WAASM

Annual Report 2008

Royal Australasian College of Surgeons

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Royal Australasian College of Surgeons

Western Australian Audit of Surgical Mortality (WAASM)

ANNUAL REPORT 2008

THE UNIVERSITY OF WESTERN AUSTRALIA

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CHAIRMAN'S REPORT

This is the fifth Annual Report published by the Western Australian Audit of Surgical Mortality (WAASM). It is an opportune moment to review how WAASM has progressed, and to look to the future.

Without question the most important change over the last five years has been the environment within which WAASM operates. Five years ago Clinical Governance was a concept being aired in the United Kingdom (UK). Clinical Governance is now central to the Quality and Safety program developing in Western Australia (WA). Five years ago WAASM was voluntary. The advent of the Western Australian Review of Mortality (WARM) has made mortality review of all in-hospital deaths mandatory. Five years ago Western Australian surgeons were an isolated group pioneering a state wide surgical audit. The Royal Australasian College of Surgeons (the College) has now established the Australian and New Zealand Audit of Surgical Mortality (ANZASM).

The biggest change during the next five years is going to be the environment within which WAASM operates. This change will be fast, substantial and focused on patients and their outcomes. In the United States Pay for Performance (P4P) and in the UK Payment by Results (PbR) are becoming well established. It is absolutely certain that the extra public health funding the current Australian Federal Government has promised the states will be linked to a requirement to publicly report outcome measurements. These demands will include the private sector that receives substantial federal government subsidies. The federal government has a moral and political responsibility to ensure it spends taxpayers' money in the most clinically effective way. Neither politicians nor patients are going to tolerate resistant doctors or hospitals withholding the publication of outcome data they believe they have the right to see and have paid for. The Australian medical community appears to be ill-prepared for the demands that are going to be placed on it.

Those who doubt that change is coming to Australia, and more rapidly than they think, need only look to the National Health Service (NHS). Mortality rates for individual UK cardiac surgeons have been available on the website for three years, which now has 12,000 hits a month. This is strong evidence that patients want and use this data. The UK cardiac surgeons themselves acknowledge that there is compelling evidence to show that publication of this data has improved outcomes. The same data also refutes initial claims this would lead to case selection, risk avoidance and other outcome gaming. Not only have UK cardiac surgeons crossed the Rubicon, nobody drowned on the way! Indeed life on the other side is probably better as the results of cardiac surgery in the UK are now the best in Europe.

This positive experience has prompted the NHS to extend this process and by late 2008 similar outcome data for hip and knee replacements and aortic aneurysm surgery will be available on the NHS website. Outcome data for other specialities will follow as data quality becomes more robust. Initially this data will be based on units, but the NHS is committed to publishing a wide range of individual consultant data. In WA the Department of Health's decision to mandate participation in WARM is only a gentle introduction of what is to come.

The College has invested considerable time, money and potentially its reputation in establishing ANZASM. The College has been unwavering when arguing that its core business is establishing and maintaining surgical standards. It will be difficult for those outside the College to understand how attendance at Annual Scientific Conferences is mandatory, but participation in arguably the College's most important quality and safety initiative is not. It would seem inevitable that complete participation in ANZASM will become a mandatory requirement of Continuing Professional Development (CPD), as anything less will have the potential to jeopardise the College's reputation for safety and quality. It will only take one non-participating surgeon to hit the media for the wrong reasons and the College will appear unable to discharge one of its self proclaimed core responsibilities. The College cannot afford for ANZASM to fail. WAASM would encourage those few WA surgeons who are not participating to submit all of their deaths.

During the last five years WA hospital accreditation committees have not embraced WAASM as they might. Hospitals should have already made participation in WAASM a requirement of accreditation. In the UK consultants undergo an annual appraisal and surgeons must include details of their national mortality audit participation. WA hospitals accreditation committees need to take a greater interest in ensuring that safety and quality processes are not only in place, but take place. Once again the profession should note that in the absence of an adequate response the WA Department of

Health took it upon itself to make mortality audit mandatory in public hospitals through WARM. It will inevitably extend this to private hospitals through the licensing process. The next step will be for this data to become public in some form.

Florence Nightingale recorded that patients left the hospital 'dead, relieved or unrelieved'. In Australia 150 years later we only know whether patients leave dead or alive. Patient Reported Outcome (PROMS) are being strongly promoted by Sir Bruce Keogh, the NHS medical director. A leading advocate of PROMS over the last 10 year has been the British United Provident Association (BUPA), then the UK's largest private hospital operator, who considered this data when reviewing consultants' admitting rights. BUPA is currently expanding into Australia as a health fund and there is every reason to believe they will support the introduction of a quality process they found valuable in the UK. Health minister Lord Darsi's final review (High Quality Care for All) has open publication outcomes as one of its core goals. Of note both Sir Bruce and Lord Darsi are surgeons.

Surgeons have understandable concerns about the validity, interpretation and verification of their outcome data. The surest way to ensure accurate data is for surgeons to take responsibility for the process from its collection through to its dissemination. Others will rightly argue that surgeons have a professional responsibility to know what they are doing and how they are doing it. It is certain that if the profession does not do this, others will.

In the UK the inquiry into cardiac surgery in Bristol was a watershed event. Despite a number of widely reported failures of care, there has not yet been such an event in Australia. A manslaughter trial in Bundaberg may yet prove to be that watershed event. The Australian surgical community needs to be prepared.

In May 2008 the Royal College of Surgeons England held a seminar on 'Outcome Measurement in Surgery'. Sir Bruce warned the representatives of the medical colleges 'There is no going back'. The Department (of Health) is not seeking your permission. It is merely seeking your help. 'All changed, changed utterly'.[1]

James Aitken
WAASM Chairman

ABBREVIATIONS

ASA	American Society Anesthesiologists
ANZASM	Australian & New Zealand Audit of Surgical Mortality
BUPA	British United Provident Association
CPD	Continuing Professional Development
DVT	Deep Vein Thrombosis
HDU	High Dependency Unit
ICU	Intensive Care Unit
IQR	Interquartile Range
NHS	National Health Service
P4P	Pay for Performance
PbR	Payment by Results
PROMS	Patient Reported Outcome Measurements
RACS	Royal Australasian College of Surgeons
SASM	Scottish Audit of Surgical Mortality
SPSS	Statistical Package for Social Sciences
TOPAS	The Open Patient Administration System
UK	United Kingdom
UWA	The University of Western Australia
WA	Western Australia
WAASM	Western Australian Audit of Surgical Mortality
WADH	Western Australian Department of Health
WARM	Western Australian Review of Mortality

EXECUTIVE SUMMARY

Background

The Western Australian Audit of Surgical Mortality (WAASM) is an external independent peer review of surgical mortality. WAASM is now in its seventh year having commenced in June 2001 as a pilot project under the management of the University of Western Australia (UWA). In 2005 the management was transferred to the Royal Australasian College of Surgeons. Subsequently the college established the Australian and New Zealand Audit of Surgical Mortality (ANZASM). Similar mortality audits are now being established in all other states and territories.

WAASM is funded by the Western Australian Department of Health (WADH) and has qualified privilege protection under federal legislation.

Audit process and reporting conventions

WAASM is notified of all in-hospital deaths. Cases where a surgeon was involved in the care of the patient are audited. A structured proforma is sent to the surgeon for self completion. Completed proformas are de-identified and then peer reviewed by another consultant surgeon (first-line assessment).

Approximately 700 deaths are reported to WAASM each year. There has been a substantial increase in the number of proformas returned from 65% in 2002 to 95% in the current reporting year (2007).

Second-line assessment

The number of second-line assessments (case note reviews) has progressively decreased since 2002 with 7% of cases referred for second-line assessment in 2007 down from 23 % in 2002.

Analysis

This report contains an analysis of cases reported to WAASM from January 2002 to December 2007 that had completed the audit process by 31 March 2008 (n=2634). Some data are missing due to incomplete information in proformas and where this occurs it is noted in the text.

Comparison of surgeons' and assessors' view of areas of concern and adverse events

Similar to previous years, WAASM has noted that assessors report almost double the areas of concern or adverse events compared to the level of clinical incidents reported by surgeons

Patient sample demographics

Of the 2634 cases which had completed the audit process (2002-2007), the median age was 78 years with an interquartile range (IQR) of 67-85 years. Neurosurgical patients had a median age of 60 years (IQR 45-75 years). Orthopaedic patients had a median age of 85 years (IQR 80-90 years). Approximately 60% of cases had an American Society of Anesthesiologists (ASA) grade of four or more. The majority of cases (96%) had at least one or more comorbidity which increased the patient's risk of death. The main causes of death in patients aged 70 years or less were brain haemorrhage, heart failure, septicaemia, malignancy and brain injury The main cause of death in patients aged over 70 years included heart failure, septicaemia, multiple organ failure, malignancy, pneumonia and respiratory failure.

Western Australian Review of Mortality (WARM)

The WADH issued an operational directive in November 2006 which requires all in-hospital deaths to be classified and reviewed within three months of the date of death by the Western Australian Review of Mortality (WARM); however, deaths that have completed the audit process through WAASM are exempt from the WARM process. While it seems that the introduction of WARM has had no negative effect on WAASM, the full impact of WARM on the audit process will become clearer over the next year.

Recommendations

The recommendations of this report are as follows:

- Western Australian surgeons should submit their deaths through WAASM rather than WARM.
- Western Australian surgeons should ensure that all proformas are completed fully.
- The ANZASM should define an agreed list of adverse events to ensure uniformity of data collection across the country.
- A detailed study on the reasons for delay should be included in the next WAASM annual report.

1 INTRODUCTION

Key points

- WAASM is an external, independent peer-review audit of the process of care associated with all surgically related deaths in WA.
- This annual report covers the period from 1 January 2002 to 31 December 2007, as audited on 31 March 2008.
- Particular attention is paid to areas of concern and adverse events.
- The audit process involves a self-assessment by the surgeon followed by a first-line assessment by another surgeon. If necessary a more detailed review of the case notes (second-line review) may be completed.
- WAASM's main role is to feed back information to inform, educate, facilitate change and improve quality of practice.
- WAASM provides feedback to surgeons, hospitals and the community.

1.1 Background

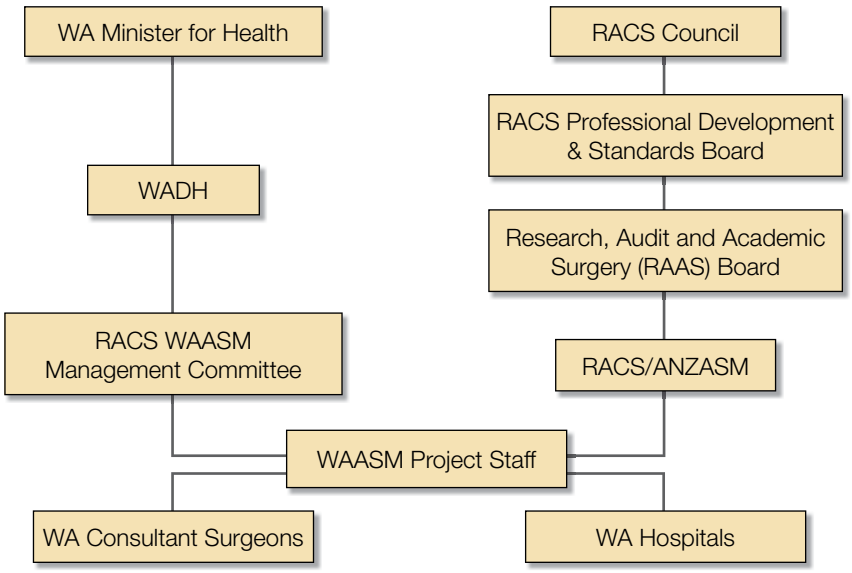
WAASM is an external independent peer review audit of the process of care associated with all surgically-related deaths that occur in Western Australia (WA). The principle aim of an audit is to improve the quality of care provided to the patient.[2-4]

WAASM is now in its seventh year having commenced in June 2001 as a pilot project under the management of the University of Western Australia (UWA). WAASM's methodology is based on the Scottish Audit of Surgical Mortality (SASM).[5] In 2005 management was transferred to the Royal Australasian College of Surgeons (the College). Subsequently, the College established the Australian and New Zealand Audit of Surgical Mortality (ANZASM). Similar mortality audits are now being established in all other states and territories.

1.2 Governance

WAASM is protected by both state and federal legislation. The WAASM Management Committee is registered under the Western Australian Health Services Quality Improvement Act 1994 (gazetted 26 July 2005). ANZASM is protected under the Commonwealth Privilege scheme under part VC of the Health Insurance Act 1973 (gazetted 6 November 2006).

Figure 1.1: The structure of the Western Australian Audit of Surgical Mortality (WAASM)



ANZASM = Australian & New Zealand Audit of Surgical Mortality,
RACS = Royal Australasian College of Surgeons, WA = Western Australia,
WADH = Western Australian Department of Health, WAASM = Western Australian Audit of Surgical Mortality.

2 THE AUDIT PROCESS

2.1 Methodology

The detailed methodology of the WAASM audit process is contained in the 2003 to 2007 WAASM annual reports[6-9], that are also available on the College website.‡

Deaths in most public hospitals are reported to WAASM through the open patient administration system (TOPAS). Private hospitals, smaller public hospitals and regional centres that are not linked in with TOPAS notify WAASM of deaths via their medical records department. All cases in which a surgeon was involved with the care of the patient are included in the audit, whether or not the patient underwent a surgical procedure.

WAASM sends the consultant surgeon associated with the case a structured proforma for completion. The completed proforma is returned to WAASM, is de-identified and then assessed by a 'first-line' assessor. This will be a different surgeon of the same specialty ('peer review'). The first-line assessor will either close the review or advise that the case should undergo further assessment, i.e. a 'second-line' or 'case note review'.
Cases may be referred for a second-line assessment if:

- areas of concern or adverse events are thought to have occurred during the clinical care of the patient that warrants further investigation
- a report could usefully draw attention to lessons to be learned, either for clinicians involved in the case or as part of a collated assessment for wider distribution.

Second-line assessors are different consultant surgeons from the same specialty as the surgeon associated with the case, and work in a different hospital to the one where the death occurred.

2.2 Providing feedback

The main aim of WAASM is to inform, educate, facilitate change and improve practice. Individual surgeons are provided the assessors feedback on their cases. Collated case note reviews are disseminated to all surgeons. All information is de-identified so that events cannot be linked to the patient, hospital or surgeon.

2.3 Reporting conventions

2.3.1 Reporting clinical incidents

In the structured proforma the surgeon is asked to document whether there were any clinical incidents in the care of the patient. The surgeon is asked to:

- report on the impact of the incident on the outcome, that is, whether the incident:
  - made no difference to outcome
  - may have contributed to death
  - caused the death of a patient who would otherwise have been expected to survive.
- give their opinion as to whether the incident was preventable, using the following categories:
  - definitely
  - probably
  - probably not
  - definitely not.
- indicate who the incident/event was associated with:
  - audited surgical team
  - another clinical team
  - hospital
  - other.

The assessor(s) also complete the same matrix.

‡ http://www.surgeons.org/waasm

2.3.2 Analysis of clinical incidents

The focus of the WAASM reports is primarily on areas of concern and adverse events. While data on areas for consideration are collected, they are excluded from the analysis and are not included in this report because they generally make no difference to the outcome. However, it is still important to obtain information on areas of consideration as information on 'less serious events' are important for improving the overall care of the patient.

2.4 Data analysis

WAASM audits all deaths that occur in hospital while under the care of a surgeon. Terminal care cases are excluded from the full audit process. The 2008 annual report covers deaths reported to WAASM from 1 January 2002 to 31 December 2007, censored as on 31 March 2008. Due to the time lag some 2007 cases are still under review and will be included in the next annual report. Case figures in previous annual reports may vary from this report because some cases were completed after the censor dates of the previous annual reports.

Data are entered and stored in a Microsoft Office Access (2003) database and analysed using the Statistical Package for Social Sciences (SPSS), version 15.0 and Microsoft Office Excel (2003). Numbers in the parentheses in the text (n) represent the number of cases analysed. As not all data were completed, the total number of cases used in the analyses varies. The total numbers of cases included in the analyses are provided at the bottom of all tables and figures in the report.

Neurosurgeons complete an abbreviated surgical proforma; consequently, some data is missing from the dataset. For certain analyses neurosurgical data is not included; where this is the case, it is noted.

2.5 Performance review

Recommendations were included in the 2007 WAASM report.[9] An important measure of the success of WAASM is whether these recommendations have been addressed or achieved. A list of recommendations and progress reports are listed in Section 5.

3 AUDIT PARTICIPATION & ASSESSMENT

Key points
• Participation in WAASM is voluntary. • There has been a slight decrease in the number of reported deaths from 2006 to 2007.

3.1 Overview of participation

3.1.1 Deaths reported to WAASM

Prior to the commencement of the WARM on 1 January 2007, participation in the WAASM was voluntary. Following the commencement of WARM, all deaths have to be reported either via WAASM or WARM. Table 3.1 summarises the data on deaths reported to WAASM. Percentage participation is calculated on the completion and return of the proformas. The audit process is complete once the proforma has been assessed either by the first- or second-line assessor.

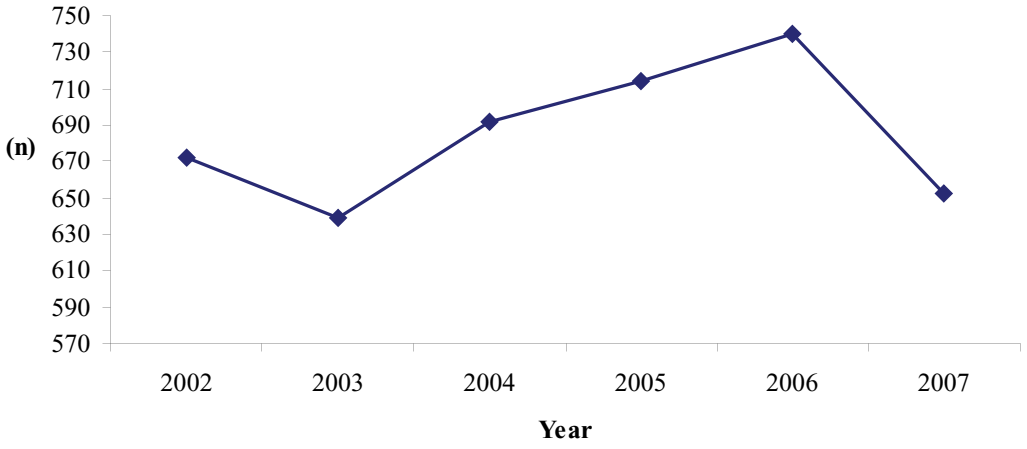
Table 3.1: Deaths reported to WAASM between 1 January 2002 and 31 December 2007 (audit status as at 31 March 2008)

	No. of cases (%)						
	2002	2003	2004	2005	2006	2007	Total
Total deaths reported	672	639	692	714	740	652	4109
Audit process complete	411 (61)	383 (60)	468 (68)	505 (71)	526 (71)	341 (52)	2634 (64)
Proforma complete, awaiting assessment[a]	0	0	4 (<1)	25 (4)	131 (18)	260 (40)	420 (10)
Proforma not returned	205 (31)	191 (30)	142 (21)	110 (15)	24 (3)	9 (1)	681 (17)
Terminal care cases (excluded)	5 (<1)	9 (1)	16 (2)	28 (4)	24 (3)	18 (3)	100 (2)
Closed no information available	4 (<1)	7 (<1)	2 (<1)	7 (1)	1 (<1)	0	21 (<1)
Case associated with nonparticipant[b]	47 (7)	49 (8)	60 (9)	39 (5)	34 (5)	24 (4)	253 (6)

[a] Case awaiting first- or second-line assessment

[b] Nonparticipants are surgeons who have indicated that they do not wish to participate in WAASM

Figure 3.1: Reported number of deaths to WAASM (2002 – 2007) (n=4109)



Comment

There has been a slight decrease in the number of deaths reported to WAASM in the period 2006 -2007. However, this number is within the normal variation reported to WAASM and is similar to the number of deaths reported in previous years (2002-2004).

3.2 Participation in WAASM

Key points

- The percentage of proformas returned has increased from 65% in 2002 to 95% in 2007. This suggests that surgeons prefer to report any deaths to WAASM.
- Surgeon participation in the audit has increased.
- Over the total audit period, surgeons returned 77% of proformas.

Figure 3.2: Proforma completion rates (2002 to 2007) (n=4109)

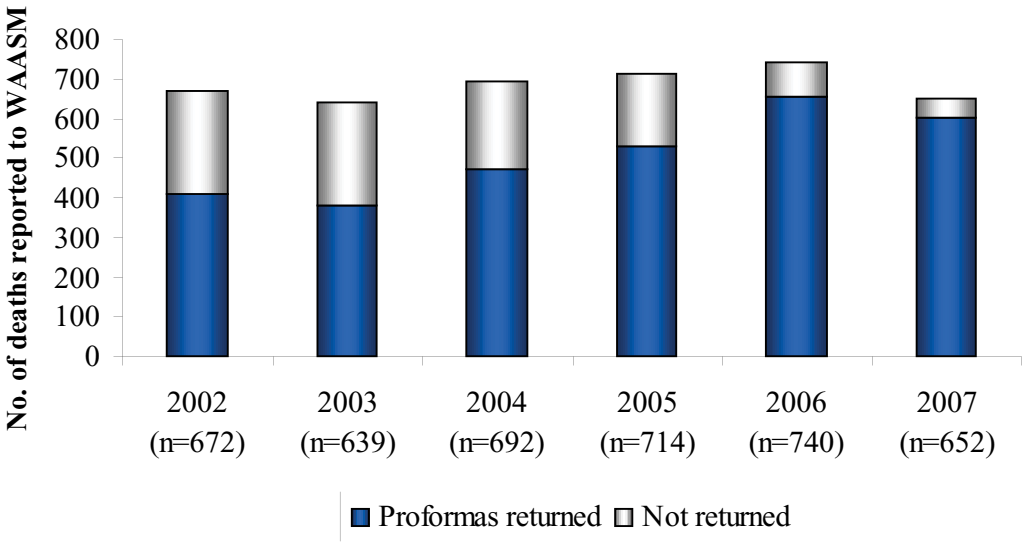


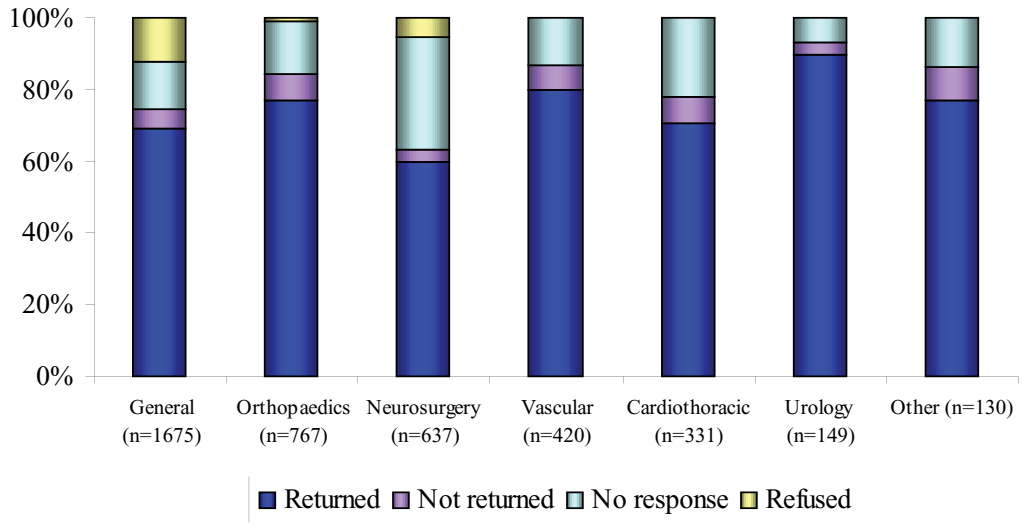
Figure 3.2 above includes terminal care cases, cases still awaiting assessment and cases associated with nonparticipants.

Table 3.2: Surgeon Participation

	No. of cases (%)						
	2002	2003	2004	2005	2006	2007	Total
Reported deaths	672	639	692	714	740	652	4109
Surgeons associated with reported deaths	146	139	147	141	146	170	889
Proformas returned[a] (%)	420 (63)	399 (62)	490 (71)	565 (79)	682 (92)	619 (95)	3175 (77)
Surgeons with 3 or more deaths:	81	76	75	79	82	80	473
Case status completed	51 (63)	49 (64)	51 (68)	61 (77)	63 (77)	50 (63)	325 (69)
Case status in progress	0 (0)	0 (0)	2 (2)	1 (1)	14 (17)	28 (35)	45 (10)
Returned no forms[b]	25 (31)	24 (32)	17 (23)	14 (18)	2 (2)	0 (0)	82 (17)
Nonparticipants[c]	5 (6)	3 (4)	5 (7)	3 (4)	3 (4)	2 (2)	21 (4)

[a] Includes terminal care cases, cases awaiting assessment & closed cases no further information available
[b] Consultant no response
[c] Surgeon refused to participate

Figure 3.3: Proforma status by specialty (2002 – 2007) (n=4109)



Other = obstetrics & gynaecology, otolaryngology & ophthalmology, paediatrics and plastic surgery

Comment

Approximately 700 deaths are reported to WAASM each year (Figure 3.1). Consultant participation has increased from 61% in 2002 to 95% in 2007 (Figure 3.2). Total participation for 2007 will be greater than reported due to additional cases moving through the audit process. They will be included in the next report. This suggests surgeons prefer to report any deaths via WAASM.

3.3 Hospital Participation

Key points

- All hospitals in WA (both public and private) participate in the audit (n=38).
- 80% of audited deaths occurred in public hospitals.
- 74% of audited deaths occurred in three public hospitals.
- 25% of cases had been transferred from one hospital to another.

All 38 hospitals in WA take part in the audit process. Hospitals in WA range from small district hospitals to larger regional centres in rural areas and the metropolitan area, and from large teaching hospitals to smaller public and private hospitals.

Figure 3.4: Reported deaths associated with 38 hospitals in WA in which surgical procedures take place (n=4109)

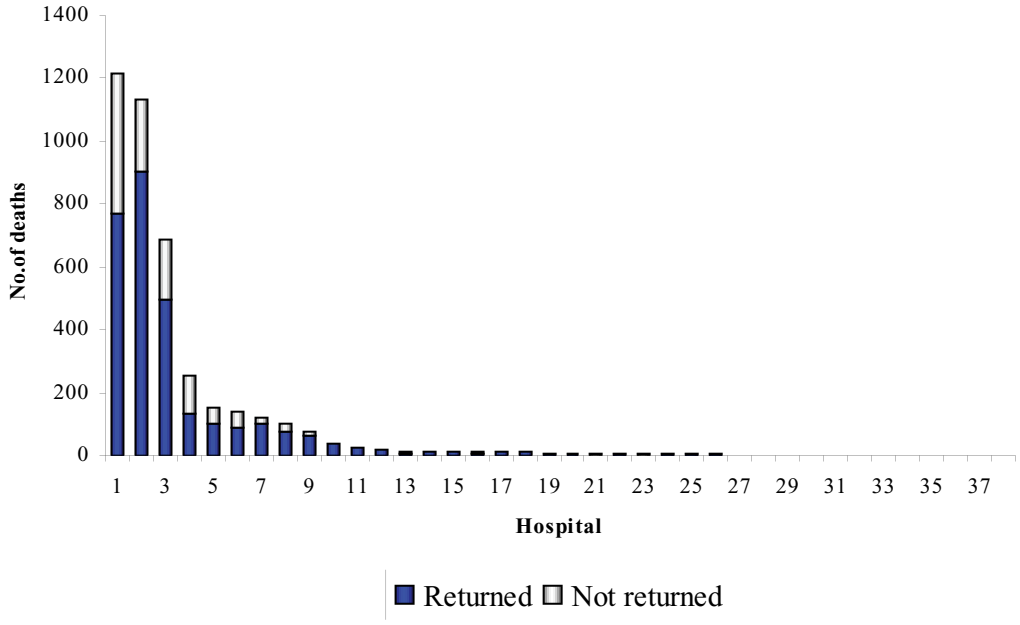
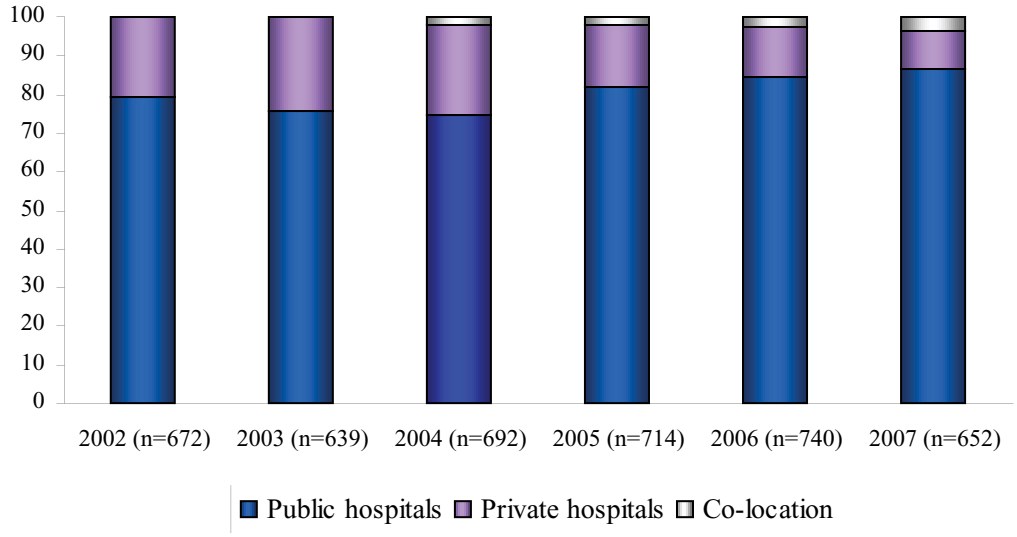


Table 3.3: Cases where the patient was transferred from one hospital to another hospital

	No. of cases (%)						
	2002	2003	2004	2005	2006	2007	Total
Completed cases[a]	402	388	454	441	419	257	2361
Patient transferred	93 (23)	104 (27)	110 (24)	107 (24)	110 (26)	61 (24)	585 (25)

[a] These data were computed on completed cases (including terminal care case); neurosurgical cases where the question was not on the neurosurgical proforma have been excluded. There are also missing data for these fields. Numbers of completed cases are reflected in Table 3.1

Figure 3.5: Patients admitted to public or private hospital in WA (2002 – 2007) (n=4109)



Note: Co-location refers to a case in which the patient has been in both public and private hospital.

Comment

Seventy four percent of deaths occurred in three public hospitals. Twenty five percent of cases had been transferred from one hospital to another.

3.4 Second-line assessment

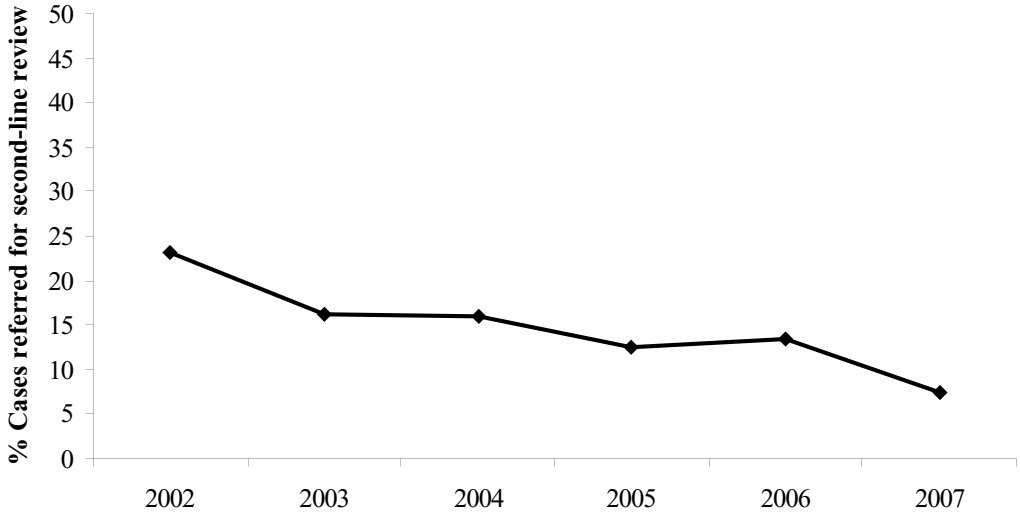
Key points
• Request for second-line assessors has continued to decrease over the audit period.

Table 3.4: Cases referred for second-line assessment

	No. of cases (%)						
	2002	2003	2004	2005	2006	2007	Total
Completed cases[a] and cases with second-line in progress	411	383	471	514	558	355	2692
Cases referred for second-line assessment	95 (23)	62 (16)	75 (16)	64 (12)	75 (13)	26 (7)	397 (15)
Proforma returned, first-line in progress	0	0	1	14	95	244	354

[a] Terminal care cases were excluded

Figure 3.6: Proportion of cases referred for second-line assessment (2002 – 2007) (n=397)



Comment

The proportion of cases referred for second-line review has progressively decreased over the first six years (23% in 2002 to 7% in 2007). One of the important reasons for this is that surgeons are completing the proformas more comprehensively and more are including letters and discharge summaries. These are very helpful as they often explain the rationale underlying the process of care. With this additional detail it is often possible for WAASM to close the review without a second-line assessment. WAASM would encourage all consultants to include relevant letters and discharge summaries.

4 RESULTS

4.1 Overview and patient sample demographics

Key points

- A total of 2634 cases had completed the audit (2002 – 2007) as of 31 March 2008.
- 55% of cases were male; the median age was 78 years (76 and 81 years for males and females respectively).

When censored on 31 March 2008 a total of 2634 cases were reported between the 1 January 2002 and 31 December 2007 (Table 4.1).

Table 4.1: Completed cases (2002 – 2007)

	No. of cases						
	2002	2003	2004	2005	2006	2007	Total
Audit process complete	411	383	468	505	526	341	2634

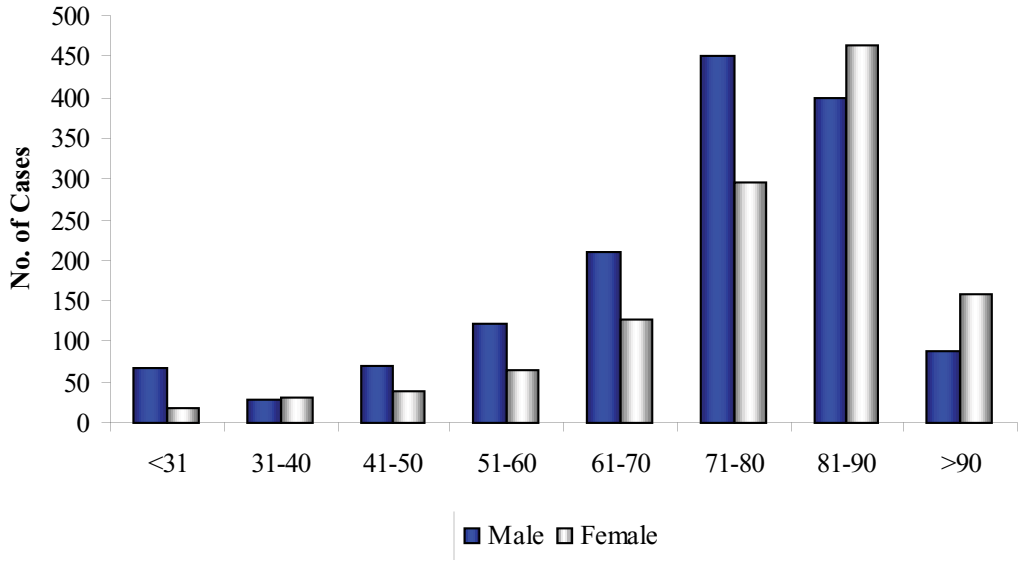
4.1.1 Age and sex distribution

Table 4.2 shows the median age and sex of the audited patients, while figures 4.1 and 4.2 look at the distribution of age by sex. Figure 4.3 reports on age by specialty.

Table 4.2: Median age and sex (2002 – 2007)

	No. of cases	Median age (years)	Inter-quartile range (years)
All patients	2634	78	67 – 85
Male (55%)	1436	76	65 – 83
Female (45%)	1198	81	72 – 87

Figure 4.1: Age distribution by sex (2002 – 2007) (n=2634)

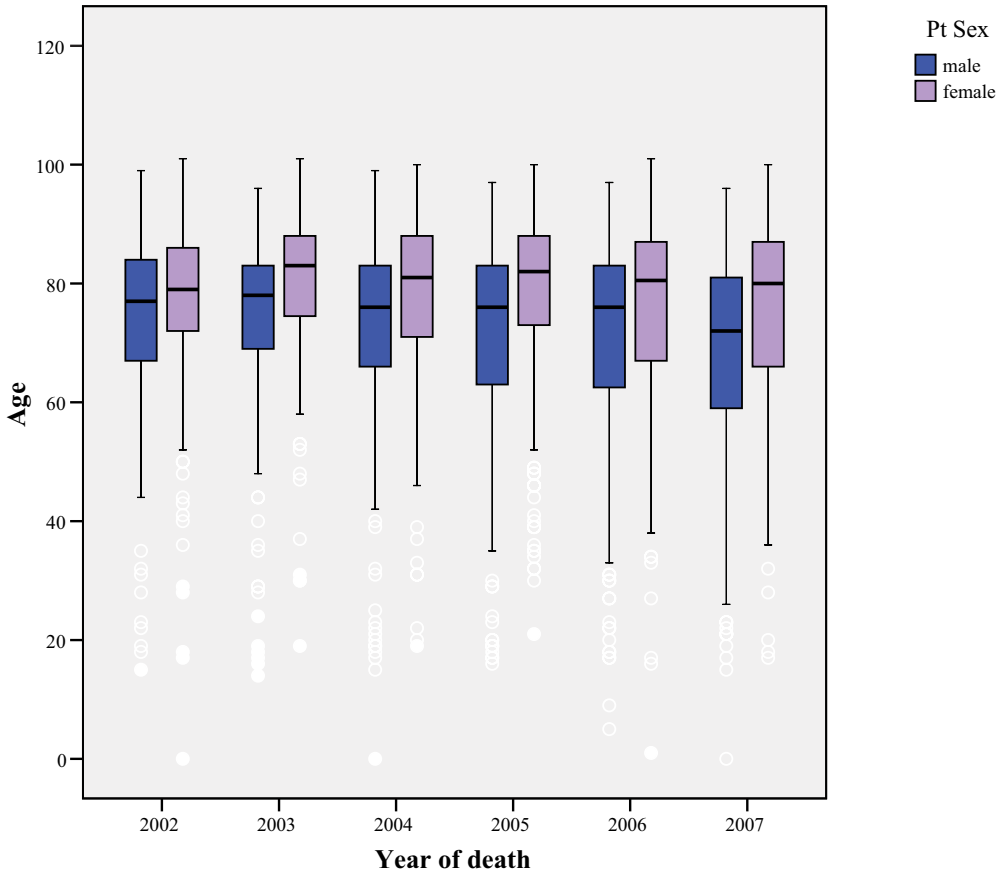


Figures 4.2 and 4.3 are box and whisker plots, in which the:

- Central box represents the values from the lower to upper quartile (25-75 percentiles)
- Middle line represents the median value
- Vertical line extends from the minimum value to the maximum value, excluding outliers and extreme values (i.e. values larger than the upper quartile and plus 1.5 or 3 times the inter-quartile range)

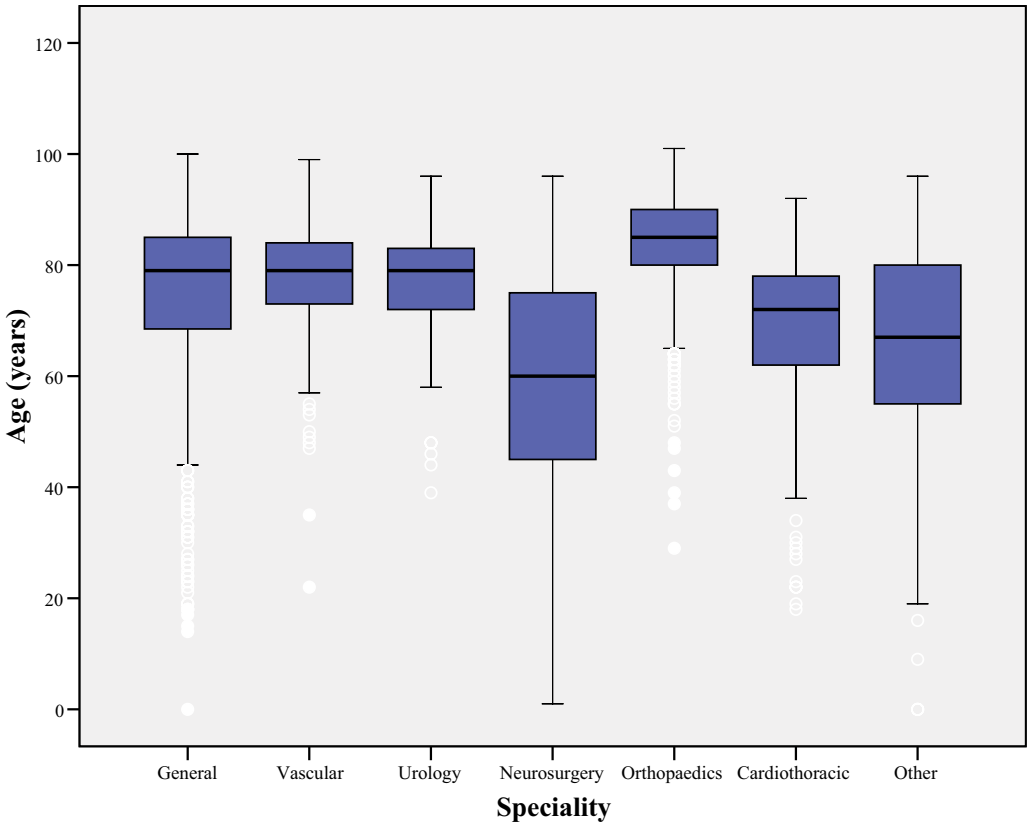
Outliers and extreme values can be displayed at separate points; however, in figures 4.2 and 4.3 they have been excluded.

Figure 4.2: Age distribution of audited patients (2002 – 2007) (n=2634)



Note: Outliers and extreme values have been excluded.

Figure 4.3: Age of audited patients by specialty (2002 – 2007) (n=2634)



Other = obstetrics & gynaecology, ophthalmology & otolaryngology, paediatrics and plastic surgery

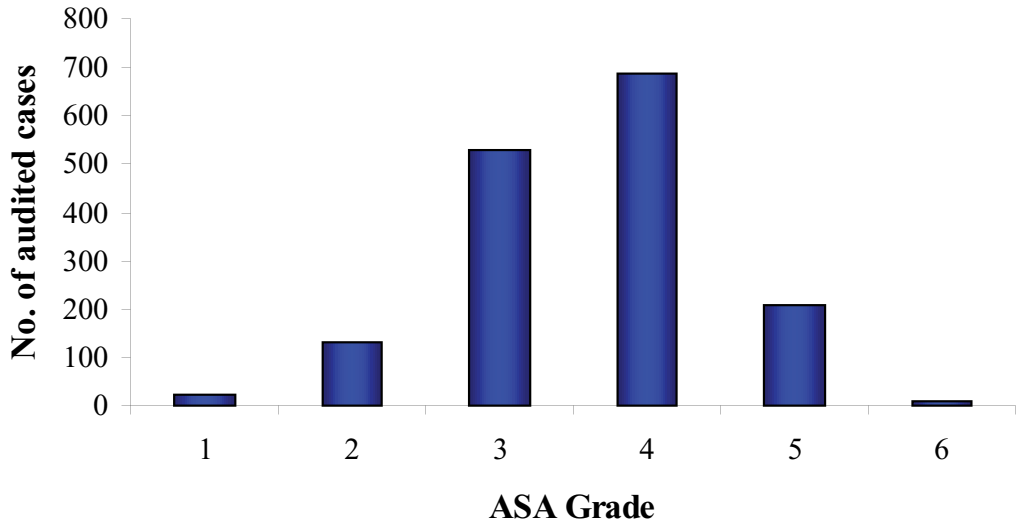
4.1.2 American Society of Anesthesiologists (ASA) grades

The audit collects information on the American Society of Anesthesiologists grades; these are an internationally recognised classification used to quantify preoperative physical status. Table 4.3 describes the six ASA grades.

Table 4.3: ASA grades

ASA Grade	Characteristics
1	A normal healthy patient
2	A patient with mild systemic disease and no functional limitation
3	A patient with moderate systemic disease and definite functional limitation
4	A patient with severe systemic disease that is a constant threat to life
5	A moribund patient unlikely to survive 24 hours, with or without an operation
6	A brain dead patient for organ donation

Figure 4.4: ASA Grades (2002 – 2007) (n=1587)



Note: data missing for 1047 cases

Comment

The majority of patients in the audit have an ASA grade of either 3 or 4, meaning that they were assessed as either having a moderate or severe degree of systemic disease prior to treatment.

4.1.3 Cause of death

The most common causes of death among audited cases are shown in Table 4.4. The most common causes of death in those aged less than 70 years were brain haemorrhage and heart failure; in those older than 70 years the main cause of death was heart failure and septicaemia. Details on cause of death for all patients can be found in Appendix 1.

Table 4.4: Most common causes of death in audited cases (2002 – 2007) (n=2571)

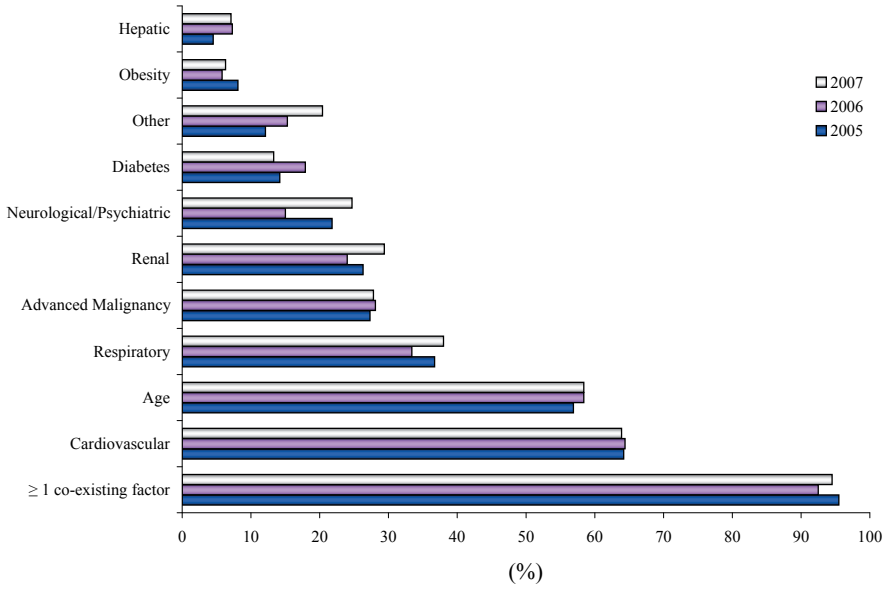
CAUSE OF DEATH	n	(%)
Cases <70years old (n =722)		
Brain haemorrhage	87	11
Heart failure	87	11
Septicaemia	67	9
Multiple organ failure	62	8
Malignancy	59	8
Severe brain injury	58	8
Cases ≥ 70 years old (n=1849)		
Heart failure	441	24
Septicaemia	172	9
Multiple organ failure	132	7
Pneumonia	121	7
Respiratory failure	118	6
Malignancy	104	6

Note: data missing for 63 of the 2634 cases

4.1.4 Comorbidity

Surgeons are asked to indicate if there are any significant comorbidities (Figure 4.5) Neurosurgeons do not complete this question in their form and are therefore excluded from this analysis.

Figure 4.5: Comorbidity status in completed cases 2005, 2006 & 2007



Note**:** neurosurgical cases excluded

Comment

Most patients had more than one co-existing factor for the last three years of the audit.

4.1.5 High dependency and intensive care units

Table 4.5: Actual use & assessor opinion of use of a high dependency or intensive care unit

No. of cases (%)		2002 (n=399)	2003 (n=380)	2004 (n=451)	2005 (n=430)	2006 (n=413)	2007 (n=255)
Use of	ICU	160 (40)	165 (43)	195 (43)	175 (41)	163 (40)	97 (38)
	HDU	71 (18)	74 (20)	90 (20)	74 (17)	64 (16)	50 (20)
Assessors opinion on cases where patient was not admitted to either ICU or HDU							
ICU should have been used		11 (3)	9 (2)	18 (4)	14 (3)	14 (3)	10 (4)
HDU should have been used		71 (18)	36 (10)	38 (8)	32 (7)	20 (5)	22 (9)

Note: above analysis excludes neurological cases. ICU = intensive care unit, HDU = high dependency unit

Comment

Each year assessors note that 5-10% of patients who were not admitted to HDU might have benefited from such an admission. This data does not include patients who had a fractured hip who rarely go to HDU and would overwhelm these units if they were admitted. Looking to the future the demand for HDU support is likely to increase. Current planning of medical services in metropolitan WA needs to be flexible enough to cope with the likely additional future demand.

4.2 Comparison of surgeons' and assessors' views

Key points
• Assessors reported more areas of concern or adverse events than the associated surgeon

Incidents reported by the surgeons and assessors were compared (Table 4.6). This system of classifying events was introduced in November 2003; hence, data reported is from 2004 to 2007.

Kappa scores measure the level of agreement or variation between two observers. Kappa scores were obtained for surgeons and assessors view on performance.

Table 4.6: Surgeons' and assessors' views on performance (2004 – 2007)

Year	Surgeon	Assessor				
		Consideration	Concern	Adverse event	No event	Total
2004	Consideration	22	15	5	22	64
	Concern	5	7	9	4	25
	Adverse event	3	0	5	3	11
	No event	43	23	16	286	368
	Total	73	45	35	315	468
2005	Consideration	12	13	5	15	45
	Concern	2	8	5	5	20
	Adverse event	1	2	5	1	9
	No event	27	21	21	362	431
	Total	42	44	36	383	505
2006	Consideration	14	4	6	13	37
	Concern	2	9	2	8	21
	Adverse event	1	3	2	2	8
	No event	26	17	15	402	460
	Total	43	33	25	425	526
2007	Consideration	5	7	2	12	26
	Concern	2	4	0	2	8
	Adverse event	0	1	3	2	6
	No event	14	5	14	268	304
	Total	21	17	19	284	341

Notes: Data can only be analysed where both surgeon & assessor have completed the proforma. Missing data will account for differences in numbers.

Figure 4.6: Percentage of adverse events reported by surgeons and assessors

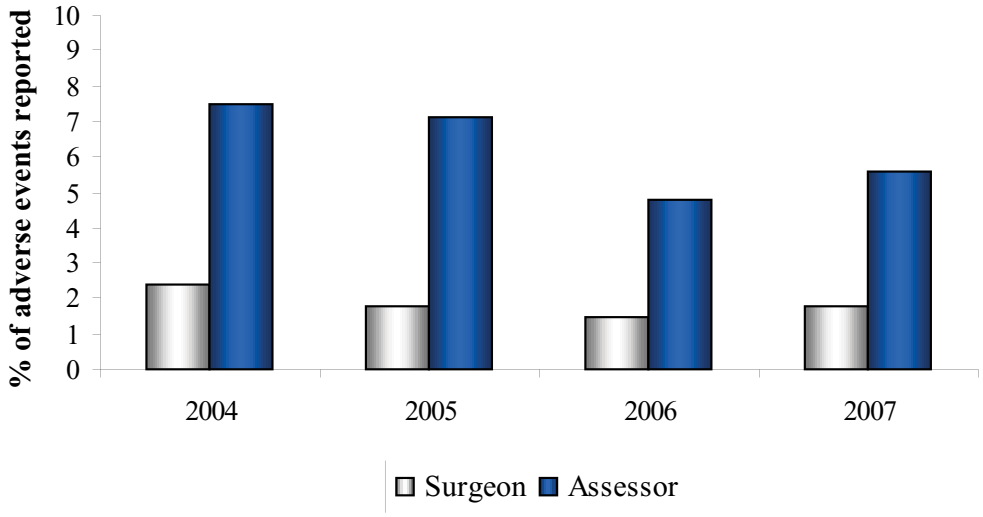


Figure 4.6 compares the percentage of adverse events reported by surgeons and assessors for the same cases. There is a clear trend over the years presented of assessors concluding that more adverse events occurred in these cases than reported by the treating surgeons. Levels of agreement (Kappa score) by year can be seen in table 4.7.

Table 4.7: Level of agreement between surgeons' and assessors' views on performance

Year	Kappa score (95% confidence interval)
2004	0.29 (0.21 – 0.36)
2005	0.31 (0.24 – 0.39)
2006	0.34 (0.25 – 0.42)
2007	0.31 (0.20 – 0.42)

Interpretation of Kappa scores: <0 = no agreement, 0.0-0.19 = poor agreement, 0.20-0.39 = fair agreement, 0.40-0.59 = moderate agreement, 0.60-0.79 = substantial agreement, 0.80-1.00 = almost perfect agreement.

Comment

WAASM has consistently demonstrated a level of disagreement between assessors and surgeons. Surgeons appear to under-report events that the assessors believe represent an area of concern or adverse events. For example, in 2007 assessors reported 19 adverse events compared to six adverse events reported by the surgeon. This strongly emphasises the essential role of external independent review.

4.3 Clinical events

Key points
• Assessors considered that a preventable adverse event caused death in 1% of cases.

4.3.1 Reported areas for consideration, of concern and adverse events

Table 4.8 summarises all clinical events reported by assessors by year.

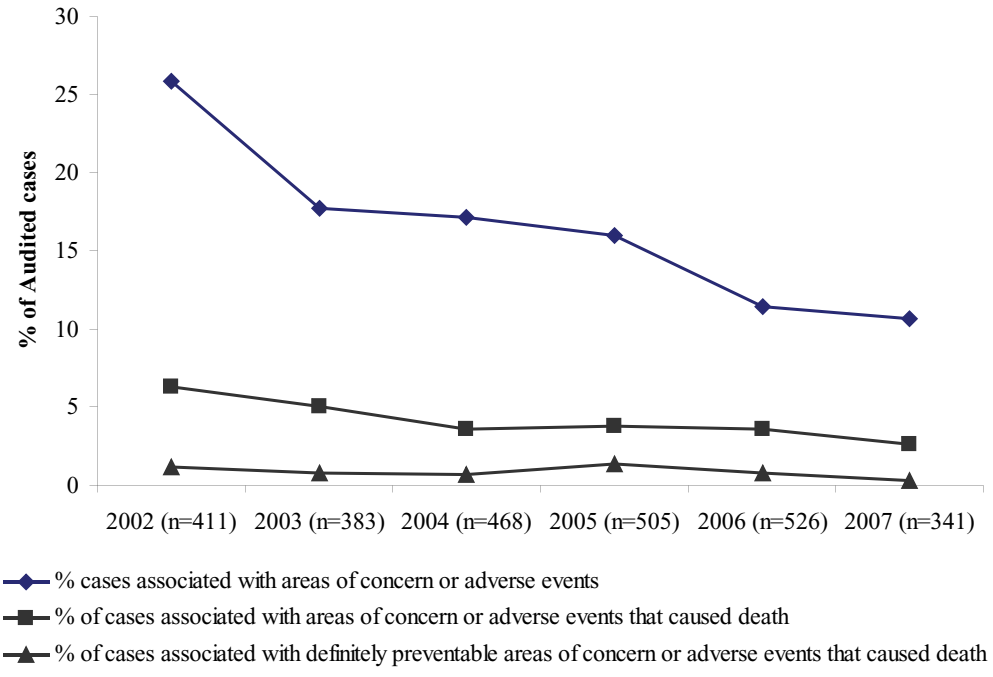
Table 4.8: Audited deaths associated with areas for consideration, of concern, or adverse events as reported by assessors (most significant event only)

	No. of cases (%)						
	2002 (n=411)	2003 (n=383)	2004 (n=468)	2005 (n=505)	2006 (n=526)	2007 (n=341)	Total (n=2634)
Area for consideration	19 (5)	32 (8)	74 (16)	42 (8)	43 (8)	21 (6)	228 (9)
Area for concern	42 (10)	33 (9)	45 (10)	44 (9)	33 (6)	17 (5)	214 (8)
Adverse event (AE)	62 (15)	35 (9)	35 (7)	36 (7)	25 (5)	19 (6)	214 (8)
AE that caused death	24 (6)	19 (5)	17 (4)	19 (4)	19 (4)	9 (3)	109 (4)
AE that caused death, considered definitely preventable	8 (2)	4 (1)	3 (<1)	7 (1)	4 (1)	1 (<1)	27 (1)

Comment

In 16% of cases, assessors considered that there was an area of concern or adverse event. In 1% of cases the assessors considered that the adverse event which caused the death was preventable. The proportion of cases that were associated with areas of concern or adverse events has continued to decrease over the last six years of the audit (Figure 4.7).

Figure 4.7: Cases associated with adverse events or areas of concern (2002 – 2007)



For the period 2002 to 2007 (significance was determined in each case using the Cochran-Armitage 2-sided trend test):

- the proportion of cases associated with areas of concern or adverse events decreased significantly ($p<0.001$)
- the proportion of cases associated with areas of concern or adverse events that caused death also decreased significantly ($p<0.001$)
- the proportion of cases associated with preventable areas of concern or adverse events also significantly decreased ($p<0.001$).

4.4 Admissions

Key points

- Over the period 2002-2007, 80% of cases were admitted to public hospitals.
- Of the 2101 cases admitted to public hospitals, 14% were elective admissions. Of the 460 cases admitted to private hospitals, 40% were elective admissions.
- Of the emergency cases admitted to public hospitals 67% underwent an operation, compared to 85% of emergency cases admitted to private hospitals ($p<0.001$)
- The proportion of areas of concern or adverse events associated with cases that underwent an operation (elective and emergency admissions) was not significantly different between public and private hospitals ($p=0.495$).[a]
- Considering all hospitals, the proportion of areas of concern or adverse events associated with emergency admissions (13%) was significantly less than the proportion of clinical events associated with elective admissions (28%) ($p<0.001$).[a]

[a] Pearson's Chi-square test

4.4.1 Overview of admissions

The audit data with regards to admission covers:

- the type of hospital (public or private)
- the type of admission (emergency or elective)
- whether the patient underwent an operation (operative or non-operative).

The results presented in this section examine these different areas.

Table 4.9: Emergency and public hospital admissions of audited patients

	2002	2003	2004	2005	2006	2007	Total
Audit process completed	411	383	468	505	526	341	2634
% of emergency admissions	73	80	81	82	87	86	81
% of public hospital admissions	79	71	75	82	84	87	80

Figure 4.8: Emergency and elective admissions in audited patients (2002 – 2007) (n=2634)

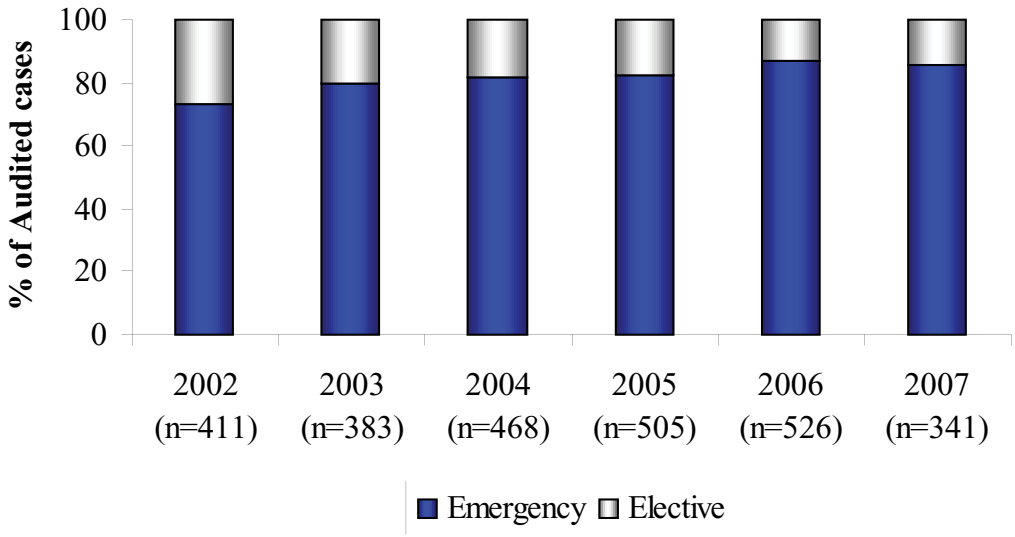
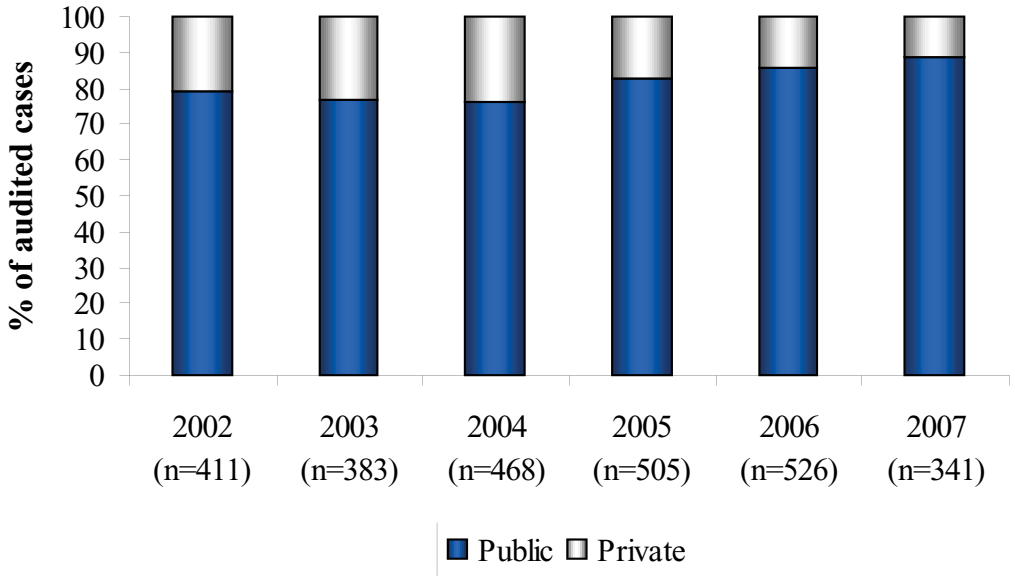


Figure 4.9: Admission of cases to public and private hospitals (n=2634)



Comment

The proportion of deaths occurring in public hospitals has increased. A greater proportion of these cases were being admitted as emergency cases. WAASM only reviews patients who die and this has the potential to bias any interpretation; however, the implications of this trend may be important. Patients that WAASM assesses have a disproportionately high ASA grade, and many are emergencies. Both these factors will increase the clinical acuity of the patients and this has many implications, for example longer average length of stay and increased ICU and HDU usage.

4.4.2 Relationship between factors related to admission data

Key points

- 74% of cases underwent one or more operations.
- 95% of the elective cases underwent an operation. Among elective cases undergoing surgery, the proportion admitted to private hospitals (95%) was not significantly different from the proportion admitted to public hospitals (95%) (p=0.808).[a]
- Of the 2132 emergency admissions, 70% underwent an operation. A significantly higher proportion of emergency admissions admitted to private hospitals underwent surgery compared to those admitted as an emergency to public hospitals (p<0.001).[a]
- Among emergency admissions undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to private hospital (14%) was not significantly different from the proportion admitted to public hospital (18%) (p=0.110).[a]
- Among elective cases undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to a private hospital (25%) was not significantly different to the proportion admitted to a public hospital (32%) (p=0.079).[a]
- Among cases undergoing surgery, the proportion of elective cases associated with areas of concern or adverse events (29%) was significantly greater than the proportion of emergency cases associated with such events (17%) (p<0.001).[a]

[a] Pearson's Chi-square test

Table 4.10: Elective and emergency admissions to public and private hospitals (all cases, 2002 – 2007)

No. of cases (%)				
		Elective	Emergency	Total
(a) All cases – elective & emergency admissions, public & private hospitals	Private	186 (40)	274 (60)	460
	Public	286 (14)	1815 (86)	2101
	Co-location	7 (14)	43 (86)	50
	Total	479 (18)	2132 (82)	2611
(b) Cases that underwent an operation* – elective & emergency admissions, public & private hospitals	Private	177 (95)	233 (85)	410 (89)
	Public	272 (95)	1224 (67)	1496 (71)
	Co-location	7 (100)	25 (58)	32 (64)
	Total	456 (95)	1482 (70)	1938 (74)
(c) Cases that underwent an operation that were associated with an area of concern or adverse event‡	Private	44 (25)	33 (14)	77 (19)
	Public	87 (32)	221 (18)	308 (21)
	Co-location	2 (29)	4 (16)	6 (19)
	Total	133 (29)	258 (17)	391 (20)

Note: Co-location refers to a case in which the patient has been in both public and private hospital.
*Percentages relate to the figures given in part (a) of the table (all cases).
‡Percentages relate to the figures given in part (b) of the table.

For example:
Part (b) = Out of 186 private elective cases, 177 (95%) underwent an operation.
Part (c) = Out of 177 private elective cases, 44 (25%) were associated with an area of concern or adverse event.

Table 4.11: Emergency admissions to private and public hospitals (2002 – 2007)

Table 4.11 reports on emergency admissions by both hospital type (public/private) and specialty.

No. of cases (%)		
(a) By specialty		
	Emergency admissions to private hospitals (n = 274)	Emergency admission to public hospitals (n=1815)
Specialty:		
General	124 (45)	661 (36)
Orthopaedics	70 (26)	421 (23)
Urology	25 (9)	41 (2)
Cardiothoracic	19 (7)	98 (5)
Vascular	21 (8)	220 (12)
Neurosurgery	8 (3)	320 (18)
Other	7 (3)	54 (3)
Underwent operation	233 (85)	1224 (67)
(b) Emergency admissions where no operation was performed		
	Emergency admission to private hospital (n=43)	Emergency admission to public hospital (n=591)
Reason for no operation:		
Active decision not to operate	24 (59)	268 (45)
Not a surgical problem	7 (17)	77 (13)
Patient refused operation	5 (12)	44 (7)
Rapid death	6 (15)	53 (9)
Missing data	1 (2)	149 (25)

Figure 4.10: Percentage of elective admissions that underwent an operation (2002 – 2007) (n=479)

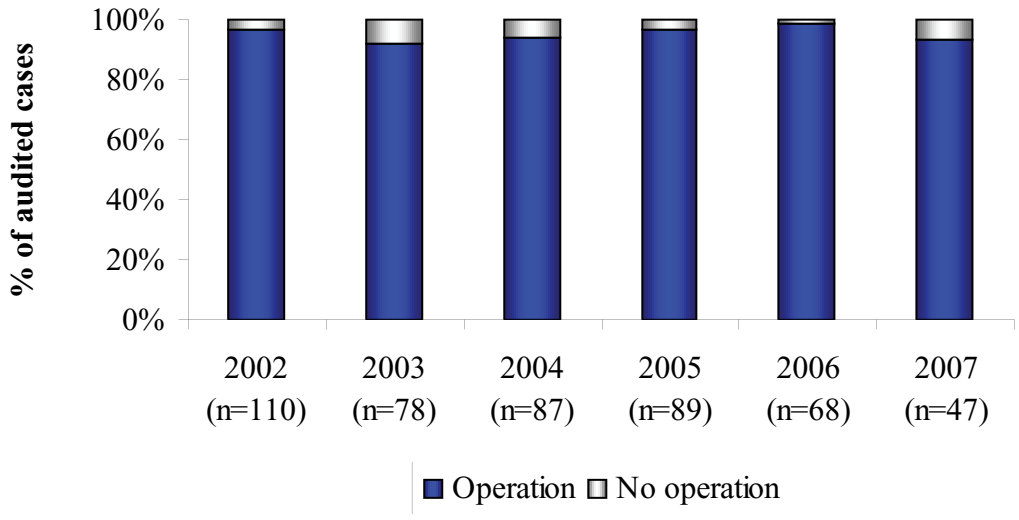


Figure 4.11: Percentage of emergency admissions that underwent an operation (2002 – 2007) (n=2131)

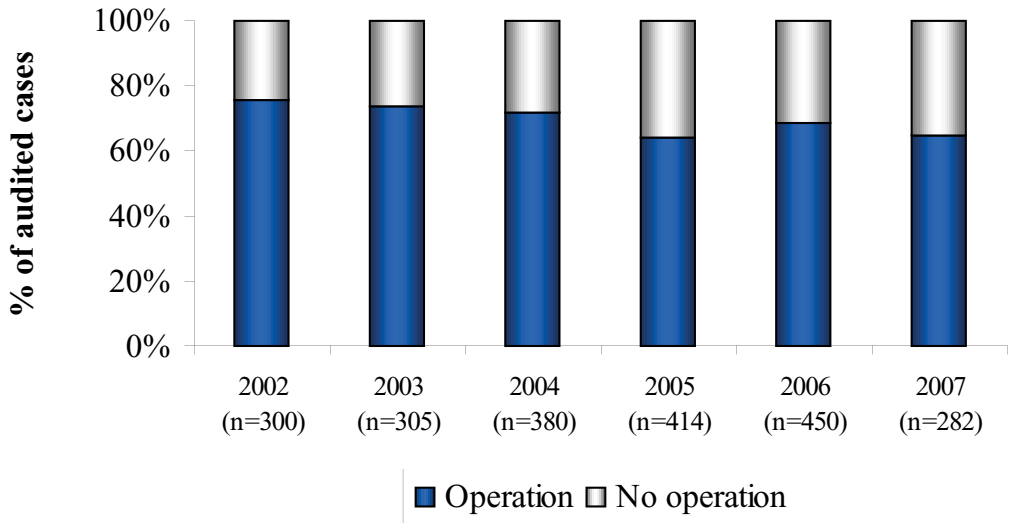


Figure 4.12: Cumulative proportion of operative cases associated with areas of concern or adverse events – elective and emergency admissions (2002 – 2007)

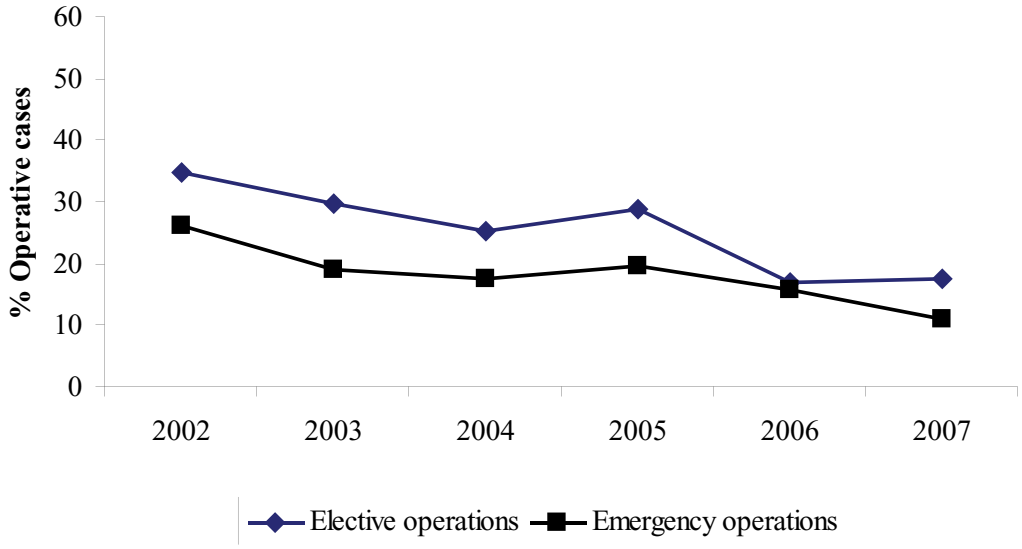
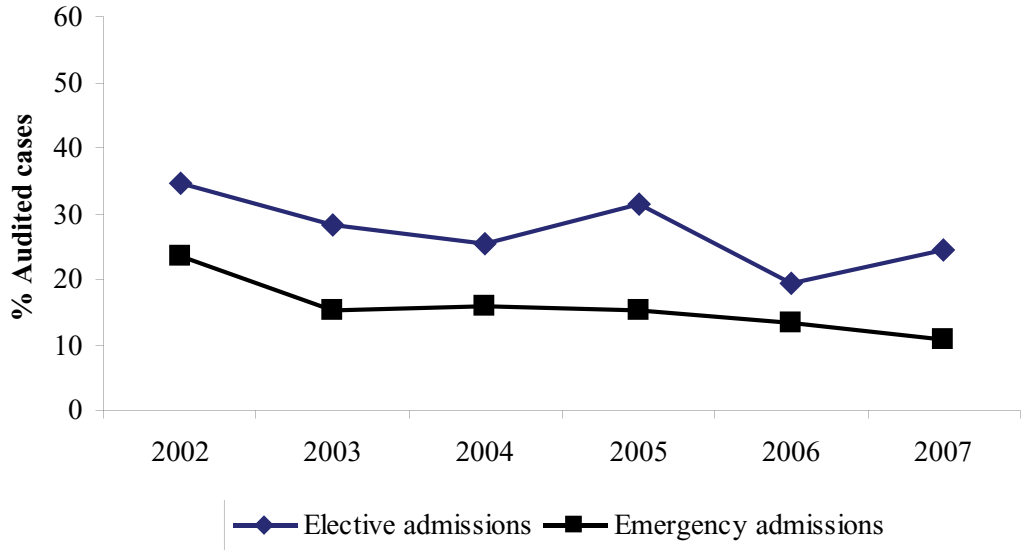


Figure 4.13: Cumulative proportion of all audited emergency and elective admissions associated with areas of concern or adverse events (2002 – 2007)



4.4.3 Areas of concern or adverse events associated with emergency or elective admissions

Table 4.12: Emergency and elective admissions that were associated with areas of concern or adverse events (2002 – 2007)

	Areas of concern or adverse events		
	Yes	No	Total
Elective admission	132 (6)	336 (14)	468 (20)
Emergency admission	292 (13)	1560 (67)	1852 (80)
Total	424 (18)	1896 (81)	2320

Data missing on 314 cases, cross tabulation only on complete data

Table 4.13: All areas of concern or adverse events associated with elective admissions (2002 – 2007) (n=468)

Area of concern or adverse event	No.	(%)
Related to open surgery	51	11
Incorrect or inappropriate therapy	47	10
General complications	20	4
Failure to use facilities	15	3
Delays	14	3
Assessment problems	13	3
Patient factors	6	1
Related to endoscopic surgery	5	1
Anaesthesia-related problems	5	1
Drug-related problems	4	<1
Staff problems	3	<1
Communication failures	3	<1
Related to laparoscopic surgery	2	<1
Diagnosis-related problems	1	<1
Transfer problems	1	<1
Monitoring problems	1	<1
TOTAL	191	

Note**:** Some cases are associated with more than one event.

Table 4.14: All areas of concern or adverse events associated with emergency admissions (2002 – 2007) (n=1852)

Area of concern or adverse event	No.	(%)
Incorrect or inappropriate therapy	120	6
Delays	105	6
Related to open surgery	49	3
Failure to use facilities	47	3
General complications	37	2
Patient factors	24	1
Communication failures	19	1
Drug-related problems	17	<1
Diagnosis-related problems	15	<1
Transfer problems	8	<1
Staff problems	7	<1
Assessment problems	6	<1
Related to radiological surgery	5	<1
Related to laparoscopic surgery	4	<1
Related to endoscopic surgery	4	<1
Anaesthesia-related problems	4	<1
Monitoring problems	4	<1
Resuscitation problems	4	<1
Equipment-related problems	2	<1
Problems with blood/blood products	2	<1
TOTAL	483	

Note: Some cases are associated with more than one event.

Comment

Incorrect or inappropriate therapy and delays remain the most common reasons for an area of concern or adverse event in an emergency admission. WAASM is looking into delays in greater detail and will provide feedback in the next WAASM annual report.

4.5 Operative and non-operative cases

Key points

- 26% of cases did not undergo an operation.
- The proportion of surgeons making an active decision not to operate has increased over the audit.
- Of the 1952 cases in which an operation was undertaken, in 6% of cases the operation was abandoned.

4.5.1 Operative cases

Table 4.15: Operations performed (2002 – 2007) (n=2630)

	No. of cases (%)						
	2002 (n=411)	2003 (n=383)	2004 (n=468)	2005 (n=504)	2006 (n=524)	2007 (n=340)	Total (n=2630)[a]
No operation	78 (19)	86 (22)	111 (24)	151 (30)	144 (27)	108 (32)	678 (26)
1 operation	234 (57)	220 (57)	275 (59)	279 (55)	283 (54)	183 (54)	1474 (56)
2 operations	64 (16)	48 (13)	55 (12)	47 (9)	68 (13)	30 (9)	312 (12)
3+ operations	35 (9)	29 (8)	27 (6)	27 (5)	29 (6)	19 (6)	166 (6)

Note: data missing on 4 cases

Figure 4.14: Number of operations (2002 – 2007) (n=2630)

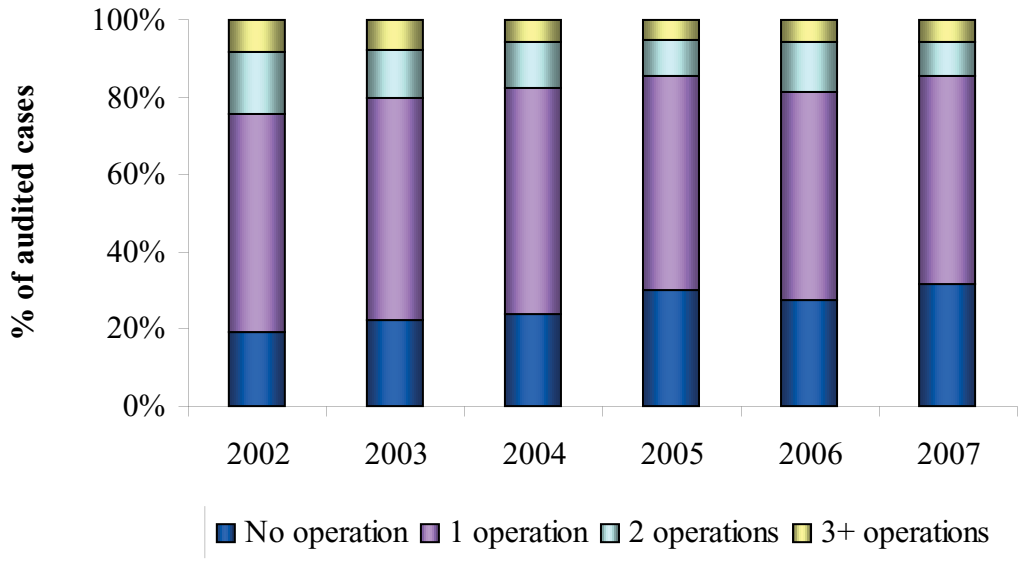
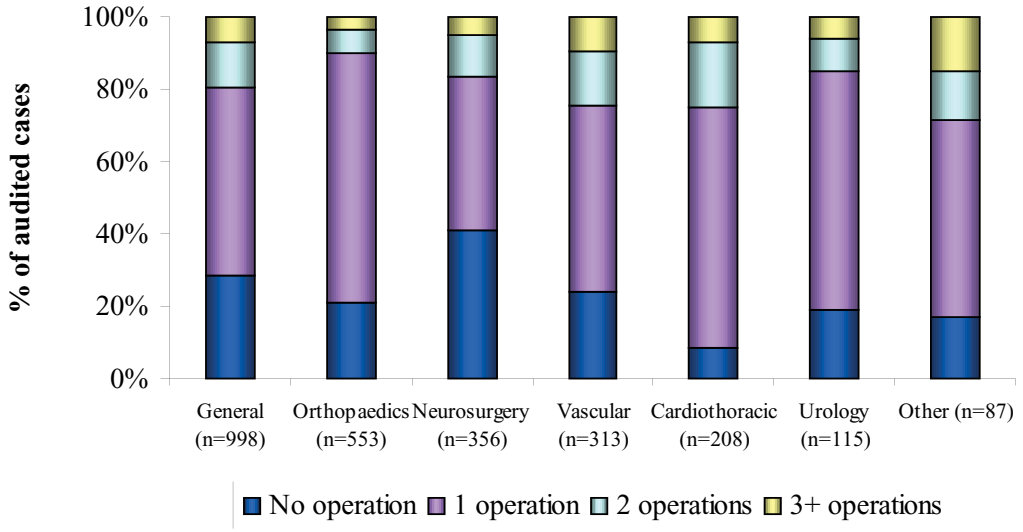


Figure 4:15: Number of operations by specialty (2002 – 2007) (n=2630)



4.5.2 Non-operative cases

Figure 4.16: Reasons for no operation, all specialties (2002 – 2007) (n=561)

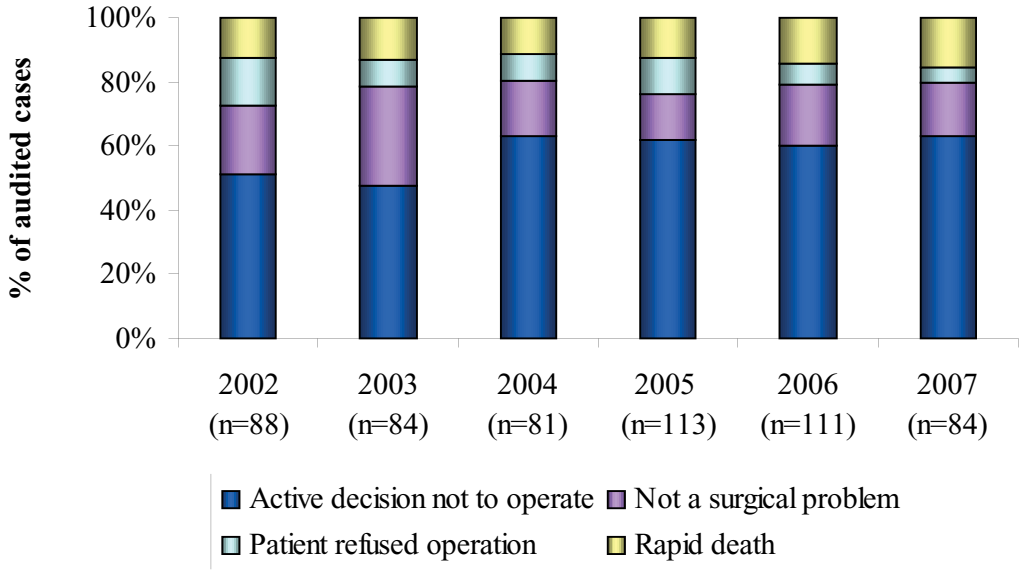


Table 4.16: Operations abandoned, including patients undergoing one or more surgical procedures (2002 – 2007)

	2002	2003	2004	2005	2006	2007	Total
1st operation	19	22	11	19	11	6	88
2nd operation	6	2	2	4	3	0	17
3rd operation	2	3	1	4	0	0	10
Total # of abandoned cases	27	27	14	27	14	6	115
(%) operations abandoned	(8)	(9)	(4)	(8)	(4)	(3)	(6)
Total # of operative cases	333	297	357	353	380	232	1952

4.5.3 Risk of death before surgery

Surgeons and assessors alike are required to categorise the patient's preoperative risk of death following an operation(s) (Table 4.17).

Table 4.17: Comparison of views of surgeons and assessors on pre-operative risk of death in cases undergoing an operation

No. of cases (%)				
Assessors' view of risk	Surgeons' view of risk			
	minimal/small	moderate	considerable/ expected	Total
minimal/small	94 (5)	43 (2)	39 (2)	176 (9)
moderate	68 (4)	178 (9)	188 (10)	434 (23)
considerable/expected	81 (4)	288 (15)	949 (49)	1318 (68)
Total	243 (13)	509 (26)	1176 (61)	1928

Note: Kappa measurements can only be calculated on complete information from both surgeon and assessor. Kappa score (K) = 0.28, 95% CI 0.24 – 0.32, indicating that the surgeon and assessor were in 'fair agreement'.

4.5.4 Areas of concern or adverse events associated with operative and non-operative cases

Figure 4.17: Cumulative proportion of cases associated with areas of concern or adverse events in all participating hospitals

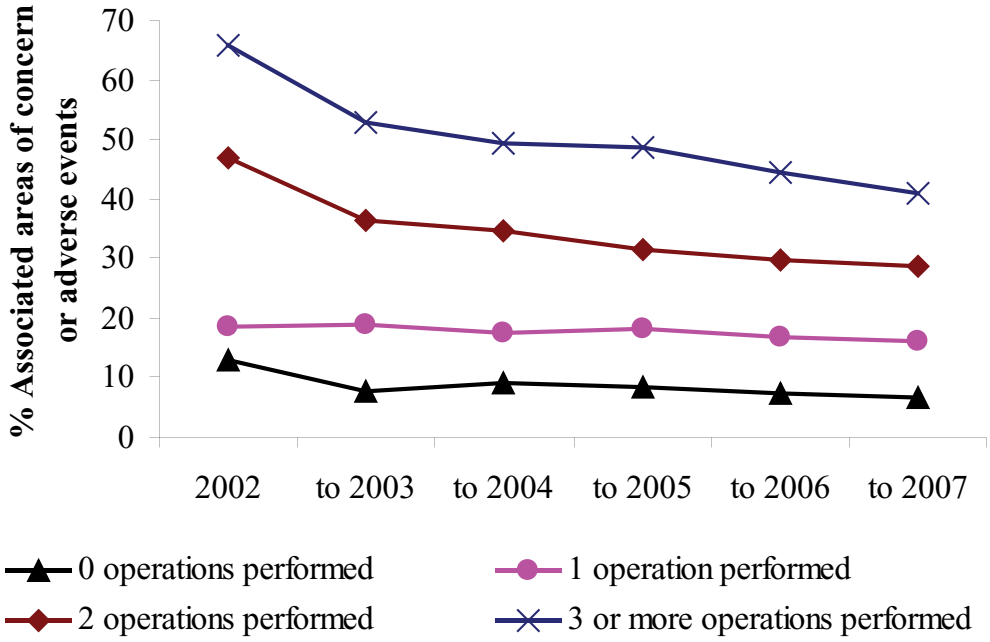
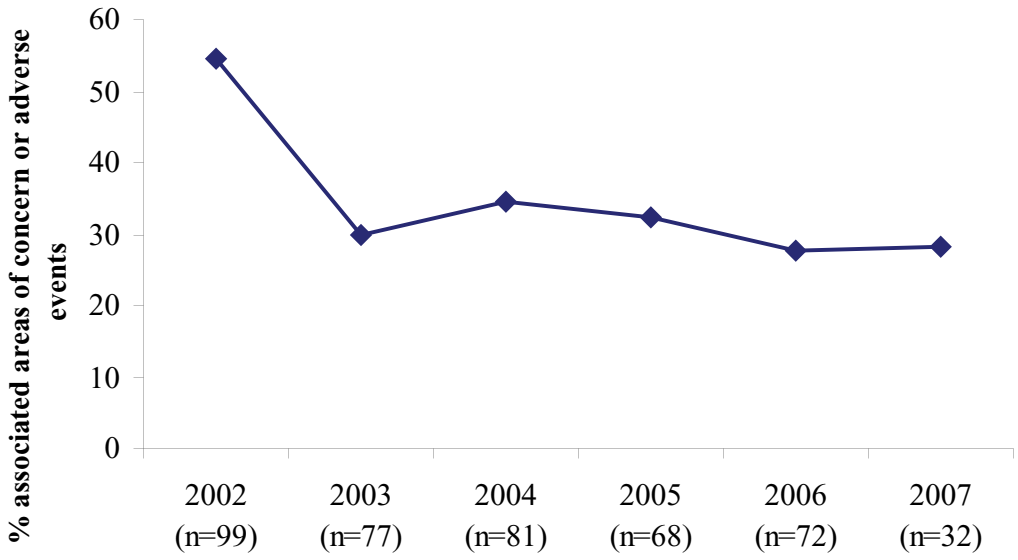


Figure 4.18: Areas of concern or adverse events associated with cases where more than one operation was performed in Western Australian teaching hospitals (n=429)



4.5.5 Unplanned return to theatre

Table 4.18: Unplanned return to theatre (2004 – 2007)

	2004	2005	2006	2007	Total
Total number of cases where an operation was performed	357	353	380	232	1322
Cases where surgeons reported an unplanned return to theatre (%)	50 (14)	51 (14)	42 (11)	20 (9)	163 (12)

4.6 Grade of surgeon (teaching hospitals)

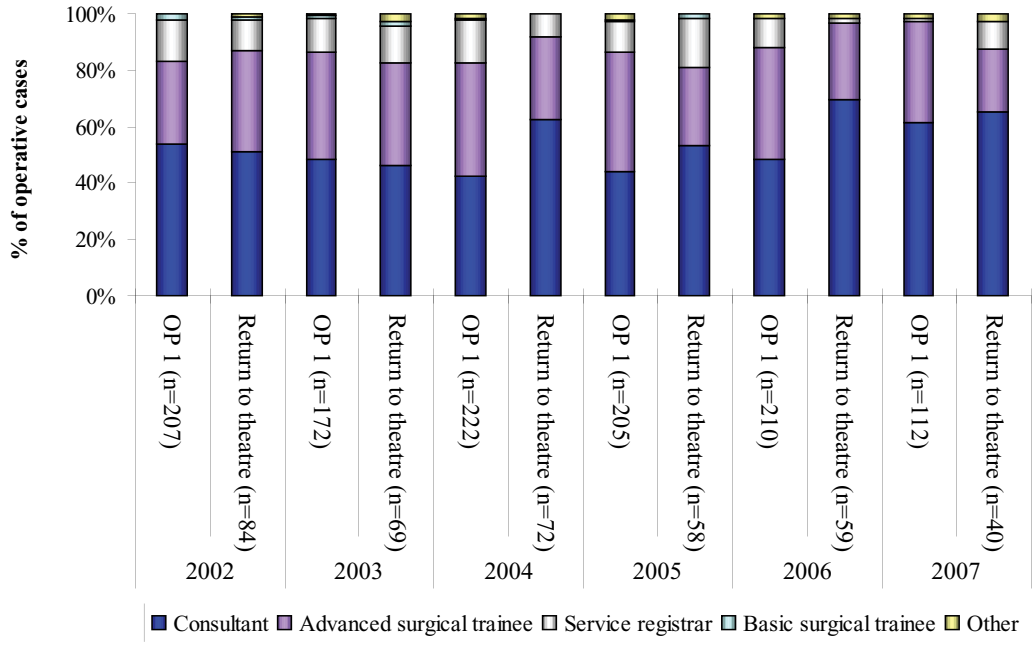
When completing the proforma surgeons are asked to indicate the grade of surgeon making the operative decision, the grade of surgeon performing the operation and the grade of surgeon directly assisting in the operation.

Table 4.19: Cases that underwent operation in Western Australian teaching hospitals (2002 – 2007)

	No. of cases					
	2002	2003	2004	2005	2006	2007
Number of audited operative cases in teaching hospitals	225	191	242	251	286	174
Consultant decision to operate	192	162	203	201	238	159
Consultant operating or directly assisting	123	105	123	116	146	105

Note: data missing as not all proformas are completed

Figure 4.19: Grade of surgeon performing first and subsequent operations, by year in Western Australian teaching hospitals (2002 – 2007)[a]

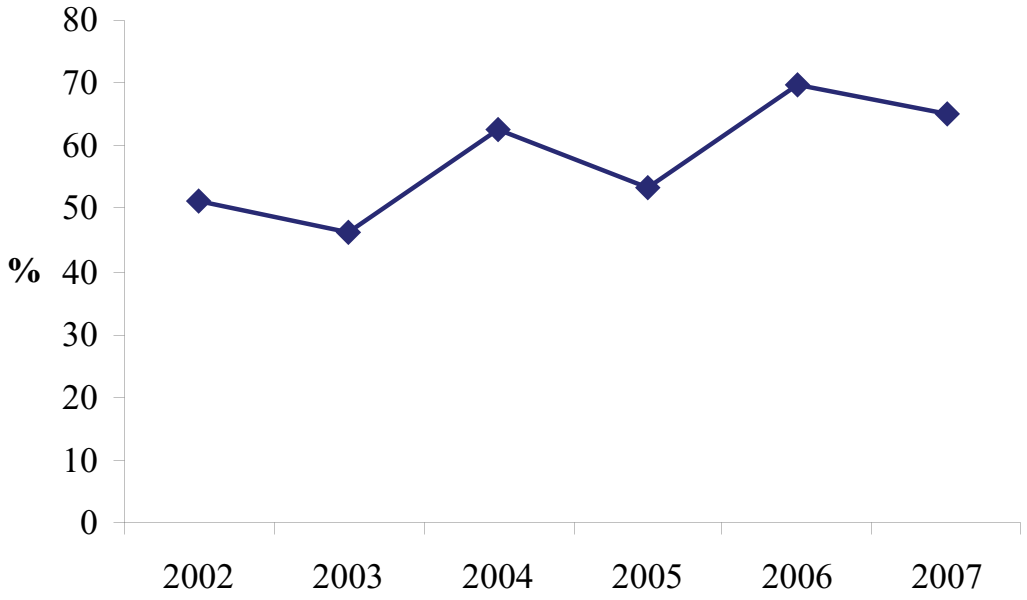


[a] (Total OP1 n=1128, total return to theatre n=382)

Notes:

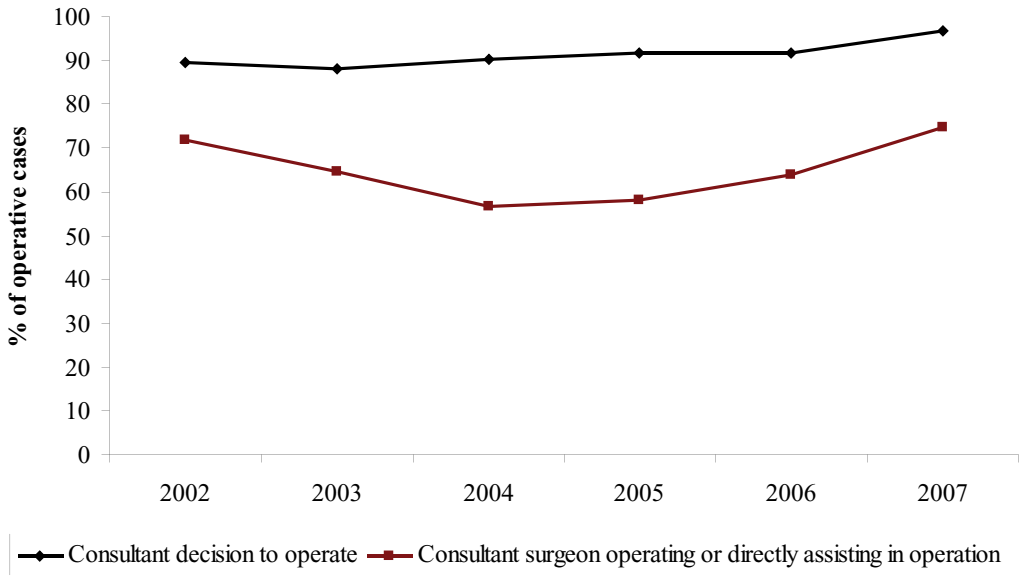
1. 'Return to theatre' includes all second, third or subsequent operations.
2. Some of the information on grade of operating surgeon was missing.
3. 'Other' includes interns, resident medical officers and senior registrars.

Figure 4.20: Consultant supervision in cases returned to theatre



Note: Return to theatre includes all second, third or subsequent operations.

Figure 4.21: Consultant surgeons involved in primary operations, by year in Western Australian teaching hospitals (2002 – 2007) (n=1369)



Comment

There has been a progressive increase in the involvement of consultants when a patient undergoes a second or subsequent operation. In association, the proportion of areas of concern or adverse events associated with cases returned to theatre has decreased (refer to figure 4.18).

4.7 Prophylaxis of thromboembolism

Surgeons are asked on the proforma whether deep vein thrombosis (DVT) prophylaxis was used and if not the reason why it was withheld. During case review assessors indicate whether they think that the decision was appropriate

Figure 4.22: Use of DVT prophylaxis, by year (2002 – 2007) (n=2261)

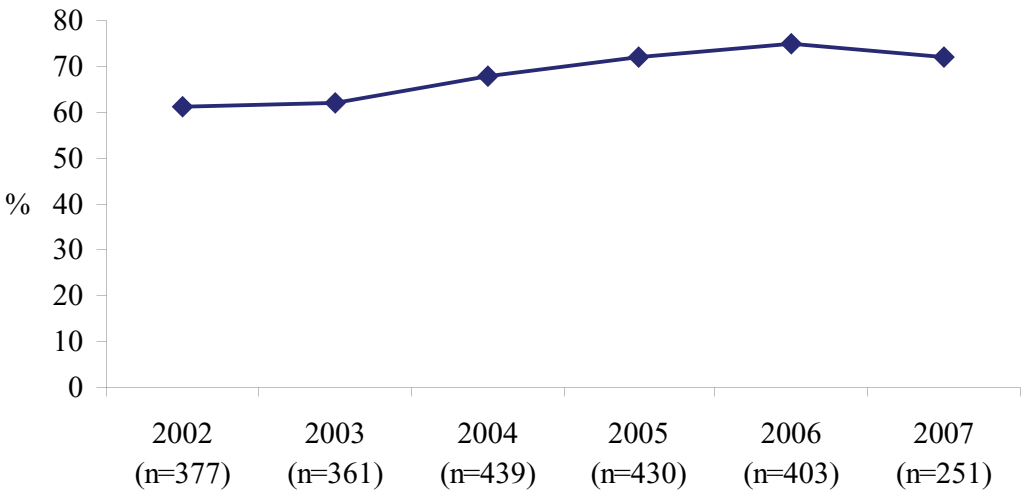
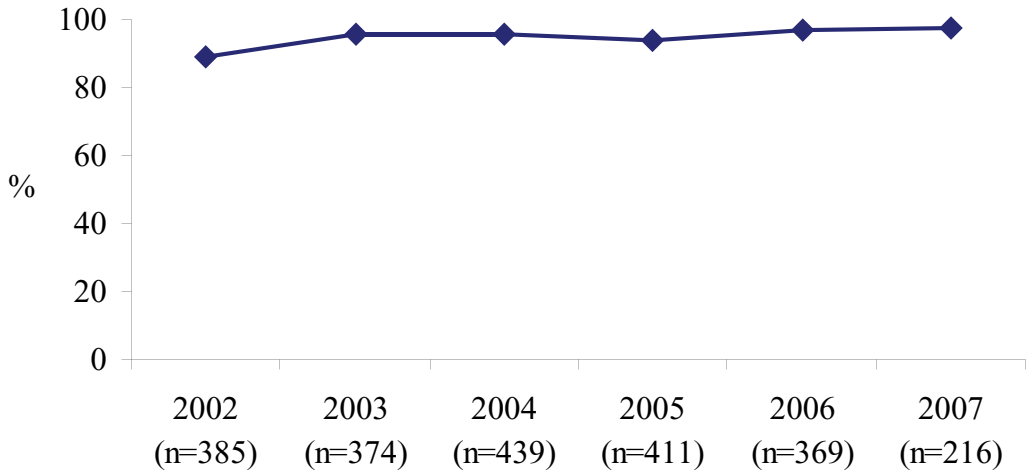


Figure 4.23: Cases where assessors noted that use of DVT prophylaxis was appropriate, by year (n=2194)



[a] Neurosurgeons do not complete this question in their proforma unless it has been flagged as an area of concern or adverse event.

5 PERFORMANCE REVIEW

This section reviews progress against each of the recommendations of the 2007 WAASM annual report.

5.1 Surgeons should be encouraged to support WAASM.

The introduction of WARM does not appear to have had a negative impact on WAASM. The number of proformas returned has increased (65% in 2002 to 95% in 2007) and suggests that surgeons are reporting their deaths through WAASM.

5.2 The introduction of WARM should be monitored and surgeons should be provided with evidence of audit compliance in a timely manner.

All participating surgeons are provided with a detailed list of all cases that have been through the WAASM process on a quarterly basis.

5.3 Communication channels with other states and territories where similar mortality audits are in progress should be facilitated.

Mortality audits have now been established in most states. Regular teleconferences are undertaken. The states are now working to ensure that procedures (e.g. data collection and analyses) are similar in all the audits in order to facilitate the pooling of data.

5.4 An interstate second-line assessment system should be established.

An interstate second-line assessment system is in progress.

5.5. The issue of fluid balance management should be brought to the attention of the Western Australian Clinical Community.

A symposium on 'Peri-operative Fluid Management in the Surgical Patient' was held in March 2008 at the University Club of Western Australia. Over 200 surgeons, anaesthetists, nurses and medical students attended. The presenters had different views, but their talks contained common themes such as identifying patients at risk, avoiding rigid adherence to hourly urine output and encouraging junior doctors to seek help at an early stage. This symposium highlighted that fluid management is an issue for doctors of any seniority and in every discipline.

5.6 WAASM, WADH and the Coroner's Court of Western Australia should liaise to ensure that postmortem results are routinely returned to surgeons.

WAASM is working together with the WADH and the Coroner's Court of WA to ensure that postmortem results are available to surgeons.

5.7 Falls remain the leading cause of adverse events. Surgeons should work with hospitals to reduce the incidence of falls.

Falls remain a serious cause of concern. This is a systemic problem through all health systems. WA already has a process that attempts to identify patients at risk so that pre-emptive strategies can be put in place. Clearly this problem has not been completely solved.

5.8 Delays are the greatest reported cause for an area of concern or adverse event. WAASM should undertake a detailed study of the nature of adverse events in elective and emergency admissions to provide the reasons behind these delays.

WAASM is currently undertaking a prospective review of the reasons that underlie delays. Results from this investigation will be in next year's annual report.

5.9 To comply with the WARM timetable, hospitals should review their timelines for providing surgeons with case notes for review.

The Qualified Privileged Act does not permit WAASM to forward data on cases to be reviewed directly to the hospitals. As a result, surgeons who have the deaths of their patients reviewed through WAASM must provide their hospital with evidence this has occurred. Currently this is done by a paper report to the surgeon who then has to forward the data to the hospital. WAASM is currently exploring ways that this participation data, and participation data alone, might be sent directly to the hospitals.

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  - Mr James Aitken
  - Mr Stephen Baker
  - Mr Robert Davies
  - Professor David Fletcher
  - Ms Anne Mckenzie
  - Mr Mark Smith
  - Mr Ivan J Thompson
  - Dr Nedra Van Den Driesen
- WAASM Staff:

Chairman	Mr James Aitken
Project Manager	Dr Marie Deverell
Project Officer	Ms Claire Findlater
Project Officer	Ms Adeline Neo

APPENDIX 1: Causes of death reported to WAASM

Table A1.1: Cause of death in men aged <70 years (n=470)

	n	(%)
Heart failure	61	13
Severe brain injury	48	10
Malignancy	40	9
Brain haemorrhage	38	8
Septicaemia	37	8
Multiple organ failure	36	8
Brain stroke	25	5
Respiratory failure	18	4
Pneumonia	15	3
Renal failure	12	3
Cardiorespiratory failure	10	2
Pulmonary embolism	10	2
Missing data	10	2
Vascular insufficiency of the intestines	8	2
Aortic aneurysm	7	1
Liver failure	7	1
Cause unknown	7	1
Cerebral oedema	7	1
Aspiration pneumonia	5	1
Severe multiple injuries	4	1
Other	65	14

Table A1.2: Cause of death in women aged <70 years (n=269)

	n	(%)
Brain haemorrhage	49	18
Septicaemia	30	11
Heart failure	26	10
Multiple organ failure	26	10
Malignancy	19	7
Respiratory failure	13	5
Brain stroke	12	4
Severe brain injury	10	4
Vascular insufficiency of the intestines	8	3
Liver failure	5	2
Cerebral oedema	5	2
Renal failure	4	1
Cardiorespiratory failure	4	1
Pulmonary embolism	4	1
Aspiration pneumonia	3	1
Pneumonia	2	<1
Aortic aneurysm	2	<1
Severe burns	2	<1
Cause unknown	1	<1
Other	37	14

Table A1.3: Cause of death in men aged ≥70 years (n=965)		
	n	**(%)**
Heart failure	226	23
Septicaemia	85	9
Pneumonia	71	7
Malignancy	65	7
Respiratory failure	59	6
Renal failure	55	6
Multiple organ failure	52	5
Aortic aneurysm	43	4
Vascular insufficiency of the intestines	41	4
Cardiorespiratory failure	33	3
Brain haemorrhage	29	3
Brain stroke	24	2
Aspiration pneumonia	24	2
Missing data	18	2
Pulmonary embolism	17	2
Cause unknown	13	1
Severe brain injury	10	1
Liver failure	4	<1
Other	96	10

Table A1.4 Cause of death in women aged ≥70 years (n=929)		
	n	**(%)**
Heart failure	215	23
Septicaemia	87	9
Multiple organ failure	80	9
Respiratory failure	62	7
Pneumonia	47	5
Vascular insufficiency of the intestines	44	5
Renal failure	43	5
Malignancy	39	4
Cardiorespiratory failure	32	3
Brain haemorrhage	29	3
Brain stroke	29	3
Aortic aneurysm	22	2
Cause unknown	22	2
Aspiration pneumonia	21	2
Pulmonary embolism	18	2
Other	112	12

APPENDIX 2: WAASM assessor report details of adverse events and areas of concern (2002 – 2007)

Table A2.1 Details of adverse events and areas of concern as reported by assessors in 432 of 4009 cases reported to WAASM (2002 – 2007)

Related to open surgery (n=91)	No.
Anastomotic leak after open surgery	35
Related to open surgery	14
Postoperative bleeding after open surgery	12
Infection	6
Injury to organ during surgery	5
Complication of open surgery	3
Perforation of duodenum during endoscopic operation	3
Cerebrovascular accident following open surgery	2
Wound infection after open surgery	2
Fistula from colon after open surgery	2
Failed arterial reconstruction after open surgery	1
Air embolism after surgery	1
Blood clot dislodged	1
Bowel infarction after open vascular operation	1
Dislocated hip prosthesis	1
Arterial occlusion related to open surgery	1
Sepsis peritonitis related to jejunostomy	1

Delays (n=78)	No.
Delay to surgery – earlier operation desirable	20
Delay in diagnosis	12
Delay in transfer to surgical unit	11
Delay starting DVT prophylaxis	6
Delay in transfer to tertiary hospital	5
Delay in transfer to surgeon by physician	4
Delay in recognising complication	4
Delay to endoscopic retrograde cholangiopancreatography	3
Delay starting medical treatment	2
Delay in surgery due to missed diagnosis	2
Delay to surgery whilst obtaining a computed tomography scan	2
Delay to starting ventilation	1
Delay in transferring patient to ICU	1
Delay to blood transfusion	1
Delay in recognising a bleeding complication	1
Delay in recognising an anastomotic leak	1
Delay in transfer to surgeon by general practitioner	1
Delay starting antibiotics	1

Incorrect or inappropriate therapy (n=60)	No.
Fluid balance unsatisfactory	16
Decision to operate	12
Better to have done different operation or procedure	8
Wrong surgical approach used	3
Better not to have treated laparoscopically	2
Operation should have been done	2
Operation should not have been done or was unnecessary	2
Duration of operation too long	2
Operation would have been better delayed	2
Tracheostomy problems	2
Incorrect or inappropriate therapy	1
Better to have had more extensive surgery	1
Operation following recent cessation of anticoagulant drug	1
Postoperative care unsatisfactory	1
More aggressive treatment of infection needed	1
Over transfusion of blood	1
Too early removal of nasogastric tube	1
Unsatisfactory medical management	1
Wrong operation performed	1

General complications (n=47)	No.
Aspiration pneumonia	18
Septicaemia	8
Wound infection	5
Pulmonary embolus	4
Cerebrovascular accident	2
Peri-operative intracranial infarction	2
Abdominal abscess	1
Postoperative pancreatitis	1
Postoperative bleeding due to coagulopathy	1
Postoperative intracranial haematoma	1
Renal failure	1
Wound skin necrosis	1
Wound dehiscence	1
Fasciitis	1

Failure to use facilities (n=35)	No.
Failure to use DVT prophylaxis	21
Failure to use high dependency unit	5
Failure to use intensive care unit	3
Failure to use antibiotic prophylaxis	2
Failure to use drug for treatment or prophylaxis	2
Failure to use facilities	1
Failure to obtain postmortem	1

Patient related factors (n=25)	No.
Injury caused by fall in hospital	18
Patient refused treatment	4
Patient related factors	3

Drug-related problems (n=14)	No.
Anticoagulation causing postoperative bleeding	4
Under anticoagulation	3
Over anticoagulation	2
Wrong drug used	2
Drug-related complication	1
Reaction to drugs	1
Anaphylactic shock related to drug treatment	1

Problems related to diagnosis (n=14)	No.
Diagnosis missed by surgeons	5
Diagnosis missed by medical unit	5
Diagnosis missed by radiologist	2
Diagnosis missed by referring hospital	1
Diagnosis missed by unspecified	1

Assessment problems (n=12)	No.
Pre-operative assessment inadequate	9
Failure to recognise severity of illness	1
Failure to investigate or assess adequately	1
Assessment problems	1

Communication failures (n=11)	No.
Poor documentation	5
Communication failures	2
Poor communication in emergency department	1
Poor communication between physician and surgeon	1
Failure in communication between x-ray department and clinicians	1
No protocol for DVT prophylaxis	1

Related to endoscopic surgery (n=9)	No.
Related to endoscopic surgery	3
Perforation of duodenum during endoscopic operation	3
Bladder complication of endoscopic operation	1
Injury to duodenum during endoscopic operation	1
Operation-induced acute pancreatitis after endoscopic operation	1

Related to anaesthesia (n=6)	No.
Pneumothorax complication general anaesthetic	2
Premature extubation	2
Technique not ideal during general anaesthetic	1
Intubation failed for general anaesthetic	1

Staff problems (n=6)	No.
Surgeon too junior	2
Failure of junior surgeon to seek advice	1
Fatigue of operating surgeon	1
Surgeon operating without a specialty	1
Anaesthetist should have been involved in preparation and resuscitation	1

Related to laparoscopic surgery (n=6)	No.
Anastomotic leak related to laparoscopic operation	4
Arterial bleeding after laparoscopic operation	1
Fistula from duodenum after laparoscopic operation	1

Related to radiological surgery (n=5)	No.
Arterial bleeding after radiological operation	2
Bile leakage from liver after radiological operation	1
Heart complication of radiological operation	1
Distal arterial embolism after radiological procedure	1

Transfer problems (n=5)	No.
Transfer should not have occurred	2
Transfer necessary due to bed shortage	2
Problem during transfer	1

Resuscitation problems (n=4)	No.
Resuscitation inadequate	3
Fluid and electrolyte resuscitation inadequate	1

Monitoring problems (n=2)	No.
Inadequate metabolic monitoring	1
CVP insertion failed	1

Related to equipment (n=1)	No.
Failure of equipment	1

Problems with blood or blood products (n=1)	No.
Blood product complication	1

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