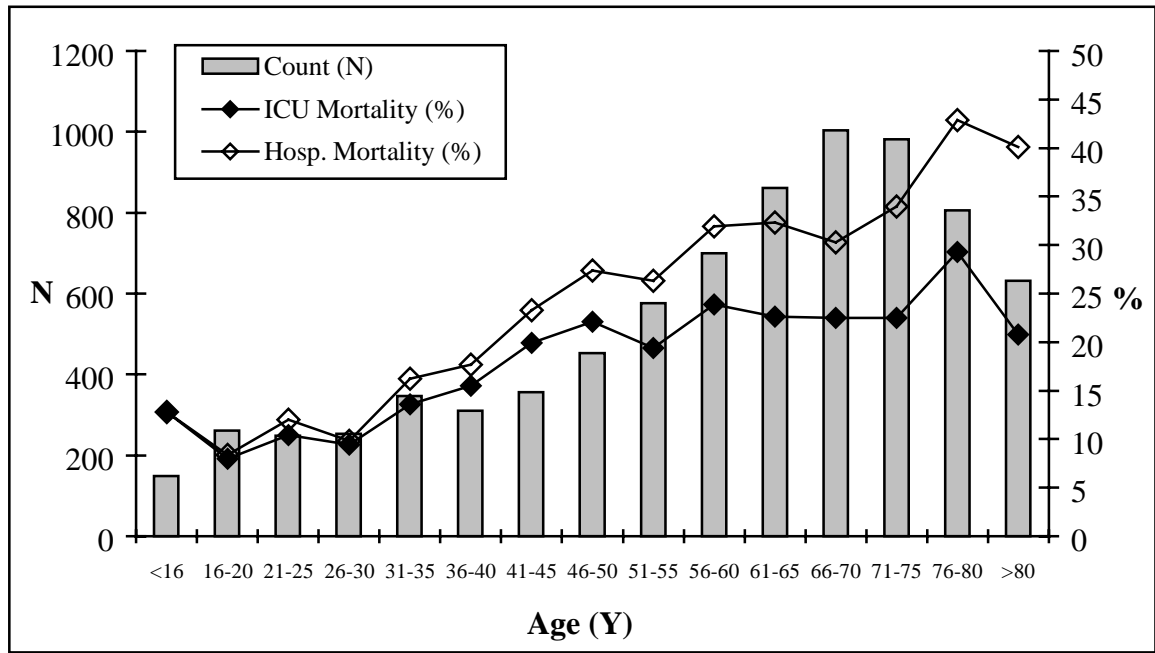


Figure 77. Scotland: Age & Outcome, 2000.

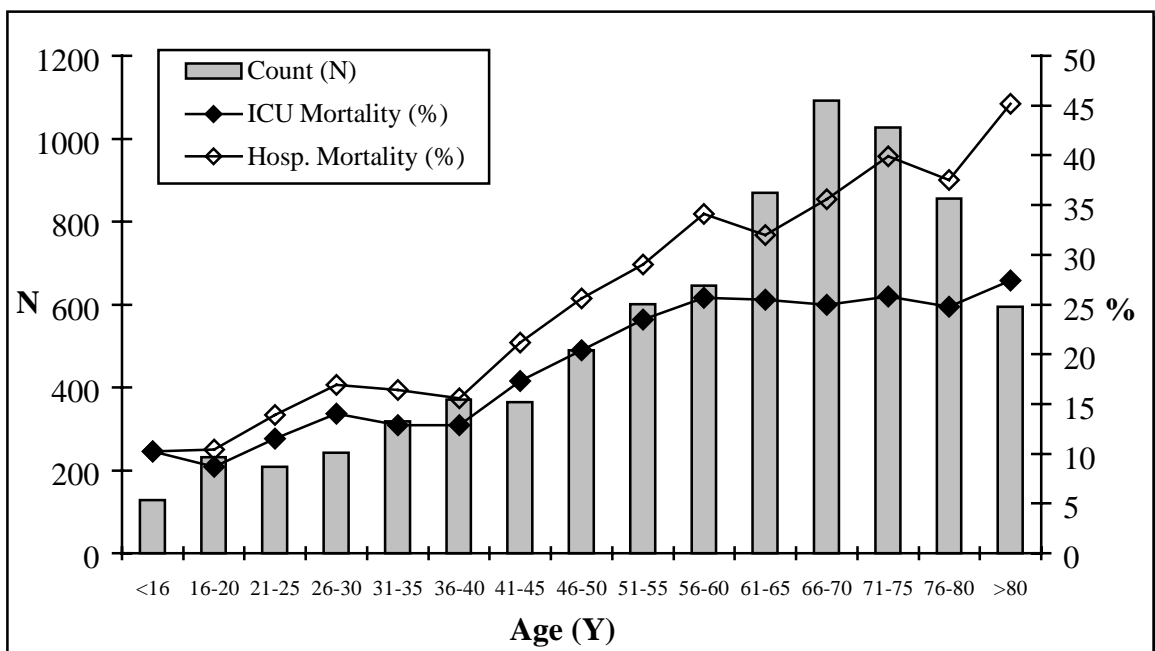




Figure 78. Scotland: Age & Outcome, 1998-2000.

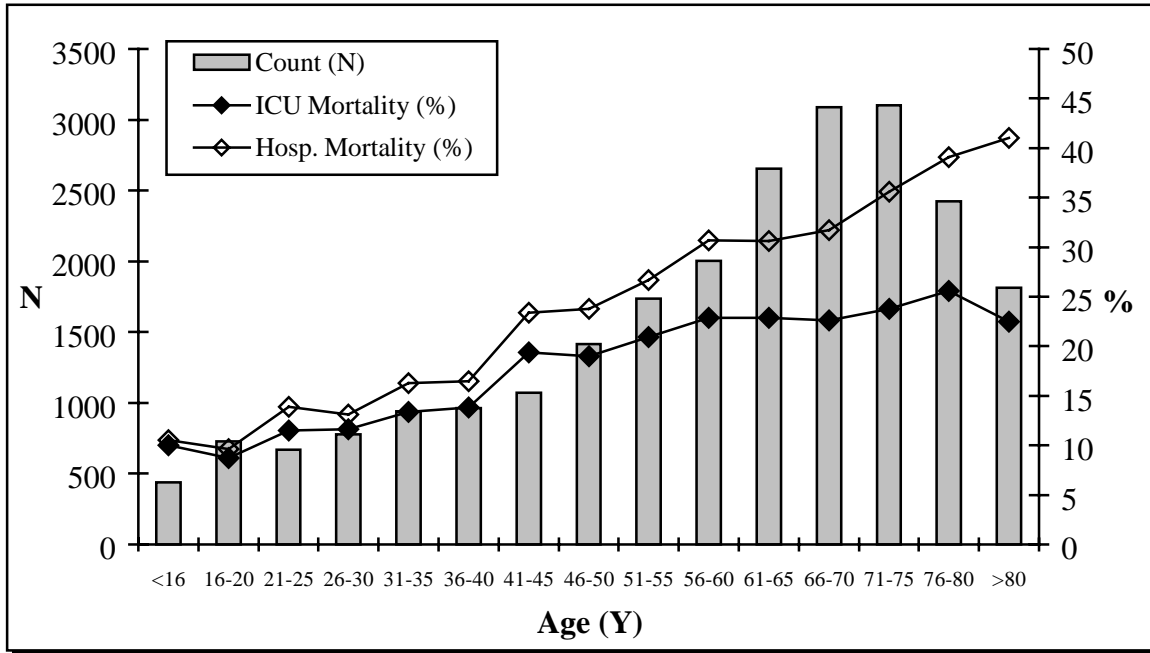
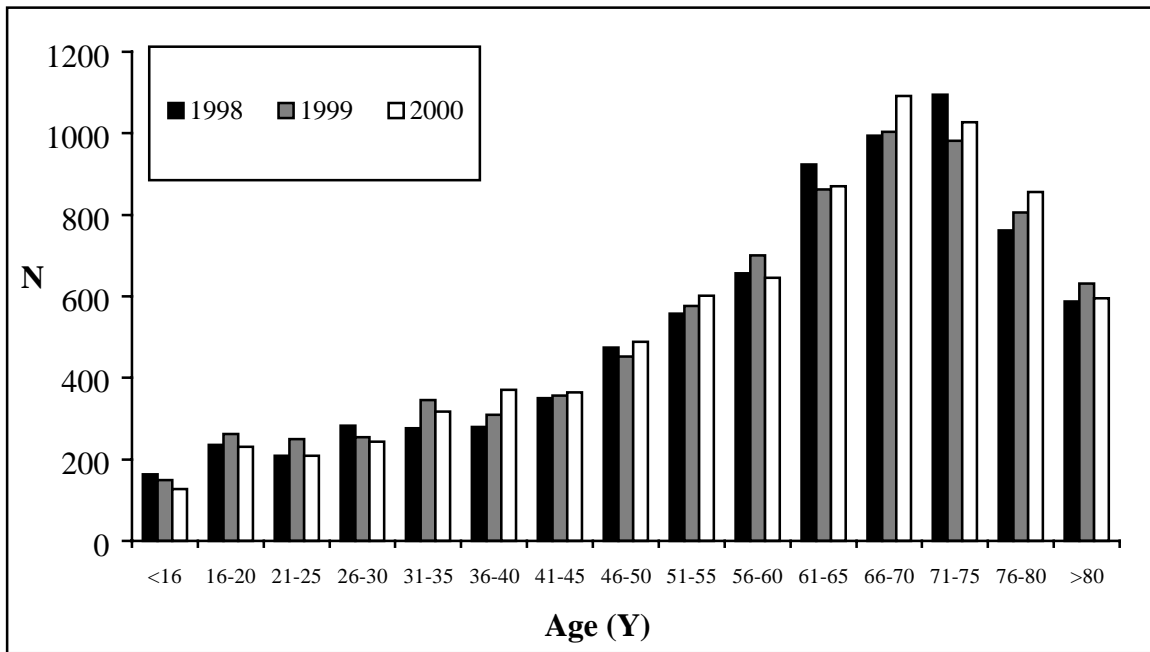


Figure 79. Age distribution of Scottish ICU admissions over time.





D. 13. Data validation.

82. An integral part of the audit of ICU admissions in Scotland has always been the validation of the data collected. In a number of ICUs over the last year, approximately 5% of patients entered onto the audit database were identified and a review of these case notes carried out. Although it is not necessary for changes to be made to the database, errors have been highlighted and reports prepared for these units. Severity of illness scores have been generated using those values obtained during validation, thereby revealing any subsequent adjustment to both the scores and hospital mortality probabilities. This section provides an overview of validation.

83. With regards to 'Admission and Identity Data', most information concerning source of admission is accurate. In instances where this information has been incorrect, this later has an impact upon related datafields, including nature of surgery and APACHE diagnosis. For the purpose of APACHE diagnosis, the classification of patients as either medical or surgical relies upon the admission source. Thus, an inaccurate entry may also result in an incorrect APACHE diagnosis and consequently, mortality probability. The correct source of admission to identify is the department or area the patient was managed immediately prior to transfer to the ICU.

84. Collection of data on the 'History' screen indicates severity of illness at the time of admission to ICU. The first set of vital signs recorded following admission to ICU, or in the hour prior to ICU admission, are the reference values for this screen.

85. The collection of 'Past Medical History' data contributes to the assessment of illness severity which may be underestimated if 'Evidence to Assess Past Medical History' is denied.



86. Discrepancies are commonly identified with regards to information pertaining to 'Nature of Surgery'. Ward Watcher utilises four definitions – Emergency, Urgent, Scheduled and Elective - to describe the type of surgery carried out. Surgery is typically described as either elective or emergency, however, it is important to recognise that this may differ from the *definitions* on the audit database: **Surgery** is defined as undergoing all or part of a surgical procedure or anaesthesia for a surgical procedure in an operating theatre or an anaesthetic room; **EMERGENCY**: immediate surgery, where resuscitation (stabilisation and physiological optimisation) is simultaneous with surgical treatment; **URGENT**: surgery as soon as possible after resuscitation (stabilisation and physiological optimisation); **SCHEDULED**: early surgery but not immediately life-threatening; **ELECTIVE**: surgery at a time to suit both patient and surgeon.

87. Data collected on the 'Severity of Illness' screen refer to the first 24 hours following ICU admission. In the first instance, entering the correct time of admission on the 'Admission and Identity' screen is of clear importance as this dictates the first 24 hour period identified by Ward Watcher on the severity screen. Within each unit, recording of vital signs is often good with accurate reference made to only those measurements taken within the specified time period. However, a common error occurring is incorrect calculation of total urine voided within the first 24 hours of ICU stay. It appears that urine measured prior to transfer to ICU is often included in this volume. Thus, to reiterate, collection and measurement of total urine output should only commence upon arrival in ICU.

88. Blood test results are frequently the greatest data entry error identified during validation. Review of the biochemistry and haematology results within the case notes will reveal that the values presented on the database *do* exist. Yet, the values remain incorrect as the blood sample was obtained outwith the first 24 hours of ICU stay. The values stated are typically from samples of blood obtained before the patient was transferred to ICU and may have been taken in Theatre/recovery or Accident & Emergency.



89. Few discrepancies have been identified with regards to 'Unit Discharge Details'. It would appear that data pertaining to patient outcome on discharge from the unit as well as discharge destination, date and time are all accurately entered. In addition, very few patients have wrongly been excluded from severity of illness scoring.

90. Overall data entry is generally very good with a few common errors evident. The process of validation is ongoing and it is hoped mostly positive feedback will help to renew interest in the continuing audit of ICU activity in Scotland. As can be seen from the extent of this Annual Report, it is vital that data are recorded as accurately as possible.

91. Figures 80 and 81 demonstrate the high level of agreement between the original and validated APACHE II scores and mortality probabilities in 65 records validated in 5 ICUs in the past year.

Figure 80. Comparison of original and validated APACHE II scores.

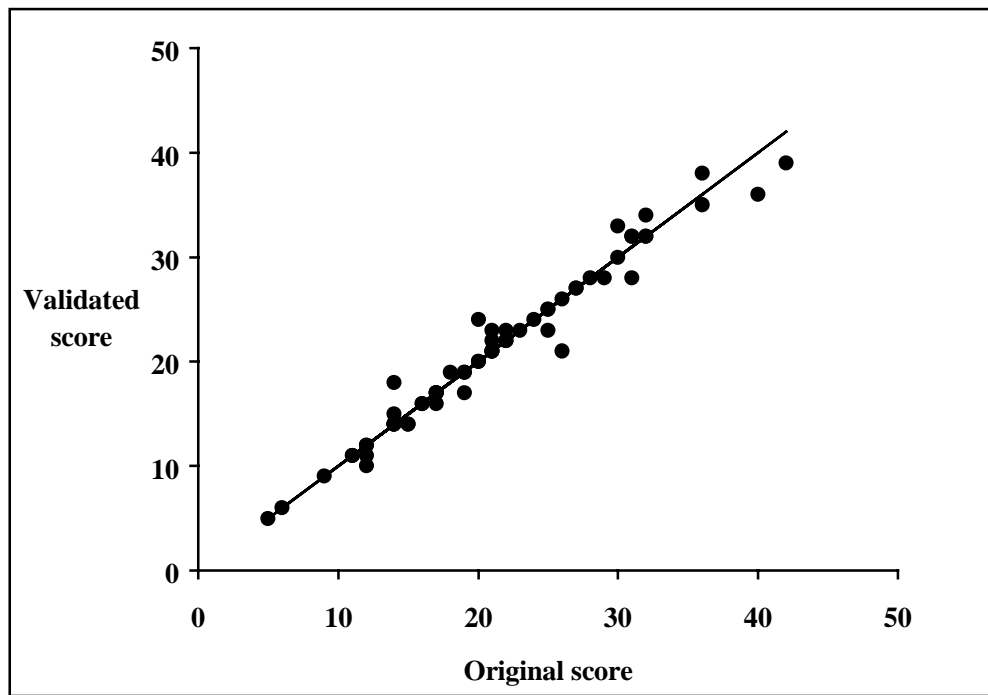
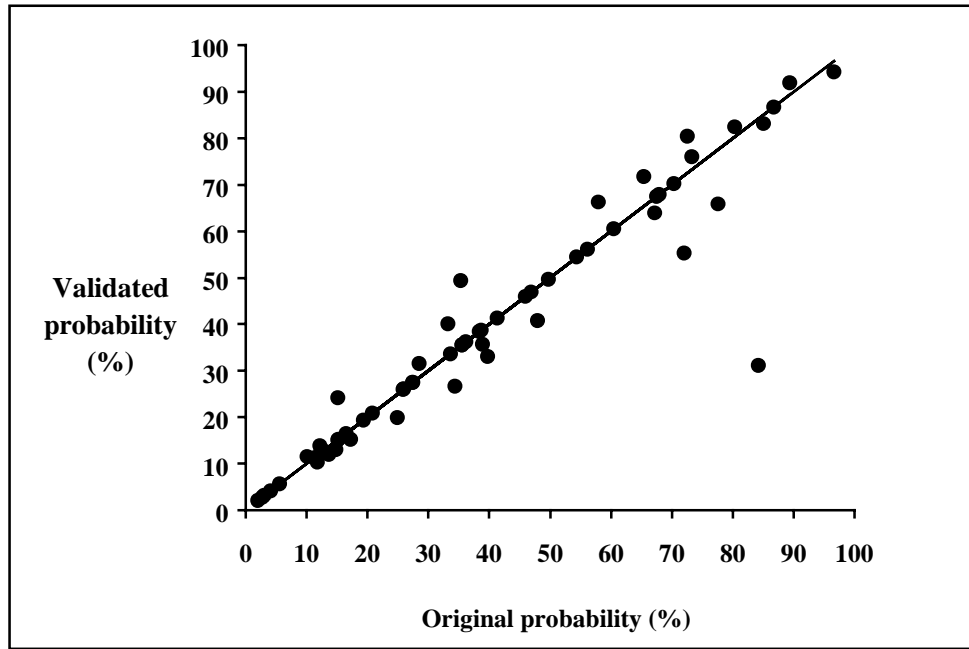




Figure 81. Comparison of original and validated APACHE II mortality probabilities.



Alison MacLeod

Audit Nurse

Scottish Intensive Care Society Audit Group



E. ADDITIONAL ASPECTS OF THE AUDIT.

E.1. Developing surveillance of hospital acquired infections, antibiotic resistance and prescribing in ICUs in Scotland: A Pilot Project.

92. Recent reports have identified the need for robust data on hospital acquired infections and for adequate organisational structures within the health service to monitor and control these infections [24]. Rapidly increasing levels of antibiotic resistance in organisms isolated from patients are a major public health threat and the need for systems to monitor resistance has been given a high priority [25,26]. Patients in intensive care units are at particularly high risk of HAI due to the urgency and intensity of the care they require and the many invasive procedures which are necessary in the course of their care. The incidence of antibiotic resistant infections in these units is higher than anywhere else in the hospital due to the need to prescribe for patients with complex and severe illness [27,28].

93. In June 2002 a subgroup of the Advisory Group on Infection (AGI), set up by the Scottish Executive Health Department to advise it on surveillance of hospital acquired infection and antibiotic resistance, recommended that surveillance of HAI, antibiotic resistance and prescribing be piloted in ICUs in Scotland [29]. 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 [30,31].

94. The Scottish Intensive Care Society Audit Group has been undertaking continuous audit of the care of ICU patients throughout Scotland since 1995 [32]. The minimum dataset recorded by clinical staff in the units includes patient demographic and clinical information. The addition and collection via the audit database of items related to the presence of HAI, and the extraction of antibiotic susceptibility data from laboratory computers (LIMS) could allow the creation of a database for reporting on the surveillance of HAI, antibiotic resistance and prescribing in Scottish ICUs. The development of a system whereby microbiology laboratory data are electronically



transferred into the audit database could provide clinicians with data that will facilitate appropriate diagnosis and prescribing.

95. A pilot project to examine the feasibility and implications of the surveillance system proposed is being developed in a collaboration between SICSAAG, the Scottish Centre for Infection and Environmental Health, microbiologists and clinicians in Scottish hospitals. We are not aware of this approach to surveillance through the use of an automated audit program being adopted elsewhere in the United Kingdom.

96. Aims and Objectives.

The project aims to monitor:

- the incidence of HAI in patients
- antibiotic susceptibility patterns of organisms isolated from the patients, and
- antibiotic prescribing for patients in ICUs.

The information obtained will be used to guide the development of interventions to reduce the incidence of HAI and to control antibiotic resistance. This will be achieved through regular feedback of data and guidance to clinicians, infection control and clinical governance committees and local policy makers. In addition clinicians will have the benefit of ‘on-screen’ microbiology data to assist their prescribing.

97. Outcomes Measures.

Outcome data which the project will provide include:

- incidence of hospital acquired infections
- antibiotic usage
- anti-microbial susceptibility
- device utilization rates



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98. Method. Four to eight ICUs and microbiology laboratories in Scotland will be invited to take part in the pilot project. Participating microbiology laboratories will use common protocols for susceptibility testing. The SICSAG database will be augmented to include screens that facilitate the recording of data on HAI. Such screens will include the standard surveillance definitions [29] of the infections (e.g., pneumonias & bacteraemias) and relevant patient-specific clinical and microbiological data. Local clinicians and microbiologists will decide on the best way to record the presence/absence of HAI. Prescribing data will be obtained by aggregating the individual patient's prescribing data collected on the SICS audit database. An extract containing the data items for HAI surveillance and prescribing will be sent to SCIEH on a regular basis. Methods enabling electronic transfer of microbiology results, including antibiotic susceptibility, will be developed and the data transferred from the LIMS in each lab into the local audit database for use by the clinician in ICU. On a regular basis a dataset of antibiotic susceptibility results will be extracted from each of the LIMS and sent to SCIEH for entry onto the project database. SCIEH will collate and feedback the data to units on a regular basis.

99. The evaluation of the pilot project will inform decisions about ongoing national surveillance of HAI, antibiotic resistance and prescribing in ICUs in Scotland.

Dr Ahilya Noone, on behalf of the Project Development Group,
Consultant Epidemiologist
Scottish Centre for Infection and Environmental Health



E.2. Intensive care research report.

100. Following the development of multi-centre research group within the SICS, a number of developments have moved intensive care research in Scotland forward.

101. We have now had research meetings prior to the last two annual January SICS meetings. These have combined presentations on individual research projects, progress reports on the multi-centre projects and national or international expert speakers. These meetings have been very well attended and demonstrate the quality and enthusiasm for research in the Scottish Intensive Care Society.

102. The continued support from the SICS Audit underpins the ability to develop large-scale research projects in Scotland. Through the Audit it has been possible to establish patient incidence, outcomes and characteristics of patients with a variety of intensive care problems; renal failure, sepsis, ARDS and transfusion requirements in Scottish ICUs have been well-defined on a national basis for the first time.

103. A number of research developments have been facilitated. The extensive data from the Audit of Transfusion in Intensive Care in Scotland (ATICS) study have now been collected and analysed and preliminary results presented at the UK ICS Annual Meeting in May 2002. This will lead to a number of publications and future collaboration with the Scottish Blood Transfusion Service.

104. A large-scale randomised trial of nutrition in intensive care has been planned and is in the final stages of the application process to the Medical Research Council and the outcome of this application is expected in June 2002. A study of intervention in ARDS is also planned and may involve a number of Scottish ICUs. A fluid optimisation study is also in the final stages of submission for grant support.



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105. These studies have become possible due to the collaboration of the Scottish Intensive Care Society and ICU staff, and on this strong basis it will be possible to develop a number of high quality studies in the next few years.

John Kinsella

Senior Lecturer

Anaesthetics & Intensive Care

Glasgow Royal Infirmary



**E.3. Evidence based medicine in Scottish ICUs – The current state of play.
March 2002.**

106. In anticipation of the Clinical Standards Board's interest in intensive care, following completion of work on anaesthetic services, the SICS thought it would be prudent to be pre-emptive and begin to develop a tool to aid evidence-based practice. October the 8th 2001 saw the inaugural meeting of the SICS Evidence Based Medicine (EBM) Group. There was a series of excellent presentations and discussions covering a wide range of EBM topics. The aim of the group is to develop an evidence-based resource for the SICS to be available to all intensive care units within Scotland.

107. The following agreed to be representatives on a Steering Group:

Dr C Cairns	WGH, Edinburgh (co-ordinator)
Dr B Cuthbertson	ARI, Aberdeen
Dr M Daniel	GRI, Glasgow
Sr F Dixon	ARI, Aberdeen
Dr M Garrioch	SGH, Glasgow
Dr S Mackenzie	RIE, Edinburgh
Dr R White	Crosshouse Hospital, Kilmarnock
CNM G Percival	WGH, Edinburgh

108. The Steering Group is responsible for overseeing and developing all aspects of the EBM resource. It will canvass ICUs to discover the areas of intensive care where there is the greatest demand for 'evidence'. By so doing it is hoped that this will introduce the Group to the ICU community in the most positive light. As an interim measure, work on three evidence-based guidelines, agreed by the Group as a priority, has started. This will enable the Steering Group to begin developing an approach towards data collection, appraisal and presentation. Each topic will be investigated by a Sub-Group (under the direction of a team-leader), which will review relevant literature and submit this with conclusions to the Steering Group. The Steering Group will then edit the information in order to produce a common format for each topic. In



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order to unify the literature reviews, review software (CATmaker, Centre for Evidence-Based Medicine, Oxford) is being used for which the EBM group has a general license.

109. These principles were warmly received when presented to the SICS Audit Group Meeting in October 2001. Since October many of the steering group have been busy familiarising themselves with the CATmaker software, performing literature searches and generating a stock of critical appraisals. All three groups are now underway and it is hoped that samples of the appraisals will be published on the SICS web site in the near future. All three of the sub-group team leaders would welcome enthusiastic assistance:

<u>Topic</u>	<u>Sub-group Team leader</u>
ARDS	Dr B Cuthbertson b.h.cuthbertson@abdn.ac.uk
Gastric Prophylaxis	Dr T Walsh tim@walsh.sol.co.uk
Sepsis	Dr M Daniel md235@udcf.gla.ac.uk

110. Ultimately, the hope is for a large evidence-based facility, accessible via the SICS web site, which can be used by all ICUs in Scotland. The main challenge of the group is to provide a useful resource without being seen as prescriptive. If anyone wishes any further information or is keen to become involved in any of the current or future work of the EBM group I would be delighted to hear from them.

Chris Cairns
Specialist Registrar, ICU,
Edinburgh Royal Infirmary Chris.Cairns@btinternet.com



E.4. Scottish Transplant Group.

111. The Scottish Transplant Group was set up in 1999 at the instigation of the Scottish Executive Health Department. It was seeking advice regarding organ donation and transplantation and sought representation from the Scottish Intensive Care Society. Despite advances in the field of transplantation in the last 20 years, transplantation rates have been falling and the group has examined some of the problems surrounding the shortage of donor organs. The donor rate is around 13 per million population in the UK with 33 per million in Spain.

112. Intensive care clinicians have been interested and involved for many years in organ retrieval issues. Following discussion at the Annual Audit Meeting in October 2001, many already will be aware of the intention to add fields that might lead to increasing requests for organ donation, improved acceptance rates and to an increase in donation of solid organs and other tissues. As a side issue these modifications may also improve the impetus to optimise pre-donation management of patients after brain stem death. All neurosurgical ICUs as well as the general units in Scotland will soon be participating in the SICS Audit.

113. The Scottish Transplant Group should publish a report in the very near future. Among the issues being considered include a dedicated organ retrieval team which would include an anaesthetist, probably at consultant level, who would be an integral part of this team.

114. Under the auspices of UK Transplant several donor liaison sisters have been appointed (two in Scotland). The nurse appointed to the South Glasgow Trust will, in addition to local audit, work with us to investigate the variation in organ donation rates which we have observed from our current limited SICS dataset. In Spain every hospital has a medically qualified transplant co-ordinator. This, however, is an expensive option and these donor liaison sisters are seen as a halfway house to improve organ donation rates and will work in conjunction with the current transplant co-ordinator network.



115. Non-heart beating donation is likely to figure prominently in new initiatives. This involves perfusion cannulae being inserted into the femoral vessels immediately after death. A ruling on the legality of this in Scotland is awaited. Whether these programmes, once funded, are initially introduced in intensive care or in A&E departments remains debatable but in some areas such as Newcastle and Leicester they have demonstrated that the number of kidney transplants can be increased by up to 20%. Organ survival appears to be at least as good as with live donors.

116. Elective ventilation is illegal at present. It was felt by the group that reintroduction would not be feasible. This is in keeping with the views strongly held by most members of our Society. Issues of consent may be involved here. In the future a change in the law may make elective ventilation possible if a patient has requested this in an advanced directive.

117. The Transplant Group report will again raise the profile of transplantation within Scottish ICUs. A recent SICS audit demonstrated a surprising variation between ICUs in the proportion of brain stem death cases which resulted in successful donation. Hopefully a combination of the above initiatives will help to increase the availability of suitable organs for an ever-increasing number of needy donors.

118. It remains important that the intensive care community continue to engage in the dialogue.

Jim Dougall
Consultant Anaesthetist
Western Infirmary, Glasgow.



E.5. Consent in the intensive care unit.

As a result of changes to the law, which occurred after this section was written, it is important that you read the note on Page 125 in conjunction with this section.

119. It is a legal and ethical requirement that all medical treatment requires the consent of the patient. Any non-consensual contact is an assault. The only exception to this is where immediate life-saving treatment is required. The 'principle of necessity' in English Law allows for the continuation of treatment following the life-saving event but the Common Law in Scotland would not appear to. Strictly speaking in Scotland then, once the immediate life-threatening episode has passed any further supportive therapy (if non-consensual) is assault.

120. The issue, therefore, of gaining a patient's consent for interventions in the intensive care unit is problematic. There are, however, imminent changes in the law in Scotland that will change, but not completely resolve, this problem.

121. The Law as it stands. Under current Scottish (and English) law incapacitated patients, such as those in ICU, are left in a legal limbo. Once an adult patient cannot act independently (to give or refuse consent) no other adult can act on behalf of the incapax. Consequently, all subsequent decisions are made on a 'best interests' basis. It is then left to clinicians to decide what constitutes 'best interest'. Although common practice is to take account of the relatives' opinions, they have no actual power of consent. Nevertheless, assent is usually sought from relatives for any major intervention.

122. The incapacitated person and research. The same legal restraints apply to research. Research into the causes, diagnosis and treatment of critical illness, although necessary, is performed without the patients' consent. Until now it has been normal practice for subjects to be recruited with the relatives' assent. This, whilst pragmatic, does not provide the incapacitated person with the same degree of protection proffered to the competent research subject.



123. Current alternatives. There are currently two ways to appoint a person to act as a substitute decision-maker but neither have much relevance for the critically ill. The more common of these is a Power of Attorney. Unfortunately, they do not have the authority to be involved in healthcare decision making. A Tutor Dative, however, does have these powers but must be appointed by the Court of Session. It is rare for this route to be taken given the time and expense involved. Also, for the majority of ICU patients, the process of appointing a Tutor would be too slow.

Adults with Incapacity (Scotland) Act 2000.

124. It is estimated that there are approximately 100,000 adults in Scotland with varying degrees of impaired capacity. In response to a general recognition that the law was failing to adequately address their welfare, financial and medical needs the Scottish Parliament passed the Adults with Incapacity (Scotland) Act 2000 [33]. There are several parts to the Act with varying implications for intensivists. Part 5, which covers medical treatment and research, will be the most pertinent.

125. For the purposes of the Act, an adult is somebody over the age of 16 years. Incapacity will mean:

- incapable of acting, or
- making decisions, or
- communicating decisions, or
- understanding decisions, or
- retaining memory of decisions

by reason of mental disorder or the inability to communicate because of physical disability.



126. A Welfare Power of Attorney will provide a mechanism for substitute decision-making [34]. A person may appoint a Welfare Power of Attorney who could be anyone of their choosing who is agreeable. Only if the person becomes incapacitated can the Welfare Power of Attorney act as a proxy decision-maker. On recovery the person resumes responsibility for his or her own decision-making. Welfare Powers of Attorney should be registered with the Public Guardian's Office in Falkirk [35].

127. Part 5: Medical treatment and research. Any patient who lacks capacity should be certified as such by the consultant in charge using a *Certificate of Incapacity* form. This gives the doctor (and the rest of the healthcare team) the authority to treat the patient. It is expected that the doctor will consult relatives or others in order to ascertain, if possible, the patient's wishes. The treatment given should be the least restrictive but not necessarily the least invasive. In effect, treat the patient as you would treat any other patient.

128. A certificate may last for up to one year but must be revoked when the patient is fit to act independently again. There are some exceptions to the doctor's authority (e.g., psychosurgery) but none that are likely to arise in the ICU.

129. If a Welfare Attorney exists then this person's consent is required (where it is reasonable and practicable to do so) for all non-emergency interventions. Thus the Attorney acts as proxy decision-maker. Should the Attorney disagree with a course of treatment there will be an escalating review process. First with an independent practitioner, then the Court of Session.

130. In practical terms, each patient admitted to the ICU will, in all probability, require a Certificate of Incapacity completed. This is not necessary for emergency treatment. The Public Guardian's office should be contacted to confirm the existence (or otherwise) of a Welfare Attorney. The Attorney should then, whenever possible, be involved in the decision-making process to represent the patient. The Attorney will have the power to give or withhold consent on behalf of the patient.



131. In the absence of an Attorney, the relatives (or others close the patient such as carers) should be consulted about what the patient's wishes would be. Although they do not have the power of consent in the same way as an Attorney their views should be taken into account.

132. Research. A new Ethics Committee will be established to review proposed research involving the incapacitated. It is likely that this will be part of the Multi-centre Research Ethics Committee (MREC) remit.

133. Research is likely to be very difficult under the terms of the Act. The main sticking point is that there must be no, or minimal foreseeable, risk or discomfort to the patient. This is unlikely in the setting of critical care research. It is possible, but not at all certain, that the Ethics Committee could interpret this criterion as no, or minimal additional, risk or discomfort compared to the normal treatment for the condition under investigation.

134. Limitations of allowing proxy decision-making. The major limitation of using a proxy is whether or not the proxy can accurately represent the patient's wishes? It is expected that a person appointing a Welfare Attorney will discuss their wishes with that person (this is stated in the instructions to granters and potential Attorneys). There is, however, little evidence to suggest that in the absence of prior discussion that one relative knows another's wishes [36]. Few couples or families ever discuss these topics [37]. Interestingly, not even the time that people have lived together guarantees any knowledge of the partner's concerns and wishes in respect of life sustaining treatment [38].



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135. When does all this happen? The latest from the website is that Part 5 of the Act will come into force on 1st July 2002. You can familiarise yourselves with the Act by logging on to the website where you can access the Act, Codes of Practice, Certificates of Incapacity and other relevant information (http://www.scotland.gov.uk/health/cmo/incapacity_act_toc.asp). For information about Welfare Powers of Attorney (and appropriate forms should you wish to appoint one) contact The Office of Public Guardian, Hadrian House, Callander Business Park, Falkirk, FK1 1XR, Tel: 01324 678300.

Malcolm G Booth
Consultant Anaesthetist
Glasgow Royal Infirmary



E.6. The Electronic Bed Bureau

136. A key element in achieving ongoing funding has been the perceived value of the electronic Bed Bureau, which runs in the background of the audit system. This was commissioned initially by Greater Glasgow Health Board to address a recommendation following a Fatal Accident Inquiry. There are minimal additional recurrent costs associated with running the Bed Bureau.

137. The major driver for the critical care reports produced in both Scotland and England in 2000 [1,4] was the winter beds crisis of 1999-2000. Critical Care Delivery Groups were, therefore, given responsibility for establishing local winter “coping” strategies. This involves, where necessary, providing safe transfer of critically ill patients to the most appropriate ICU and the development of local escalation policies during times of increased demand. In Scotland, a comprehensive *eBed* Bureau was established in 2001. This functions in the background of the national audit system, utilising the NHSnet to provide real-time updates of ICU bed availability. This system was the first of its kind in the UK; indeed we are not aware of a comparable system being described prior to this time. It is anticipated that it will be widely replicated. Currently, it is being extended to allow small hospitals in remote and rural areas to rapidly access the closest ICU with an available bed.



E.7. Intensive care developments North and South of the Border.

138. The winters of 1998-9 and then 1999-2000 had a profound impact on the UK Government's attitude to provision of intensive care. The widely publicised bed capacity problems, with patients being transferred across the country between ICUs, led to a feeling that "something must be done". In England and Wales, a National Expert Group, which had representation from the UK Intensive Care Society as well as the great and good of intensive care, was established by the Department of Health to examine all aspects of critical care, and in particular to ensure that the crisis of 1998-9 did not recur. The work of the group was overtaken by the even more disastrous winter of 1999-2000, which also had its effect on the recommendations published by the Expert Group in *Comprehensive Critical Care* in May 2000 [4].

139. In Scotland we had a rather complacent view that our NHS was better, lubricated by the higher *per capita* spending here. That view was shaken by the winter of 1999-2000 when our problems of ICU capacity were equally as bad as those South of the Border. This prompted a one-off funding tranche (£6.8 million) from the Executive to boost critical care provision (much of which did not permeate through to ICUs or HDUs). Early in 2000, the Chief Medical Officer established a short-life working group including representatives of SICS, the Scottish Audit of Surgical Mortality (SASM), who had also warned about lack of critical care beds, and senior nurses. Amongst other contributions this group took cognisance of data from SICSAG and the National Expert Group's recommendations in England once published [4], and produced the report, *Better Critical Care* [1].

140. These two reports have much in common in terms of highlighting the importance of effective use of critical care resources: *Outreach* to ensure early recognition and prompt treatment of critically ill patients, flexibility of facilities to meet peak demands on them and follow-up of patients following discharge from ICU. Both reports make formation of "Critical Care Delivery Groups" central to plans for an integrated and flexible approach to critical care services in each Trust.



141. There were differences however. *Comprehensive Critical Care* divided its recommendations into those to be implemented immediately, and those to be implemented in the medium term. Critical care in England probably started from a lower base line than in Scotland but the plans contained in *Comprehensive Critical Care* are certainly more ambitious. They demand data collection on critically ill patients throughout the hospital, (the so-called Augmented Care Period data [39]) the formation of regional networks for critical care and of critical care outreach services. They also recommended a review of consultant staffing of ICUs. The Scottish report was much more specific on practical issues such as numbers of HDU and ICU beds, nurse training for critical care and the establishment of pools of trained nurses to deal with high demand periods. A review of *Better Critical Care* is available to read within the www.scottishintensivecare.org.uk/forums.

142. Following publication of the two reports, the approach of the Departments of Health, North and South of the Border, could not have been more different. In Scotland there has been no formal review of the implementation of the recommendations made in *Better Critical Care*. Implementation has largely been left to the SICS and the individual Trusts through their Critical Care Delivery Groups. SICS will continue to conduct the data collection exercise, extending into HDUs, and will also act as the unofficial network for critical care in Scotland. The Critical Care Delivery Groups are left to interpret and implement other recommendations, e.g., those relating to 'Outreach'. In England, data on critically ill patients (the ACP dataset) are collected by the Department of Health regional offices, and a new body, the National Patients Access Team (NPAT) has been established to oversee implementation of the major recommendations in *Comprehensive Critical Care*. NPAT has a senior intensive care clinician (Mike Pepperman) and a senior nurse at its head, and is devoting considerable resources in a number of fields, establishing expert groups to develop detailed strategies for implementation of all the major recommendations in the report. For example, *Comprehensive Critical Care* identified the adverse effect of long-term ICU patients on bed occupancy, and hence NPAT set up a subgroup to examine the need for weaning centres and services for the co-ordination of long-term (home) ventilation for those who could not be weaned.



143. Perhaps the different approaches North and South of the Border are best exemplified by the issue of ICU Outreach. In England the recommendation for Outreach services has been rapidly implemented, presumably in the hope of averting ICU admissions and relieving pressure on ICU beds. Large numbers of ICU nurses have been recruited to man “Outreach Teams”, some largely with an educational role but some with a 24 hour clinical role. Little evidence of benefit exists for such a practice, in contra-distinction to the published benefit accruing from Medical Emergency Teams, and in addition numbers of trained ICU nurses are depleted. The Scottish report recommended patient at-risk guidelines be drawn up, but left it to the Critical Care Delivery Groups to decide how to improve care of the “at-risk” patients. This was certainly less prescriptive, and hopefully we shall be able to take our time and develop a rational Outreach strategy.

144. The current situation is that both in England and Scotland, Critical Care Delivery Groups have been formed in the vast majority of hospitals. ACP data are being collected appropriately in 75% of hospitals in England but in Scotland, the SICS has only recently extended into HDU data collection, and collection of data on critically ill patients outwith ICUs and HDUs is virtually non-existent. In England, 29 regional networks for critical care are in place. No official networks exist in Scotland, but with our small population it would be difficult to justify such a structure. In England, 104 hospitals have Outreach services for which a common dataset is being developed. In Scotland we are barely off the starting blocks. Most critical care units in England have data input clerks; in Scotland, clinical staff struggle without them.

145. Even with our more informal approach, we are making progress on implementing *Better Critical Care* in Scotland. All Trusts have established Critical Care Delivery Groups. These groups are all doing what is expected of them in assessing the adequacy of their critical care capacity. All groups say they have an agreed policy for escalating critical care capacity, although only half appear to have equipped some of their HDU beds to ICU standard to deal with periods of increased pressure. Progress towards an integrated critical care service in each Trust with co-



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located or mixed ICUs and HDUs, combined nurse administration and formation of critical care nursing pools is very variable across Scotland.

146. As already alluded to, Scotland has made little progress on critical care Outreach. This is not for want of effort; all CCDGs appear to be working on “patient at-risk” guidelines. This would appear to be an area where co-ordination across Scotland would expedite progress and prevent duplication of effort. A forum has been set-up within the SICS website to encourage communication between staff involved in developing Outreach services (<http://www.scottishintensivecare.org.uk/forums>).

147. In summary, on both sides of the Border we are moving in a similar direction in developing our critical care services. In England, however, Government is directing implementation of the *Comprehensive Critical Care* report centrally and monitoring developments through official channels (NPAT and the regional Department of Health offices). In Scotland, implementation of *Better Critical Care* has been left to local Trusts and the voluntary efforts of intensive care clinicians through the SICS. It is for the reader to decide whether the Government-directed and funded development of critical care (in England) or the informal, clinician-led development (in Scotland) is preferable. A lot depends on whether the Scottish Executive supports our efforts with funding to match that South of the Border.

148. Further information about the National Patients Access Team can be found at: <http://www.modernnhs.nhs.uk/criticalcare>.

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E.8. High dependency audit in Scotland.

149. Since our telephone survey of high dependency facilities in 2000 and incorporation of the results into *Better Critical Care* [1] and the Audit Group's last Annual Report [40], implementation of audit within high dependency units has begun. This process was supported by two HDU nurses (1 WTE), seconded for a period of 8 months (October '01– June '02): Lynn Gillies from the Royal Infirmary of Edinburgh and Alison MacLeod from the Victoria Infirmary. A report of the progress of HDU Audit in Scotland is available for you to read or download on the SICS website [41].

150. Ongoing support for HDU audit has been sought recently by “selling” the system to individual Trusts. This is the way in which funding of intensive care audit is provided in England. The annual cost will be £2,500 per annum for each HDU site. The response, thus far, will allow us to appoint one further full-time member of staff to support our “Critical Care” audit.



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- Medical and nursing staff who are responsible for data entry in addition to their routine duties.
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- Mike Pepperman, Director of NPAT Critical Care Programme, for his update on progress in England.
- Brian Millar, Critical Care Audit Ltd., Yorkshire.



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**Appendix I. Surveillance system for unusual and unexplained illness in Scotland:
Proposal, April 2002.**

CLINICAL PROTOCOL - Draft 30.04.02

This protocol is not intended to change normal initial patient management. Investigations of greatest likely yield and clinical usefulness should continue to be used in initially undiagnosed infected patients. What is required, however, is awareness, at certain stages of the clinical course, of the need to report unusual illnesses.

1 Aims

To facilitate early detection and rapid reporting of severe illness caused by:

- 1.1 deliberate release of toxic (including nuclear/radiological) or infectious material.
- 1.2 new or re-emerging serious infection.

2 Mechanisms

- 2.1 Suspected cases should be reported, preferably within 48hrs of admission, to the local CPHM (CD/EH) or on-call CPHM.
- 2.2 At any stage, if case definition 3.2 is met, report immediately to CPHM (CD/EH) or on-call CPHM.
- 2.3 Monthly summary of cases to SCIEH (especially null returns).

3 Clinical Case Definitions

- 3.1 Previously healthy individuals, aged under 50 years, with no known pre-disposing trauma or chronic medical condition (see 5), who present with acute onset of a severe undiagnosed illness (resulting in hospitalisation or death) with hallmarks of infection.
- 3.2 Occurrence of clinical suspicion of a 'likely biological agent' (including apparent hallmarks of toxic or radiological exposure) in any patient (see Annexes A & B) indicates IMMEDIATE reporting.

4 Hallmarks of infective disease

- Tachycardia, tachypnoea, fever or hypothermia, leukocytosis or raised CRP
- Involvement of the following organ systems:
 - Cardiovascular (hypotension and tachycardia suggestive of myocarditis, sepsis or toxic shock)
 - Respiratory (severe acute respiratory failure including ARDS)
 - Gastro-intestinal (severe diarrhoea, hepatitis, fulminant hepatic failure)
 - Neurological (unexplained coma, eg due to encephalitis or meningitis, or unexplained sensory or motor neuropathy)
 - Soft tissues (including muscle, eg myonecrosis and skin, eg abscesses, fasciitis or rash)
 - Renal failure
- Histopathologic evidence of acute infection



5 Reason for Exclusion

Pre-existing malignancy, history of immunosuppressive therapy, or other known immunocompromise (including HIV infection; chronic, excessive alcohol use; chronic renal, hepatic, or connective tissue disease; or diabetes mellitus).



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
D&GRI	Dumfries & Galloway Royal Infirmary	Dr D Williams
FRI	Falkirk Royal Infirmary	Dr H Robb
GRI	Glasgow Royal Infirmary	Dr MG Booth
Hairmyres	Hairmyres Hospital, East Kilbride	Dr B Cook
IRH	Inverclyde Royal Hospital, Greenock	Dr F Munro
Monklands	Monklands Hospital, Airdrie	Dr R MacKenzie
Ninewells	Ninewells Hospital, Dundee	Dr AJ Shearer
PRI	Perth Royal Infirmary	Dr FD Magahy
QMH	Queen Margaret Hospital, Dunfermline	Dr P Curry
Raigmore	Raigmore Hospital, Inverness	Dr I Skipsey
RAH	Royal Alexandra Hospital, Paisley	Dr S Madsen
RIE	Royal Infirmary of Edinburgh	Dr SJ Mackenzie
St. John's	St. John's Hospital, Livingston	Dr M Fried
SRI	Stirling Royal Infirmary	Dr M Worsley
Stobhill	Stobhill Hospital	Dr C Miller
SGH	Surgical ICU, Southern General Hospital	Dr P Oates
VOL	Vale of Leven DGH, Alexandria	Dr WR Easy
VHK	Victoria Hospital, Kirkcaldy	Dr C Wilson
VIG	Victoria Infirmary, Glasgow	Dr A Davidson
WGH	Western General Hospital, Edinburgh	Dr IS Grant
WIG	Western Infirmary, Glasgow	Dr L Plenderleith
Wishaw	Wishaw Hospital (Law Hospital until mid 2001)	Dr N Willis



Appendix III. Figures 74.A – 74.X. The relationship between mean length of ICU stay and mortality probability in Scottish ICU survivors (S) and non-survivors (NS).

Figure 74.A. Unit A.

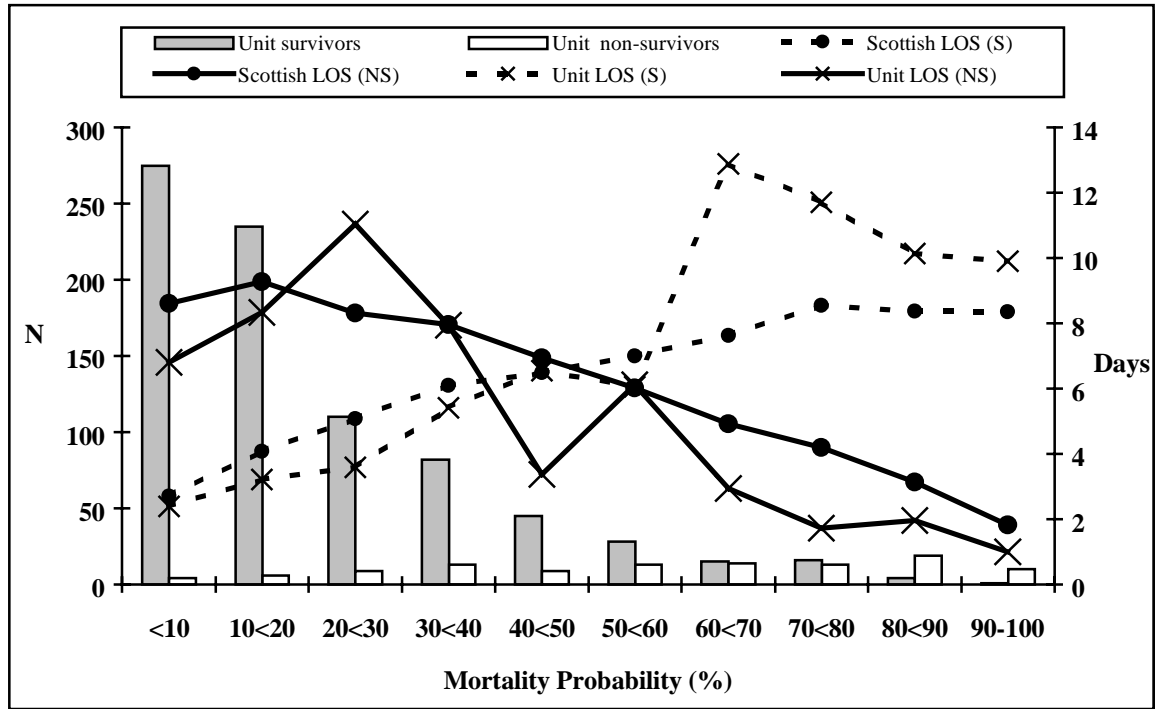




Figure 74.B. Unit B.

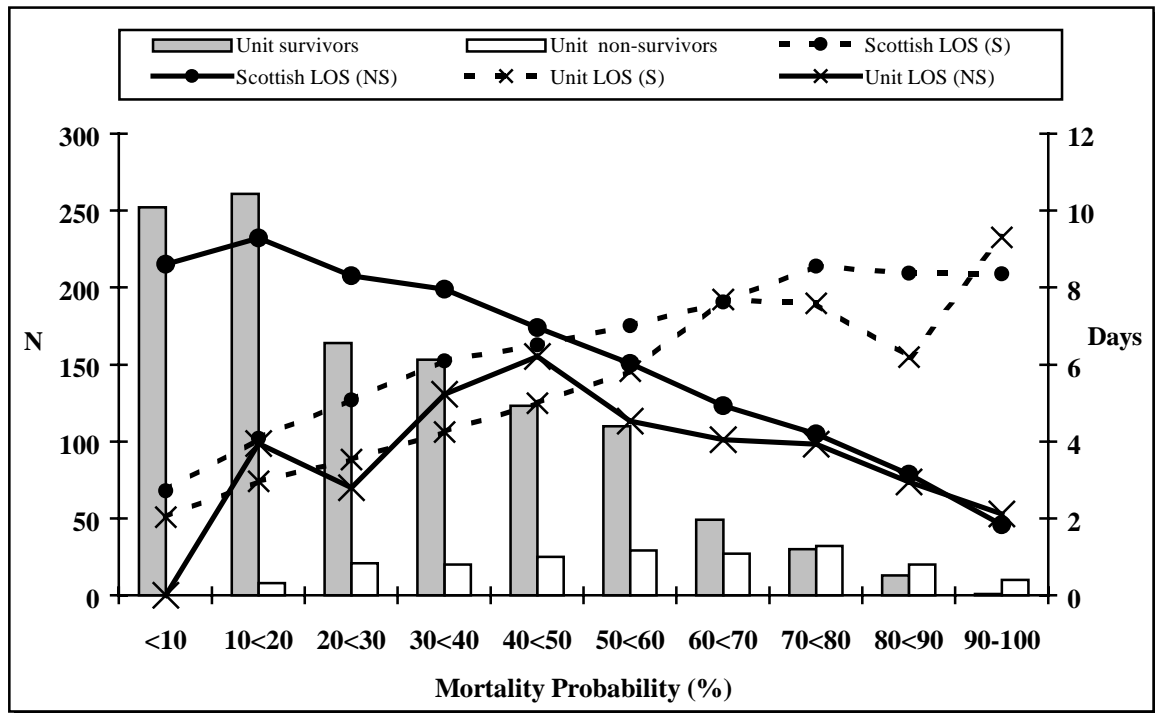


Figure 74.C. Unit C.

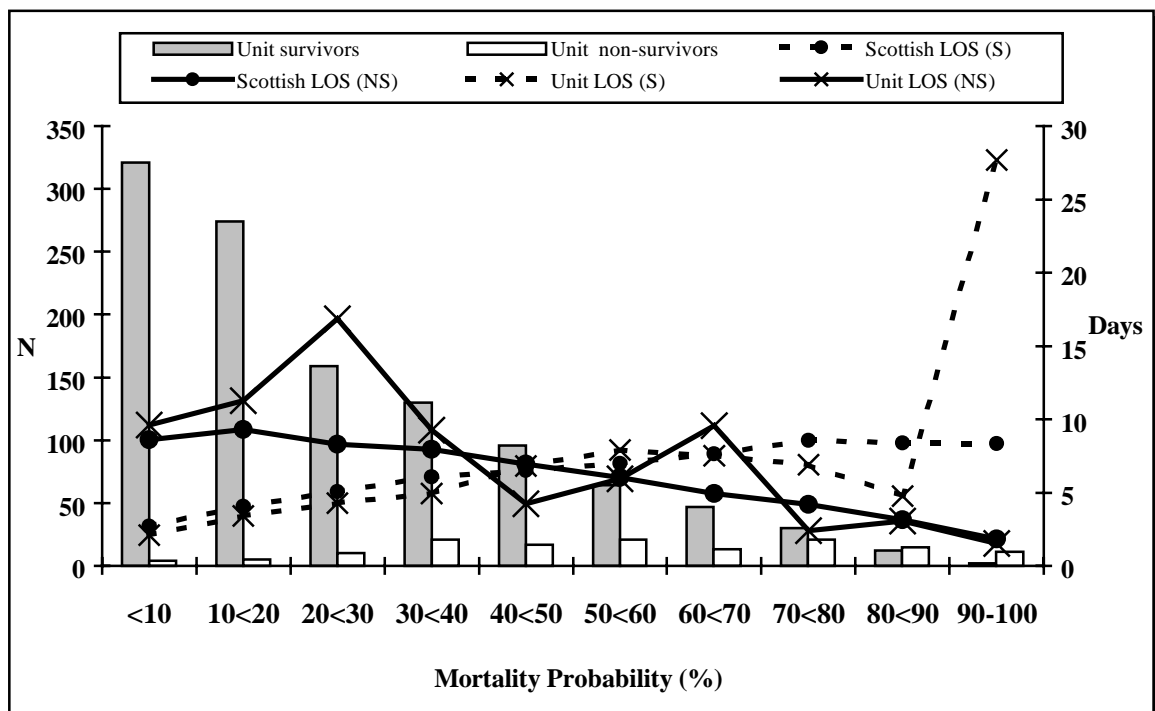




Figure 74.D. Unit D.

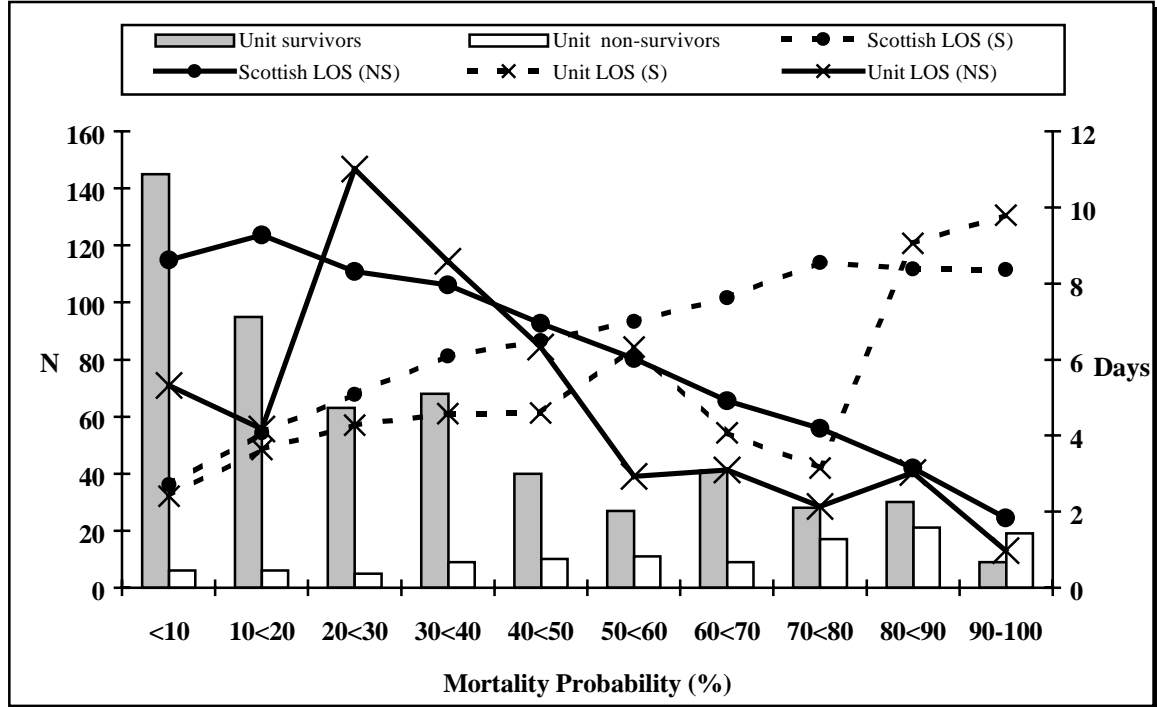


Figure 74.E. Unit E.

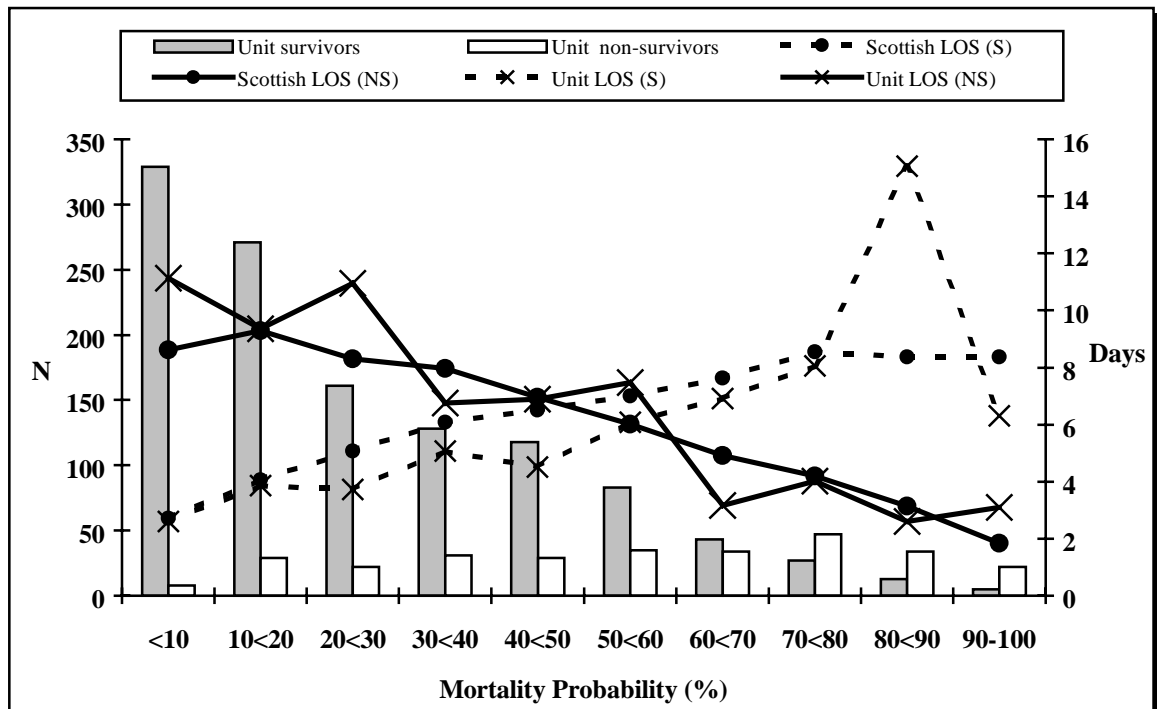




Figure 74.F. Unit F.

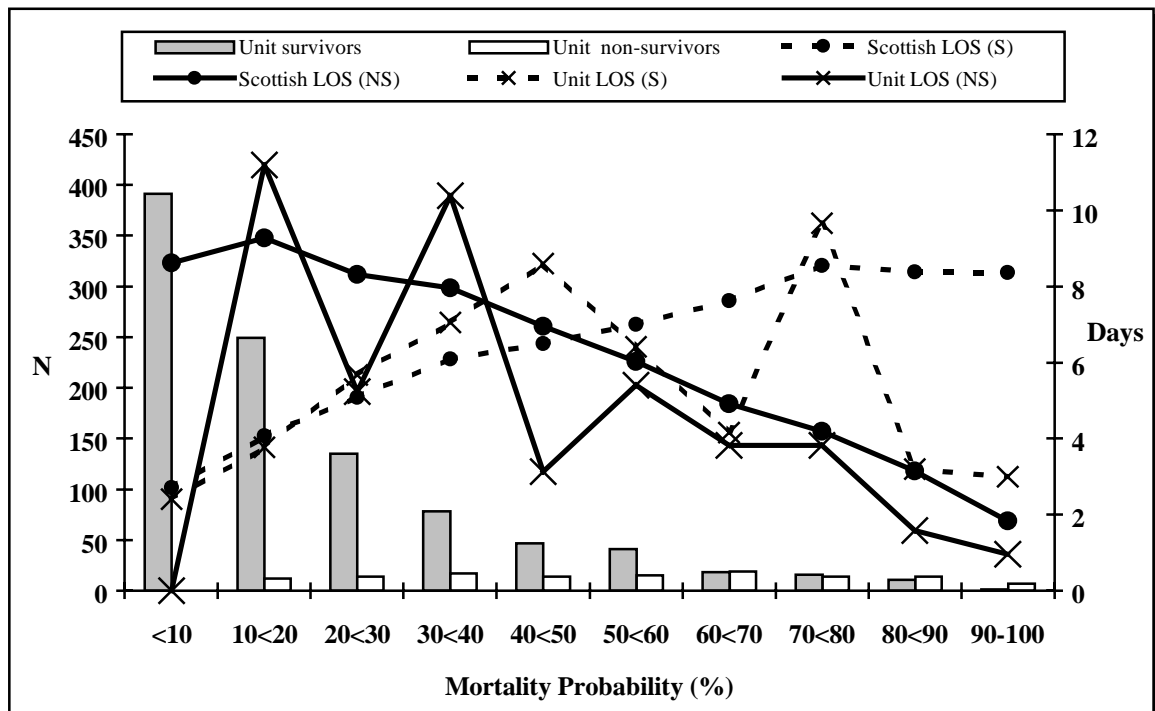


Figure 74.G. Unit G.

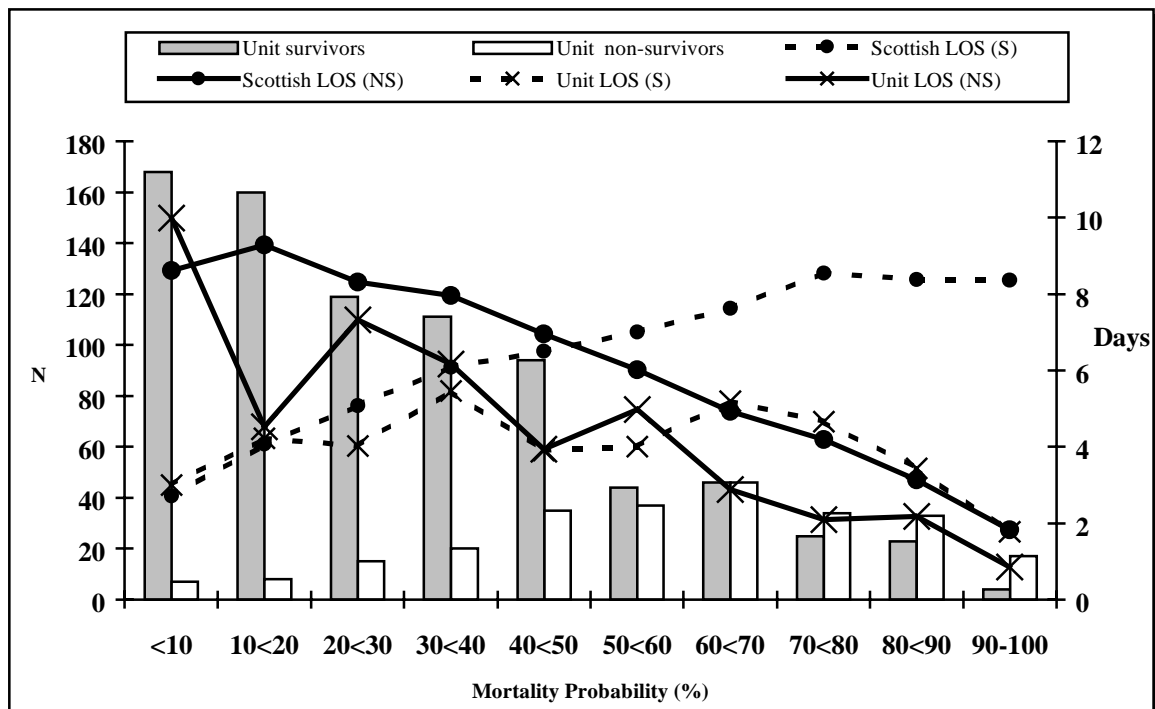




Figure 74.H. Unit H.

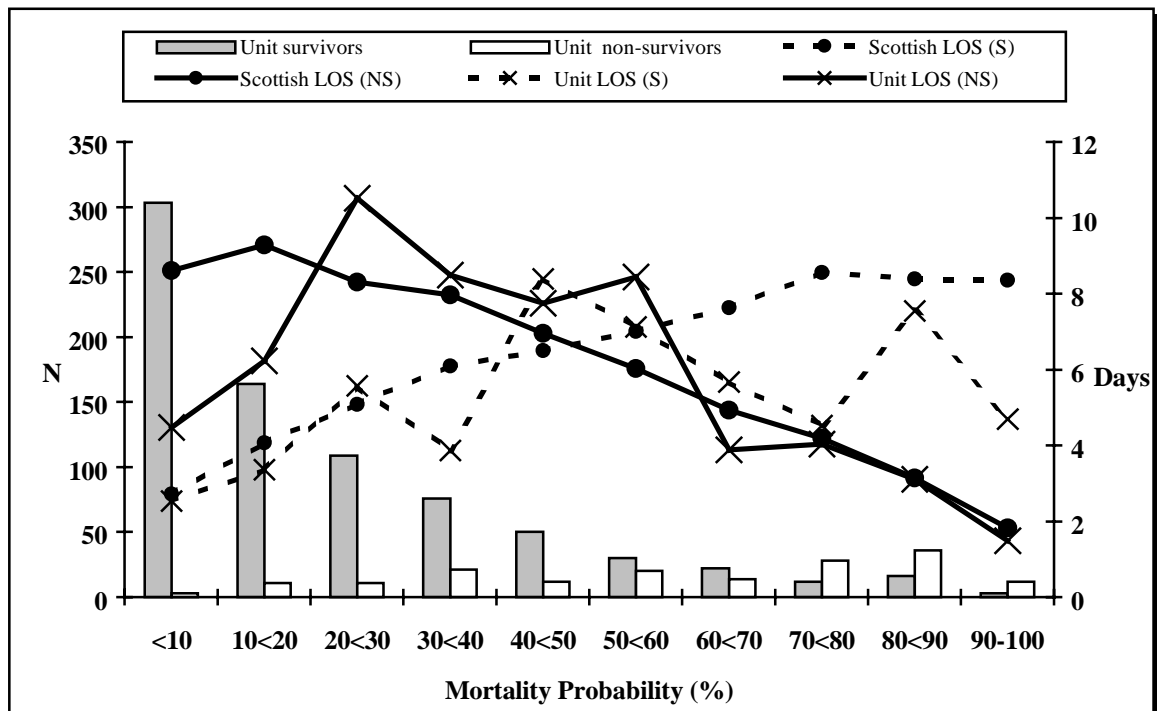


Figure 74.I. Unit I.

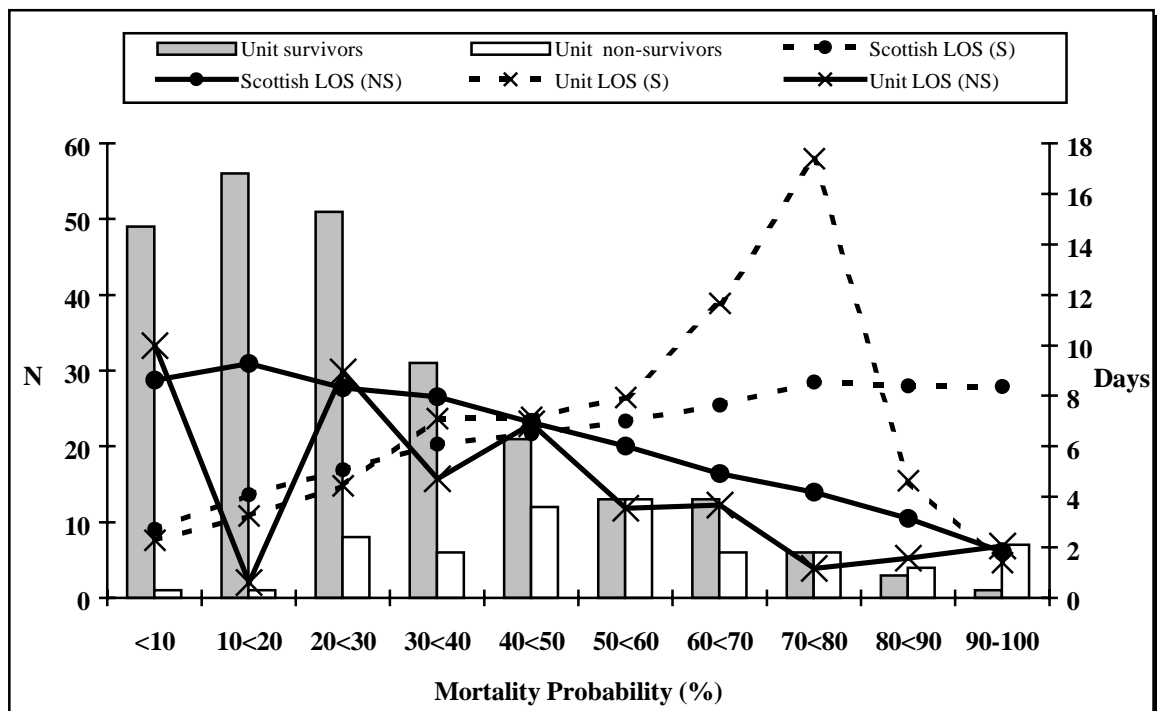




Figure 74.J. Unit J.

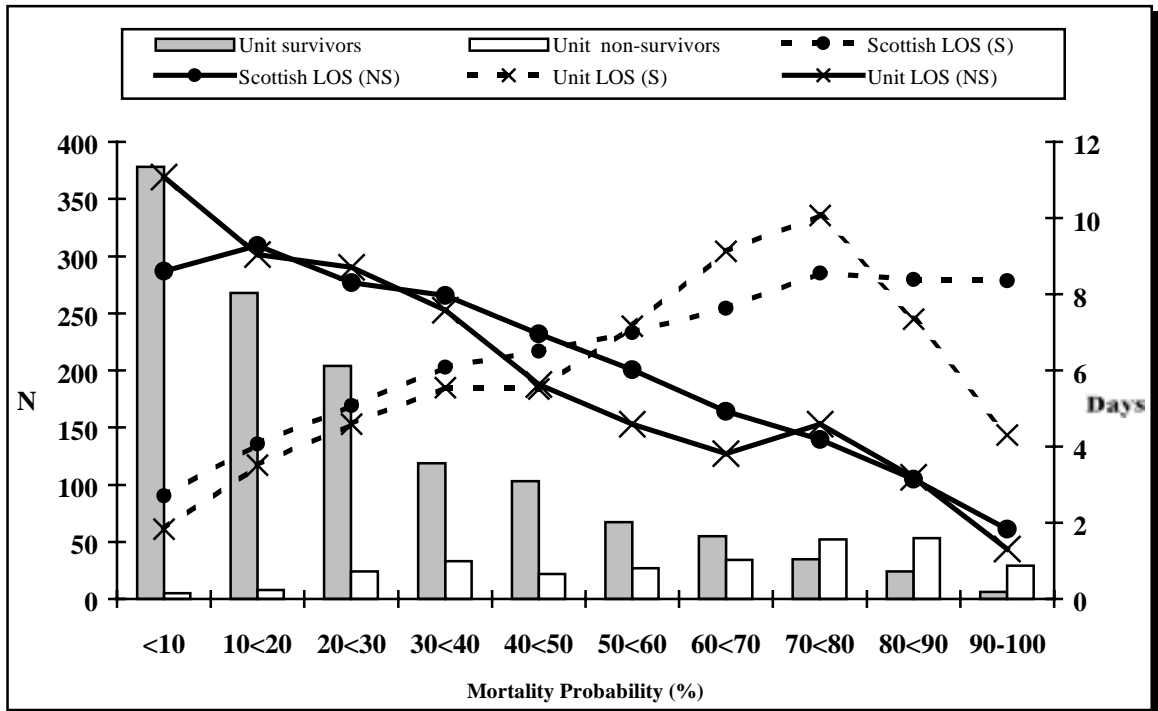


Figure 74.K. Unit K.

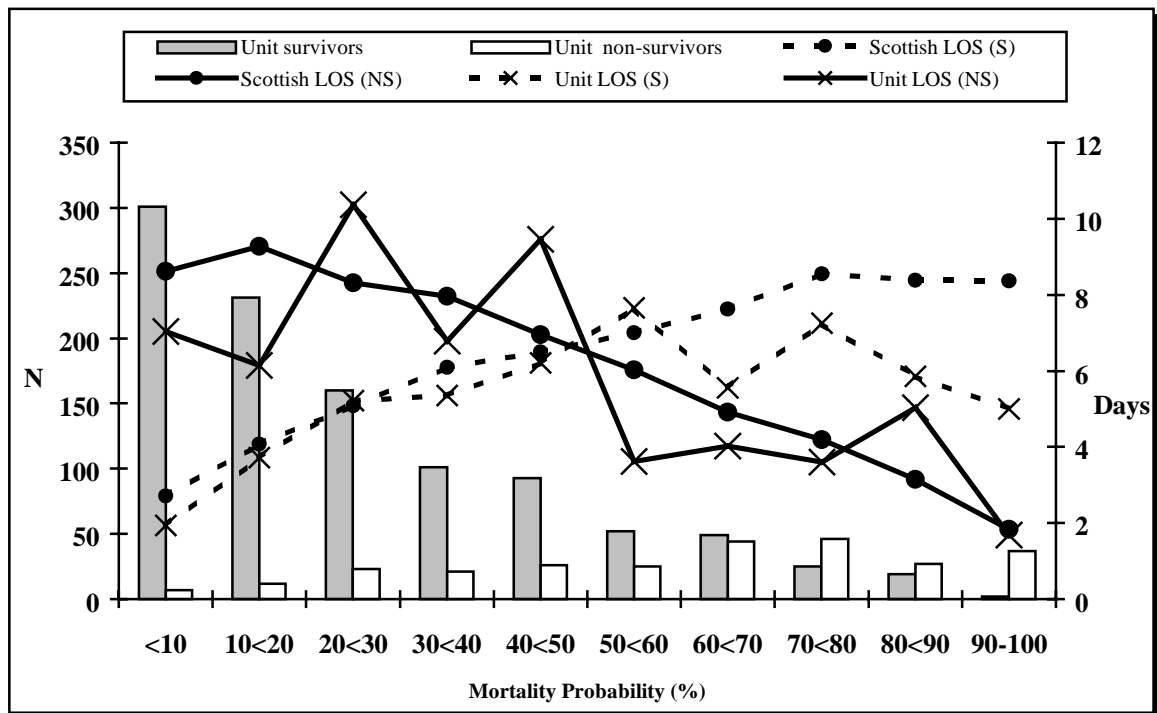




Figure 74.L. Unit L.

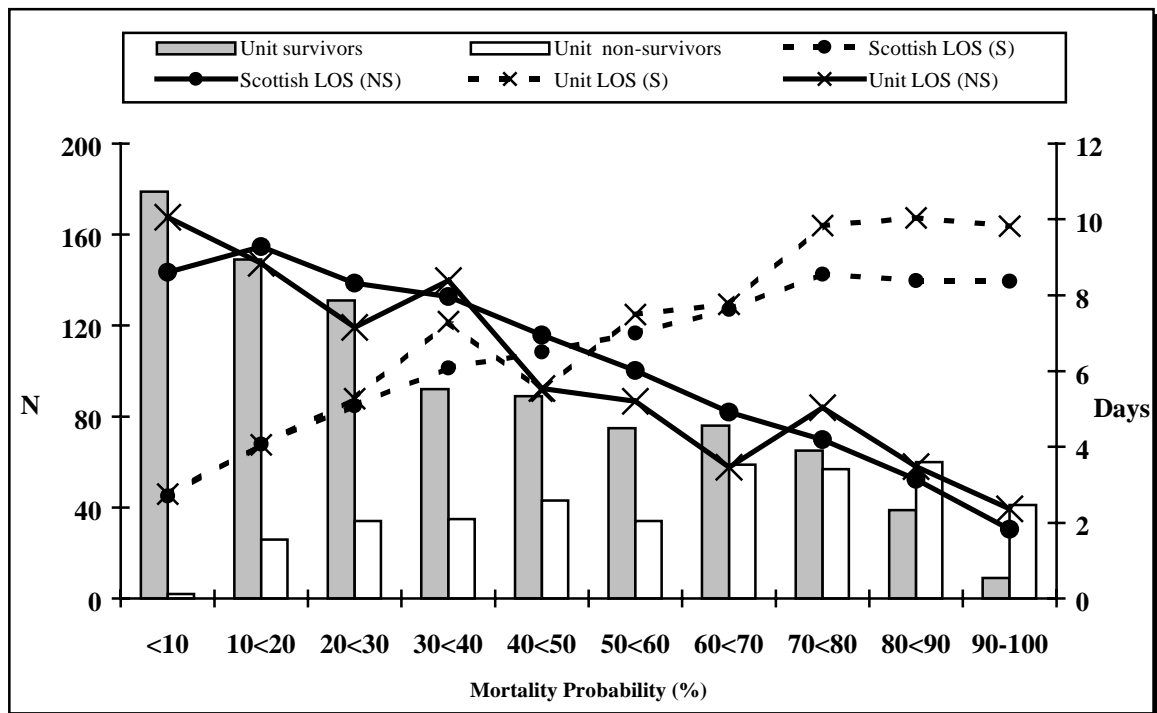


Figure 74.M. Unit M.

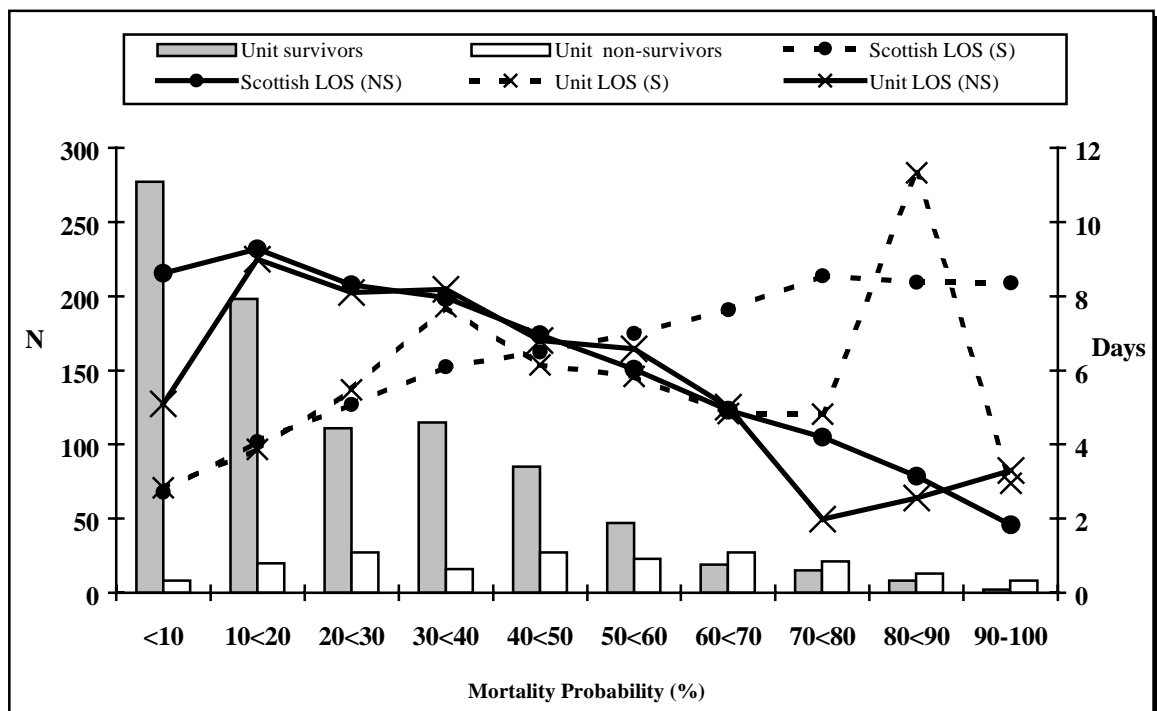




Figure 74.N. Unit N.

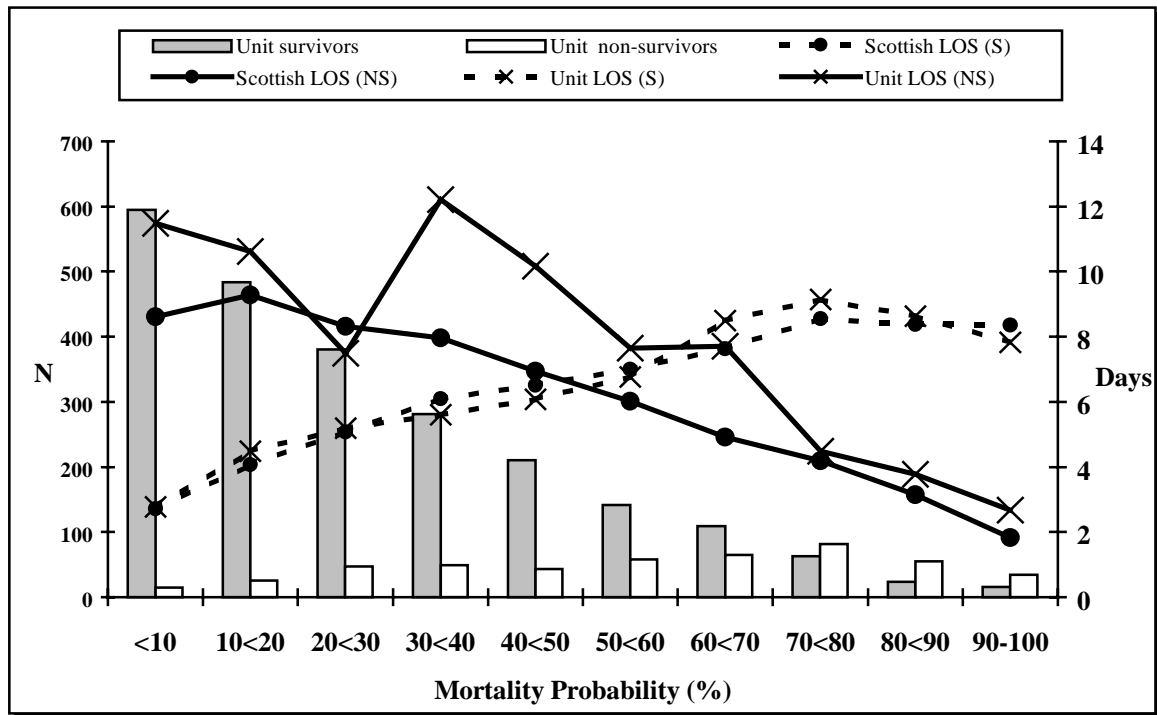


Figure 74.O. Unit O.

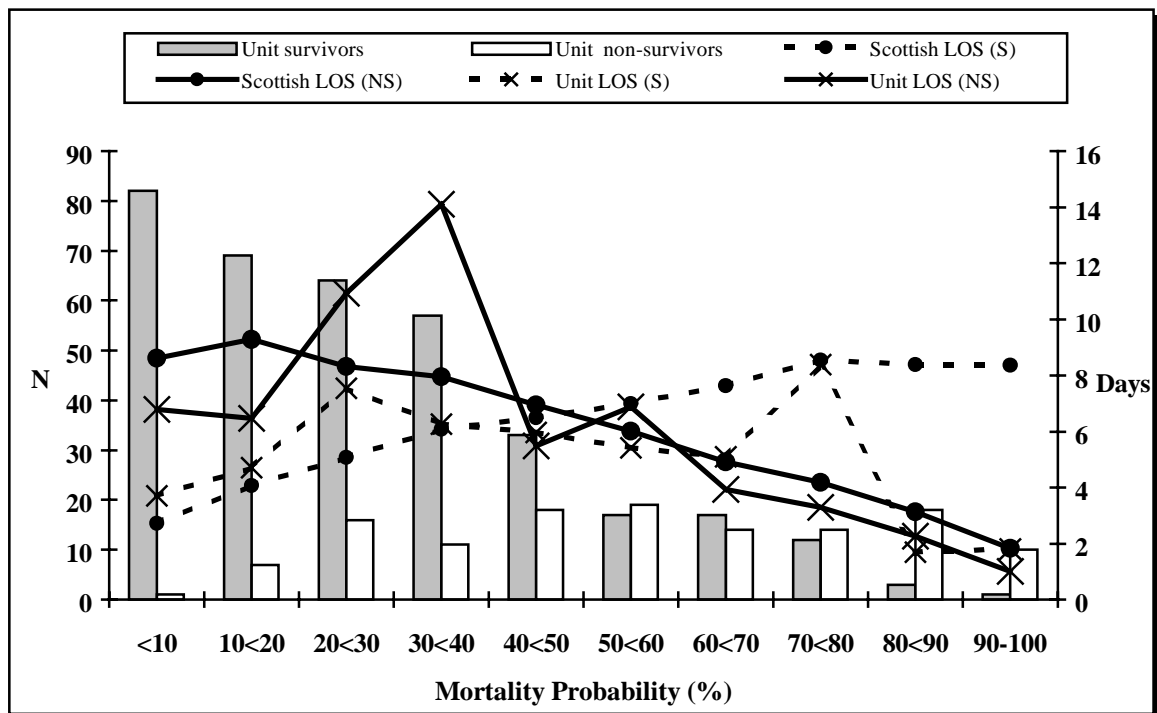




Figure 74.P. Unit P.

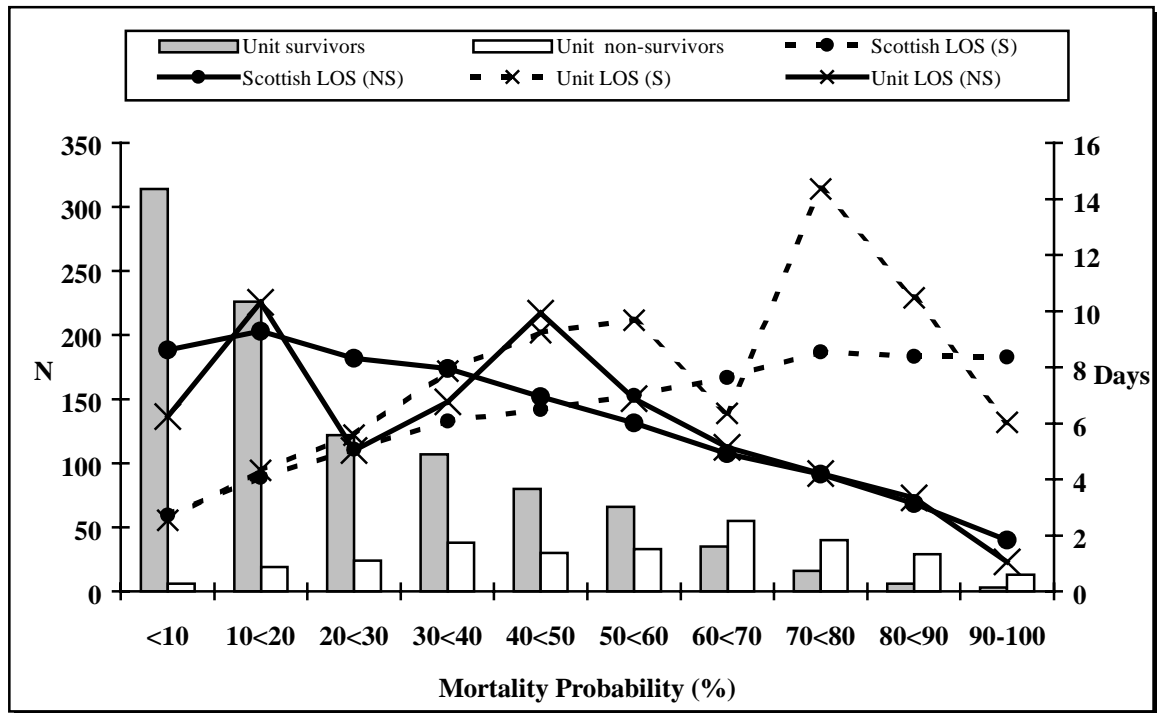


Figure 74.Q. Unit Q.

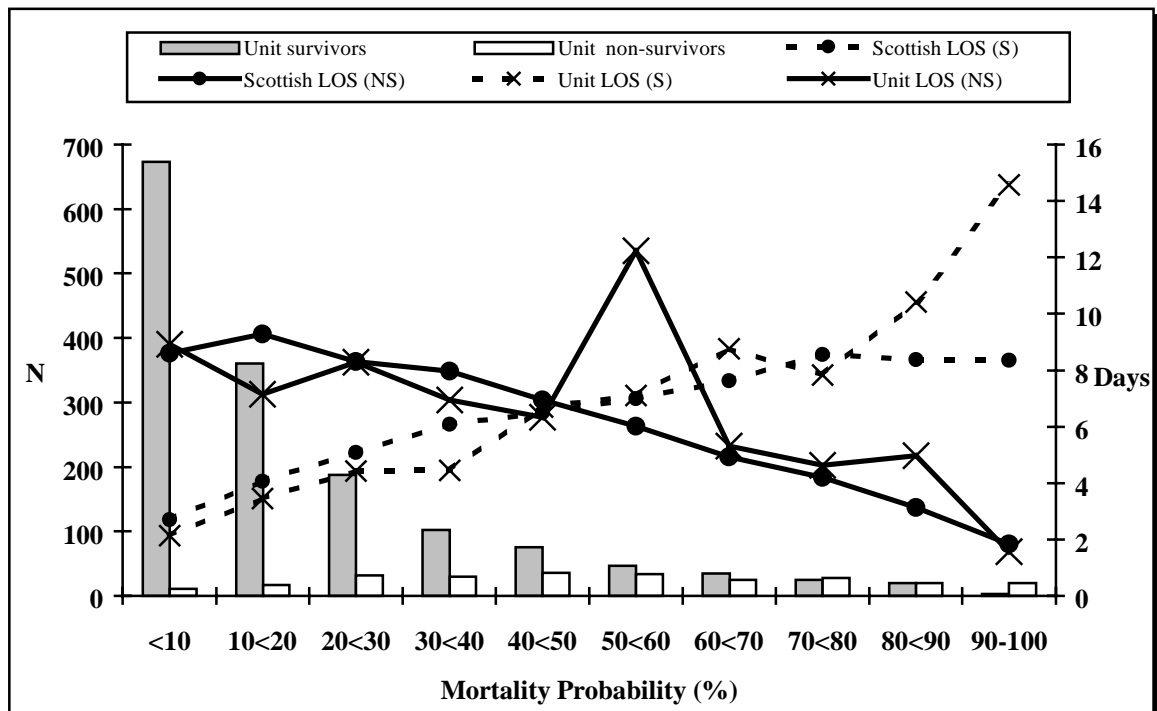




Figure 74.R. Unit R.

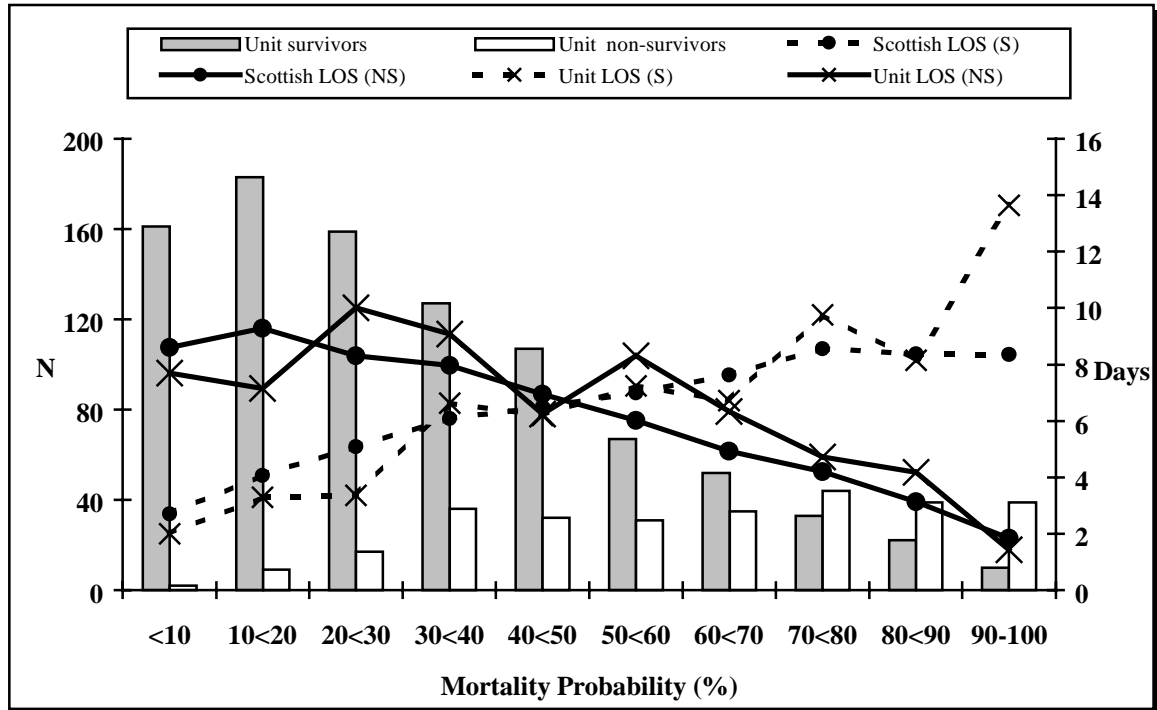


Figure 74.S. Unit S.

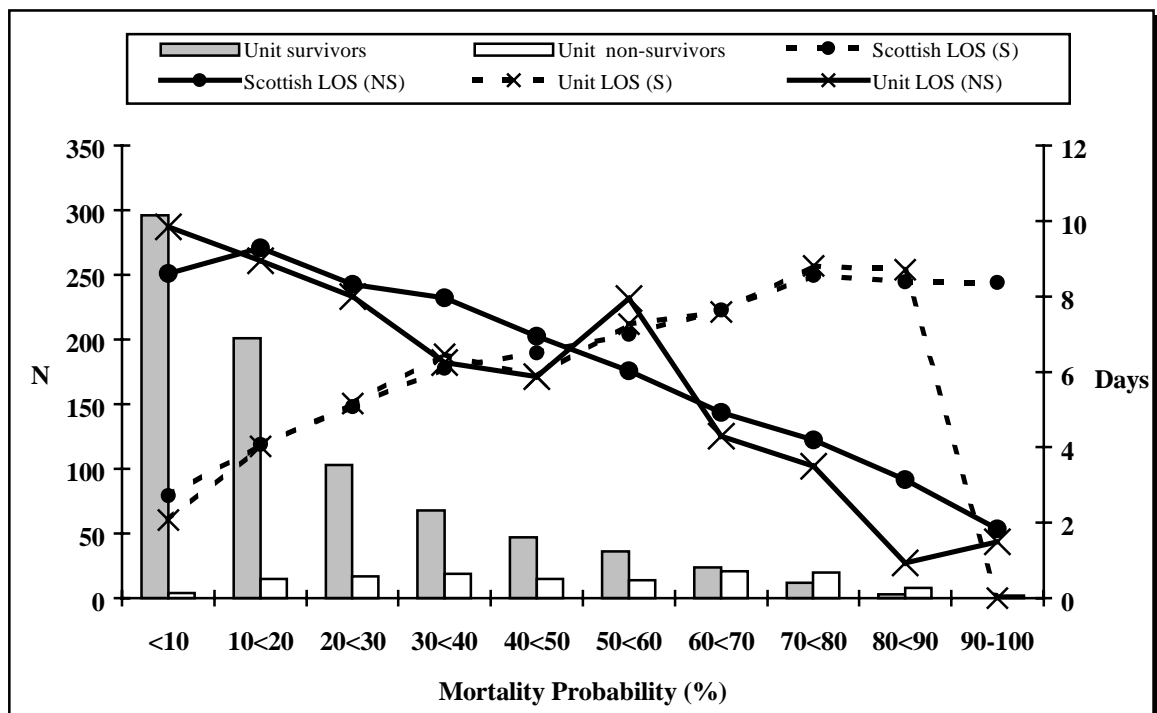




Figure 74.T. Unit T.

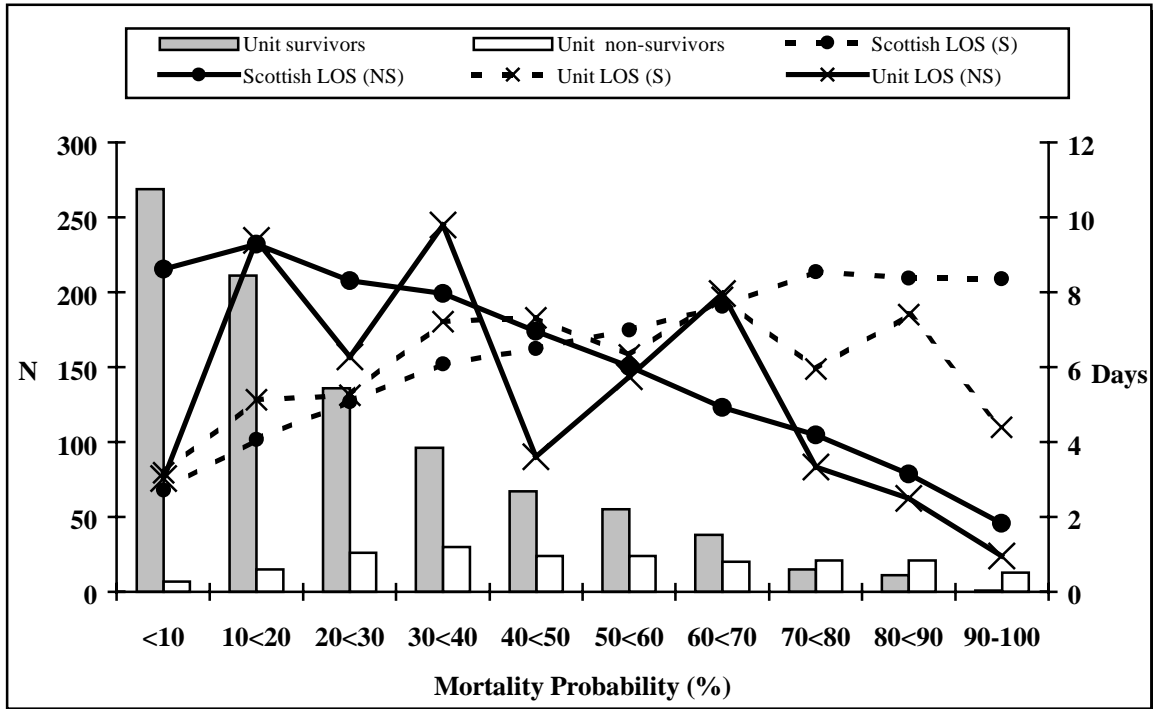


Figure 74.U. Unit U.

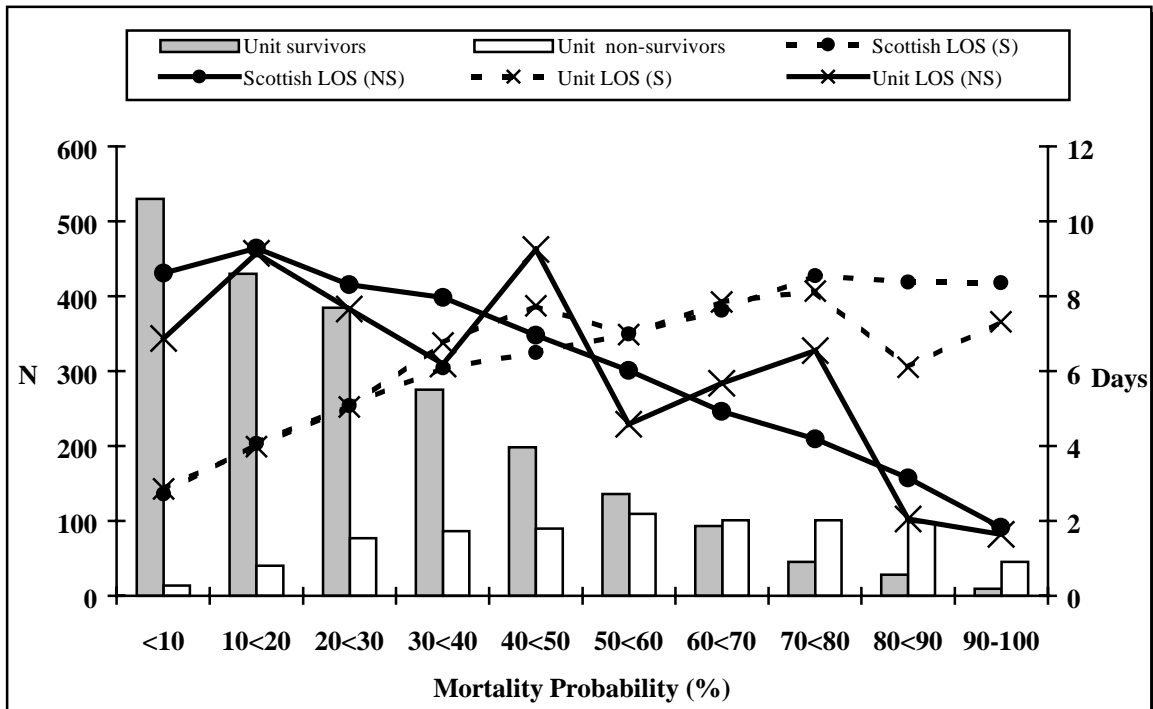




Figure 74.V. Unit V.

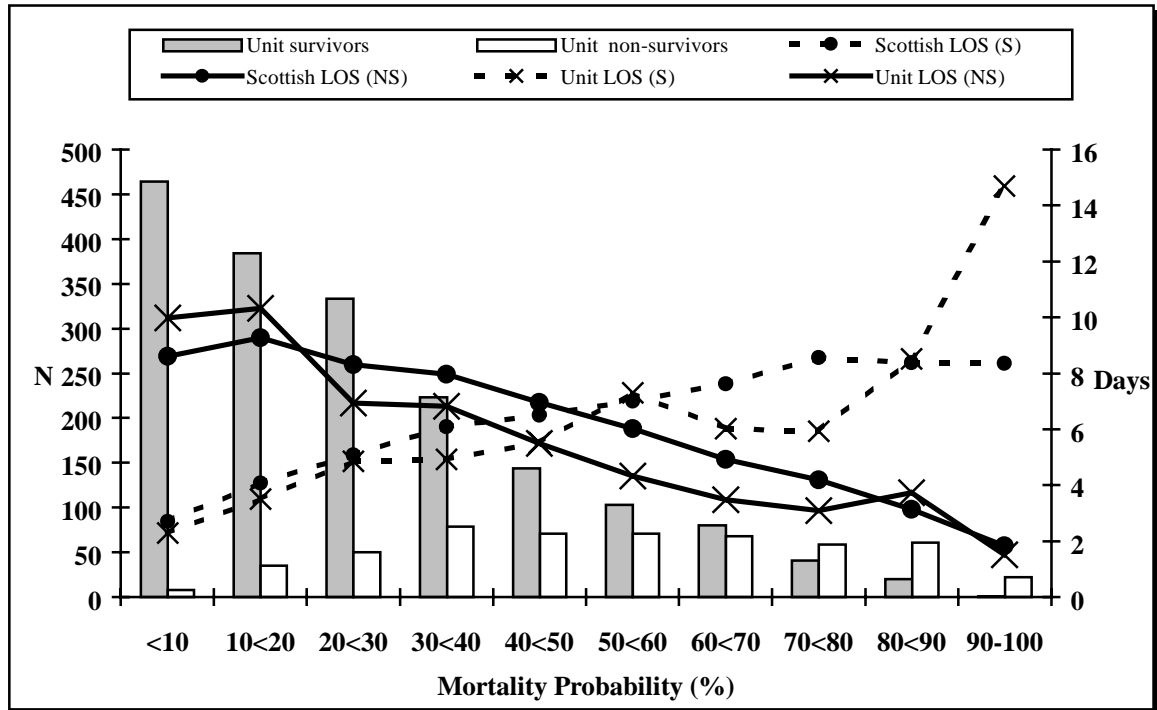


Figure 74.W. Unit W.

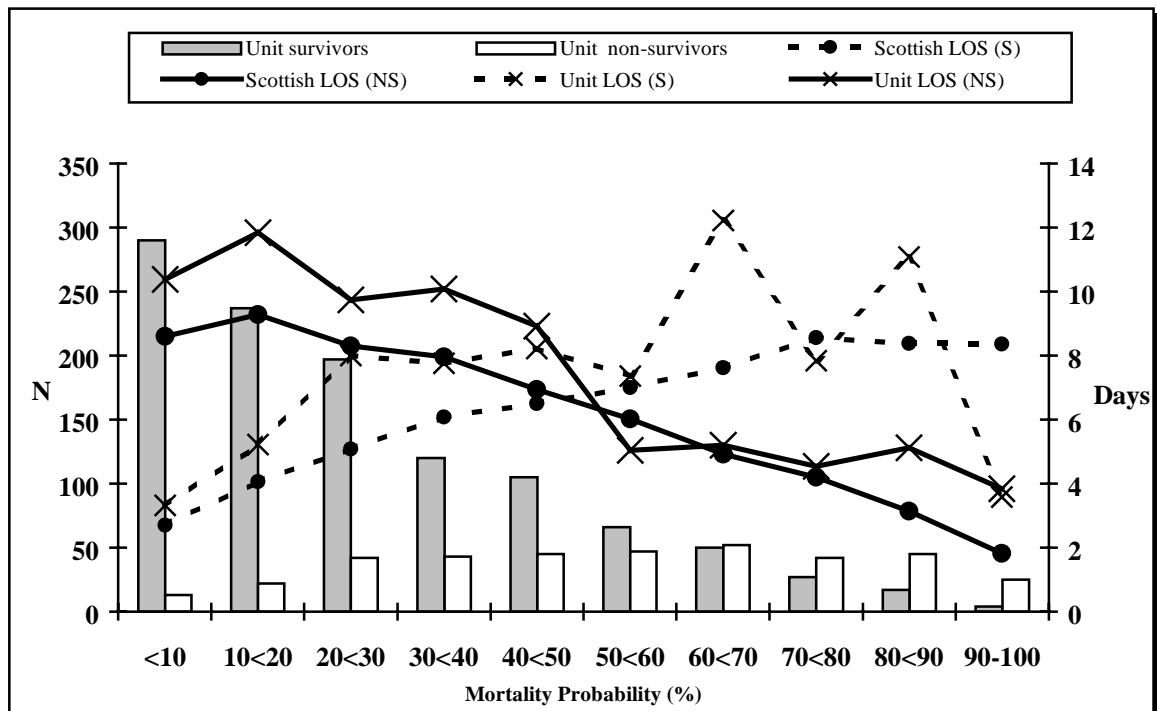
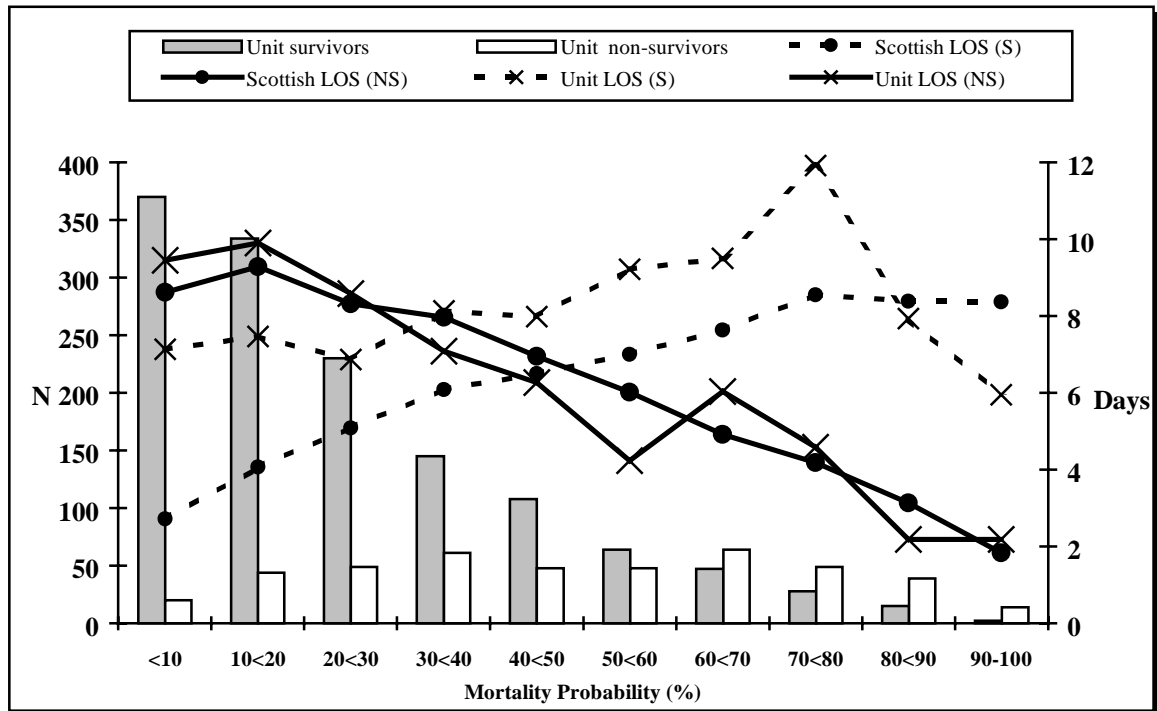




Figure 74.X. Unit X.





IMPORTANT NOTE.

READ IN CONJUNCTION WITH SECTION E.5. *CONSENT IN THE INTENSIVE CARE UNIT.*

Part 5 (Medical Treatment and Research) of the Adults with Incapacity (Scotland) Act 2000 ("The Act") came into force in Scotland on Monday 1 July 2002 and changed the law about treatment and research in adults who are incapable of reaching a decision for themselves because of mental disorder or inability to communicate. This must be borne in mind when reading Section E5 "Consent in the intensive care unit" of this year's report, which was written prior to that date.

Paragraph 119 is unaffected and paragraph 120 heralds the Act, but paragraphs 121 to 123 were superseded when the law changed. For a current list of treatments (paragraph 128) which are excepted from the authority to treat, granted by s47 of the Act, please see the websites given below. Please note that psychosurgery has been removed from the list of excepted treatments.

Welfare Guardians, Welfare Attorneys and holders of appropriate Intervention Orders have the authority to be involved in treatment decisions. Guardians or Welfare Attorneys with appropriate powers can also make decisions on the adult's participation in research. The new Ethics Committee (paragraph 132) has now been appointed and their approval is required prior to any research on adults with incapacity.

Details of the Act, its Codes of Practice and related information can be found on CMO's website http://www.scotland.gov.uk/health/cmo/incapacity_act_toc.asp or the Justice Department website <http://www.scotland.gov.uk/justice/incapacity/news.asp>.