



Western Australian Audit of Surgical Mortality

Royal Australasian
College of Surgeons

Annual Report 2012

Contact

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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 23 August 2011).



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CHAIRMAN'S REPORT

It is now ten years since WAASM commenced. The number of deaths under the care of a surgeon has progressively fallen and when corrected for the increasing WA population this fall is almost 26% (Figure 3.1). This Annual Report reviews how WAASM has influenced practice over this time.

It is also ten years since UK cardiac surgeons, in the aftermath of the inquiry into paediatric cardiac surgery in Bristol, started to collect and disseminate detailed, individual risk adjusted outcome data. Their last report showed a 50% decrease in mortality and their outcomes are 25% better than the European average¹. The average bed stay in the UK was 10% less than Europe. This reduced length of stay alone resulted in direct savings that exceeded the cost of the audit.

There are now numerous studies showing that publically available audit improves performance. There will be increasing and irresistible pressure on Australian surgeons to measure and publish transparent data that can be compared against agreed standards. Patients have a right to know who is providing safe and effective care. Unless surgeons take the lead others will publish performance data for them.

In July 2012 the editor of the *British Medical Journal* lamented the lack of clinical leadership in the push for public access to performance data². She was critical of the UK Royal Colleges and challenged specialist societies and associations to fill the void. In Australia, cardiac surgeons in particular have shown leadership and are at the forefront of risk adjusted audit. Open publication of performance data has not precipitated professional armageddon, but it has resulted in a measureable improvement in performance.

Every year WAASM has implored all WA surgeons to take part. Participation has always been the first question asked when the WAASM Annual Report is published. Now all States and Territories have joined the Australian and New Zealand Audit of Surgical Mortality (ANZASM) and the Royal Australasian College of Surgeons (RACS) has made participation a mandatory requirement for Continuing Professional Development (CPD). Those who do not contribute have been specifically warned that they are jeopardising their registration with the Medical Board of Australia. Following the successful introduction of surgical mortality audits across Australia, it is not only public hospitals that are participating but more private hospitals are coming on board. There is however, further work to be done to achieve full participation across Australia.

ANZASM will only be as good as the data it collects. Fellows should anticipate that the next step will be to improve the data quality. In anticipation of this the current ANZASM proforma, which is based on WAASM's original dataset, is being revised. As data collection becomes web based, all fields will need to be completed though surgeons will be prompted by pop-up windows and reminders. Surgeons will benefit by the development of an ability to automate participation in the audit of surgical mortality for verification of CPD. Patients, health funders and the profession benefit from accurate data about adverse events and mortality.

The ANZASM is a repository of much data. ANZASM will be making a major contribution to the plenary session on safety and quality at 2013 Annual Scientific Congress. Some publications are already in press and others are in preparation. WA surgical trainees looking to gain experience in research and participate in quality improvement (which will also enhance their CV) should be encouraged to approach ANZASM to access this valuable research data source.

RJ Aitken
Chairman
Western Australian Audit of Surgical Mortality



SHORTENED FORMS

AE	Adverse event
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anaesthesiologists
CPD	Continuing Professional Development
DVT	deep vein thrombosis
HDU	high dependency unit
ICU	intensive care unit
RACS	Royal Australasian College of Surgeons
RTT	return to theatre
WA	Western Australia
WAASM	Western Australian Audit of Surgical Mortality



EXECUTIVE SUMMARY

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 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 feedback from the assessors to the treating surgeon.

Notification of deaths

In 2011, 577 deaths were reported to WAASM from 44 hospitals. The number of deaths reported to WAASM has progressively fallen from 740 in 2006 to 577 in 2011.

Consultant participation

The WAASM database indicates that there are 436 surgeons in Western Australia. Of these, 432 (99%) are participating in the audit, with only 4 (<1%) surgeons actively refusing to participate. Of the participating surgeons, 382 (88%) have agreed to be first-line assessors and 385 (89%) have agreed to be second-line assessors.

Analysis of completed cases

Data analysed for this report covers cases that were reported to WAASM from 1 January 2002 to 31 December 2011 and had completed the audit process by 31 March 2012. Areas of concern or adverse events ascribed to the case by the first- or second-line assessors were analysed. Where cases were associated with more than one event, the most serious event was included in the analysis.

In 2011, 243 (42%) completed WAASM proformas were returned and are awaiting first- or second-line assessment. Additionally, a further 300 cases completed the entire audit process when censored on 31 March 2012. Overall, this accounts for 94% of cases reported in 2011.

Second-line assessment

The proportion of cases referred for second-line assessment (case note review) in 2011 was 57 (20%) out of 282 completed cases (excluding terminal care cases).

Comparison of surgeons’ and assessors’ views of areas of concern and adverse events

In 2011, assessors reported 56% more areas of concern or adverse events (3.7%) than surgeons (2.5%).



Patient sample demographics

Of the 6575 cases reported between 2002 and 2011, the median age was 78 years, with an interquartile range of 66–85. A total of 54% of cases were male. Fifty-six per cent had an American Society of Anaesthesiologists (ASA) grade of 4 or higher. More than 90% 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, multiple organ failure, septicaemia, malignancy and acute myocardial infarction. The main causes of death in patients older than 70 years were coronary-related issues, multiple organ failure, septicaemia, pneumonia and respiratory failure.

Areas for consideration, of concern and adverse events

The proportion of cases associated with areas of concern or adverse events has decreased since 2002. Overall, assessors thought that an adverse event caused the death of a patient in 4% of the 4592 completed 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 operated on at private hospitals who underwent an operation (87%) was significantly greater than the proportion in public hospitals (66%). Sixteen per cent of all operative cases were associated with areas of concern or adverse events.

Operative and non-operative deaths

In 27% of the 4592 audited deaths, no operation was performed. In 6% of overall cases the operative procedure was abandoned. Seven per cent of audited patients underwent three or more operations. In 14% of cases from 2004 to 2011 surgeons reported an unplanned return to theatre.

Grade of surgeon - teaching hospitals

Consultant surgeons operated or directly assisted in theatre in 50% of overall cases. There appeared 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 was also observed over the same period of time.



RECOMMENDATIONS

Hospital participation

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

Surgeon participation

Develop a system by which new Fellows are automatically sent WAASM participation forms to encourage complete participation in the audit.

Ensure that a process is put in place to encourage proformas to be returned promptly.

Audit process

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

Reporting

Investigate the impact of 10 years of WAASM initiatives.

Clinical management

Continue to investigate falling surgical mortality rates and to identify trends in which further perioperative improvements can be made.

Encourage full completion of proforma to reduce unnecessary second line assessments.



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 (WA).
- This annual report covers the period 1 January 2002 to 31 December 2011, as audited on 31 March 2012.
- WAASM's main role is to feedback information to 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 WA Department of Health and its methodology is based on the Scottish Audit of Surgical Mortality.³

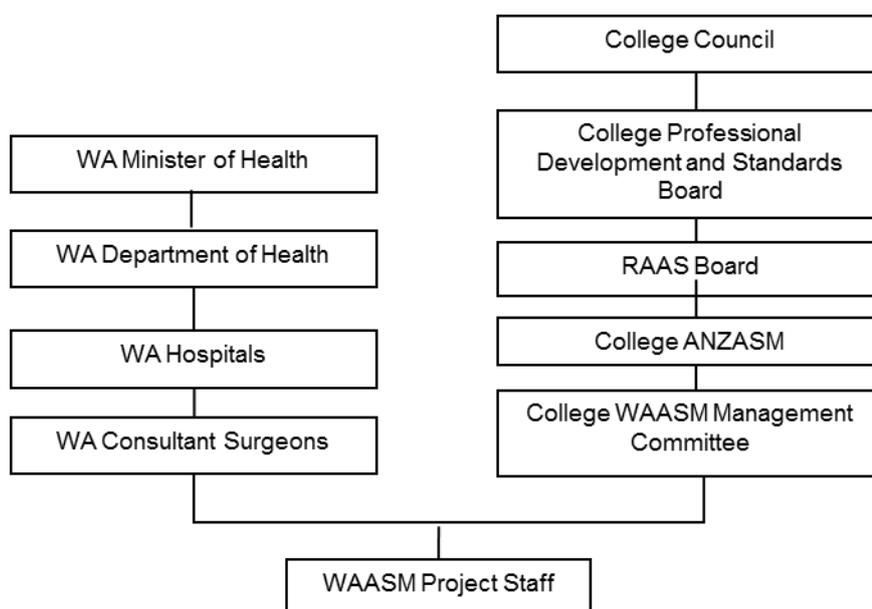
The timeline for the project was as follows:

- 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. In the same year, the College formed the Australian and New Zealand Audit of Surgical Mortality (ANZASM), with the purpose of establishing similar mortality audits to other states and territories. The College has now established mortality audits across all Australian states and territories.

1.2 Project governance

The project governance structure is illustrated in Figure 1.1. WAASM has protection under federal legislation. ANZASM (including WAASM) has protection under the Commonwealth Qualified Privilege Scheme, under Part VC of the *Health Insurance Act 1973* (gazetted 23 August 2011).

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; RAAS = Research, Audit and Academic Surgery.



2. THE AUDIT PROCESS

2.1 Methodology

Detailed methodology of the WAASM audit process is contained in the WAASM annual reports⁴⁻¹² which are available on the College website at <<http://www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm/waasm/>>.

In brief, WAASM is notified of all in-hospital deaths through either The Open Patient Administration System (TOPAS), a Web-based Patient Administration System (webPAS) or directly via medical records departments. All cases in which a surgeon was involved in the care of a 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 on 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 WA hospitals while the patient is under the care of a surgeon; however, terminal care cases are excluded from the full audit process. The 2012 Annual Report covers deaths reported to WAASM from 1 January 2002 to 31 December 2011, censored on 31 March 2012. 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 have been completed after the censor dates of the previous annual reports.

Data is entered and stored in a Microsoft Office Access (2010) database and analysed using the Statistical Package for Social Sciences version 19.0 and Microsoft Office Excel (2010). 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 2011 WAASM Annual Report¹². An important measure of the success of WAASM 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 AND ASSESSMENT

KEY POINTS

- Participation in WAASM is now a mandatory College requirement for Continuing Professional Development accreditation.
- There has been a progressive decrease in the number of deaths reported from 2002 to 2011.

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 2011. Percentage participation is calculated on the completion and return of the proformas by 31 March 2012. The audit process is completed once the proforma has been assessed by the first- and, if required, the second-line assessor.

Table 3.1 Deaths reported to WAASM between 01 January 2002 and 31 December 2011

Year	Number of cases (%)										Total
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Total deaths reported	672	639	692	713	740	667	682	601	592	577	6575
Audit process complete	416 (62)	392 (61)	486 (70)	552 (77)	621 (84)	557 (84)	585 (86)	466 (78)	397 (67)	300 (52)	4772 (73)
Proforma complete, awaiting assessment^a	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	3 (<1)	1 (<1)	12 (2)	44 (7)	243 (42)	304 (5)
Proforma not returned^b	205 (31)	191 (30)	143 (21)	115 (16)	58 (8)	69 (10)	52 (8)	70 (12)	97 (16)	1 (1)	1001 (15)
Terminal care cases (excluded)	5 (1)	9 (1)	16 (2)	28 (4)	24 (3)	23 (3)	16 (2)	16 (3)	25 (4)	18 (3)	180 (3)
Closed (no information available)	4 (1)	7 (1)	3 (0)	6 (1)	11 (1)	5 (1)	12 (2)	21 (3)	11 (2)	1 (<1)	81 (1)
Cases associated with non-participation^c	47 (7)	49 (8)	60 (9)	40 (6)	49 (7)	33 (5)	32 (5)	32 (5)	43 (7)	32 (6)	417 (6)

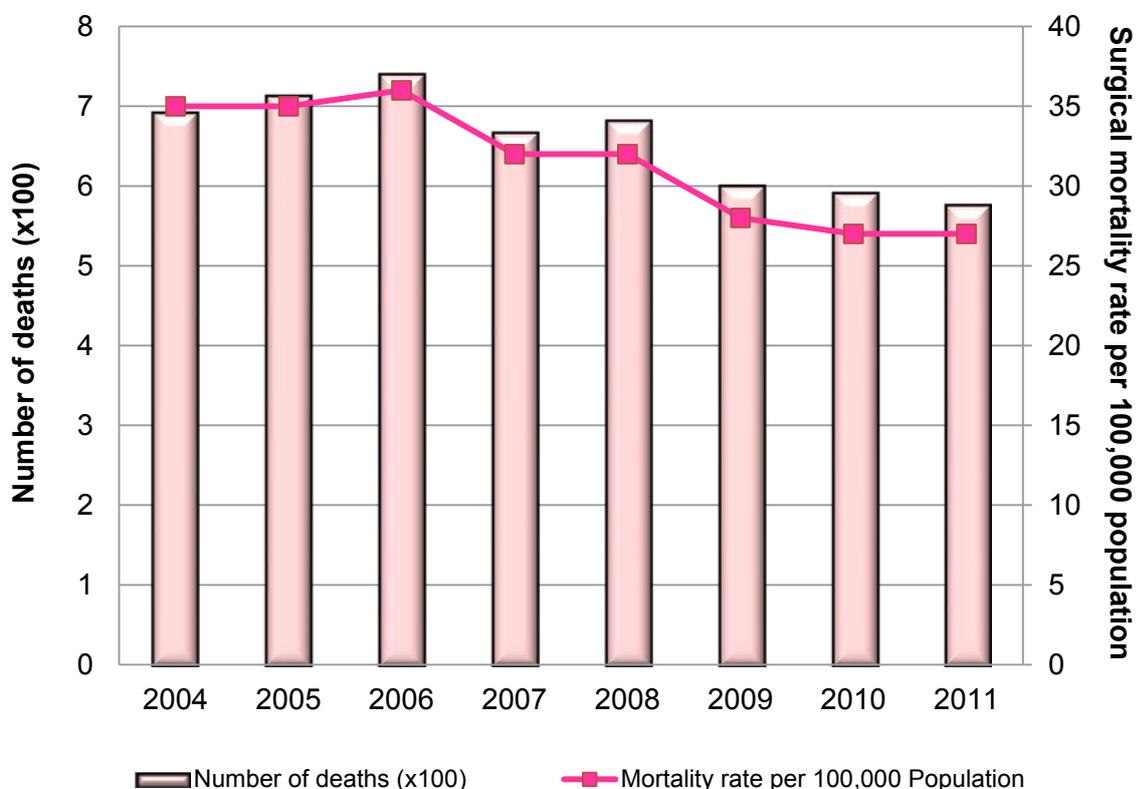
a Case awaiting first- or second-line assessment.

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 compared with surgical mortality rates per 100,000 population



Note: Total number of cases n=5264.

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 ^{#*}
2004	692	35
2005	713	35
2006	740	36
2007	667	32
2008	682	32
2009	601	28
2010	592	27
2011	577	26

Only surgically related deaths that meet WAASM selection criteria were used in this analysis.

* Population data compiled from the Australian Bureau of Statistics¹¹³.

Comment:

The process of surgical death notification to WAASM occurs through WA hospitals and is entirely independent of the surgeon and their participation in the audit. WAASM has observed a steady decrease in the number of deaths of patients while under the care of a surgeon. The number of deaths per 100,000 population has decreased from 35 in 2004 to 26 in 2011; this is a decrease of 26%.



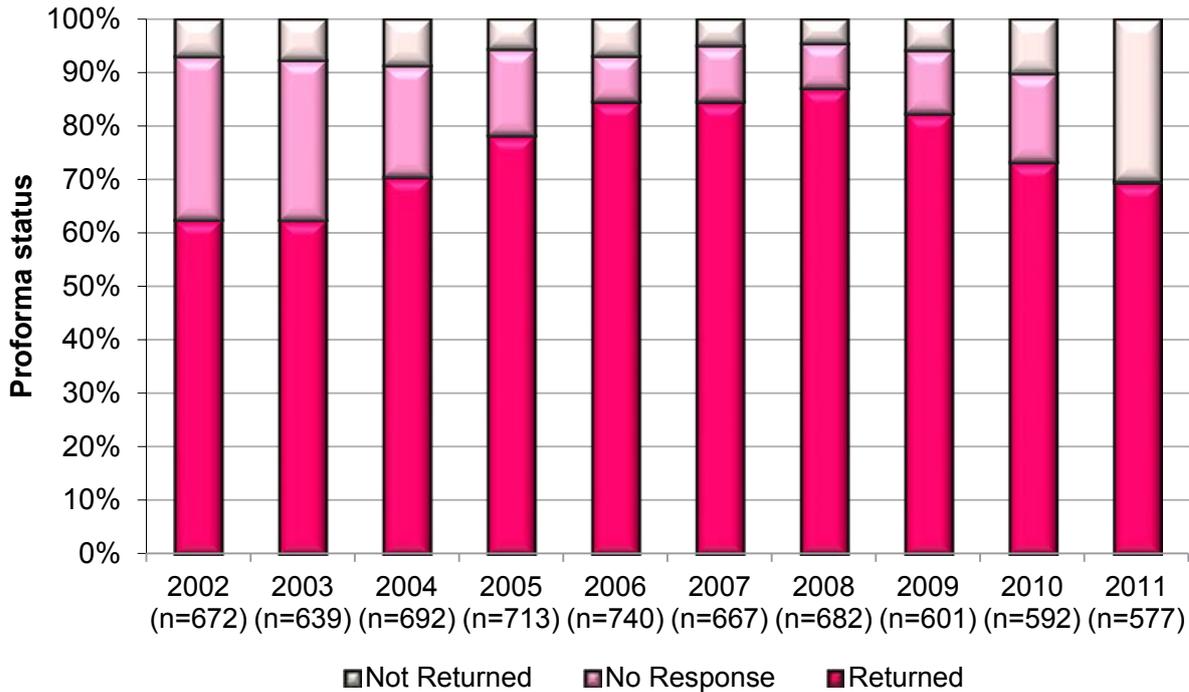
3.2 Participation in WAASM

KEY POINTS

- The percentage of proformas returned has decreased in recent years.
- In 2002 to 2011, overall 73% of cases completed the entire audit process.

Participation in WAASM from 2002 to 2011 is depicted in Figures 3.2, 3.3 and Table 3.3.

Figure 3.2 Proforma completion rates



Note: Proformas not returned include cases in progress (not yet returned) and cases associated with non-participants. Total number of cases n = 6575.

Figure 3.3 Proforma status by specialty

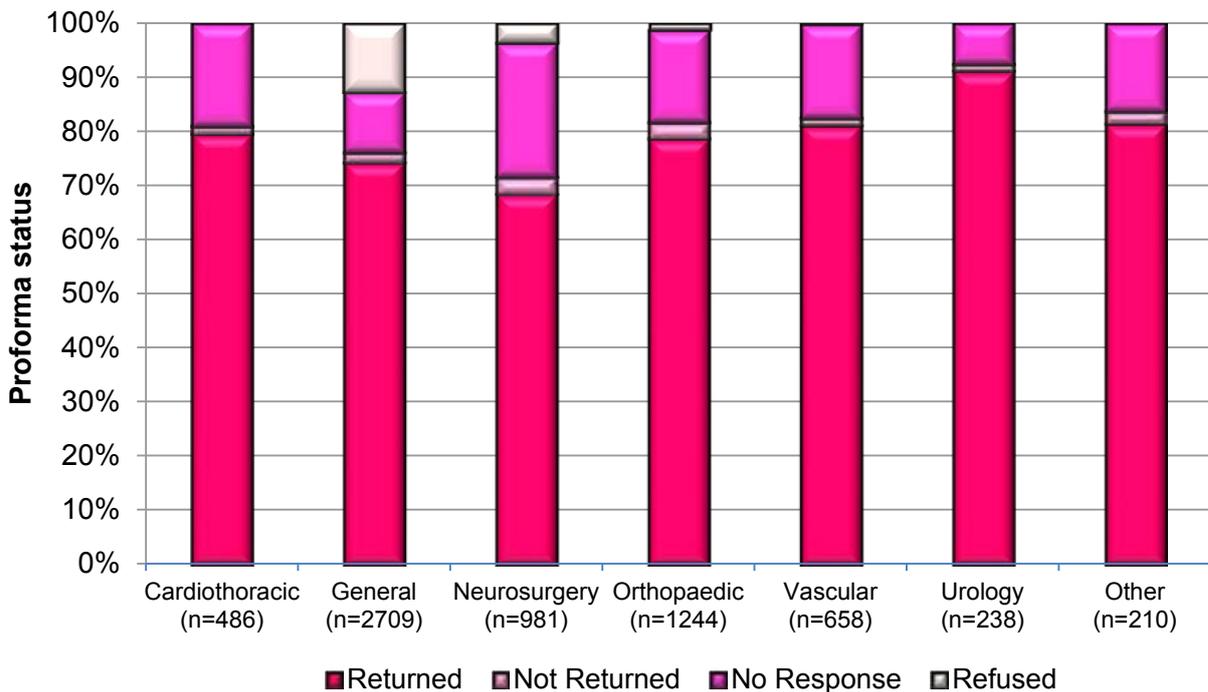




Table 3.3 Surgeon participation

Number of cases (%)											
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Reported deaths	672	639	692	713	740	667	682	601	592	577	6575
Number of surgeons associated with reported deaths	146	139	146	141	147	172	182	153	151	162	334
Proforma returned ^a	420 (63)	399 (62)	488 (71)	558 (78)	626 (85)	564 (85)	594 (87)	495 (82)	434 (73)	401 (69)	4979 (76)
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)	72 (48)	72 (44)	255 (76)
Total deaths related to surgeons associated with three or more deaths	587 (87)	554 (87)	593 (86)	628 (88)	655 (89)	549 (82)	545 (80)	492 (82)	480 (81)	463 (80)	4695 (71)
Number of cases in progress	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	3 (<1)	0 (0)	9 (1)	34 (6)	190 (33)	237 (4)
Number of cases in which forms were not returned ^b	192 (29)	180 (28)	125 (18)	107 (15)	58 (8)	61 (9)	46 (7)	72 (12)	82 (14)	1 (<1)	924 (14)
Number of cases associated with non-participants ^c	46 (7)	49 (8)	60 (9)	40 (6)	48 (6)	33 (5)	32 (5)	30 (5)	41 (7)	32 (6)	411 (6)

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

Comment:

The return of proformas by consultants has increased from 63% in 2002 to 73% in 2010. Overall proforma returns average 76% (Figure 3.2; Table 3.3).

The decrease in proforma completion in 2011 may have been impacted by the WAASM office relocation. WAASM moved into its new premises in February 2011 – the normal office processes and flow of the audit took time to resume. There were delays between December 2010 and February 2011 in sending out reminders to surgeons and this may have impacted on proforma returns in that reporting period.

3.3 Hospital participation

KEY POINTS
<ul style="list-style-type: none"> • All hospitals in WA (public and private) participate in the audit. • 81% of audited deaths occurred in public hospitals. • 16% of audited deaths occurred in private hospitals. • 20% of cases overall were transferred from one hospital to another.

All hospitals in which surgery is performed in WA take part in the audit process. Figure 3.4 indicates the number of reported deaths of patients admitted for surgery in 38 hospitals and the proforma status (returned versus not returned) for each hospital.



Figure 3.4 Reported deaths of patients admitted for surgery in Western Australian hospitals

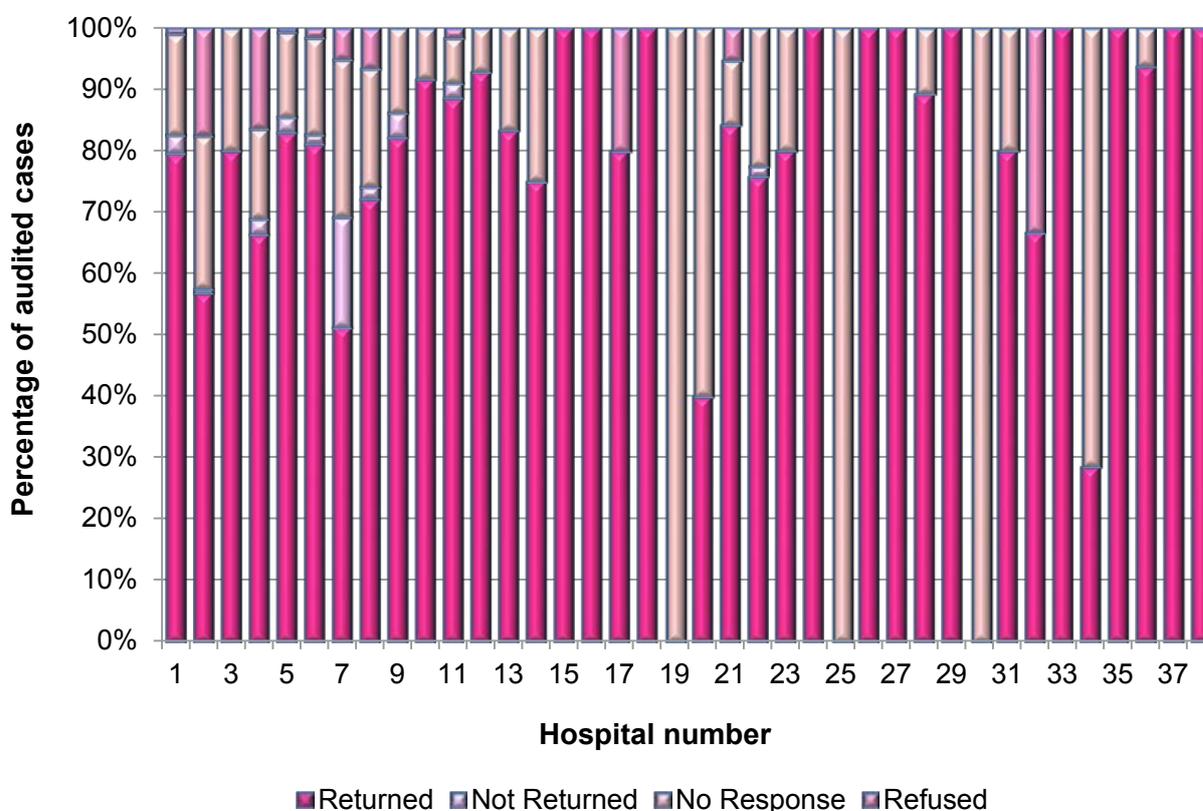


Table 3.4 Cases where the patient was transferred from one hospital to another hospital

Number of transfer cases (%)											
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Completed cases	416	392	486	551	621	557	585	466	397	300	4771
Patients transferred^a	90 (22)	102 (26)	88 (18)	93 (17)	124 (20)	104 (19)	125 (21)	92 (20)	83 (21)	58 (19)	959 (20)

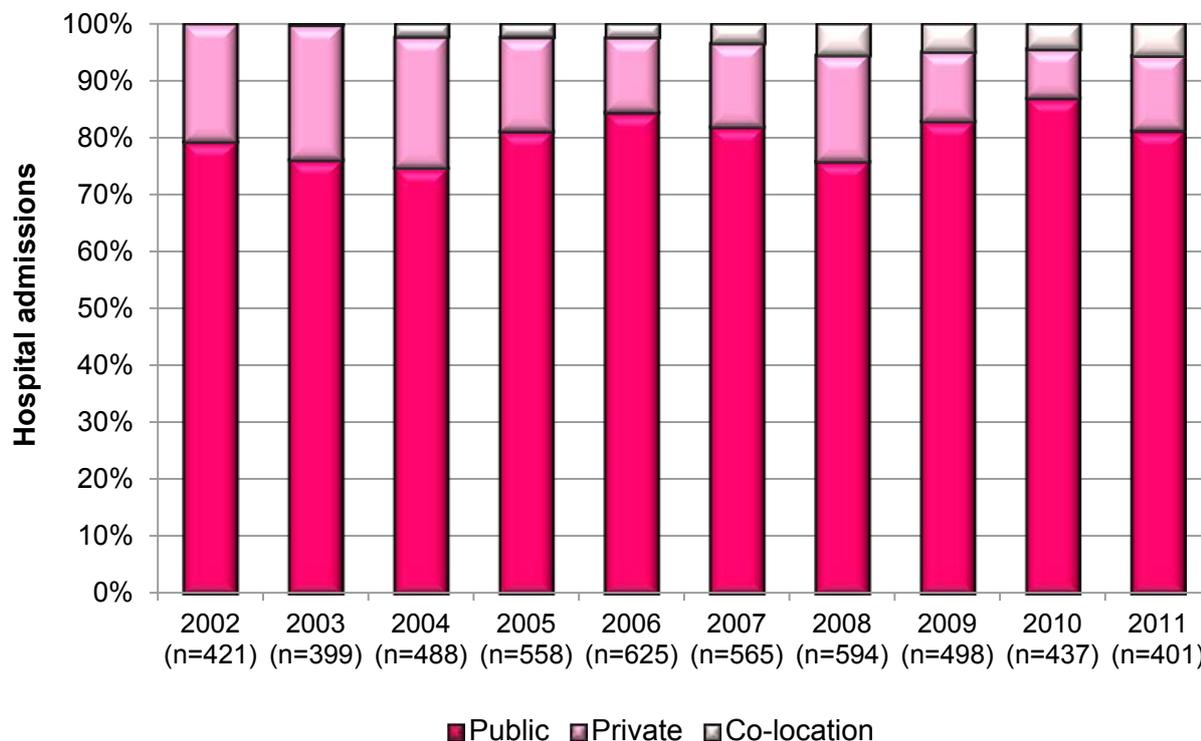
^a This data was calculated based on completed cases (including terminal care cases). Neurosurgical cases (where the question was not on the neurosurgical proforma) have been excluded (170 cases).

Comment:

The cases that involved a transfer between hospitals, typically between a regional and metropolitan facility, remained stable throughout the total audit period (2002–2011). Overall, in 20% of cases a patient was transferred between hospitals (Table 3.4).



Figure 3.5 Patients admitted to public or private hospitals



Note: Co-location refers to a case in which a patient has been in both a public and private hospital. Total number of cases n= 4986.

Comment

Overall, 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

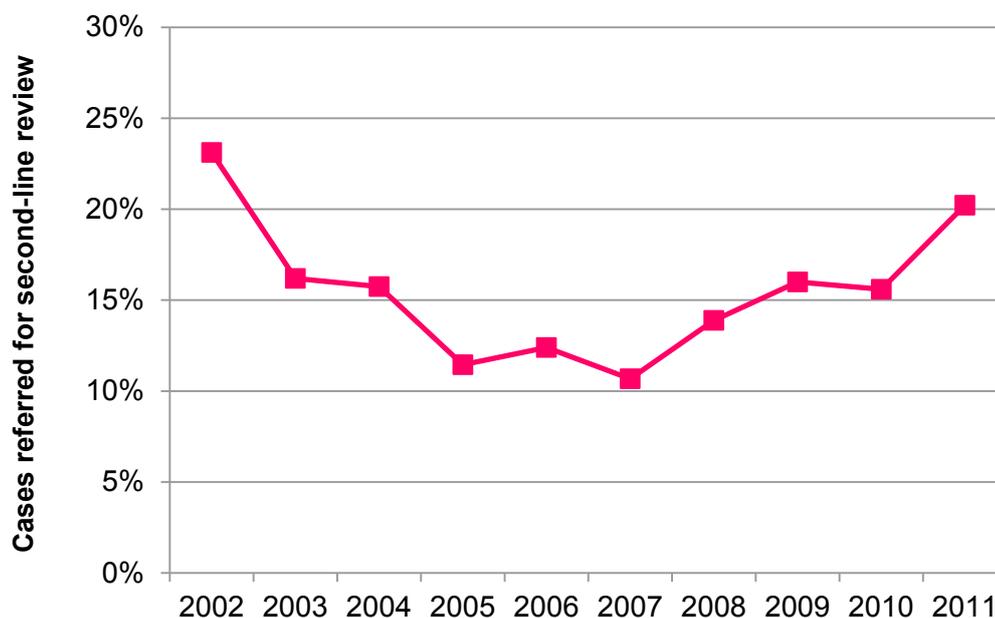
KEY POINTS

- Requests for second-line assessments have increased in the last five years.

Table 3.5 Cases referred for second-line assessment

Year of death	Number of cases (%)										Total
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Completed cases^a	411	383	470	524	597	534	569	450	372	282	4592
Cases referred for second-line assessment	95 (23)	62 (16)	74 (16)	60 (11)	74 (12)	57 (11)	79 (14)	72 (16)	58 (15)	57 (20)	688 (15)
Proforma returned, assessment in progress	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	3 (1)	1 (<1)	9 (2)	28 (8)	98 (35)	140 (3)

^a Terminal care cases were excluded.

**Figure 3.6 Proportion of cases referred for second-line assessment**

Note: Total number of cases n=688.

Comment:

The proportion of cases referred for second-line review has increased from 11% to 20% in the last five years (Table 3.5, Figure 3.6). Second-line reviews may not be necessary if the consultant completes the WAASM proforma in full with all relevant information, letters or documentation. As first-line assessments are purely based on the information in the WAASM proforma, it is important that proformas are completed fully in order to reduce unnecessary referral to second-line assessors.

4. ANALYSIS OF AUDIT DATA**4.1 Overview and patient sample demographics****KEY POINTS**

- A total of 4772 cases had fully completed the audit (2002–2011) as of 31 March 2012.
- 54% of all cases were male; the median age was 78 years (76 and 80 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.

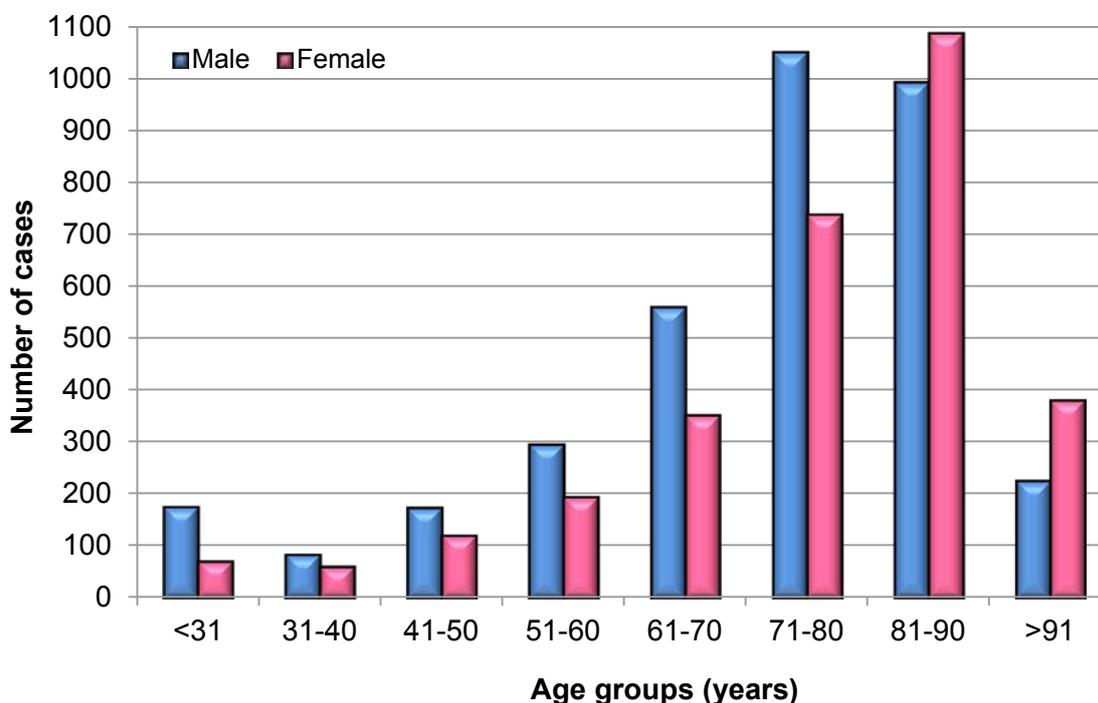
Table 4.1 Median age and gender, 2002 - 2011

	Number of cases	Median age (years)	Interquartile range (years)
All patients	6573	78	66 - 85
Male	3563	76	64 - 83
Female	3010	80	69 - 87

Data missing for 2 cases



Figure 4.1 Age distribution by gender, 2002 - 2011



Note: Total number of cases n= 6573. Data missing for 2 (<1%) cases.

Figure 4.1 shows that the gender trend changes as age increases. Males predominate in the 41–80 age 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:

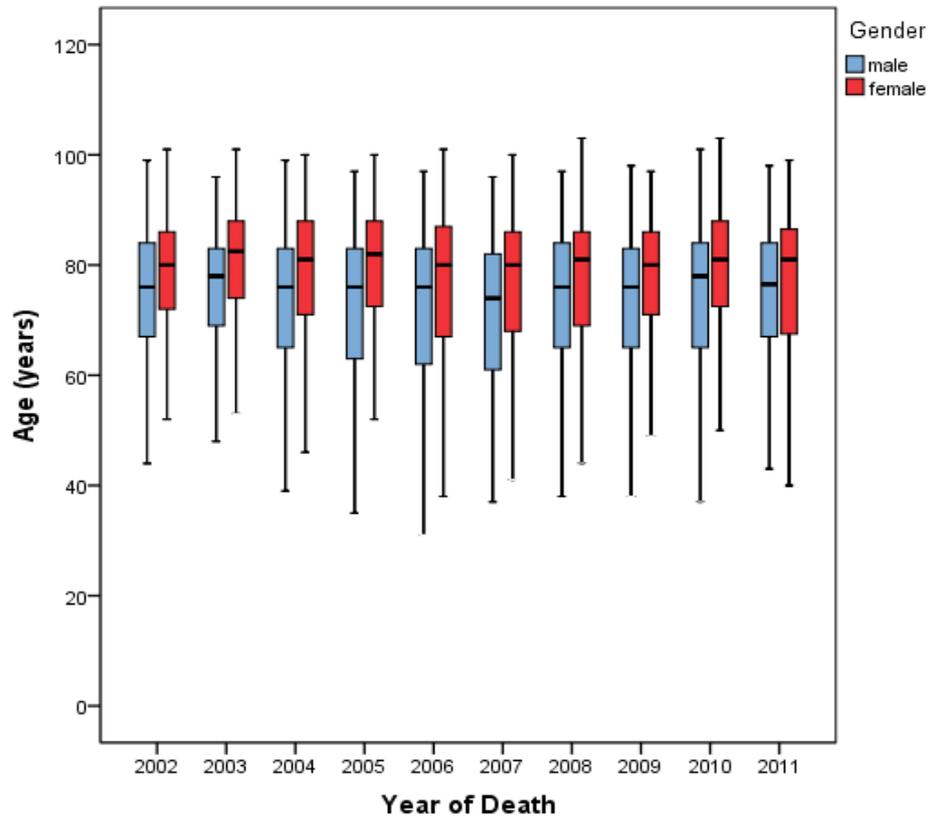
- the central box represents the values from the lower to upper quartile (25–75 percentiles)
- the middle line represents the median value
- the vertical line extends from the minimum value to the maximum value, excluding outliers and extreme values (i.e. values larger than the upper quartile and plus 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 in the other specialities.

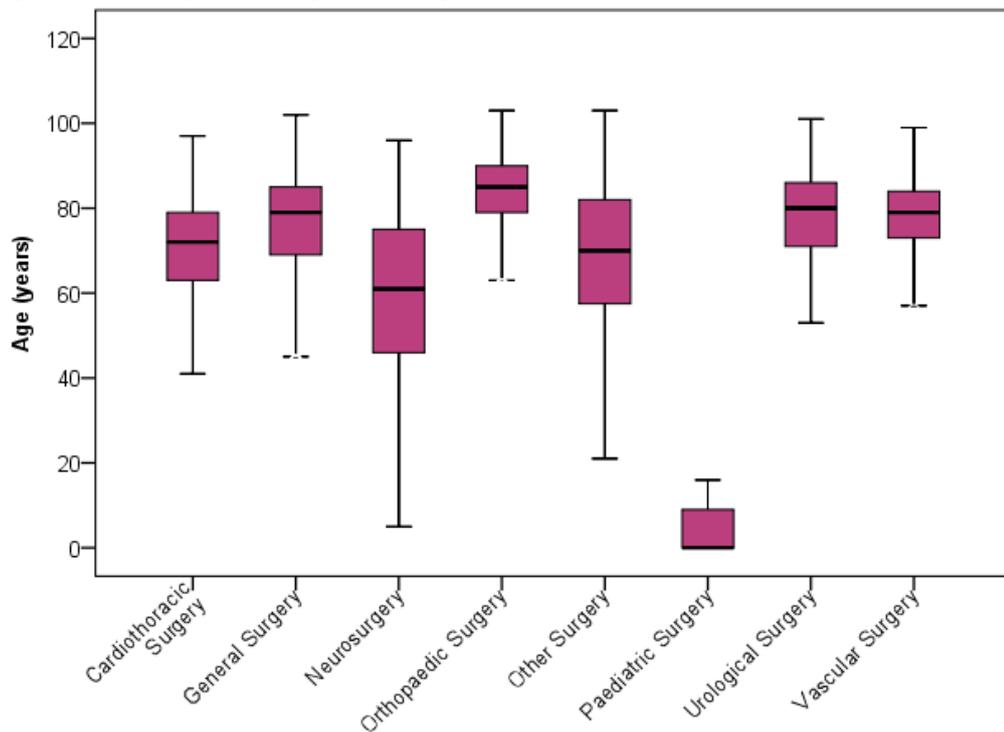


Figure 4.2 Age distribution of audited patients



Note: Total number of cases n= 4988. Outliers and extreme values are excluded.

Figure 4.3 Age of audited patients by speciality



Note: Total number of cases n= 4767. 'Other surgery' includes obstetrics & gynaecology, ophthalmology & otolaryngology and plastic surgery.



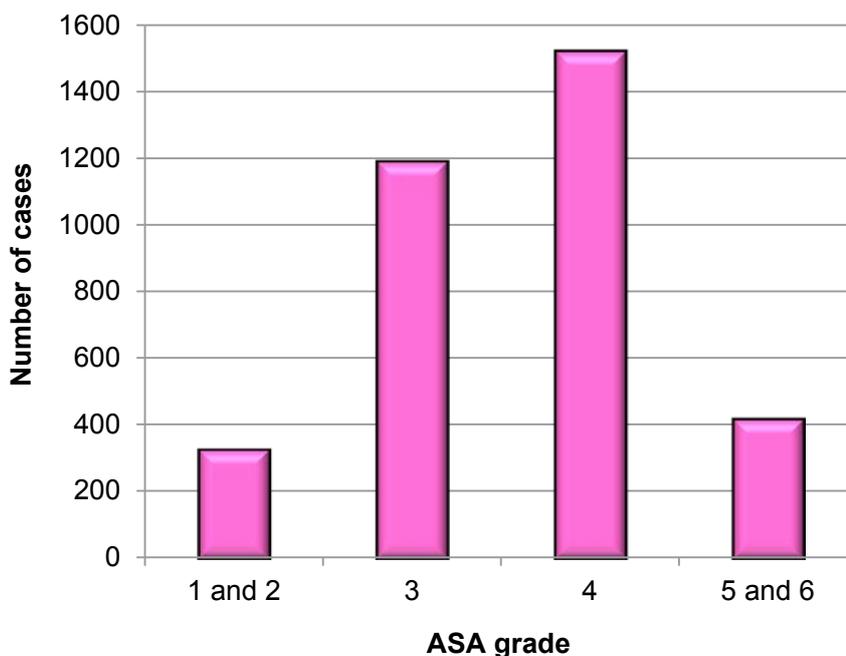
4.1.2 American Society of Anaesthesiologists (ASA) grades

The American Society of Anaesthesiologists grades are an internationally recognised classification of preoperative physical status (see Table 4.2 and Figure 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



Note: Total number of cases n= 3072.

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 3112 forms (47%) returned to WAASM over the entire audit period (2002–2011). Surgeons need to address this. It will become a critical issue if 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 multiple organ failure. In those older than 70 years the main causes of death were coronary-related and multiple organ failure. Details on cause of death for all patients can be found in Appendix A.

Table 4.3 Most common causes of death in cases of surgical mortality

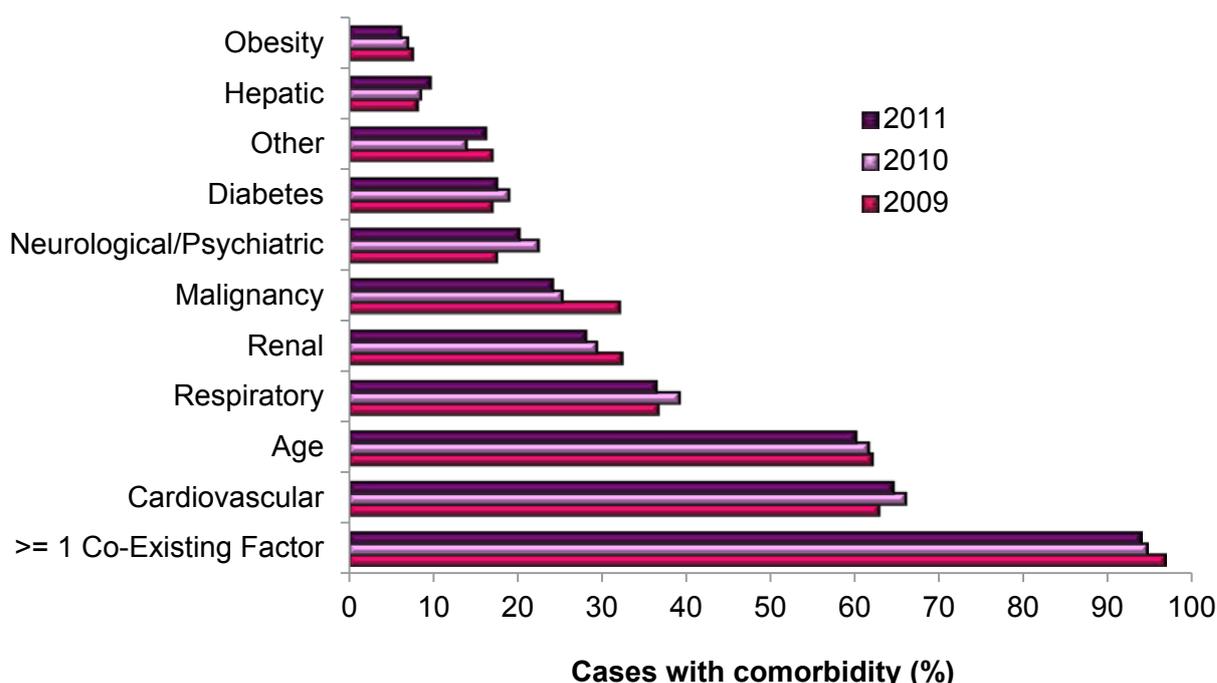
CAUSES OF DEATH		
Cases <70 years (n=1980)	n	(%)
Brain haemorrhage	158	8
Multiple organ failure	126	6
Septicaemia	118	6
Malignancy	92	5
Acute myocardial infarction	86	4
Respiratory failure	59	3
Cases ≥70 years (n=4594)	n	(%)
Coronary issues	623	14
Multiple organ failure	353	8
Septicaemia	307	7
Pneumonia	285	6
Respiratory failure	201	4
Vascular insufficiency of the intestine	145	3

Note: Total number of cases (n) = 6574. Data missing for 1 case.

4.1.4 Comorbidity

Surgeons are asked to indicate if there are any significant comorbidities associated with each case (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



Note: 'Other' significant comorbidities (as specified by the consultant surgeon) include anticoagulation states, anaemia, alcohol abuse, immunosuppression, osteoporosis and other disease states. 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 increases based upon the pre-existing patient condition.

4.1.5 High dependency and intensive care units

Table 4.4 shows the use (actual and assessor’s perception) of a high dependency unit (HDU) or intensive care unit (ICU).

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

Number of cases (%)											
Year death	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Number of cases	395	377	415	440	476	441	482	371	317	228	3942
Use of ICU	142 (36)	149 (40)	154 (37)	158 (36)	187 (39)	150 (34)	165 (34)	135 (36)	103 (32)	68 (30)	1411 (36)
Use of HDU	64 (16)	68 (18)	72 (17)	66 (15)	66 (14)	83 (19)	79 (16)	62 (17)	57 (18)	38 (17)	655 (17)
Assessors’ opinions on whether ICU or HDU should have been used											
ICU should have been used	9 (2)	1 (<1)	14 (3)	5 (1)	9 (2)	8 (2)	4 (1)	5 (1)	10 (3)	8 (4)	73 (2)
HDU should have been used	66 (17)	33 (9)	32 (8)	27 (6)	22 (5)	29 (7)	39 (8)	22 (6)	17 (5)	9 (4)	296 (8)

Note: Number of cases is based on completed cases and excludes neurological cases.

Comment:

Approximately 36% of surgical deaths reported to WAASM used ICU facilities, while 17% of cases reported use of an HDU.

This data indicates that there are still patients who would potentially have benefited from ICU/HDU support but who were not admitted to such a unit. This data has been consistent over many years.

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 2011. Data presented for 2011 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' and assessors' views on performance**

YEAR	SURGEON	ASSESSOR				Total
		Consideration	Concern	Adverse event	No event	
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	37	25	19	426	507
Total		57	47	40	453	597
2007	Consideration	8	9	6	20	43
	Concern	4	9	2	5	20
	Adverse event	1	1	10	2	14
	No event	37	16	30	374	457
Total		50	35	48	401	534
2008	Consideration	20	12	8	13	53
	Concern	1	9	4	3	17
	Adverse event	2	5	8	2	17
	No event	55	21	33	373	482
Total		78	47	53	391	569
2009	Consideration	7	5	3	16	31
	Concern	4	8	3	5	20
	Adverse event	1	4	7	0	12
	No event	35	14	12	326	387
Total		47	31	25	347	450
2010	Consideration	10	6	3	11	30
	Concern	2	3	1	2	8
	Adverse event	0	3	3	4	10
	No event	22	10	15	277	324
Total		34	22	22	294	372
2011	Consideration	5	2	0	5	12
	Concern	2	2	0	1	5
	Adverse event	1	0	5	1	7
	No event	17	2	6	233	258
Total		25	6	11	240	282

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 and assessors

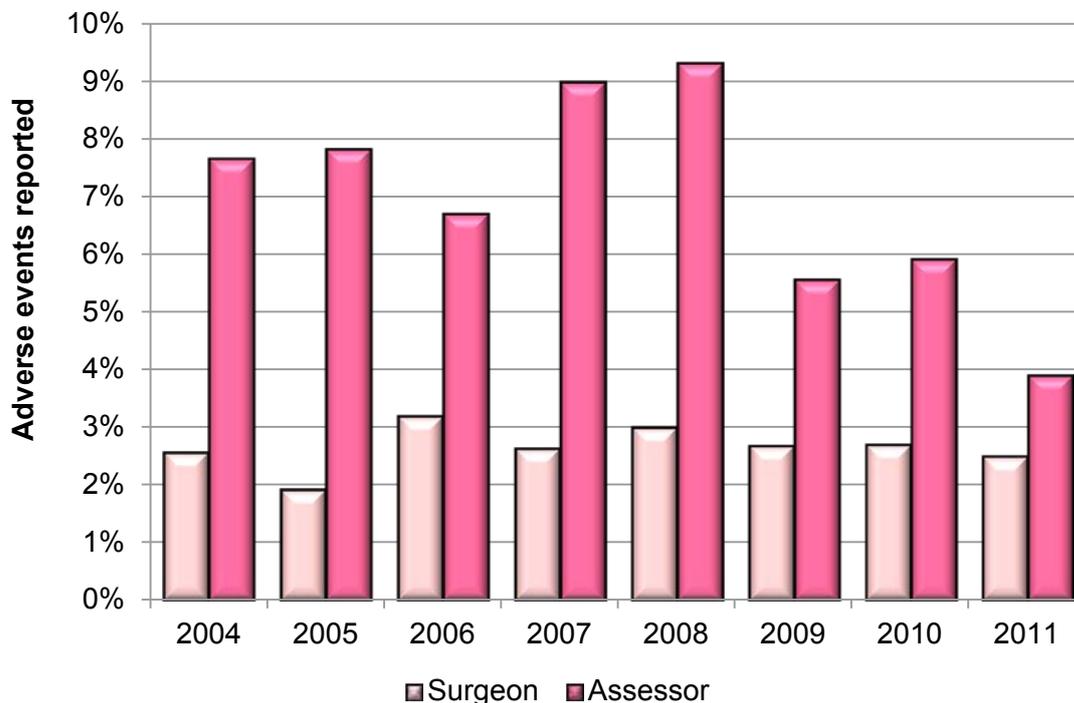


Figure 4.6 compares the proportion of adverse events reported by surgeons and assessors for the same cases. Each year the assessors reported more adverse events than the treating surgeons.

Kappa scores measure the level of agreement or variation between two observers. Kappa scores were obtained for surgeons' and assessors' views on performance. The level of agreement (Kappa score) by year can be seen in Table 4.6. 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' and 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	0.326 (0.253-0.398)	Fair agreement
2007	0.278 (0.201-0.355)	Fair agreement
2008	0.301 (0.234-0.368)	Fair agreement
2009	0.303 (0.216-0.389)	Fair agreement
2010	0.295 (0.198-0.393)	Fair agreement
2011	0.393 (0.250-0.536)	Fair agreement
Overall	0.310 (0.282-0.338)	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 2011 assessors reported 11 adverse events compared to seven reported by the surgeons. However, in recent years it appears as if the gap in reporting adverse events between surgeons and assessors is decreasing (Table 4.5).

4.3 Clinical events

KEY POINTS

- Assessors reported that preventable adverse events caused death in 34 (1%) cases throughout the entire audit period (2002–2011).

4.3.1 Reported areas for consideration, of concern and adverse events

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

Table 4.7 Audited deaths associated with areas for consideration, of concern or adverse events as reported by assessors

	Number of cases (%)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Total number of cases	411	383	470	524	597	534	569	450	372	282	4592
Area for consideration	17 (4)	32 (8)	73 (16)	47 (9)	57 (10)	50 (9)	78 (14)	47 (10)	34 (9)	25 (9)	460 (10)
Area for concern	42 (10)	33 (9)	45 (10)	49 (9)	47 (8)	35 (7)	47 (8)	31 (7)	22 (6)	6 (2)	357 (8)
Adverse event (AE)	64 (16)	35 (9)	36 (8)	41 (8)	40 (7)	48 (9)	53 (9)	25 (6)	22 (6)	11 (4)	375 (8)
AE that caused death	26 (6)	18 (5)	14 (3)	22 (4)	22 (4)	27 (5)	35 (6)	17 (4)	12 (3)	6 (2)	199 (4)
AE that caused death, considered definitely preventable	5 (1)	2 (1)	3 (1)	7 (1)	3 (1)	4 (1)	4 (1)	3 (1)	2 (1)	1 (<1)	34 (1)

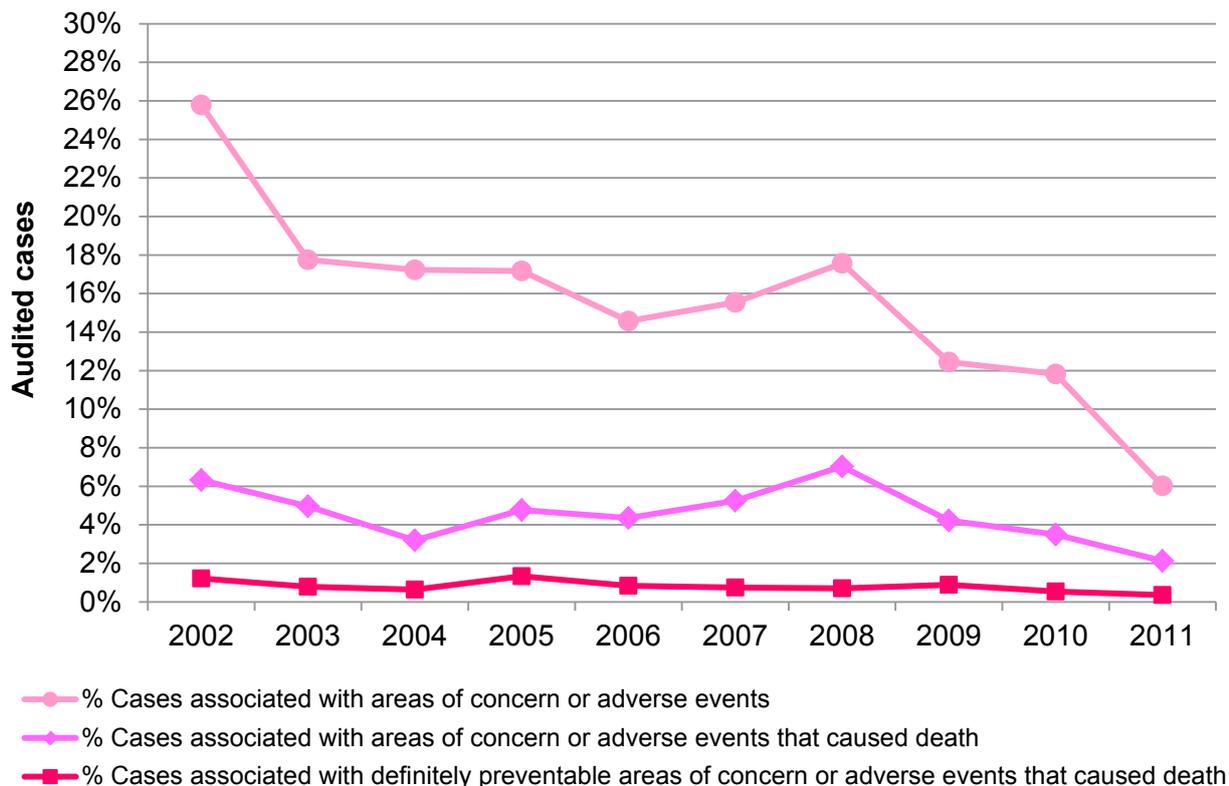
Note: The most significant event only is included for each case. Terminal care cases are excluded.

Comment:

Areas of concern or adverse events were reported by assessors in 732 (16%) cases overall since 2002. Six (2%) cases in 2011 were associated with an adverse event that caused death, one case of which was associated with an event that was considered 'definitely preventable' (Table 4.7). The percentage of audited cases associated with adverse events or areas of concern (2002–2011) is provided in Figure 4.7, which shows a steady decrease in the percentage of audited cases associated with an area of concern or adverse event overall.



Figure 4.7 Cases associated with adverse events or areas of concern



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 (as seen in Table 4.8).

KEY POINTS

- Over the period 2002–2011, 81% of cases were admitted to public hospitals, 16% were admitted to private hospitals and 3% were admitted to both private and public hospitals.
- Of the 3647 cases admitted to public hospitals, 13% were elective admissions.
- Of the 741 cases admitted to private hospitals, 42% were elective admissions.
- Of the emergency cases admitted to public hospitals, 66% underwent an operation, compared to 87% 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 ($p = 0.3$).^a
- Considering all private and public hospitals (excluding co-location), the proportion of areas for concern or adverse events associated with emergency admissions (12%) was significantly less than the proportion of these events associated with elective admissions (36%) ($p < 0.001$).^a

^a a Pearson's Chi-squared test.

**Table 4.8 Elective and emergency admissions to public and private hospitals, 2002 - 2011**

Number of cases (%)				
	Hospital admissions	Elective	Emergency	Total
(a) All audited cases	Private	311 (42)	430 (58)	741 (16)
	Public	480 (13)	3167 (87)	3647 (81)
	Co-location	20 (15)	113 (85)	133 (3)
	Total	811 (18)	3710 (82)	4521
(b) Cases that underwent an operation	Private	300 (96)	374 (87)	674 (91)
	Public	455 (95)	2079 (66)	2534 (69)
	Co-location	19 (95)	70 (62)	89 (67)
	Total	774 (95)	2523 (68)	3297 (73)
(c) Cases associated with an area of concern or adverse event	Private	84 (27)	58 (13)	142 (19)
	Public	151 (31)	410 (13)	561 (15)
	Co-location	5 (25)	17 (15)	22 (17)
	Total	240 (30)	485 (13)	725 (16)
(d) Cases that underwent an operation that were associated with an area of concern or adverse event	Private	84 (28)	54 (14)	138 (20)
	Public	146 (32)	359 (17)	505 (20)
	Co-location	5 (26)	13 (19)	18 (20)
	Total	235 (30)	426 (17)	661 (20)

Note: Co-location refers to a case in which the patient has been in both a public and private hospital. Missing data will account for differences in numbers. Overall 71 (2%) of cases are missing.

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

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

4.4.2 Relationship between factors related to admission data

KEY POINTS (See Table 4.8)

- In total, 73% of cases underwent one or more operations.
- In total, 95% of elective cases underwent an operation.
- Among elective cases undergoing surgery, the proportion admitted to private hospitals (96%) was not significantly different from the proportion admitted to public hospitals (95%) ($P=0.3$).^a
- Of the 3710 emergency admissions, 68% underwent an operation. A significantly higher proportion of emergency admissions admitted to private hospitals underwent surgery (87%) compared to those admitted as an emergency to public hospitals (66%) ($P<0.001$).^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 (17%) ($P=0.2$).^a
- Among elective cases undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to private hospitals (28%) was not significantly different to the proportion admitted to public hospitals (32%) ($P=0.2$).^a
- In those cases undergoing surgery, the proportion of elective cases associated with an area of concern or adverse event (30%) was significantly greater than the proportion in emergency cases (17%) ($P<0.001$).^a

^a a Pearson's Chi-squared test.

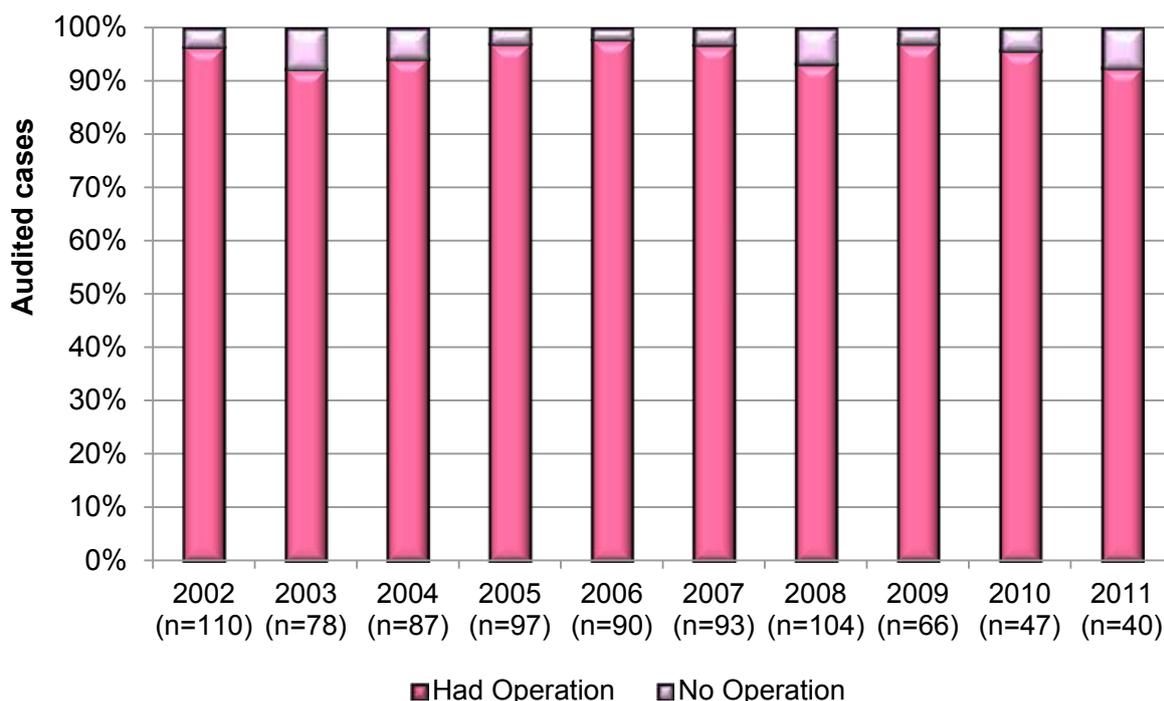


Table 4.9 Emergency admissions to private and public hospitals

Number of emergency cases by specialty (%)			
Specialty	Admissions to private hospitals (n=430)	Admissions to public hospitals (n=3166)	Admissions at co-location (n=113)
Underwent operation	374 (87)	2079 (66)	70 (62)
General surgery	193 (45)	1230 (39)	65 (57)
Orthopaedic surgery	105 (24)	705 (22)	42 (37)
Urological surgery	36 (8)	73 (2)	3 (3)
Cardiothoracic surgery	38 (9)	151 (5)	0 (0)
Vascular surgery	35 (8)	360 (11)	3 (3)
Neurosurgery	16 (4)	557 (18)	0 (0)
Other surgery*	7 (2)	90 (3)	0 (0)
Emergency admissions where no operation was performed			
Reason for no operation	Admissions to private hospitals (n=56)	Admissions to public hospitals (n=1088)	Admissions at co-location (n=43)
Active decision not to operate	30 (53)	466 (43)	21 (35)
Not a surgical problem	8 (14)	137 (13)	4 (6)
Patient refused operation	6 (11)	80 (7)	4 (6)
Rapid death	7 (13)	101 (9)	2 (3)
Missing data	5 (9)	304 (28)	31 (50)

*Other surgery' includes ENT, ophthalmology, obstetrics & gynaecology, plastic, paediatrics, oral maxillofacial.

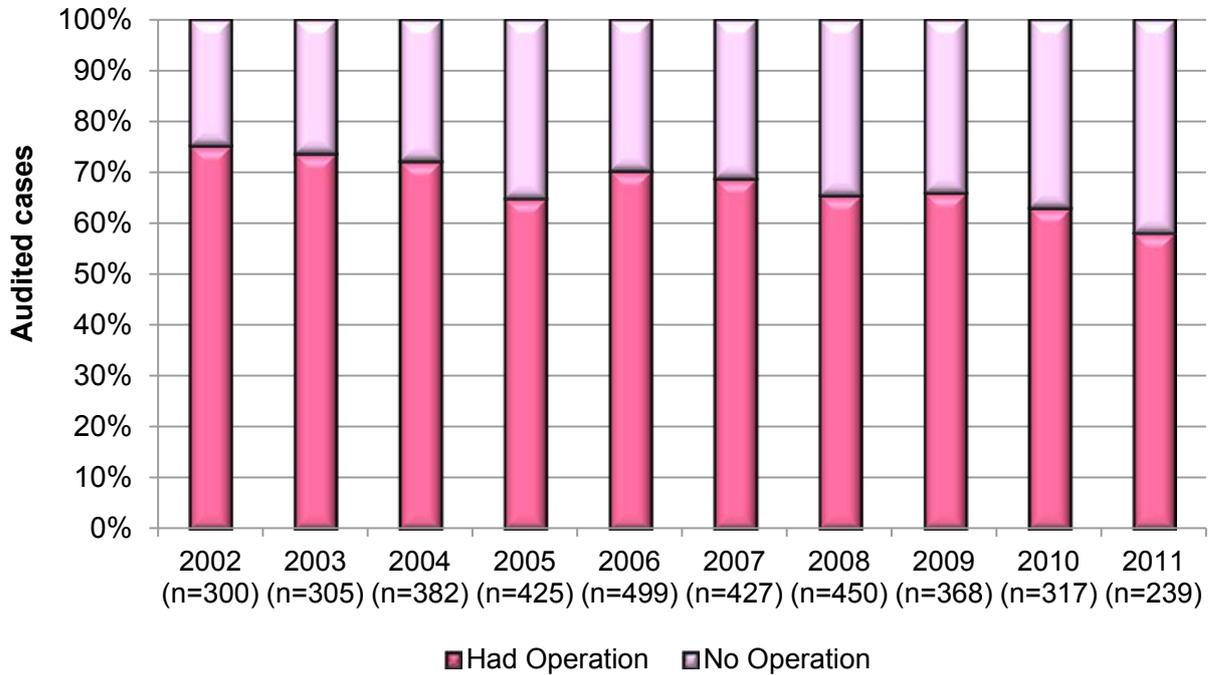
Figure 4.8 Percentage of elective admissions associated with an operation



Note: Graph represents completed cases only.



Figure 4.9 Percentage of emergency admissions associated with an operation or no operation



Comment:

A decreasing trend (17%) in emergency admissions that underwent an operation was observed from 2002 to 2011, is displayed in Figure 4.9. WAASM has previously highlighted the avoidance of futile surgery in previous annual reports and this may be an explanation for the decreasing trend.

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

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. Details of areas of concern or adverse events in elective and emergency admissions are given in Tables 4.11 and 4.12 respectively.

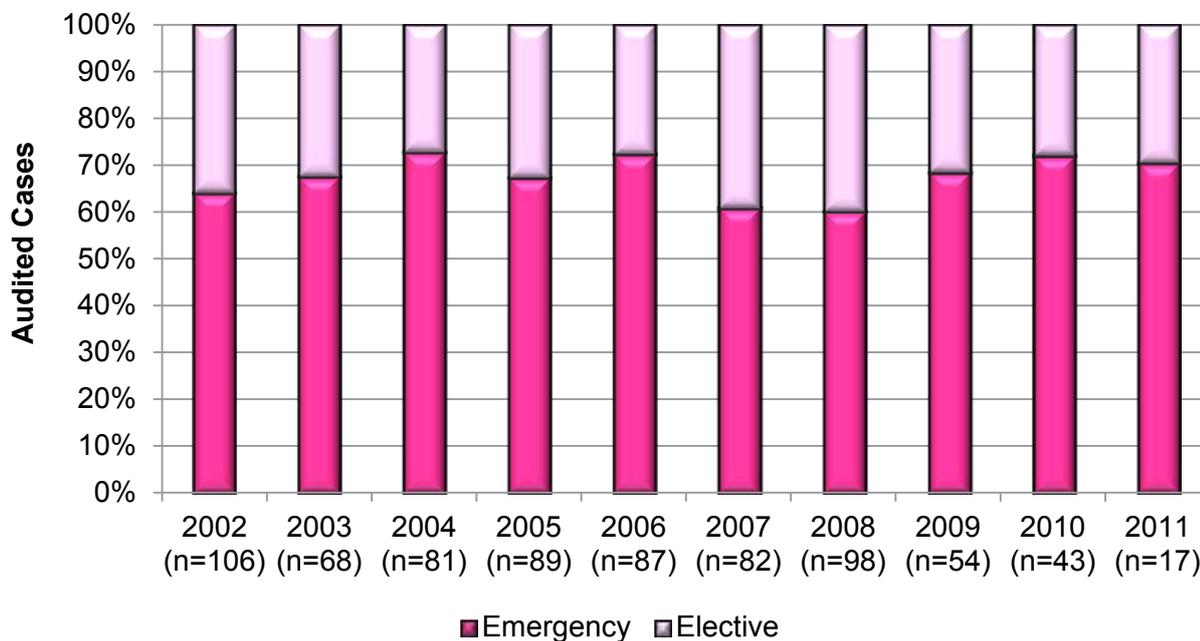
Table 4.10 Emergency and elective admissions that were associated with areas of concern or adverse events

Admission type	Areas of concern or adverse events (%)		
	Yes	No	Total
Elective	240 (5)	572 (13)	812 (18)
Emergency	485 (11)	3227 (71)	3712 (82)
Total	725 (16)	3799 (84)	4524

Note: Data missing on 68 (2%) of cases; cross tabulation only on complete data.

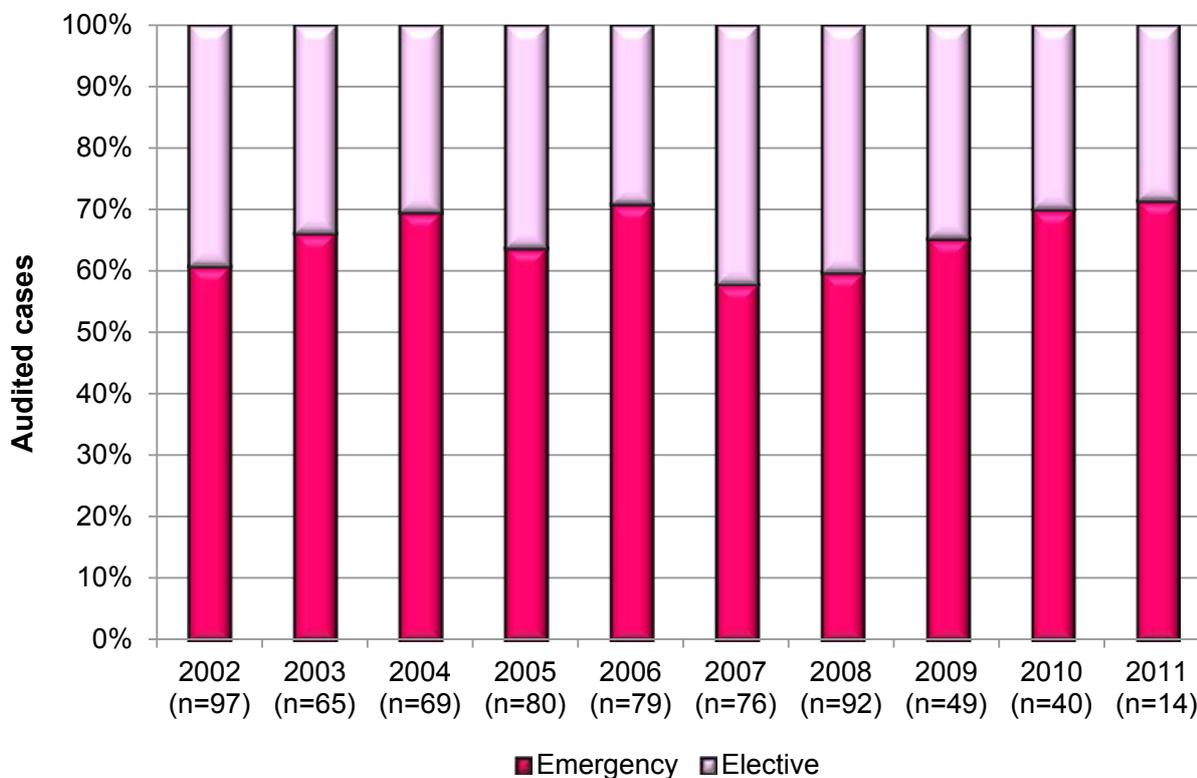


Figure 4.10 Emergency and elective admissions associated with areas of concern or adverse events



Note: Total number of cases n= 725 Data missing for 7 (1%) of cases.

Figure 4.11 Operative cases associated with areas of concern or adverse events – elective and emergency admissions



Note: Total number of cases n= 661. Data missing on 5 (<1%) of cases

Comment:

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**

Elective admissions associated with an area of concern or adverse event (n=240)		
Area of concern or adverse event	Number of events	Percentage
Related to open surgery	44	18
General complications	32	13
Incorrect or inappropriate therapy	11	5
Decision to operate	9	4
Delays	6	3
Assessment problems/diagnosis missed	6	3
Related to endoscopic surgery	6	3
Failure to use facilities	5	2
Drug-related problems	4	2
Patient factors	4	2
Fluid balance	3	1
Anaesthesia-related problems	2	1
Related to laparoscopic surgery	1	<1
Monitoring problems	1	<1
Communication failures	1	<1
TOTAL	135	57

Note: Total number of elective admissions is 811

Table 4.12 All areas of concern or adverse events associated with emergency admissions

Emergency admissions associated with an area of concern or adverse event (n=485)		
Area of concern or adverse event	Number of events	Percentage
Delays	62	13
General complications	49	10
Related to surgery	46	9
Drug-related problems	29	6
Patient factors	26	5
Assessment problems/diagnosis missed	17	4
Decision to operate	12	2
Communication failures	10	2
Related to endoscopic surgery	10	2
Incorrect or inappropriate therapy	9	2
Monitoring problems	9	2
Failure to use facilities	8	2
Fluid balance	6	1
Related to radiological surgery	6	1
Related to laparoscopic surgery	6	1
Transfer problems	5	1
Anaesthesia-related problems	3	1
Staff problems	1	<1
TOTAL	314	100

Note: Total number of emergency admissions is 3710



Comment:

Events related to open surgery and general complications are the most common reasons for areas of concern or adverse events in elective admissions, while delays and general complications 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	
•	In 27% of cases an operation was not performed.
•	In 3344 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.

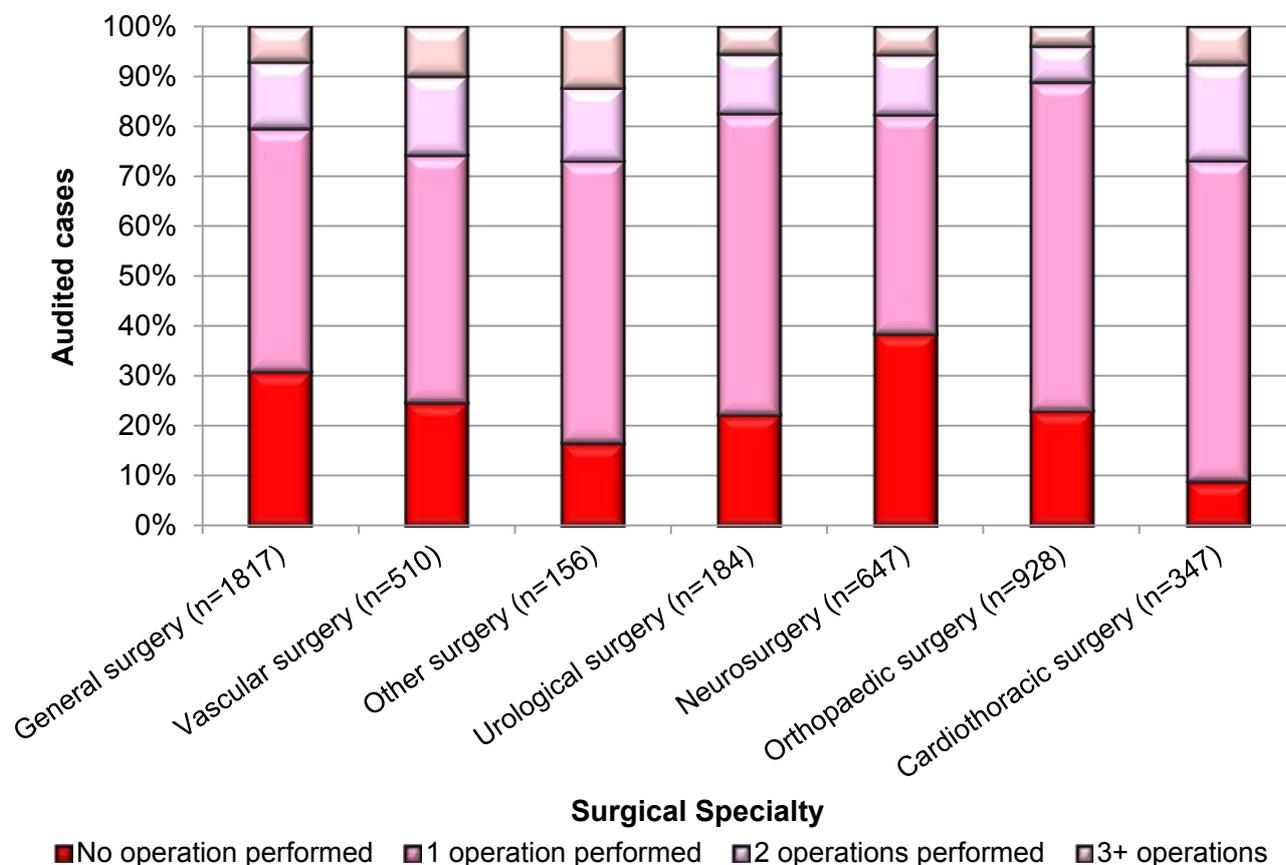
Table 4.13 Operations performed

Year	Number of cases (%)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Completed cases per year	411	383	470	524	597	534	569	450	372	282	4592
Total operative cases	333 (81)	297 (78)	359 (76)	371 (71)	444 (74)	393 (74)	404 (71)	314 (70)	250 (67)	179 (63)	3344 (73)
No operation performed	78 (19)	86 (22)	111 (24)	153 (29)	153 (26)	141 (26)	165 (29)	136 (30)	122 (33)	103 (37)	1248 (27)
1 operation performed	234 (57)	220 (57)	277 (59)	289 (55)	319 (53)	298 (56)	296 (52)	222 (49)	183 (49)	119 (42)	2457 (54)
2 operations performed	64 (16)	48 (13)	55 (12)	51 (10)	81 (14)	62 (12)	73 (13)	67 (15)	40 (11)	41 (15)	582 (13)
3 or more operations performed	35 (9)	29 (8)	27 (6)	31 (6)	44 (7)	33 (6)	35 (6)	25 (6)	27 (7)	19 (7)	305 (7)

Note: Cross-tabulation performed with complete data only.



Figure 4.12 Number of operations by speciality



Note: Total number of cases n=4589. Data missing in 3 (<1%) of cases.

Comment:

Cases of surgical mortality in which an operation was performed have decreased from 333 (81%) cases in 2002 to 179 (63%) cases in 2011. The majority of patients (54%) had one operation, while 13% had a second operation. Seven per cent of cases underwent three or more operations, while 27% of cases overall did not undergo an operation (Table 4.13).

Table 4.14 Operations abandoned, including patients undergoing one or more surgical procedures

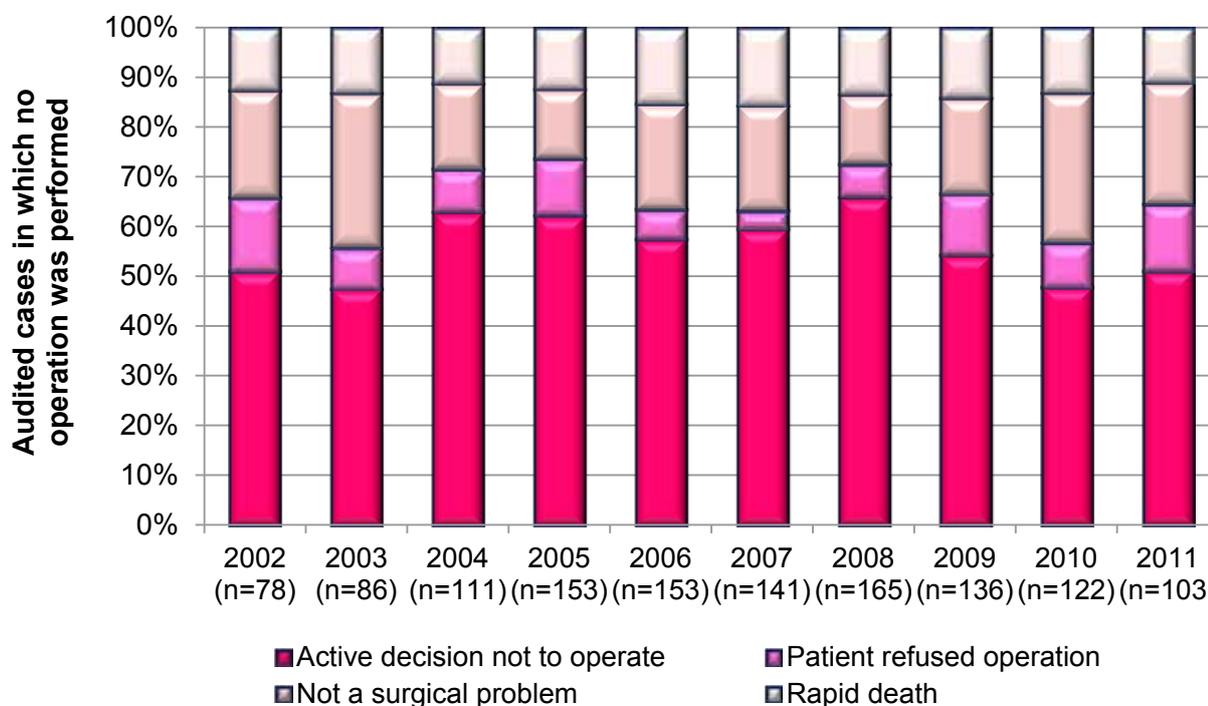
Year Death	Number of cases (%)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Total number of operative cases	333	297	359	371	444	393	404	314	250	179	3344
Abandoned at 1st operation	19 (6)	22 (7)	11 (3)	19 (5)	13 (3)	14 (4)	17 (4)	10 (3)	14 (6)	5 (3)	144 (4)
Abandoned at 2nd operation	6 (2)	2 (1)	2 (1)	4 (1)	3 (1)	4 (1)	2 (<1)	2 (1)	1 (<1)	3 (2)	29 (1)
Abandoned at 3rd operation	2 (1)	3 (1)	1 (0)	4 (1)	0 (0)	1 (<1)	1 (<1)	1 (0)	1 (<1)	1 (1)	15 (0)
Total number of cases in which an operation was abandoned	27 (8)	27 (9)	14 (4)	27 (7)	16 (4)	19 (5)	20 (5)	13 (4)	16 (6)	9 (5)	188 (6)



4.5.2 Non-operative cases

Data on non-operative cases appears below in Figure 4.13.

Figure 4.13 Reasons for no operation, all specialities



Note: Total number of cases n=1248. 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.

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) (as seen in Table 4.15).

Table 4.15 Comparison of views of surgeons and assessors on preoperative risk of death in cases undergoing an operation

Number of cases (%)				
Assessor's view of risk	Surgeon's view of risk			Total
	Minimal/small	Moderate	Considerable/expected	
Minimal/small	148 (5)	71 (2)	50 (2)	269 (8)
Moderate	118 (4)	298 (9)	304 (9)	720 (22)
Considerable/expected	133 (4)	500 (16)	1592 (50)	2225 (69)
Total	399 (12)	869 (27)	1946 (61)	3214

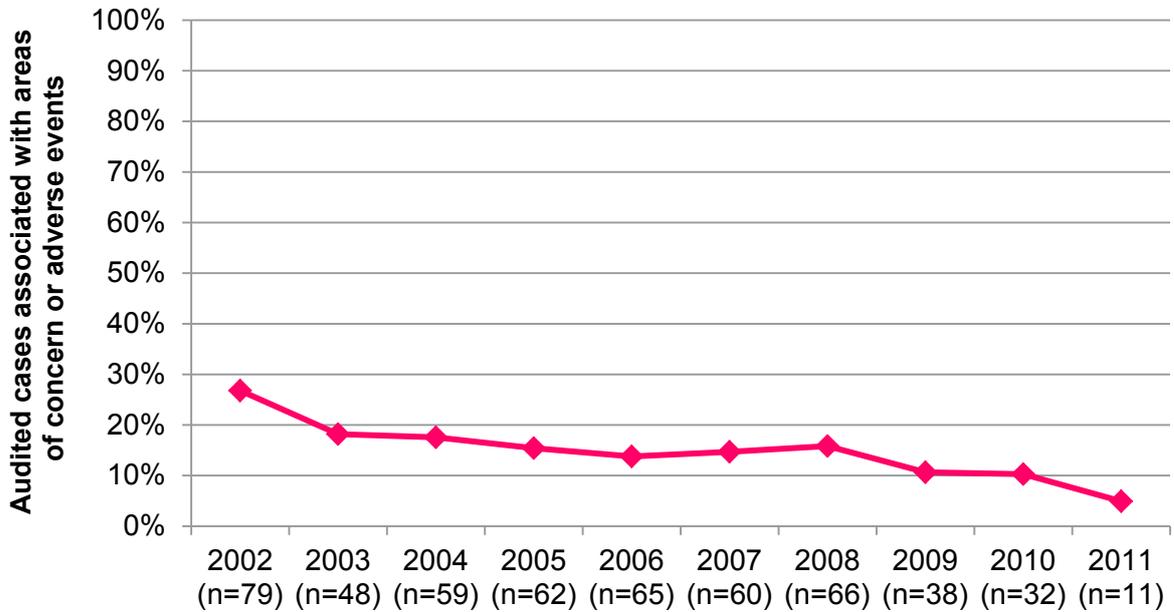
Note: Data missing for 1378 (43%) of cases. Kappa measurements can only be calculated on complete information from both surgeon and assessor; Kappa score (K) = 0.282, 95% CI 0.253-0.312 (p<0.001), indicating that surgeons and assessor were in 'fair agreement'.



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

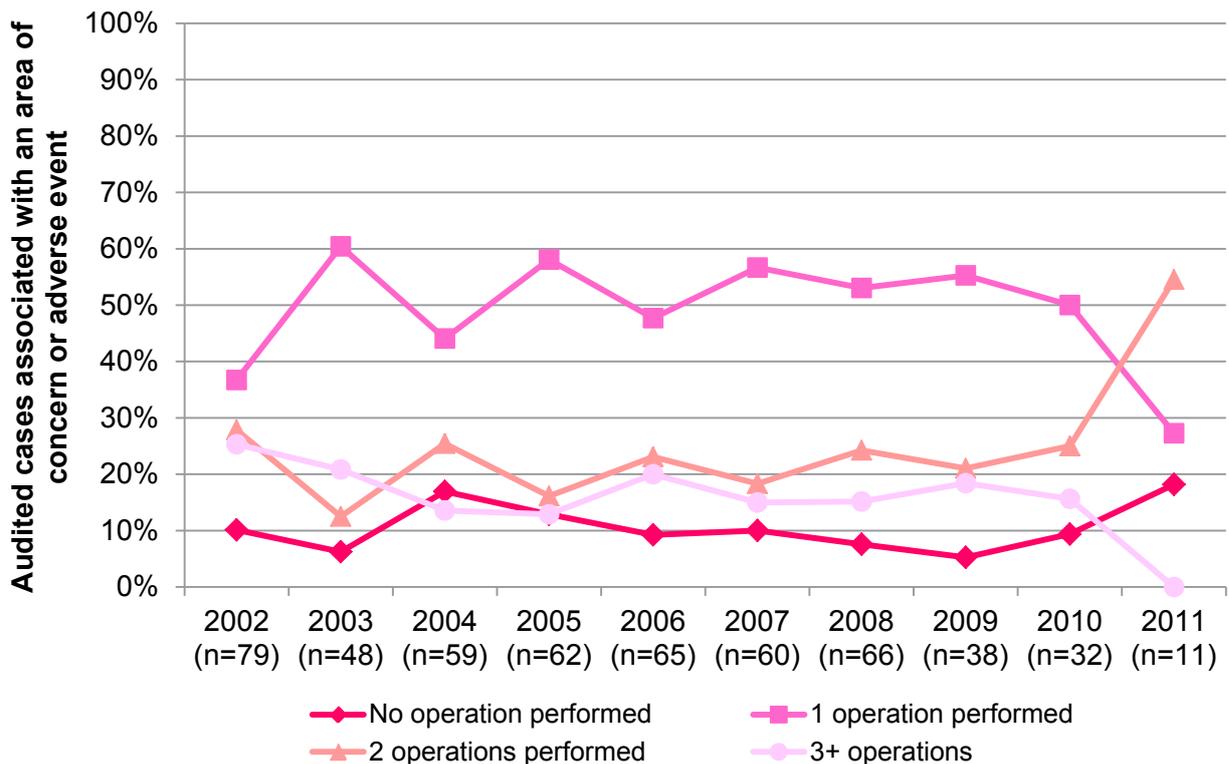
Areas of concern and adverse events are depicted in Figures 4.14 and 4.15.

Figure 4.14 Cases associated with areas of concern or adverse events in Western Australian teaching hospitals



Note: Total number of cases n=520.

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



Note: Total number of cases n=520.



4.5.5 Unplanned return to theatre

Unplanned return to theatre cases are given in Table 4.16.

Table 4.16 Unplanned return to theatre

Unplanned returns to theatre	Year								
	2004	2005	2006	2007	2008	2009	2010	2011	Total
Number of cases in which at least one operation was performed	359	371	444	393	404	314	250	179	2714
Cases where surgeons reported an unplanned return to theatre (%)	50 (14)	55 (15)	61 (14)	45 (11)	62 (15)	43 (14)	35 (14)	20 (11)	371 (14)

Comment:

The proportion of patients dying after an unplanned return to theatre has remained consistent with an overall average of 14% from 2004 to 2011.

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 or directly assisting during the operation.

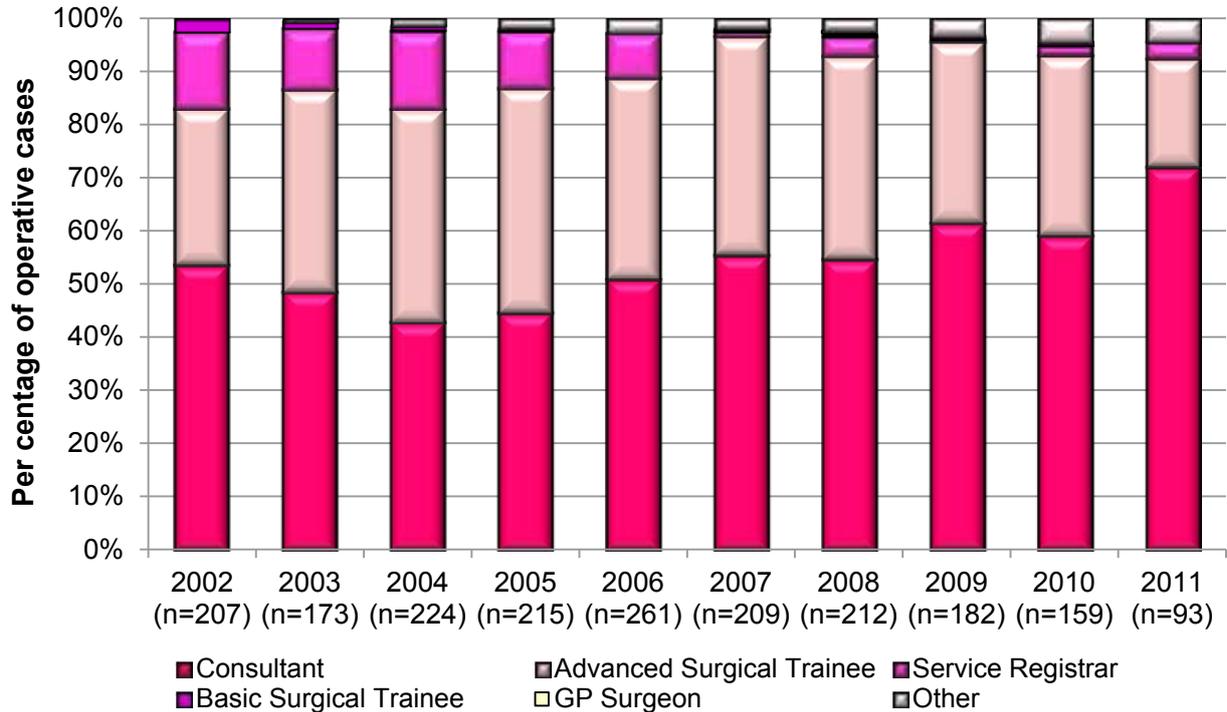
The number of audited operative cases in teaching hospitals has decreased since 2006 (Table 4.17). The number of consultants performing primary operations in teaching hospitals has increased (Figure 4.16); while the number of consultants performing subsequent operations in return to theatre cases has remained relatively stable (Figure 4.17).

Table 4.17 Deaths after surgery in Western Australian teaching hospitals

	Number of cases (%)										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Number of audited operative cases in teaching hospitals	225	192	246	268	346	283	275	236	204	132	2407
Consultant decision to operate	188 (84)	158 (82)	202 (82)	198 (74)	246 (71)	208 (73)	197 (72)	172 (73)	159 (78)	90 (68)	1818 (76)
Consultant operating or directly assisting	131 (58)	96 (50)	114 (46)	113 (42)	158 (46)	132 (47)	140 (51)	132 (56)	110 (54)	77 (58)	1203 (50)

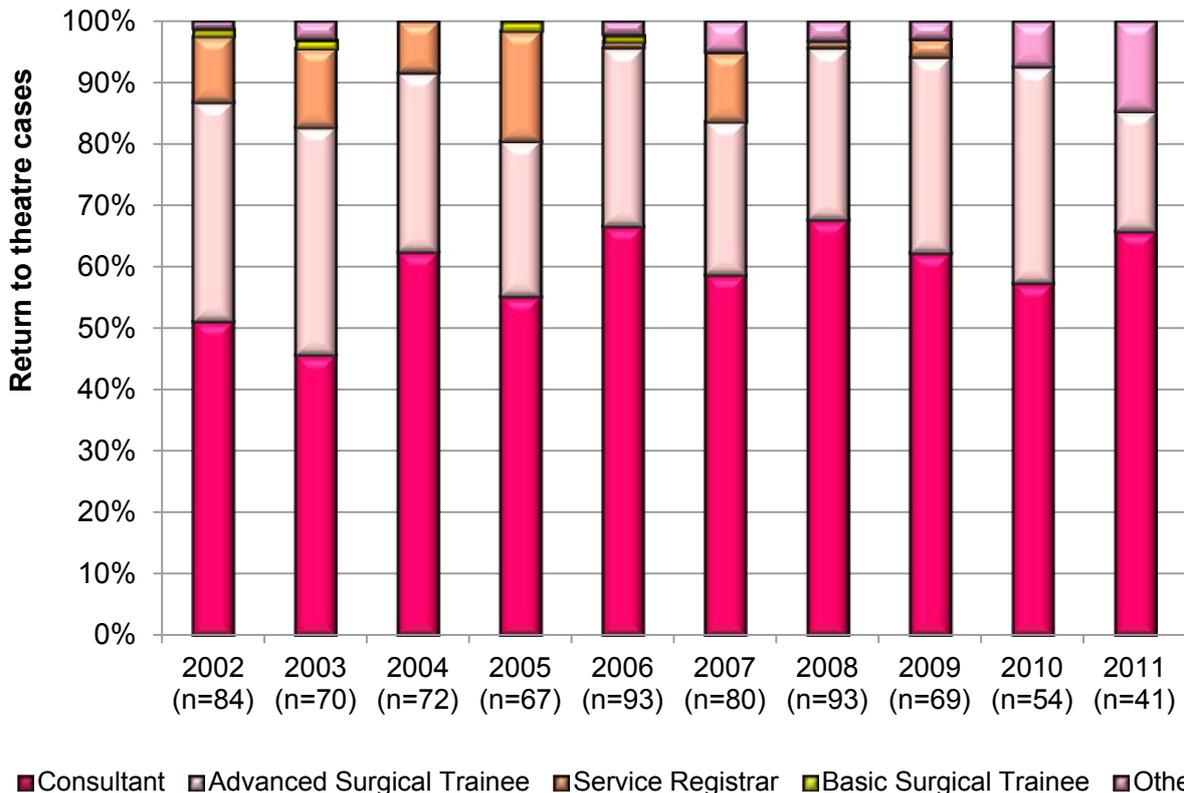


Figure 4.16 Grade of surgeon performing first operation in Western Australian teaching hospitals^a



^a Total number of first operations is 1935. 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 in Western Australian teaching hospitals



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 in Western Australian teaching hospitals

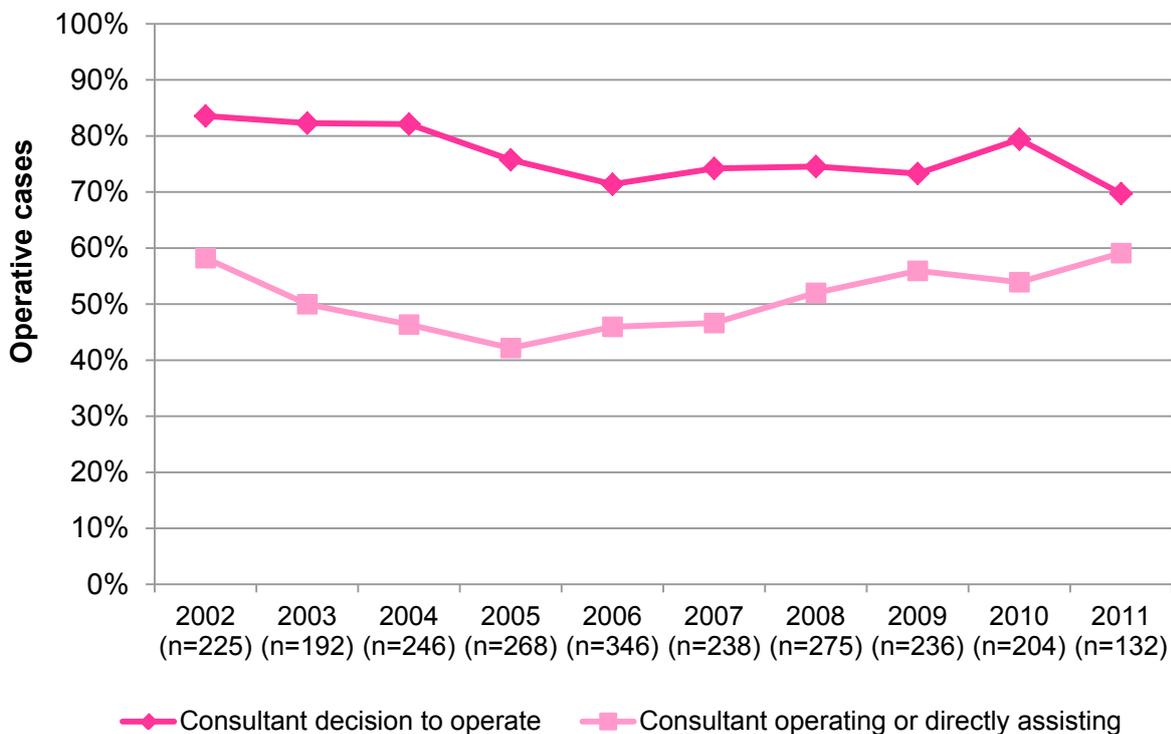
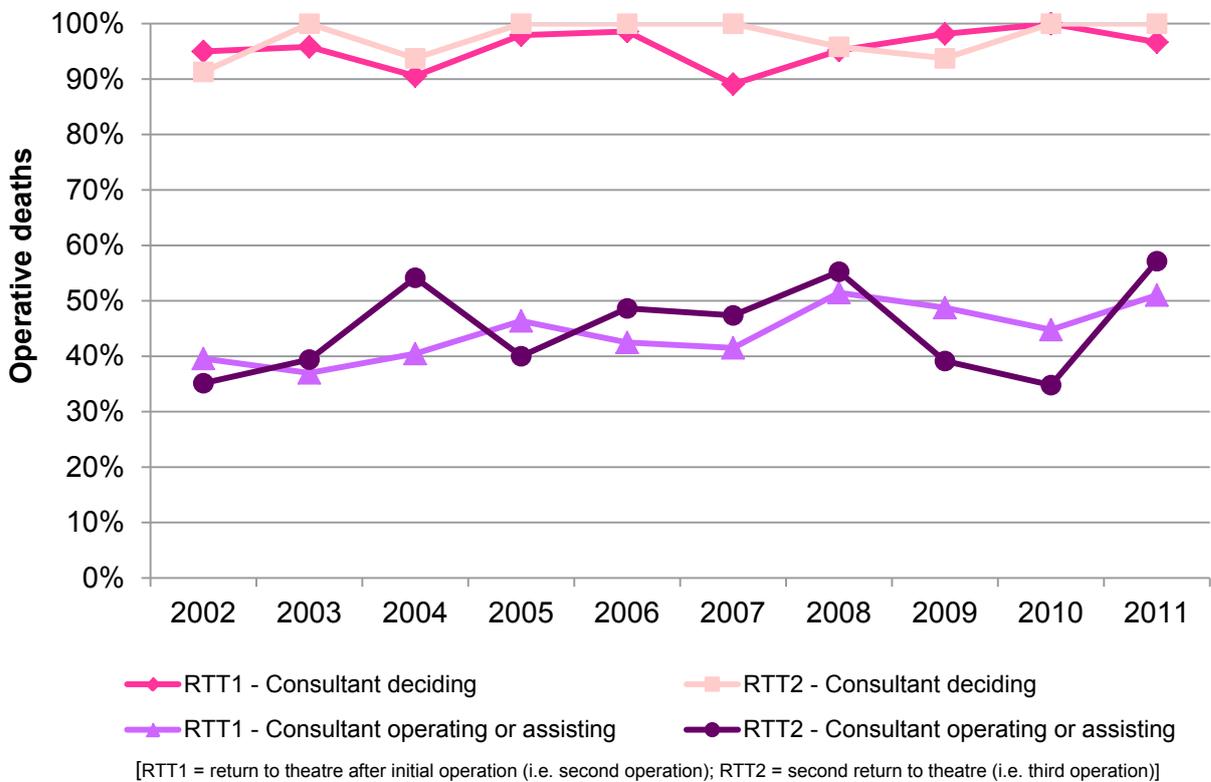




Figure 4.20 Consultant surgeons involvement in returns to theatre (RTT) in Western Australian teaching hospitals



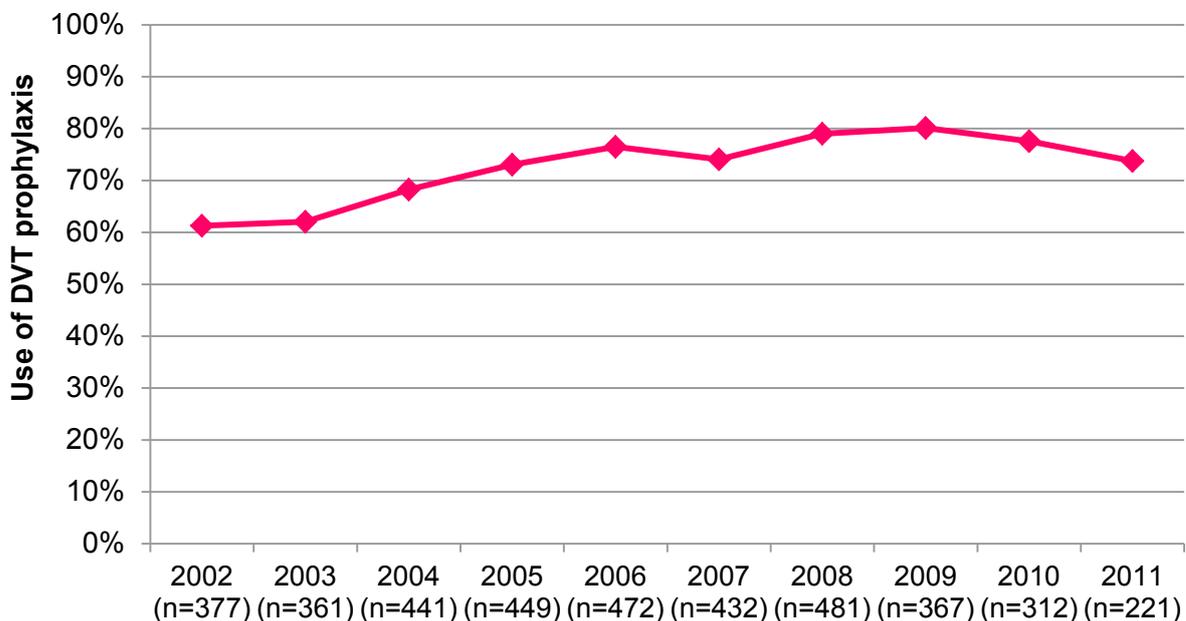
Comment:

Direct consultant supervision of patients being returned to theatre has been highlighted in all previous annual reports and there was a welcome increase over the last few years (Figures 4.18, 4.19 and 4.20).

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.

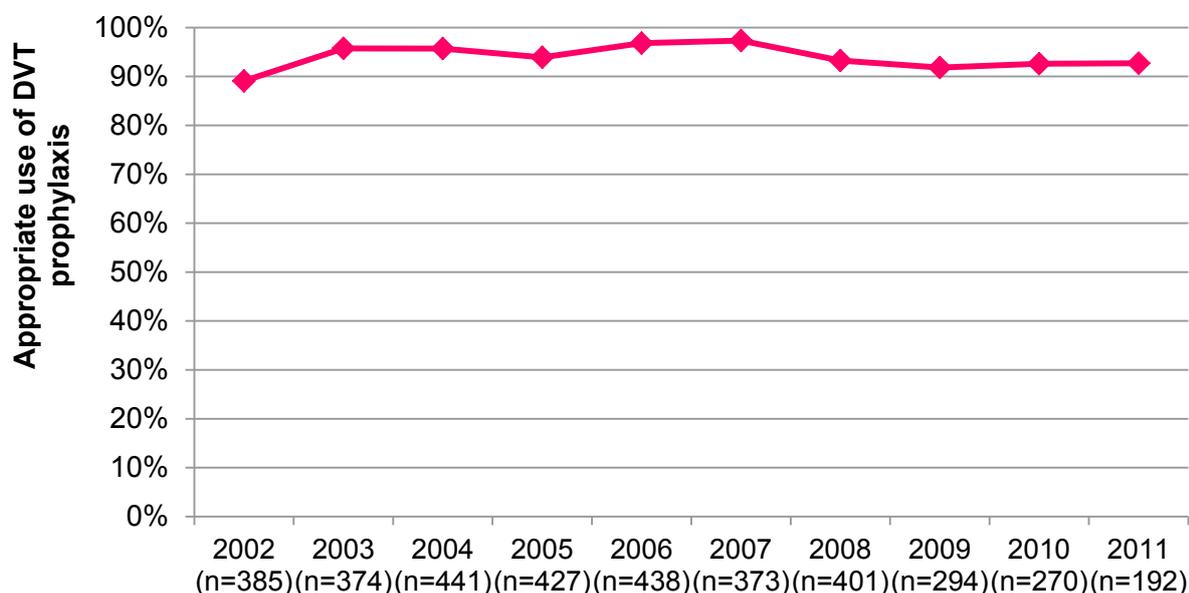
Figure 4.21 Use of DVT prophylaxis



Note: Total number of cases n=3913. Data missing on 679 (17%) cases.



Figure 4.22 Cases where assessors noted that use of DVT prophylaxis was appropriate



Note: Total number of cases n=3595. 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 997 (28%) of cases.

Comment:

The importance of DVT prophylaxis has consistently been highlighted in previous annual reports and symposiums. Data on DVT prophylaxis was missing in 679 proformas and 997 assessments returned to the WAASM office.

It is vital that surgeons critically review DVT prophylaxis with each case and report the findings accurately when filling out WAASM proformas.



5. PERFORMANCE REVIEW

This section reviews progress made on each of the recommendations of the 2011 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 under review and the accuracy of WAASM data is improving.

Surgeon participation

WAASM has encouraged surgeons to participate in the audit at every opportunity. Surgeon participation in WAASM has increased over the entire audit period.

Audit process

Evaluation forms were sent to all surgeons in WA in July 2012 so that they may assess and provide feedback on the WAASM process. We anticipate that the data will be collected and evaluated by the end of 2012 and we will share the findings with WA surgeons on completion of the study.

Clinical management

WAASM is currently investigating trends in surgical mortality. A decrease of surgical mortality of up to 26% has been identified in monitoring and analysing 10 years of data. The WAASM team is in the process of investigating the factors causing this decrease and will make the findings known once the study has been completed.

Reporting

WAASM is preparing to migrate onto the Bi-National Audit System to align itself with the rest of the ANZASM regional audits.



6. TEN YEARS OF WAASM

WAASM commenced its first year of complete data collection on 1 January 2002. Ten years on, there is a wealth of information locked inside the WAASM database – with each annual report trends in admission types, hospital status, demographics and relevant perioperative issues have been identified. The most exciting trend observed to date has been the fall in surgically-related deaths that fit the WAASM inclusion criteria. While the WAASM team is currently investigating the explanations behind the 26% decrease in surgical mortality (Figure 3.1; Section 3.1.1), there have been a number of initiatives facilitated by the audit that may have contributed to the observation:

Deep vein thrombosis (DVT) prophylaxis

In the first year of the audit an observation was made that DVT prophylaxis was either not prescribed or not administered correctly. WAASM held a symposium on the topic in 2002 and data collected via the audit has since shown a measurable increase of 15% in patients receiving DVT prophylaxis (Figure 4.21; Section 4.7).

Anticoagulation in the perioperative patient

WAASM observed a problematic trend in the management of perioperative patients receiving anticoagulation. There appeared to be a clear need for guidance on the risk of thromboembolic events when anticoagulation was interrupted and the risk of bleeding following a procedure. A multidisciplinary symposium was organised in 2005 and there has not been a death secondary to anticoagulation mismanagement reported since.

Perioperative fluid management

A number of preventable deaths directly related to postoperative fluid load were identified through WAASM. A symposium on the topic was organised in 2008 and a recommendations report was produced that was disseminated to all WA surgeons. Subsequently, significant improvements have been observed through WAASM data. In 2007, prior to the symposium and report, some 52 deaths were associated with fluid balance issues. In 2011, this figure has fallen to nine – a significant decrease in preventable deaths directly related to fluid load.

Whipple procedure

WAASM has also identified a series of deaths associated with the Whipple procedure (pancreatoduodenectomy). In 2009, in conjunction with the WA Chief Medical Officer and the WA Health Department, a working party was organised to discuss the issues associated with undertaking a Whipple resection. In 2009, a recommendation that pancreatic resections should only be undertaken in teaching hospitals by experienced surgeons with appropriate training and multidisciplinary support was made. Only one death since 2009 has been associated with a Whipple resection.

Other WAASM initiatives that may have contributed to the decrease in surgical mortality over the years include: advocating the separation of emergency and elective general surgery in Perth teaching hospitals; disseminating information on futile surgery and delays leading to patient death; and hosting a symposium on recognising the deteriorating patient to highlight the need to facilitate the escalation process within the entire multidisciplinary perioperative team.

Improvements in the care of surgical patients arise from many small improvements in all aspects of perioperative care. The initiatives and recommendations developed by WAASM as described above have produced measurable improvements in surgical outcomes and have undoubtedly contributed to the decrease in surgical mortality over the last 10 years, none of which could have been achieved without the continued participation and support of WA surgeons.



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
- Patient Safety Surveillance Unit, Performance Activity and Quality Division at the Western Australia 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 Steering Committee

- College WAASM Management Committee:
 - Mr James Aitken Clinical Director, WAASM Chair and General surgical representative
 - Mr Tom Bowles Consultant general surgeon, Rural surgical representative
 - Mr Ian Gollow Consultant paediatric surgeon, Paediatric surgical representative

- WAASM staff:
 - 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 and Academic Surgery (RAAS staff, particularly:
 - Professor Guy Maddern Chair ANZASM Steering Committee
 - 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

Men Aged <70		
Cause of Death (n=814)	n	%
Brain haemorrhage	76	9
Multiple organ failure	65	8
Septicaemia	65	8
Malignancy	61	7
Head injury	43	5
Brain stroke	39	5
Other	38	5
Acute myocardial infarction	38	5
Respiratory failure	28	3
Cerebral oedema	25	3
Cardiac arrest	24	3
Pneumonia	23	3
Aneurysm	23	3
Brain injury	21	3
Injury to organ	20	2
Pulmonary embolism	16	2
Aspiration pneumonia	16	2
Haemorrhage	16	2
Sudden death cause unknown	15	2
Cardiorespiratory failure	15	2
Renal failure	14	2
Heart failure	14	2
Missing data	13	2
Hepatic failure	11	1
Brain death	9	1
Ischaemic heart disease	9	1
Vascular insufficiency of the intestine	8	1
Infection	8	1
Respiratory distress and disease	7	1
Subdural haematoma	5	1
Acute pancreatitis	4	<1
Hypovolemic shock	4	<1
Acute endocarditis	4	<1
Peritonitis	4	<1
Cardiac dysrhythmias	4	<1
Intestinal obstruction	3	<1
Embolism and thrombosis	3	<1
Respiratory arrest	3	<1
Motor vehicle accident	3	<1
Fistula	3	<1



Liver disease	3	<1
Motor vehicle accident	3	<1
Drug related causes	3	<1
Suicide	3	<1
Multiple injuries	2	<1

Table A.2 Causes of death in women aged <70

Women Aged <70		
Cause of Death (n=490)	n	%
Brain haemorrhage	79	16
Septicaemia	49	10
Other	40	8
Multiple organ failure	35	7
Malignancy	34	7
Respiratory failure	18	4
Cerebral oedema	18	4
Heart failure	13	3
Pulmonary embolism	13	3
Acute myocardial infarction	11	2
Stroke and cerebrovascular accident unspecified	11	2
Haemorrhage	11	2
Injury to organs	11	2
Aneurysm	11	2
Cardiac arrest	10	2
Hepatic failure	9	2
Unknown causes of mortality or morbidity	9	2
Head Injury	9	2
Missing data	8	2
Renal failure	8	2
Brain infarction	8	2
Intestinal vascular insufficiency NOS	6	1
Brain death	6	1
Other aspiration pneumonia as a complication of care	5	1
Embolism and thrombosis	5	1
Intestinal obstruction	4	1
Subdural haematoma nontraumatic	4	1
Vascular insufficiency of the intestine	4	1
Acute pancreatitis	4	1
Cardiorespiratory failure	4	1
Pneumonia due to unspecified organism	3	1
Peritonitis	3	1
Cardiogenic shock	3	1
Complication of gastrointestinal anastomosis or bypass	3	1
Infection	3	1
Anoxic brain damage	2	<1



Tracheostomy complication	2	<1
Respiratory arrest	2	<1
Fracture	2	<1
Brain haemorrhage	2	<1
Ischaemic heart disease	2	<1
Fistula of intestine	2	<1
Pneumonia	2	<1
Hypovolemic shock	2	<1

Table A.3 Causes of death in men aged >=70

Men Aged >=70		
Cause of Death (n=1647)	n	%
Septicaemia	143	9
Myocardial infarction	135	8
Pneumonia	110	7
Multiple organ failure	107	6
Other	99	6
Malignancy	88	5
Respiratory failure	85	5
Missing Data	83	5
Heart failure	66	4
Aspiration pneumonia	60	4
Renal failure	60	4
Vascular insufficiency of the intestine	60	4
Cardiac arrest	58	4
Ruptured abdominal aortic aneurysm	53	3
Brain haemorrhage	46	3
Cardiorespiratory failure	40	2
Stroke and cerebrovascular accident unspecified	34	2
Sudden death cause unknown	28	2
Cardiogenic shock	23	1
Ischaemic heart disease	22	1
Haemorrhage	17	1
Infection	16	1
Brain other	16	1
Respiratory other	14	1
Congestive heart failure	13	1
Cardiovascular other	13	1
Ruptured aneurysm	12	1
Subdural haematoma nontraumatic	10	1
Intestinal obstruction	10	1
Perforation of intestine	10	1
Acute pancreatitis	9	1
Hepatic failure	9	1
Acute pulmonary oedema	8	<1



Diffuse brain injury	7	<1
Aneurysm	7	<1
Cardiac arrhythmias and dysrhythmias	7	<1
Atrial fibrillation	6	<1
Chronic renal failure	6	<1
Respiratory arrest	6	<1
Fracture of neck of femur	6	<1
Severe head injury	6	<1
Duodenal ulcer	6	<1
Left ventricular failure	6	<1
Post-operative pulmonary embolus	4	<1
Peripheral vascular disease	4	<1
Pseudo-obstruction	4	<1
Volvulus of the sigmoid colon	4	<1
Complication of gastrointestinal anastomosis or bypass	4	<1
Multiple injuries	4	<1
Embolism and thrombosis	3	<1

Table A.4 Causes of death in women aged ≥ 70

Women Aged ≥ 70		
Cause of Death (n=1639)	n	%
Septicaemia	147	9
Multiple organ failure	138	8
Acute myocardial infarction	135	8
Heart failure	100	6
Respiratory failure	90	5
Renal failure	73	4
Pneumonia	65	4
Other	63	4
Malignancy	61	4
Vascular insufficiency of the intestine	57	3
Brain haemorrhage	52	3
Cardiac arrest	50	3
Cardiorespiratory failure	49	3
Stroke and cerebrovascular accident	44	3
Aspiration pneumonia	41	3
Missing Data	35	2
Sudden death cause unknown	35	2
Pulmonary embolism	25	2
Ruptured abdominal aortic aneurysm	25	2
Intestinal vascular insufficiency	23	1
Haemorrhage	21	1
Acute pulmonary oedema	20	1
Peripheral vascular disease	19	1
Intestinal obstruction	18	1



Cardiovascular other	18	1
Brain other	17	1
Respiratory other	16	1
Ischaemic heart disease	15	1
Perforation of intestine	15	1
Acute pancreatitis	15	1
Cardiogenic shock	15	1
Aneurysm	13	1
Other disorders of the intestine	13	1
Chronic ischaemic colitis	12	1
Infection	12	1
Peritonitis	11	1
Fracture of neck of femur	10	1
Subdural haematoma	9	1
Bronchopneumonia	9	1
Cardiac dysrhythmias/arrhythmias	9	1
Post-operative pulmonary embolus	6	<1
Injury	6	<1
Old age	6	<1
Complication of gastrointestinal anastomosis	5	<1
Head injury	5	<1
Hepatic failure	5	<1
Left ventricular failure	4	<1
Perforated diverticulum	4	<1
Embolism and thrombosis	3	<1



APPENDIX B: WAASM assessors' report – details of adverse events and areas of concern

Table B.1 Details of adverse events and areas of concern as reported by assessors in 1186 of 6575 cases reported to WAASM

Incorrect or Inappropriate Treatment (n=287)	No.
Decision to operate	153
Better to have done different operation or procedure	29
Post-operative care unsatisfactory	13
Unsatisfactory medical management	10
Operation should not have been done or was unnecessary	8
Wrong surgical approach used	6
Better to have had more extensive surgery	6
Operation should have been done	5
Incorrect or inappropriate therapy	4
Operation would have been better delayed	4
No protocol for DVT prophylaxis	3
Wrong operation performed	3
Duration of operation too long	3
Premature extubation	3
Earlier operation desirable no theatre available	2
Operation would have been better deferred or delayed	2
Premature discharge from ITU	2
Premature discharge from hospital	2
Care unsatisfactory not otherwise specified	2
More aggressive treatment of infection needed	2
Other Incorrect inappropriate therapy	2
Better not to have been treated laparoscopically	2
Failure to recognise severity of illness	1
Accidental disconnection of equipment	1
CT scan not available	1
Operation should have been done after initial resuscitation	1
Better treated radiologically	1
Hospital admission to wrong ward or specialty	1
Inappropriate surgical admission	1
Premature discontinuation of treatment	1
Too early removal of nasogastric tube	1
Nasogastric tube not used	1
Re operation should have been done	1
Post-operative over sedation	1
Poor terminal care management	1
Better to have performed more limited surgery	1
Over sedation	1
Over transfusion of blood	1
Adverse factors in management	1



Inappropriate treatment prior to surgical referral	1
Unsatisfactory management of hypotension	1
CT scan should have been done pre-operatively	1
Management error led to pressure ulcer	1

Delays (n=220)	No.
Delay to surgery (earlier operation desirable)	78
Delay in diagnosis	38
Delay in transfer to surgical unit	19
Delay in transfer to tertiary hospital	15
Delay in recognising complications	13
Delay starting DVT prophylaxis	10
Delay in transfer to surgeon by physicians	9
Delay to surgery whilst obtaining a CT scan	6
Delay to operation caused by missed diagnosis	4
Delay in recognising a bleeding complication	4
Delay starting medical treatment	4
Delay to blood transfusion	3
Delay to endoscopic retrograde cholangiopancreatography	3
Delay in recognising anastomotic leak	2
Delay in investigating the patient	2
Delay to re operation	2
Delay starting antibiotics	2
Delay in transfer to surgeon by General Practitioner	1
Delay in obtaining blood products, x-match or typing	1
Delay in transferring patient to ITU	1
Delay in transfer to ITU post operatively	1
Delay in transfer to HDU post operatively	1
Delay to starting ventilation	1

Related to Open Surgery (n=149)	No.
Anastomotic leak after open surgery	60
Post-operative bleeding after open surgery	23
Related to open surgery	22
Complication of open surgery	10
Injury to organ during open surgery	9
Intra-operative bleeding during open surgery	4
Extension of ischemia after open surgery	4
Cerebrovascular accident following open surgery	4
Wound dehiscence after open surgery	2
Fistula from colon after open surgery	2
Wound infection after open surgery	1
Post-operative obstruction after open surgery	1
Post-operative bronchopleural fistula following open surgery	1



Peri -operative bleeding problems after open surgery	1
High intracranial pressure following open surgery	1
Failed arterial reconstruction after open surgery	1
Division of thoracic duct during open surgery	1
Bowel infarction after open vascular operation	1
Arterial occlusion related to open surgery	1

General Complications (n=130)	No.
Aspiration pneumonia	39
Pulmonary embolus	12
Septicaemia cause unspecified	9
Infection of hip prosthesis	7
Sepsis related to an intravenous line	6
Wound infection	4
Wound dehiscence	4
Graft infection	4
Displacement of tracheostomy tube	4
Post-operative intracranial haematoma	3
Pulmonary embolus with prophylaxis given	3
Central nervous system	2
Cerebrovascular accident	2
Post-operative pancreatitis	2
Renal failure	2
Dislocated hip prosthesis	2
Deep vein thrombosis	2
Tracheostomy problems	2
abdominal abscess	1
Pelvic abscess	1
Liver complication	1
Liver failure	1
Heart complication	1
Fasciitis	1
Failure of wound healing	1
Wound skin necrosis	1
Secondary haemorrhage	1
Sepsis related to a urinary catheter	1
Air embolism after surgery	1
Sepsis peritonitis related to jejunostomy	1
Blood clot dislodged	1
General complications of treatment	1
CVP insertion failed	1
Other prosthetic hemiarthroplasty of hip	1
Pulmonary embolus with no prophylaxis given	1
Pneumonia as a general complication of treatment	1
Peri operative intracranial infection	1



Peri operative cerebral ischaemia or infarction	1
Wrong choice of suture material	1

Drug-Related Problems (n=91)	No.
Failure to use DVT prophylaxis	42
Drugs related complication	9
Reaction to drugs	6
Anticoagulation causing post-operative bleeding	6
Under anticoagulation	5
Failure to use a drug for treatment or prophylaxis	4
Wrong dose of drug used	3
Over anticoagulation	3
Failure to use antibiotic prophylaxis	3
Wrong drug used	2
Post-operative bleeding due to coagulopathy	2
Anaphylactic shock related to drug treatment	1
Over anticoagulation before admission	1
Under anticoagulation during admission	1
Overdose of narcotics	1
Drug interaction	1
Operating following recent cessation of anticoagulant drug	1

Patient Related Factors (n=42)	No.
Injury caused by fall in hospital	28
Patient refused treatment	10
Patient related factors	3
Patient unfit for surgery and anaesthesia	1

Communication Failures (n=37)	No.
Poor documentation	12
Failure to obtain a post mortem	6
Poor communication between physician and surgeon	5
Failure of communication unspecified	4
Communication failure	3
Poor communication between anaesthetist and surgeon	1
Poor communication with GP	1
Failure to communicate with senior staff	1
Failure in communication between x-ray department and clinicians	1
Failed surgical communication through rotation of staff	1
Poor communication in Emergency Department	1
Poor communication between nursing and surgical staff	1



Assessment Problems (n=36)	No.
Pre-operative assessment inadequate	25
Failure to investigate or assess patient fully	5
Assessment problems	3
Cardiac pre-operative assessment inadequate	2
Pre-operative respiratory assessment inadequate	1
Endoscopic retrograde cholangiopancreatography not used or not available	1

Related to Fluid Balance (n=36)	No.
Fluid balance unsatisfactory	22
Post-operative fluid balance unsatisfactory	8
Fluid overload	3
Post-operative fluid overload	3

Related to Diagnosis (n=30)	No.
Diagnosis missed by medical unit	8
Diagnosis missed by surgeons	7
Diagnosis missed unspecified	6
Diagnosis missed by referring hospital	4
Diagnosis missed by radiologist	4
Diagnosis missed on endoscopy	1

Failure to Use Facilities/Facilities Unavailable (n=29)	No.
Failure to use HDU	8
Failure to use HDU post-operatively	6
Failure to use ICU/ICU full	5
Failure to use ICU post-operatively	2
HDU not used post-operatively no HDU in hospital	2
Failure to use ICU pre-operatively no ICU in hospital	1
Failure to use ICU no ICU in hospital	1
HDU not used post-operatively HDU full	1
HDU not used post-operatively, admission refused	1
Premature discharge from HDU	1
Lack of hospice beds	1

Related to Endoscopic Surgery (n=22)	No.
Perforation of duodenum during endoscopic operation	4
Perforation of colon during endoscopic operation	4
Endoscopic surgery organ related technical	3
Stomach complication related to endoscopic operation	3
Post-operative bleeding related to endoscopic operation	2
Upper GI complication related to endoscopic operation	1



Injury to duodenum during endoscopic operation	1
Operation induced acute pancreatitis after endoscopic operation	1
Injury to heart during endoscopic operation	1
Bladder complication of endoscopic operation	1
Peri-operative bleeding related to endoscopic operation	1

Staff-Related Issues (n=17)	No.
Surgeon too junior	7
Problems with appropriate staffing	4
Failure of junior surgeon to seek advice	2
Inadequate anaesthetic assistance	1
Surgeon operating without specialty	1
Anaesthetist should have been involved in preparation and resuscitation	1
Fatigue of surgeon operating	1

Transfer-Related Issues (n=13)	No.
Transfer should not have occurred	7
Problems during transfer	2
Transfer necessary to obtain ICU bed	1
Transfer necessary to obtain ICU bed no ICU in hospital	1
Transfer necessary due to bed shortage	1
Better transferred between hospitals pre-operatively for CTU support	1

Related to Laparoscopic Surgery (n=12)	No.
Anastomotic leak related to laparoscopic operation	4
Perforation of colon related to laparoscopic operation	2
Fistula from small bowel after laparoscopic operation	1
Anastomotic leak from small bowel after laparoscopic operation	1
Extension of ischaemia after laparoscopic operation	1
Arterial bleeding after laparoscopic operation	1
Intra-operative bleeding during laparoscopic operation	1
Post-operative bleed after laparoscopic operation	1

Related to Radiological Surgery (n=8)	No.
Radiological surgery organ related technical	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



Related to Anaesthesia (n=7)	No.
Pneumothorax complicating general anaesthetic	3
Aspiration pneumonia after anaesthetic	1
Technique not ideal during general anaesthetic	1
Better not to have had a general anaesthetic	1
Intubation failed for general anaesthetic	1

Monitoring Problems (n=7)	No.
Post-operative inadequate respiratory monitoring	3
Monitoring problem	1
Inadequate monitoring	1
Inadequate metabolic monitoring	1
Monitoring problems during regional anaesthetic	1

Problems with Blood or Blood Products (n=5)	No.
Blood products complication	2
No blood available	3

Resuscitation Problems (n=5)	No.
Resuscitation inadequate	4
Fluid and electrolyte resuscitation inadequate	1

Related to Equipment (n=3)	No.
Equipment not available	1
Failure of equipment	1
Other equipment related complication	1



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