

Annual Report -1999-

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SASM
SCOTTISH AUDIT
OF SURGICAL
MORTALITY

The Scottish Audit of Surgical Mortality would not be possible without the support of all those who help with the gathering of the data.

Mortuary staff, ward clerkesses, nursing and medical staff, consultants' secretaries, departmental secretaries and hospital records office staff all assist the SASM office staff in identifying the information required.

Surgeons and anaesthetists as well as first line assessors and case note reviewers continue their voluntary collaboration in this audit.

Grateful thanks are due to all of the above-mentioned.

In addition, SASM are very grateful for the help received in the preparation of this report from the Information and Statistics Division of the Common Services Agency. In particular, we would like to thank Ann Gould and Gillian McPhillips for the statistical work which they undertook on our behalf, and Angela Bailey for her work on the SASM web site.

The content of this report was compiled and collated by Mrs Helen Burton, Principal Audit Officer, Royal College of Physicians and Surgeons of Glasgow.

The report was edited and verified by the Management Committee of SASM, under the Chairmanship of Mr Peter Stonebridge, Ninewells Hospital, Dundee.

This site contains the full text of the report which can be read and printed. The full tables and graphs for each specialty report are available for download and printing as word documents. Printed copies of the full tables and graphs are not available from SASM and can only be accessed through this site

[Please click here to request a published copy of this report](#)

The views expressed in this report are not necessarily those of the SASM Executive, Management or Advisory Groups.

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FOREWORD

This is my first opportunity as chair to write about the Scottish Audit of Surgical Mortality. It is a unique exercise in carefully auditing the outcomes of the work of anaesthetists and surgeons in Scotland. The almost 100% participation and compliance indicates a real willingness on the part of those professionals involved to study their work and its results and thus attempt to continuously improve the standards of patient care. The voluntary nature of the involvement has allowed results to be scrutinised and the analysis thereof to present messages which can lead to the lessening of similar complications and deaths in the future.

In previous years there have been areas of potential improvement which could be taken forward. The availability of high dependency unit beds was one such example. Some of the other lessons which are clearly evident have not been furthered as robustly as perhaps would have been wished for. The reports highlight specific issues which could be further examined. These have been very aptly categorised into two areas.

1. Service delivery issues and problems
2. The role of the individual clinician

Service delivery issues and problems are areas where good evidence, once it has been acquired and formulated, can be presented to government, and to the National Health Service Management Executive for further discussion and potential action. Examples include access to emergency operating theatres, the whole issue of the relationship between education and service and the effects of Working Time Directive on opportunities and abilities to train doctors and deliver service.

As far as the individual clinicians are concerned, notwithstanding the beneficial effects of the SASM audit, there is at present no obvious way to alter clinical practice for those who choose to ignore the clear messages.

This brings me to what will become one of the most difficult areas for SASM to negotiate in the next couple of years. The SASM process itself is entirely voluntary and confidential but we are now moving into the situations where clinical audit is one of the main tools to inform the whole process of clinical governance. Behind this are the "duties of the doctor" as set out by the General Medical Council very clearly in *Good Medical Practice*. This dilemma has created a tension for SASM and those who participate, which needs to be resolved. Where there is clear evidence of continuing poor practice which is judged to be remedial is it right, appropriate and in the best interests of patient care to continue to use voluntary processes which are totally confidential? Clearly where pressure can be brought to bear to look at change in practice there is no need to alter the present format of SASM, but the question still remains - how should we proceed when such lessons can or will not be learnt?

In my opinion as the incoming Chairman, these are areas which the whole SASM structure needs to look at. Public confidence is the cornerstone of ensuring good medical practice and I believe we have a duty to see that we do everything we can to restore it where that is lacking, but more importantly maintain it where it already exists. I look forward enormously to the challenges ahead which SASM can help negotiate and to working with you to achieve this.

Professor John Temple
President, Royal College of Surgeons of Edinburgh
Chairman, SASM Executive Group

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CONCLUSIONS

Patient transfer

There are infrequent but significant problems in this area. These encompass delay, difficulties during the journey and inappropriate transfer.

Peri-operative care

There was a reduction in the incidence of adverse events related to peri-operative management. However, this remains an area of concern, particularly with regard to the identification of the ill patient. Monitoring, including invasive monitoring, is under-used.

Grade of Staff

Despite the high level of consultant presence recorded in Scotland, there continues to be a small number of cases where assessors felt that trainees worked outwith their level of expertise without adequate direct supervision.

Critical Care

SASM continues to highlight problems with the provision and use of HDU and ICU. The Scottish Executive established a working party in the Summer of 2000 which has reported on this area.

Orthopaedics/Trauma

The grade of anaesthetist in ASA 3 and 4 orthopaedic cases is a particular cause for concern.

Audit

Based on our experience of the audit process since 1994, the marked variation in style and availability of case notes inhibits truly effective audit. Furthermore, it is impossible to put the data into full context without access to data on total activity (denominator and case-mix data).

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RECOMMENDATIONS

Patient transfer

There are accepted minimum standards for the transfer of critically ill patients. The safe transfer of patients is a vital component of any Managed Clinical Network. Trusts **must** ensure a satisfactory level of care through documented protocols and the provision of necessary resources, not by *ad hoc* arrangements. Each geographical area requires different solutions and the provision should be locally relevant with a full assessment of its impact. This will be the subject of further enquiry in a future audit cycle.

Peri-operative care

This is an area for consensus guidelines. A collaboration between SIGN (Scottish Intercollegiate Guideline Network) and SASM has begun to address this.

Whenever possible, peri-operative quantitative grading of the patient's physiological and pathological status, encompassing previous ill health, current condition and the nature of the operation, is recommended (e.g. POSSUM).

The early identification of the *at risk* patient is of prime importance. To facilitate this, serious consideration should be given to introducing tools such as early warning scoring systems on patient monitoring charts.

Grade of Staff

ASA 4 and 5 cases undergoing anaesthesia, **must** be discussed with a consultant anaesthetist.

Cases at 'considerable risk' of death undergoing an operation **must** be discussed with a consultant surgeon.

Critical Care

SASM welcomes the response of the Scottish Executive to previous annual reports. We commend the conclusions of the recent publication "Better Critical Care". It is likely that the perceived need for critical care beds will continue to outstrip provision and it is vital that clear admission and discharge protocols are established, used and audited.

Orthopaedics/Trauma

Daily dedicated trauma sessions, staffed by consultant surgeons and consultant anaesthetists, are urgently required.

Audit

There is a pressing need for a national approach to patient identifiers, operation notes and anaesthetic forms with the establishment of agreed main data sets within specialties. This in turn would begin to supply, along with the progression of the current collaboration between SASM and ISD (Information and Statistics Division of the Common Services Agency), reliable and clinically relevant denominator and case-mix data.

METHODS AND STRUCTURE

AIMS

The Scottish Audit of Surgical Mortality (SASM) is a confidential, national, surgical and anaesthetic mortality audit, designed to offer the profession a confidential peer review analysis of the management of all patients dying in Scottish Hospitals whilst under the care of a consultant surgeon. This includes both patients who have and have not undergone surgery during the last hospital admission. Individual consultant data generated by SASM will not be released to a third party except through the consultant.

ADMINISTRATION

Three committees, the Chief Executive Group, the Management Committee and the Advisory Group administer SASM.

SASM EXECUTIVE GROUP

Since 1997, the overall policy and direction of SASM has been overseen by the Executive Group, comprising:

SASM Executive Group Members - 1999	
Mr C MacKay	President, Royal College of Physicians & Surgeons of Glasgow (Chairman)
Prof A Maran	President, Royal College of Surgeons of Edinburgh
Prof J C Petrie	President, Royal College of Physicians of Edinburgh
Prof J A Wildsmith	Chairman, Scottish Standing Committee, Royal College of Anaesthetists
Mr P A Stonebridge	Chairman, SASM Management Group & SASM Vascular Coordinator, Dundee
Mr W R Murray	Chairman, SASM Surgical Subgroup & Surgical Coordinator, Glasgow
Dr D J Wright	Chairman, SASM Anaesthetic Subgroup & Anaesthetic Coordinator, Edinburgh
Mr R Keenan	Surgical Coordinator, Aberdeen
Mr S J Nixon	Surgical Coordinator, Edinburgh

The Executive Group is responsible for strategic planning and policy making. The Chairmanship rotates round the College Presidents on a 3 yearly basis. From 1997 until October 2000, the Chairman was Mr Colin MacKay. SASM owes him a deep debt of gratitude for his strong chairmanship during his time in office. Professor John Temple, President of the Royal College of Surgeons of Edinburgh has now succeeded Mr MacKay in this role.

SASM MANAGEMENT COMMITTEE

The Management Committee (Chairman - Mr P A Stonebridge) comprises the following staff and coordinators from the four SASM offices plus Mr D R Harper (as Chairman of the SASM Advisory Group) and Mr G Mitchell (Unit Head, ISD):

SASM Management Committee Members		
Aberdeen Royal Infirmary, Aberdeen	Surgical Coordinator Anaesthetic Coordinator Audit Officer	Mr R Keenan Dr H McFarlane Mrs M Turner
Ninewells Hospital, Dundee	Surgical Coordinator Anaesthetic Coordinator Vascular Coordinator Audit Officer	Mr A M Thompson Dr E Wilson Mr P A Stonebridge Mrs W Ritchie
The Royal College of Surgeons of Edinburgh	Surgical Coordinator Anaesthetic Coordinator Audit Officer	Mr S J Nixon Dr D J Wright Mrs M A Hunter
The Royal College of Physicians and Surgeons of Glasgow	Surgical Coordinator Anaesthetic Coordinator Orthopaedic Coordinator Principal Audit Officer	Mr W R Murray Dr T J Winning Mr U G Fazzi Mrs H D Burton
Others	Chairman, Advisory Group Unit Head, ISD, CSA	Mr D R Harper Mr G Mitchell

The committee is responsible for the broad management of the audit, the production of a draft annual report and development of future plans and projects.

The Executive Group appoints the Chairman of the Management Committee.

The Chairman, current Mr Peter A Stonebridge, holds office for 3 years and is eligible for a second term of office. Membership of the Management Committee is presently through nomination by the Management Committee for appointment by the Executive Group.

SASM ADVISORY GROUP

The Advisory Group consists of a broad base of all relevant surgical and anaesthetic specialty groups and geographical areas, plus the members of the Management Committee.

SASM Advisory Group Members - 1999			
General Surgery	Mr A G Coutts Mr J Gollock Mr N W S Harris Mr C Johnston Mr W R Murray Mr W O Thomson Miss P Whitford	Anaesthetics	Dr G A Douglas Dr H Hosie Dr B Kennedy Dr N P Leary Dr N T B Watson
Orthopaedics	Mr A S Jain Mr I Stother	Neuroanaesthetics	Dr D F Cossar
Urology	Mr S Bramwell Mr L E F Moffat Mr G Smith	Vascular Surgery	Mr J L Duncan Mr D R Harper (Chair) Mr G H Welch
Gynaecology	Dr D I M Farquharson Dr J Kennedy	Neurosurgery	Mr C T Blaiklock
Paediatric Surgery	Mr F D Munro	ENT	Mr A I G Kerr Mr R Mountain Mr B O'Reilly
Plastic Surgery	Mr J D Watson	Oral/Maxillofacial	Mr J McManners
Ophthalmology	Prof C Kirkness		
Colleges	Mr M K Browne Dr W F D Hamilton Prof P F Jones	Public Health	Dr H Burns

The Advisory Group is the contact point between the profession and SASM. It meets twice yearly, with the possibility of extraordinary meetings, as decided by the Chairman. Its role is to advise the Management Committee and Executive Group on areas of interest, methodology and future development and on the content and emphasis of the Annual Report.

The Advisory Group elects its own Chairman and Secretary, who serve for three years after their election and are eligible for re-election.

SASM MANAGEMENT

The annual budget for SASM is £238,650. The day-to-day running of SASM is based in 4 regional offices. Apart from General Surgery cases, which are administered on a regional basis by the local SASM office, surgical specialties are administered as a true national audit through the following offices (1999 case numbers are in parentheses):

SASM National Specialty Offices 1999			
Aberdeen	ENT (92) Plastic Surgery (29) Maxillofacial (11) Paediatric Surgery (10)	Dundee	Vascular Surgery (569)
Edinburgh	Ophthalmology (2)	Glasgow	Orthopaedics (679) Urology (254) Neurosurgery (235) Gynaecology (106)

1999 first line assessors by speciality and geographical distribution (SASM office)			
Anaesthesia			
Aberdeen Dr G Byers	Dr A Campbell	Dr G M Johnston	Dr H J McFarlane
Dundee Dr E Wilson			
Edinburgh Dr S McKenzie	Dr C Wallis	Dr D J Wright	
Glasgow Dr B N Cowan Dr E A James Dr I McMenemin Dr D Thomson	Dr G A Douglas Prof G N C Kenny Dr J Palmer Dr J M Thorp	Prof W Fitch Dr J McKellar Dr H M Robb Dr G Weetch	Dr G Gillies Dr T T C McLintock Dr M C Thomas Dr N W Willis
General Surgery			
Aberdeen Mr D R Harper	Prof P F Jones	Mr R A Keenan	Prof Z H Krukowski
Dundee Mr A M Thompson	Mr D Smith		
Edinburgh Mr S J Nixon	Mr T J Crofts		
Glasgow Mr D S Byrne Mr A L Forster Mr A J McMahon Mr R N Scott	Mr H Campbell Mr P Horgan Mr I McMillan Mr R Stuart	Mr C R Carter Mr D G Knight Mr A H M Nassar Mr B W A Williamson	Mr J C Ferguson Mr J R McGregor Mr J J Reidy Miss P Whitford
Orthopaedics			
Mr I H Annan Miss P S Costigan Mr H Potts	Mr M Bransby-Zachary Mr P James Mr A T Reece	Mr K Buring Mr N Maffulli Prof D I Rowley	Mr C B Clowes Mr G McGarrity
Vascular Surgery			
Mr A W Bradbury Mr G Griffiths Mr R N Scott	Mr R T A Chalmers Ms A Howd Mr P A Stonebridge	Mr K S Cross Mr A J McKay	Mr J Duncan Mr J J Morrice
Urology			
Mr S P Bramwell Mr A J Yates	Mr L E F Moffat	Mr G Smith	Mr M F Smith
Neurosurgery			
Mr E S Ballantyne	Mr C T Blaiklock	Mr M S Eljamel	
Gynaecology			
Dr R Cassie Dr R J S Hawthorn	Dr D H Gibson Dr C B Lunan	Dr D Gilmore	Dr K Hanretty
ENT			
Dr A I G Kerr	Mr B F O'Reilly		
Plastic Surgery			
Mr J D Holmes	Mr D S Soutar	Mr J D Watson	Mr M Webster
Maxillofacial Surgery			
Mr J McManners	Mr R Mitchell		
Paediatric Surgery			
Mr G Haddock	Mr F D Munro	Mr G G Youngson	
Ophthalmology			
Prof C M Kirkness			

ADVERSE EVENTS

When cases are reviewed, by either first line assessors or at case note review, events or factors which are thought to be either suboptimal or could have been dealt with differently, have been recorded as "adverse events". These encompass issues that are specific to surgical and anaesthetic care, or may relate to hospital or handling concerns. From 2001, these observations will be termed "audit events". These will be allocated to specific areas of care and will be divided into "areas for consideration" (areas requiring further thought by the

clinicians involved in the case, possibly reflecting alternative approaches in management), and “areas of concern” (management considered to be suboptimal). This should result in a focussed assessment with graduated critical comment.

DATA ENTRY

The diagnoses and operations are recorded using Read codes. Any adverse factors in management noted by the assessors are coded using locally devised codes, structured along the same lines as Read codes. The data are all entered on a Microsoft Access database.

HOSPITAL/HEALTH BOARD FEEDBACK

Individual hospitals and Health Boards received analysis of the data for 1998, providing a summary of their data along with a comparison against the total for the rest of the country. After the publication of the annual report for 1999, this feedback will again be sent to each hospital and Health Board.

INDIVIDUAL FEEDBACK

Clinicians are given the option to request feedback on individual cases, even if no adverse events in management are identified by assessors. Any cases which had any specific comments made by assessors are automatically fed back to the consultant surgeon and/or anaesthetist involved in the care of the patient.

RIGHT OF APPEAL

Clinicians who wish to dispute either fact or opinion reported by either 1st line or case note assessor may do so through the relevant SASM office. In this event the SASM co-ordinator will review the facts of the case and may ask for a further assessment or case note review.

CASE REPORT BOOKS

Anonymised collated case reports are circulated to surgical and anaesthetic consultants and trainees at intervals.

ANNUAL REPORT

After an agreed deadline of 15th of May 2000 for the return of all surgical, anaesthetic, surgical assessors' and anaesthetic assessors' pro formas, the databases from each of the four offices were combined and validated. Tables of data were sent to the authors of the various specialty chapters included in this report. The SASM Advisory Group at its meeting on 29th September 2000 approved the draft of the annual report. As well as being distributed to all participants in printed form, the annual report will also be available on this new web site WWW.SHOW.SCOT.NHS.UK/SASM. Here, the full text of the report can be read and downloaded, along with full tables and graphs for each specialty. The web site also contains information about current and future developments in SASM.

***Mr Peter A Stonebridge, Chairman of the SASM Management Committee,
Ninewells Hospital, Dundee***

***Mrs Helen D Burton, Principal Audit Officer,
Royal College of Physicians and Surgeons of Glasgow***

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FIVE YEARS OF SASM ANNUAL REPORT – SO WHAT?

In 1994 the Glasgow Audit of Surgical Deaths and the Scottish Mortality Study combined and expanded to become the Scottish Audit of Surgical Mortality (SASM). The first Chairman of the National Council of SASM, Mr Hugh Forrest, wrote in his introduction – *"the publication of the first National Report of the Scottish Audit of Surgical Mortality is a considerable achievement and it is the result of close co-operation by the members of staff of the 4 Audit Offices in Scotland – in Edinburgh, Glasgow, Aberdeen and Dundee. Much more than this, however, it is the outcome of the voluntary participation of a very high percentage of the Surgeons and Anaesthetists in all hospitals in Scotland. I would like to emphasize that this Audit is conducted by the medical profession for the medical profession and that each member participating can have an influence in the way the Audit is conducted through his or her Regional or Specialty representative on the National Council of the SASM."*

Four annual reports have followed, each the result of painstaking data collection, peer review, data analysis and further peer review prior to input and approval from the Advisory Group, the Management Committee and the Chief Executive Group. Each year over 4000 "surgical" deaths have been identified (range 4331 to 4533: cardiothoracic surgery and paediatric surgery did not contribute to these reports). Anaesthetists and Surgeons in Scotland completed 97% of SASM proformas sent to them in 1994 and 95% in 1998. This is a phenomenal compliance by any standard and we should be justifiably proud of these figures.

What recommendations have the SASM annual reports made, has anyone paid any attention to them and have the recommendations led to change in practice? These questions are basic to any audit cycle and an attempt should be made to answer them at a National, Health Board, Trust and personal level. Table 1 shows the main SASM recommendations made each year.

Table 1

SASM recommendation		94	95	96	97	98
1	Increase the number of ICU/HDU units and beds	✓	✓	✓	✓	✓
2	Guidelines to improve post-op management of seriously ill patients in general wards.	✓	✓	✓	✓	✓
3	Follow SIGN guidelines on DVT prophylaxis.	✓	✓	✓		✓
4	Juniors must discuss <u>all emergency patients for major surgery</u> and <u>all > ASA 3 patients</u> with their consultant.	✓	✓	✓		
5	The use of CVP monitoring should be increased.	✓			✓	
6	Endoscopists should adhere to National guidelines.			✓		
7	Hospital discharge documentation should be improved.			✓		
8	Gastrointestinal anastomotic leakage should be audited.			✓		
9	Scottish review of vascular surgery needed.			✓		
10	Pre-op assessment should be improved.				✓	
11	A Scottish Surgical IT system is needed.				✓	
12	Managed clinical networks should be developed.					✓

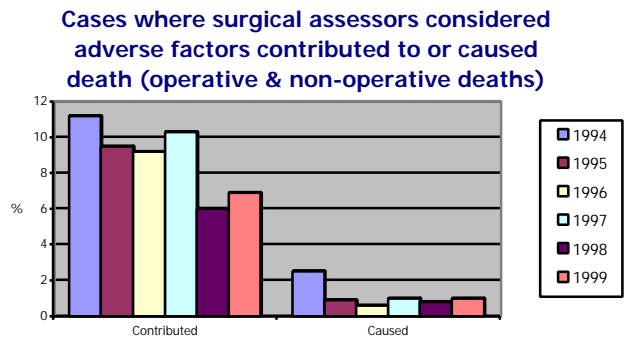
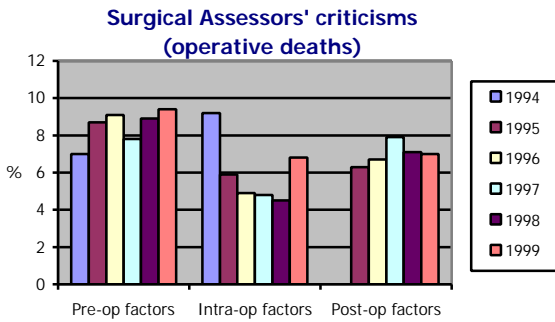
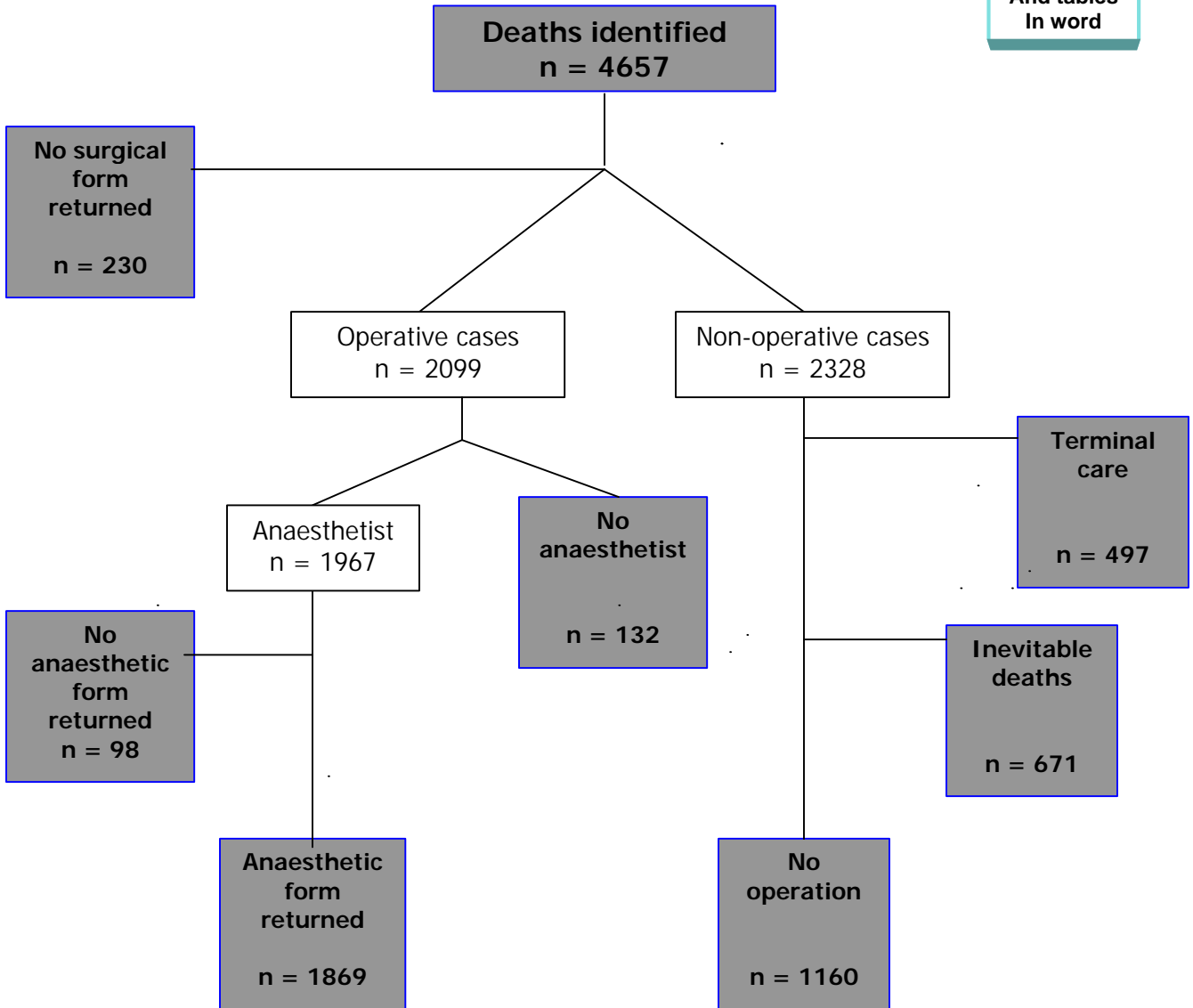
Recommendations 1 to 3 are clearly perceived by SASM as being important and worth repeating until audited evidence of significant improvement can be reported. Each reader should assess the spread sheet from his or her own perspective, be it National, Health Board, Trust or individual and try to answer the key questions – have you paid any attention to the recommendations and have the recommendations led to a change in practice. Hopefully "yes" will outnumber "no", but only time and continuing audit will tell.

**Mr W R Murray, Consultant Surgeon
Glasgow Royal Infirmary**

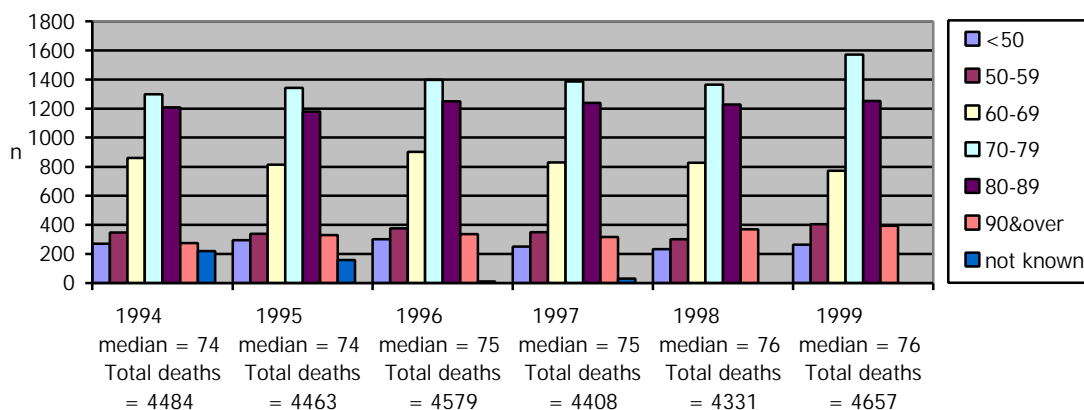
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ALL DEATHS

Download Full graphs And tables In word



Age distribution (all deaths) by year



Test for trend: p value = <0.0001

The p value here is very significant, which suggests that a trend exists. The chart indicates that the age is increasing slightly over the years 1994-1999. These indicators combined suggest that there is a strong upward trend in the age distribution over time.

Age ≥80 and <60 by year

Age	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
≥80	1483	34.8	1511	35.1	1588	34.8	1555	35.5	1600	36.9	1645	35.3
<60	620	14.5	636	14.8	680	14.9	602	13.8	538	12.4	669	14.4

Type of admission by year

Emergency	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	2812	84.2	1896	81.8	2935	83.9	2760	84.1	3009	85.5	2752	84.9
No	527	15.8	423	18.2	565	16.1	521	15.9	511	14.5	489	15.1
unknown	366		1423		412		415		295		919	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.075**

The p value here suggests that there is no real significant change in the percentage of emergency admissions over the years.

ASA grade 4 (at 1st operation) by year

ASA	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Grade 4	595	36.2	623	38.6	586	35.7	563	35.1	629	38.3	673	36.7

Chi-squared test for trend: p value = 0.895

The p value here is rather large, which does not support the hypothesis that there is any trend in the percentage of patients in ASA grade 4.

Operative cases with Consultant Surgeon operating by year (This does not include consultant surgeons assisting or present in theatre)

Cons Surg	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	1053	58.0	1042	58.6	1122	60.7	1051	59.6	1122	59.8	1220	60.5
No	761	42.0	735	41.4	725	39.3	711	40.4	754	40.2	797	39.5
Unknown	132		83		111		121		105		85	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.522**

The p value here is quite high, indicating that there is not a significant change over the years in the percentage of operative cases where there was a consultant surgeon operating.

Operative cases with Consultant Anaesthetist present by year

Cons Anae	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	900	54.5	977	60.6	1021	61.8	1060	65.9	1103	67.1	1225	67.0
No	751	45.5	634	39.4	632	38.2	549	34.1	540	32.9	602	33.0
Unknown	295		249		305		274		338		275	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = <0.001**

The p value here is highly significant, which strongly suggests that a trend exists. Figures in the table also suggest that there is a strong upward trend in the percentage of operative cases where an anaesthetist was present.

ALL DEATHS – AN OVERVIEW

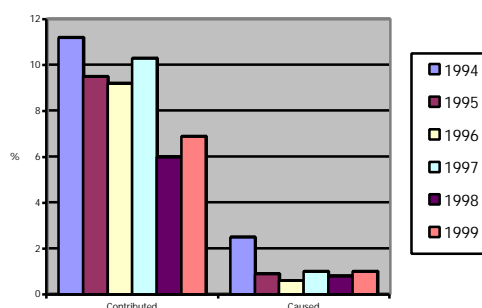
With over 4,500 deaths while in surgical care, it is salutary to find that over half of the patients did not have an operation. Presuming that a proportion of these individuals were destined to die, one might question whether surgical wards can provide adequate terminal care for the 11% of the patients admitted specifically for such care. Some patients and relatives may actually prefer the hospital setting in these circumstances. Given that some patients arrive on surgical wards in extremis, or in the latter stages of a disease process, and a further 25% (1160/4657) had no operation, it is heartening that peer review rarely (n = 9) finds an operation should actually have been performed.

For the operative cases 6% (132/2099) had no anaesthetist present. Endoscopic procedures account for a substantial proportion of these deaths, as described in the 1998 report and currently the subject of more detailed audit through SASM. More use should be made of anaesthetists to help with the management of poor risk patients undergoing endoscopy. Similarly, operative procedures under local or regional anaesthesia may be no safer than an appropriately administered general

anaesthetic, as a recent SASM publication has suggested (McGugan et al, JRCSEd, 2000).

Overall, adverse factors identified by surgical assessors have fallen over the first six years of the audit, from 11% to 7%, and surgical adverse factors remain at 1% as the cause of death (Figure 1).

Figure 1



These criticisms, though very rare for individuals, are keenly felt by surgeons. This fall in adverse factors contributing to death suggests that data from SASM reflects continuing improvements in surgical and anaesthetic care.

**Mr Alastair M Thompson, Senior Lecturer and Consultant Surgeon
Ninewells Hospital, Dundee**

Most Common Adverse Events in Management - All Deaths	
Surgical Assessors	Anaesthetic Assessors
Delay to surgery, ie earlier operation desirable	Failure to use HDU
Wrong operation performed	Unsatisfactory medical management
Surgeon too junior	Inadequate monitoring
Op should not have been done/unnecessary	Anaesthetist too junior

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A SECOND LOOK AT WHO MANAGED WHOM, WHEN AND WHO DID THEY TELL

The 1998 SASM annual report carried a paper ⁽¹⁾ discussing the seniority of surgical and anaesthetic input to the in-theatre management of seriously ill patients. The two broad groups considered were those emergency cases graded by the anaesthetist as ASA 4 or by the surgeon to be at “considerable risk” of death. Similar data are available for 1999 and this allows assessment of the degree of consultant involvement as well as the level of experience of non-consultant staff undertaking theatre management of such cases.

METHODS

SASM data for 1999 were used to provide information on ASA grade, pre-operative assessment of risk of death, time of operation (divided as in 1998 into 4 time bands), grade of surgeon and anaesthetist.

RESULTS AND DISCUSSION

Data were available from 2757 emergency admissions, of which 1384 (50%) underwent surgery.

ASA grade of patient by time into anaesthetic room

Data on time of entry into anaesthetic room were available on 1102 patients. Of these, 5 had no information on ASA grade.

Table 1 Emergency cases/ASA grade/Time of operation

Time	0800 – 1259	1300 – 1759	1800 – 2159	2200 – 0759
Total	348	422	179	148
ASA 1	1	2	1	0
ASA 2	36 (10%)	41 (10%)	14 (8%)	11 (7%)
ASA 3	128 (37%)	164 (39%)	55 (31%)	34 (23%)
ASA 4	149 (43%)	172 (41%)	83 (46%)	70 (47%)
ASA 5	34 (10%)	43 (10%)	26 (15%)	334 (22%)

Thus, ASA grade 4 forms the largest single group in all 4 time bands when emergency surgery is considered. Given that this is an audit of surgical deaths, this finding is not surprising.

Only 148 (14%) of cases were operated on in the overnight period (2200 – 0759 hrs) with 70% of cases entering theatre in daytime (0800 – 1759 hrs). On average, severity of illness as judged by ASA grade is greater in the overnight period, with a larger proportion of ASA 5 cases during this time.

As in the 1998 report, data for consultant presence in theatre for both ASA 4 patients and those patients judged pre-operatively by the surgeon to be at “considerable risk of death” were analysed.

Table 2 Consultant presence in theatre/time period/ASA 4

Time	0800 – 1259	1300 – 1759	1800 – 2159	2200 – 0759
Number of cases	149	172	83	70
Consultant surgeon	108 (72%)	119 (69%)	63 (76%)	48 (69%)
Consultant anaesthetist	108 (72%)	120 (70%)	54 (65%)	43 (61%)

Consultant surgeons were present in theatre for 338 (71%) and consultant anaesthetists for 325 (69%) of the 474 ASA 4 patients who underwent emergency surgery. Comparison to 1998 data reveals a rise in consultant surgeon presence (66% to 71%) with no change in

consultant anaesthetist presence in theatre. This figure represents consultant surgeon input for all surgical specialties, and may vary between different specialty areas.

Table 3 Consultant presence in theatre/time period/patients at "considerable risk" of death

Time	0800 – 1259	1300 – 1759	1800 – 2159	2200 – 0759
Number of cases	168	214	97	96
Consultant surgeon	106 (63%)	150 (70%)	73 (75%)	59 (62%)
Consultant anaesthetist	116 (69%)	151 (71%)	54 (56%)	51 (53%)

Thus, in cases assessed by the surgeon to be at considerable risk of death, a consultant surgeon was present in theatre for 388 (68%) and a consultant anaesthetist present for 372 (65%) of 575 cases. This again reflects an increase in consultant surgeon presence when compared to 1998 data (65% to 68%) while consultant anaesthetic presence is maintained at 65%.

Other staff involved in management of emergency cases

Thus, significant numbers of cases graded ASA 4, or to be at considerable risk of death, have surgery or anaesthesia performed by non-consultant staff. Is this of concern?

SASM is a peer-review audit process. All cases undergo peer review by 1st line assessors with approximately 10% of cases undergoing 2nd line assessment by way of case note review. Data on criticism of the grade of surgeon and anaesthetist by the assessors are available and can be outlined as follows for "high risk" emergency cases.

Table 4

ASA 4 cases: (474 cases)		
Criticism of grade of surgeon	n=20	(4%)
Criticism of grade of anaesthetist	n=10	(2%)
Cases at "considerable risk" of death (575 cases)		
Criticism of grade of surgeon	n=20	(4%)
Criticism of grade of anaesthetist	n=20	(4%)

Thus the peer review process in itself does not highlight widespread concern amongst the consultant body in Scotland in relation to consultant input in theatre for emergency surgery. Nonetheless, it is clear that emergency surgery and anaesthesia should be undertaken by appropriate clinicians. Given current resource and patterns of work, rigid protocols aiming for 100% in-theatre consultant involvement for the patients previously discussed would seem unworkable. Even if feasible, is such a change necessary or even desirable?

Many of the types of cases analysed above do indeed require the presence of a consultant anaesthetist in theatre. Certainly these cases should be discussed with a consultant. However, there is no evidence to suggest that, for example, a senior SpR in anaesthesia should not provide in-theatre management for a proportion of these cases. Indeed in terms of training it is important that senior anaesthetic SpRs manage such cases as the senior anaesthetist in theatre while knowing that consultant advice and back-up is available at all times. The view of the Royal College of Anaesthetists⁽²⁾ that "Senior SpRs", i.e. those in years 3, 4 and 5 of SpR training, should have increased autonomy for their own work with increased daytime and on-call responsibility for the activities of more junior staff, to my mind, sits comfortably with this view. Trainees however must not work in a situation where no consultant back-up is available. Consultant involvement in care need not always mean the physical presence of a consultant in theatre.

A Senior SpR in anaesthesia at the end of, say, SpR year 4 will have already undertaken a minimum of six years training in anaesthesia during which their clinical development and

competencies are regularly assessed. To suggest they should never provide anaesthesia to sick patients without direct in-theatre consultant supervision both devalues and diminishes the quality of anaesthesia training in the United Kingdom.

The Royal College of Anaesthetists has recently produced a compendium of audit recipes for quality improvement in anaesthesia⁽³⁾. While stressing that these are not College guidelines, they do provide guidelines to suitable standards of care. The section on emergency anaesthesia includes the following audit standards:-

1. 100% of emergency cases of ASA grade 4 or 5 should be discussed with a consultant anaesthetist before anaesthesia begins.
2. 100% of cases of ASA grade 4 or 5 should have a consultant or Senior SpR available in theatre, i.e. Senior House Officers and Junior SpRs should not anaesthetise such cases without the direct supervision of a consultant or Senior SpR.

Audit targets of 100% are by definition difficult to achieve but to provide high quality care we should aspire to these. Not all hospitals have Senior SpRs in anaesthesia and significant increased out of hours work by consultants should be reflected in job plans. Where emergency cover is provided by non-consultant career grade staff then local guidelines must reflect the experience and competencies of such staff.

Application of the above audit standard to SASM data reveals that 429 (76%) of 561 cases rated as being at considerable risk of death were anaesthetised by either a consultant or Senior SpR. Of the remainder, 10% of cases were anaesthetised by non-consultant career grade staff.

CONCLUSIONS / KEY POINTS

- Consultant surgeon presence in theatre for cases rated ASA 4 (71%) and at considerable risk of death (68%) has risen by 5% and 3% respectively when compared to 1998 data.
- Consultant anaesthetist presence is maintained at 1998 levels (ASA 4 69%; considerable risk of death 65%.)
- The peer-review SASM process does not highlight grade of surgeon and anaesthetist in emergency care as a significant concern, in the view of the assessors.
- In relation to anaesthesia all cases graded ASA 4/5 should be discussed with a consultant prior to anaesthesia.
- Many cases graded ASA 4/5 will require the presence of a consultant anaesthetist in theatre. ASA 4/5 cases should have a consultant or Senior SpR in anaesthesia present in theatre. Local departmental guidelines should determine the suitability of non-consultant career grade anaesthetist involvement in these cases.

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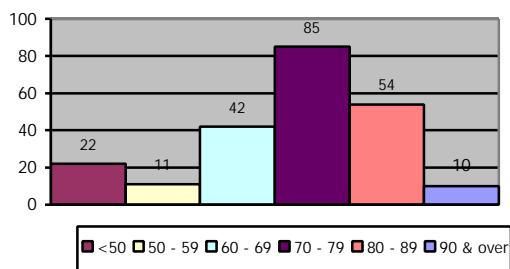
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DEATHS WITHIN 48 HOURS OF OPERATION: WHO DIES? WHY? AND WHAT ACTION COULD WE TAKE?

Some 10% of patients who fall within the remit of SASM die within 48 hours of a surgical operation. During 1999, the dates of operations and death were not recorded on the SASM database. However, by linking SASM recorded deaths with SMR1 data on deaths within 48 hours of operation from ISD, 224 patients were identified for the first 6 months of 1999 (the most recent linked SMR1/GRO data available at the time).

One hundred and thirteen were male, the mean age was 72, with 149 patients over 70 years (Figure 1);

Figure 1 - Age groups

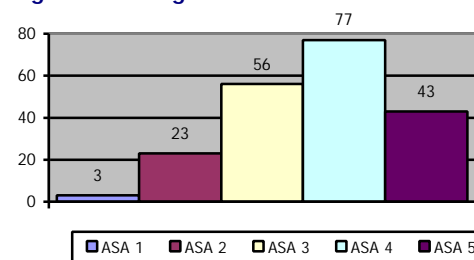


severe head injury (8) and spontaneous intracranial haemorrhage (8). In addition, cardiac deaths (41 patients), septicaemia (13) and direct complications of care (10) were given as causes of death.

178 were admitted and operated upon as an emergency (44 elective, 2 not known) and 176 were ASA3 or greater (Figure 2).

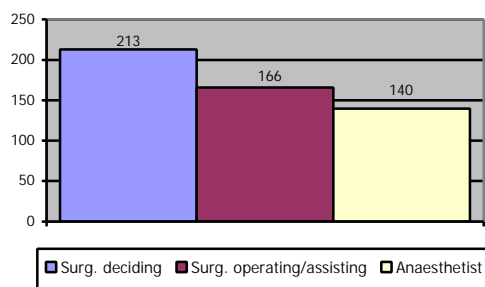
The types of surgery after which patients most frequently died were, not unexpectedly, colonic surgery (26 patients), exploratory laparotomy (26), abdominal aortic aneurysm (21), perforated duodenal ulcer (10), upper endoscopy (12), femoral fracture surgery (15) and cement related hip replacement (10).

Figure 2 - ASA grades



Consultant surgeons decided that operative intervention was required in 213/224 patients and were the principle operators (144) or assistant (22) in 166/224 operations; in keeping with this, a consultant anaesthetist was involved in 140 procedures (Figure 3).

Figure 3 - Consultant presence



technical management (14) and grade of surgeon operating (6).

Adverse factors were noted in the preoperative management of 27 patients, particularly delay to surgery (8) and postoperative care of 26 patients including delay in recognising complications (8); failure to use HDU/ICU was identified in 9 patients by both surgeons and anaesthetists, usually where no bed was available. Intraoperative management was criticised most by the surgical assessors - including the decision to operate at all (10), choice of operation (5), timing of surgery (18),

However, the anaesthetic assessors identified inadequate monitoring (7), general anaesthetic complications (5) and anaesthetist too junior (5) as factors.

Overall, adverse factors caused or contributed to death in a minority of patients (Table 1).

Table 1 Adverse factors and death within 48 hours of operation

	Surgical Assessors	Anaesthetic Assessors
Adverse event caused death	6	3
Adverse event contributed to death	27	19
Non- contributory adverse event	35	35
No adverse event	140	135
(not known)	(16)	(10)
Total cases	224	202

CONCLUSIONS

The majority of patients who die within 48 hours of operation are elderly and unfit and the underlying disease processes may leave little room for manoeuvre. Reassuringly, consultant surgeon and consultant anaesthetic input was high.

While adverse surgical or anaesthetic management caused (3% and 2%) or contributed (12% and 9%) to few deaths, preoperative and postoperative management, including failure to use HDU/ICU, continue to leave room for improvement.

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DEATHS IN PATIENTS AGED 16 AND UNDER

1999 was the first year that Paediatric Surgeons in Scotland participated in the Scottish Audit of Surgical Mortality. Prior to 1999 deaths of children under the care of consultants in other surgical specialities (for example neurosurgery) were also not regularly identified and audited by SASM. There were some difficulties experienced in initially establishing mechanisms for identification of deaths in the paediatric centres and elsewhere, but we now believe we have reasonably complete ascertainment. In view of the small numbers of childhood deaths it was felt that it would be useful to review them as a group across all specialities as well as in the individual speciality reports.

A total of 28 deaths were identified of children (up to and including 16 years of age) with 23 surgical forms returned (82% compliance). The specialities involved were Paediatric Surgery (13 cases), Neurosurgery (13 cases), Orthopaedics (1 case – a head injury) and Plastic Surgery (1 case – 90% burns). The median age was 3 years (range 3 days – 16 years). All deaths under the age of one year occurred in specialist children's hospitals under the care of Paediatric Surgeons.

Intensive care was used appropriately in 20 cases. It is not possible to ascertain the type of ICU used from the data in all cases (i.e. paediatric ICU, neonatal ICU, general ICU or single speciality ICU). In one instance an ICU bed was not available for a post-operative neurosurgical case and in one case of head injury, with a depressed conscious level but normal CT scan, observation took place on the ward rather than in a High Dependency area. The issue of Paediatric intensive care provision in Scotland has already been investigated by the SPICA study, but it does still seem from these data that there is a shortfall in provision in some areas.

It is encouraging that a consultant was either the operating surgeon or first assistant in all those cases where an operation was carried out. Similarly a consultant anaesthetist was present in all but two cases where a post CCST trainee gave the anaesthetic after consultation.

Adverse factors were identified by the surgeon or surgical assessor in 10 cases, but in only two cases were they felt to have significantly affected the outcome. These cases are discussed further in the following neurosurgical and paediatric surgical commentaries. The only common theme that emerges is that two deaths occurred from intra operative haemorrhage during attempts at resection of large tumours. The assessors suggested that pre-operative management might have been different in these two instances. There is perhaps a case for greater centralisation of the surgical care of rarer childhood tumours.

The anaesthetist or anaesthetic assessor identified adverse factors in 3 cases, but in none were they thought to have influenced the outcome.

CONCLUSION

It is encouraging that review of surgical mortality in children has been well supported. There is however room for improvement in timely notification of cases and completion of forms. One would hope, given the small number of cases, that 100% compliance might be achieved in 2000.

It is also notable that the surgical and anaesthetic care of seriously ill children is provided almost entirely at consultant level.

There does however still seem to be an issue, even in this age group, with access to ICU or HDU beds, a lack of availability being identified as an adverse factor in two cases.

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DEATHS IN THE ELDERLY (AGED 85 AND OVER)

Despite some recent speculation, age alone has never been a bar to surgery. Although surgery is often carried out in patients aged over 85, it is never undertaken lightly and patients are generally considered to be at higher risk because of increasing frailty and the consequences of co-existing disease. In Scotland, in 1999, life expectancy at birth was 73 years for men and 78 years for women. More than 77,000 people were over the age of 85 years and, of these, two thirds were women (General Register Office for Scotland Annual Report). Twenty five per cent of those aged 85 and over are often housebound and 20% suffer from dementia. (Strathclyde Elderly Forum).

In Scotland in 1999, 863 patients aged over 85 died in surgical wards. Seventy per cent had been admitted as emergencies. Three hundred and sixty nine had undergone surgery and this figure represents 18% of all surgical deaths in Scotland. Sixty eight per cent were female. Of the non-operative cases, almost three quarters had been admitted for terminal care or death was deemed inevitable on admission. In this age group, 93% of post-operative deaths occurred in the specialties of general, vascular and orthopaedic surgery. The rest of the comparative data in this article are confined to these specialties.

OPERATIVE CASES – COMPARISON WITH ALL SURGICAL DEATHS

- 13% of all general surgical deaths occur in the over 85s
- 10% of all vascular surgical deaths occur in the over 85s
- 41% of all orthopaedic deaths occur in the over 85s

COMPARISON WITH ALL OPERATIVE DEATHS IN THE OVER 85s

- 38% of all operative deaths in the over 85s are in general surgery (54% for under 85)
- 9% of all operative deaths in the over 85s are in vascular surgery (16% for under 85)
- 46% of all operative deaths in the over 85s are in orthopaedic surgery (14% for under 85)

Given the preponderance of deaths in orthopaedics, are there differences in factors which might influence outcome? The following data are presented as percentage of total in each specialty. Figures in brackets represent those under 85 years.

Risk factors

	General	Vascular	Orthopaedics
CVS	58 (49)	75 (74)	76 (56)
Respiratory	22 (31)	18 (36)	31 (37)
Renal	17 (17)	12 (17)	25 (14)
Neurological/Psychiatric	8 (9)	27 (11)	36 (28)

Specific CVS risk factors

	General	Vascular	Orthopaedics
Angina	14 (12)	15 (19)	10 (13)
Cardiac Failure	19 (11)	24 (20)	21 (15)
Arrhythmia	21 (12)	27 (18)	20 (10)
Tachycardia	19 (27)	12 (18)	11 (14)

Respiratory, renal and neurological/psychiatric risk factors are higher in those over 85 undergoing orthopaedic surgery, when compared with those over 85 undergoing general/vascular surgery. No tests of significance have been applied. Patients over 85 have in general more specific cardiovascular risk factors than those under 85. Orthopaedic patients over 85 are not at greater risk from specific cardiovascular risk factors.

Risk of death – pre-operative assessment

	General	Vascular	Orthopaedics
Considerable or expected	60 (54)	46 (63)	53 (50)
ASA Grade 3+4	75 (72)	76 (72)	87 (79)

The risk of death is not considered higher in orthopaedic surgery although more patients undergoing orthopaedic surgery are classed ASA 3 and 4.

Consultant presence

	General	Vascular	Orthopaedics
Consultant operating	50 (64)	69 (78)	31 (44)
Consultant operating or assisting	68 (77)	85 (83)	45 (54)

Consultant presence in theatre is lower in the over 85s in general and orthopaedic surgery.

	General	Vascular	Orthopaedics
Consultant anaesthetist	66 (69)	76 (75)	57 (73)

In the over 85 age group consultant anaesthetists are present less often during general and orthopaedic procedures. To put these figures into a UK perspective, the "Extremes of Age" report from NCEPOD (1999) which analysed deaths in patients over 90 years in England and Wales showed an overall consultant presence in theatre of 43% for surgeons and 43% for anaesthetists.

Use Of ICU/HDU

	General	Vascular	Orthopaedics
ICU used	31 (44)	12 (33)	3 (10)
If not, should have been	3 (2)	0 (0)	0 (0)
HDU used	31 (25)	15 (17)	6 (10)
If not, should have been	30 (17)	12 (8)	19 (12)

Clinicians consider that use of HDU is sub-optimal across all specialties.

CVP used

	General	Vascular	Orthopaedics
Yes	48 (52)	24 (43)	3 (7)

For a population with considerable renal risk factors the use of CVP monitoring in orthopaedics could be considered low. Yet this must be balanced by the fact that a large number of patients have their surgery under a regional technique (47% Spinal/Epidural – Scottish Hip Fracture Audit) and most anaesthetists might choose to retain the simplicity of this technique and rely on clinical acumen instead.

DISCUSSION

Perhaps it is important to maintain a sense of perspective when considering these figures. Of the total population of just over 5 million in Scotland, 0.09% die in surgical wards each year. In patients aged over 85 years, 1% die on surgical wards yet a tenfold difference is hardly surprising in this elderly population.

Are the figures for orthopaedics of concern? The large preponderance of orthopaedic deaths in the over 85s reflects a greater susceptibility to injury in the elderly. For example, of 5952 patients admitted with a fractured hip, 2148 were aged over 85. This group is already audited nationally by the Scottish Hip Fracture Audit.

The question of whether greater consultant input in theatre would influence outcome is an important yet unresolved question. The relationship seems unlikely as assessors thought the surgeon too junior in only 13 cases out of 369 (6 general surgery, 7 orthopaedic). Consultants need not be present in theatre for every case as long as trainees are operating within their competence and consultants are aware of the case. However consultants must not abrogate their responsibility for the peri-operative management of these elderly and infirm patients. Expert care before and after the operation is vital in this age group and it is in this area that consultants must take the lead in what is often a multidisciplinary approach.

Surgeons and assessors considered adverse factors caused death in a total of 8 cases (3 general surgery, 1 neurosurgery, 2 orthopaedic surgery, 1 ENT and 1 vascular). In only two was there agreement between surgeon and assessor (1 general surgery, 1 neurosurgery).

Perhaps the only remaining question concerns the place of surgery in some elderly patients in whom the risks are almost impossibly high. Can we not yet relieve pain and suffering with dignity even perhaps in the pre- hospital setting without resorting to surgery?

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PERI-OPERATIVE RISK ASSESSMENT WITHIN SASM

Whilst the nature and type of surgery and the pathology for which it is being performed contribute to the overall risk of death, it has long been recognised that associated co-existing disease can increase that risk of death substantially. The incidence of such co-existing risk factors have been sought on both the surgical and anaesthetic assessment forms, however only recently have questions been included that enquire how this incidence impacted on the management of the patient. This report will concentrate on the concurrence between surgeon and anaesthetist in assessment of co-existing risk factors, and with particular reference to cardiac risk factors, whether their presence impacted on the timing of surgery, the grade of surgeon or anaesthetist at operation, and the use of critical care facilities (ICU/HDU). For the purposes of this report percentage rates have been used for comparison, and no tests of significance have been applied.

CO-EXISTING RISK FACTORS

Table 1 indicates the organ systems and the incidence of risk factors.

Table 1 Significant co-existing factors increasing risk of death

Risk Factor	SURGICAL		ANAESTHETIC	
	n (%)	% opinion (% consultant)	n (%)	% opinion (% consultant)
Cardiac	1131 (61)	44 (81)	1169 (63)	22 (80)
Respiratory	671 (36)	36 (82)	654 (35)	16 (92)
Renal	312 (17)	42 (78)	347 (19)	20 (91)
Hepatic	154 (8)	37 (89)	132 (7)	24 (100)
Neurological/psychiatric	347 (19)	24 (79)	337 (18)	17 (100)
Advanced malignancy	359 (19)	36 (100)	350 (19)	35 (88)
Obstructive jaundice	43 (2)	63 (81)	25 (1)	40 (80)
Other	378 (20)	28 (80)	468 (25)	19 (89)

It comes as no surprise that cardiovascular risk factors are the most frequent (63%), followed by respiratory (35%), renal (19%) and advanced malignancy (19%). There is good agreement between surgeon and anaesthetist in all categories. With regard to whether these risk factors were referred for specialist opinion, there is an almost twofold higher referral rate from surgeons than anaesthetists for the equivalent risk factor. This may well represent a confusion as to which specialist opinion is being sought, with some of the surgical referrals being actually to anaesthetic colleagues. Likewise some anaesthetists may have felt that an anaesthetic opinion was the most appropriate in the circumstances, and recorded this in a non-uniform manner. In all systems, 80% of the opinions sought were from a consultant.

ASSESSMENT OF RISK OF DEATH

Table 2 indicates that overall there is good concurrence between assessments performed by surgeon and by the anaesthetist.

Table 2 Risk of death

SURGICAL	n	%	ANAESTHETIC	n	%
Minimal	44	2	ASA 1	23	1
Small	204	12	ASA 2	242	14
Moderate	556	31	ASA 3	666	37
Considerable	824	46	ASA 4	656	37
Expected	156	9	ASA 5	197	11

However Table 3 indicates that surgeon and anaesthetist agree on the risk in only 47% of cases.

Table 3 Risk of death (surgical view) v ASA grade (anaesthetic view)

<i>Anaesthetic</i>	ASA 1	ASA 2	ASA 3	ASA 4	ASA 5	TOTAL %
<i>Surgical</i>						
Minimal	6	2	12	4	0	44 (2)
Small	7	78	90	22	7	204 (12)
Moderate	4	97	288	146	21	556 (31)
Considerable	4	39	255	409	117	824 (46)
Expected	2	6	21	75	52	156 (9)
TOTALS	23 (1%)	242 (14%)	666 (37%)	656 (37%)	197 (11%)	1784 (100%)

Over estimation occurs in 29% with respect to surgeons and 25% with respect to anaesthetists. Given the fact that all these patients died, there is an obvious underestimate in risk of death generated by the uncertainty of pathology prior to operation, and the advent of complications. However less than 15% of patients had low estimates of death which is reassuring!

RISK OF DEATH v GRADE OF CLINICIAN

Table 4 details the percentage of patients within each risk category with consultant surgeon or consultant anaesthetist as the lead clinician.

Table 4 Risk of death v consultant

Pre-op Risk	Consultant Surgeon n (%)	Consultant Anaesthetist n (%)
Minimal	27 (61)	30 (68)
Small	137 (67)	146 (72)
Moderate	305 (55)	352 (63)
Considerable	472 (57)	551 (67)
Expected	106 (68)	110 (71)

Neither the level of supervision nor the experience of the non-consultant grade is available, and therefore it is difficult to be over-critical of the percentages seen. More detailed analysis would require additional questions to be incorporated in the assessment form.

CARDIAC RISK FACTORS PRESENT AT LEAST 24 HOURS PRE-OPERATIVELY

Table 5 shows the incidence of angina, cardiac failure, arrhythmia and tachycardia, along with pre-existing treatment and the percentage of patients who required new treatment to be instituted.

Table 5 Cardiac risk factors present at least 24 hours pre-op

	Risk factor n (%)	Pre-existing treatment n (%)	New treatment instituted n (%)
Angina	280 (24)	374 (32)	44 (4)
Cardiac Failure	293 (25)	335 (29)	92 (8)
Arrhythmia	282 (24)	235 (20)	84 (7)
Tachycardia (>100)	415 (36)	114 (10)	109 (9)

These risk factors were recorded as being present in at least 24% of all cases. With the addition of hypertension and myocardial infarction the incidence increases to 63%. Interpretation is difficult given the variability of treatment percentages and the very small number of patients that required additional treatment. It may well be that there has been confusion with concurrent symptoms of over 24 hours duration, and previous symptoms that have occurred in the past, both being reported.

CRITICAL CARE USE v CARDIAC RISK FACTORS v URGENCY OF SURGERY

The overall SASM population reveals that only 15% of patients who died underwent elective surgery. The same pattern is reflected within the 4 cardiac risk factors (angina 24%, cardiac failure 15%, arrhythmia 16%, tachycardia 8%) in Table 6.

Table 6 Critical care (ICU & HDU) use v cardiac risk factor v urgency of surgery

	Angina n (%)	Cardiac Failure n (%)	Arrhythmia n (%)	Tachycardia n (%)
Elective	57 (54)	21 (37)	30 (40)	23 (43)
Immediate	21 (70)	9 (74)	13 (77)	40 (60)
Urgent	60 (55)	66 (53)	70 (41)	159 (58)
Scheduled Urgent	53 (29)	59 (24)	56 (29)	84 (37)
TOTAL	191 (44)	155 (36)	169 (37)	306 (49)

The overall use of critical care facilities for patients who died with these pre-existing risk factors shows that less than 50% received either intensive or high dependency care. Whilst a higher incidence was seen within the immediate surgery group, a surprisingly low incidence was seen in the scheduled urgent group, which is difficult to explain. Further investigation into this group with regard to the nature of the operation may well reveal characteristics of these patients which would make the use of critical care facilities inappropriate.

Detailed examination of the differential use between ICU and HDU reveals that ICU is more likely to be used if a patient has had angina or tachycardia, whereas pre-existing arrhythmia or cardiac failure does not increase the usage of ICU. High dependency admission is uniform across all categories ranging between 10-17%, and is not affected by the presence of the cardiac risk factor. One can only query whether admission to HDU is governed more by the operation performed or other risk factors as yet to be identified.

CRITICAL CARE USE v CARDIAC RISK FACTOR v CONSULTANT

Table 7 shows that both surgeon and anaesthetist consultant input is marginally less for patients with pre-existing cardiac failure or arrhythmia when compared to those with angina and tachycardia.

Table 7 Critical care (ICU & HDU) use v cardiac risk factor v consultants

	Angina n (%)	Cardiac Failure n (%)	Arrhythmia n (%)	Tachycardia n (%)
Consultant Surgeon	120 (49)	108 (46)	103 (46)	176 (52)
Consultant Anaesthetist	156 (47)	132 (42)	131 (42)	198 (51)

These differences are unlikely to be significant and reveal a recorded consultant involvement in patients with cardiac risk factors of approximately 50%. Without knowing the seniority of staff involved or the individual cases, it would be rash to conclude that this percentage is inappropriately low.

CONCLUSIONS

Whilst there is good concurrence between anaesthetist and surgeon in the assessment of risk of death, it is difficult to find evidence that this affects patient management in terms of timing of surgery, grade of clinician involved or the use of critical care facilities. Pre-existing angina and/or tachycardia is associated with increased intensive therapy admission, whilst the equally serious risk factors of arrhythmia and/or cardiac failure are not. Further refinement of the questions in the assessment forms may lead to greater insight into these problems.

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PATIENT TRANSFER

The inter-hospital transfer of patients is a fundamental component of a health care system allowing access to various levels of care and medical sub-specialisation for individuals and communities, which may not have access to such care. The transport of critically ill patients always involves some degree of risk to the patient and therefore the decision to transport must be based on assessment of the potential benefits of transport weighed against the potential risks. Within the NHS in Scotland development of increasing surgical sub-specialisation and the concurrent introduction of managed clinical networks may well lead to an increase in inter-hospital transfer in the future.

In 1999, of 4657 surgical patients who died 787 deaths occurred in patients who were transferred between hospitals. This represents 17% of all deaths. In years 94-98 the percentage of deaths that were transferred was around 22%. The sub-specialities organised on a regional basis, Neurosurgery and Vascular Surgery, not surprisingly accounted for the highest percentage of transferred patients at 63% and 18% respectively. Emergency cases were more likely to require transfer than elective cases. Two-thirds of the patients who died were transferred less than 30 miles. There was a delay in transfer of 11% of patients and in 3% a problem was acknowledged during transfer. Transfer was considered by reviewers to be inappropriate in 30%.

Within the confines and limitation of the current audit it is difficult to define the precise problems encountered during transfer, but of significant concern is that 30% of patients were considered to have been inappropriately transferred. Again it is impossible with the current data to establish the reasons that the transfer was considered inappropriate, but the age data confirms that over 200 patients aged 80 and over were transferred between hospitals and subsequently died. An interesting fact that SASM reveals is a fall in the number of patients, who subsequently died, who were transferred. A number of explanations are possible; a greater number of patients are surviving after transfer; alternatively fewer patients are being transferred and deaths are occurring in the primary hospital. The latter may be the more likely explanation given the increased high dependency resources that have been made available. Increased high dependency beds may have taken some of the pressure off Intensive Care Units thus reducing the requirement to transfer patients for ICU. In addition the number of patients transferred for surgical care as opposed to ICU care has remained relatively constant.

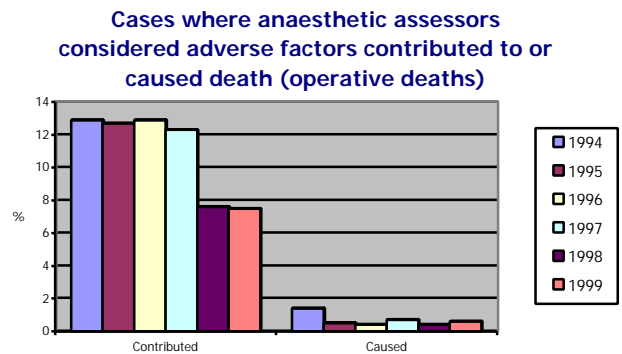
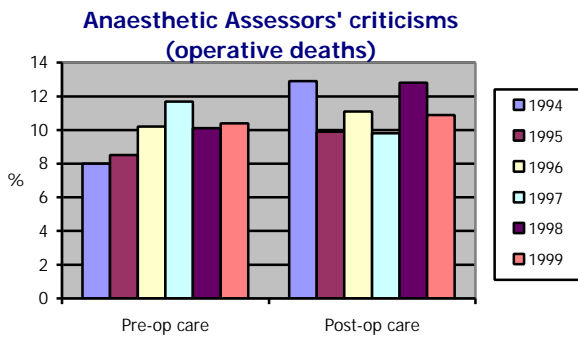
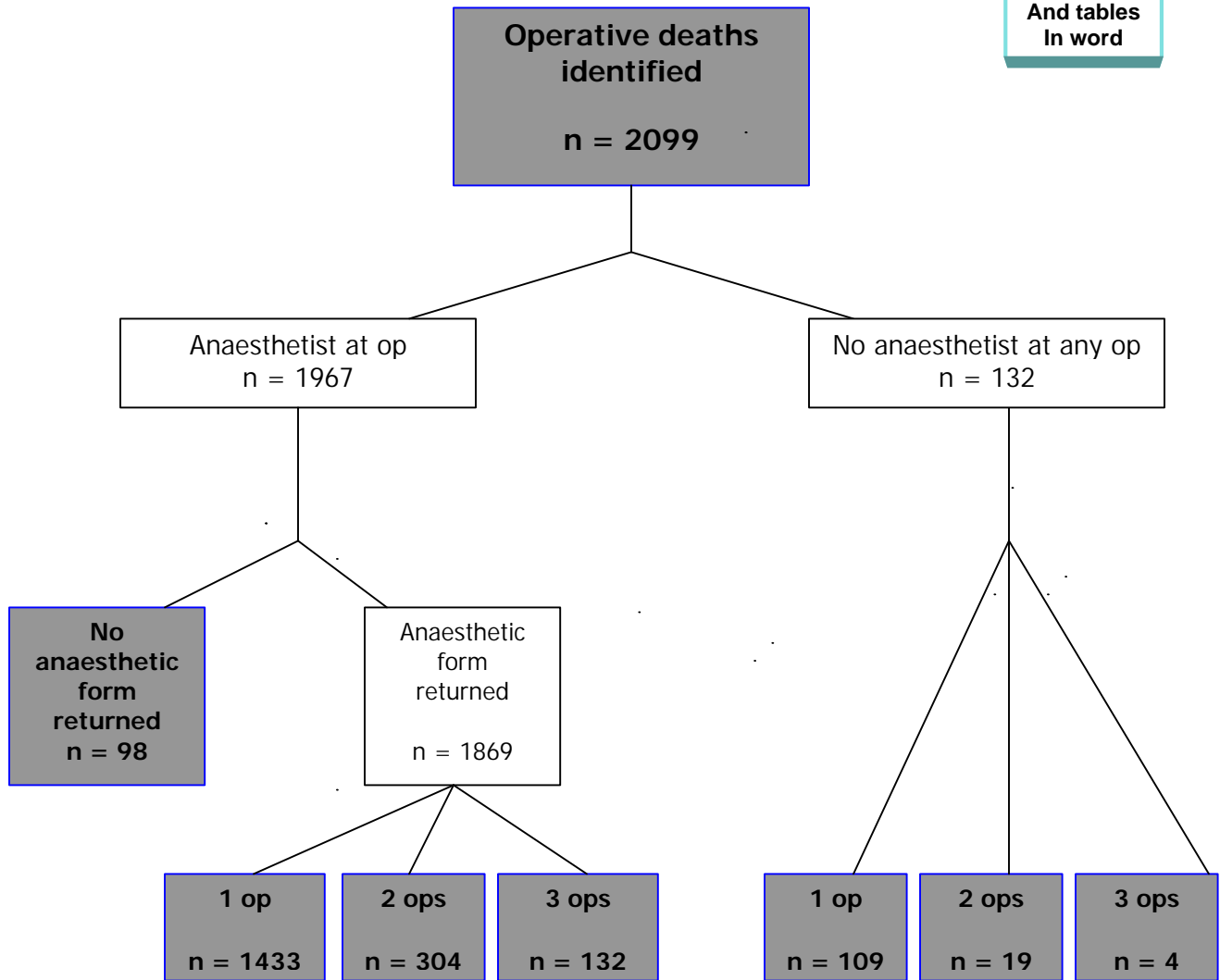
The inter-hospital transfer of critically ill patients facilitates the existence of an integrated health care system and occurs with the expectation that potential complications on route may be adequately managed by transporting personnel. Risks to the patient during transfer can therefore be minimised by careful planning, adequate communication and an appropriate level between the referring and the receiving unit, with the use of appropriate qualified accompanying staff and selection of appropriate equipment. There must be no interruption during transport in the monitoring and maintenance of the patient's vital functions. SASM has shown that in a small number of all patients this is not happening. Ideally, a dedicated specially trained team should perform inter-hospital transport of critically ill patients. Several organisations including the Intensive Care Society, the Association of Anaesthetists of Great Britain and Ireland and the American College of Critical Care Medicine have developed guideline documents concerning inter-hospital transport. These documents represent the minimum standard that should be provided during transport of any critically ill patient. The development and implementation of such protocols should avoid unnecessary transportation of patients who are unlikely to benefit from transport.

***Mr George H Welch, Consultant Vascular Surgeon
Southern General Hospital, Glasgow***

Index

ANAESTHETICS

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ANAESTHETICS OVERVIEW

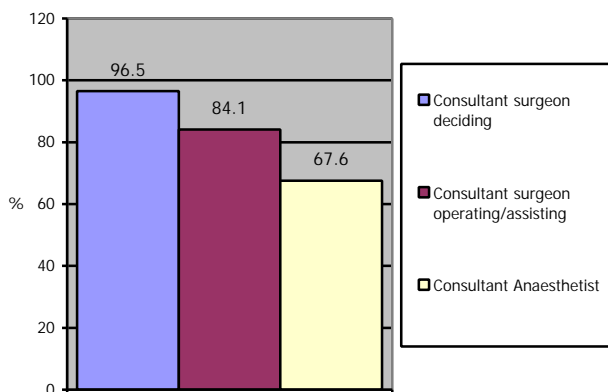
The Scottish Audit of Surgical Mortality is an on-going and evolving peer-review process. Nonetheless, many of the issues raised each year follow a familiar theme. Subjects such as the chronic under provision of HDU and ICU beds have been highlighted over successive years to good effect. Indeed, media coverage of recent SASM reports has certainly helped concentrate political minds on this on-going problem.

However, we must aim to avoid "audit fatigue" and, to this end, SASM continues to focus on new topics of interest to surgeons and anaesthetists in Scotland. This year's report contains articles either written or co-written by anaesthetists on subjects such as peri-operative risk assessment and deaths in the over 85s, as well as a further look at the level of senior staff involvement in the in-theatre care of sick patients undergoing emergency surgery. Details of these reports appear elsewhere in this volume.

As stated previously, much of the SASM data is available year on year and this allows for comparison between years. The main points from 1999 can be outlined as follows:-

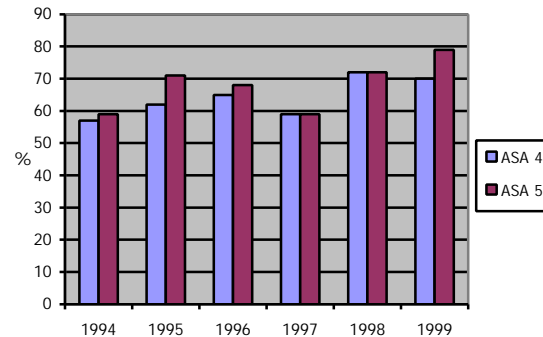
In 1999 SASM received information from 1869 completed anaesthetic forms. Of these, 1316 (71%) were completed by a consultant anaesthetist. Of cases where data on the grade of anaesthetist were available, a consultant anaesthetist was present in theatre for 1495 (68%) of 2212 procedures (Figure 1).

Figure 1



Sub-division of this data for the sickest patients is as follows (Figure 2), with previous years' SASM figures for comparison:-

Figure 2



These figures reflect a trend of increased in-theatre management of ASA 4 and 5 patients by consultant anaesthetists as documented in successive SASM annual reports.

Data on grade of anaesthetist are considered more fully in a separate article.

VIEWS OF ANAESTHETIC ASSESSORS

Peer review allows feedback from assessments.

Pre-operative management was criticised by anaesthetic assessors in 169 (10%) of cases (1998:10%). Most common criticisms in this period were: inadequate monitoring (24 cases), unsatisfactory medical management (23 cases), delay in transfer to surgeons by physicians (19 cases) and inadequate resuscitation (19 cases).

Intra-operative management was criticised by anaesthetic assessors in 91 (5.6%) of cases. The commonest adverse factors highlighted here were: inadequate monitoring (19 cases) and anaesthetist too junior (16 cases).

Criticism by anaesthetic assessors of post-operative management occurred in 173 (11%) of cases (1998: 9%). The most common adverse factors in this group were: failure to use HDU (49

cases), unsatisfactory medical management (33 cases) and inadequate monitoring (25 cases). When considering overall management from admission to time of death, anaesthetic assessors found no adverse factors in 75% of cases. In a further 17% of cases any adverse factors identified were felt to have had no impact on outcome. Inadequate monitoring is highlighted as an adverse factor throughout the peri-operative period. In particular, lack of the appropriate use of Central Venous Pressure monitoring continues to be of concern.

ICU/HDU

SASM has regularly highlighted problems in the availability of ICU and, in particular, HDU care.

In 1999 only 12 cases are highlighted where ICU was not used but should have been. This compares to 35 cases in 1998. Inter-hospital transfer to provide ICU care is not uncommon and this may to some

extent mask a more significant deficiency in this area.

Failure to use HDU care where it should have been used is highlighted in 118 cases compared to 92 cases in 1998. The lack of availability and use of HDU care continued to be a significant problem in 1999. Given the high political profile attached to critical care services, it will be of interest to assess the impact of any future improved provision.

CONCLUSION

The provision of anaesthesia in Scotland is of a high standard. By its very nature a mortality audit will highlight even minor adverse factors. The levels of significant criticism by assessors are low, with 94% of cases having no criticism of in-theatre anaesthetic management. Consultant anaesthetist presence in theatre for ASA 4 and 5 cases has in general increased over successive years of SASM. Under provision of HDU care continued to be a concern in 1999.

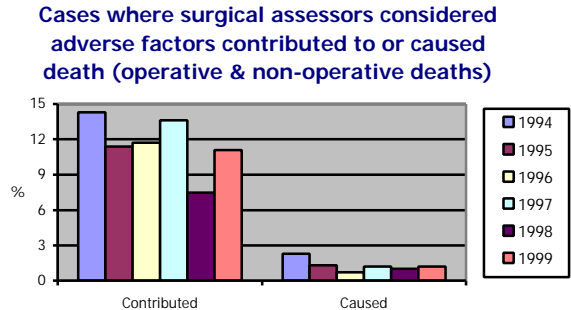
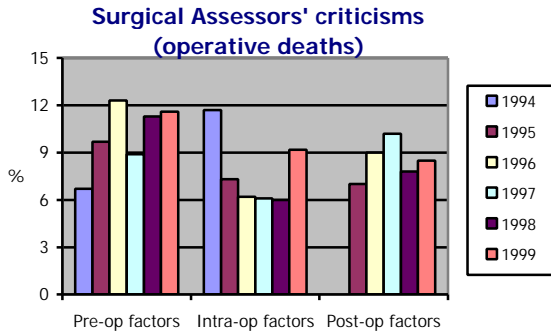
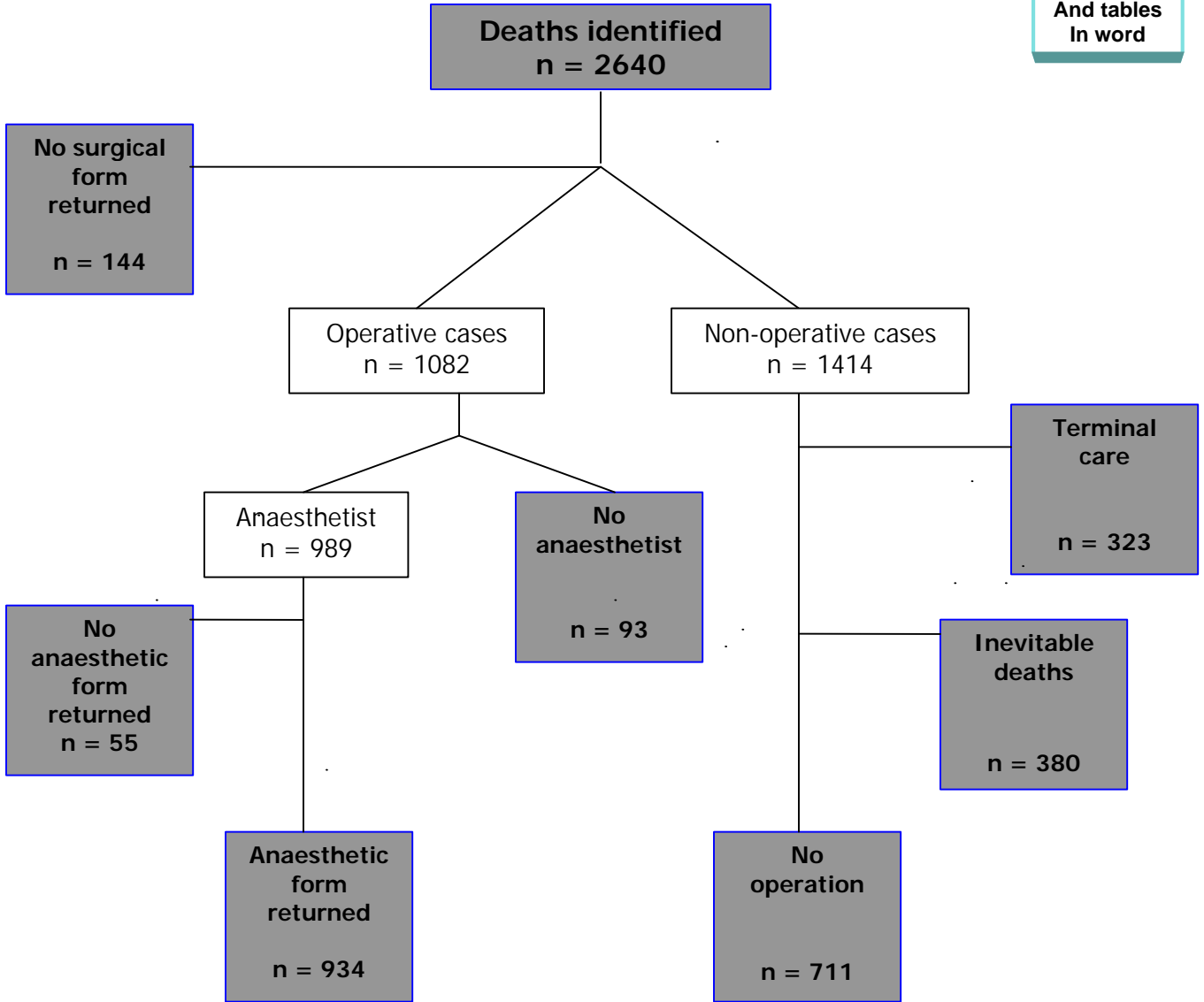
***Dr E Wilson, Consultant in Anaesthesia and Intensive Care
Ninewells Hospital, Dundee***

<i>Most Common Adverse Events in Management</i>
ANAESTHETIC ASSESSORS
Failure to use HDU
Unsatisfactory medical management
Inadequate monitoring
Anaesthetist too junior

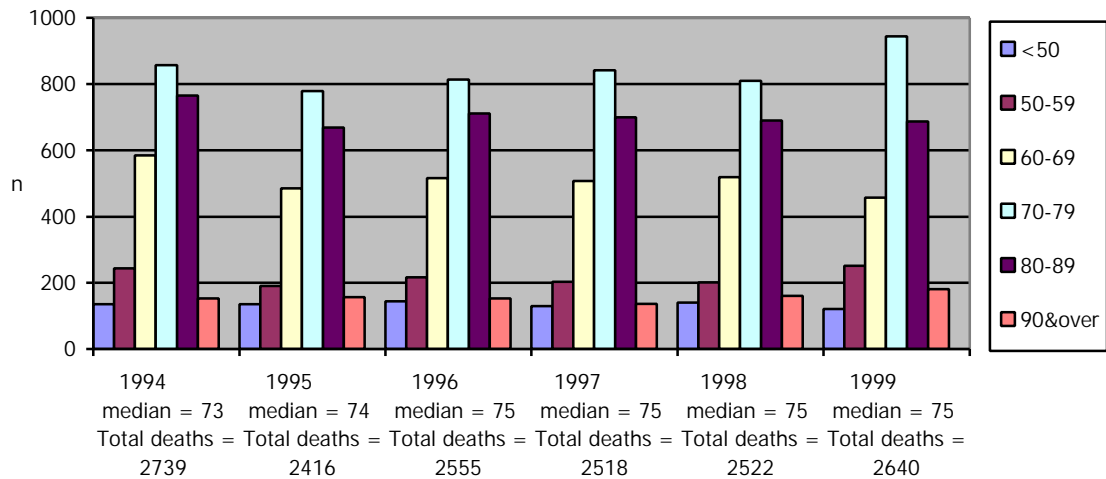


GENERAL SURGERY

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Age distribution (all deaths) by year



Test for trend: p value = 0.157

The p value here is rather high, suggesting that there is not a significant change in the age distribution over the years, although the median age changes from 73 in 1994 to 75 in 1999. The chart shows that the increase occurs only in the first 3 years.

Age ≥ 80 and < 60 by year

Age	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
≥ 80	918	33.5	826	34.2	864	33.8	836	33.2	851	33.7	867	32.8
< 60	379	13.8	326	13.5	361	14.1	333	13.2	342	13.6	372	14.1

Type of admission by year

Emergency	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	1653	82.6	1073	83.2	1564	83.7	1509	84.1	1667	84.1	1560	85.6
No	349	17.4	217	16.8	304	16.3	286	15.9	314	15.9	262	14.4
unknown	247		754		251		248		216		495	

Percentages shown exclude the "unknown" cases Chi-squared test for trend: p value = 0.132

The p value here is again rather high, suggesting there is no significant change in the percentage of emergency admissions over time.

ASA grade 4 (at 1st operation) by year

ASA	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Grade 4	343	36.1	322	38.4	296	37.6	297	36.8	349	41.5	354	38.7

Chi-squared test for trend: p value = 0.116

The p value is also rather high, which again suggests no significant change over time in the percentage of patients in ASA grade 4.

Operative cases with Consultant Surgeon operating by year (this does not include consultant surgeons assisting or present in theatre)

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	643	60.7	572	60.9	583	63.4	582	63.1	644	63.4	642	62.1
No	416	39.3	367	39.1	336	36.6	340	36.9	371	36.6	391	37.9
Unknown	76		42		54		58		59		51	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.663**

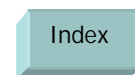
The p value shown here indicates that there is no significant change over time in the percentage of operative cases where a consultant surgeon operated.

Operative cases with Consultant Anaesthetist present by year

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	528	55.6	510	61.0	500	63.5	562	69.7	588	69.8	625	68.6
No	422	44.4	326	39.0	288	36.5	244	30.3	254	30.2	286	31.4
Unknown	185		145		185		174		232		173	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = <0.001**

Here, the p value is highly significant, which strongly indicates that a trend exists. Figures in the table also suggest that there is an increase. These indicators combined, strongly suggest that there is an upward trend in the percentage of operative cases where an anaesthetist was present.

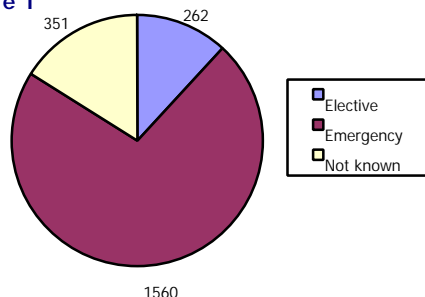


GENERAL & GASTROINTESTINAL OVERVIEW

During 1999 2,640 patients died in Scottish hospitals while under the care of General and /or Gastrointestinal Surgeons. This figure represents 57% of all Scottish "surgical" deaths. The surgical proforma was returned to the appropriate SASM Office for 95% of deaths (n=2,496), the form having been completed by a consultant surgeon in 87% of cases. Consultants defined themselves as General Surgeons (64%), General Surgeons with a special interest in Gastroenterology (27%) or General Surgeons with a special interest in Vascular Surgery (9%).

Eighty-six per cent of the patients reviewed were admitted to a surgical unit as an emergency. (Figure 1)

Figure 1



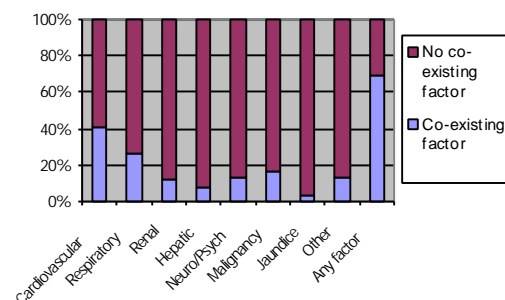
Eighteen per cent of these patients were transferred within or between hospitals during their last admission. There was no delay in transfer in 90% of cases, no problems during transfer in 98% of cases and a satisfactory information handover was achieved in 96% of cases. By far the commonest reason for delay in transfer to a surgical unit was found to be a perceived failure of non-surgical staff diagnosing surgical conditions or complications in non-surgical units. The review found that **within** surgical units complications were recognised promptly in 95% of cases.

Fifty-seven per cent of the 2,496 patients reviewed in this section had no invasive intervention during their last admission. Fifty per cent of these 1,414 patients were admitted for palliative or terminal care. Only 1,082 of the 2,496 patients reviewed in this section underwent an invasive procedure prior to death (91% under general anaesthesia). Twenty-five per cent of these 1,082 patients were classified as "expected to die" prior to any

surgical intervention and therefore only 813 patients (33% of the total reviewed in this section) represent a true failure of "surgical" management for whatever reason. In other words the SASM review process has revealed that 67% of the patients who died under the care of a General and/or Gastrointestinal Surgeon in Scotland during 1999 had no chance of surviving their terminal illness and only 33% of these patients had any potential to be discharged from hospital alive.

To make things worse 69% of the patients who were offered surgical treatment with some hope of benefit had significant ongoing morbidity in at least one main physiological body system other than the system primarily affected by the acute presentation (Figure 2).

Figure 2

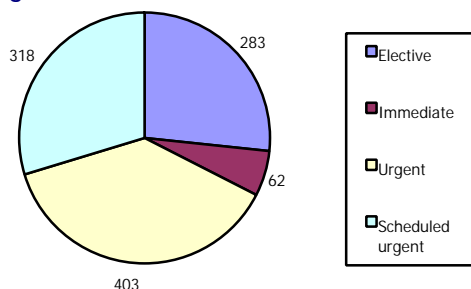


Where possible, specialist advice was sought for the majority of these patients (22% to 60% depending on the system/systems involved) and that advice was given by another consultant in 88% of cases.

The 1999 SASM data has revealed that in fatalities subsequent to surgery a Consultant General and/or Gastrointestinal Surgeon was scrubbed up at the operating table in 88% of cases. Where trainee surgeons operated without a consultant present it was found that the consultant surgeon in charge of the patient was fully informed about the case and entirely confident in the trainees ability to perform the procedure in 96% of these operations. The vast majority of trainee surgeons who operated without a consultant present had 2 – 6 years experience in their grade (median = 4 years).

This audit reveals that 27% of post-operative deaths (within the same admission) followed a primary procedure that was classified by the surgeon completing the proforma as "elective" (Figure 3).

Figure 3



This indicates that even following an emergency admission there was adequate time for pre-operative management and this relatively high figure raises an issue which could be the subject of further audit. Is our pre-operative risk management poor or is our patient population co-morbidity such that we cannot really expect a better outcome?

Five hundred and twenty-four of the patients in this section of the audit were managed in an Intensive Therapy Unit at some time during their admission. A review of the cases concluded that a further 7 patients may have benefited from ICU care. Four hundred and eighteen of the patients in this section of the audit were managed in a High Dependency Unit at some time during their admission. Review concluded that a further 58 patients may have benefited from HDU care. These findings support the conclusion that during 1999 the High Dependency bed complement in Scotland was insufficient to meet patient needs.

Appropriate prophylaxis against deep venous thrombosis was prescribed in 73% of patient admissions reviewed in this

section of the audit. A documented decision not to employ DVT prophylaxis was made in 93% of the remaining cases.

On retrospective analysis the surgeon completing the proforma concluded that a change in management could not have altered the fatal outcome in 88% of patients. Independent peer review of the data (11% of cases went for full case note review) produced exactly the same figure of 88%.

The adverse factors recorded by both the surgeon completing the proforma and the peer review surgeon mainly fall into three categories, namely pre-operative management (n=115), post-operative care (n=83) and intra-operative management (n=90). It will be noted that criticism of intra-operative care is outnumbered by criticism of the systems providing care before and after surgery.

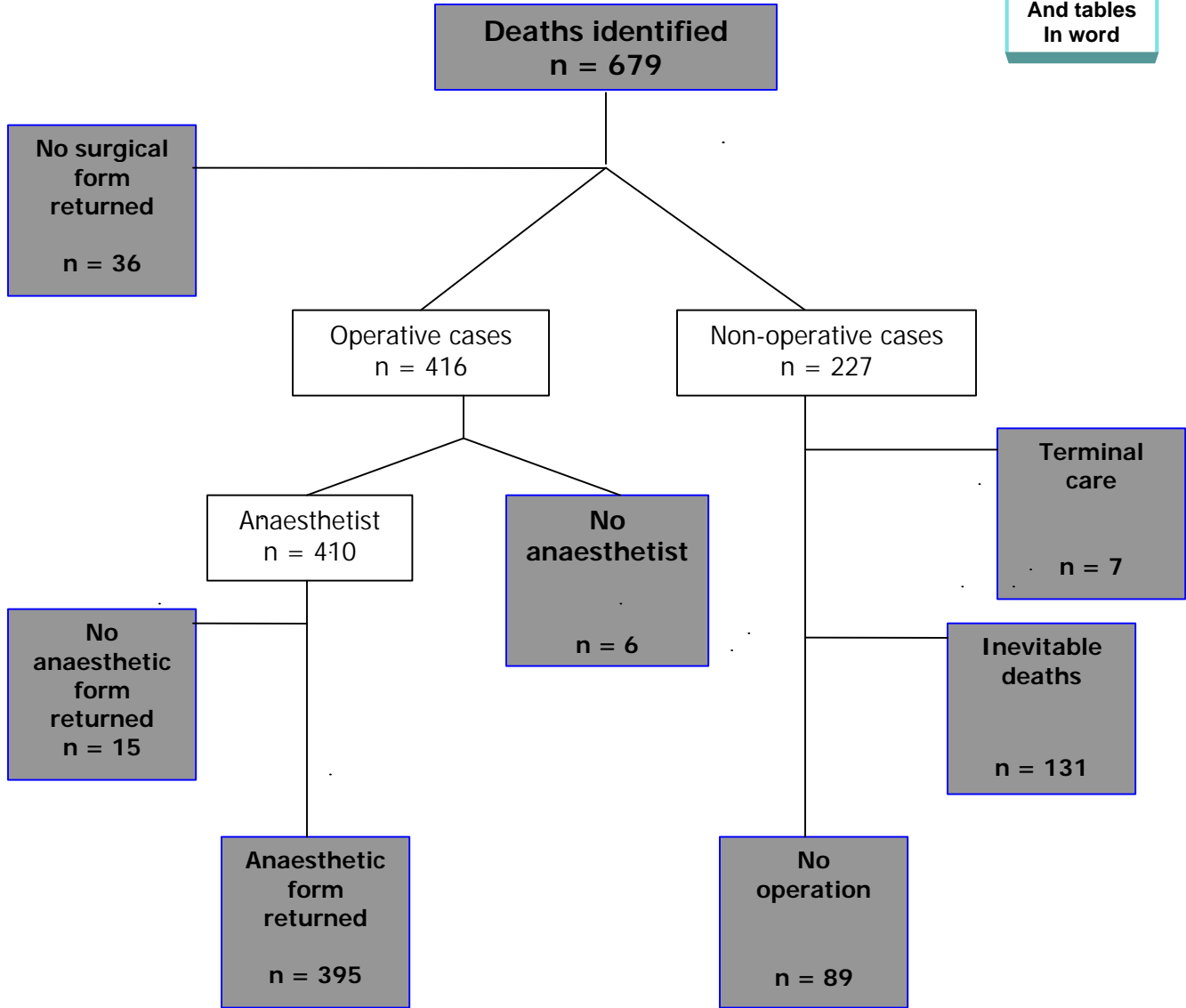
In conclusion, the 1999 SASM data of deaths of patients under the care of General and/or Gastrointestinal Surgeons shows yet again that the vast majority of patients who die do so following an emergency admission with pathology that is, in the majority, irreversible. It is also important to note that the treatment of potentially manageable pathology is adversely affected in the vast majority of patients by significant ongoing co-morbidity. These two critical factors dominate outcome which, in my opinion, cannot be significantly improved by addressing the minor issues. Surgical teams can, however, fine-tune their performance and this audit suggests that special attention should be paid to pre-operative risk management and the basic principles of post-operative care.

**Mr W R Murray, Consultant Surgeon
Glasgow Royal Infirmary**

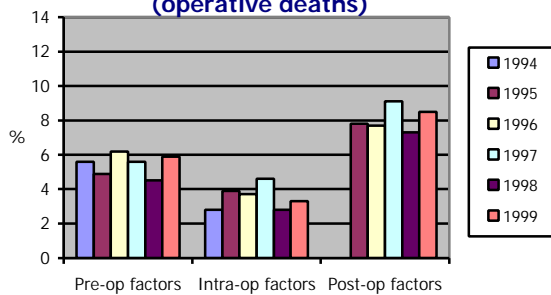
Most Common Adverse Events in Management – General Surgery	
Surgical Assessors	Anaesthetic Assessors
Delay to surgery, ie earlier operation desirable	Failure to use HDU
Wrong operation performed	Inadequate monitoring
Surgeon too junior	Unsatisfactory medical management

ORTHOPAEDICS

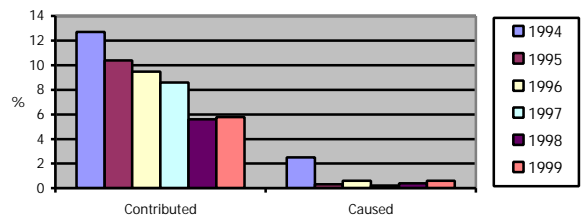
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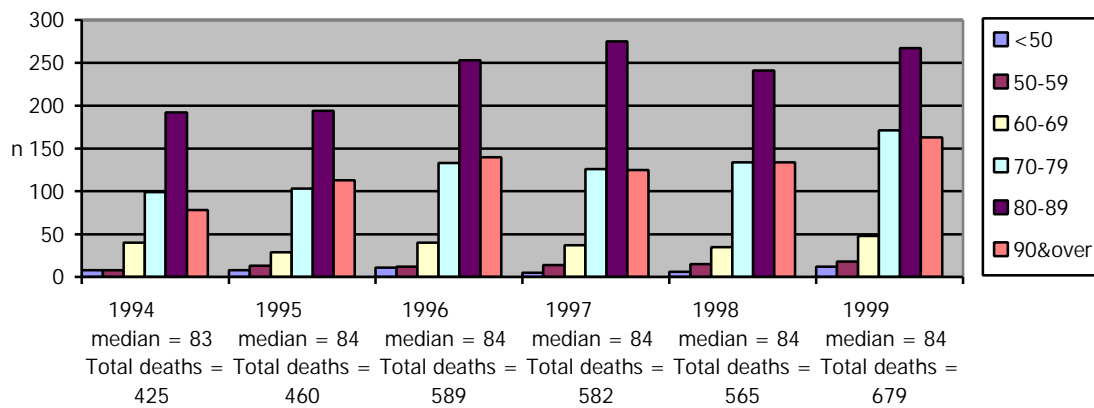
Surgical Assessors' criticisms (operative deaths)



Cases where surgical assessors considered adverse factors contributed to or caused death (operative & non-operative deaths)



Age distribution (all deaths) by year



Test for trend: p value = 0.229

The p value here indicates that there is no significant change in the age distribution over time.

Age >=80 and <60 by year

	1994		1995		1996		1997		1998		1999	
Age	No	%	No	%	No	%	No	%	No	%	No	%
>=80	270	63.5	307	66.7	393	66.7	400	68.7	375	66.4	430	63.3
<60	16	3.8	21	4.6	23	3.9	19	3.3	21	3.7	30	4.4

Type of admission by year

	1994		1995		1996		1997		1998		1999	
Emergency	No	%	No	%	No	%	No	%	No	%	No	%
Yes	359	95.2	254	89.8	489	94.4	486	94.9	518	97.7	503	95.3
No	18	4.8	29	10.2	29	5.6	26	5.1	12	2.3	25	4.7
unknown	46		177		64		64		35		144	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.011**

The p value suggests that a trend exists in the data. Figures from the table suggest that, although they are rather erratic, there is an underlying upward trend in the percentage of emergency admissions over the years 1994-1999.

ASA grade 4 (at 1st operation) by year

	1994		1995		1996		1997		1998		1999	
ASA	No	%	No	%	No	%	No	%	No	%	No	%
Grade 4	65	28.9	68	28.1	99	31.3	108	33.4	104	31.0	122	31.2

Chi-squared test for trend: p value = 0.388

Here, the p value is quite high, again suggesting that there is not a significant change over time in the percentage of patients in ASA grade 4.

Operative cases with Consultant Surgeon operating by year (this does not include consultant surgeons assisting or present in theatre)

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	74	31.8	75	28.8	136	39.9	133	39.9	123	35.9	157	38.4
No	159	68.2	185	71.2	205	60.1	200	60.1	220	64.1	252	61.6
Unknown	20		8		13		21		15		8	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.022**

The p value again suggests that there is a trend. Figures from the table indicate that, although they are erratic, there is an underlying upward trend in the percentage of operative cases where a consultant surgeon operated.

Operative cases with Consultant Anaesthetist present by year

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	104	46.0	120	49.2	159	49.8	163	50.2	172	51.8	215	55.0
No	122	54.0	124	50.8	160	50.2	162	49.8	160	48.2	176	45.0
Unknown	27		24		35		29		26		26	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.027**

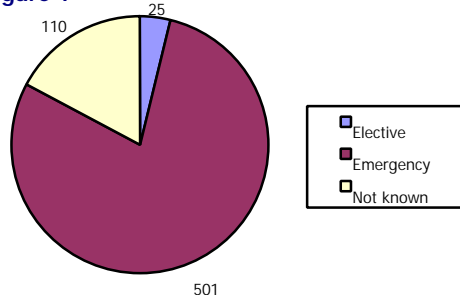
The p value suggests that a trend exists in the data. Figures from the table indicate that there is a significant upward trend in the percentage of operative cases where an anaesthetist was present.

ORTHOPAEDICS OVERVIEW

The Scottish Audit of Surgical Mortality (SASM) has revealed that 679 patients died while under the care of Orthopaedic surgeons in 1999. This accounts for 14% of all surgical deaths in 1999, a proportion which is unchanged from previous years. The standard proforma was returned in 643 cases (95%) and the form had been completed by a consultant orthopaedic surgeon in 93% of cases. This would seem to indicate strong continuing support from the orthopaedic community for SASM.

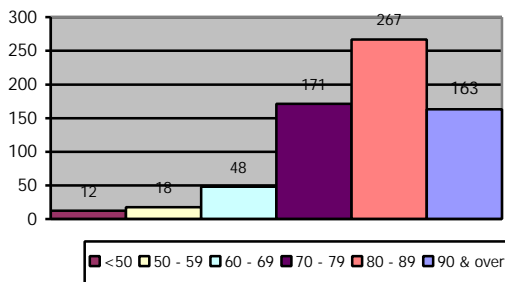
The case mix was not significantly altered from previous years. Ninety-five per cent of the deaths had been admitted as emergencies (Figure 1)

Figure 1



and 87% were over 70 years of age (Figure 2).

Figure 2



Thirty-five per cent of the cases did not undergo surgery during their last admission. Of the 416 operative cases, the commonest surgical diagnosis was a fracture of the proximal femur (65%).

Of the 227 non-operative cases, 138 (61%) were thought to be terminal care cases or "inevitable" deaths. A review of the surgical cases revealed that in 8% death was "expected" and in a further 45% the patient was classified as having a

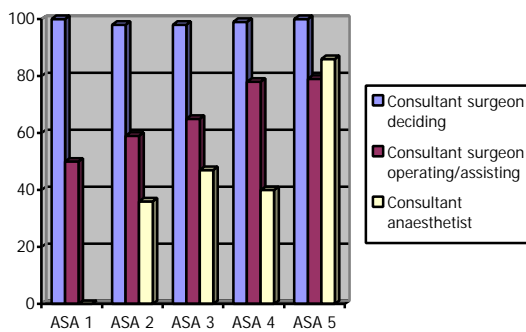
"considerable risk of death". If these figures are taken together, then it would appear that 53% of all admissions had a significant risk of dying during their admission and only 47% had any realistic potential to be discharged from hospital alive. These statistics have not significantly changed from previous years.

Previous annual reports from SASM commented that the commonest adverse factors identified appeared to be collected in three main groups, pre-operative management, grade of surgeon operating and post-operative care. The final group related predominantly to the use of ICU and HDU. A review of the adverse factors identified in 1999 reveals that once again they fall into the same groups. As stated earlier, the majority of patients admitted are elderly and a significant number present with co-morbidity affecting other physiological systems. When co-morbidity is present, a specialist opinion was obtained in 22-100% of cases, depending on the system involved. This was a consultant opinion in 62% of the occasions a referral was made. I believe this is an aspect of the patient's care which could be improved. Until now ortho-geriatric units have developed to deal predominantly with post-operative rehabilitation. Access to geriatric review preoperatively is not commonly available. The concept of an acute unit staffed on a daily basis by both orthopaedic surgeons and geriatricians has been suggested. This would appear to be an ideal solution but unfortunately would require significant alterations to current practice.

It has been reported in previous annual reviews that the percentage of operative cases where a consultant operated was low (1997 - 40%). It was also highlighted in 1997 that the percentage of 2nd and 3rd procedures where a consultant was present was low (1997 - 37% and 31% respectively). This caused concern as it was felt that further procedures may represent complications of the initial surgery. The 1999 figures show some improvement. A consultant surgeon was present in theatre in 69% of the primary procedures (38% of the operating

surgeons were consultants, and the remainder were assisting). Of the 37 patients requiring a 2nd procedure the consultant was present in 74% of cases (50% of operating surgeons). Of the 12 patients requiring a 3rd procedure, the consultant was present in 80% of cases (62% of operating surgeons). I believe this improvement reflects the increasing acceptance that dedicated trauma sessions are required for orthopaedic consultants. There was however a 20% - 30% variance between the attendance of Consultant Surgeons and Consultant Anaesthetists at ASA 2, 3 and 4 cases (Figure 3).

Figure 3



In previous years the lack of ICU and HDU facilities has been highlighted. The

number of hospitals without these facilities for post-operative care has dropped considerably since SASM started its audit. Despite this there remain a significant number of patients where it is felt that HDU should have been used post-operatively and was not. The surgeons involved felt that 11% of the cases that were not admitted to HDU would have benefited from this form of intervention. The anaesthetists' figure was identical at 10%. In contrast, the use of ICU does not appear problematic with less than 1% of both surgeons and anaesthetists suggesting it should have been used when it was not. It is not clear whether the lack of use of HDU was due to inadequate bed numbers or due to reluctance to refer to these facilities.

In conclusion, there has been some improvement in the areas where concern has been raised in the past. However, to improve the situation further will probably require significant changes in practice. There appears to be a strong continuing support from orthopaedic consultants for SASM and in the current climate of clinical governance I believe this should be encouraged.

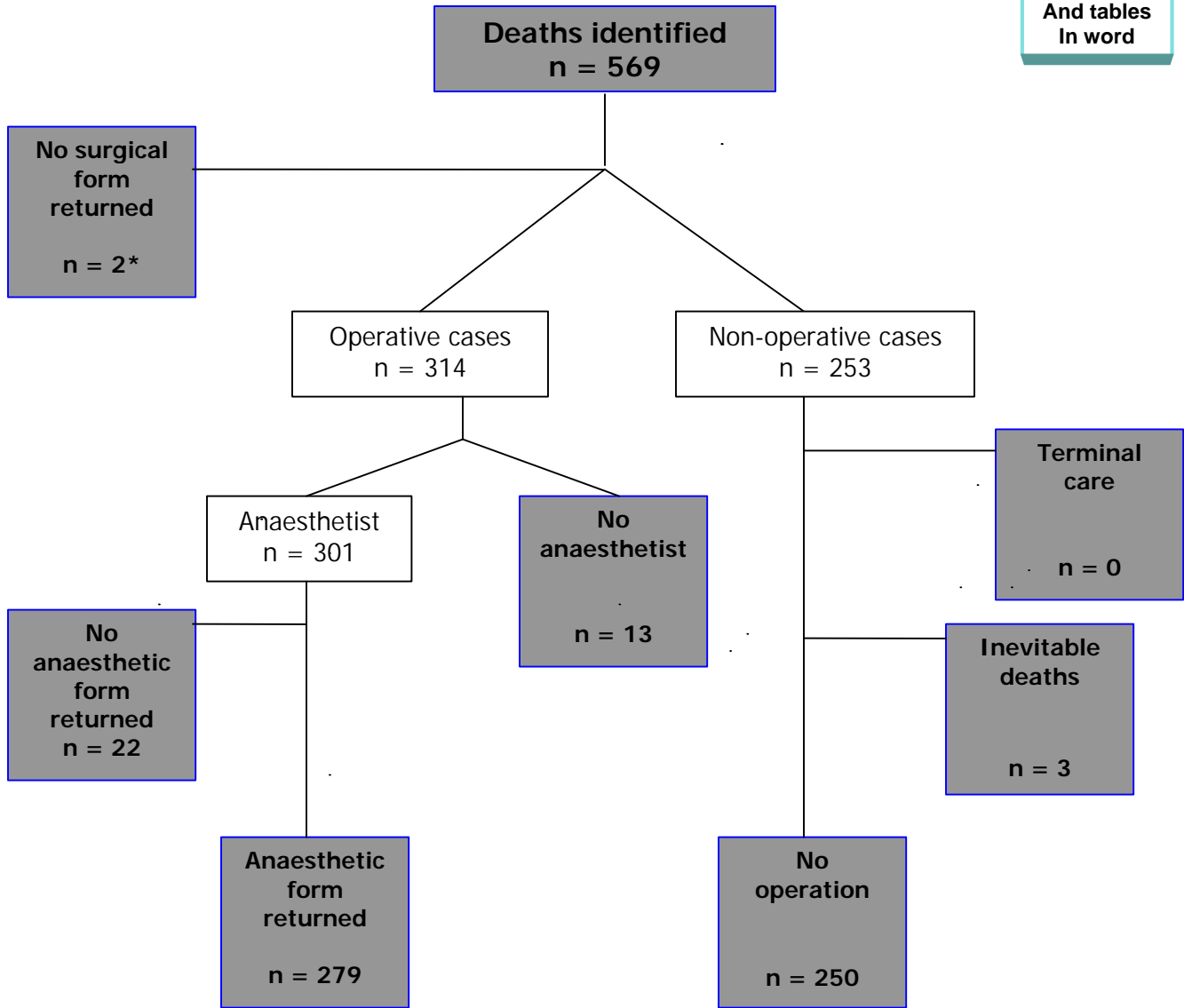
**Mr Umberto G Fazzi, Consultant Orthopaedic Surgeon
Western Infirmary, Glasgow**

Most Common Adverse Events in Management – Orthopaedics	
Surgical Assessors	Anaesthetic Assessors
Surgeon too junior	Failure to use HDU
Poor documentation	Unsatisfactory medical management

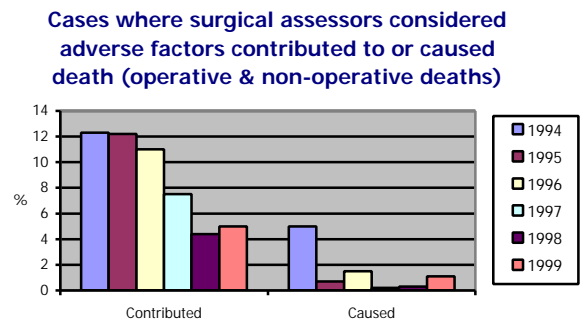
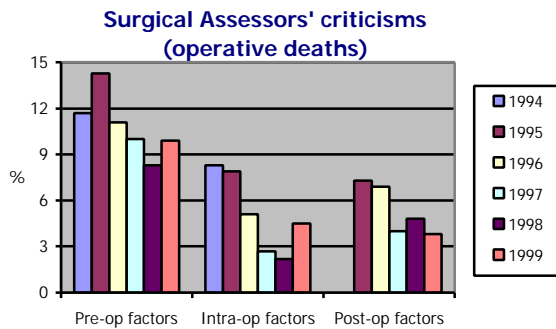
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VASCULAR SURGERY

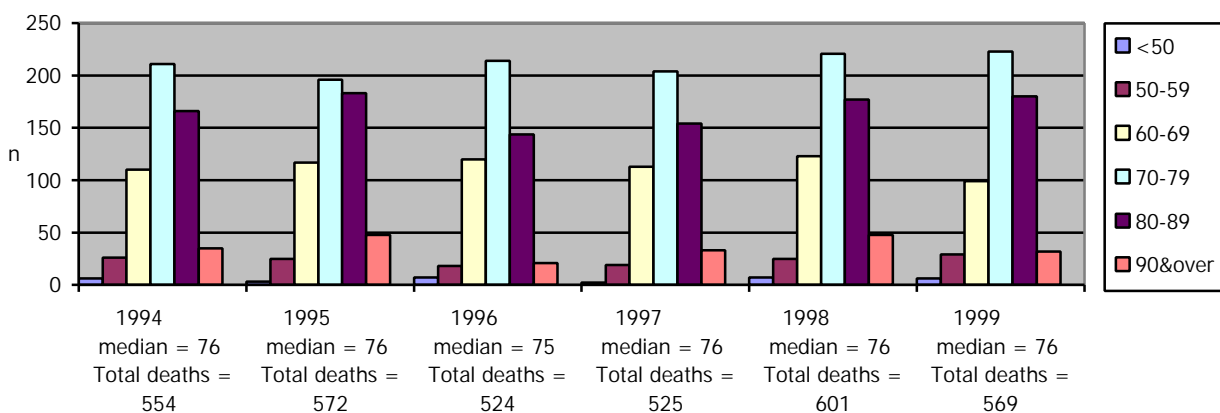
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* Does not include forms not returned from General/Vascular surgeons which may turn out to be vascular cases



Age distribution (all deaths) by year



Test for trend: p value = 0.448

The p value is relatively high, indicating that there is no significant change in the age distribution over the years 1994-1999.

Age ≥ 80 and < 60 by year

Age	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
≥ 80	201	36.3	231	40.4	165	31.5	187	35.6	225	37.4	212	37.3
< 60	32	5.8	28	4.9	25	4.8	21	4.0	32	5.3	35	6.2

Type of admission by year

Emergency	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	475	86.5	302	86.8	415	83.0	424	86.7	517	87.3	377	84.3
No	74	13.5	46	13.2	85	17.0	65	13.3	75	12.7	70	15.7
unknown	5		221		19		33		9		122	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.627**

The p value here is rather high. This again suggests there is no trend in the percentage of emergency admissions over the years.

ASA grade 4 (at 1st operation) by year

ASA	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Grade 4	117	41.6	113	45.4	94	37.3	98	38.1	107	39.3	119	43.6

Chi-squared test for trend: p value = 0.792

Again, the p value is rather high, suggesting no significant change in the percentage of patients in ASA grade over time.

Operative cases with Consultant Surgeon operating by year (this does not include consultant surgeons assisting or present in theatre)

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	209	66.8	190	71.2	209	73.3	197	69.4	206	67.5	235	76.8
No	104	33.2	77	28.8	76	26.7	87	30.6	99	32.5	71	23.2
Unknown	13		8		11		10		9		8	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = 0.058**

The p value here suggests that there is a weakly significant trend in the data. The table suggests that there is a weak upward trend in the percentage of operative cases where a consultant surgeon operated.

Operative cases with Consultant Anaesthetist present by year

Present	1994		1995		1996		1997		1998		1999	
	No	%	No	%	No	%	No	%	No	%	No	%
Yes	153	53.9	167	68.2	171	67.3	182	70.3	198	72.3	204	75.3
No	131	46.1	78	31.8	83	32.7	77	29.7	76	27.7	67	24.7
Unknown	42		30		42		35		40		43	

Percentages shown exclude the "unknown" cases **Chi-squared test for trend: p value = <0.001**

The p value here is very significant, indicating that a trend exists. From the table it is clear that there is a strong upward trend in the percentage of cases where an anaesthetist was present.

VASCULAR SURGERY OVERVIEW

During 1999 569 patients died in Scottish hospitals while under the care of Vascular and General/Vascular Surgeons. This figure represents 12% of all Scottish "surgical" deaths. The average age was 74 for males and 78 for females with a male to female ratio of 1:0.7 (Table 1).

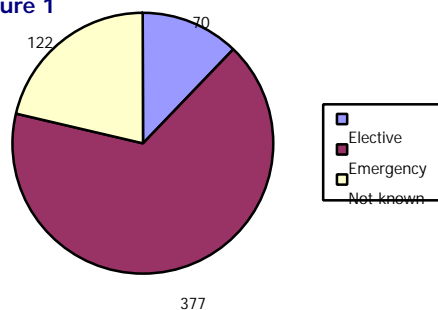
Table 1

Age (years)	Males n = 326	Females n = 243	All n = 569
Min	21	31	21
Max	98	100	100
Mean	74	78	76
Median	75	79	76

For the Vascular section of the Audit the surgical proforma was returned for 99.7% of deaths (n=567), the form having been completed by a consultant surgeon in 94% of cases. Consultants defined themselves as Vascular Surgeons (44%), General Surgeons with a special interest in Vascular Surgery (53%) or General Surgeons / Gastrointestinal Surgeons / Urologists and Orthopaedic Surgeons (3%). With respect to the anaesthetic proforma 93% of possible forms were returned and of these 75% were completed by a Consultant Anaesthetist.

Sixty-six per cent of the patients reviewed were admitted as an emergency, 12% as an elective case and in 21% the admission type was not known (Figure 1).

Figure 1



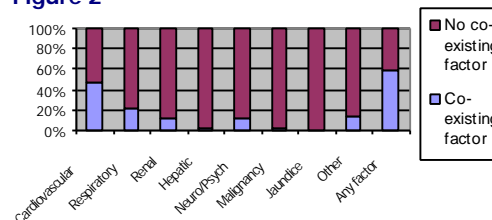
Eighteen per cent of these patients were transferred between hospitals during their last admission at an average distance of 31 miles. There was no delay in transfer in 84% of cases, no problems during transfer in 96% of cases and there was a satisfactory handover of information in 96% of cases. However 20% of transfers

were thought to be inappropriate by the receiving hospital.

Forty five per cent of the 567 patients reviewed in this section had no invasive intervention during their last admission. In 1% of these 253 patients death was deemed inevitable. Only 314 of the 567 patients (55%) reviewed in this section underwent an invasive procedure prior to death (96% under general anaesthetic).

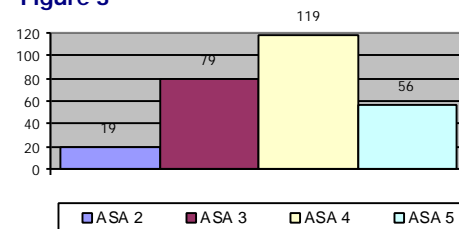
Of the 314 patients who underwent an operative procedure 58% had a significant co-existing risk factor increasing the risk of death (Figure 2).

Figure 2



Of these the commonest risk was cardiovascular (48%) with 120 patients having had a previous myocardial infarction and 101 suffering from angina. Where possible, specialist advice concerning these co-existing factors was sought for many of these patients (17% to 78% depending on the system/systems involved) and that advice was given by another consultant in 84 - 100% of cases. The anaesthetist classified patients undergoing an operation as the most severe ASA grade 4/5 in 63% of cases (Figure 3).

Figure 3

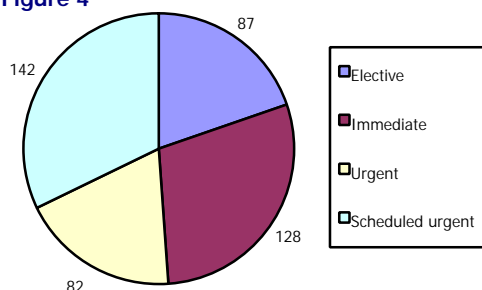


In the anaesthetic assessors' opinions pre-operative management could have been improved in 10% of cases.

Nineteen per cent of post-operative deaths followed a primary procedure that was classified as "elective", 50% as "immediate or urgent" and 32% as

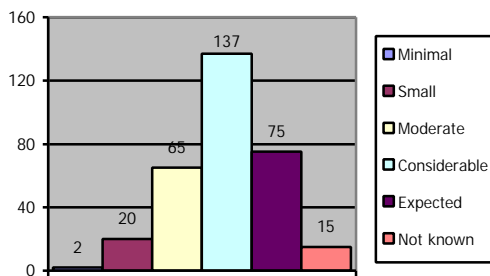
“scheduled urgent” (i.e. the patient was admitted as an emergency but the procedure was scheduled to take place more than 24 hours after admission) (Figure 4).

Figure 4



The 1999 SASM data has revealed that in fatalities subsequent to surgery a Consultant Surgeon was scrubbed up at the operating table in 94% of cases. Where trainee surgeons operated without a consultant present it was found that the consultant surgeon in charge of the patient was fully informed about the case and confident in the trainee’s ability to perform the procedure in 98% of these operations. Trainee surgeons who operated without a consultant present had 2 – 6 years experience in their grade (median = 3.6 years). A Consultant Anaesthetist was present in 74% of cases. Where a trainee anaesthetist anaesthetised without a consultant present it was found that a consultant anaesthetist was fully informed about the case and confident in the trainee’s ability to perform the procedure in 94% of these operations. Immediately following surgery 71% were either expected to die or be at considerable risk of death, with a further 22% at moderate risk of death (Figure 5).

Figure 5



One hundred and seventeen of the patients in this section of the audit were managed in an Intensive Therapy Unit at some time during their admission. A review of the cases concluded that a further single patient might have benefited from ICU care. Eighty-three of the patients in this section of the audit were managed in a High Dependency Unit at some time during their admission. Review concluded that a further 8 patients may have benefited from HDU care. The review found that within surgical units complications were recognised promptly in 96% of cases.

Of the 119 patients in whom prophylaxis against deep venous thrombosis was not prescribed a documented decision not to employ DVT prophylaxis was made in 92% of the cases.

On retrospective analysis the surgeon completing the proforma concluded that a change in management could not have altered the fatal outcome in 88% of patients. Independent peer review of the data by 1st and case note assessors (7% of cases went for full case note review) produced a slightly higher figure of 94%.

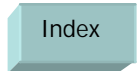
The adverse factors recorded by both the surgeon completing the proforma and the peer review surgeon mainly fall into three categories, namely pre-operative management (n=29), post-operative care (n=11) and intra-operative management (n=13). It will be noted that criticism of intra-operative care is outnumbered by criticism of the systems providing care before and after surgery. Surgical assessors highlighted delay to surgery as the most common pre-operative factor (n=23) usually as a consequence of a delay in diagnosis (n=9). Intra-operative factors included “surgeon too junior” (n=3) and “peri-operative decision making” (n=18). Post-operative problems revolved around delays in recognising complications and the consequent delay to re-operation. Anaesthetic assessors echoed all the surgical assessors conclusions adding “anaesthetist too junior” (n=2) and “poor communication between surgeon and anaesthetist” (n=2).

In conclusion, the 1999 SASM data of deaths of patients under the care of Vascular and/or General/Vascular Surgeons reveals yet again that the vast majority of patients who die do so following an emergency admission with pathology that is, in the majority, irreversible. It is also important to note that the treatment of potentially manageable pathology is adversely

affected in the majority of patients by significant ongoing co-morbidity. There is an extremely high compliance rate by clinicians in the vascular section of the Audit and the care of the Vascular patients has a very high Consultant presence. This year's Audit indicates that the area where surgical teams should focus their attention is pre-operative risk management.

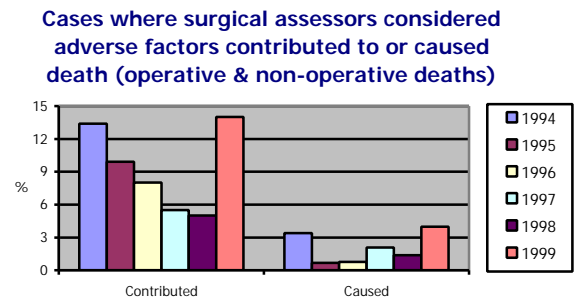
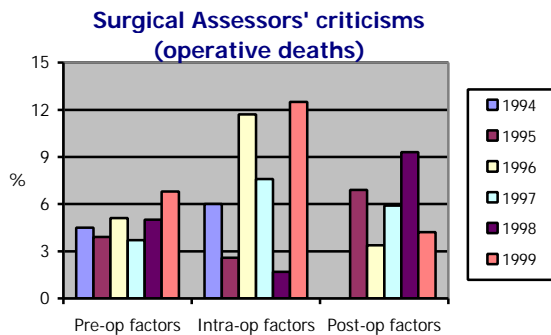
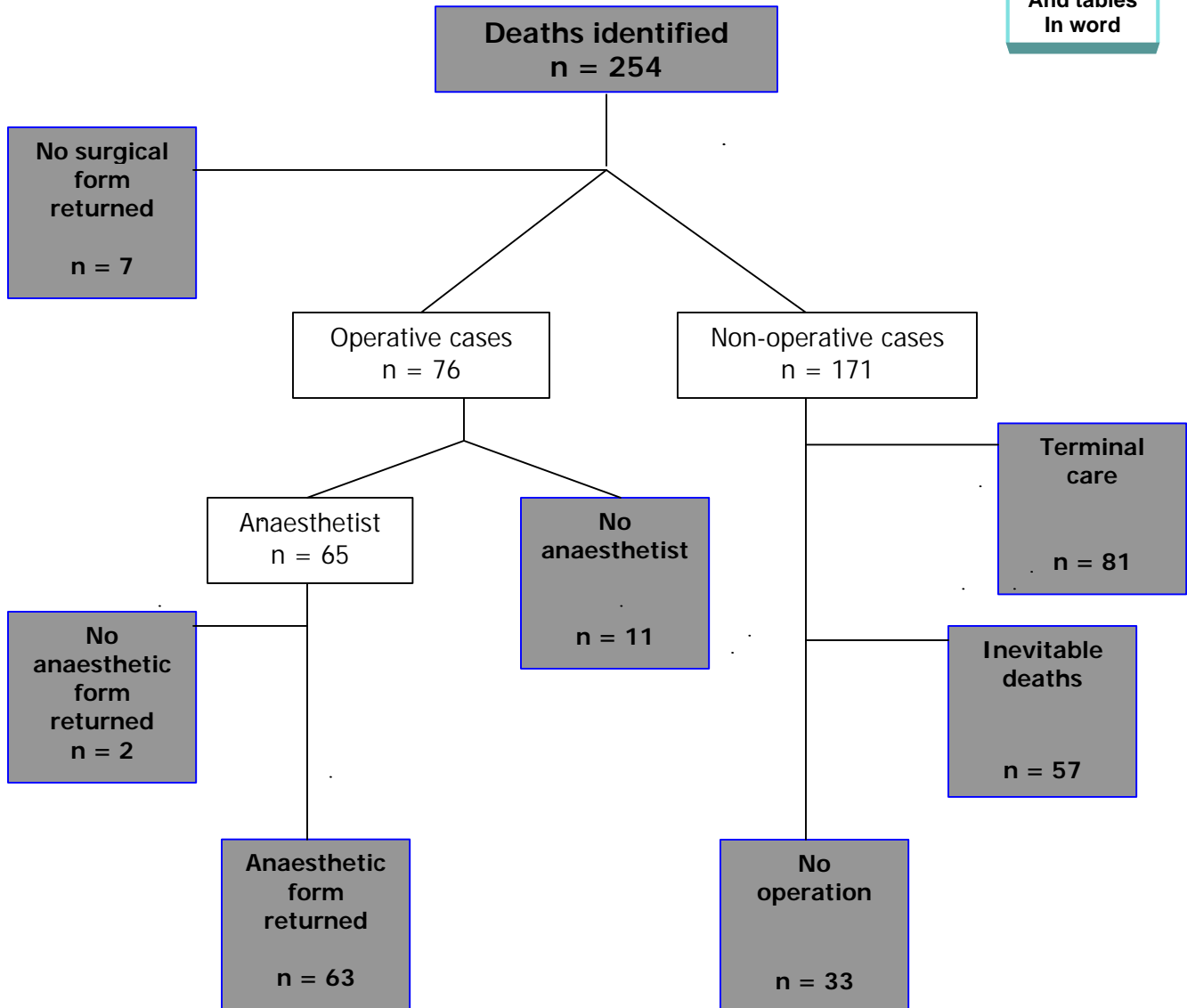
**Mr Peter A Stonebridge, SASM Vascular Co-ordinator
Ninewells Hospital, Dundee**

Most Common Adverse Events in Management – Vascular surgery	
Surgical Assessors	Anaesthetic Assessors
Op should not have been done/unnecessary	Delay in transfer
Delay in transfer	



UROLOGY

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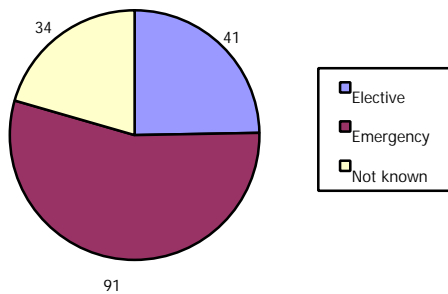
UROLOGY OVERVIEW

A consistently high compliance with SASM continues in the specialty of Urology, with the vast majority of forms being filled out by consultants.

Seventy-six cases died following an operation, and only 7 cases were referred for case note review, suggesting that the circumstances surrounding death in most patients are well accounted for.

Nevertheless, one third of deaths occurred following elective admissions (8% within non urological, ie general surgical units – Figure 1).

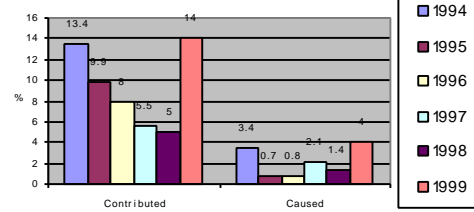
Figure 1



In 18% surgeons reported adverse events which made a significant contribution to death (14%) or caused death (4%) (Figure 2). This is an increase from last year's figures. However, it should be

noted that these are small numbers, and the data should be treated with caution (Figure 2).

Figure 2



DVT prophylaxis was appropriately adhered to, with only 3 out of a total of 245 dying of thrombo-embolic disease. No problems were reported with delays on transport and selection of availability of ICU and HDU beds was not an issue in 1999 in this specialty.

After urological cancer, cardiorespiratory complications remain the second commonest cause of death. A great deal of information is being gathered for the 1999 report and is analysed in detail elsewhere. This should be compulsory reading for all surgeons and anaesthetists as we strive to recognise and minimise the impact of risk factors, particularly in elective surgical cases.

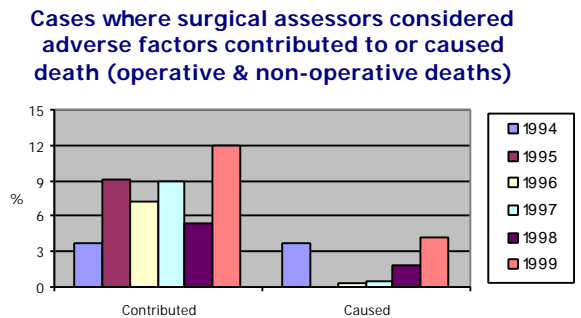
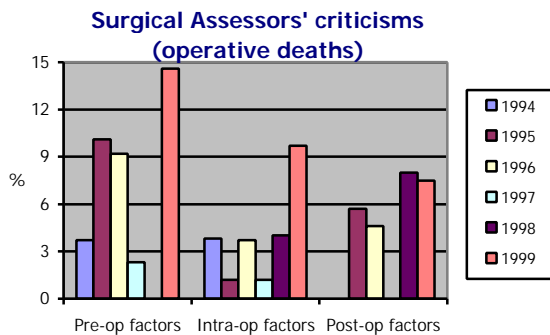
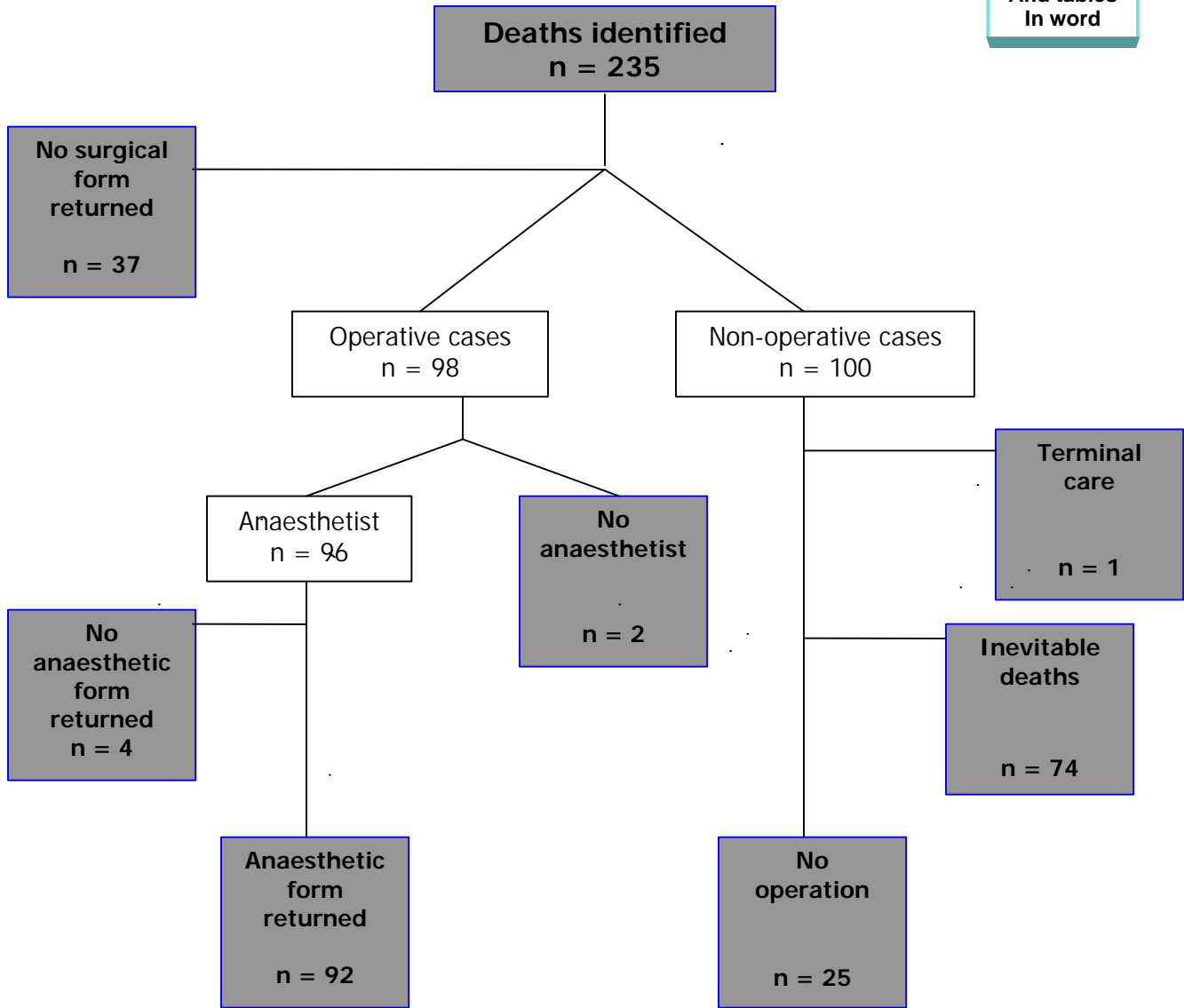
**Mr S P Bramwell, Consultant Urologist
Raigmore Hospital, Inverness**

Most Common Adverse Events in Management – Urology	
Surgical Assessors	Anaesthetic Assessors
Delay in recognising complications	Delay in recognising complications
	Failure to use HDU

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NEUROSURGERY

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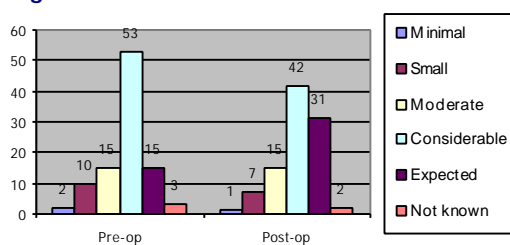
NEUROSURGERY OVERVIEW

In 1999 there was a much higher return of completed forms than 1998 with 84% returned. As is typical with neurosurgical deaths, approximately half of the cases were operated on. Of those not operated on 74% were judged to be "inevitable" deaths. The majority of forms were completed by consultants.

Three quarters of the patients were transferred from other units with the majority of these judged to be appropriate and without delay or problems. This reflects on the whole efficient resuscitation, assessment and systems for transfer of neurosurgical patients within Scotland. Approximately 10% of transfers were judged by the surgeon to be delayed and a similar number were inappropriate. This data needs to be interpreted with caution as both an "acceptable" delay and "appropriate" transfer has not been defined and agreed for the variations in geography, facilities and pathology treated. What is clear from the data is that the level of care provided during transfer was appropriate and transfer of information satisfactory.

Of the surgical cases the majority occurred in cases with at least a "moderate" risk of death reflecting neurosurgical pathology, but of more concern is the 13% of cases where the risk was regarded as small or minimal (Figure 1).

Figure 1



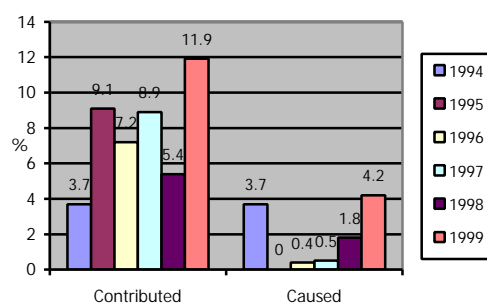
**Mr William A S Taylor, Consultant Neurosurgeon
Institute of Neurological Sciences, Southern General Hospital, Glasgow**

It is interesting to note that the surgeons reported an increased risk of death following surgery suggesting unexpected events during the procedure and this type of case may warrant closer scrutiny in the future.

HDU and ICU facilities for these patients appears to have been satisfactory with no reports of them being unavailable post-operatively. However as the majority of cases are transferred into a bed prior to surgery, the data may not truly reflect availability and data should be perhaps collected on whether patients were treated in their "home" unit.

The most interesting data is the discrepancy between the data of the surgical assessors and the surgeons filling in the forms. These assessors recorded double the number of adverse events which either significantly contributed to or caused the patient's death (Figure 2).

Figure 2



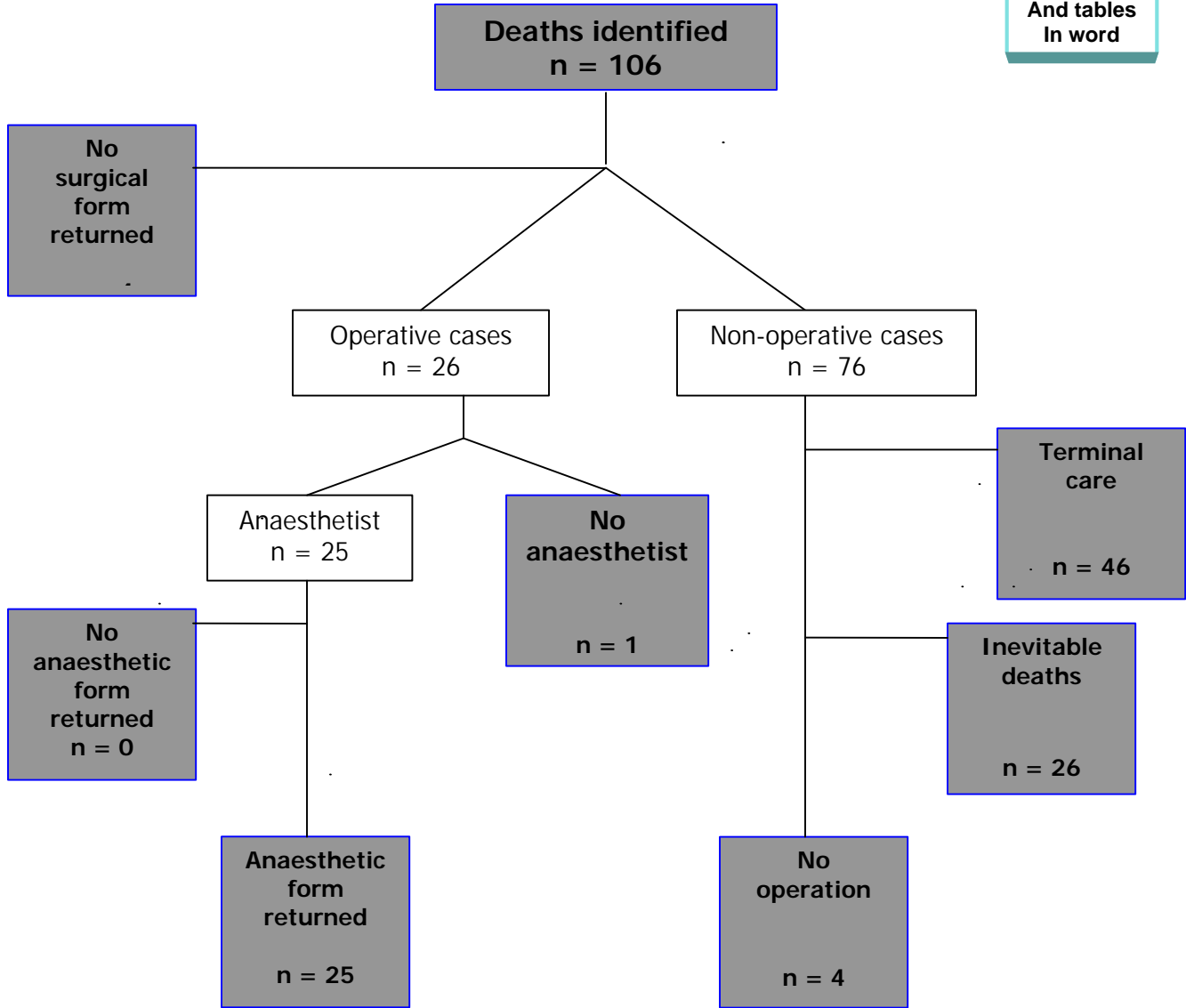
They also judged that nine patients should have had surgery when no operation was performed. Although one might expect small differences in the data due to the fact that the audit is based on opinion, this does raise serious concerns about the assessment process by either the surgeons or the assessors and warrants closer investigation to try and identify reasons for it.

Most Common Adverse Events in Management – Neurosurgery	
Surgical Assessors	Anaesthetic Assessors
Bleeding/coagulation problems	Respiratory tract complications
Op should not have been done/unnecessary	

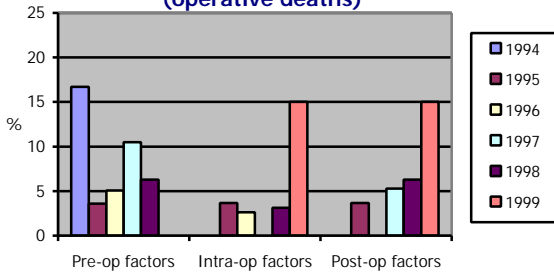
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GYNAECOLOGY

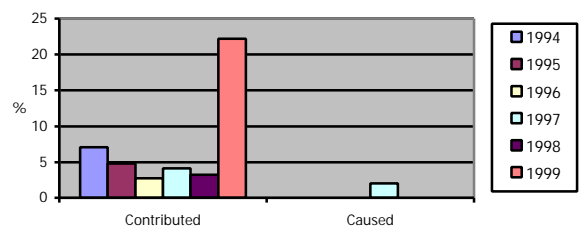
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Surgical Assessors' criticisms (operative deaths)



Cases where surgical assessors considered adverse factors contributed to or caused death (operative & non-operative deaths)



GYNAECOLOGY OVERVIEW

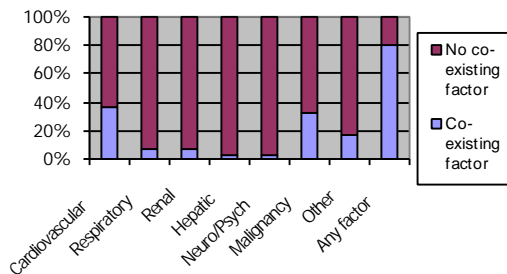
In 1999 there were 106 cases reported. This accounts for 2.3% of the total Scottish 'surgical' deaths. Ninety-six per cent of forms were returned and when recorded these were all filled in by the consultant. From the information available only two cases were not under the care of a gynaecologist.

Malignancy, not surprisingly was the most common admission diagnosis. This was noted in 87 cases (82%). Ovarian cancer accounted for 62% of these cases. Pre-operative transfer did not seem an important factor in any instance. Ideally this should be consultant to consultant.

Seventy six cases (75%) were not operated upon, more than half of them being admitted specifically for terminal care.

Only three of the 26 cases that underwent surgery were performed by non-consultant grades. The decision to operate had been made in all cases by a consultant. Cardiovascular problems and advanced malignancy were the most common co-existing risk factors (Figure 1).

Figure 1

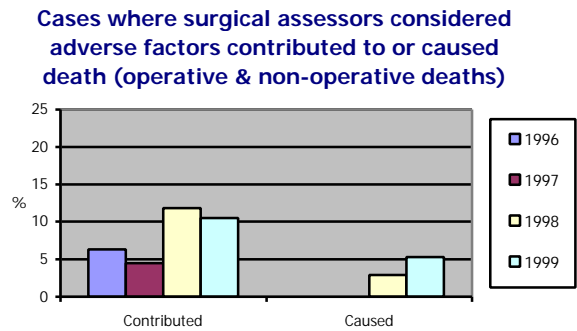
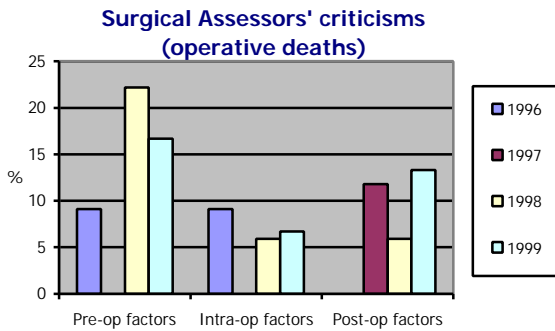
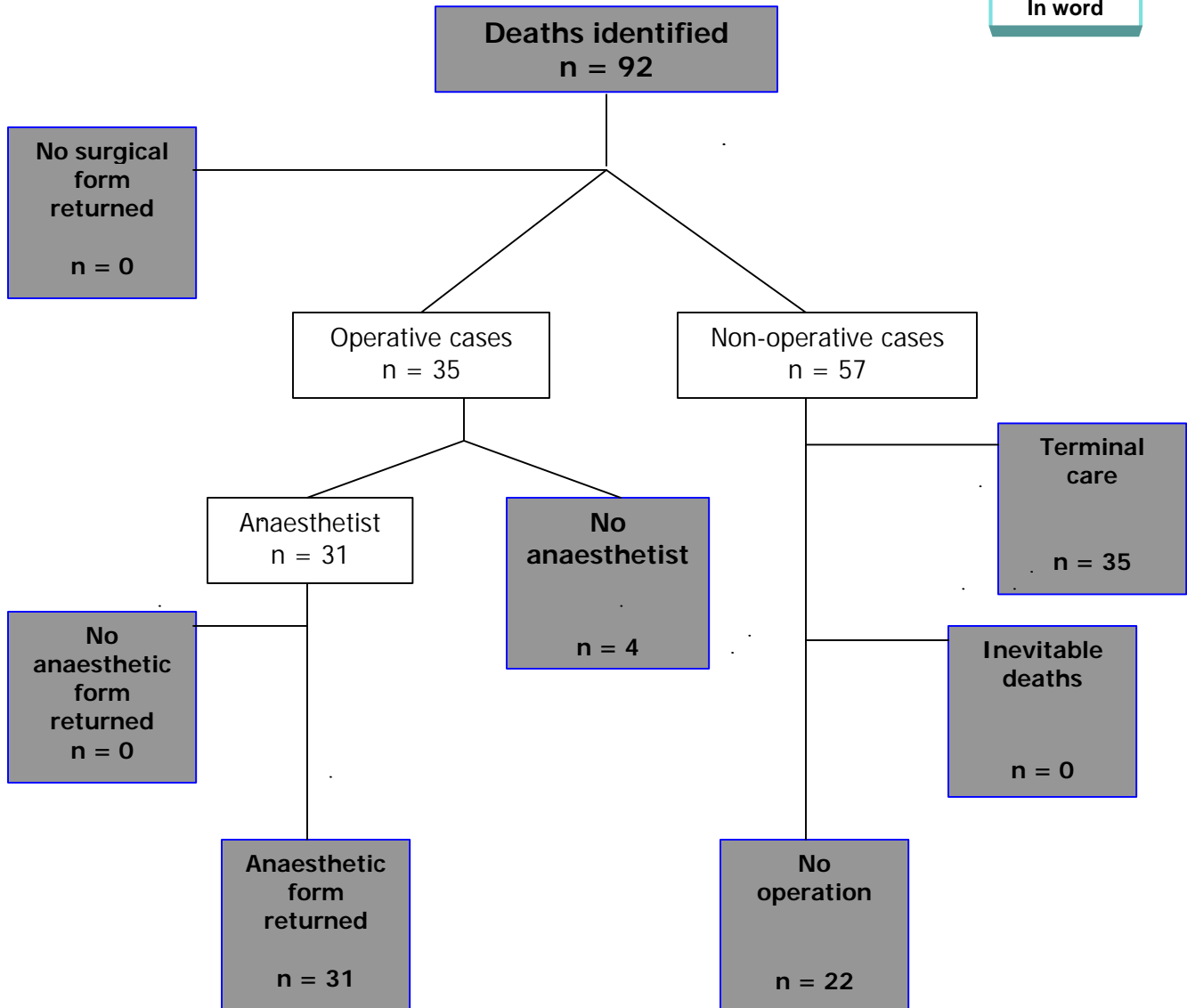


**Dr J Kennedy, Consultant Gynaecologist
Glasgow Royal Infirmary**

Most Common Adverse Events in Management – Gynaecology	
Surgical Assessors	Anaesthetic Assessors
Secondary haemorrhage	Delay in recognising complications
Failure to use HDU post-op	

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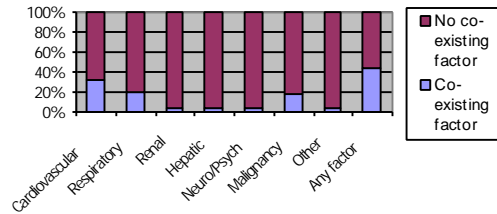
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ENT OVERVIEW

The mortality review continues to be weighted towards Head & Neck malignancy. Of the 92 deaths, 35 had been admitted for terminal care and 44% had significant co-existing factors, mainly major cardiovascular or respiratory problems (Figure 1).

Figure 1



Of the 35 cases operated upon 25 were undergoing head & neck resections or biopsies and in 18 of these the surgeons' assessment of risk of death was moderate, considerable or expected. There were no concerns this year about ICU beds being

available and in only 2 cases should HDU have been used and it was not. In 6 patients there were adverse events identified which made a considerable contribution to the patient's death. Three of these involved a delay in the patient presenting to the surgical team and 2 involved misdiagnoses. One patient admitted with epistaxis and one patient who had excision of a sebaceous cyst of the neck died, again emphasising the risk of any surgery and the importance of careful preparation and post-operative care.

There was an encouraging increase in post-mortems being carried out and 5 out of the 17 post-mortems showed additional information which may have changed management.

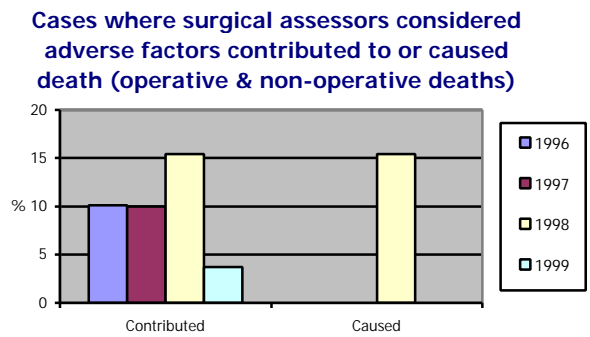
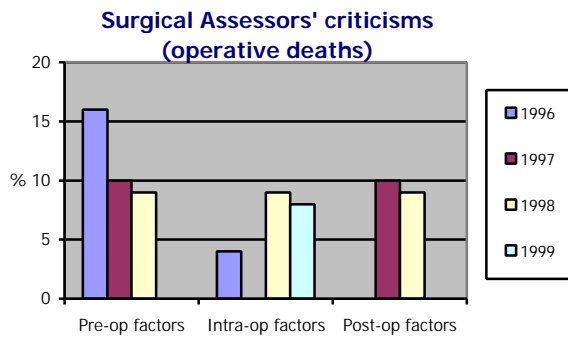
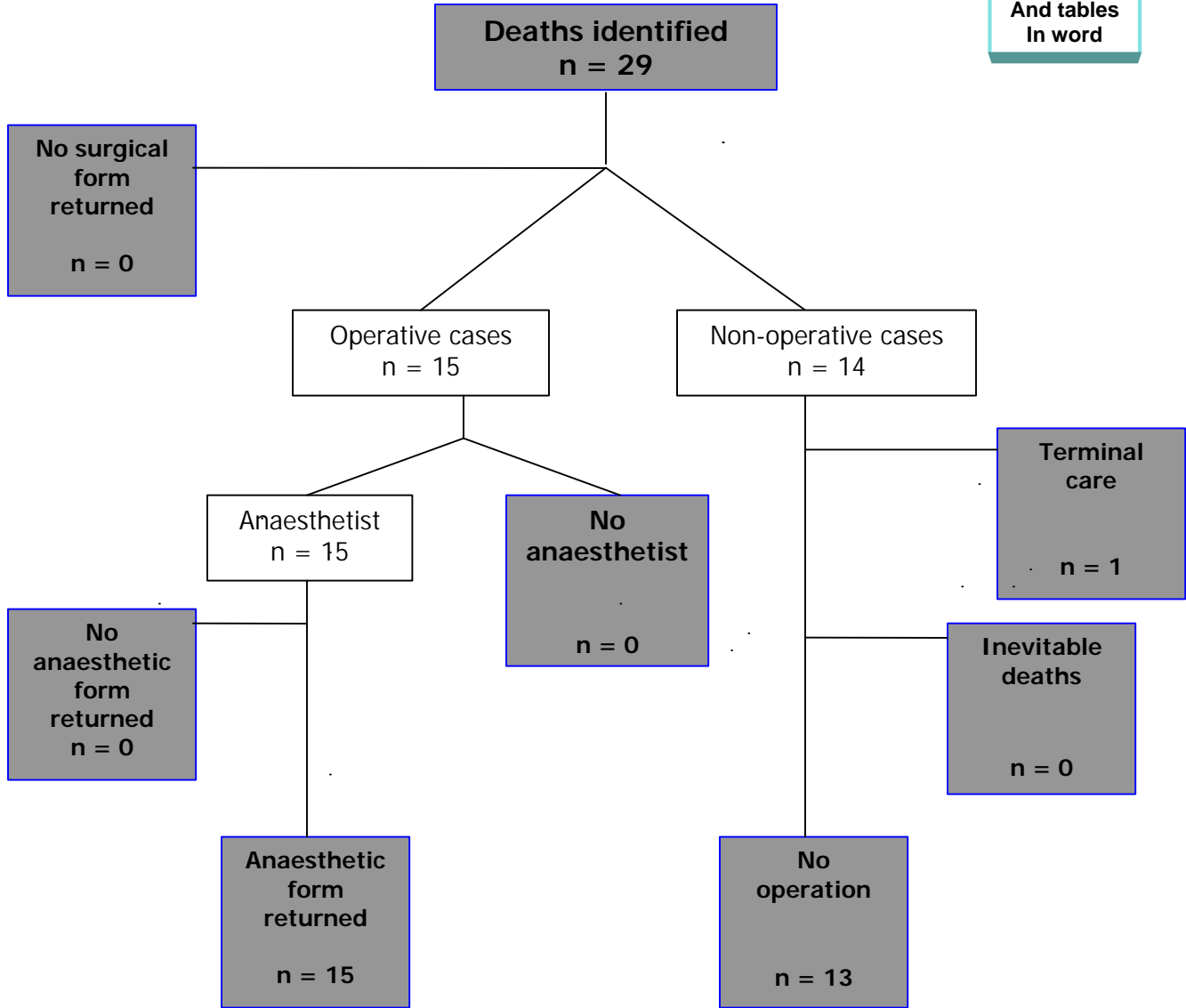
***Dr A I G Kerr, Consultant Otorhinolaryngologist
The Lothian University Hospitals NHS Trust***

Most Common Adverse Events in Management – ENT	
Surgical Assessors	Anaesthetic Assessors
Diagnosis missed	General anaesthetic complications

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PLASTIC SURGERY

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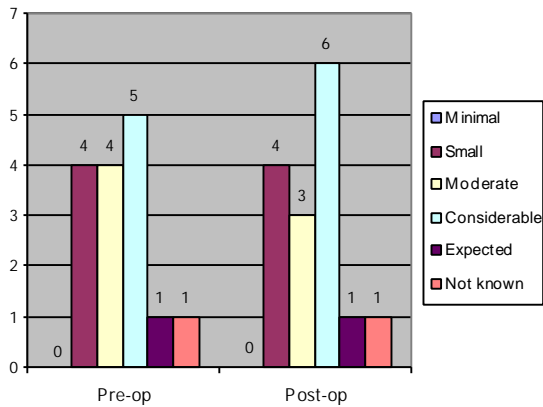


PLASTIC SURGERY OVERVIEW

In 1999, 29 deaths from Scottish Plastic Surgery Units were reported. Of these, 15 followed a surgical procedure. Ten of the patients died as a result of burns and their consequences. The vast majority of the remainder were associated with a diagnosis of malignant disease of the skin or the head and neck.

In 6 of the post-operative deaths the surgeon's pre-operative view of overall risk of death was "considerable" or greater (Figure 1).

Figure 1



In each of the 15 operated cases the decision to operate was made by a consultant and of the 7 who had second operations the decision was again made by a consultant. A consultant surgeon was present at all of the operations. It was felt by the surgeon that the use or not of ICU or HDU had no effect on the outcome of any case. The anaesthetists, on the other hand, felt that in one case there would have been benefit from ICU care and one from HDU. In only one patient was it felt by the surgeon that there could have been better pre-operative management. The post-operative care was criticised in one case by the surgeon while the anaesthetists felt that care could have been better in 3 cases.

For a small specialty it is difficult to draw any firm conclusion from these data. However it would appear that no major problems have been identified.

**Mr James D Watson, Consultant Plastic Surgeon
St John's Hospital at Howden, Livingston**

Most Common Adverse Events in Management – Plastic surgery	
Surgical Assessors	Anaesthetic Assessors
Intra-operative bleeding	Intubation required post-op after GA
Delay in transfer to surgeon by GP	Poor documentation
Inappropriate surgical admission	

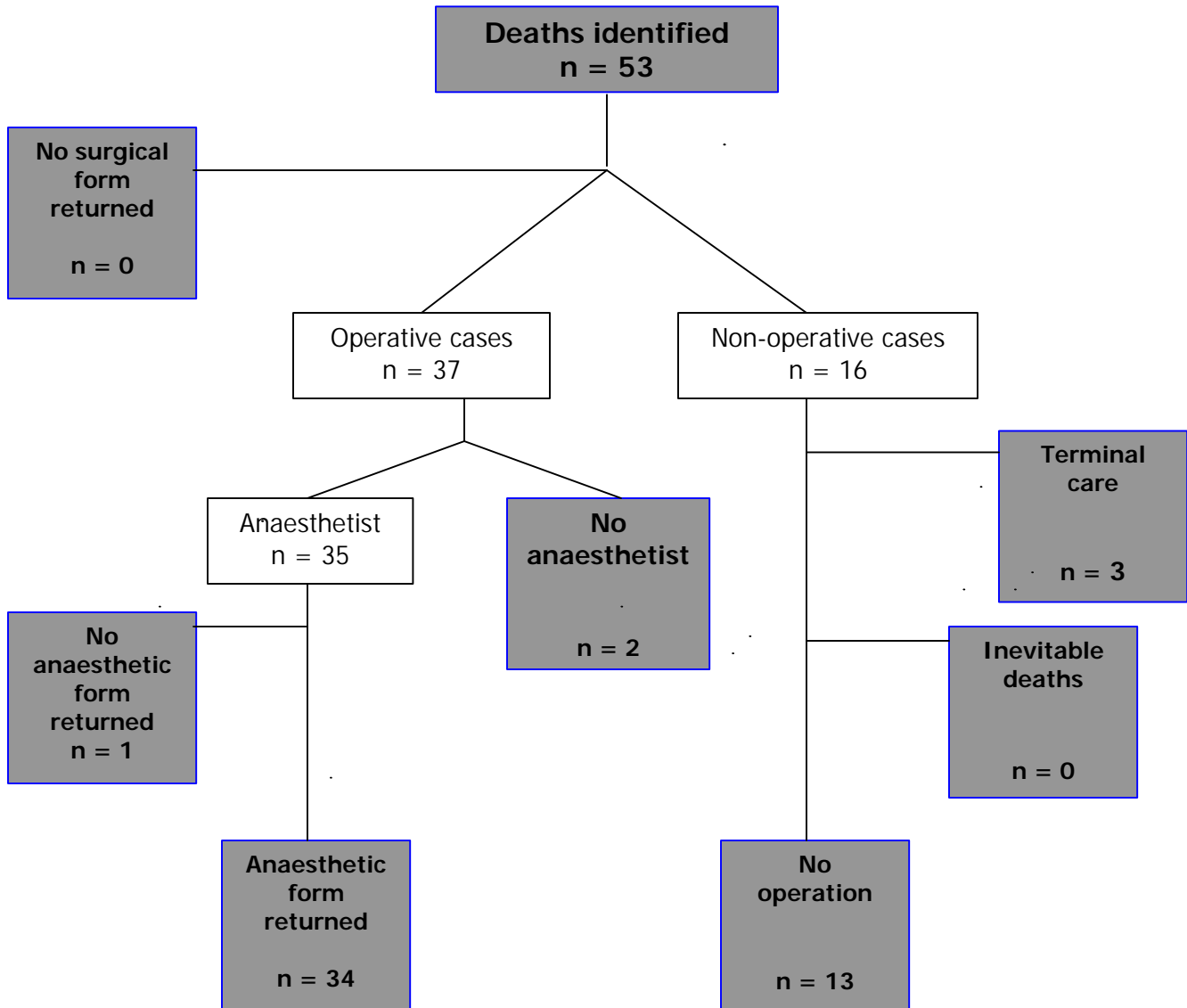
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OTHER SURGICAL SPECIALTIES

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Specialty	n
Thoracic*	19
Maxillo-facial	11
Other	11
Paediatrics	10
Ophthalmology	2
Total	53

*Thoracic surgeons do not participate nationally



PAEDIATRIC SURGERY OVERVIEW

The number of deaths occurring in Paediatric surgery is very small. Hence it is not surprising that no broad trends or recurring themes emerge from the data.

For the first year of participation compliance has been reasonably good, with 11 of 13 surgical forms returned (85%). Most of the deaths were in the first year of life and due either to congenital malformations, complications of prematurity or overwhelming infection. All occurred in specialist units. Eight children were transferred to the Paediatric Surgical units concerned. No problems were identified during transfer but in one baby with a congenital diaphragmatic hernia there was thought to have been a delay in transfer and in one case of a baby transferred from overseas the clinical information was felt to be insufficient.

Post mortems were only performed in 5 cases. In none was it felt that significant extra information was gained.

Ten of the 11 children underwent at least one operative procedure. In all cases a consultant was either the operating surgeon or first assistant.

All but one of the children were nursed in either a paediatric or neonatal intensive care unit pre or post operatively or both. The exception was a 13 year old with recurrent adenocarcinoma of the rectum which was unresectable after chemotherapy and whose subsequent care was palliative.

Adverse events were identified by the surgeon or surgical assessor in 4 cases, but in none did they make any difference to the outcome. A premature baby died from an intercurrent bacterial meningitis following surgery for intestinal obstruction. The abdominal problem had been identified antenatally and it was felt that in utero transfer allowing earlier surgical assessment after birth might have been beneficial. The second case was a 1 year

old with short bowel syndrome, bronchopulmonary dysplasia and TPN associated cholestasis who underwent removal of an infected femoral central line. The line fractured on withdrawal necessitating exploration of the iliac vein for removal of the tip. The baby died 4 days later from complications of his chest problems thought to be unrelated to the surgery. In the case of the baby with a congenital diaphragmatic hernia it was felt that there were adverse events relating to the timing of transfer and surgery. Lastly a newborn presented with a very large intra-abdominal tumour compromising ventilation. An attempt was made to remove the tumour after frozen section biopsies suggested it would not be responsive to chemotherapy. Unfortunately there was uncontrollable bleeding during resection and the baby died on the table. The subsequent definitive histology showed immature or frankly malignant elements in the tumour suggesting it would have been chemosensitive. There could have been an alternative strategy of biopsy with pre-operative chemotherapy and subsequent resection, but no certainty of a different outcome.

Anaesthesia was provided by consultants in all but two cases. In both instances experienced SpRs gave the anaesthetic after consultation. The consultants involved all had a significant routine paediatric workload.

In no cases were there significant adverse events related to anaesthesia or invasive monitoring.

Whilst no clear message emerges from the first year of participation, I believe it is essential that paediatric surgeons continue to participate in the audit. With data accumulated over several years we may be able to focus on specific issues and identify potential improvements in practice.

***Mr Fraser D Munro, Consultant Paediatric Surgeon
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PAEDIATRIC NEUROSURGERY OVERVIEW

There were 13 deaths with forms complete for 11. Seven were due to the severity of the primary injury (five head injury alone, one head with other severe injuries, and one drowning with subarachnoid haemorrhage).

In four children there was some concern about avoidable factors.

One 12 year old child, who presented to Paediatricians with headache and abdominal pain, had a diagnosis of subarachnoid haemorrhage missed until the child had coned from hydrocephalus.

In two children there were concerns about the level of observation after initial assessment or operation. In one the

Glasgow Coma Scale was not used to assess consciousness, then neurogenic pulmonary oedema was missed. In another, no ICU bed was available after evacuation of a spontaneous intracerebral haematoma. Both died of brain swelling and cerebral infarction.

Finally one child succumbed due to heavy peri-operative bleeding from a choroid plexus carcinoma. No consideration of pre or peri-operative angiography or embolisation was apparent (in the proforma). Perhaps unusual paediatric tumours should be dealt with in one centre in Scotland, although the prognosis for this tumour would have been very poor anyway.

***Mr P Statham, Consultant Neurosurgeon
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ORAL AND MAXILLOFACIAL SURGERY OVERVIEW

In 1999, as in previous years from a small specialty, there are low mortality figures which make drawing conclusions difficult. The majority are from management of head and neck cancer. Four of the eleven deaths were non-operated cases (three "inevitable" and one "terminal care").

There may be some benefit in looking at two of the three cases with adverse surgical assessments.

One death was in a patient with significant medical co-morbidity. This case may have benefited from more senior input in pre-

operative treatment selection and assessment.

Another death occurred in a younger patient treated for a jaw fracture. This case highlights the need for special recovery provision for these patients, for a defined post-operative period. It also emphasises the necessity to try and treat as many of these patients as possible, with consultant involvement on proper trauma lists in the right setting.

Of the three adverse factors mentioned, only one made a significant contribution to deaths as determined by the assessor.

***Mr J McManners, Consultant Oral and Maxillofacial Surgeon
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PARTICIPANTS 1999

Table 1 Consultant Surgeons and Anaesthetists eligible to take part by specialty:

Specialty	n of Consultants
Anaesthesia	434
General/Vascular	230
Gynaecology	150
Orthopaedics	139
ENT	74
Ophthalmology	70
Urology	56
Plastic	25
Neurosurgery	21
Maxillo-facial	21
Paediatrics	15
Other	3
Thoracic *	3*
Total	1241

* Thoracic surgeons do not participate nationally

Table 2 Consultant Surgeons who returned some forms, but less than 80%:

Specialty	n of surgeons	n of forms outstanding
Orthopaedics	10	29
Neurosurgery	7	27
General	5	40
Plastic surgery	1	9
Total	23	105

Table 3 Consultant Surgeons who failed to return any of their forms:

Specialty	n of surgeons	n of deaths
Gynaecology	2	5
General	1	19
Neurosurgery	1	6
Plastic surgery	1	5
Orthopaedics	1	4
Total	6	39

Table 4 Consultant Surgeons who declined to participate during 1999:

Specialty	n of surgeons	n of deaths
General	1	7
Neurosurgery	1	20
Total	2	27

Due to difficulties in identifying the Consultant Anaesthetist responsible for each case, it is not possible to provide the above information for Anaesthesia.

A list of names of Consultant Surgeons and Anaesthetists fully participating in SASM in 1999 (by returning at least 80% of their forms) will appear in each Trust/Health Board report.

POSSUM SCORING OF OPERATIVE MORTALITY RISK – A FUTURE ROLE IN SASM

INTRODUCTION

In a recent surgical review article on the subject of Risk Scoring in Surgical Patients (Jones 1999) it was concluded that “the POSSUM score is the most appropriate of the currently available scores for general surgical practice” in the estimation of risk of dying. Despite first being reported in 1991 (Copeland 1991), POSSUM has not become widely used in the UK although it is more popular in the North West of England, close to its original base, and has been adopted by a few enthusiasts across the world. A database of 250,000 patients has apparently been gathered. Surgeons seem to be generally more aware of POSSUM than anaesthetists who regularly use ASA for general patients and APACHE for the critically ill. This is probably because most of the relevant publications have been in surgical journals. If ASA is considered to be too simplistic and highly subjective whilst APACHE is too complex for general use, then POSSUM neatly fits into the gap, requiring only 12 physiological and 6 operative facts, all easily available from routine admission and operation data.

POSSUM was developed as a tool to compare morbidity and mortality in a wide-ranging basket of general surgical procedures and is best applied at the time of operation to patients of all risk categories. However, it is of relevance to SASM as an objective and quantitative assessment of risk in patients who died after surgery. The management group has therefore decided to include POSSUM in SASM forms during 2001 for some specialties. It is hoped that some Scottish Surgical Centres may take the opportunity of piloting POSSUM more widely at the same time. This review has been written to increase the general awareness of POSSUM across Scottish surgery and anaesthetics.

WHAT IS POSSUM ?

A **Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity** was developed as an attempt to quantify the quality of surgical care and to allow comparison between different surgeons, units, hospitals and regions. The ideal tool would be quick and easy to use, widely applicable, include elective and emergency work and accurately predict outcome. The initial researchers examined 62 factors. As in many similar areas of mathematical predication, multivariate analysis was able to identify the most powerful predictors and reduced these to just 12 physiological and 6 operative factors. Other factors no doubt do predict outcome but so strongly duplicate these 18 that they offer no additive predictive power. Each of the 18 factors were divided into two, three or four levels and computer analysis calculated that a weighting of 1, 2, 4 or 8 approximated well to the relative predictive power, much simplifying the calculation.

Physiological factors	Operative factors
Age	Operative complexity
Cardiac	Multiple procedures
ECG report	Blood loss
Respiratory	Peritoneal contamination
Blood Pressure	Extent of malignant spread
Pulse rate	Elective v emergency op
Glasgow Coma Scale	
Haemoglobin	
White Cell Count	
Urea	
Sodium	
Potassium	

Therefore, a low risk patient undergoing minor surgery would score 12 for physiology and 6 for operation. At the other extreme, the most high risk patient could score 88 for physiology

and 48 for the operation (two of the physiological factors can only score a maximum of 4 not 8). The overall physiology and operation scores are then applied to a logistic regression formula to calculate morbidity and mortality.

THE ACTUAL MATHEMATICS

(NOT FOR THE FAINT HEARTED)

The initial researchers reported two formulae for morbidity and mortality, the latter being :

$$R/1-R = -7.04 + (0.13 * \text{physiology score}) + (0.16 * \text{operation score})$$

A second group (Whiteley 1996) applied this formula to their own data and concluded that it overestimated risk of dying for all groups but especially for low risk patients. They reworked the calculation and suggested a modified formula that fitted their data better. Further work (Prytherch 1998) revisited the problem and reported the formula shown below. This has become known as the "P-POSSUM". Wijesinghe has suggested that the apparent difference between the original and P-POSSUM formulae is the result of how they are applied to a group rather than due to any fundamental difference.

P-POSSUM formula for mortality:

$$R/1-R = -9.065 + (0.1692 * \text{physiology score}) + (0.1550 * \text{operation score})$$

Even the P-POSSUM formula is accepted to overestimate risk in low risk groups. For example, it calculates that minor surgery in healthy patients has a mortality of 0.22% ie. one in 500. This appears to be a common problem with multivariate mathematical models. In higher risk groups the P-formula seems to give an excellent fit.

For the benefit of Access/Visual Basic Programmers, the actual percentage risk of dying is calculated as:

$$\% \text{ Risk} = 100 \times (\text{Exp}(\text{formula}) / (1 + \text{Exp}(\text{formula})))$$

THE APPLICATION OF POSSUM

The original authors and the Portsmouth group have reported the use of POSSUM in the context of general surgery (Copeland 1991, Copeland 1995, Whiteley 1996, Prytherch 1998) suggesting that application of this tool would allow valid comparison between surgeons and hospitals. It could be used to assess an individual surgeon's performance, highly topical in the era of clinical governance.

Some authors have applied POSSUM to more specific areas of surgery whilst others have used it as a tool to allow valid comparison of outcome in a range of patient groups.

Gotohda (1998) examined the relation between POSSUM and resource use showing that the physiological component of POSSUM did not correlate well either with post-operative hospitalisation or with antibiotic use. However, the operative component did correlate well and they concluded that POSSUM is useful for predicting the post-operative clinical course.

POSSUM has been used as a tool to evaluate the technique of preoptimisation in high risk patients. Curran (1998) concluded that patients who were admitted to ICU before surgery had the greatest reduction in mortality and morbidity compared to POSSUM predictions, supporting the case for preoptimisation. Jones (1999b) adopted a similar technique when comparing outcome in two groups of patients who either were managed in high dependency units or in general surgical wards, concluding that HDU use was associated with fewer cardio-respiratory problems.

Menon (1999) used POSSUM when comparing the outcome of MSRA positive patients with controls to show that patients with MRSA are more debilitated and have undergone a greater

surgical insult. Treharne used POSSUM to compare open and endovascular aneurysm repair and Teh-Kuang (1998) analysed results from colorectal perforation with barium enema.

A number of authors have applied POSSUM to specific areas of surgery with mixed results. Brunelli concluded that POSSUM may be appropriately used as a tool of surgical audit in lung surgery and Cagigas came to a similar conclusion in bariatric surgery with vertical banded gastroplasty. By contrast, Lazarides reported that POSSUM did not predict mortality in Ruptured Infrarenal Aortic Aneurysm although Midwinter showed that POSSUM satisfactorily predicted mortality and morbidity in patients undergoing general vascular surgical procedures. Sagar (1994) found POSSUM to be valuable for comparative audit in colorectal resection. Parikh used POSSUM when studying the operative learning curve for D2 gastrectomy concluding that 3 years' experience are required to reach an optimal level of performance.

COMPUTER PROGRAM FOR POSSUM CALCULATION

Copyright does not apply to the POSSUM formula itself. However, to our knowledge, there is no computer program freely available although commercial packages do exist. As a result we have developed a program using Access '97 (or later) that employs a single screen to calculate the risk of morbidity and P-POSSUM mortality. [This is available here on the website](#) It is hoped to develop this package further linked to details of the diagnosis, operation, surgeon etc. allowing the user to compare actual mortality with that expected by POSSUM.

CONCLUSIONS

Almost from its inception, we have accepted that the value of SASM data would be considerably enhanced if denominator data were available, ie. the numbers of cases managed and operated/anaesthetised by each consultant. Some progress is being made in this regard in collaboration with ISD. However, valid comparison can only be made after adjustment for case-mix. A general formula like POSSUM is no substitute for highly developed scoring systems aimed at specific areas such as pancreatitis and the Glasgow Coma Scale. However, the literature does seem to justify the view that it is the most appropriate tool for case mix analysis of a wide range of surgical conditions and therefore ideally applicable to SASM data.

With the current interest in minimum data sets for cancer patients being developed by SIGN, the time is right for a pre-operative, minimum data set and there is a strong argument for inclusion of POSSUM factors as they have a proven ability to assess morbidity and mortality risk. It may be that POSSUM proves to be too complicated for routine use but it is probable that further simplification could be achieved without loss of predictive power due to strong inter relations between the 18 parameters. For instance, 4 factors relate to cardiac function and 3 indicate the complexity of surgery. It may be possible to reduce the 18 factors to 11 by considering age, cardiac, respiratory, renal, metabolic, CNS, operative complexity, operation urgency, malignancy, haemorrhage and infection as relatively independent parameters. This would require a re-working of the formula but is perfectly possible using the large store of retrospective data which has been gathered.

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Evidence based management of acute diverticulitis – state of the art lecture

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Scottish Audit of Surgical Mortality

Nixon SJ

Meeting of Royal Australasian College of Surgeons, Perth WA, August 2000

Scottish Audit of Surgical Mortality

Nixon SJ

Meeting of Royal Australasian College of Surgeons, Melbourne, August 2000

Past, Present and Future of Audit in Scotland

Nixon SJ

Audit Symposium in Hong Kong, November 2000

The Future of the Scottish Audit of Surgical Mortality

Stonebridge PA

CRAG Clinical Effectiveness Symposium, Dunblane, November 2000

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THE SCOTTISH AUDIT OF SURGICAL MORTALITY (SASM) – CHAIRMAN OF THE MANAGEMENT COMMITTEE COMMENTS

The single greatest achievement of SASM is that routine objective peer review of surgical deaths takes place in Scotland. This unique feat is all the more remarkable as current participation in SASM is entirely voluntary. The success of SASM depends totally on the profession's sense of ownership, which is reflected by the very high compliance rates. This in turn is a testament to the commitment of the surgical and anaesthetic clinicians involved to continuous audit in clinical practice.

Compliance by specialty

Specialty	Total number of cases identified	Cases not returned	Per cent compliance
General	2640	144	94.6
Vascular	569	2	99.7
Urology	254	7	97.3
Neurosurgery	235	37	84.3
Orthopaedics	679	36	94.7
ENT	92	0	100
Gynaecology	106	4	96.3
Plastic	29	0	100
Other surgical specialties	53	0	100
<i>(Anaesthesia)</i>	<i>1969</i>	<i>100</i>	<i>95.0</i>
Total number of cases	4657	230	95.1

Furthermore, the Case Note Reviews (CNR) which are a vital part of the audit process are carried out by virtually every practising clinician within the audited specialties on behalf of their colleagues and for the benefit of patients undergoing surgical care in Scotland.

Case note reviews by specialty

Specialty	Surgical	Anaesthetic	Surgical & Anaesthetic	Total CNR	Total Cases	% cases CNR
General	106	33	45	184	2496	7.4
Vascular	21	10	12	43	567	7.6
Urology	5	5	1	11	247	4.4
Neurosurgery	7	1	0	8	198	4.0
Orthopaedics	44	16	5	65	643	10.1
Thoracic	1	0	0	1	19	5.3
ENT	6	1	1	8	92	8.7
Paediatrics	3	0	1	4	10	40.0
Gynaecology	1	0	2	3	102	2.9
Plastic	1	0	0	1	29	3.4
Maxillofacial	2	0	0	2	11	18.2
Total	197	66	67	330	4414	7.5

The role of the Scottish Audit of Surgical Mortality is educational. This is achieved in a number of ways:

- Individual consultant feedback is the primary aim of the audit. These reports contain both positive and negative comments on the management of individual cases. This aspect of the audit is unique.

- Individual consultant surgeon annual reviews. Consultant surgeons were offered this service this year. These reviews detail all the cases held by SASM associated with an individual consultant. This process, which is in its first year, has uncovered a small number of incidences of inaccuracy. This will allow the data process to be improved. Even so the reviews have been well received by the consultant body. We hope in the future to provide an individual consultant with anonymous comparative audit data by calculation of the Scottish mean and 2 standard deviations for the larger specialities. An individual clinician is probably unaware of how, even in very broad terms, he compares with his peers. Any of the above is only possible when consultants have agreed that we might hold their data. Below are the results of an approach by SASM to retain such data.

Permission for data retention by specialty

Region	Keep forever	Keep for 1 year only	Erase after review	No reply	Total
Anaesthesia	267 (63%)	73	37	47	424
General/Vascular	169 (72%)	35	9	21	234
Gynaecology	117 (82%)	12	10	4	143
Orthopaedics	97 (73%)	13	8	15	133
ENT	47 (80%)	5	5	2	59
Urology	39 (83%)	5	0	3	47
Ophthalmology	37 (63%)	4	14	4	59
Plastic Surgery	13 (65%)	2	2	3	20
Oral/Maxillofacial	12 (92%)	0	1	0	13
Paediatrics	10 (83%)	0	1	1	12
Neurosurgery	8 (44%)	2	6	2	18
Other/not known	6 (86%)	0	1	0	7
Total	822 (71%)	151 (13%)	94 (8%)	102 (9%)	1169

- Annual report, detailing specialty data and commentaries in all the surgical and anaesthetic specialities.
- Annual Hospital/Health Board reports, comparing individual Hospitals/Health Boards with all others. *(A pilot scheme is currently under way to provide an expert, independent commentary on each report. An offer will be made by this expert to attend a hospital meeting and explain his/her comments and opinions. This service is however not funded and will not be able to be extended under the present budget.)*
- Individuals, and/or departments, in some instances collate these responses to help identify recurring themes, which require closer scrutiny.
- Compilations of selected anonymised Case Note Reviews that identify problem areas of interest to the wider surgical and anaesthetic communities. These compilations are circulated to all participants in the audit and are also of interest to trainee staff.

The data are also available, on request, for use at local audit meetings. There is a growing requirement for these as Hospitals and Health Boards scrutinise each year's annual local feedback and identify areas of increasing (or decreasing) concern. *(There are insufficient funds to cover the cost of such requests if they were to increase beyond the current level.)* The establishment of collaborative supra-regional audit meetings is also possible to support smaller specialities or Managed Clinical Networks. It should be noted that the **Management Committee will not release any data concerning an individual consultant to a third party except via the consultant or with his/her signed permission.**

Problems of practice can be identified at various stages of the audit mechanism. This can be through self-audit by individual clinicians completing the SASM audit form, or by external

assessors, including detailed case note review. Detailed assessment of cumulative data on an annual basis to highlight common concerns such as HDU/ITU availability and utilisation also highlights difficulties. Assessors and case note reviewers also gain an insight as to what is happening in their field of interest in Scotland.

SASM, together with ISD, is hoping to extend the coverage of the audit process to include deaths within 30 days of operation even if the patient has been discharged. Collaboration with ISD will also allow an objective assessment of the reliability of some of the data we hold in common. Data linkage currently proposed between SASM and ISD data will establish the potential for obtaining denominator data from SMR1 records.

The current mortality audit of every surgical death is labour intensive. Consultants completing proformas, conducting case note reviews, performing analyses of data sets and writing reports, do so without payment. Thus, the cost per death audited (£52) remains extremely good value for money.

The organisational structure of SASM is currently under review with the membership and role of the Advisory Group being more clearly defined. The aim is to increase the level of democracy in the composition of the Advisory group. Once the Advisory Group has settled into its new format and function, attention will have to be turned to the Management Committee and how to keep the group fresh and recruit new members as the current generation move on to other activities or simply take a rest.

Currently SASM has no clearly defined role in terms of clinical governance. The present funding level and structure is incompatible with the rigours required for such a role. Furthermore, due to the regional nature of the General Surgical aspects of the audit, (the remaining specialities being true national audits in that they are co-ordinated from a single SASM office), there is some variation in how cases are handled between offices. As a result, the necessary standardisation such a role would require is not present. Quality Assurance, with continuous validation of methodology (reporting and assessment) would also need the commitment of more resource. As stated previously, any release of data for purposes of revalidation, for example, would also have to be agreed in writing by individual clinicians.

It is however self evident that society is increasing its requirement for clinical accountability and external safeguards. It would be up to the audited members of the profession to decide whether a professionally derived body facilitating peer review is the basis for a way forward. However, any development that adversely affects how the clinicians view the audit may very well result in its failure. Hopefully these differing points will be balanced through discussion and consensus.

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