Western Australian Audit of Surgical Mortality

Annual Report 2011

Royal Australasian College of Surgeons

Contact

Royal Australasian College of Surgeons
Western Australian Audit of Surgical Mortality
Mailing Address: M308, University of Western Australia, Stirling Hwy, Crawley WA 6009
Office Address: 184 Hampden Road, Nedlands WA 6009

Telephone: +61 8 6389 8650
Facsimile: +61 8 6389 8655
Email: waasm@surgeons.org
Website: www.surgeons.org/waasm

The information contained in this annual report has been prepared by the Royal Australasian College of Surgeons Western Australian Audit of Surgical Mortality Management Committee, which is a declared quality improvement committee under section 7(1) of the *Health Services (Quality Improvement) Act 1994* (Gazetted 26 July 2005). The Australian and New Zealand Audit of Surgical Mortality, including the Western Australian Audit of Surgical Mortality, also has protection under the Commonwealth Qualified Privilege Scheme under Part VC of the *Health Insurance Act 1973* (Gazetted 6 November 2006).

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAIRMAN'S REPORT

In 2010 the College completed its negotiations with the Australian states and territories, and the Australian and New Zealand Audit of Surgical Mortality (ANZASM) now covers the whole of Australia. Negotiations with New Zealand have gathered momentum recently and there is every reason to believe that the College's original aim of a bi-national mortality audit will soon become a reality. The enormous effort by the ANZASM executive in Adelaide to achieve this needs to be fully recognised.

The Western Australian Audit of Surgical Mortality (WAASM) has also made progress, despite a difficult year. Funding uncertainty in 2010 resulted in staff changes and this, coupled with the College moving its Western Australian (WA) offices from CTEC to Hampden Road, was certainly challenging. The constant focal point in this disruptive period has been Diana Azzam, the WA Project Manager, and on behalf of all WA surgeons, and myself in particular, I would like to acknowledge and thank her for the enormous additional contribution she has made over the last year. WAASM is now well established in its new offices and is rapidly returning back to real-time activity.

Despite these difficulties, WAASM organised and hosted a very successful symposium on 'The Deteriorating Patient'. This was heavily oversubscribed and the feedback, included in section 6 of this annual report, demonstrated that this symposium successfully addressed an important subject. So much so that other states are now planning similar symposia and the WA Health Department is considering what follow-up would best consolidate the undoubted need this symposium uncovered. Unlike similar education evenings hosted by WAASM, this symposium deliberately targeted non-surgical staff, particularly nurses, as they often first encounter the deteriorating patient. Perhaps the single most welcome feedback on the symposium was that many of these non-surgical staff felt that it had helped them fully understand the potentially catastrophic impact of delay, and that it had given them the knowledge and confidence to act earlier and, if required, with greater assertiveness.

WAASM now has almost 10 years of data and should be fertile ground for trainees looking for surgical projects. Many surgical trainees are required to complete a scientific project as part of their training and WAASM would be pleased to support any who wish to use its data. As other states also gather data, the opportunity for national studies will develop. ANZASM has established a committee to vet such approaches and to facilitate the necessary consents and approvals.

The importance of ongoing eternal vigilance has been demonstrated in this report. By definition an unplanned return to theatre (RTT) means there has been a problem and appropriate supervision of trainees undertaking these RTT is essential. This has been highlighted in every annual report and there was a welcome increase in supervision level for many years. However, over the last two years there has been a drop in supervised RTT in patients who have subsequently died. Consultants need to review their practice in this regard.

The most interesting data in this annual report lies in section 3, which shows an apparent fall in the annual number of deaths under WA surgeons between 2004 (when WAASM was fully established) and 2010 (the last year of available data). The most obvious explanation is that some deaths are slipping through the notifications process. WAASM cannot find any evidence of this and whilst the notification process of deaths to WAASM has not changed

over the last 10 years the progressive fall in deaths suggests an ongoing process. Whilst this observation is welcome it remains to be seen whether it is substantiated over the next few years. There have been many improvements in surgical care over this period, and WA surgeons would undoubtedly claim that WAASM has played an important role.

In the second half of 2011, WAASM will move to the ANZASM web-based Fellows interface system. This will enable WAASM to send electronic surgical case and first-line assessment forms to its participants for completion on-line via secure means. The notable exception will be the second-line assessments, due to the volume of the medical case notes involved. A further important part of the Fellows interface is the provision of real-time data on their status within WAASM. This will include reports, for example on timeliness and their participation record, for Continuing Professional Development (CPD) audit purposes, WA surgeons will be provided with full details nearer the time.

Despite the adoption of the College's mortality audit across Australia, there are still a small number of WA surgeons who do not take part in WAASM, and others who complete their proformas in a manner that is less than satisfactory. The College Council has made participation in ANZASM (where available) a mandatory part of its CPD process. At the same time Council has doubled the number of Fellows whose CPD returns are audited each year. These Fellows have to obtain a certificate from WAASM to confirm their participation. It will not be possible to provide those who do not participate with a certificate and this may potentially jeopardise their College CPD compliance. Annual registration with the Medical Board of Australia is conditional on providing evidence of compliance with the College's CPD program. Thus WA surgeons who do not participate in WAASM risk losing their registration with the Medical Board of Australia. Without registration they cannot work.

My personal thanks again go to our Project Manager and the project staff for their daily efforts in maintaining the audit process.

RJ Aitken

SHORTENED FORMS

ACT	Australian Capital Territory
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anesthesiologists
CPD	Continuing Professional Development
DVT	deep vein thrombosis
HDU	high dependency unit
ICU	intensive care unit
IQR	interquartile range
RTT	return to theatre
SASM	Scottish Audit of Surgical Mortality
SPSS	Statistical Package for Social Sciences
TOPAS	The Open Patient Administration System
WA	Western Australian
WAASM	Western Australian Audit of Surgical Mortality

EXECUTIVE SUMMARY

Background and findings

Background

The Western Australian Audit of Surgical Mortality (WAASM) is an external, independent, peer-reviewed audit of the process of care associated with surgically related deaths in Western Australia (WA). WAASM was established in 2001 and is funded by the Western Australian Department of Health and has Qualified Privilege protection under federal legislation.

Audit process and reporting conventions

WAASM is notified of deaths in all hospitals and, where a surgeon was involved in the care of the patient, the death is included in the audit. WAASM then sends a proforma to the surgeon for completion, with events to be reported against the following criteria:

- *area for consideration*—where the clinician believes an area of care could have been improved or different, but recognises that there may be debate about this
- *area of concern*—where the clinician believes that an area of care should have been better
- *adverse event*—an unintended 'injury' caused by medical management, rather than by the disease process, which is sufficiently serious to:
  - lead to prolonged hospitalisation
  - lead to temporary or permanent impairment or disability of the patient at the time of discharge
  - contribute to or cause death.

The surgeon completes the proforma, highlighting any areas for consideration or concern, or adverse events that may have occurred during the process of care. The completed proforma is anonymised and then peer reviewed by another consultant surgeon (this process is referred to as 'first-line assessment'). The reviewing surgeon uses the criteria described above to decide whether the case warrants detailed case-note review (second-line assessment). Cases are referred for second-line assessment if areas of concern or adverse events are thought to have occurred, or where a more detailed review could usefully draw attention to lessons to be learned. WAASM provides the surgeon involved with feedback from the assessors.

Notification of deaths

In 2010, 597 deaths were report to WAASM by 44 hospitals. The number of deaths reported to WAASM has progressively fallen from 713 in 2005 (Table 3.1).

Consultant participation

In 2010, 323 (54%) completed WAASM proformas were returned (Table 3.1). This compares with an average of 527 proformas (81%) in the previous three years. As in previous years the number of completed proformas will increase as delayed proformas are returned. WAASM proforma returns in 2010 were likely impacted by the office move which started in November 2010 and continued through to February 2011.

Second-line assessment

The proportion of cases referred for second-line assessment (case-note review) in 2010 was 26 out of 234 cases (11%). The proportion of cases referred for second-line assessment has decreased since WAASM commenced (Table 3.5).

Analysis of completed cases

Data analysed for this report covers cases that were reported to WAASM from 1 January 2002 to 31 December 2010 and had completed the audit process by 31 March 2011. WAASM analysed areas of concern or adverse events ascribed to the case by the first- or second-line assessors. Where cases were associated with more than one event, the most serious event was included in the analysis.

Comparison of surgeon and assessor views of areas of concern and adverse events

In 2010, assessors reported twice as many areas of concern or adverse events than surgeons did.

Patient sample demographics

Of the 6001 cases reported between 2002 and 2010, the median age was 74 years, with an interquartile range (IQR) of 67–85. A total of 54% of cases were male. Fifty six per cent had an American Society of Anesthesiologists (ASA) grade of 4 or higher. More than 95% of cases were associated with at least one significant comorbidity that contributed to the death of the patient. The main causes of death in patients aged 70 years or less were brain haemorrhage, acute myocardial infarction, respiratory failure, septicaemia, multiple organ failure and malignancy. The main causes of death in patients older than 70 years were acute myocardial infarction, respiratory failure, vascular diseases, septicaemia, multiple organ failure and malignancy.

Areas for consideration, of concern and adverse events

The proportion of cases associated with areas of concern or adverse events has decreased every year since 2002. Overall, assessors thought that an adverse event caused the death of a patient in 4% of the 4103 cases. In 1% of cases this adverse event was thought to be preventable.

Admissions: public and private hospitals

A higher proportion of cases were emergency rather than elective admissions. A higher proportion of cases were admitted to public rather than private hospitals. The proportion of emergency patients admitted to private hospitals who underwent an operation (85%) was significantly greater than the proportion admitted to public hospitals (64%). Twenty percent of all operative cases were associated with areas of concern or adverse events.

Operative and non-operative deaths

In 29% of the 4036 audited deaths, no operation was performed. In 6% of cases the operative procedure was abandoned. Seven per cent of audited patients underwent three or more operations. In 13% of cases from 2004 to 2010 surgeons reported an unplanned return to theatre.

Grade of surgeon – teaching hospitals

Consultant surgeons operated or directly assisted in theatre in 49% of overall cases. There appears to be an increasing trend in the direct involvement of consultant surgeons when a patient undergoes a second or subsequent operation. A decrease in the proportion of cases associated with adverse events is also observed over the same period of time.

RECOMMENDATIONS

Hospital participation

- Ensure participation of all new hospitals in which surgery is performed in WA.

Surgeon participation

- Encourage the participation of all surgeons in the audit process in light of the changes to the College Continuing Professional Development (CPD) program effective from January 2010. Audit participation is a mandatory requirement for surgeons working in hospitals which participate in a mortality audit. Surgeon participation requires timely and detailed completion of the surgical case forms to ensure accurate data collection.

Audit process

- Evaluate audit processes and the value of feedback reports to surgeons.

Reporting

- Collect baseline data for all surgical admissions across WA (elective and emergency) to put mortality rates into context.
- Migrate WAASM data onto the national web-based system facilitating surgeons inputting case forms online.

Clinical management

- Investigate falling surgical mortality rates to identify trends that may have impacted on them, including WAASM procedures.
- Examine preoperative delays or errors in confirming surgical diagnosis.
- Explore areas in which perioperative management could be improved from collected data.

1. INTRODUCTION

KEY POINTS

- WAASM is an external independent peer-reviewed audit of the process of care associated with all surgically related deaths in Western Australia.
- This annual report covers the period 1 January 2002 to 31 December 2010, as audited on 31 March 2011.
- WAASM's main role is to feed back information to inform, educate, facilitate change and improve quality of practice.

1.1 Background

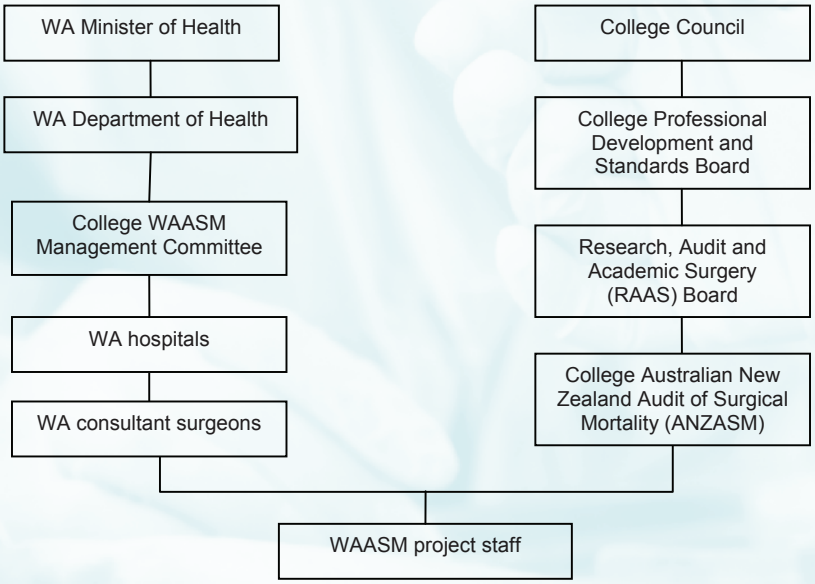
The Western Australian Audit of Surgical Mortality (WAASM) is an external, independent peer-reviewed audit of the process of care associated with surgically related deaths in WA. The project is funded by the Western Australian (WA) Department of Health and its methodology is based on the Scottish Audit of Surgical Mortality (SASM).[1]
The timeline for the project was as follows:

- WAASM commenced in June 2001 as a pilot project under the management of the University of Western Australia.
- In 2005, WAASM's management was transferred to the Royal Australasian College of Surgeons (the College). In the same year, the College formed the Australian and New Zealand Audit of Surgical Mortality (ANZASM), with the purpose of extending similar mortality audits to other states and territories. The College has now established mortality audits across all the other states and territories.

1.2 Project governance

The project governance structure is illustrated in Figure 1.1. WAASM has protection under both state and federal legislation. ANZASM (including WAASM) has protection under the Commonwealth Qualified Privilege Scheme, under Part VC of the *Health Insurance Act 1973* (gazetted 6 November 2006).

Figure 1.1 Project governance structure



ANZASM =Australian and New Zealand Audit of Surgical Mortality, College = Royal Australasian College of Surgeons; WA = Western Australia, WAASM = Western Australian Audit of Surgical Mortality.

2. THE AUDIT PROCESS

2.1 Methodology

Detailed methodology of the WAASM audit process is contained in the WAASM annual reports[2-8], which are also available on the College website at <http://www.surgeons.org/Content/NavigationMenu/Research/Audit/WAASM/>.

In brief, WAASM is notified of all in-hospital deaths through either The Open Patient Administration System (TOPAS) or directly via medical records departments. All cases in which a surgeon was involved in the care of the patient are included in the audit, whether or not the patient underwent a surgical procedure.

The consultant surgeon associated with the case is sent a structured proforma for completion. The completed proforma is returned to WAASM where it is de-identified and then assessed by a first-line assessor. This will be another surgeon working in the same specialty (peer review) but not the same hospital. The first-line assessor will either complete the review and close the case or recommend that the case undergo further assessment, i.e. a second-line assessment 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 warrant 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 (case note review book) for wider distribution.

Second-line assessors are different consultant surgeons to the first-line assessors, but they work in the same specialty. Like the first-line assessors, these surgeons work in a different hospital to that in which the death occurred.

2.2 Providing feedback

One of the main aims of WAASM is to provide feedback to inform, educate, facilitate change and improve practice.

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 during 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.

First- and second-line assessors also complete the same assessment matrix.

2.3.2 Analysis of clinical incidents

WAASM primarily focuses upon areas of concern and adverse events. Data regarding areas for consideration are collected, but they are 'less serious events' and have little impact on the overall care of the patient; they are generally excluded from the analysis because they make no difference to the outcome.

2.4 Data analysis

WAASM audits all deaths occurring in Australian hospitals while the patient is under the care of a surgeon; however, terminal care cases are excluded from the full audit process. The 2011 Annual Report covers deaths reported to WAASM from 1 January 2002 to 31 December 2010, censored on 31 March 2011. Due to the time lag some cases are still under review and will be included in the next annual report. Numbers in previous annual reports may vary from this report because some cases are completed after the censor dates of the previous annual reports.

Data is entered and stored in a Microsoft Office Access (2003) database and analysed using the Statistical Package for Social Sciences (SPSS) version 19.0 and Microsoft Office Excel (2003). The number of cases analysed is represented in parentheses in the text (n=). As not all data points were completed, the total number of cases used in the analyses varies. The total numbers of cases included in the analyses are provided in all tables and figures in the report.

2.5 Performance review

Recommendations were included in the 2010 WAASM Annual Report.[9] An important measure of the success of ASM is whether these recommendations have been addressed or achieved. A list of recommendations and progress against these are listed in Section 5 of this annual report.

3. AUDIT PARTICIPATION & ASSESSMENT

KEY POINTS

- Participation in WAASM is now a mandatory College requirement for CPD accreditation.
- There has been a progressive decrease in the number of deaths reported from 2008 to 2010.

3.1 Overview of participation

3.1.1 Deaths reported to WAASM

Tables 3.1 and 3.2, and Figure 3.1 summarise the deaths reported to WAASM from 1 January 2002 to 31 December 2010. Percentage participation is calculated on the completion and return of the proformas by 31 March 2011. The audit process is complete once the proforma has been assessed by the first- and, if required, the second-line assessor.

Table 3.1 Deaths reported to WAASM between 1 January 2002 and 31 December 2010 (audit status as at 31 March 2011)

	Number of cases (%)									
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Total deaths reported	672	639	692	713	740	667	681	600	597	**6001**
Audit process complete	416 (62)	392 (61)	486 (70)	551 (77)	620 (84)	554 (83)	572 (84)	440 (73)	234 (39)	**4265 (71)**
Proforma complete, awaiting assessment[a]	0 (0)	0 (0)	1 (<1)	0 (0)	6 (1)	10 (1)	21 (3)	58 (10)	323 (54)	**419 (7)**
Proforma not returned[b]	205 (31)	191 (30)	143 (21)	115 (16)	61 (8)	70 (10)	56 (8)	67 (11)	0 (0)	**908 (15)**
Terminal Care cases (excluded)	5 (1)	9 (2)	16 (3)	28 (5)	24 (4)	23 (4)	16 (3)	16 (4)	25 (11)	**162 (3)**
Closed no information available	4 (1)	7 (2)	3 (1)	7 (1)	8 (1)	2 (<1)	4 (1)	4 (1)	1 (<1)	**40 (<1)**
Cases associated with non-participation [c]	47 (11)	49 (13)	60 (12)	40 (7)	48 (8)	32 (6)	32 (6)	32 (7)	39 (17)	**379 (6)**

a Case awaiting first- or second-line assessment
b Proformas are considered 'not returned' if they have not been received by the WAASM office within one year of the notification of death
c Non-participants are surgeons who have indicated that they do not wish to participate in the WAASM

Figure 3.1 Number of deaths reported to WAASM and surgical mortality rates per 100,000 population (2002-2010) (n=6001)

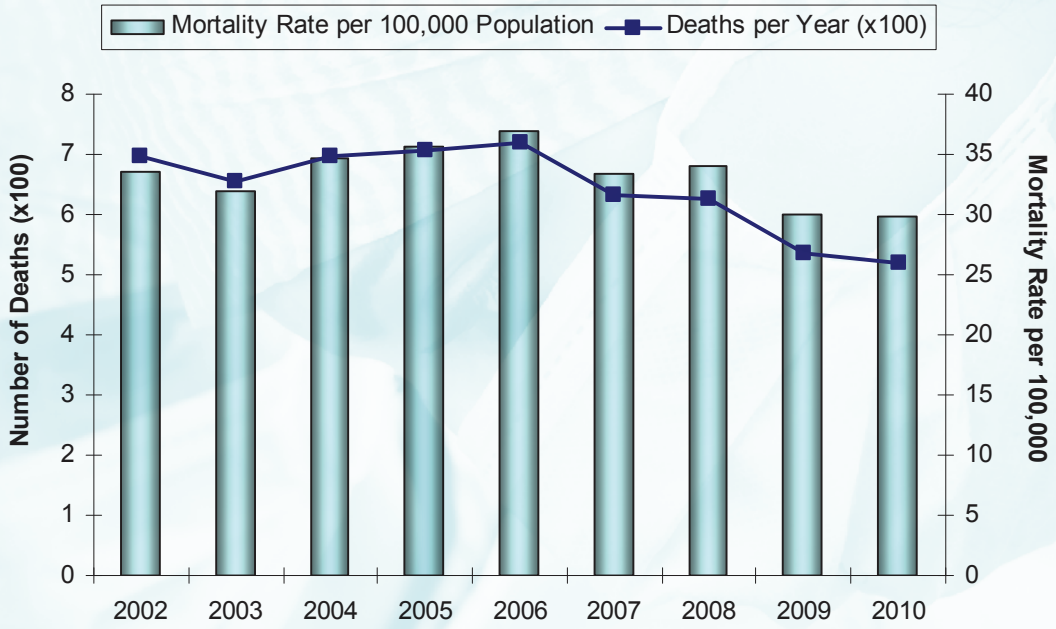


Table 3.2 Number of surgically-related deaths per 100,000 population

Year	Number of deaths reported to WAASM per year	Estimated WAASM-reported surgical mortality rate per 100,000 population # *
2002	672	35
2003	639	33
2004	692	35
2005	713	35
2006	740	36
2007	667	32
2008	681	31
2009	600	27
2010	597	26

\# Only surgically-related deaths that meet WAASM selection criteria were used in this analysis.
* Population data compiled from the Australian Bureau of Statistics[10]

Comment

Deaths are notified to WAASM by the hospitals and this is independent of the surgeon and their participation in the audit process. The notification process was established in the first few months of WAASM's commencement and has remained unchanged. The total number of patients who died while under the care of a surgeon has progressively fallen over each of the last five years. During this period the WA population has increased by 367,399 from 1.926 to 2.293 million (4.8%)[10]. The number of deaths per 100,000 population has decreased from 35 to under 28. This is a fall of greater than 20%.

During this period the number of patients who died without an operation increased (see Table 4.2). Thus the fall in the number of postoperative deaths will be slightly greater.

A recent publication in the *New England Journal of Medicine* reported an 8% fall in postoperative deaths in the United States, but that study was limited to eight elective high risk operations.[11] This WAASM data reports a total population, a quite different group. This is an intriguing observation and WAASM will be exploring it further. The obvious explanation is that WAASM's notification process has missed some deaths. WAASM has already undertaken a number of subset analyses and spot checks and to date has not been able to find any evidence of a notification failure.

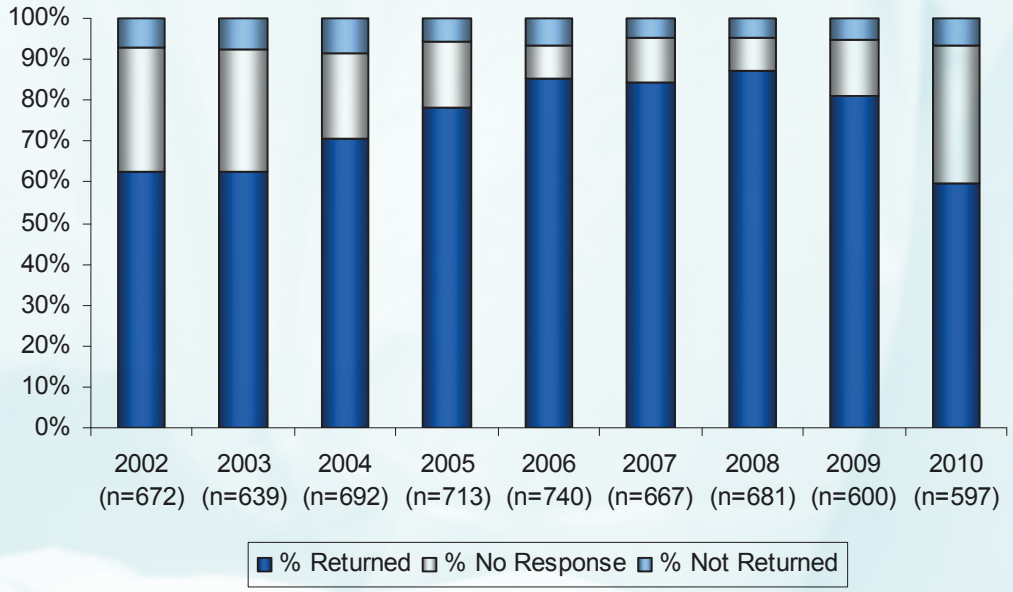
3.2 Participation in WAASM

KEY POINTS

- The percentage of proformas returned has increased by 22% from 2002 to 2008.
- In 2002 to 2010, 71% of proformas were returned by surgeons overall.

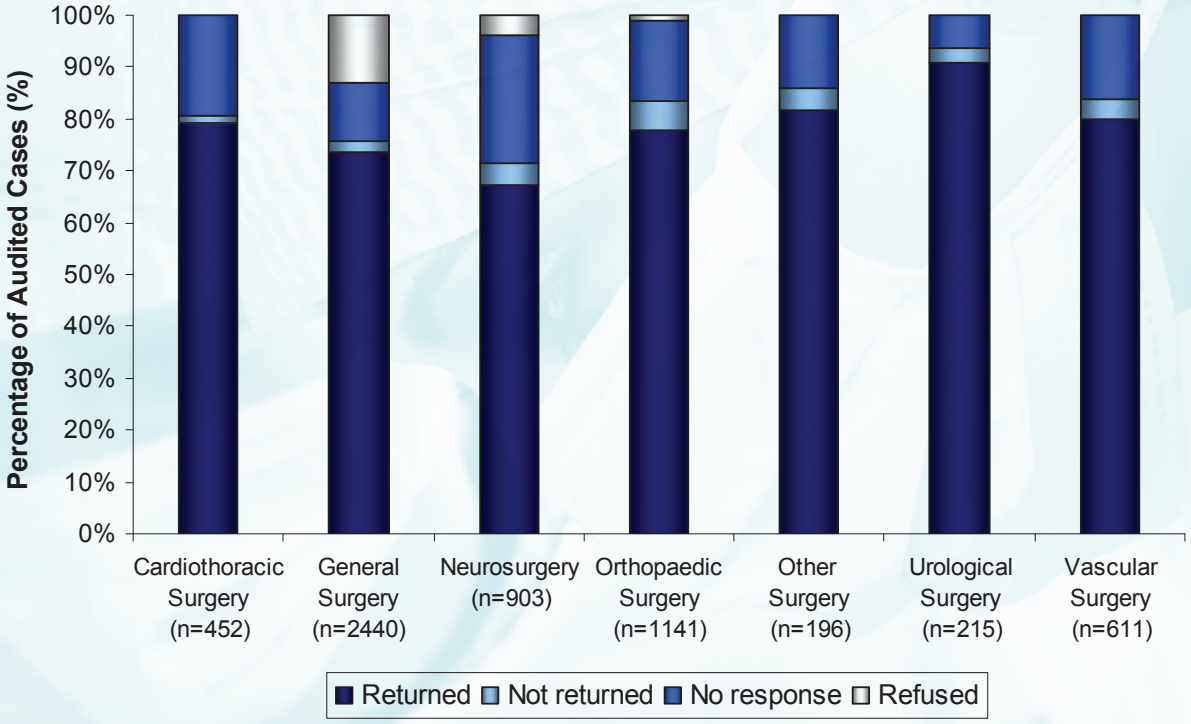
Participation in WAASM from 2002 to 2009 is depicted in Figures 3.2 and 3.3, and Table 3.3.

Figure 3.2 Proforma completion rates (2002–2010) (n=6001)



Note: Proformas not returned include cases 'in progress (not yet returned) and cases associated with 'non-participants'.

Figure 3.3 Proforma status by specialty (2002–2010) (n=5958)



Note: 'Other surgery' includes the specialties of obstetrics & gynaecology, otolaryngology & ophthalmology, paediatric surgery and plastic surgery. Missing data n=43.

Table 3.3 Surgeon participation

Number of cases (%)										
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Reported deaths	672	639	692	713	740	667	681	600	597	6001
Number of surgeons associated with reported deaths	146	139	146	141	147	172	181	153	142	1367
Proforma returned[a]	420 (63)	399 (62)	488 (71)	558 (78)	630 (85)	564 (85)	594 (87)	485 (81)	356 (60)	4494 (75)
Case statistics of surgeons associated with three or more deaths										
Number of surgeons associated with three or more deaths	81 (55)	76 (55)	75 (51)	79 (56)	82 (56)	84 (49)	78 (43)	76 (50)	69 (49)	700 (51)
Reported deaths related to surgeons associated with three or more deaths	349 (52)	325 (51)	408 (59)	481 (67)	547 (74)	449 (67)	456 (67)	360 (60)	194 (32)	3569 (59)
Number of cases in progress	0 (0)	0 (0)	0 (0)	0 (0)	5 (<1)	9 (1)	16 (2)	44 (7)	260 (44)	334 (6)
Number of cases in which forms were not returned[b]	192 (28)	180 (28)	125 (18)	107 (15)	56 (8)	59 (9)	41 (6)	58 (10)	1 (<1)	819 (14)
Number of cases associated with non-participants[c]	46 (7)	49 (8)	60 (9)	40 (6)	47 (6)	32 (5)	32 (5)	30 (5)	37 (6)	373 (6)

a Includes terminal care cases; b Consultant no response; c Surgeon refused to participate.

Comment

Consultant participation has increased by 24% since the inception of WAASM, that is from 63% in 2002 to 87% in 2008 (Figure 3.2; Table 3.3).

There was a decrease in the proportion of proformas returned from 87% in 2008 to 60% in 2010.

The decrease in proforma completion in 2010 was due to various factors that affected the operational efficiency in the WAASM office during the last couple of months of 2010. These include staffing issues and the organisation and project management of the WAASM office relocation, which commenced in December 2010 and was completed by early February 2011. During this time, proforma return rates were impacted by the inability of the office to receive notifications of death and mail being held for the purposes of the move. The backlog has largely been addressed and will be reflected in the 2012 Annual Report.

3.3 Hospital participation

KEY POINTS

- All hospitals in Western Australia (public and private) participate in the audit (n=44).
- 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 44 hospitals in Western Australia take part in the audit process. Figure 3.4 shows the number of reported deaths of patients admitted for surgery in all 44 hospitals and the proforma status (returned versus not returned) for each hospital.

Figure 3.4 Reported deaths of patients admitted for surgery in 44 hospitals in Western Australia (2002-2010)

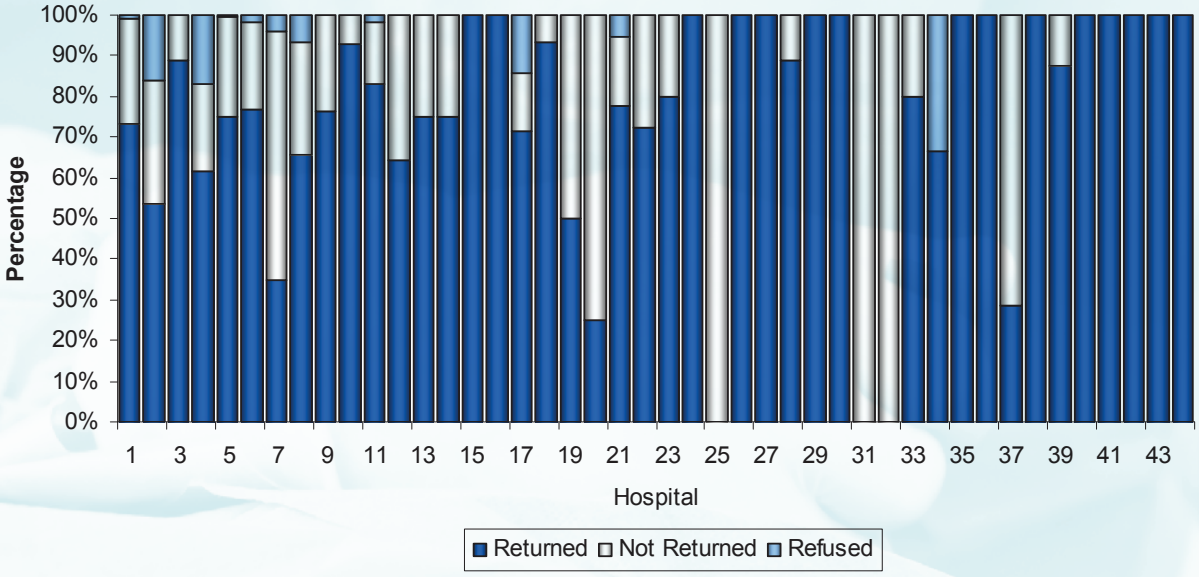


Table 3.4 Cases where the patient was transferred from one hospital to another hospital

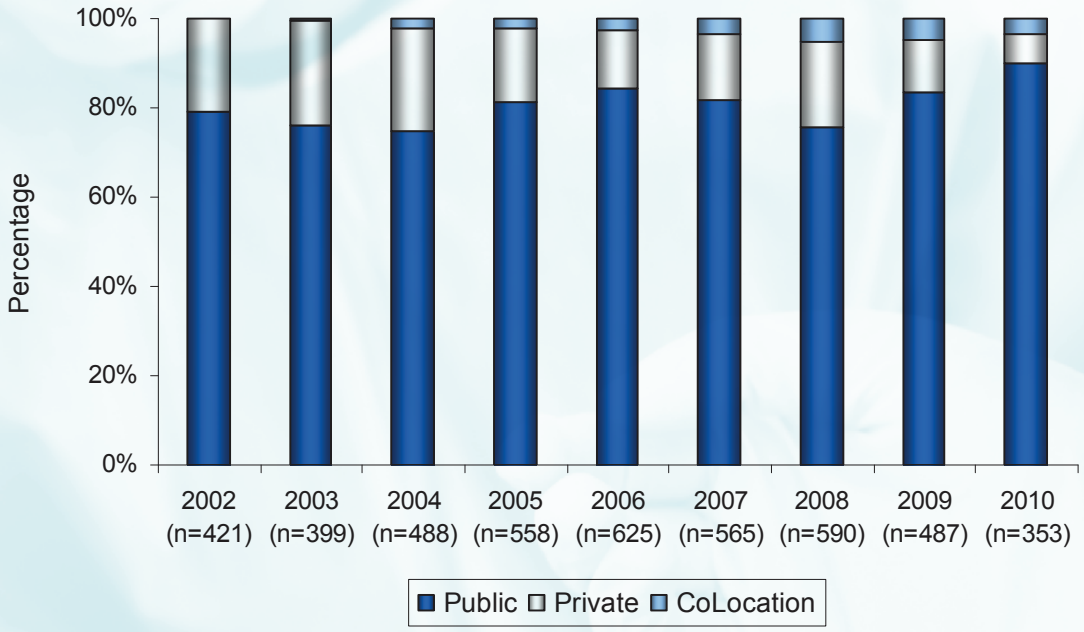
Number of transfer cases (%)										
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Completed cases[a]	402	388	456	460	488	437	479	352	178	3640
Patients transferred	93 (23)	104 (27)	110 (24)	107 (23)	130 (27)	105 (24)	128 (27)	90 (26)	57 (32)	924 (25)

a This data was computed on completed cases (including terminal care cases). Neurosurgical cases where the question was not on the neurosurgical proforma have been excluded. Numbers of completed cases are reflected in Table 3.1. (Data missing for 631 cases.)

Comment

The cases that involved a transfer between hospitals, typically between a regional and metropolitan facility, remained stable between 2002 and 2009. While lower numbers of completed cases and transfers were observed in 2010, the proportion of cases in which a patient was transferred was consistent with the overall trend observed throughout the total audit period (2002-2010). Overall, in 25% of cases a patient was transferred between hospitals.

Figure 3.5 Patients admitted to public or private hospitals (2002–2010) (n=4486)



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

Comment

Approximately 81% of deaths occurred in public hospitals, 16% of deaths in private hospitals and 3% of deaths involving co-locations.

3.4 Second-line assessment

KEY POINTS

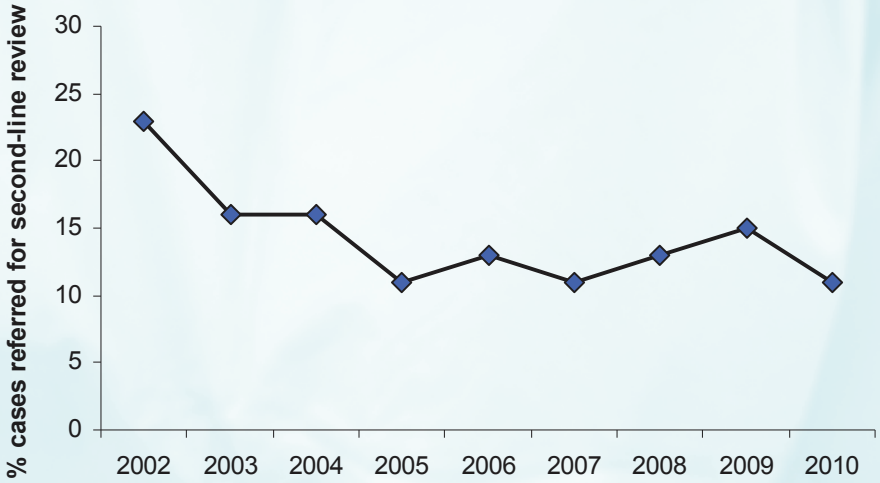
- Request for second-line assessors remained consistent throughout the audit period.

Table 3.5 Cases referred for second-line assessment

	Number of cases (%)									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Completed cases and cases with second-line assessment in progress[a]	411	383	470	523	600	536	565	439	234	4161
Cases referred for second-line assessment	95 (23)	62 (16)	74 (16)	60 (11)	75 (13)	58 (11)	76 (13)	64 (15)	26 (11)	590 (14)
Proforma returned, first-line assessment in progress	0 (0)	0 (0)	0 (0)	0 (0)	6 (1)	9 (2)	18 (3)	41 (9)	118 (50)	192 (5)

a Terminal care cases were excluded.

Figure 3.6 Proportion of cases referred for second-line assessment (2002–2010) (n=590)



Comment

The proportion of cases referred for second-line review has consistently been between 11% and 15% in the last 5 years. The need for a second-line assessment can often be avoided if the consultant completes the WAASM proforma in full and attaches any relevant letters or documentation. WAASM would again like to encourage all surgeons to fully complete the surgical proformas and provide as much additional detail as possible.

4. ANALYSIS OF AUDIT DATA

4.1 Overview and patient sample demographics

KEY POINTS

- A total of 4265 cases had completed the audit (2002 - 2010) as of 31 March 2011.
- 54% of cases were male; the median age was 78 years (76 and 81 years for males and females respectively).

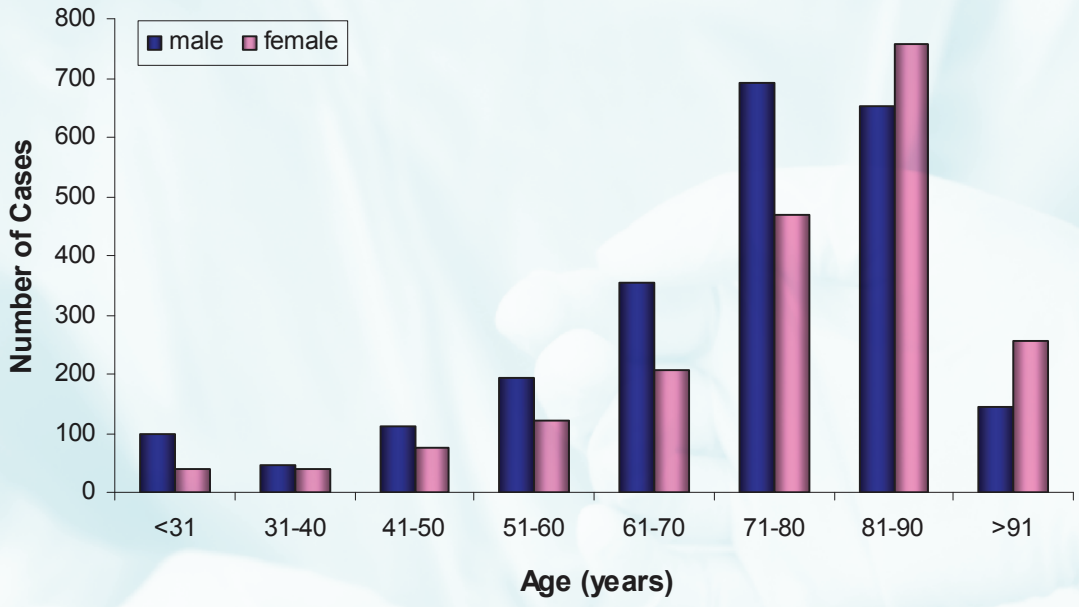
4.1.1 Age and gender distribution

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

Table 4.1 Median age and gender (2002–2010)

	Number of cases	Median age (years)	Interquartile range (years)
All patients	4788	74	67–85
Male (54%)	2578	76	65–83
Female (46%)	2210	81	71–87

Figure 4.1 Age distribution by gender (2002–2010) (n=4262)



Note: Data missing for 3 cases.

Figure 4.1 shows that the gender trend changes as age increases. Males predominate in the 41–50, 51–60, 61–70 and 71–80 year ranges, whilst females predominate in the 81–90 and >91 year age range. This is likely due to the longer average life expectancy of women.

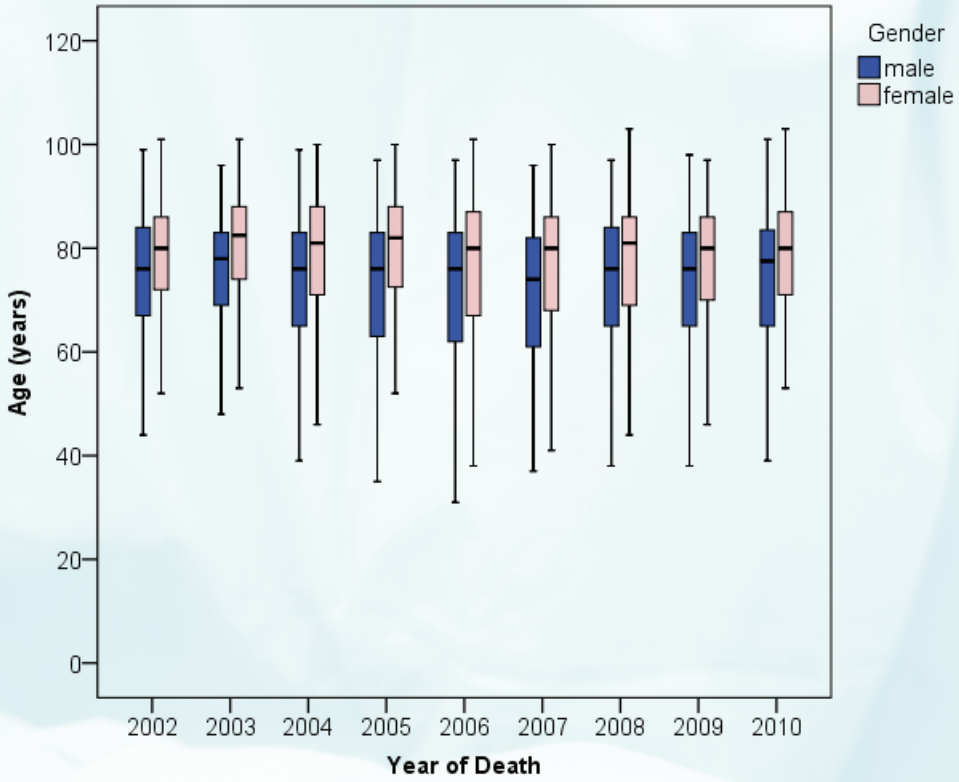
Figures 4.2 and 4.3 are box-and-whisker plots, in which:

- the central box represents the values from the lower to upper quartile (25–75 percentiles)
- the middle line represents the median value
- the 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 interquartile range)

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

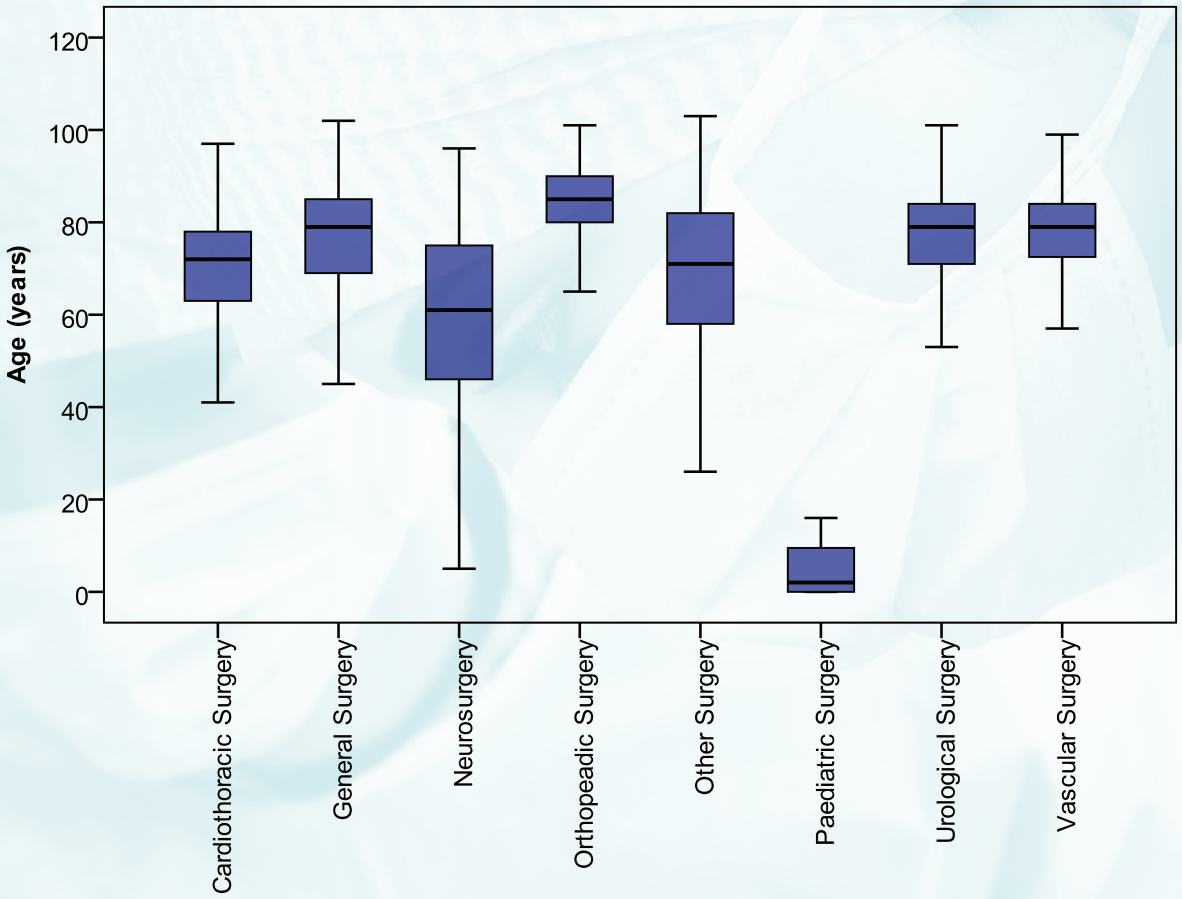
As expected, the age of patients varies depending on the speciality, with patients in the neurosurgery and paediatrics categories being appreciably younger than the other specialities.

Figure 4.2 Age distribution of audited patients (2002–2010) (n=4262)



Note: Outliers and extreme values are excluded; data missing on 3 cases.

Figure 4.3 Age of audited patients by speciality (2002–-2010) (n=4265)



Note: Other specialties include obstetrics & gynaecology, ophthalmology & otolaryngology and plastic surgery.

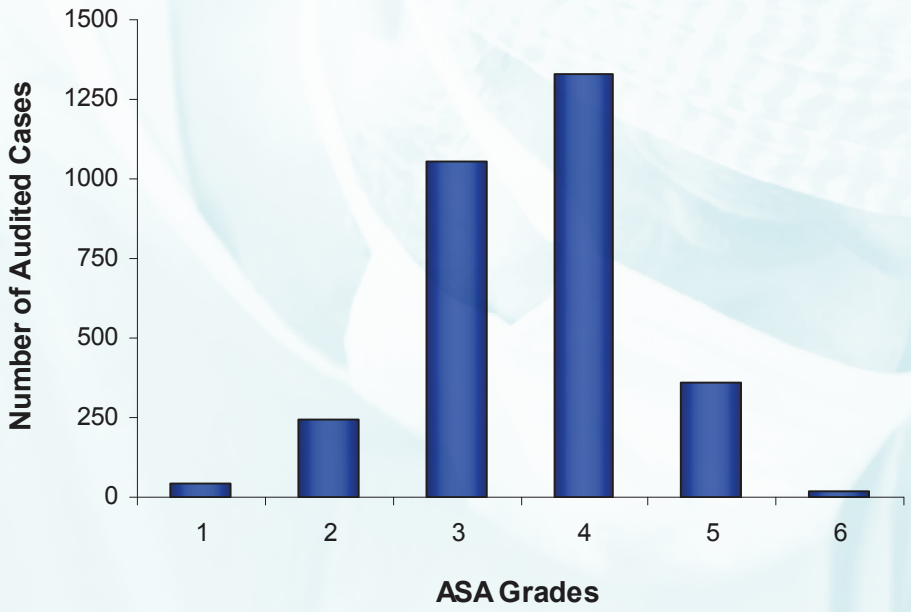
4.1.2 American Society of Anaesthesiologists (ASA) grades

The American Society of Anaesthesiologists grades are an internationally recognised classification of preoperative physical status (see tables 4.3 and 4.4).

Table 4.2 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 (2002–2010) (n=3054)



Comment

Seventy eight per cent of patients were assigned an ASA grade of either 3 or 4, meaning that they were assessed as either having a moderate or severe degree of systemic disease upon admission to hospital.

ASA grade is a simple but important measure of comorbidity and is routinely recorded on the anaesthetic record. This important data point was missing in 2947 forms returned to WAASM over the entire audit period (2002–2010). Surgeons need to address this. It will become a critical issue if any further analysis with risk adjustment is undertaken.

4.1.3 Causes of death

The most common causes of death among audited cases are shown in Table 4.3. The most common causes of death in those aged less than 70 years were brain haemorrhage and acute myocardial infarction. In those older than 70 years the main causes of death were acute myocardial infarction and respiratory failure. Details on cause of death for all patients can be found in Appendix A.

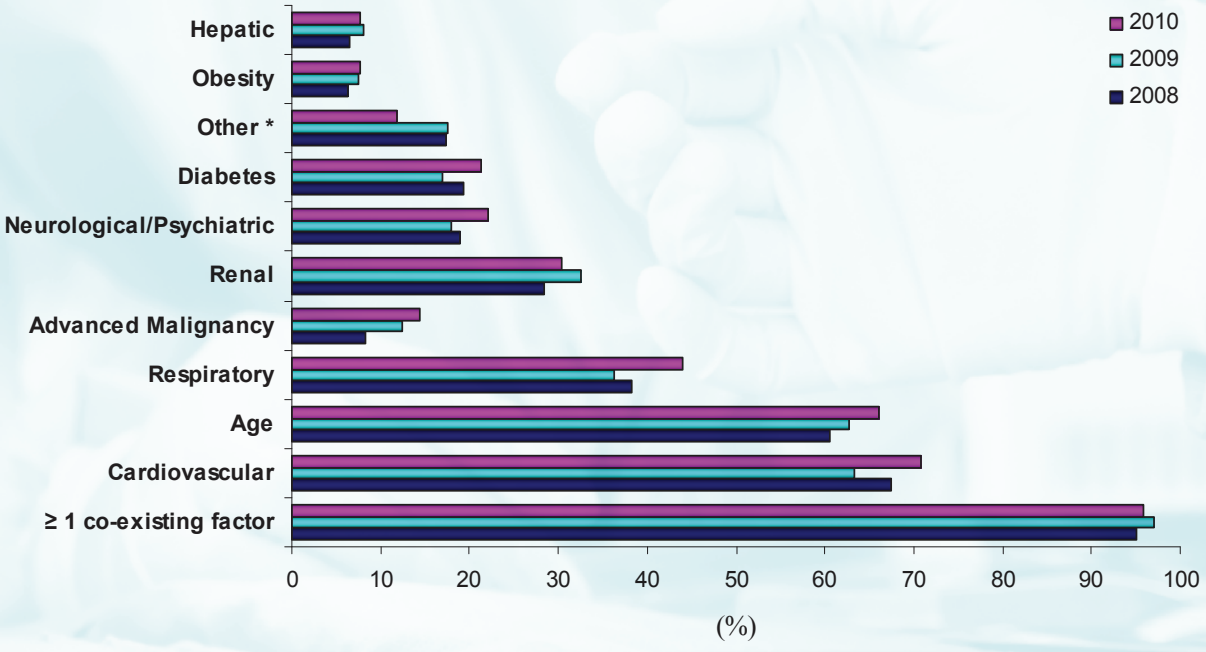
Table 4.3 Most common causes of death in audited cases (2002–2010) (n=4265)

CAUSES OF DEATH		
Cases <70 years old (n=1222)	**n**	**(%)**
Brain haemorrhage	140	11
Acute myocardial infarction	127	10
Respiratory failure	123	10
Septicaemia	115	9
Multiple organ failure	109	9
Malignancy	70	6
Cases ≥70 years old (n=3043)	**n**	**(%)**
Acute myocardial infarction	626	21
Respiratory failure	415	14
Vascular diseases	347	11
Septicaemia	317	10
Multiple organ failure	308	10
Malignancy	137	5

4.1.4 Comorbidity

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

Figure 4.5 Comorbidity status in completed cases 2008–2010



*Other significant comorbidities (as specified by the consultant surgeon) include anticoagulation states, anaemia, alcohol abuse, immunosuppression, osteoporosis and other disease states. Note: Neurosurgical cases were omitted.

Comment

In the last three years of the audit, over 95% of patients had more than one coexisting comorbidity associated with their surgery. Surgical risk increased based upon the pre-existing patient condition.

4.1.5 High dependency and intensive care units

Table 4.4 shows the use (actual and perceived) of a high dependency or intensive care unit.

Table 4.4 Actual use & assessor opinion of use, of a high dependency or intensive care unit

	Number of Cases (%)									
	2002 n=397	**2003 n=386**	**2004 n=429**	**2005 n=464**	**2006 n=496**	**2007 n=461**	**2008 n=485**	**2009 n=361**	**2010 n=184**	**Total n=3663**
Use of ICU	142 (36)	149 (39)	154 (36)	158 (34)	185 (37)	148 (32)	160 (33)	119 (33)	54 (29)	1269 (38)
Use of HDU	64 (16)	69 (18)	72 (17)	66 (14)	66 (13)	82 (18)	74 (15)	55 (15)	26 (14)	574 (16)
Assessors opinion on cases where patient was not admitted to either ICU or HDU										
ICU should have been used	9 (2)	1 (<1)	14 (3)	5 (1)	9 (2)	8 (2)	4 (1)	5 (1)	1 (1)	56 (2)
HDU should have been used	66 (17)	33 (9)	32 (7)	27 (6)	21 (4)	29 (6)	38 (8)	21 (6)	7 (4)	274 (7)

Note: Number of cases based on completed cases and excludes neurological cases. ICU = intensive care unit, HDU = high dependency unit

Comment

Approximately 38% of surgical deaths reported to WAASM used intensive care unit (ICU) facilities, while 16% of cases reported use of a high dependency unit.

As in previous years, a significant number of patients who would potentially have benefited from high dependency unit (HDU) care were not admitted to such a unit. This data has been consistent over many years and the clear implication is that there is a deficiency of HDU use in WA.

4.2 Comparison of surgeons' and assessors' views

KEY POINTS

- Assessors reported more areas of concern or adverse events than surgeons.

Incidents reported by the surgeons and assessors were compared (Table 4.5). This system of classifying events was introduced in November 2003; hence data reported is from 2004 to 2010. Data presented for 2010 may not be complete due to the censor date; it is likely that the numbers presented will increase. Cases undergoing second line reviews are more likely to be associated with areas of concern or adverse events and delays in returns to the WAASM office are also more likely to occur due to the detailed nature of the assessment.

Table 4.5 Surgeons' & assessors' views on performance (2004–2010)

		ASSESSOR				
YEAR	SURGEON	Consideration	Concern	Adverse event	No event	Total
2004	Consideration	22	15	5	23	65
	Concern	5	7	9	4	25
	Adverse event	3	0	6	3	12
	No event	43	23	16	286	368
	Total	**73**	**45**	**36**	**316**	**470**
2005	Consideration	14	15	5	15	49
	Concern	3	9	6	5	23
	Adverse event	1	2	6	1	10
	No event	29	23	24	366	442
	Total	**47**	**49**	**41**	**387**	**524**
2006	Consideration	14	7	8	16	45
	Concern	3	10	4	9	26
	Adverse event	3	5	9	2	19
	No event	36	25	18	426	505
	Total	**56**	**47**	**39**	**453**	**595**
2007	Consideration	8	9	6	20	43
	Concern	4	9	2	5	20
	Adverse event	1	1	9	2	13
	No event	36	15	30	374	455
	Total	**49**	**34**	**47**	**401**	**531**
2008	Consideration	20	12	7	13	52
	Concern	1	9	4	3	17
	Adverse event	2	5	7	2	16
	No event	53	19	31	368	471
	Total	**76**	**45**	**49**	**386**	**556**
2009	Consideration	7	3	3	16	29
	Concern	4	7	2	5	18
	Adverse event	0	3	7	0	10
	No event	32	14	9	312	367
	Total	**43**	**27**	**21**	**333**	**424**
2010	Consideration	5	3	1	3	12
	Concern	2	1	0	2	5
	Adverse event	0	1	0	3	4
	No event	9	2	7	170	188
	Total	**16**	**7**	**8**	**178**	**209**

Note: Data can only be analysed when 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 & assessors

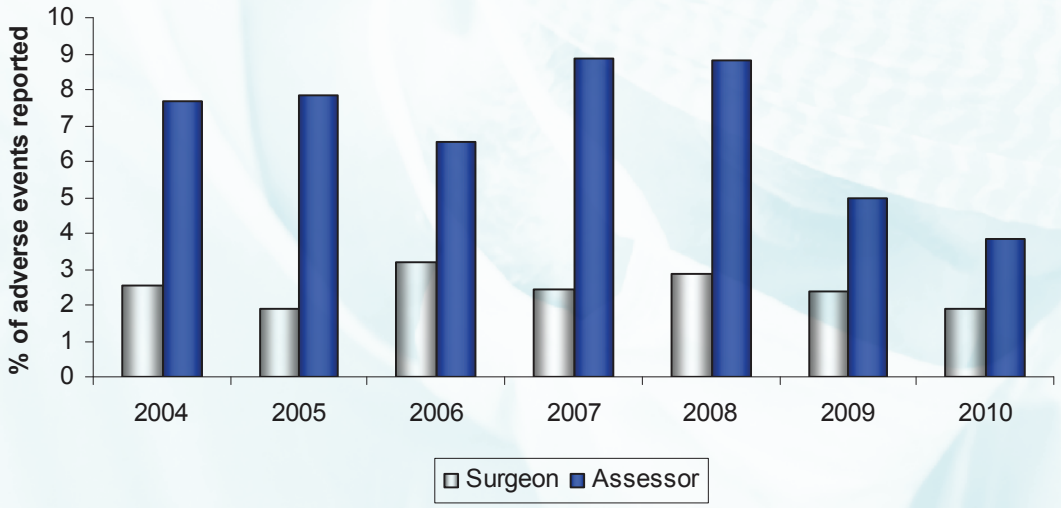


Figure 4.6 compares the proportion of adverse events reported by surgeons and assessors for the same cases. Each year the assessors reported more adverse events than the treating surgeons.

Kappa scores measure the level of agreement or variation between two observers. Kappa scores were obtained for surgeon and assessors view on performance. The levels of agreement (Kappa score) by year can seen in Table 4.7. The Interpretation of Kappa scores is as follows:

Kappa score	Interpretation
<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

Table 4.6 Level of agreement between surgeons' & assessors' views on performance

Year	Kappa score (95% confidence interval)	Interpretation of Kappa score
2004	0.288 (0.217–0.359)	Fair agreement
2005	0.322 (0.249–0.395)	Fair agreement
2006	0.333 (0.257–0.403)	Fair agreement
2007	0.276 (0.199–0.353)	Fair agreement
2008	0.306 (0.238–0.375)	Fair agreement
2009	0.306 (0.212–0.401)	Fair agreement
2010	0.307 (0.163–0.452)	Fair agreement
Overall	0.308 (0.278–0.338)	Fair agreement

Comment

Following the data trend over the audit years, it appears that surgeons under-report events that the assessors believe represent an area of concern or adverse event. For example, in 2010 assessors reported eight adverse events compared to four reported by the surgeons.

4.3 Clinical events

KEY POINTS

- Assessors reported that preventable adverse events caused death in 1% of cases throughout the entire audit period (2002-2010).

4.3.1 Reported areas for consideration, of concern and adverse events

Areas of consideration, concern and adverse events related to audited cases were analysed. Table 4.7 reports the number of cases associated with each event of consideration, concern or adverse occurrence.

Table 4.7 Audited deaths associated with areas for consideration, of concern or adverse events as reported by assessors (most significant event only)

	Number of cases (%)									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Total number of cases	411	383	470	524	595	531	556	424	209	4103
Area for consideration	17 (4)	32 (8)	73 (16)	47 (9)	56 (9)	49 (9)	76 (14)	43 (10)	16 (8)	409 (10)
Area for concern	42 (10)	33 (9)	45 (10)	49 (9)	47 (8)	34 (6)	45 (8)	27 (6)	7 (3)	329 (8)
Adverse event (AE)	64 (16)	35 (9)	36 (8)	41 (8)	39 (7)	47 (9)	49 (9)	21 (5)	8 (4)	340 (8)
AE that caused death	26 (6)	18 (5)	14 (3)	22 (4)	22 (4)	27 (5)	32 (6)	14 (3)	3 (1)	178 (4)
AE that caused death, considered definitely preventable	5 (1)	2 (<1)	3 (1)	7 (1)	3 (<1)	4 (1)	3 (<1)	3 (1)	0 (0)	30 (1)

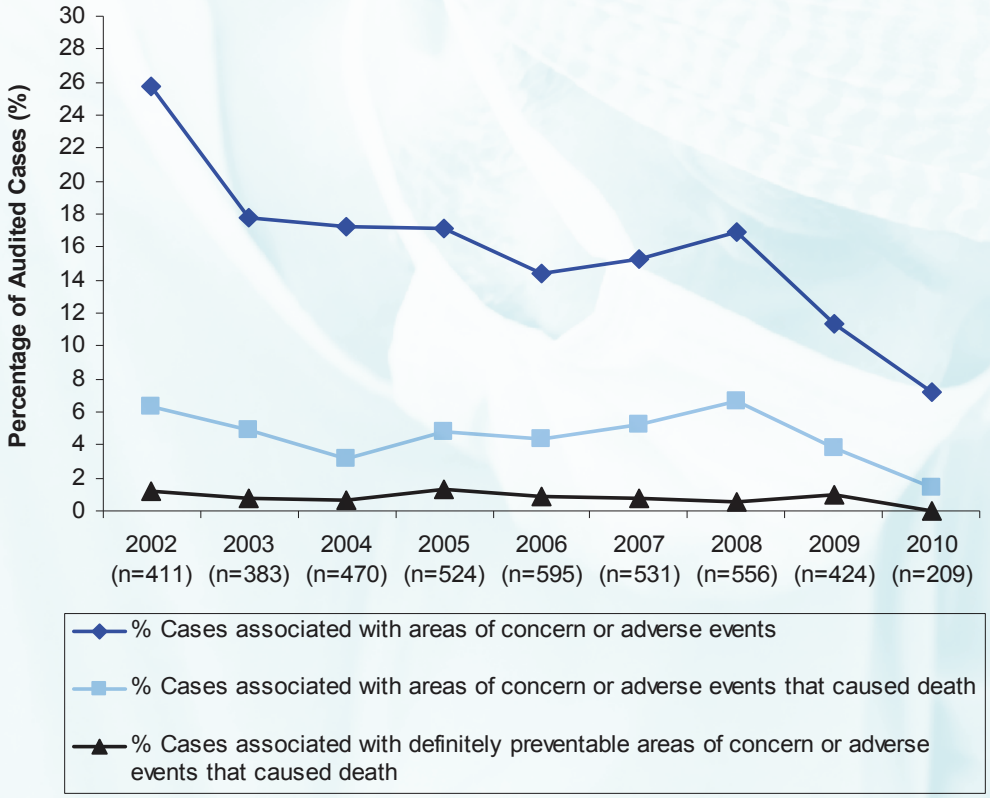
Note: Terminal care cases excluded.

Comment

Assessors reported areas of concern or adverse events in 16% of all cases over the audit period. In 2010, 1% of cases were associated with an adverse event that caused death and in none of those cases were the deaths considered definitely preventable (Table 4.7).

Both of these figures are below the overall averages with 4% of all cases associated with an adverse event that caused death and 1% of cases associated with an adverse event that caused death but was considered definitely preventable for the total audit period (2002–2010) (Table 4.7). Figure 4.7 shows the percentage of audited cases associated with adverse events or areas of concern (2002–2010).

Figure 4.7 Cases associated with adverse events or areas of concern (2002–2010)



4.4 Admissions

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.

KEY POINTS (Table 4.8)

- Over the period 2002–2010, 80% of cases were admitted to public hospitals, 17% were admitted to private hospitals and 3% were admitted to both private and public hospitals.
- Of the 3243 cases admitted to public hospitals, 13% were elective admissions.
- Of the 682 cases admitted to private hospitals, 41% were elective admissions.
- 64% of emergency cases in public hospitals underwent an operation, compared to 85% of emergency cases in private hospitals (p<0.001).
- The proportion of area of concern or adverse events associated with cases that underwent operation (elective and emergency admissions) was not significantly different between public and private hospitals (p=0.312).[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 events associated with elective admissions (30%) (p<0.001).[a]

a Pearson's Chi-squared test.

Table 4.8 Elective and emergency admissions to public and private hospitals (All cases, 2002–2010)

Number of cases (%)				
		Elective	**Emergency**	**Total**
(a) All cases	**Private**	283 (41)	399 (59)	682 (17)
	Public	433 (13)	2810 (87)	3243 (80)
	Co-location	16 (14)	95 (86)	111 (3)
	Total	732 (18)	3304 (82)	4036
(b) Cases that underwent an operation*	**Private**	266 (94)	338 (85)	604 (89)
	Public	396 (91)	1804 (64)	2200 (68)
	Co-location	15 (94)	60 (63)	75 (68)
	Total	677 (92)	2202 (67)	2879 (71)
(c) Cases associated with an area of concern or adverse event*	**Private**	79 (28)	54 (14)	133 (20)
	Public	140 (32)	373 (13)	513 (16)
	Co-location	3 (19)	13 (14)	16 (14)
	Total	222 (30)	440 (13)	662 (16)
(d) Cases that underwent an operation that were associated with an area of concern or adverse event†	**Private**	77 (29)	49 (14)	126 (21)
	Public	132 (33)	317 (18)	449 (20)
	Co-location	3 (20)	11 (18)	14 (19)
	Total	212 (31)	377 (17)	589 (20)

Note: Co-location refers to a case in which the patient has been in both public and private hospital. Missing data will account for differences in numbers. (Overall 51 cases are missing.)

* Percentages in parts (b) and (c) relate to figures in part (a).

† Percentages given in part (d) relate to figures in part (b).

4.4.2 Relationship between factors related to admission data

KEY POINTS (Table 4.8)

- 71% of cases underwent one or more operations.
- 92% of the elective cases underwent an operation.
- Among elective cases undergoing surgery, the proportion admitted to private hospitals (94%) was not significantly different from the proportion admitted to public hospitals (91%) (P=0.310).[a]
- Of the 3304 emergency admissions, 67% underwent an operation. A significantly higher proportion of emergency admissions admitted to private hospitals underwent surgery (85%) compared to those admitted as an emergency to public hospitals (64%) (P<0.001).[a]
- Among emergency admissions undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to private hospitals (14%) was not significantly different from the proportion admitted to public hospitals (18%) (P=0.168).[a]
- Among elective cases undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to private hospitals (29%) was not significantly different to the proportion admitted to public hospitals (33%) (P=0.234).[a]
- In those cases undergoing surgery, the proportion of elective cases associated with an area of concern or adverse event (31%) was significantly greater than the proportion in emergency cases (17%) (P<0.001).[a]

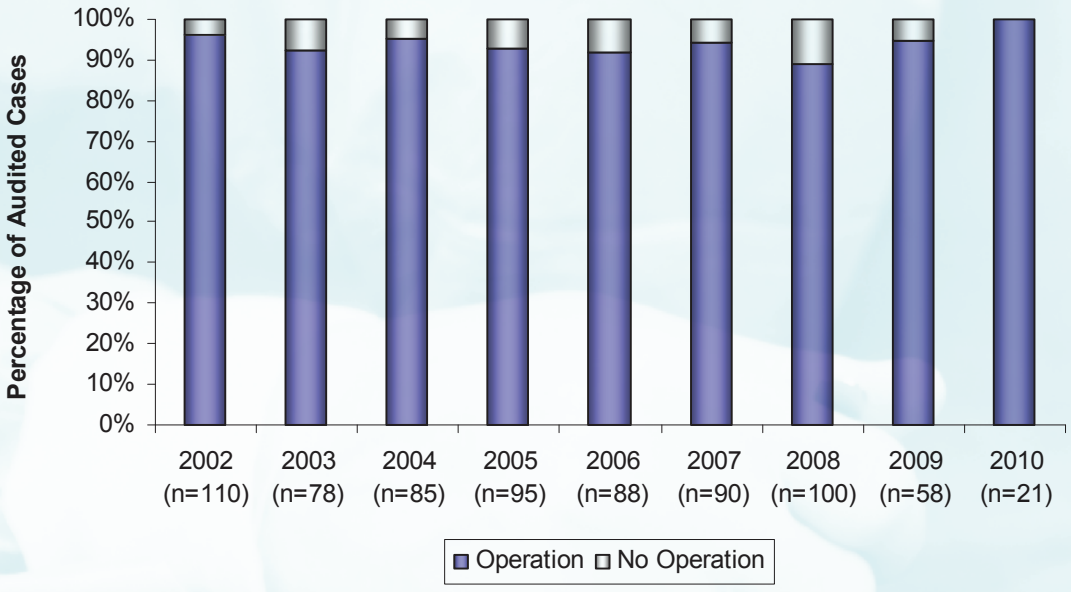
a Pearson's Chi-squared test.

Table 4.9 Emergency admissions to private and public hospitals (2002–2010)

Number of cases (%)		
By specialty		
Specialty	**Emergency admissions to private hospitals (n=397)**	**Emergency admission to public hospital (n=2789)**
General surgery	176 (44)	1056 (38)
Orthopaedic surgery	94 (24)	639 (23)
Urological surgery	35 (9)	65 (2)
Cardiothoracic surgery	35 (9)	137 (5)
Vascular surgery	35 (9)	313 (11)
Neurosurgery	16 (4)	490 (18)
Other surgery*	6 (2)	89 (3)
Underwent operation	338 (85)	1804 (64)
Emergency admissions where no operation was performed		
Reason for no operation	**Emergency admissions to private hospitals (n=58)**	**Emergency admission to public hospital (n=968)**
Active decision not to operate	30 (52)	423 (44)
Not a surgical problem	8 (14)	122 (13)
Patient refused operation	6 (10)	65 (7)
Rapid death	7 (12)	91 (9)
Missing data	7 (12)	267 (28)

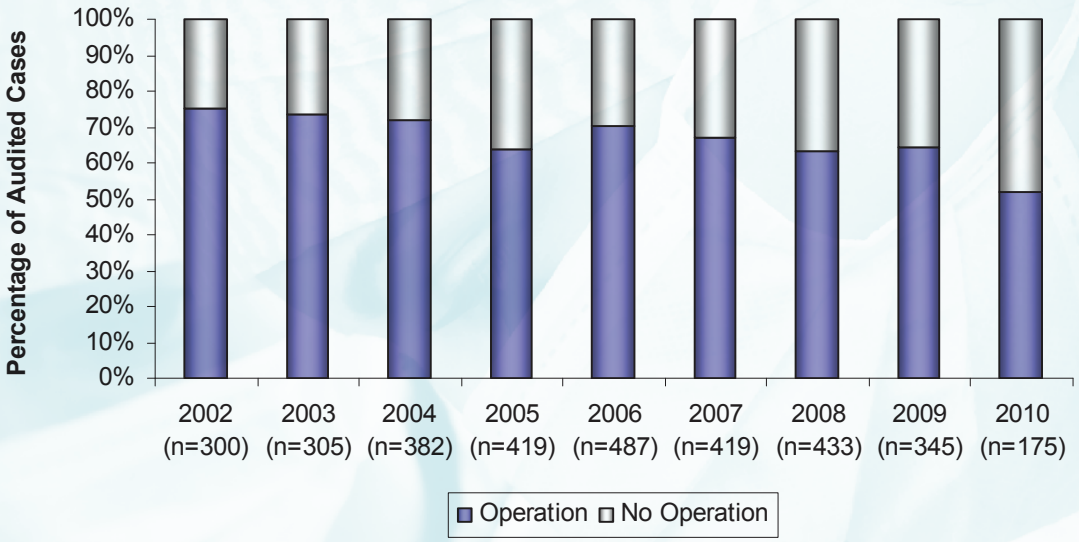
*'Other surgery' includes ENT, ophthalmology, obstetrics & gynaecology, plastic, paediatrics, oral maxillofacial.
Note: Data missing for operative emergency admissions to private hospital n=2. Data missing for operative emergency admissions to public hospital n=21. Data missing for emergency non-operative admissions to private hospitals n=3. Data missing for emergency non-operative admissions to public hospitals n=38.

Figure 4.8 Percentage of elective admissions associated with an operation (2002–2010) (n=725)



Note: Data missing for 8 cases; graph represents complete cases only.

Figure 4.9 Percentage of emergency admissions associated with an operation or no operation (2002–2010) (n=3265)



Note: Data missing for 41 cases; graph represents complete cases only.

Comment

The proportions of emergency admissions that underwent an operation display a decreasing trend over the total audit period from 75% in 2002 to 52% in 2010. The avoidance of futile surgery has been highlighted by WAASM in previous annual reports.

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

The statistics of cases in which areas of concern or adverse events have been identified and that are associated with emergency or elective admissions are outlined in Table 4.10 and Figures 4.10 and 4.11. Reported areas of concern or adverse events in elective and emergency admissions have been identified in Tables 4.11 and 4.12 respectively.

Table 4.10 Emergency & elective admissions that were associated with areas of concern or adverse events (2002–2010)

	Areas of concern or adverse events (%)		
Admission type	**Yes**	**No**	**Total**
Elective	222 (5)	511 (13)	733 (18)
Emergency	440 (11)	2866 (71)	3306 (82)
Total	662 (16)	3377 (84)	4039

Note: Data missing on 64 cases; cross tabulation only on complete data.

Figure 4.10 Emergency and elective admissions associated with areas of concern or adverse events (2002–2010) (n=662)

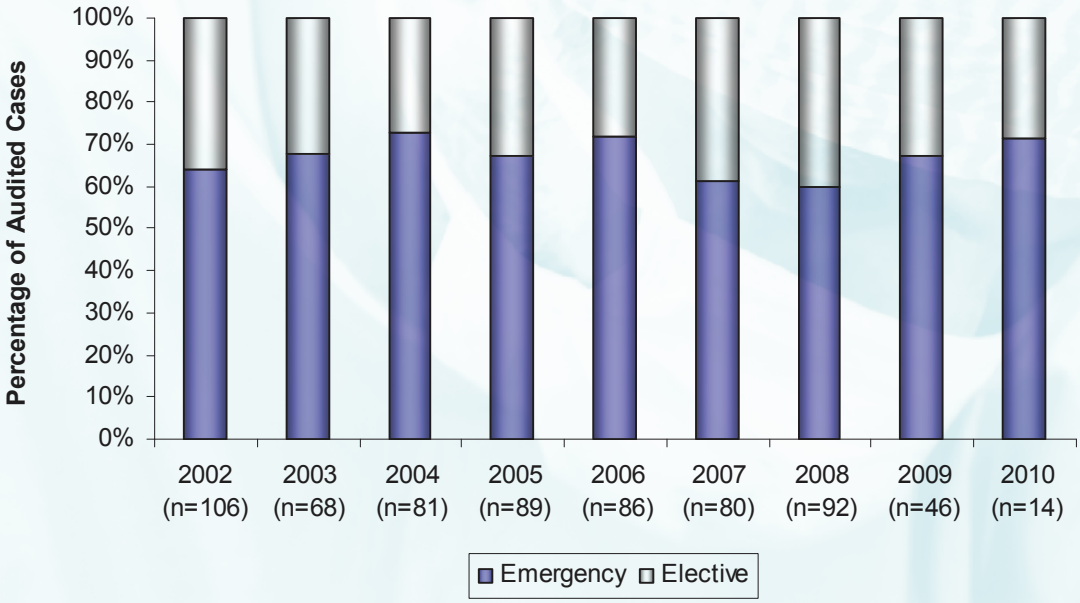
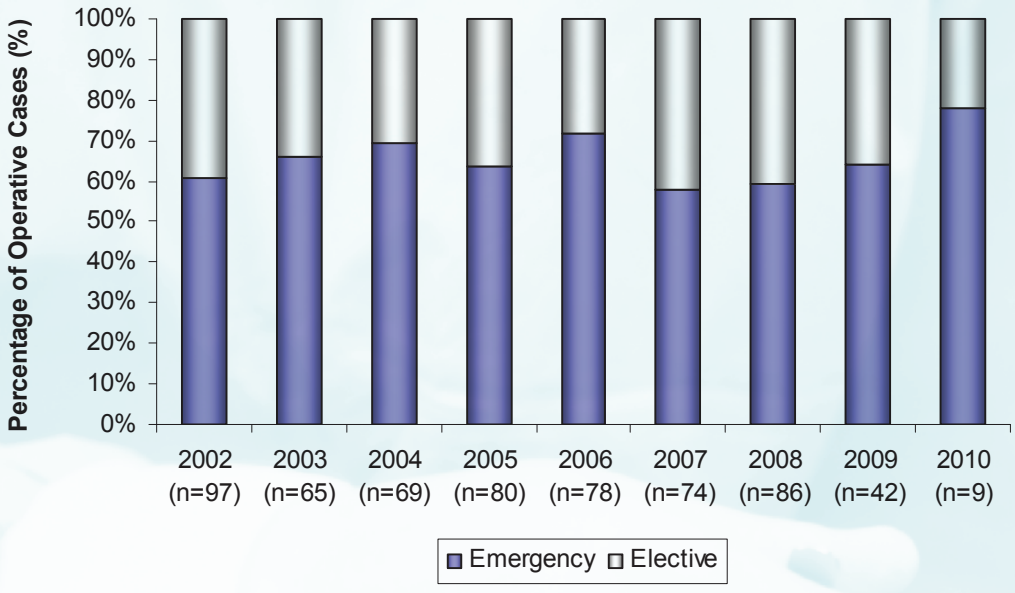


Figure 4.11 Operative cases associated with areas of concern or adverse events – elective and emergency admissions (2002–2010) (n=600)



Comment

There is a decreasing trend in emergency operations associated with areas of concern or adverse events. Similarly, there is a decrease in the proportion of elective surgeries associated with areas of concern or adverse events over the total audit period.

Table 4.11 All areas of concern or adverse events associated with elective admissions (2002–2010) (Total number of elective admissions =732)

Elective admissions (n=218)		
Area of concern or adverse event	**Number of events**	**Percentage**
Related to surgery	72	33
General complications	32	15
Incorrect or inappropriate therapy	21	10
Delays	15	7
Assessment problems/diagnosis missed	12	5
Fluid balance	11	5
Related to endoscopic surgery	11	5
Decision to operate	10	5
Drug-related problems	7	3
Patient factors	6	3
Failure to use facilities	6	3
Related to laparoscopic surgery	4	2
Anaesthesia-related problems	3	1
Monitoring problems	3	1
Communication failures	2	1
Staff problems	2	1
Related to radiological surgery	1	<1
TOTAL	**218**	**100**

Missing data n=4

Table 4.12 All areas of concern or adverse events associated with emergency admissions (2002–2010) (Total number of emergency admissions=3304)

Emergency admissions (n=423)		
Area of concern or adverse event	**Number of events**	**Percentage**
Delays	103	24
Related to surgery	56	13
General complications	52	12
Incorrect or inappropriate therapy	45	11
Drug-related problems	39	9
Patient factors	26	6
Assessment problems/diagnosis missed	24	6
Fluid balance	13	3
Decision to operate	10	2
Communication failures	8	2
Monitoring problems	8	2
Failure to use facilities	8	2
Related to radiological surgery	7	2
Related to endoscopic surgery	7	2
Related to laparoscopic surgery	6	1
Transfer problems	5	1
Staff problems	4	1
Anaesthesia-related problems	2	<1
TOTAL	**423**	**100**

Missing data n=17

Comment
Surgery-related events and general complications are the most common reasons for areas of concern or adverse events in elective admissions, while delays and surgery-related events remain the most common reasons for an area of concern or adverse event in emergency admissions.

4.5 Operative and non-operative cases

KEY POINTS

- 27% of cases did not undergo an operation.
- In 2997 cases in which an operation was undertaken, 6% of cases were abandoned.

4.5.1 Operative cases

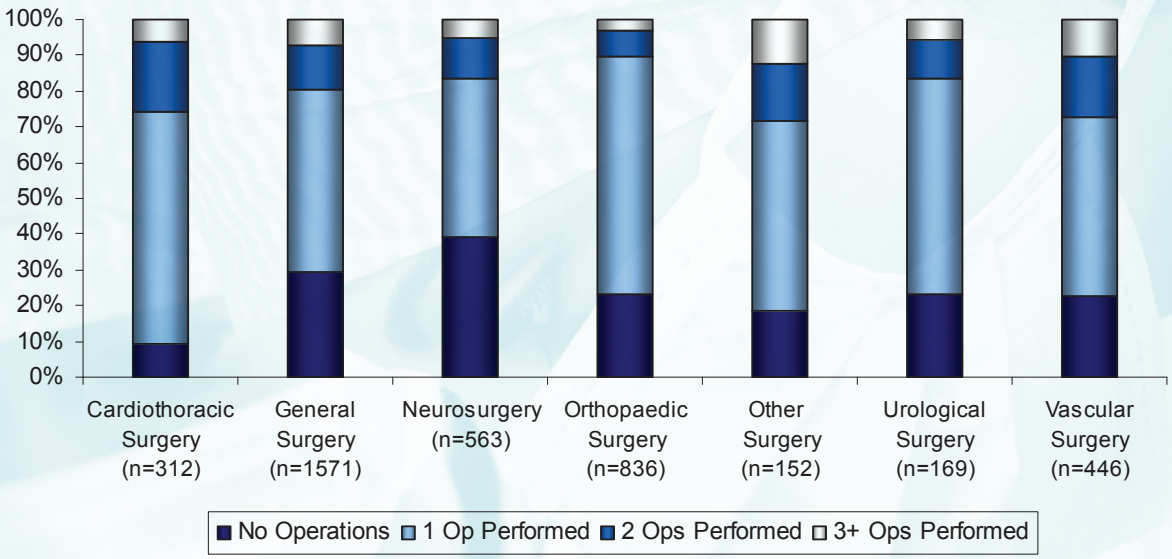
Data on operative cases appears in Table 4.13 and in Figure 4.12.

Table 4.13 Operations performed (2002-2010)

Number of cases (%)										
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Total cases/year	411	383	470	523	593	529	556	416	197	4078
Total operative cases	333 (81)	297 (78)	359 (76)	371 (71)	442 (75)	389 (74)	393 (71)	285 (69)	128 (65)	2997 (73)
No operation performed	78 (19)	86 (22)	111 (24)	152 (29)	151 (25)	140 (26)	163 (29)	131 (31)	69 (35)	1081 (27)
1 operation performed	234 (57)	220 (57)	277 (59)	289 (55)	318 (54)	296 (56)	289 (52)	207 (50)	100 (51)	2230 (55)
2 operations performed	64 (16)	48 (13)	55 (12)	51 (10)	80 (13)	60 (11)	70 (13)	56 (13)	16 (8)	500 (12)
3+ operations performed	35 (9)	29 (8)	27 (6)	31 (6)	44 (7)	33 (6)	34 (6)	22 (5)	12 (6)	267 (7)

Note: Data missing on 25 cases; cross-tabulation performed with complete data only.

Figure 4.12 Number of operations by speciality (2002–2010) (n=4049)



Note: Data missing on 54 cases.

Comment

The proportion of patients having an operation has decreased 16% from 333 operative cases (81%) in 2002 to 128 cases (65%) in 2010. On average 27% of cases reported to WAASM did not undergo an operation. Of those cases where an operation was performed, 55% underwent one operation, 12% underwent two operations and 7% underwent three or more operations (Table 4.13).

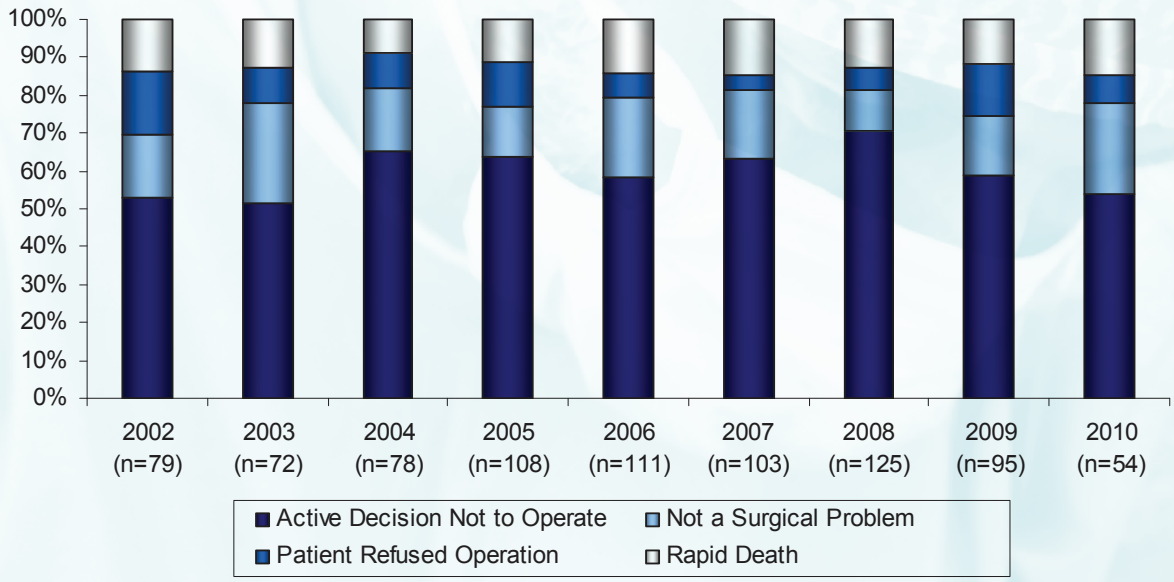
Table 4.14 Operations abandoned, including patients undergoing one or more surgical procedures (2002–2010)

	Number of cases (%)									
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Total number of operative cases	333	297	359	371	442	389	393	285	128	2997
Abandoned at 1st operation	19 (6)	22 (7)	11 (3)	19 (5)	13 (3)	14 (4)	16 (4)	7 (2)	11 (9)	132 (4)
Abandoned at 2nd operation	6 (2)	2 (1)	2 (<1)	4 (1)	3 (1)	3 (1)	2 (<1)	2 (1)	0 (0)	24 (1)
Abandoned at 3rd operation	2 (1)	3 (1)	1 (<1)	4 (1)	0 (0)	1 (<1)	1 (<1)	1 (<1)	0 (0)	13 (<1)
Total number of cases in which an operation was abandoned	27 (8)	27 (9)	14 (4)	27 (7)	16 (4)	18 (5)	19 (5)	10 (4)	11 (9)	169 (6)

4.5.2 Non-operative cases

Data on non-operative cases appears below.

Figure 4.13 Reasons for no operation, all specialities (2002–2010) (n=825)



Note: Some cases are associated with more than one reason for no operation.

Comment

Figure 4.13 illustrates a consistent trend towards an active decision on the part of the surgeon, patient and/or next of kin not to operate. In 2010, compared to previous years, it appears that in a higher proportion of audited cases the patients did not have a surgical problem.

4.5.3 Risk of death before surgery

Both surgeons and assessors are required to categorise the patient's preoperative risk of death following an operation(s) (Table 4.15).

Table 4.15 Comparison of views of surgeons & assessors on preoperative risk of death in cases undergoing an operation (2002-2010)

Number of cases (%)				
	Surgeon's view of risk			
Assessors' view of risk	**Minimal/small**	**Moderate**	**Considerable/expected**	**Total**
Minimal/small	129	62	44	235
Moderate	101	250	258	609
Considerable/expected	113	434	1138	1685
Total	343	746	1440	2529

Note: Data missing for 391 cases. Kappa measurements can only be calculated on complete information from both surgeon and assessor; Kappa score (K)=0.255, 95% CI 0.22–0.29 (p<0.001), indicating that surgeons and assessor were in 'fair agreement'.

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

Areas of concern and adverse events are depicted in figures 4.14 and 4.15.

Figure 4.14 Cases associated with areas of concern or adverse events in Western Australian teaching hospitals (n=473)

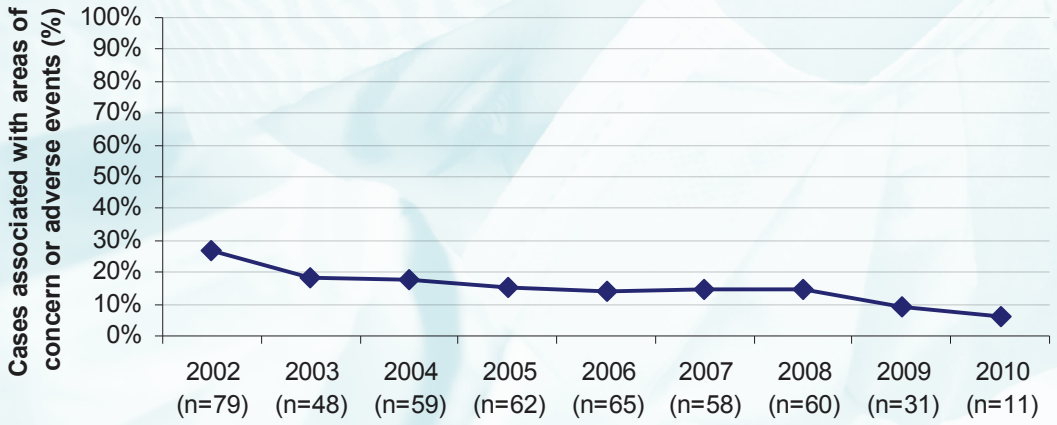
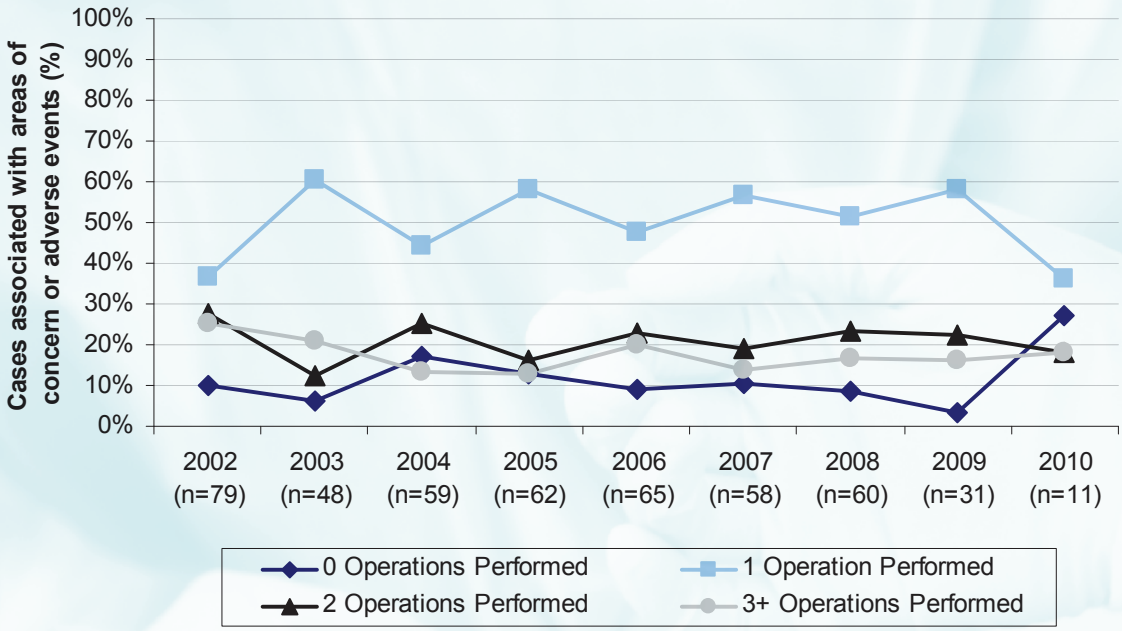


Figure 4.15 Areas of concern or adverse events associated with cases where more than one operation was performed in Western Australian teaching hospitals (n=473)



4.5.5 Unplanned return to theatre

Unplanned return to theatre is depicted in Table 4.16.

Table 4.16 Unplanned return to theatre (2004-2010)

	Year							
Unplanned returns to theatre	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Number of cases in which at least one operation was performed	359	371	442	389	393	285	128	2367
Cases where surgeons reported an unplanned return to theatre (%)	49 (14)	55 (15)	59 (13)	44 (11)	59 (15)	34 (12)	11 (9)	311 (13)

Comment

The proportion of patients dying after an unplanned return to theatre has remained consistent (10–15%) over 7 years.

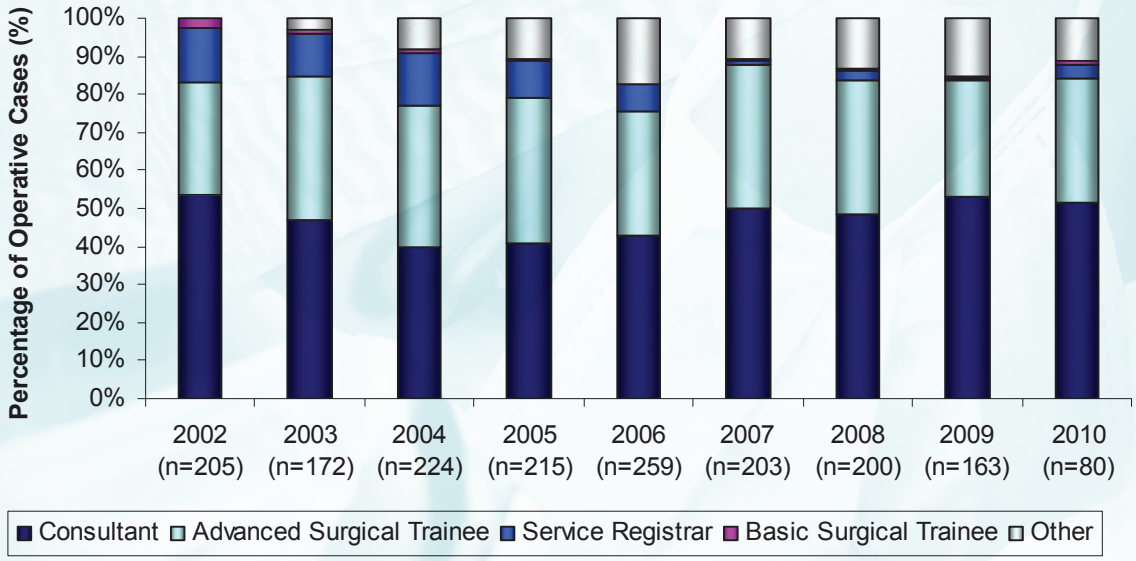
4.6 Grade of surgeon (teaching hospitals)

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

Table 4.17 Deaths after surgery in Western Australian teaching hospitals (2002–2010)

	Number of cases (%)									
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Number of audited operative cases in teaching hospitals	223	191	246	268	343	277	262	212	112	2134
Consultant decision to operate	186 (83)	157 (82)	202 (82)	198 (74)	244 (71)	202 (73)	185 (71)	154 (73)	80 (71)	1608 (75)
Consultant operating or directly assisting	129 (58)	95 (50)	114 (46)	113 (42)	156 (46)	128 (46)	132 (50)	118 (56)	51 (46)	1036 (49)

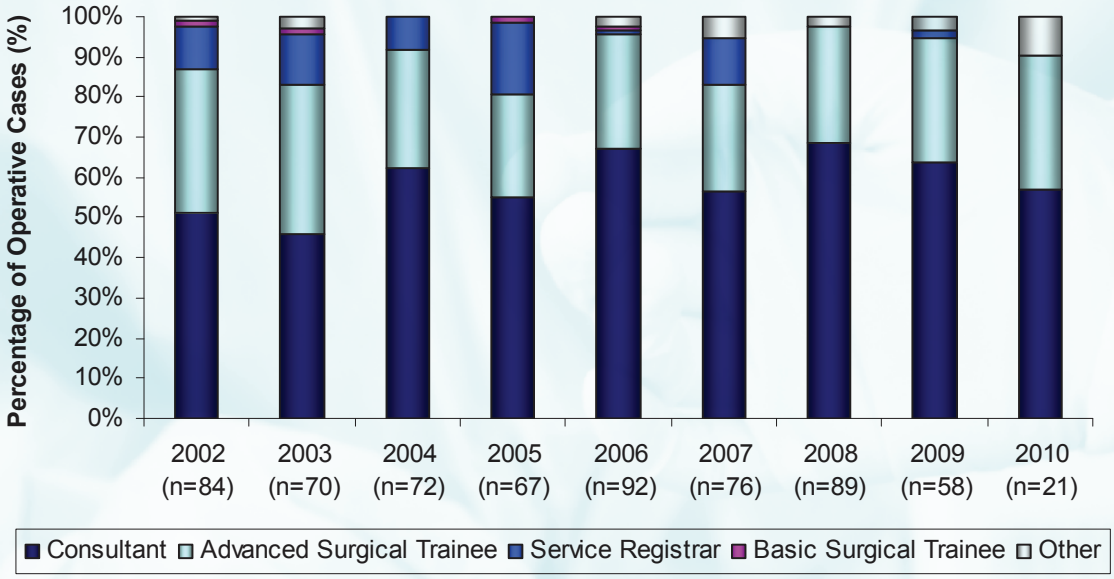
Figure 4.16 Grade of surgeon performing first operation, by year in Western Australian teaching hospitals (2002–2010)[a]



a Total OP1 n=1579; total return to theatre n=583. Some of the information on grade of operating surgeon was missing.

Note: 'Other' includes interns, resident medical officers and senior registrars.

Figure 4.17 Grade of surgeon performing subsequent operations in return to theatre cases, by year in Western Australian teaching hospitals (2002–2010)



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

Figure 4.18 Consultant supervision in cases returned to theatre in Western Australian teaching hospitals

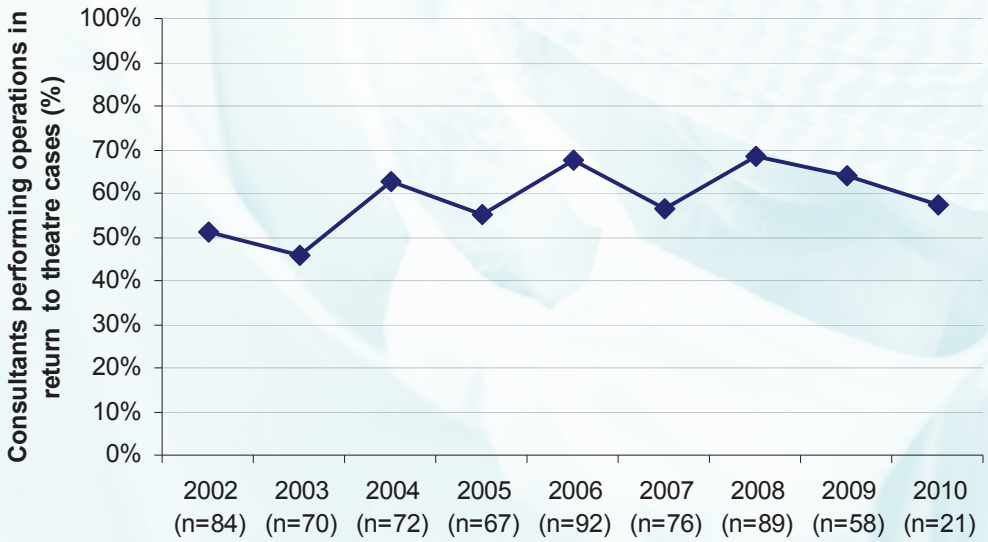


Figure 4.19 Consultant surgeons involved in primary operations, by year in Western Australian teaching hospitals (2002-2010)

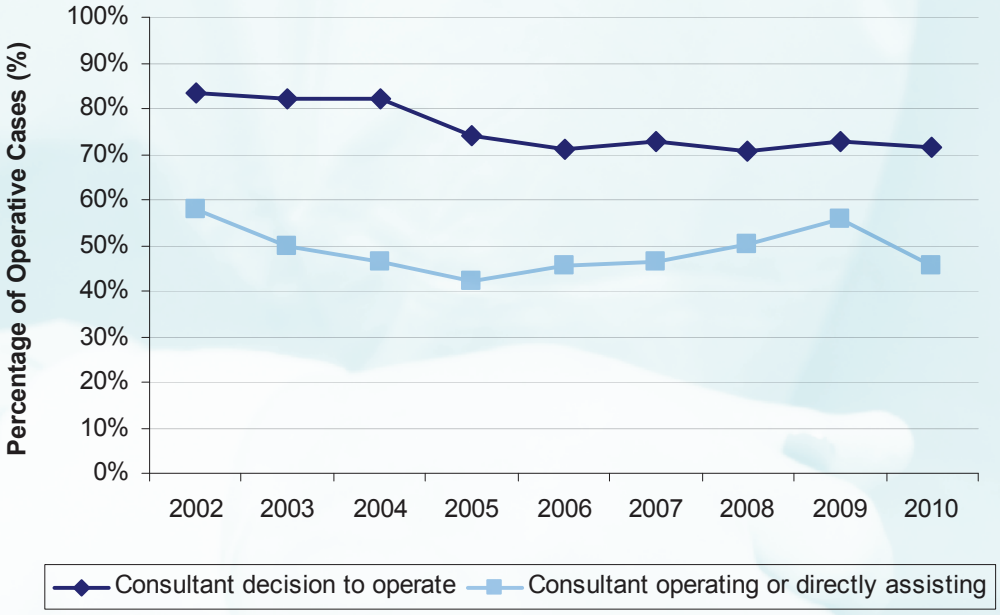
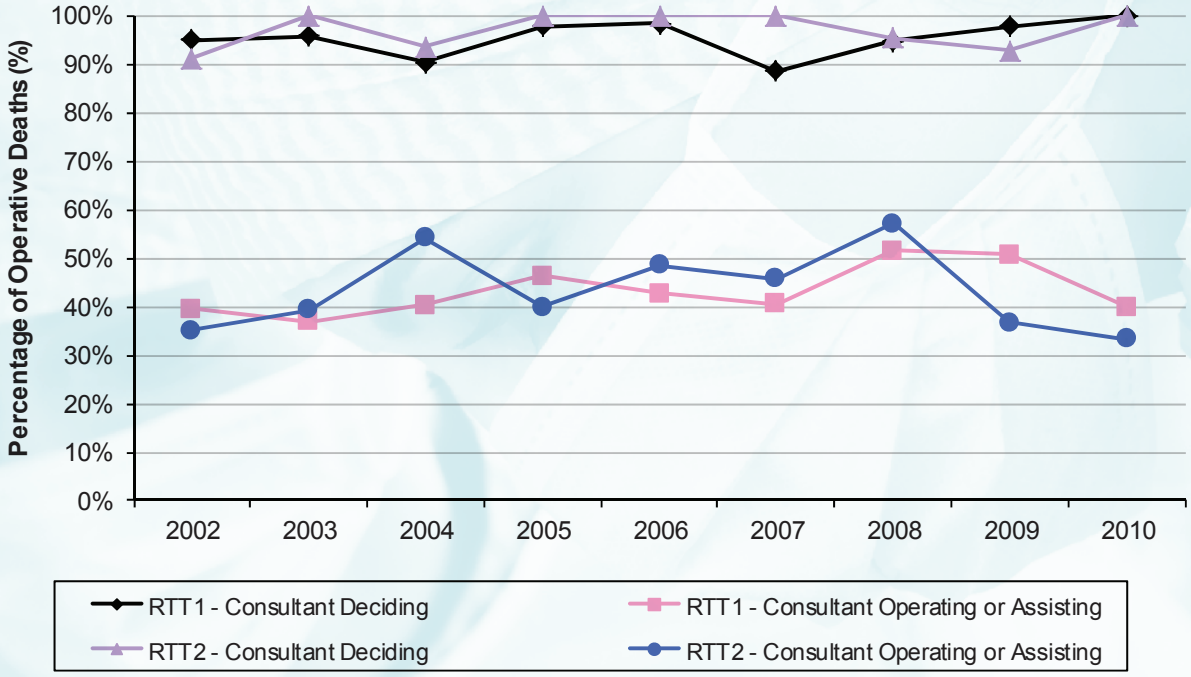


Figure 4.20 Consultant surgeons involvement in returns to theatre (RTT) by year in Western Australian teaching hospitals



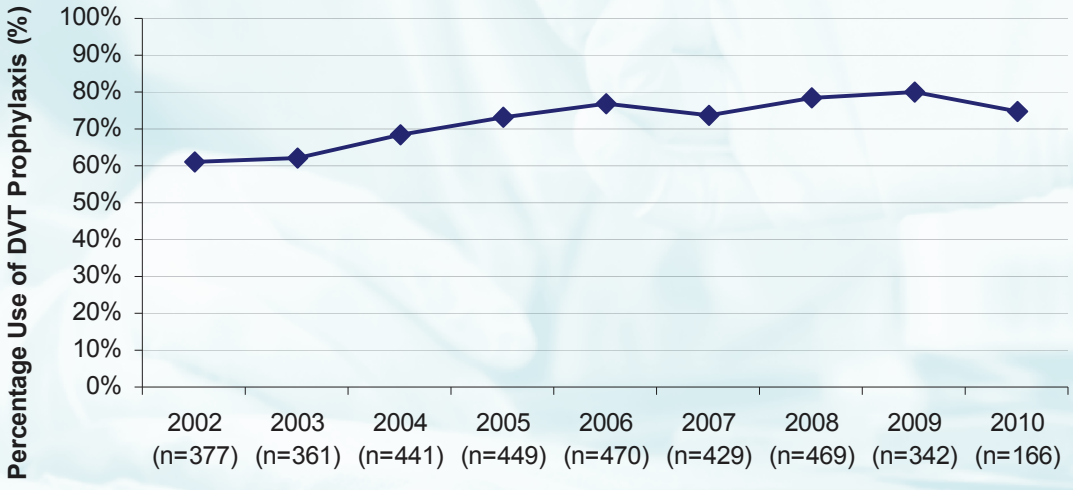
Comment

Direct consultant supervision of patients being returned to theatre has been highlighted in all previous annual reports and there was a welcome increase in consultant supervision over time. However, the last two years have shown a reversal of this increased level of consultant supervision (Figures 4.19 and 4.20). This is an unwelcome observation.

4.7 Prophylaxis of thromboembolism

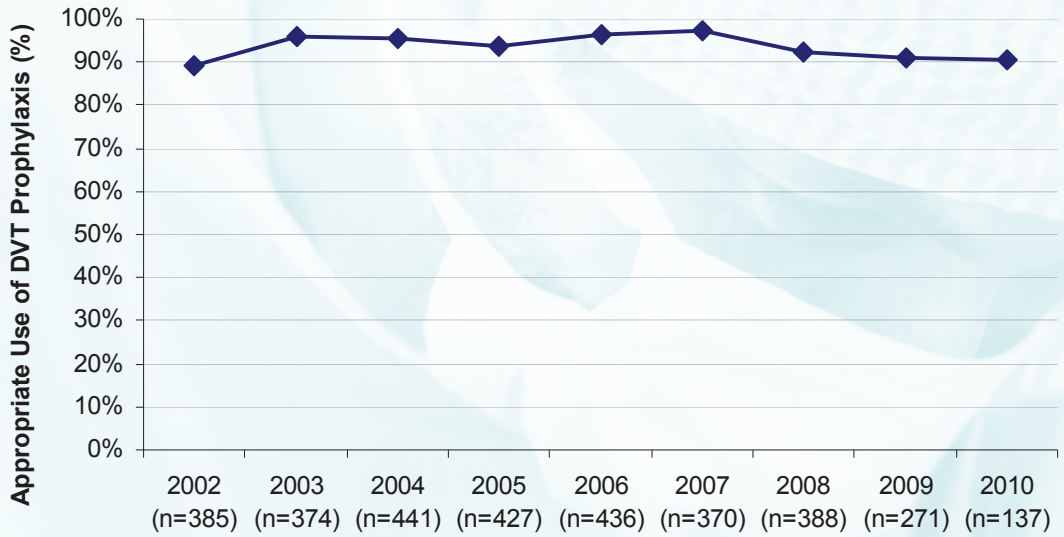
Surgeons are asked on the proforma whether deep vein thrombosis (DVT) prophylaxis was used and if not the reason why it was withheld. During case review assessors indicate whether they think that the decision was appropriate.

Figure 4.21 Use of DVT prophylaxis, by year (2002–2010) (n=3504)



Note: Data missing on 600 cases.

Figure 4.22 Cases where assessors noted that use of DVT prophylaxis was appropriate, by year (n=3229)



Note: Neurosurgeons do not complete this question in the proforma unless it has been flagged as an area of concern or adverse event. Data missing on 875 cases.

Comment

DVT prophylaxis has been an important initiative in the Western Australian Safety and Quality agenda and has been given a very high priority over the last decade. The overall trend recorded by WAASM is encouraging, but given that the value of DVT prophylaxis is so well known this figure is less than satisfactory. Multiple factors almost always combined to create an overall failure in care. WAASM urges surgeons to very critically review what actually happened, as opposed to what was intended, whenever confronted by a DVT or pulmonary embolism.

Data on DVT prophylaxis was missing in 600 proformas and 875 assessments returned to the WAASM office.

5. PERFORMANCE REVIEW

This section reviews progress made on each of the recommendations of the 2010 WAASM annual report.

Notifications and hospital participation

WAASM has followed up with hospitals in cases where notifications of death have not been sent to the office regularly. This process is continually in review and the accuracy of WAASM data is improving.

Surgeon participation

In anticipation of the recent changes to College CPD, at the end of 2010 WAASM encouraged all surgeons to complete participation forms so that they may meet this requirement. Surgeon participation in the WAASM has increased by ~5% since October 2010.

Surgeon feedback

WAASM continues to send feedback to surgeons in regards to proforma returns and the number of cases which they have assessed.

Clinical management

WAASM is currently investigating trends in fluid balance data, returns to theatre and ICU admissions in elective and emergency cases. These reports will become available once they have been finalised.

Reporting

WAASM is currently preparing to migrate onto the Bi-National Audit System to align itself with the rest of the ANZASM regional audits. This migration is anticipated to be completed by the end of 2011.

6. RECOGNISING THE DETERIORATING PATIENT SYMPOSIUM 2011

Introduction

In the 2009 WAASM Annual Report[8] it was noted that over a two-year period 5.3% of deaths (73 deaths out of a total of 1371) that occurred under the care of a surgeon were attributed to some form of delay. Data presented in Table B.1 in the present annual report indicated that over the entire audit period, from 01 January 2002 to 31 December 2010, 18.5% (124 cases out of a total of 669) of areas of concern or adverse events reported by assessors were attributed to delays with the second leading cause of death being a 'delay in diagnosis'.

In response to this data, WAASM, in collaboration with the WA Department of Health, held a symposium in February on 'Recognising the Deteriorating Patient'. The symposium was heavily oversubscribed.

The symposium highlighted the difficulties experienced by ward staff in detecting the early signs of clinical deterioration, which are often very subtle. Early identification of clinical deterioration leads to better outcomes and decreases adverse events associated with a delayed response.

Methods

Two hundred and sixty evaluation forms were distributed to attendees during the symposium and 151 were returned to the WAASM office. Data was entered and stored in a Microsoft Office Access (2003) database and analysed using the Statistical Package for Social Sciences (SPSS), version 19.0 and Microsoft Office Excel (2003).

Results

Health professions attending the symposium

The majority of health professionals attending the symposium were nurses (58%), followed by consultant surgeons (21%), surgical trainees (7%), registrars or registered medical officers (RMOs) (4%) and junior medical doctors or medical students (2%) (Figure 6.1). Eight per cent of attendees were classified as 'other', which included health administrative and education staff (Figure 6.1).

Figure 6.1 Breakdown of participants that attended the symposium (responders n=151)

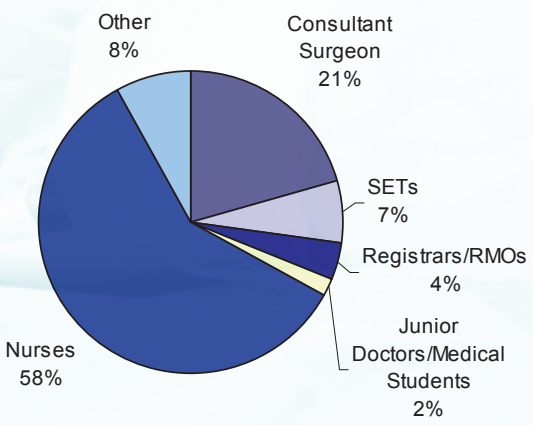
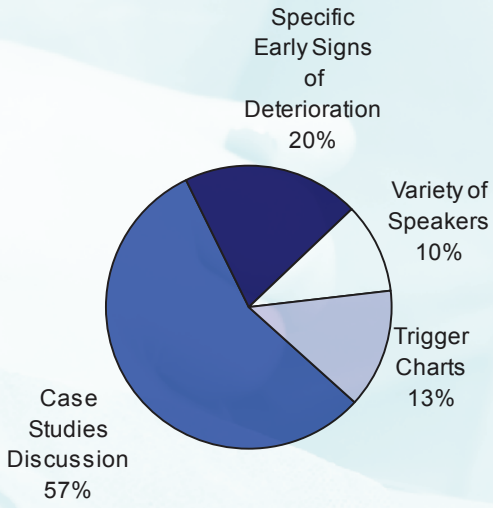


Figure 6.2 Aspects of the symposium that attendees found most useful



Most useful aspects of the symposium

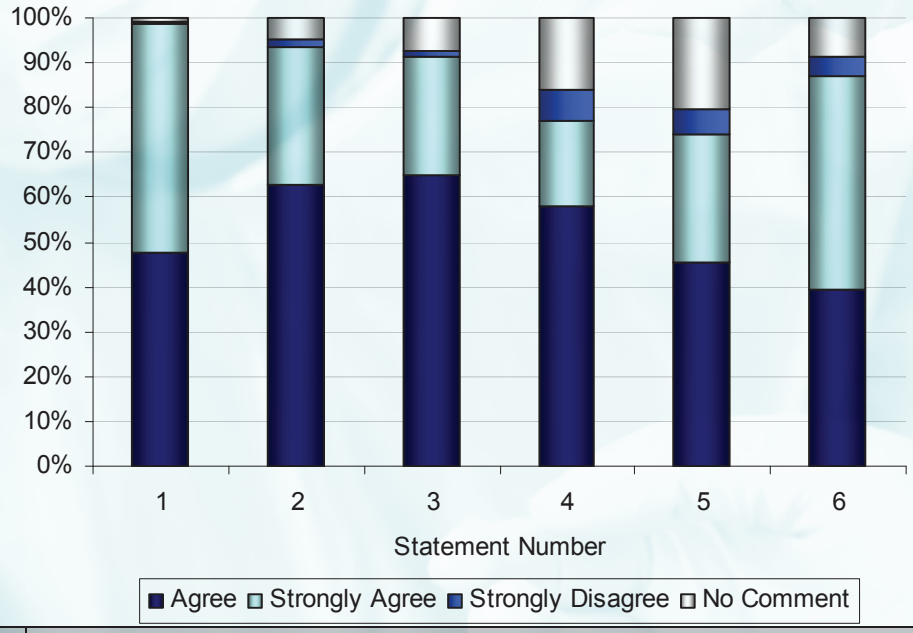
A majority of attendees (57%) found the discussions on case studies during the symposiums very useful. The information provided on the specific early signs of deterioration during the symposium was appreciated by 20% of attendees, while 13% of attendees found the presentation on trigger charts to be the most useful. Ten percent of attendees indicated that they liked the range of speakers and topics presented from different disciplines and perspectives (Figure 6.2).

Responses to feedback statements in the evaluation form

The evaluation forms contained six statements (see Figure 6.3 for statements) that participants had to score into four different categories:

- strongly agree
- agree
- strongly disagree
- no comment.

Figure 6.3 Analysis of responses to feedback statements in the evaluation form



Statement number	Evaluation statement
1	I found the symposium very informative.
2	Following this symposium I will be able to pick up signs of a deteriorating patient.
3	Following this symposium I will review my day-to-day practices.
4	Following this symposium I will change my day-to-day practices.
5	Following this symposium I will use trigger charts.
6	I would be interested in a more detailed symposium that explains the deteriorating patient.

Statement 1 – 'I found the symposium very informative.' (Figure 6.3)

- 99% of attendees overall agreed the symposium was informative (51% strongly agreed).
- Less than 1% disagreed and stated that the message in the symposium was repeated too many times.

- A few attendees expressed that they possess sufficient experience and knowledge to recognise the signs of a deteriorating patient.

Statement 2 – 'Following this symposium I will be able to pick up signs of a deteriorating patient.'

- 93% of attendees felt that they were better able to pick up the signs of a deteriorating patient after attending the symposium (31% strongly agreed).
- 2% disagreed and gave feedback that more details on the vital signs should have been discussed.

Statement 3 – 'Following this symposium I will review my day-to-day practices.'

- 90% of attendees felt that they would review their daily practices after attending the symposium (26% strongly agreed).
- 1% disagreed and the feedback provided was that they were confident that their practices already reflected the procedures discussed at the symposium.

Statement 4 – 'Following this symposium I will change my day-to-day practices.'

- 73% of attendees felt that they may change their daily practices after attending the symposium (18% strongly agreed).
- 7% disagreed but no explanatory comment was provided.
- 15% had no comment.

Statement 5 – 'Following this symposium I will use trigger charts.' (Figure 6.3)

- 70% of attendees indicated that they would use trigger charts when they become available (27% strongly agreed).
- 5% disagreed and several comments (verbatim) were provided as reasons:
  - '*Not relevant to acute care or NICU.'*
  - *'Current practice is appropriate and is 'best practice'.'*
  - *'Trigger charts prevent observations of TRENDS.'*
  - *'Trigger charts need to be designed to age appropriate & speciality appropriate areas.'*

Statement 6 – 'I would be interested in a more detailed symposium that explains the deteriorating patient.' (Figure 6.3)

- 85% of attendees indicated that they were interested in attending another event similar to the symposium (46% strongly agreed).
- 4% disagreed and several reasons were provided (verbatim) as follows:
  - *'A rural perspective would be welcome.'*
  - *'Symposium did not go into detail – only looked at causes of doctor/nurses non-escalation.'*
  - *'The symposium did not provide enough details; very repetitive.'*

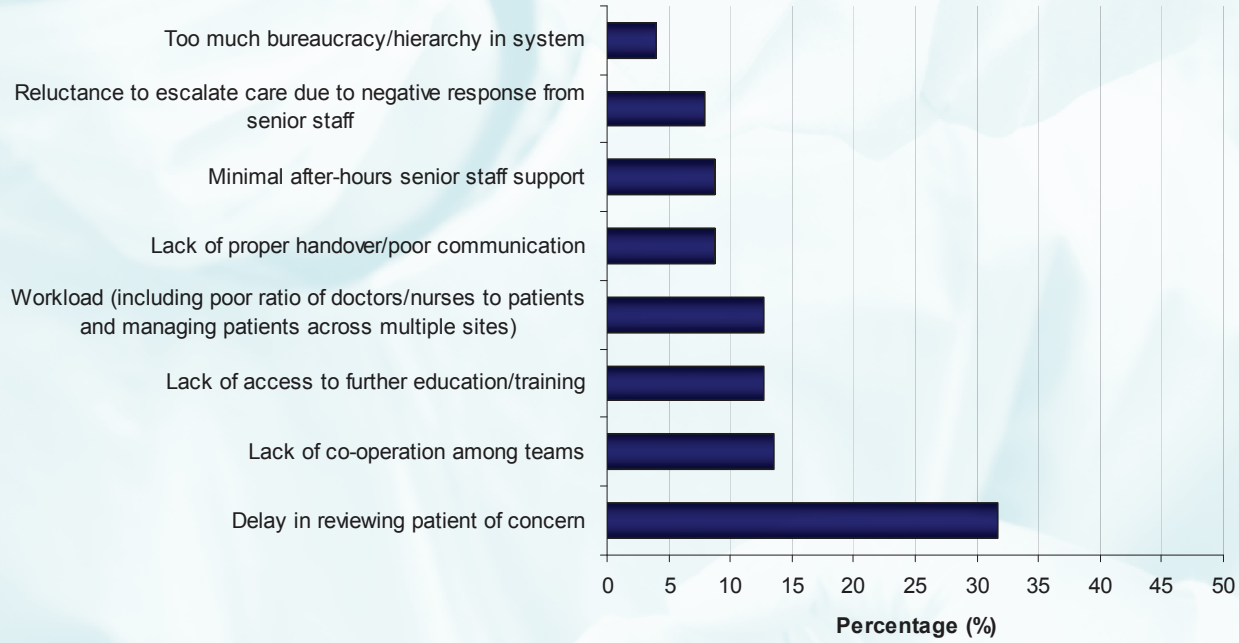
Challenges faced in health professions related to managing clinical deterioration

The challenges as grouped by theme are displayed in Figure 6.4 and described below:

- 32% of respondents felt that that there were delays in reviewing a patient of concern and that the opinions of ward staff were often ignored, hence leading to delays in patient review.
- 13% of respondents experienced difficulties in managing current workloads due to poor ratios of clinical and nursing staff to patient numbers, in addition to managing patients across multiple sites.
- 13% of respondents indicated a lack of cooperation among the team and that the lack of individual responsibility within the team was also a challenge.

- 13% of respondents indicated that they would like more educational or training opportunities and greater access to these types of programs.
- 9% of respondents felt that they needed more handover of the patient's clinical details and better communication between teams in order to do their work effectively.
- 9% of respondents indicated that they experienced difficulties in managing patients after-hours as most staff are junior or inexperienced during that period.
- 8% of respondents mentioned that they were reluctant to escalate care due to discouraging responses from the senior staff.
- 4% of respondents felt that the current system had too much bureaucracy leading to the delays in examining patients.

Figure 6.4 Challenges faced by attendees in their professions in terms of managing clinical deterioration

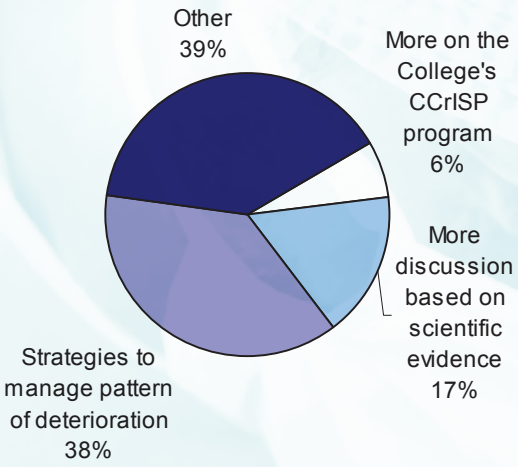


Future focus of similar symposiums

When respondents were asked what topics future symposiums should focus on:

- 38% wanted to know more about the strategies used to manage patterns of deterioration.
- 17% wanted more scientific-based evidence.
- 6% wanted to learn more about the College's CCrISP program.

Figure 6.5 Future focus of similar symposiums as suggested by attendees



Conclusions

Overall the symposium was well-received by the attendees with:

- 99% of respondents agreeing that the symposium was informative
- 93% of respondents indicating that they were better able to pick up signs of clinical deterioration after attending the symposium
- 73% indicating that they may change their daily practices and a further 90% indicating that they would review their daily practices after attending the symposium.

7. ACKNOWLEDGMENTS

The Western Australian Audit of Surgical Mortality (WAASM) would like to acknowledge the support and assistance of those individuals and institutions that have helped in the continuation and development of this project, including the:

- participating surgeons
- first-line assessors
- second-line assessors
- hospital medical records departments
- Western Australian Department of Health for funding the project
- Office of Safety and Quality at the Western Australian Department of Health for their continual commitment and support to WAASM
- Royal Australasian College of Surgeons for their infrastructure and oversight of this project
- College ANZASM Management Committee
- College WAASM Management Committee

- WAASM Staff:

  - Mr James Aitken — Clinical Director, WAASM
  - Dr Diana Azzam — WAASM Project Manager
  - Ms Adeline Neo — WAASM Project Officer
  - Dr Franca Itotoh — WAASM Project Officer

- The Royal Australasian College of Surgeons, Division of Research, Audit & Academic Surgery (RAAS) staff, particularly:

  - Professor Guy Maddern — Chair, RAAS; Chair ANZASM SC
  - A/Prof Wendy Babidge — Director, RAAS Division
  - Mr Gordon Guy — ANZASM Manager

APPENDIX A: Causes of deaths reported to WAASM

Table A.1 Causes of death in men aged <70 (n=765)

Cause of Death	n	%
Heart failure	90	12
Brain haemorrhage	76	10
Multiple organ failure	60	8
Severe brain injury	59	8
Malignancy	55	7
Septicaemia	52	7
Other	52	7
Brain stroke	43	6
Missing data	42	5
Respiratory failure	32	4
Cerebral oedema	31	4
Pneumonia	22	3
Vascular insufficiency of intestine	21	3
Haemorrhage other	16	2
Aspiration pneumonia	15	2
Aortic aneurysm	15	2
Liver failure	14	2
Cause unknown	14	2
Cardiorespiratory failure	14	2
Pulmonary embolism	13	2
Renal failure	13	2
Severe multiple injuries	9	1
Infection	4	1
Severe burns	3	<1

Table A.2 Causes of death in women <70 (n=455)

Cause of Death	n	%
Brain haemorrhage	72	16
Others	46	10
Heart failure	39	9
Septicaemia	36	8
Multiple organ failure	35	8
Malignancy	30	7
Missing data	25	5
Respiratory failure	24	5
Brain stroke	19	4
Cerebral oedema	14	3
Severe head and/or brain injury	13	3
Intestinal obstruction & other related problems	12	3
Pulmonary embolism	11	2
Vascular insuficiency of intestine	10	2
Other haemorrhage	10	2
Liver failure	9	2
Renal failure	7	2
Cause unknown	7	2
Brain death	6	1
Aspiration pneumonia	6	1
Cardiorespiratory failure	5	1
Pneumonia	5	1
Infection	5	1

Aortic aneurysm	3	1
Severe multiple injuries	2	<1
Severe burns	2	<1
Fracture related	2	<1

Table A.3 Cause of death in men aged ≥70 (n=1532)

Cause of Death	n	%
Heart failure	312	20
Septicaemia	126	8
Pneumonia	108	7
Respiratory failure	106	7
Others	94	6
Multiple organ failure	91	6
Malignancy	81	5
Missing data	76	5
Renal failure	64	4
Aortic aneurysm	62	4
Vascular insufficiency of intestine	60	4
Aspiration pneumonia	53	3
Brain haemorrhage	42	3
Brain stroke	41	3
Cardiorespiratory failure	39	3
Intestinal obstructions and perforations	39	3
Unknown cause of death	27	2
Pulmonary oedema	22	1
Pulmonary embolism	22	1
Other haemorrhage	20	1
Severe head and/or brain injury	13	1
Liver failure	9	1
Fractures	6	<1
Infection	5	<1
Severe multiple injuries	5	<1
Aneurysm (not cerebral or aortic)	4	<1
Severe burns	2	<1
Pneumonia	2	<1
Cerebral oedema	1	<1

Table A.4 Causes of death in women aged ≥70 (n=1509)

Cause of Death	n	%
Heart failure and cardiovascular-related complications	326	22
Septicaemia	134	9
Multiple organ failure	129	9
Vascular insufficiency of intestine	122	8
Respiratory failure	114	8
Brain haemorrhage	92	6
Others	76	5
Renal failure	69	5
Missing data	68	5
Pneumonia	65	4
Malignancy	56	4
Cardio respiratory failure	44	3

Aspiration pneumonia	37	2
Cause unknown	30	2
Aortic aneurysm	29	2
Pulmonary embolism	28	2
Infection	26	2
Vascular disease	20	1
Other haemorrhage	15	1
Brain stroke	8	1
Fractures	8	1
Brain other	4	<1
Hepatic failure	4	<1
Multiple injuries	3	<1
Burns	1	<1
DVT related	1	<1

APPENDIX B: WAASM Assessors' report – details of adverse events and areas of concern (2002-2010)

Table B.1 Details of adverse events and areas of concern as reported by assessors in 669 of 6001 cases reported to WAASM (2002–2010)

Delays (n=124)	No.
Delay to surgery	33
Delay in diagnosis	20
Delay in transfer to surgical unit	15
Delay in transfer to tertiary hospital	9
Delay in recognising complications	8
Delay starting DVT prophylaxis	7
Delay in transfer to surgeon by physicians	6
Delay to operation caused by missed diagnosis	4
Delay starting medical treatment	4
Delay to ERCP	3
Delay in recognising a bleeding complication	3
Delay to surgery whilst obtaining a CT scan	2
Delay to re-operation	2
Delay in starting antibiotics	2
Delay to blood transfusion	1
Delay in recognising anastomotic leak	1
Delay in investigating the patient	1
Delay in transferring patient to ITU	1
Delay to starting ventilation	1
Delay in obtaining blood products	1

Related to open surgery (n=124)	No.
Anastomotic leak after open surgery	56
Postoperative bleeding after open surgery	18
Related to open surgery	16
Injury to organ during open surgery	11
Complication of open surgery	4
Extension of ischaemia after open surgery	4
Intraoperative bleeding during open surgery	4
CVA following open surgery	2
Fistula from colon after open surgery	2
Wound dehiscence after open surgery	2
High intracranial pressure following open surgery	1
Postoperative obstruction after open surgery	1
Failed arterial reconstruction after open surgery	1
Arterial occlusion related to open surgery	1
Wound infection after open surgery	1

General complications (n=96)	No.
Aspiration pneumonia	25
Pulmonary embolus	14
Septicaemia	13
Infection of hip prosthesis	7
Wound dehiscence	4
Graft infection	4
Displacement of tracheostomy tube	4

Wound infection	3
Central nervous system	2
Cerebrovascular accident	2
Postoperative intracranial haematoma	2
General complication of treatment	1
Perioperative intracranial infection	1
Perioperative cerebral ischaemia or infarction	1
Abdominal abscess	1
Pelvic abscess	1
Postoperative pancreatitis	1
Liver failure	1
Renal failure	1
Fascitiis	1
Wound skin necrosis	1
Secondary haemorrhage	1
Air embolism after surgery	1
Tracheostomy problems	1
Blood clot dislodged	1
Dislocated hip prosthesis	1
Central venous pressure catheter insertion failed	1

Incorrect or inappropriate therapy (n=77)	**No.**
Decision to operate	21
Better to have done different operation or procedure	10
No protocol for DVT prophylaxis	3
Incorrect or inappropriate therapy	3
Wrong surgical approach used	3
Better to have had more extensive surgery	3
Operation should not have been done or was unnecessary	3
Unsatisfactory medical management	4
Postoperative care unsatisfactory	3
Premature extubation	3
Earlier operation desirable – no theatre available	2
Better not to have been treated laparoscopically	2
Operation should have been done	2
Operation would have been better delayed	3
More aggressive treatment of infection needed	2
Duration of operation too long	2
Premature discharge from ITU	1
Management error led to pressure ulcer	1
Wrong operation performed	1
Operation should have been done after initial resuscitation	1
Operating following recent cessation of anticoagulant drug	1
Over transfusion of blood	1
Tracheostomy problems	1
Failure to recognise severity of illness	1

Failure to use facilities (n=47)	**No.**
Failure to use DVT prophylaxis	26
Failure to use high dependency unit	9
Failure to use intensive care unit	6
Failure to use antibiotic prophylaxis	2
Failure to obtain a postmortem	2
Failure to use a drug for treatment or prophylaxis	2

Patient related factors (n=31)	No.
Injury caused by fall in hospital	25
Patient refused treatment	4
Patient-related factors	2

Drug-related problems (n=26)	No.
Reaction to drugs	5
Anticoagulation causing postoperative bleeding	4
Drug-related complication	3
Wrong dose of drug used	3
Under anticoagulation	3
Over anticoagulation	3
Postoperative bleeding due to coagulopathy	1
Anaphylactic shock related to drug treatment	1
Wrong drug used	1
Overdose of narcotics	1
Drug interaction	1

Problems related to diagnosis (n=23)	No.
Diagnosis missed by medical unit	7
Diagnosis missed by surgeons	6
Diagnosis missed by referring hospital	3
Diagnosis missed by radiologist	3
Diagnosis missed – unspecified	2
Diagnosis missed on endoscopy	1
Diagnostic equipment not used or not available	1

Related to fluid balance (n=21)	No.
Fluid balance unsatisfactory	10
Postoperative fluid balance unsatisfactory	4
Fluid overload	3
Postoperative fluid overload	3
Fluid and electrolyte resuscitation inadequate	1

Related to endoscopic surgery (n=18)	No.
Perforation of duodenum during endoscopic operation	4
Related to endoscopic surgery (technical)	3
Stomach complication related to endoscopic operation	3
Perforation of colon during endoscopic operation	2
Upper gastrointestinal complication related to endoscopic operation	1
Injury to duodenum during endoscopic operation	1
Operation-induced acute pancreatitis after endoscopic operation	1
Bladder complication of endoscopic operation	1
Perioperative bleeding related to endoscopic operation	1
Postoperative bleeding related to endoscopic operation	1

Assessment problems (n=16)	No.
Preoperative assessment inadequate	11
Failure to investigate or assess patient fully	3
Assessment problems	2

Communication failures (n=16)	No.
Poor documentation	7
Communication failure	4
Failure to communicate with senior staff	1
Poor communication between anaesthetist and surgeon	1
Failure in communication between x-ray department & clinicians	1
Poor communication between physician and surgeon	1
Poor communication in emergency department	1

Related to laparoscopic surgery (n=10)	No.
Anastomotic leak related to laparoscopic operation	5
Perforation of colon related to laparoscopic operation	2
Fistula from small bowel after laparoscopic operation	1
Extension of ischaemia after laparoscopic operation	1
Arterial bleeding after laparoscopic operation	1

Staff problems (n=8)	No.
Surgeon too junior	4
Surgeon operating without specialty	1
Anaesthetist should have been involved	1
Fatigue of surgeon operating	1
Failure of junior surgeon to seek advice	1

Related to radiological surgery (n=8)	No.
Related to radiological surgery	2
Arterial bleeding after radiological operation	2
Bile leakage from liver after radiological operation	1
Gall bladder complication of 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
Problems during transfer	1

Related to anaesthesia (n=5)	No.
Pneumothorax complicating general anaesthetic	3
Aspiration pneumonia after anaesthetic	1
Technique not ideal during general anaesthetic	1
Intubation failed for general anaesthetic	1

Problems with blood or blood products (n=4)	No.
Complications with blood or blood products	2
No blood available	2

Resuscitation problems (n=3)	No.
Resuscitation inadequate	3

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

Monitoring problems (n=1)	No.
Inadequate metabolic monitoring	1

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