



Royal Australasian  
College of Surgeons



# Western Australian Audit of Surgical Mortality

Annual Report 2013

## 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, as part of the Australian and New Zealand Audit of Surgical Mortality is a declared quality assurance activity under the *Health Insurance Act 1973 (Cth)*, Part VC.



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## CHAIRMAN'S REPORT

The governance and practice of surgery in Australia has always been heavily influenced by that in the United Kingdom (UK). The Western Australian Audit of Surgical Mortality (WAASM) has its roots in Scotland, and much of the Australian National Emergency Access Target (four hour rule) is based on that of the National Health Service (NHS). In the last year there have been two significant developments in the UK that will further influence Western Australia's WA practice.

The first is the delivery of emergency surgery. Minister Hames has made the management of patients presenting to Emergency Departments a high priority. Following his visit to the UK in early 2013 the Minister invited a delegation of senior NHS managers to visit WA and assess how we manage emergency surgical patients. Prior to the visitors' arrival, WA hospitals completed a questionnaire to assess their performance against the the 26 LondonHealth Quality Standards used to audit unscheduled admissions into London hospitals. These standards were derived from reports published by the Royal College of Surgeons of England in 2011 (1,2) and other reports by The National Confidential Enquiry in Patient Outcome and Death (NCEPOD), the English mortality audit.

Many of the 26 LondonHealth Quality Standards refer to issues WAASM has repeatedly highlighted since its first annual report in 2003 - that is some eight years before the publication of these UK reports. Examples include the detrimental effect of delay, adequate provision of HDUs, consultant supervision for returns to theatre, the importance of early recognition and management of sepsis, provision of day time emergency theatres *etc.* There is now a substantial body of evidence that shows each of these, if not properly addressed, can individually adversely impact on patient outcome. The fall in mortality noted by WAASM over the last ten years will undoubtedly, in part, be a consequence of WA surgeons changing their practice in the light of the feedback they received from WAASM.

That WA surgeons have changed their practice has been supported in the consultant survey WAASM undertook in 2012. The high response (greater than 70%) confirmed overwhelming support for WAASM with surgeons reporting, as in the first survey (2004), that WAASM had influenced their practice. A summary of this survey can be found in this annual report.

The second development in the UK has been open publication of individual surgeon performance. In July 2012, the *British Medical Journal (BMJ)* devoted an issue to the measurement of performance and the open publication of outcomes. The performance of individual UK cardiac surgeons has been available on the internet since 2005 and from July 2013 individual consultant performance for nine other surgical specialties will become available. The President of the Royal College of Surgeons of England hailed this as a 'watershed moment for the profession'. Sir Bruce Keogh, a cardiac surgeon and now Medical Director of the NHS, was singled out by the *BMJ* as a shining example of the leadership required to achieve this transparency and recently stated 'I want to be clear that NHS England will do everything in its power to make sure that measuring clinical outcomes will be given a priority in the new NHS. Organisations cannot know they are providing effective or safe care unless they are measuring and monitoring their services'. In WA the Department of Health has already started to offer premium payments to hospitals that collect data it can use to assess performance against agreed standards that have been adopted from the UK. WA surgeons should be under no illusion that, as in the UK, measuring individual surgeon performance and the open publication of patient outcomes is coming, and probably sooner than anticipated.

Last year's annual report, the tenth anniversary of WAASM's inception, noted a progressive fall in the mortality of patients admitted under a surgeon. A more detailed report has been accepted for publication in the *Medical Journal of Australia*. The reasons for this fall will be multi-factorial, and whilst WAASM's consistent attention to issues like those above will have undoubtedly been important, it seems an important change may have been a shift of emergency, and perhaps other high risk patients, to the teaching hospitals. This is in keeping with increasing evidence that suggests it is not the initial complication that determines outcome, but how the complication is managed. It seems that a 'failure to rescue' rather than the initial complication is a major determinant of outcome. It may be that high risk patients, and especially emergencies, are being referred to teaching hospitals in the expectation that their greater facilities may rescue patients who would not otherwise survive. This re-direction may be entirely appropriate, but it has obvious organisational implications if the teaching hospitals are required to manage an increasing number of elderly, frail and emergency patients.

The Royal Australasian College of Surgeons (the College) has recognised the importance of ensuring its Fellowship can be shown to be maintaining the standards demanded of a profession that has been given the privilege of self-regulation. It is now adding a stick to the previous carrot. Participation in its mortality audits



is now a mandatory part of Continuing Professional Development (CPD) and the proportion of Fellows who will need to have their CPD returns verified has more than doubled. Further, CPD requirements will have to be completed annually and not tri-annually. Fellows who do not comply with the CPD programme will be in breach of the College Code of Conduct and will risk not obtaining a CPD certificate without which they will not be able to register with the Medical Board.

As part of this process, proformas that have not been fully completed will no longer be accepted. Compliance is the full completion of all the case record proformas that have been sent to the surgeon by WAASM. Full completion of the proformas is required not only for CPD requirements, but because missing data significantly degrades the quality of any analysis undertaken. The Australian and New Zealand Audit of Mortality already has a number of publications in international peer review journals and more are in preparation. These analyses have great potential to identify areas requiring improvement. Indeed it has been audits and publications from NCEPOD that provided much of the data underpinning many of the standards referred to above and now coming to WA.

Participation will be greatly assisted by the move to electronic reporting. The migration of data from the original Access database has taken place and consultants can expect a gradual move to electronic notification and proforma completion in the later part of 2013. Second line assessment will remain paper based as the patient notes have to be used.

The hall mark feature of WAASM is its external peer review. This does place demands on consultants, and the College has recognised this by increasing the number of CPD points that can be obtained by undertaking a first or second line review. Consultants are encouraged to be such a reviewer, not only for its educational value, but also to share the load.

RJ Aitken  
Chairman, WAASM





## SHORTENED FORMS

AE	adverse event
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anaesthesiologists
CPD	Continuing Professional Development
BAS	Bi-National Audit System
DVT	deep vein thrombosis
ERCP	endoscopic retrograde cholangiopancreatography
HDU	high dependency unit
ICU	intensive care unit
ITU	intensive therapy unit
NCEPOD	National Confidential Enquiry into Peri-operative Deaths
NHS	National Health System
NOS	not otherwise specified
RACS	Royal Australasian College of Surgeons
RTT	return to theatre
UK	United Kingdom
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, is funded by the Western Australian Department of Health and has qualified privilege protection under Commonwealth 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. The surgeon completes the proforma, highlighting any areas for consideration or concern, as well as 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 2012, 584 deaths were reported to WAASM from 35 hospitals. The number of deaths per 100,000 population reported to WAASM has decreased from 32 in 2008 to 26 in 2012; this is a decrease of 19%.

### 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 2008 to 31 December 2012 and had completed the audit process by 31 March 2013. 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.

For 2012, 279 cases had completed the entire audit process when censored on 31 March 2013 (48%). A further 283 (48%) completed WAASM proformas were returned and are awaiting first- or second-line assessment. Overall, this accounts for 96% of cases reported in 2012.

### Second-line assessment

The proportion of cases referred for second-line assessment (case note review) in 2012 was 41 (15%) out of 279 completed cases (excluding terminal care cases).

### Comparison of surgeons' and assessors' views of areas of concern and adverse events

In 2012, assessors reported more areas of concern or adverse events (3.7%) than surgeons (2.5%).

### Patient sample demographics

Of the 3032 cases reported between 2008 and 2012, the median age was 73 years, with an interquartile range of 66–85. A total of 54% of cases were male. Fifty-seven per cent had an American Society of Anaesthesiologists (ASA) grade of 4 or higher. More than 95% of cases were associated with more than 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, septicaemia, multiple organ failure, malignancy and acute myocardial infarction. The main causes of death in patients older than 70 years were coronary-related issues, septicaemia, multiple organ failure, 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 2008. Overall, assessors thought that an adverse event caused the death of a patient in 5% of the 1781 completed cases.

### **Admissions: public and private hospitals**

Higher proportions of cases were emergency rather than elective admissions and admitted to public rather than private hospitals. The proportion of emergency patients admitted to private hospitals who underwent an operation (89%) was significantly greater than the proportion in public hospitals (61%). Seventeen per cent of all operative cases were associated with areas of concern or adverse events.

### **Operative and non-operative deaths**

In 32% of the 2112 audited deaths (from 2008 to 2012), no operation was performed. In 5% of overall cases the operative procedure was abandoned. Six per cent of audited patients underwent three or more operations. In 14% of cases from 2008 to 2012, surgeons reported an unplanned return to theatre.

### **Grade of surgeon - teaching hospitals**

Consultant surgeons operated or directly assisted in theatre in 57% 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

### Audit management

- Align WAASM with other state audits by using the standardised national surgical case form and web-based operational system.
- Complete data migration to the Bi-National Audit System (BAS) by September 2013.
- Implement online data entry by launching Fellow's Interface. Promote and evaluate the uptake of Fellow's Interface.
- Encourage high level of proforma completion to reduce amount of missing data and improve assessment process and data integrity by having compulsory fields as part of data entry for consultants.

### Reporting and audit data

- Provide individual hospital reports to participating hospitals to allow for comparison of clinical incidences with other participating hospitals in Western Australia.
- Review format of the WAASM Annual Report to ensure clarity amongst readers.
- Continue to review falling surgical mortality rates to ascertain whether the audit process has contributed to the reduction of surgical mortality in WA. This could identify trends in which further perioperative improvements can be made in collaboration with the Department.

### Clinical management

- Investigate clinically significant infections in surgical mortality.
- Investigate communication issues in cases of surgical mortality at any stage of treatment.
- Investigate return to theatre cases by comparing WA data with national data.
- Continue to monitor critical care allocations to determine if allocation practices have improved as per WAASM recommendations.



## 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 2008 to 31 December 2012, as audited on 31 March 2013.
- WAASM's main role is to provide information back to surgeons to educate, facilitate change and improve quality of practice.

### 1.1 Background

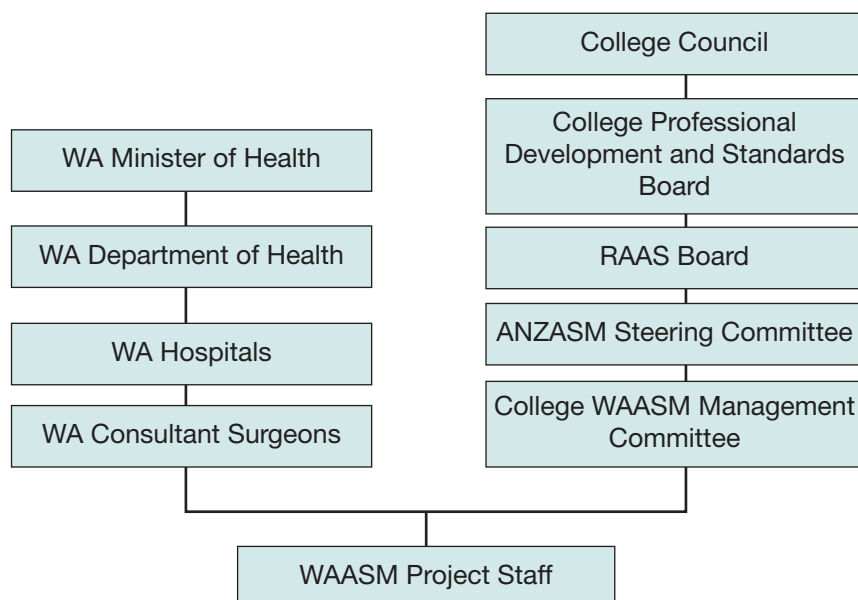
The Western Australian Audit of Surgical Mortality (WAASM) is an external, independent, peer-reviewed audit of the process of care associated with surgically related deaths in WA. The project is funded by the WA Department of Health and its methodology is based on the Scottish Audit of Surgical Mortality.<sup>1</sup>

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 in other states and territories. All Australian states and territories are now participating.

### 1.2 Project governance

The project governance structure is illustrated in Figure 1. 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 Project governance structure



WA = Western Australia; College = Royal Australasian College of Surgeons; RAAS = Research, Audit and Academic Surgery; ANZASM = Australian and New Zealand Audit of Surgical Mortality; 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<sup>2-10</sup> 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), the 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, that is, 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 warrants further investigation.
- A report could usefully draw attention to lessons 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 and educate surgeons about valuable lessons learned, facilitate change for best practice and improve surgical 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. If so, the surgeon is also 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 of Audit data 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 2008 to 31 December 2012, censored on 31 March 2013. Due to a time lag in reporting, 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=). The total number of cases used in the analyses varies as each data point may not have been completed in every case reported. The total numbers of cases included in the analyses are provided in all tables and figures in the report. Percentages are indicated in parentheses in tables – percentages are rounded up to the next whole number if the first decimal is equal to or over 5 e.g. 75.6% is rounded up to 76%.

## **2.5 Performance review**

Recommendations were included in the 2012 WAASM Annual Report.<sup>11</sup> 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.
- There has been a progressive decrease in the number of deaths reported from 2008 until 2011.

#### 3.1 Deaths reported to WAASM

Tables 1 and 2 and Figure 2 summarise the deaths reported to WAASM from 1 January 2008 to 31 December 2012. Percentage participation is calculated on the completion and return of the proformas by 31 March 2013. The audit process is completed once the proforma has been assessed by the first- and, if required, the second-line assessor.

**Table 1 Deaths reported to WAASM between 01 January 2008 and 31 December 2012**

Year	Number of Cases (%)					Total
	2008	2009	2010	2011	2012	
<b>Total deaths reported</b>	682	602	592	572	584	3032
<b>Audit process complete</b>	589 (86)	477 (79)	436 (74)	419 (73)	279 (48)	2200 (73)
<b>Proforma complete, awaiting assessment<sup>a</sup></b>	0 (0)	1 ( $<1$ )	4 (1)	19 (3)	283 (48)	307 (10)
<b>Proforma not returned<sup>b</sup></b>	55 (8)	71 (12)	90 (15)	86 (15)	0 (0)	302 (10)
<b>Terminal care cases (excluded from analyses)</b>	16 (2)	16 (3)	27 (5)	17 (3)	12 (2)	88 (3)
<b>Closed (no information available)</b>	11 (2)	22 (4)	24 (4)	13 (2)	0 (0)	70 (2)
<b>Cases associated with non-participation<sup>c</sup></b>	32 (5)	32 (5)	43 (7)	33 (6)	22 (4)	162 (5)

<sup>a</sup> Case awaiting first- or second-line assessment.

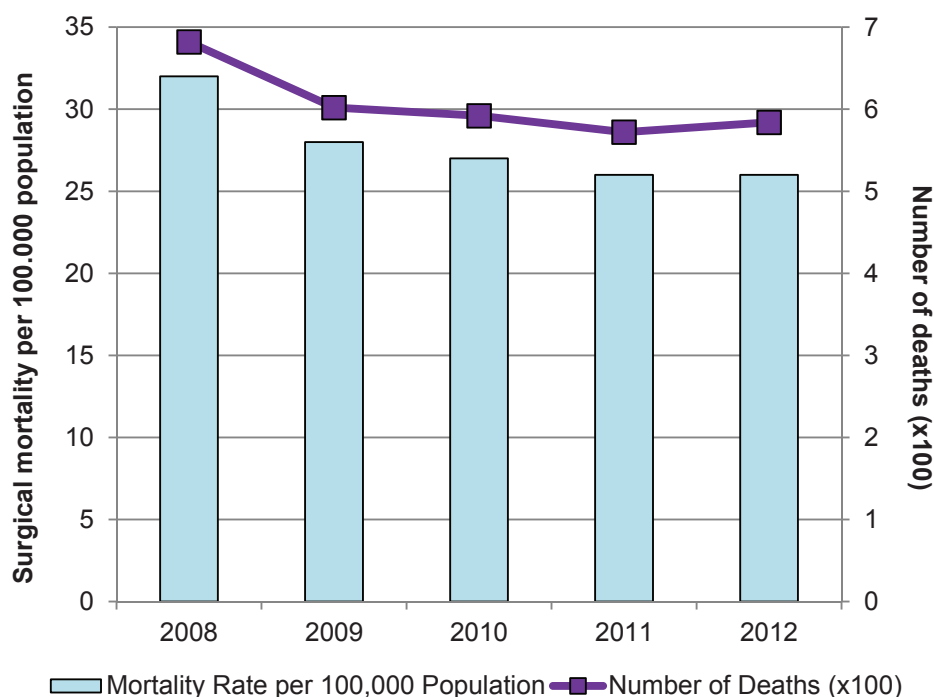
<sup>b</sup> Proformas are considered 'not returned' if they have not been received by the WAASM office within one year of the notification of death.

<sup>c</sup> Non-participants are surgeons who have indicated that they do not wish to participate in the WAASM.





**Figure 2 Number of deaths reported to WAASM compared with surgical mortality rates per 100,000 population**



Note: Total number of cases (n=3032).

**Table 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 <sup>#*</sup>
2008	682	32
2009	602	28
2010	592	27
2011	572	26
2012	584	26

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

\* Population data compiled from the Australian Bureau of Statistics.<sup>12</sup>

Please refer to Appendix C for further information.

**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 surgically-related deaths and in the surgical mortality rate – the number of deaths per 100,000 population has decreased from 32 in 2008 to 26 in 2012; this is a decrease of 19%.



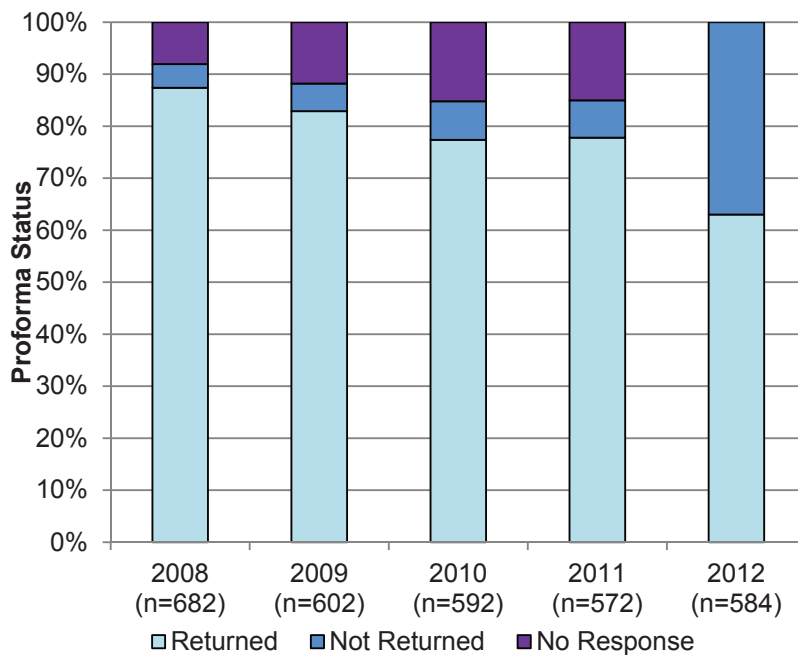
### 3.2 Participation in WAASM

#### KEY POINTS

- The percentage of proformas returned has decreased in recent years.
- Overall, 73% of cases for 2008–2012 completed the entire audit process.

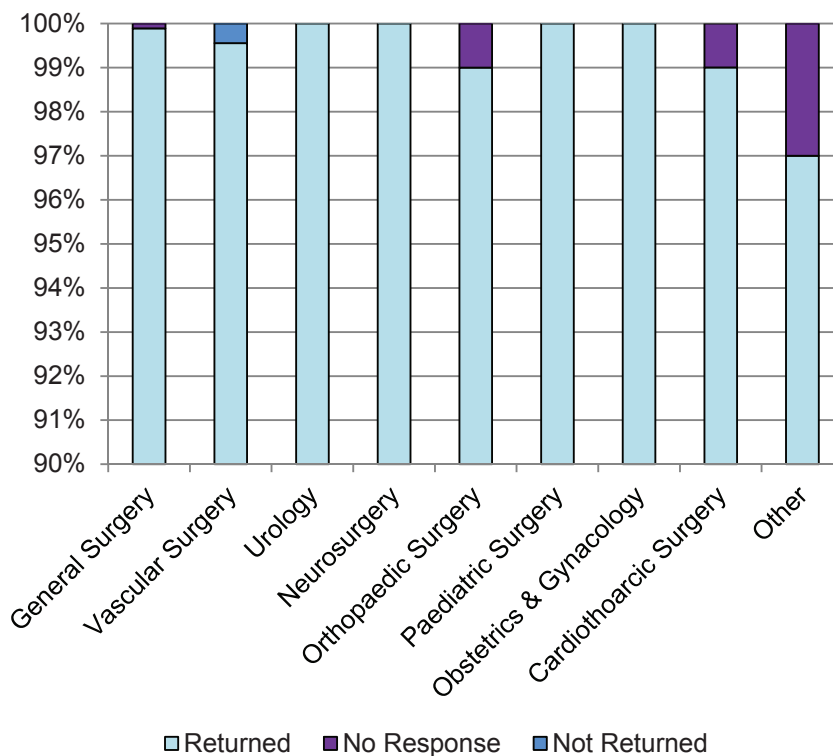
Participation in WAASM from 2008 to 2012 is depicted in Figures 3 and 4 and Table 3.

**Figure 3 Proforma completion rates**



Refer to Appendix C for further information on data. .

**Figure 4 Proforma status by specialty**



Note: 'Other' surgery includes the specialties of otolaryngology & ophthalmology and plastic surgery. Refer to Appendix C for further information on data.

**Table 3 Surgeon participation**

Year	Number of Cases (%)				
	2008	2009	2010	2011	2012
<b>Reported deaths</b>	682	602	592	572	584
<b>Number of surgeons associated with reported deaths</b>	182	154	151	162	162
<b>Proforma returned<sup>a</sup></b>	596 (87)	499 (83)	458 (77)	445 (78)	368 (63)
<b>Case statistics of surgeons associated with three or more deaths (%)</b>					
<b>Number of surgeons associated with three or more deaths</b>	78 (43)	76 (49)	71 (47)	73 (45)	75 (46)
<b>Total deaths related to surgeons associated with three or more deaths</b>	545 (80)	492 (82)	478 (81)	461 (81)	477 (82)
<b>Number of cases in progress</b>	0 (0)	1 (<1)	4 (1)	12 (3)	242 (51)
<b>Number of cases in which forms were not returned<sup>b</sup></b>	44 (8)	73 (15)	80 (17)	81 (18)	0 (0)
<b>Number of cases associated with non-participants<sup>c</sup></b>	32 (6)	30 (6)	41 (9)	33 (7)	22 (5)

<sup>a</sup> Includes terminal care cases; <sup>b</sup> Consultant no response; <sup>c</sup> Surgeon refused to participate.  
Refer to Appendix C for further information on data.

**Comment:**

Proforma returns have decreased from 87% in 2008 to 63% in 2012. This is not a welcome observation. WAASM staff are available to assist participants with whatever they may need to complete proformas. WAASM will continue to send out reminders for outstanding proformas.



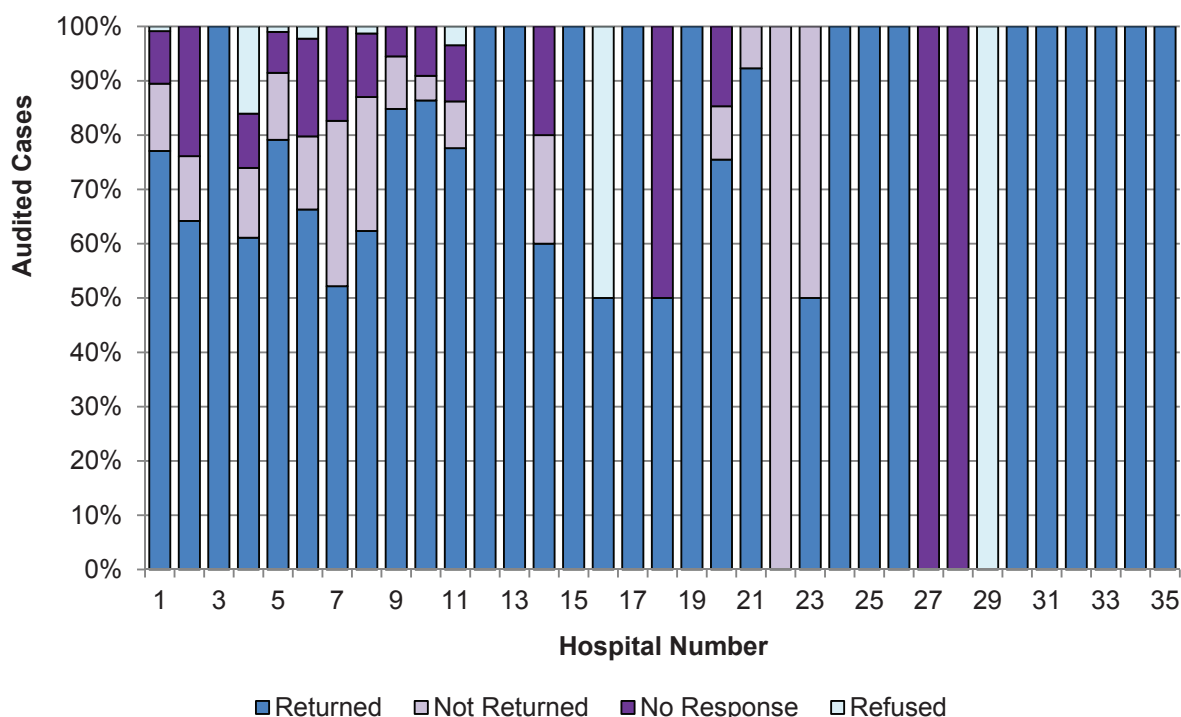
### 3.3 Hospital participation

#### KEY POINTS

- All hospitals in WA (public and private) participate in the audit.
- 82% of audited deaths occurred in public hospitals.
- 13% of audited deaths occurred in private hospitals.
- Overall, 21% of cases were transferred from one hospital to another.

Figure 5 shows the number of reported deaths of patients from 2008 to 2012 admitted for surgery in WA hospitals, and the related proforma status (returned versus not returned) for each hospital. Thirty-five hospitals were associated with the 3032 cases reported between 01 January 2008 and 31 December 2012.

**Figure 5 Reported deaths of patients admitted for surgery in Western Australian hospitals**



Refer to Appendix C for further information on data.

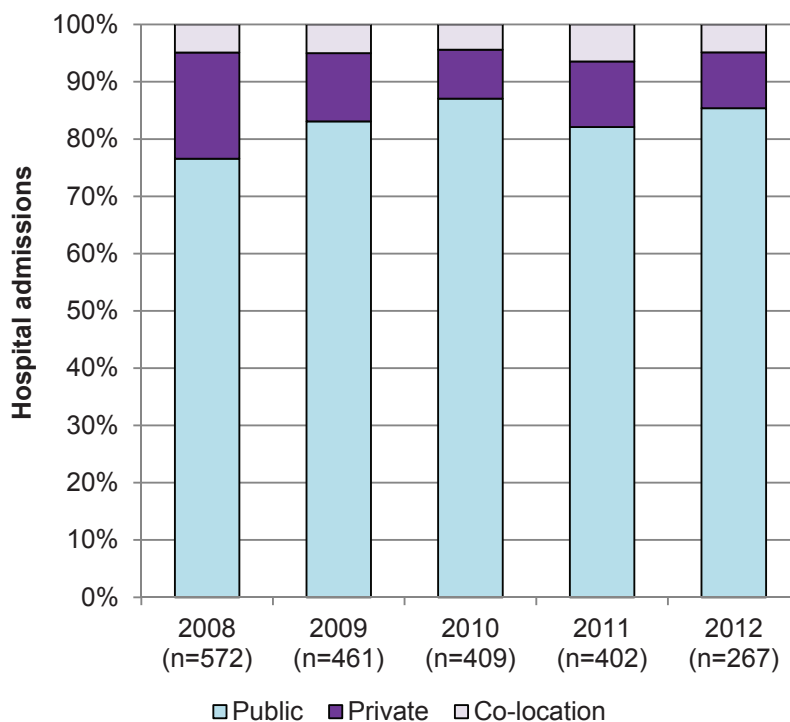
**Table 4 Cases where the patient was transferred from one hospital to another hospital**

Year	Number of Transfer Cases (%)					Total
	2008	2009	2010	2011	2012	
Completed cases	589	477	436	419	279	2200
Patients transferred <sup>a</sup>	125 (21)	94 (20)	91 (21)	88 (21)	67 (24)	465 (21)

<sup>a</sup> 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. Refer to Appendix C for further information on data.

#### Comment

Overall, in 21% of cases a patient was transferred between hospitals (Table 4). The cases that involved a transfer between hospitals, typically between a regional and metropolitan facility, remained stable from 2008 to 2012. An increase in transfer cases has been observed for 2012; this is data for one year only and it remains to be seen if this is a trend. However, it is in keeping with the overall observation that there has been an increase in the proportion of deaths occurring in teaching hospitals.

**Figure 6 Patients admitted to public or private hospitals**

Refer to Appendix C for further information on data.

**Comment**

There has been a 5% increase in public admissions from 2008 from 79% to 84%. Overall, approximately 82% of deaths occurred in public hospitals, 13% of deaths in private hospitals and 5% of deaths involving co-locations.

**3.4 Second-line assessment****KEY POINTS**

- Request for second-line assessments remained consistent throughout the audit period.
- Overall, 14% of cases were referred for second line assessments.

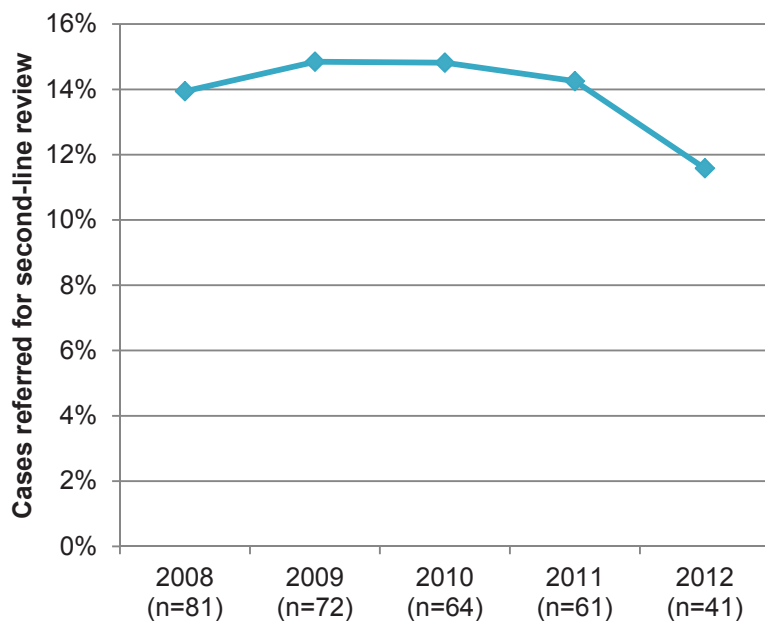
**Table 5 Cases referred for second-line assessment**

Year	Number of Cases (%)					Total
	2008	2009	2010	2011	2012	
<b>Completed proforma cases<sup>a</sup></b>	581	485	432	428	354	2280
<b>Cases referred for second-line assessment</b>	81 (14)	72 (15)	64 (15)	61 (14)	41 (12)	319 (14)
<b>Proforma returned, assessment in progress</b>	0 (0)	1 (<1)	4 (1)	13 (3)	87 (25)	105 (5)

<sup>a</sup> Terminal care cases were excluded. Refer to Appendix C for further information on data.



**Figure 7 Proportion of cases referred for second-line assessment**



**Comment:**

The proportion of cases referred for second-line review has slightly decreased in 2012 (see Table 5 and Figure 7). 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

- 54% of all cases were male and the median age of patients was 73 years (71 and 76 years for males and females respectively).
- A total of 2200 cases (2008–2012) had been through the complete audit process as of 31 March 2013.

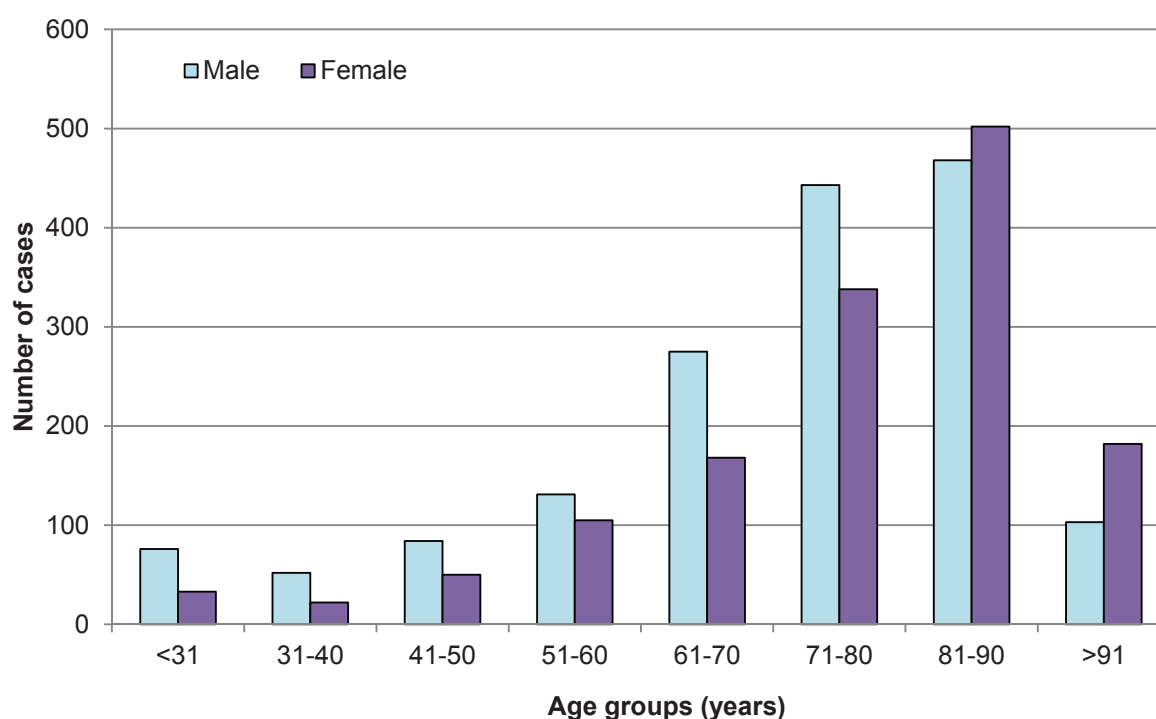
#### 4.1.1 Age and gender distribution

Table 6 shows the median age and sex of audited patients; Figures 8 and 9 look at the distribution of age by gender. Figure 10 reports on age by specialty.

Table 6 Median age by gender, 2008 - 2012

	Number of cases	Median age (years)	Interquartile range (years)
All Patients	3032	73	66-85
Male	1632 (54)	71	63-84
Female	1400 (46)	76	69-87

Figure 8 Age distribution by gender, 2008 – 2012



#### Comment:

Figure 8 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.



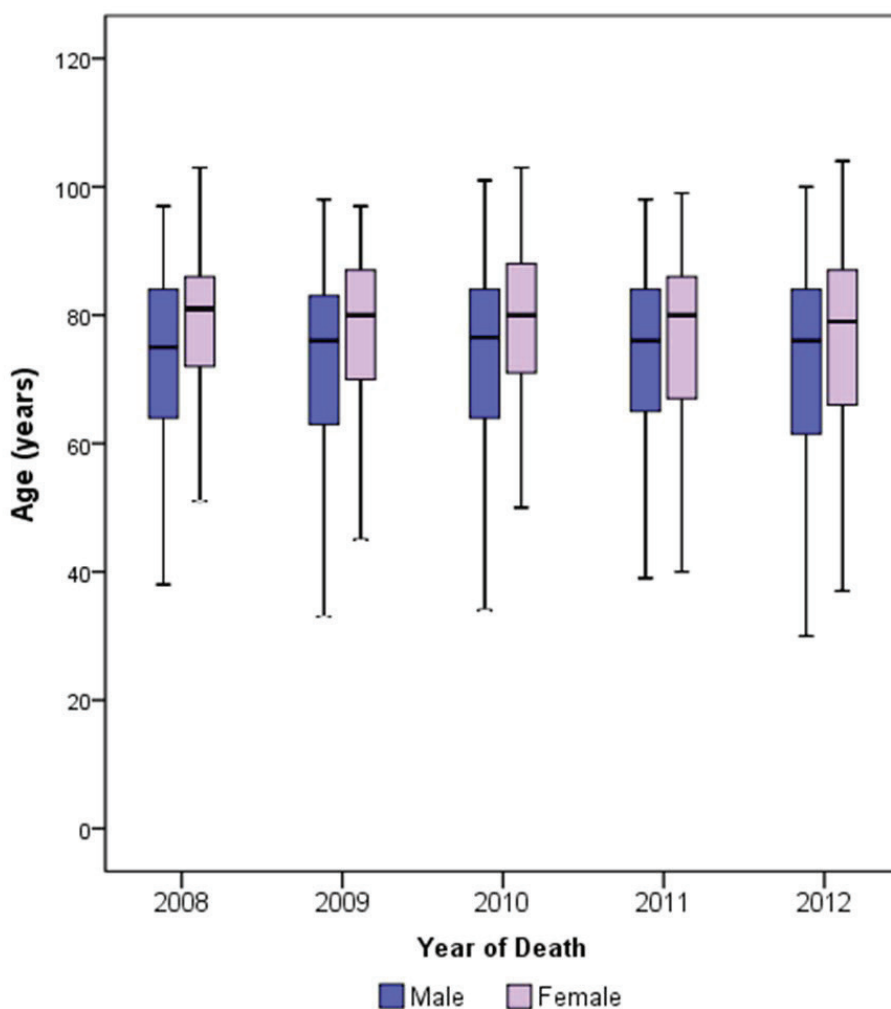
Figures 9 and 10 are box-and-whisker plots, in which:

- 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 9 and 10 they have been excluded.

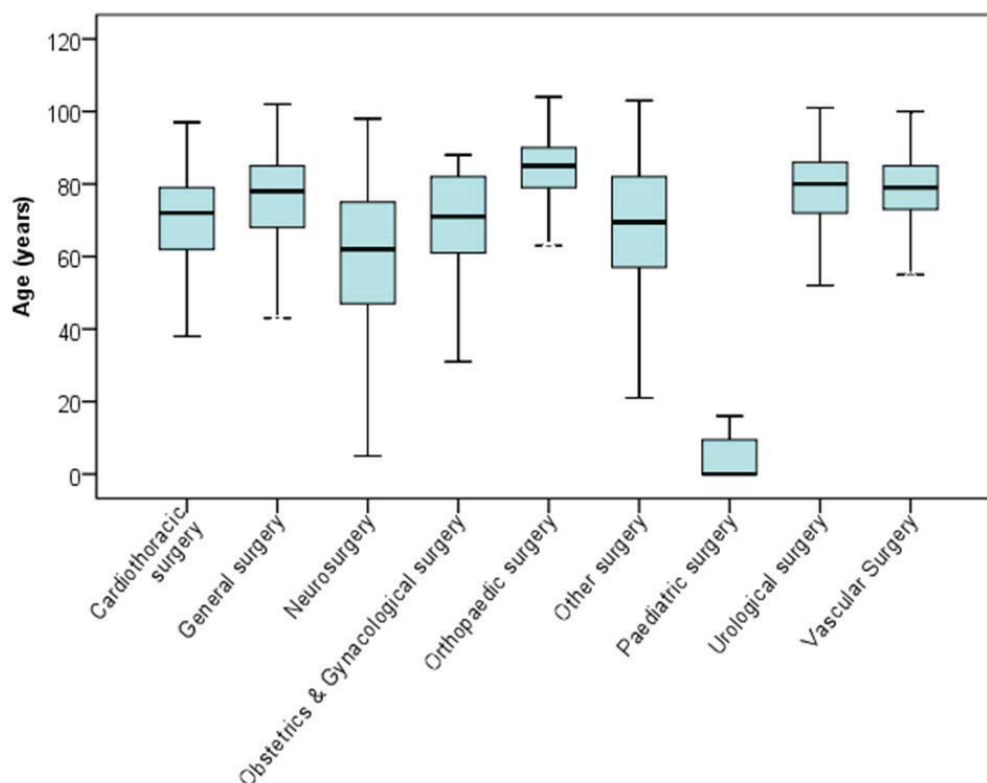
As expected, the age of patients varies depending on the speciality, with patients in the paediatrics category being appreciably younger than in the other specialities.

**Figure 9 Age distribution of audited patients**



Note: Outliers and extreme values are excluded. Refer to Appendix C for further information on data.



**Figure 10 Age of audited patients by speciality**

Refer to Appendix C for further information on data.

#### 4.1.2 American Society of Anaesthesiologists (ASA) grades

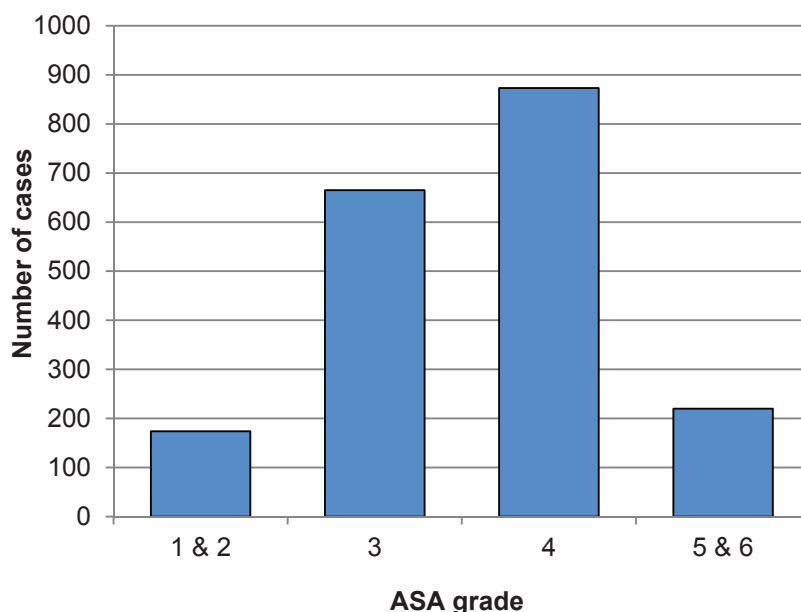
The American Society of Anaesthesiologists grades are an internationally recognised classification of preoperative physical status (see Table 7 and Figure 11).

**Table 7 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 11 ASA grades**



Note: Total number of cases (n=1932). Data missing for 1100 (36%) cases. Refer to Appendix C for further information on data.

**Comment:**

Eighty 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 1100 forms (36%) returned to WAASM over this report period (2008–2012). 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 8. The most common causes of death in those aged less than 70 years were brain haemorrhage and septicaemia. In those older than 70 years, the main causes of death were coronary-related and septicaemia. Details on cause of death for all patients can be found in Appendix A.

**Table 8 Most common causes of death in cases of surgical mortality**

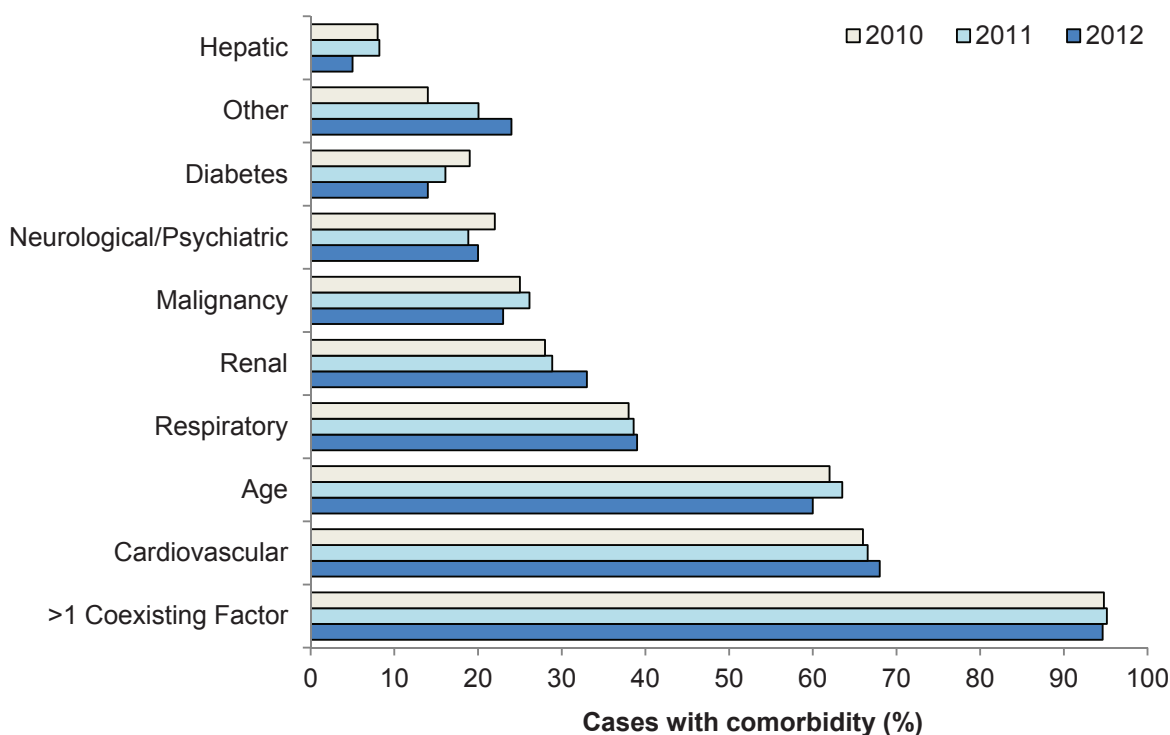
CAUSES OF DEATH		
Cases <70 years (n=1626)	n	%
Brain haemorrhage	174	12
Septicaemia	129	9
Multiple organ failure	112	8
Malignancy	105	7
Acute myocardial infarction	61	4
Respiratory failure	61	4
Cases ≥70 years (n=654)	n	%
Coronary issues	585	16
Septicaemia	348	9
Multiple organ failure	280	8
Pneumonia	212	6
Respiratory failure	198	5
Vascular insufficiency of the intestine	131	4



#### 4.1.4 Comorbidity

Surgeons are asked to indicate if there are any significant comorbidities associated with each case (see Figure 12). Neurosurgeons do not complete this question in their form and are therefore excluded from this analysis.

**Figure 12 Comorbidity statuses 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. Refer to Appendix C for further information on data.

#### Comment:

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

#### 4.1.5 High dependency and intensive care units

Table 9 shows the actual use of a high dependency unit (HDU) or intensive care unit (ICU), as well as cases where HDU or ICU were not used but, in the assessor's opinion, should have been.

**Table 9 Actual use, and assessor opinion of use, of a high dependency or intensive care unit**

Year death	Number of cases (%)					Total
	2008	2009	2010	2011	2012	
<b>Number of cases<sup>a</sup></b>	486	381	354	329	230	1780
<b>Use of ICU</b>	167 (34)	141 (37)	115 (32)	108 (33)	75 (33)	606 (34)
<b>Use of HDU</b>	79 (16)	65 (17)	61 (17)	59 (18)	39 (17)	303 (17)
<b>Assessor's opinions on whether ICU or HDU should have been used</b>						
<b>ICU should have been used</b>	4 (1)	7 (2)	14 (4)	11 (3)	2 (1)	38 (2)
<b>HDU should have been used</b>	39 (8)	23 (6)	20 (6)	15 (5)	5 (2)	102 (6)

<sup>a</sup> Number of cases is based on completed cases and excludes neurosurgical cases. Refer to Appendix C for further information on data.



**Comment:**

ICU facilities were used in 34% of surgical deaths reported to WAASM, while HDU facilities were used only in 17% of reported cases. As outlined in previous reports, there are a proportion of cases (8%) that would have potentially benefited from HDU or ICU but 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**

- Both first and second-line assessors reported more areas of concern or adverse events than surgeons.
- The number of adverse events reported by assessors has fallen from 9% of cases in 2008 to 5% of cases in 2011.
- The level of agreement between surgeon's and assessor's views on areas of concern or adverse events is improving.

Incidents reported by the surgeons and assessors are compared in Table 10. Data is reported from 2008 until 2012. The number of assessor-reported adverse events has fallen from 9% of cases in 2008 to 5% of cases in 2011. Data presented for 2012 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 10 Surgeons' and assessors' views on performance**

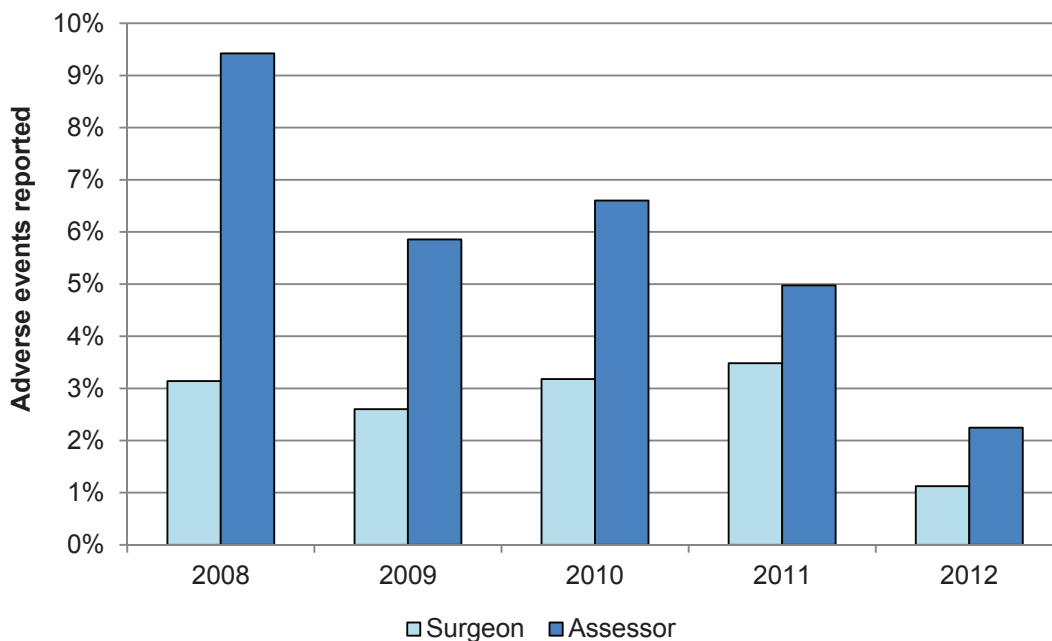
YEAR	SURGEON	ASSESSOR				Total
		Consideration	Concern	Adverse Event	No Event	
2008	Consideration	20	13	8	13	54
	Concern	1	9	4	3	17
	Adverse Event	2	5	9	2	18
	No Event	56	21	33	374	484
<b>Total</b>		<b>79</b>	<b>48</b>	<b>54</b>	<b>392</b>	<b>573</b>
2009	Consideration	7	6	3	16	32
	Concern	4	9	3	5	21
	Adverse Event	1	4	7	0	12
	No Event	38	14	14	330	396
<b>Total</b>		<b>50</b>	<b>33</b>	<b>27</b>	<b>351</b>	<b>461</b>
2010	Consideration	13	7	4	12	36
	Concern	2	3	1	2	8
	Adverse Event	0	5	3	5	13
	No Event	24	13	19	296	352
<b>Total</b>		<b>39</b>	<b>28</b>	<b>27</b>	<b>315</b>	<b>409</b>
2011	Consideration	9	7	1	11	28
	Concern	3	5	1	3	12
	Adverse Event	2	1	9	2	14
	No Event	26	9	9	304	348
<b>Total</b>		<b>40</b>	<b>22</b>	<b>20</b>	<b>320</b>	<b>402</b>
2012	Consideration	9	3	2	6	20
	Concern	1	6	2	1	10
	Adverse Event	1	0	1	1	3
	No Event	15	2	1	216	234
<b>Total</b>		<b>26</b>	<b>11</b>	<b>6</b>	<b>224</b>	<b>267</b>

Note: Data can only be analysed when both surgeon & assessor have completed the proforma. Refer to Appendix C for further information on data.



Figure 13 below compares the proportion of adverse events reported by surgeons and assessors for the same cases.

**Figure 13 Percentage of adverse events reported by surgeons and assessors**



**Comment:**

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 11. 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 11 Level of agreement between surgeons' and assessors' views on quality of clinical care**

Year	Kappa score (95% confidence interval)	Interpretation of Kappa score
2008	0.304 (0.237-0.371)	Fair agreement
2009	0.298 (0.214-0.382)	Fair agreement
2010	0.294 (0.205-0.382)	Fair agreement
2011	0.379 (0.281-0.478)	Fair agreement
2012	0.487 (0.359-0.616)	Moderate agreement
<b>Overall</b>	<b>0.333 (0.293-0.372)</b>	<b>Fair agreement</b>

**Comment:**

In previous reports, there was a trend of surgeons' under-reporting events that the assessors believe represent an area of concern or adverse event. However, in recent years it appears as if the gap in reporting adverse events between surgeons and assessors is decreasing (see Table 10). In the last two years, in particular, the level of agreement between surgeons and assessors on areas of concern or adverse events has improved dramatically. In 2012, surgeons and assessors views on quality of clinical care were in moderate agreement.

**4.3 Clinical adverse events**

KEY POINTS
<ul style="list-style-type: none"> <li>Assessors reported that preventable adverse events caused death in 11 (1%) cases throughout the audit period (2008 to 2012).</li> </ul>

**4.3.1 Reported areas for consideration, areas of concern and adverse events**

Areas for consideration, areas of concern, and adverse events related to audited cases were analysed. Table 12 reports the number of cases associated with an area for consideration, area of concern or adverse event.

**Table 12 Audited deaths associated with areas for consideration, areas of concern or adverse events, as reported by assessors**

Year of Death	Number of Cases (%)					
	2008	2009	2010	2011	2012	Total
<b>Total number of cases</b>	486	382	355	329	229	1781
<b>Area for consideration</b>	79 (16)	49 (13)	38 (11)	40 (12)	26 (11)	232 (13)
<b>Area for concern</b>	48 (10)	33 (9)	28 (8)	22 (7)	11 (5)	142 (8)
<b>Adverse event (AE)</b>	52 (11)	27 (7)	26 (7)	20 (6)	5 (2)	130 (7)
<b>AE that caused death</b>	34 (7)	19 (5)	17 (5)	10 (3)	3 (1)	83 (5)
<b>AE that caused death, considered definitely preventable</b>	3 (1)	3 (1)	2 (1)	2 (1)	1 (<1)	11 (1)

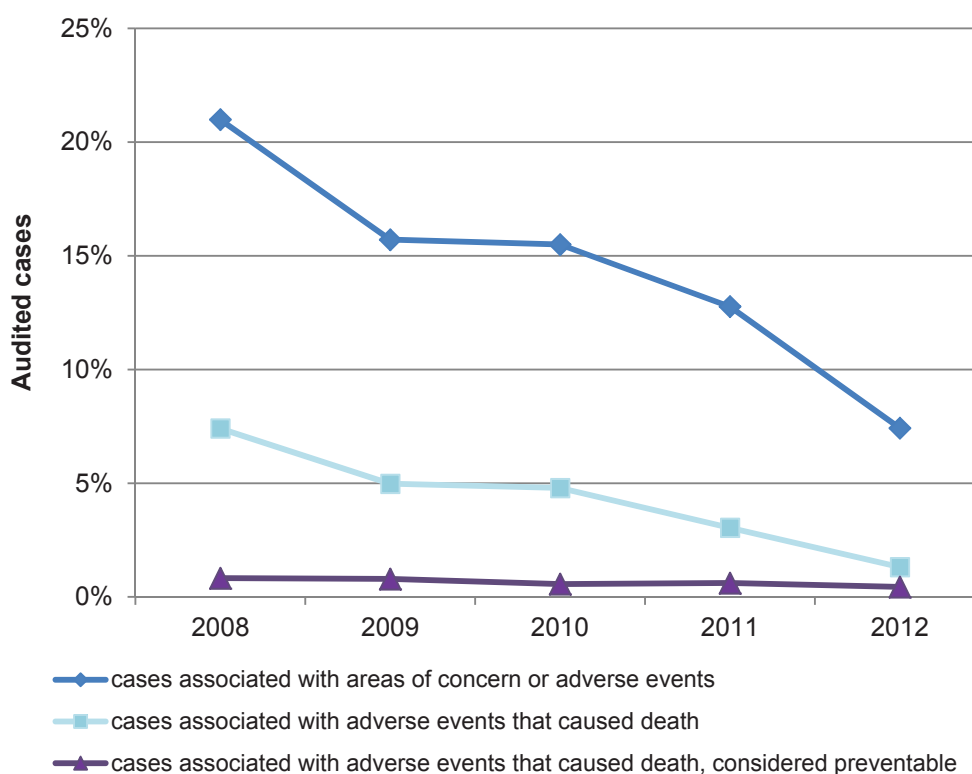
Note: The most significant event only is included for each case. Refer to Appendix C for further information on data.



### Comment:

Areas of concern or adverse events were reported by assessors in 272 (15%) cases since 2008. Three cases (1%) in 2012 were associated with an adverse event that caused death, one case of which was associated with an event that was considered "definitely preventable". The percentage of audited cases associated with adverse events or areas of concern (2008 to 2012) is provided in Figure 14, which shows a decrease in the percentage of audited cases associated with an area of concern and adverse event.

**Figure 14 Cases associated with areas of concern, adverse events that caused deaths and are preventable**



## 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 13).

KEY POINTS	
•	Over the period 2008 to 2012, 82% of cases were admitted to public hospitals, 13% were admitted to private hospitals and 5% were admitted to both private and public hospitals.
•	Of the 1696 cases admitted to public hospitals, 11% were elective admissions.
•	Of the 259 cases admitted to private hospitals, 44% were elective admissions.
•	Of the emergency cases admitted to public hospitals, 61% underwent an operation, compared to 89% of emergency cases in private hospitals ( $p < 0.0001$ ).
•	The proportion of operative cases (both elective and emergency admissions) with an area of concern or adverse event was not significantly different between public and private hospitals ( $p = 0.164$ ). <sup>a</sup>
•	Considering all private and public hospitals (excluding co-location), the proportion of cases with an area of concern or adverse event associated with an emergency admission (14%) was significantly less than the proportion of these events associated with elective admissions (29%) ( $p < 0.0001$ ). <sup>a</sup>

a Pearson's Chi-squared test.

**Table 13 Elective and emergency admissions to public and private hospitals, 2008 - 2012**

Number of Cases (%)				
	Hospital admissions	Elective	Emergency	Total
(a) All audited cases	Private	113 (44)	146 (56)	259 (13)
	Public	184 (11)	1512 (89)	1696 (82)
	Co-location	11 (10)	97 (90)	108 (5)
	<b>Total</b>	<b>308 (15)</b>	<b>1755 (85)</b>	<b>2063</b>
(b) Cases that underwent an operation	Private	109 (96)	130 (89)	239 (92)
	Public	171 (93)	929 (61)	1100 (65)
	Co-location	10 (91)	64 (66)	74 (69)
	<b>Total</b>	<b>290 (94)</b>	<b>1123 (64)</b>	<b>1413 (68)</b>
(c) Cases associated with an area of concern or adverse event	Private	31 (27)	19 (13)	50 (19)
	Public	55 (30)	148 (10)	203 (12)
	Co-location	2 (18)	16 (16)	18 (17)
	<b>Total</b>	<b>88 (29)</b>	<b>183 (10)</b>	<b>271 (13)</b>
(d) Cases that underwent an operation that were associated with an area of concern or adverse event	Private	31 (28)	17 (13)	48 (20)
	Public	51 (30)	133 (14)	184 (17)
	Co-location	2 (20)	11 (17)	13 (18)
	<b>Total</b>	<b>84 (29)</b>	<b>161 (14)</b>	<b>245 (17)</b>

Percentages in parts (b) and (c) relate to figures in part (a). Percentages in part (d) relate to figures in part (b). Refer to Appendix C for further information on data.





#### 4.4.2 Relationship between factors related to admission data

##### KEY POINTS

- In total, 68% of cases underwent one or more operations.
- In total, 94% 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 (93%) ( $P=0.204$ ).<sup>a</sup>
- Of the 1755 emergency admissions, 64% underwent an operation. A significantly higher proportion of emergency admissions admitted to private hospitals underwent surgery (89%) compared to those admitted as an emergency to public hospitals (61%) ( $P<0.0001$ ).<sup>a</sup>
- Among emergency admissions undergoing surgery and associated with areas of concern or adverse events, the proportion admitted to private hospitals (13%) was not significantly different from the proportion admitted to public hospitals (14%) ( $P=0.216$ ).<sup>a</sup>
- 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 (30%) ( $P=0.804$ ).<sup>a</sup>
- In those cases undergoing surgery, the proportion of elective cases associated with an area of concern or adverse event (29%) was significantly greater than the proportion in emergency cases (14%) ( $P<0.0001$ ).<sup>a</sup>

<sup>a</sup> Pearson's Chi-squared test.

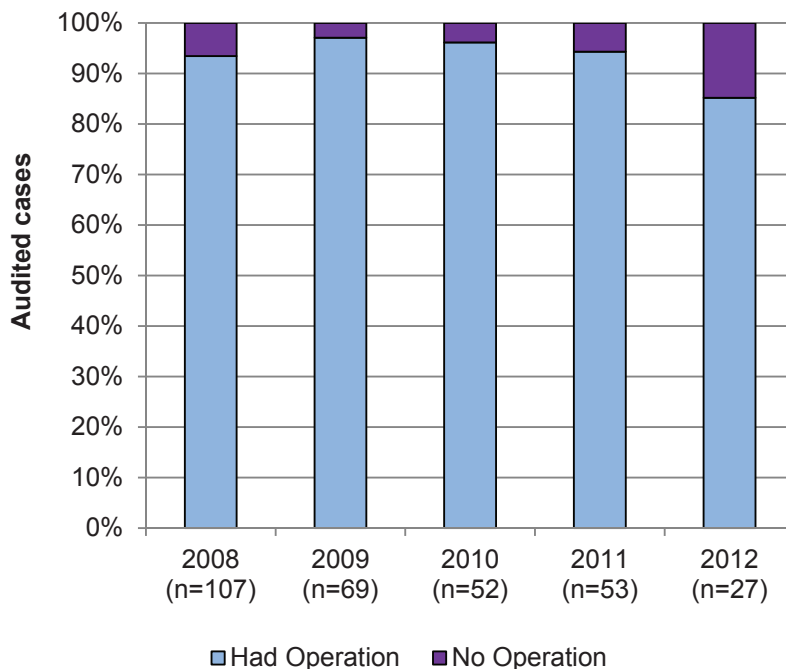
**Table 14 Emergency admissions to private and public hospitals**

Number of emergency admissions (%)			
	Admission to private hospitals (n=146)	Admissions to public hospitals (n=1512)	Admissions at co-location (n=97)
<b>Underwent operation</b>	130 (89)	929 (61)	64 (66)
Number of emergency admissions by surgical specialties (%)			
<b>General surgery</b>	65 (45)	620 (41)	57 (59)
<b>Orthopaedic surgery</b>	37 (25)	332 (22)	34 (35)
<b>Urological surgery</b>	8 (5)	37 (2)	4 (4)
<b>Cardiothoracic surgery</b>	15 (10)	63 (4)	0 (0)
<b>Vascular surgery</b>	11 (8)	144 (10)	1 (1)
<b>Neurosurgery</b>	8 (5)	275 (18)	0 (0)
<b>Paediatric Surgery</b>	0 (0)	5 (<1)	0 (0)
<b>Other surgery*</b>	2 (1)	35 (2)	1 (1)
Emergency admissions where no operation was performed (%)			
Reason for no operation	Admissions to private hospitals (n=16)	Admissions to public hospitals (n=583)	Admissions at co-location (n=33)
<b>Active decision not to operate</b>	8 (50)	241 (41)	15 (45)
<b>Not a surgical problem</b>	1 (6)	70 (12)	4 (12)
<b>Patient refused operation</b>	2 (13)	45 (8)	6 (18)
<b>Rapid death</b>	1 (6)	55 (9)	1 (3)
<b>Missing data</b>	4 (25)	172 (30)	7 (21)

\*Other surgery' includes ENT, ophthalmology, plastic and oral maxillofacial. Refer to Appendix C for further information on data.

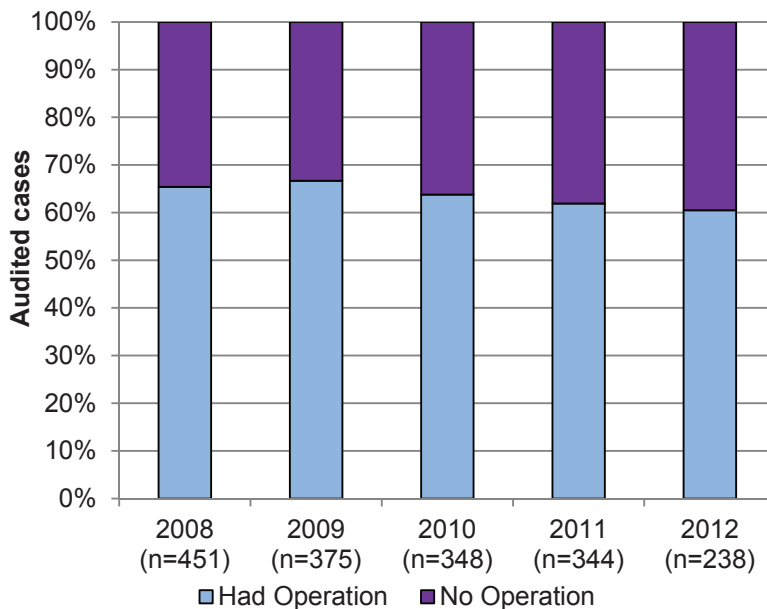


**Figure 15 Percentage of elective admissions associated with an operation or no operation**



Note: Graph represents completed cases only. Refer to Appendix C for further information on data.

**Figure 16 Percentage of emergency admissions associated with an operation or no operation**



**Comment:**

A decreasing trend in emergency admissions that underwent an operation is observed from 2009 to 2012, and is displayed in Figure 16. 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

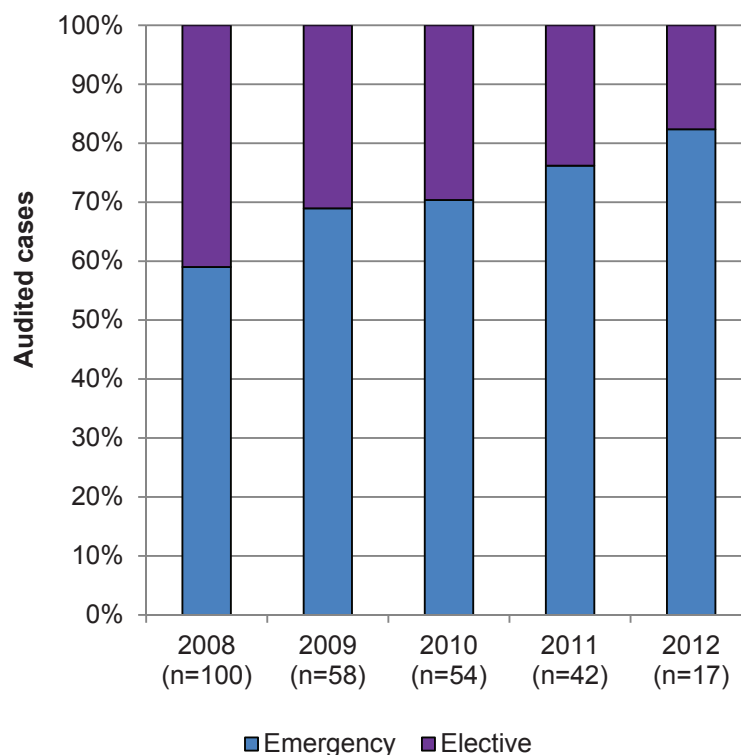
Cases in which areas of concern or adverse events have been identified and that are associated with emergency or elective admissions are outlined in Table 15 and Figures 17 and 18. Details of areas of concern or adverse events in elective and emergency admissions are given in Tables 16 and 17 respectively.

**Table 15 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	88 (4)	220 (11)	308 (15)
Emergency	183 (9)	1573 (76)	1756 (85)
<b>Total</b>	<b>271 (13)</b>	<b>1793 (87)</b>	<b>2064</b>

Note: Cross tabulation only on complete data. Refer to Appendix C for further information on data.

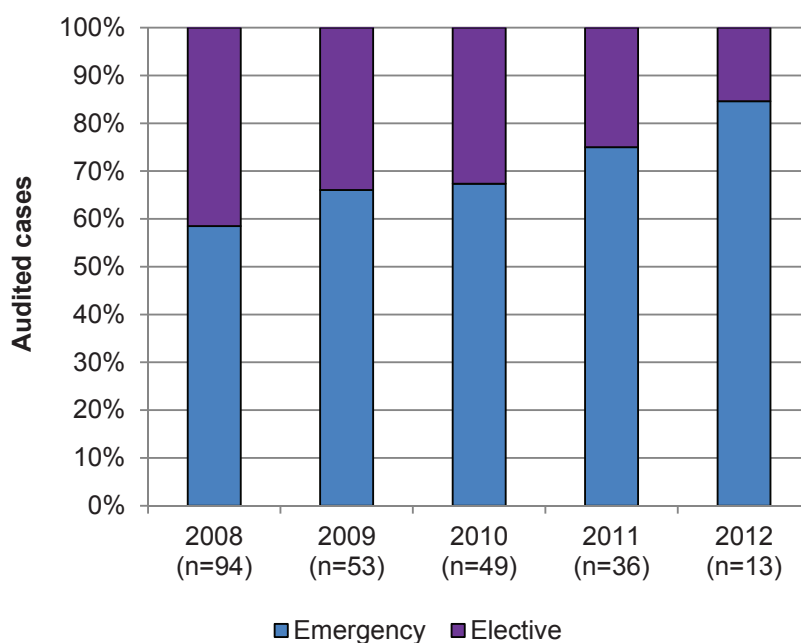
**Figure 17 Cases associated with areas of concern or adverse events – emergency and elective admissions**



Refer to Appendix C for further information on data.



**Figure 18 Operative cases associated with areas of concern or adverse events – emergency and elective admissions**



Refer to Appendix C for further information on data.

**Comment:**

There has been a dramatic decrease in the proportion of elective surgeries associated with areas of concern or adverse events from 2008 to 2012.

**Table 16 All areas of concern or adverse events associated with elective admissions**

Elective admissions associated with an area of concern or adverse event (n=88 out of a total of 308 elective cases)		
Area of concern or adverse event	Number of events	Percentage
Related to open surgery	21	24%
General complications	17	20%
Unsatisfactory medical management	9	10%
Related to delays	7	8%
Communication failures	7	8%
Related to laparoscopic surgery	5	6%
Decision to operate	5	6%
Related to endoscopic surgery	4	5%
Assessment/diagnosis related issues	4	5%
Drug-related issues	3	3%
Failure to use facilities	3	3%
Related to anaesthesia	1	1%
Fluid balance issues	1	1%
<b>Total</b>	<b>87</b>	<b>28%</b>

Note: Data missing for 1 case

**Table 17 All areas of concern or adverse events associated with emergency admissions**

<b>Emergency admissions associated with an area of concern or adverse event (n=183 out of a total of 1755 emergency cases)</b>		
<b>Area of concern or adverse event</b>	<b>Number of events</b>	<b>Percentage</b>
Related to delays	56	31%
General complications	25	14%
Unsatisfactory medical management	21	12%
Decision to operate	16	9%
Related to open surgery	14	8%
Related to endoscopic surgery	10	5%
Assessment/diagnosis related issues	10	5%
Injury caused by fall in hospital	8	4%
Communication failures	5	3%
Drug-related issues	4	2%
Fluid balance issues	4	2%
Failure to use facilities	3	2%
Related to anaesthesia	2	1%
Related to transfer	2	1%
Related to laparoscopic surgery	1	1%
Related to radiological operation	1	1%
<b>Total</b>	<b>182</b>	<b>10%</b>

Note: Data missing for 1 case

**Comment:**

For elective admissions, the most common areas of concern or adverse events were related to open surgery, general complications and unsatisfactory medical management. In emergency admissions, delays were the leading cause of areas of concern or adverse events.

**4.5 Operative and non-operative cases****KEY POINTS**

- In 32% of completed cases, an operation was not performed.
- In the 1446 cases in which an operation was undertaken, 5% of cases were abandoned.

**4.5.1 Operative cases**

Data on operative cases appears in Table 18 and in Figure 19.

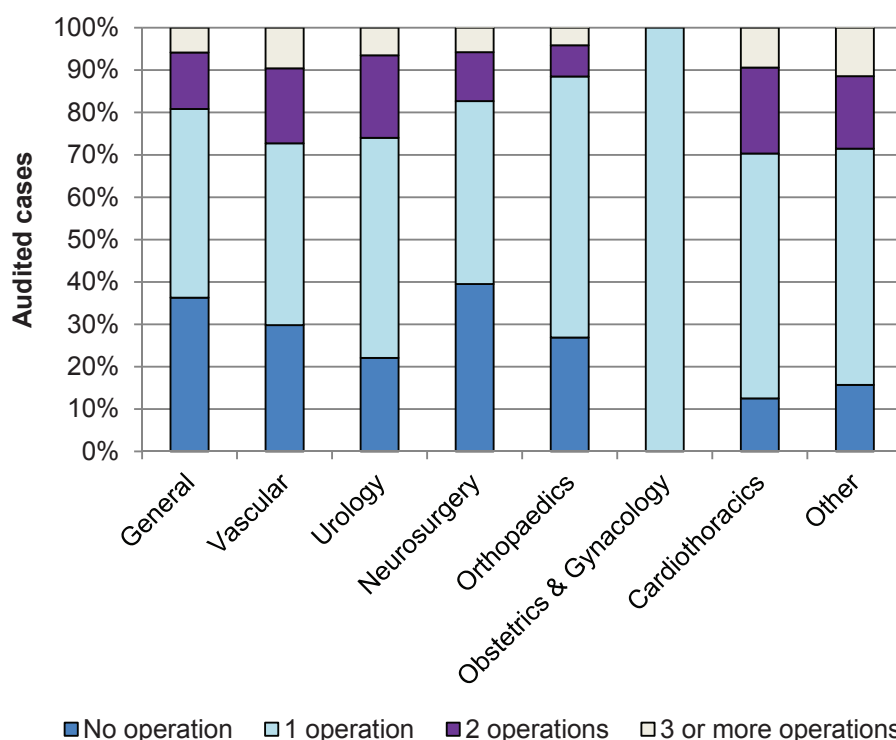


**Table 18 Operations performed**

Year	Number of Cases (%)					Total
	2008	2009	2010	2011	2012	
Completed cases per year	573	461	409	402	267	2112
Total operative cases	407 (71)	325 (70)	278 (68)	268 (67)	168 (63)	1446 (68)
No operation performed	166 (29)	136 (30)	131 (32)	134 (33)	99 (37)	666 (32)
1 operation performed	298 (52)	231 (50)	201 (49)	177 (44)	131 (49)	1038 (49)
2 operations performed	73 (13)	69 (15)	44 (11)	62 (15)	27 (10)	275 (13)
3 or more operations performed	36 (6)	25 (5)	33 (8)	29 (7)	10 (4)	133 (6)

Note: Cross-tabulation performed with complete data only. Refer to Appendix C for further information on data.

**Figure 19 Number of operations by specialty**



Refer to Appendix C for further information on data.

**Comment:**

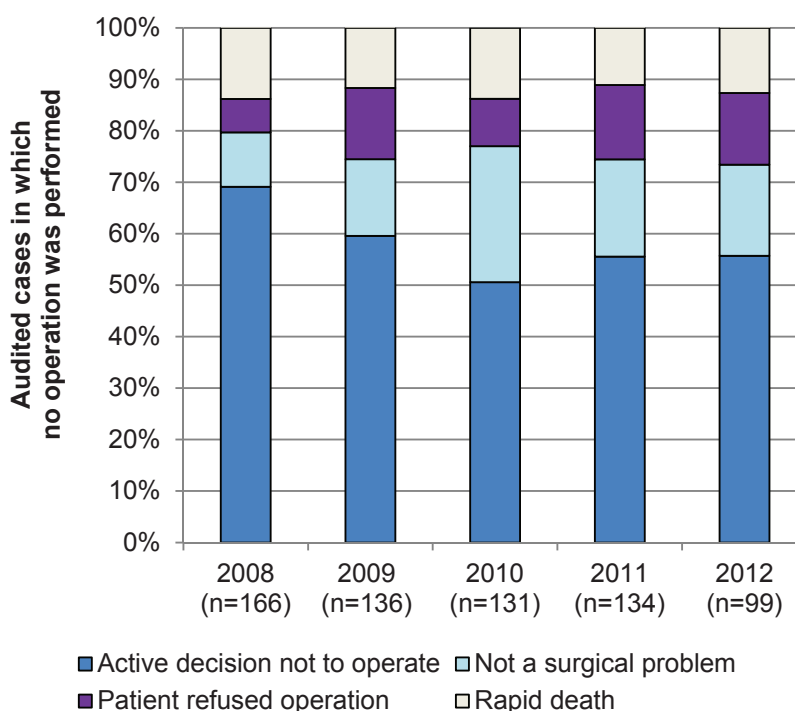
Reviewed cases of surgical mortality in which an operation was performed have decreased from 407 (71%) cases in 2008 to 168 (63%) cases in 2012. The majority of patients (49%) had one operation, while 13% had a second operation. Six per cent of cases underwent three or more operations, while 32% of cases overall did not undergo an operation (Table 18).

**Table 19 Operations abandoned, including patients undergoing one or more surgical procedures**

Year Death	Number of cases (%)					
	2008	2009	2010	2011	2012	Total
Total number of operative cases	407	325	278	268	168	1446
Abandoned at 1st operation	17 (4)	10 (3)	14 (5)	7 (3)	8 (5)	56 (4)
Abandoned at 2nd operation	2 (<1)	2 (1)	1 (<1)	5 (2)	0 (0)	10 (1)
Abandoned at 3rd operation	1 (<1)	1 (<1)	2 (1)	2 (1)	0 (0)	6 (<1)
Total number of cases in which an operation was abandoned	20 (5)	13 (4)	17 (6)	14 (5)	8 (5)	72 (5)

#### 4.5.2 Non-operative cases

Data on non-operative cases appears below in Figure 20.

**Figure 20 Reasons for no operation**

Note: Some cases are associated with more than one reason for no operation. Refer to Appendix C for further information on data.

#### 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 20).



**Table 20 Comparison of views of surgeons and assessors on preoperative risk of death in cases undergoing an operation**

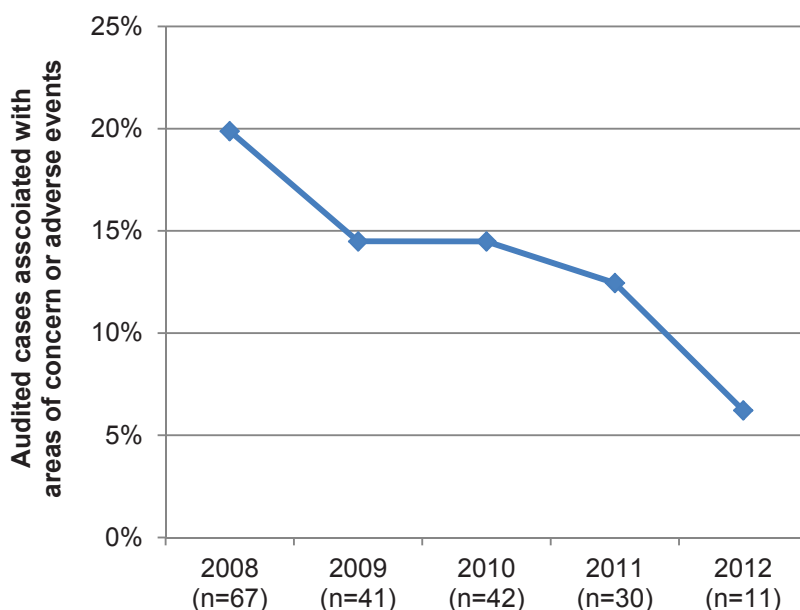
Number of Cases (%)				
Assessor's view of risk	Surgeon's view of risk			Total
	Minimal/small	Moderate	Considerable/expected	
Minimal/small	57 (4)	28 (2)	12 (1)	97 (7)
Moderate	44 (3)	123 (9)	115 (8)	282 (21)
Considerable/expected	49 (4)	206 (15)	724 (53)	979 (72)
<b>Total</b>	<b>150 (11)</b>	<b>357 (26)</b>	<b>851 (63)</b>	<b>1358</b>

Note: Data missing for 331 (20%) cases. Kappa measurements can only be calculated on complete information from both surgeon and assessor; Kappa score (K) = 0.312, 95% CI 0.266–0.358 (p<0.0001), indicating that surgeons and assessors were in 'fair agreement'. Refer to Appendix C for further information on data.

#### 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 21 and 22.

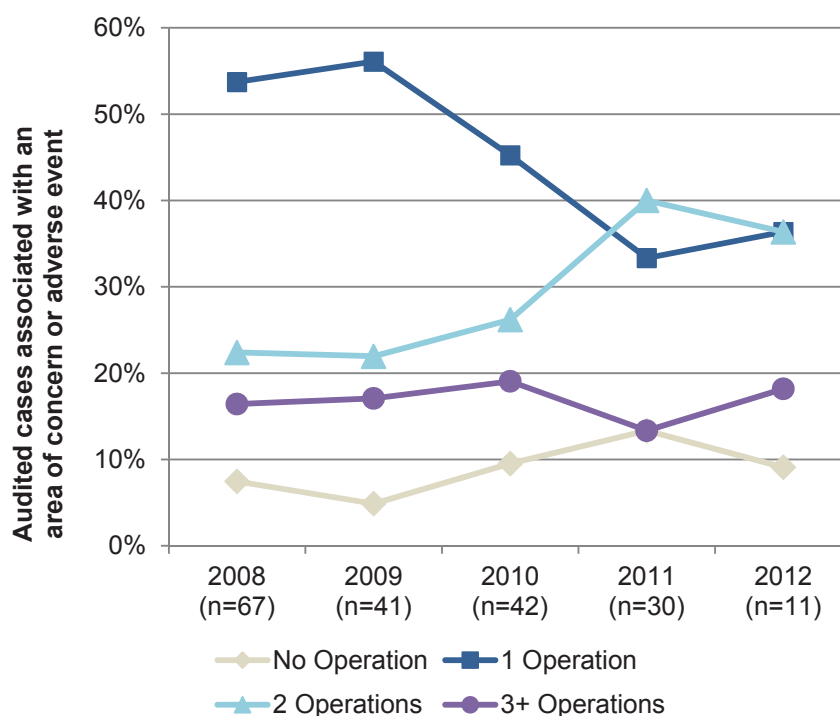
**Figure 21 Cases associated with areas of concern or adverse events in WA teaching hospitals**







**Figure 22 Cases associated with areas of concern or adverse events in WA teaching hospitals, by number of operations performed**



#### 4.5.5 Unplanned return to theatre

Unplanned return to theatre cases are given in Table 21.

**Table 21 Unplanned return to theatre**

Unplanned returns to theatre	Year					Total
	2008	2009	2010	2011	2012	
Number of cases in which at least one operation was performed	407	325	278	268	168	1446
Cases where surgeons reported an unplanned return to theatre (%)	63 (15)	44 (14)	41 (15)	33 (12)	20 (12)	201 (14)

**Comment:**

The proportion of patients dying after an unplanned return to theatre has reduced from 15% in 2008 to 12% in 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.

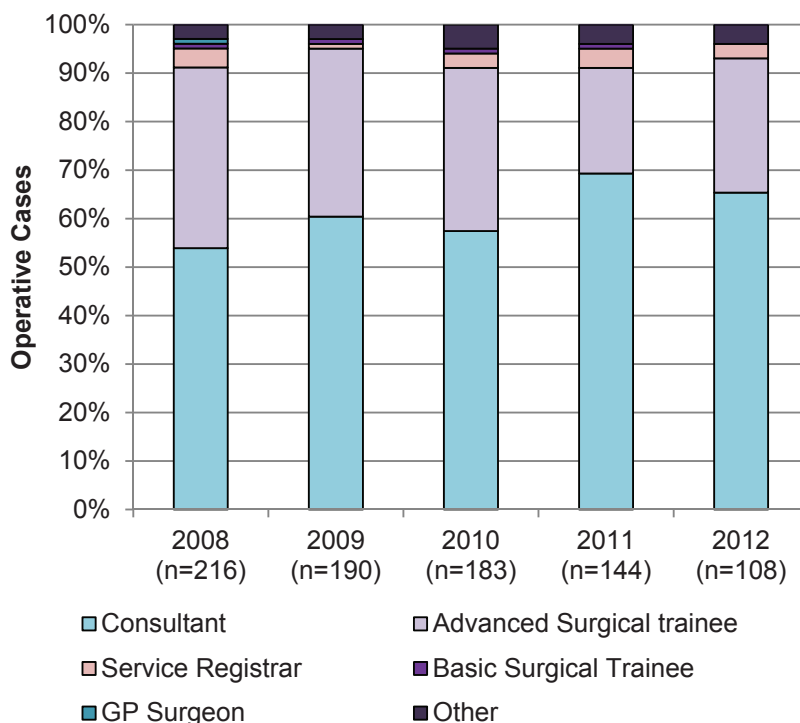
The number of audited operative cases in teaching hospitals has decreased since 2008. The number of consultants performing primary operations in teaching hospitals has increased (see Figure 23); the number of consultants performing subsequent operations in return to theatre cases has steadily increased over the years (see Figure 24).



**Table 22 Deaths after surgery in Western Australian teaching hospitals**

Year	Number of cases (%)					Total
	2008	2009	2010	2011	2012	
<b>Number of audited operative cases in teaching hospitals</b>	278	242	230	196	128	1074
<b>Consultant decision to operate</b>	200 (72)	178 (74)	180 (78)	139 (71)	101 (79)	798 (74)
<b>Consultant operating or directly assisting</b>	141 (51)	136 (56)	126 (55)	117 (60)	88 (69)	608 (57)

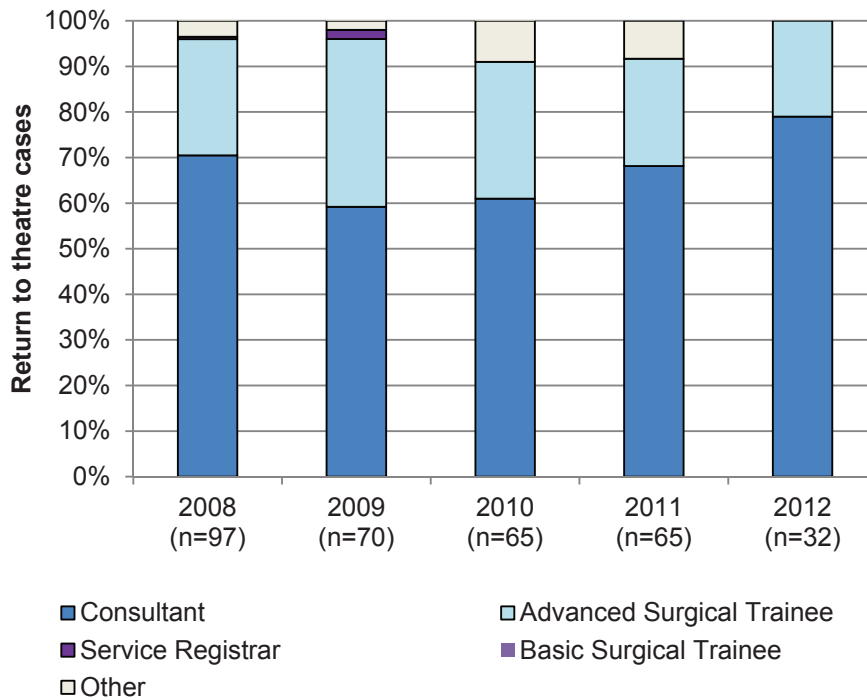
**Figure 23 Grade of surgeon performing first operation in Western Australian teaching hospitals**



Note: Some of the information on grade of operating surgeon was missing. 'Other' includes interns, resident medical officers and senior registrars. Refer to Appendix C for further information on data.

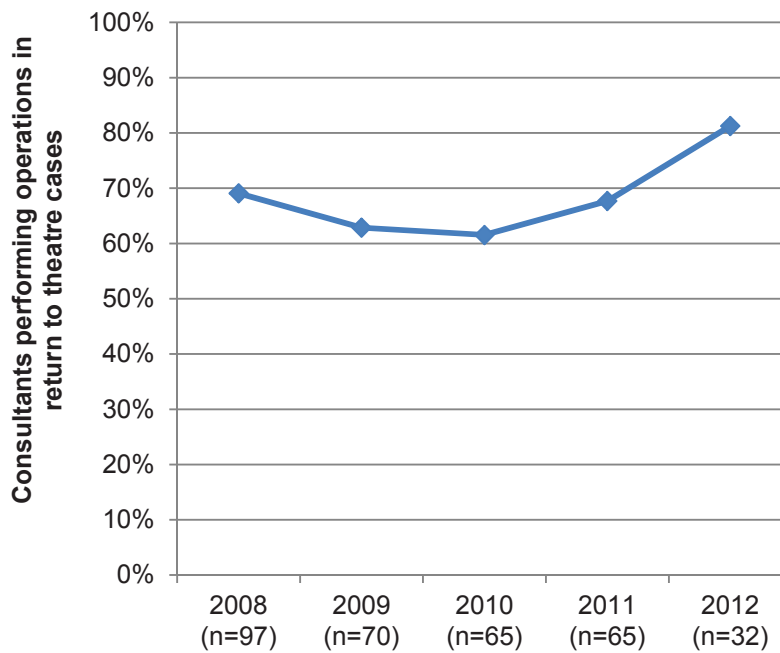


**Figure 24 Grade of surgeon performing subsequent operations in return to theatre cases in Western Australian teaching hospitals**



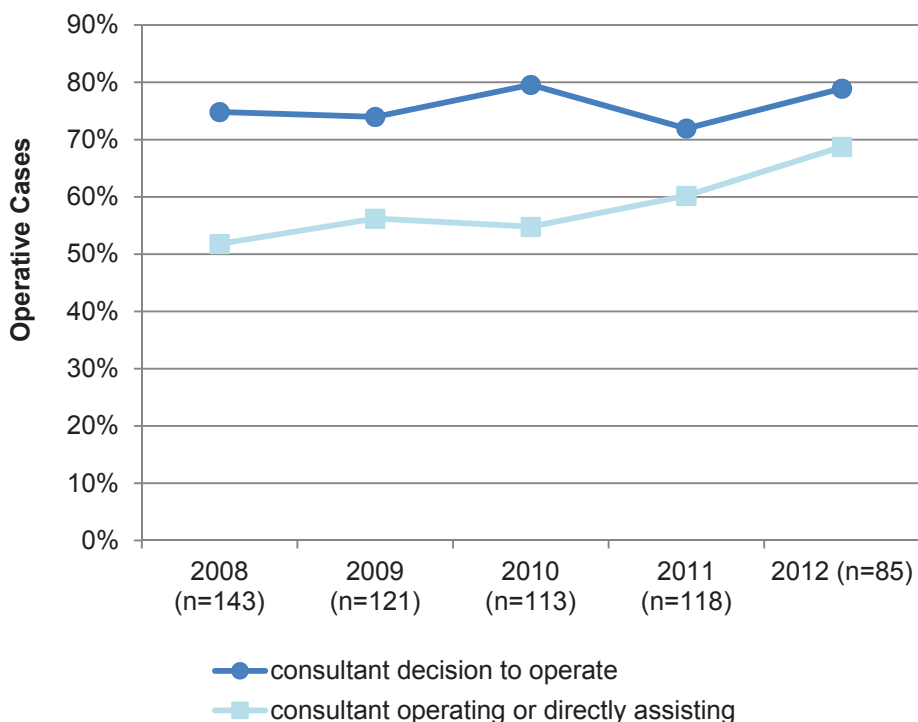
Note: 'Return to theatre' includes all second, third or subsequent operations. 'Other' includes interns, resident medical officers and senior registrars. Refer to Appendix C for further information on data.

**Figure 25 Consultant supervision in cases returned to theatre in Western Australian teaching hospitals**

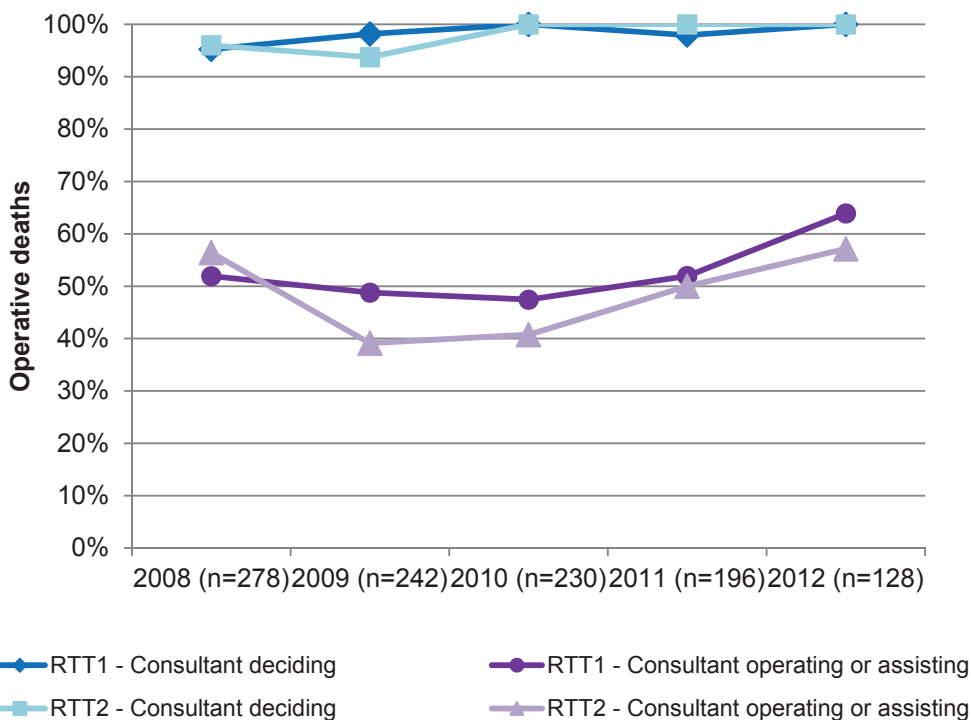




**Figure 26 Consultant surgeons involved in primary operations in Western Australian teaching hospitals**



**Figure 27 Consultant surgeons involvement in returns to theatre (RTT) in Western Australian teaching hospitals**



Note: RTT1 = return to theatre after initial operation (i.e. second operation); RTT2 = second return to theatre (i.e. third operation). Refer to Appendix C for further information on data.

**Comment:**

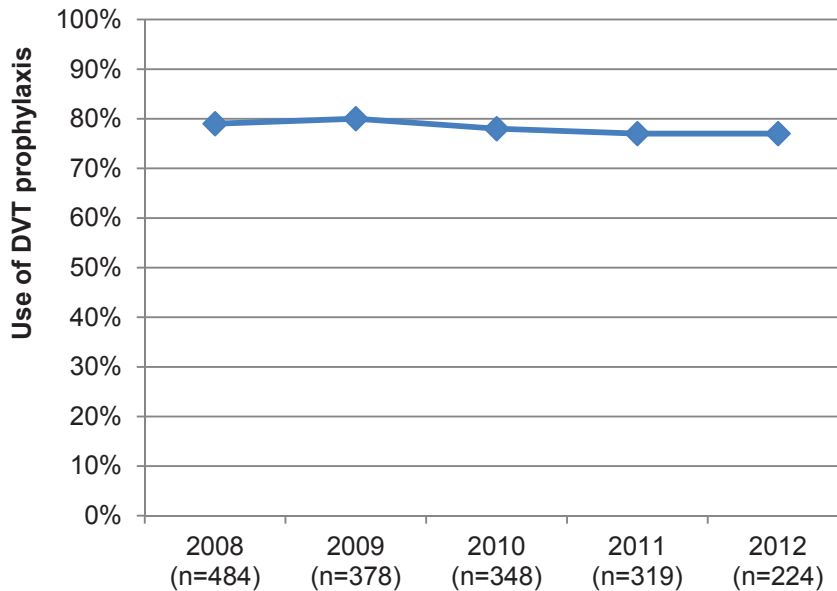
Direct consultant supervision of patients being returned to theatre has been highlighted in all previous annual reports and there was a welcome increase over the last few years (Figures 25, 26 and 27).



### 4.7 Prophylaxis of thromboembolism

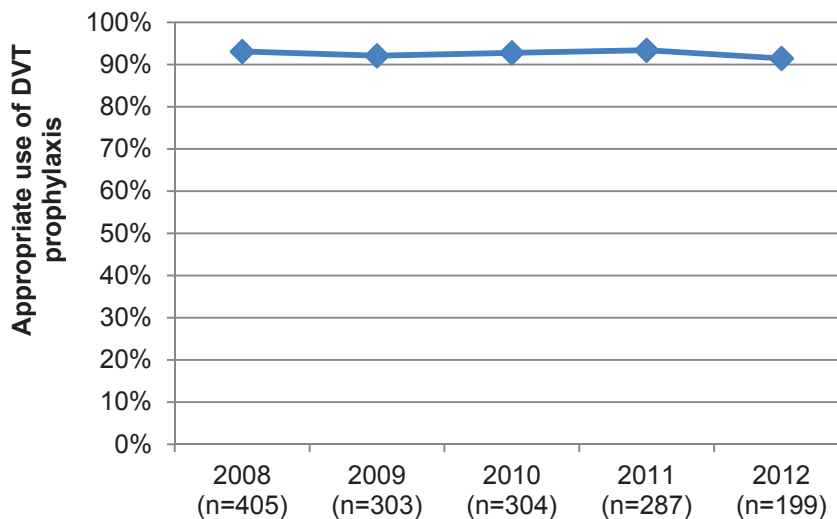
Surgeons are asked on the proforma whether deep vein thrombosis (DVT) prophylaxis was used and, if not, the reason why it was withheld. During case review, assessors indicate whether they think that the decision was appropriate (see Figure 28).

**Figure 28 Use of DVT prophylaxis**



Refer to Appendix C for further information on data.

**Figure 29 Cases where assessors noted that use of DVT prophylaxis was appropriate**



Note: Neurosurgeons do not complete this question in the proforma unless it has been flagged as an area of concern or adverse event. Refer to Appendix C for further information on data.

**Comment:**

The importance of DVT prophylaxis has consistently been highlighted in previous annual reports and symposiums. Data on DVT prophylaxis was missing in 447 proformas and 702 assessments returned to the WAASM office. DVT use has remained relatively consistent from 2008 (Figure 28). Similarly, assessors have indicated that the appropriate use of DVT prophylaxis has been consistently high, where in over 90% of cases the use of DVT prophylaxis was appropriate.

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 2012 WAASM annual report.

### **Surgeon Participation and Proforma Returns**

WAASM sends out participation forms to new WA Fellows once it is notified of their status. Reminders for outstanding proformas are sent quarterly. The upcoming migration to BAS will enable the WAASM team to utilise an automated email reminder system to encourage the prompt return of surgical case forms and assessments.

### **Audit Process Evaluation**

A consumer evaluation was done on the WAASM in mid-2012. The results of this survey have now been compiled and a brief summary is included in Section 6 of this report.

### **Clinical Management**

Data from the 2012 evaluation of the Audit has been compiled and an in-depth analysis of the data will be undertaken. It is anticipated that there will be several areas where WAASM may be able to target in educational reports or activities.

### **WAASM Reporting**

WAASM has written a paper on the first 10 years of WAASM and has included information on the trends observed, initiatives undertaken and effects observed. This paper is currently being considered for publication.



## 6. EVALUATION OF THE AUDIT

In 2004, three years after the commencement of the Western Australian Audit of Surgical Mortality (WAASM), a survey was sent out to all surgeons in Western Australia seeking their thoughts on audit processes and whether the project, in its formative years, had improved or influenced their practice. There were 190 (73%) respondents who indicated that feedback from WAASM had influenced changes in their practice.

Following the ten year anniversary of WAASM in 2012, a second survey, modelled on the 2004 evaluation, was sent out to all surgeons in WA to ascertain if a decade of audit activity had influenced their surgical practice. The survey was sent to 396 active consultants on the WAASM database and 303 (77%) completed surveys were returned. Of these, five had missing information and 15 were excluded either on the grounds of non-participation or recent recruitment to the audit. The number of valid surveys analysed is 283 (71%).

Overall, 78% of the 283 respondents indicated that involvement in or feedback from WAASM had changed their practice in at least one way. The main area in which WAASM has influenced practice is attention to prophylaxis for deep vein thrombosis with 57% of respondents indicating a change in practice in this area. This was closely followed by improvement in the quality of documentation in case notes (51%), increased constructive discussion amongst surgeon peer groups (49%), management of anti-coagulation (49%) and attention to postoperative care (48%).

When compared to the 2004 survey, responses in 2012 demonstrated an increase in reporting of the following areas as having influenced practice: appropriate referrals of patients (19% increase), attention to DVT prophylaxis (14% increase) and attention to supervision issues (13% increase). Over the years, WAASM has specifically targeted issues related to trainee supervision and DVT prophylaxis in symposia<sup>a</sup>, newsletters and case note review booklets.

Case note review booklets appear to be highly regarded by participants, with 95% of respondents who read them indicating that they were interesting and 91% stating that they were a valuable educational tool. Case reviews compiled in the booklets are actual cases (de-identified) that have been reviewed through the WAASM process and are indicative of the challenges that are faced before, during and after surgery. Overall, the preliminary results from the 2012 evaluation demonstrate that WAASM has been involved in increasing the awareness of issues related to surgery by monitoring trends in surgical mortality data and in improving quality of clinical care to achieve better patient outcomes.

<sup>a</sup> Symposia held by WAASM are as follows: DVT Prophylaxis (2002); Anticoagulation and the Peri-operative Patient (2005); Fluid Management and the Surgical Patient (2008); Recognising the Deteriorating Patient (2011).



## 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 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 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
  - Mr Stuart Salfinger                 Consultant Obstetrician & Gynaecologist, Obstetrics & gynaecology representative
  - Mr Rasa Subramaniam              Consumer 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, 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

Cause of death (n=921)	n	%
Brain haemorrhage	88	10
Septicaemia	74	8
Multiple organ failure	70	8
Malignancy	68	7
Other	50	5
Acute myocardial infarction	46	5
Head injury	44	5
Brain stroke	42	5
Respiratory failure	37	4
Cardiac arrest	34	4
Cerebral oedema	30	3
Brain injury	29	3
Pneumonia	29	3
Aneurysm	25	3
Pulmonary embolism	20	2
Aspiration pneumonia	19	2
Haemorrhage	19	2
Cardio respiratory failure	17	2
Heart failure	16	2
Sudden death—cause unknown	16	2
Renal failure	14	2
Hepatic failure	12	1
Infection	12	1
Injury to organ	10	1
Vascular insufficiency of the intestine	10	1
Brain death	9	1
Ischaemic heart disease	9	1
Multiple injuries	9	1
Respiratory distress and disease	7	1
Acute endocarditis	6	1
Cardiac dysrhythmia	6	1
Subdural haematoma	6	1
Acute pancreatitis	5	1
Hypovolemic shock	4	< 1
Liver disease	4	< 1
Peritonitis	4	< 1
Drug-related causes	3	< 1
Embolism and thrombosis	3	< 1
Fistula	3	< 1
Intestinal obstructions	3	< 1
Motor vehicle accident	3	< 1
Respiratory arrest	3	< 1
Suicide	3	< 1



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

Cause of death (n=556)	n	%
Brain haemorrhage	86	15
Septicaemia	55	10
Other	50	9
Multiple organ failure	42	8
Malignancy	37	7
Respiratory failure	24	4
Cerebral oedema	18	3
Heart failure	16	3
Acute myocardial infarction	15	3
Pulmonary embolism	14	3
Haemorrhage	14	3
Aneurysm	14	3
Head injury	13	2
Cardiac arrest	12	2
Injury to organs	12	2
Unknown causes of mortality or morbidity	12	2
Stroke and cerebrovascular accident unspecified	11	2
Hepatic failure	11	2
Brain infarction	10	2
Renal failure	8	1
Intestinal vascular insufficiency	6	1
Brain death	6	1
Other aspiration pneumonia as a complication of care	6	1
Pneumonia due to unspecified organism	6	1
Vascular insufficiency of the intestine	5	1
Embolism and thrombosis	5	1
Subdural haematoma—nontraumatic	4	1
Intestinal obstruction	4	1
Acute pancreatitis	4	1
Cardiorespiratory failure	4	1
Peritonitis	4	1
Infection	4	1
Cardiogenic shock	3	1
Complication of gastrointestinal anastomosis or bypass	3	1
Anoxic brain damage	3	1
Pneumonia	3	1
Tracheostomy complication	2	<1
Respiratory arrest	2	<1
Fracture	2	<1
Ischaemic heart disease	2	<1
Fistula of intestine	2	<1
Hypovolemic shock	2	<1

**Table A.3 Causes of death in men aged ≥70**

<b>Cause of Death (n=1857)</b>	<b>n</b>	<b>%</b>
Septicaemia	179	10
Myocardial infarction	151	8
Pneumonia	136	7
Multiple organ failure	123	7
Malignancy	98	5
Respiratory failure	93	5
Other	86	5
Heart failure	77	4
Aspiration pneumonia	73	4
Renal failure	70	4
Vascular insufficiency of the intestine	70	4
Cardiac arrest	66	4
Ruptured abdominal aortic aneurysm	58	3
Brain haemorrhage	52	3
Cardiorespiratory failure	47	3
Stroke and cerebrovascular accident—unspecified	40	2
Sudden death—cause unknown	36	2
Infection	33	2
Haemorrhage	29	2
Acute pulmonary oedema	24	1
Pulmonary embolism	24	1
Cardiogenic shock	23	1
Ischaemic heart disease	23	1
Respiratory—other	20	1
Perforation of intestine	17	1
Brain—other	16	1
Ruptured aneurysm	16	1
Congestive heart failure	15	1
Intestinal obstruction	15	1
Cardiac arrhythmias and dysrhythmias	12	1
Acute pancreatitis	11	1
Subdural haematoma—non traumatic	11	1
Fracture of neck of femur	10	1
Hepatic failure	10	1
Severe head injury	9	< 1
Aneurysm	8	< 1
Respiratory arrest	8	< 1
Diffuse brain injury	7	< 1
Duodenal ulcer	7	< 1
Peripheral vascular disease	7	< 1
Atrial fibrillation	6	< 1
Chronic renal failure	6	< 1
Left ventricular failure	6	< 1
Complication of gastrointestinal anastomosis or bypass	5	< 1
Multiple injuries	5	< 1



Embolism and thrombosis	4	< 1
Post-operative pulmonary embolus	4	< 1
Pseudo-obstruction	4	< 1
Volvulus of the sigmoid colon	4	< 1
Cardiovascular—other	3	< 1

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

Cause of Death (n=1844)	n	%
Septicaemia	169	9
Multiple organ failure	157	9
Acute myocardial infarction	145	8
Heart failure	115	6
Respiratory failure	105	6
Renal failure	83	5
Other	77	4
Pneumonia	76	4
Malignancy	65	4
Vascular insufficiency of the intestine	61	3
Brain haemorrhage	58	3
Cardiac arrest	57	3
Cardiorespiratory arrest	54	3
Aspiration pneumonia	52	3
Stroke and cerebrovascular accident	50	3
Sudden death—cause unknown	43	2
Ruptured abdominal aortic aneurysm	30	2
Pulmonary embolism	28	2
Intestinal vascular insufficiency	27	1
Haemorrhage	26	1
Intestinal obstruction	26	1
Peripheral vascular disease	25	1
Acute pulmonary oedema	22	1
Ischaemic heart disease	20	1
Brain—other	19	1
Perforation of intestine	19	1
Cardiovascular—other	18	1
Acute pancreatitis	18	1
Infection	18	1
Respiratory—other	16	1
Cardiogenic shock	16	1
Peritonitis	16	1
Fracture neck of femur	15	1
Aneurysm	13	1
Other disorders of the intestine	13	1
Chronic ischaemic colitis	13	1
Cardiac dysrhythmias and arrhythmias	10	1
Subdural haematoma	9	<1
Bronchopneumonia	9	<1



Perforated diverticulum	8	<1
Postoperative pulmonary embolus	7	<1
Old age	6	<1
Head injury	6	<1
Hepatic failure	6	<1
Injury	5	<1
Complication of gastrointestinal anastomosis	5	<1
Left ventricular failure	4	<1
Embolism and thrombosis	4	<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 276 of 3032 cases reported to WAASM between 2008 and 2012**

<b>Delays (n=64)</b>	<b>No.</b>
Delay to surgery	22
Delays in transfer	13
Delay in diagnosis	13
Delay in recognising complications	5
Delay in investigating the patient	2
Delay to operation caused by missed diagnosis	2
Delay starting medical treatment	2
Delay in recognising a bleeding complication	1
Delay starting DVT prophylaxis	1
Delay in obtaining blood products, x-match or typing	1
Delay starting antibiotics	1
Delay to re-operation	1

<b>Incorrect or Inappropriate Treatment (n=43)</b>	<b>No.</b>
Decision to operate	13
Unsatisfactory medical management	9
Better to have done different operation or procedure	5
Postoperative care unsatisfactory	5
Premature discharge from hospital	2
Resuscitation inadequate	1
More aggressive treatment of infection needed	1
Inappropriate treatment prior to surgical referral	1
Operation should not have been done or was unnecessary	1
Operation should have been done after initial resuscitation	1
Better to have had more extensive surgery	1
Wrong operation performed	1
Incorrect/inappropriate therapy	1
Operation would have been better deferred or delayed	1

<b>General Complications (n=42)</b>	<b>No.</b>
Aspiration pneumonia	11
Pulmonary embolus	9
Blood-related complications	3
Displacement of tracheostomy tube	2
Graft infection	2
Septicaemia—cause unspecified	2
Sepsis related to an intravenous line	2



Wound dehiscence	2
Drug interaction	1
Failure of wound healing	1
Deep vein thrombosis	1
Arterial or venous complication	1
Liver failure	1
Post-operative pancreatitis	1
Pelvic abscess	1
Central nervous system	1
General complications of treatment	1

<b>Related to Open Surgery (n=35)</b>	<b>No.</b>
Anastomotic leak after open surgery	14
Bleeding related to open surgery	10
Injury to organ during open surgery	2
Cardiovascular accident following open surgery	2
Arterial occlusion related to open surgery	1
Vascular complication of open surgery	1
Heart complication of open surgery	1
Postoperative obstruction after open surgery	1
Small bowel complication of open surgery	1
Pleural complication of open surgery	1
Organ-related technical issues	1

<b>Drug-related Problems (n=15)</b>	<b>No.</b>
Failure to use DVT prophylaxis	7
Reaction to drugs	4
Failure to use antibiotic prophylaxis	1
Overdose of narcotics	1
Over anticoagulation	1
Drug-related complication	1

<b>Related to Endoscopic Surgery (n=14)</b>	<b>No.</b>
Perforation of colon during endoscopic operation	7
Bleeding related to endoscopic operation	3
Stomach complication related to endoscopic operation	2
Perforation of duodenum during endoscopic operation	1
Organ-related technical issues	1



<b>Assessment problems (n=11)</b>	<b>No.</b>
Failure to investigate or assess patient fully	5
Preoperative assessment inadequate	3
Inadequate cardiac assessment	1
Assessment problems	1
Laboratory preoperative assessment inadequate	1

<b>Communication Failures (n=11)</b>	<b>No.</b>
Poor documentation	3
Adverse events related to treatment guidelines/protocols	1
Poor communication between nursing and surgical staff	1
No protocol for DVT prophylaxis	1
Failed surgical communication through rotation of staff	1
Failure to communicate with senior staff	1
Poor communication between anaesthetist and surgeon	1
Communication failure	1
Failure to obtain a post mortem	1

<b>Patient-related Factors (n=8)</b>	<b>No.</b>
Injury caused by fall in hospital	8

<b>Related to Laparoscopic Surgery (n=6)</b>	<b>No.</b>
Perforation of colon related to laparoscopic operation	2
Anastomotic leak after laparoscopic operation	2
Intra-operative bleeding during laparoscopic operation	1
Extension of ischaemia after laparoscopic operation	1

<b>Failure to Use Facilities (n=6)</b>	<b>No.</b>
HDU not used postoperatively	4
Failure to use ITU (intensive therapy unit)	1
Failure to use a specialist centre	1

<b>Fluid Balance Issues (n=5)</b>	<b>No.</b>
Postoperative fluid balance unsatisfactory	4
Fluid balance unsatisfactory	1





<b>Related to Diagnosis (n=4)</b>	<b>No.</b>
Diagnosis missed by medical unit	2
Diagnosis missed by surgeons	1
Diagnosis missed—unspecified	1

<b>Related to Anaesthesia (n=3)</b>	<b>No.</b>
Inadequate anaesthetic assistance	1
Pneumothorax complicating general anaesthetic	1
General anaesthetic complications	1

<b>Related to Transfers (n=2)</b>	<b>No.</b>
Transfer necessary to obtain ITU bed	1
Better transferred between hospitals preoperatively for ITU support	1

<b>Equipment-related Issues (n=2)</b>	<b>No.</b>
ERCP (endoscopic retrograde cholangiopancreatography) not used or not available	1
Other equipment-related complication	1

<b>Staff-related Issues (n=2)</b>	<b>No.</b>
Surgeon too junior	1
Failure of junior surgeon to seek advice	1

<b>Related to Radiological Surgery (n=1)</b>	<b>No.</b>
Gall bladder complication of radiological operation	1



## APPENDIX C: Data definitions

<b>Table 1: Deaths reported to WAASM between 01 January 2008 and 31 December 2012</b>	
<b>Definition:</b>	Count of deaths reported to WAASM and subset data relating to Audit processes.
<b>Data Notes:</b>	Total numbers of deaths reported to WAASM, separated by case and proforma status, terminal care cases and cases associated with non-participation.
<b>Data Included:</b>	All data collected from 2008 until 2012 included.
<b>Data Excluded:</b>	No data excluded.

<b>Table 2: Number of surgically-related deaths per 100,000 population</b>	
<b>Definition:</b>	Number of deaths reported to WAASM per year as a function of surgical mortality rates per 100,000 population.
<b>Data Notes:</b>	Population data compiled from the Australian Bureau of Statistics.
<b>Data Included:</b>	Total number of cases reported to WAASM from 2008-2012.
<b>Data Excluded:</b>	No exclusions.

<b>Table 3: Surgeon participation</b>	
<b>Definition:</b>	Counts of surgical mortality data in relation to consultant involvement in cases.
<b>Data Notes:</b>	Table 3 is made from composite data collected by WAASM in surgical case forms.
<b>Data Included:</b>	Data used in Table 1 (p16) on reported deaths and proformas returned. Counts of consultants associated with deaths reported. Terminal care cases included in counts of proformas returned as indicated in Table 3.
<b>Data Excluded:</b>	No exclusions.

<b>Table 4: Cases where the patient was transferred from one hospital to another hospital</b>	
<b>Definition:</b>	Percentage of cases in which a transfer from one hospital to another occurred.
<b>Data Notes:</b>	Table 4 is composed of data from Table 2 (p16) and data on transfers.
<b>Data Included:</b>	Data on transfers includes all completed cases, including terminal care cases.
<b>Data Excluded:</b>	Data on transfers excludes neurosurgical cases (n=23).

<b>Table 5: Cases referred for second-line assessment</b>	
<b>Definition:</b>	Count of cases referred to second line assessment and break down of proportion of proformas where a first- or second-line assessment is in progress.
<b>Data Notes:</b>	Table 5 includes data from Table 1 (p16).
<b>Data Included:</b>	Data on second-line assessments includes cases completed from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases excluded.

<b>Table 6: Median age by gender, 2008-2012</b>	
<b>Definition:</b>	Average age separated by gender for all cases from 2008 to 2012.
<b>Data Included:</b>	All data collected from 2008 until 2012 included.
<b>Data Excluded:</b>	No exclusions.

<b>Table 8: Most common causes of death in cases of surgical mortality</b>	
<b>Definition:</b>	Six most common causes of death in patients aged <70 and those ≥70 in cases of surgical mortality.
<b>Data Notes:</b>	Only the six most common causes of death are displayed in table.
<b>Data Included:</b>	All data collected from 2008 until 2012 included.
<b>Data Excluded:</b>	Terminal care cases excluded.

<b>Table 9: Actual use, and assessor opinion of use, of a high dependency or intensive care unit</b>	
<b>Definition:</b>	Counts and percentages of ICU and HDU use in cases of surgical mortality.
<b>Data Notes:</b>	Table 9 is composed of data from different data sets. Number of cases is based on completed cases.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 until 2012.
<b>Data Excluded:</b>	Terminal care cases and neurosurgical cases excluded.



<b>Table 10: Surgeons' and assessor's views on performance</b>	
<b>Definition:</b>	Clinical incidents reported by treating surgeons are compared to those reported by assessors. Data is separated by year.
<b>Data Notes:</b>	As assessor data is included in this table, cross tabulation can only be performed with cases that have completed the audit process so that both surgeon and assessor data for any given case is available.
<b>Data Included:</b>	All completed cases from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases excluded (n=88).

<b>Table 11: Level of agreement between surgeons' and assessor's views on performance</b>	
<b>Definition:</b>	Agreement on clinical incidents between surgeons and assessors that have completed proformas for the same case.
<b>Data Notes:</b>	Only cases in which both the surgeon and assessor have completed the audit process can be included.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases excluded (n=88).

<b>Table 12: Audited deaths associated with areas for concern or adverse events, as reported by assessors</b>	
<b>Definition:</b>	Counts and percentages of cases in which clinical incidents were identified.
<b>Data Notes:</b>	Table 12 is composed of data from multiple data sets. In cases which have recorded multiple clinical incidents, only the most significant event is counted for each category.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care (n=88) and neurosurgery cases (n=331) excluded.

<b>Table 13: Elective and emergency admissions to public and private hospitals</b>	
<b>Definition:</b>	Counts and percentages of elective or emergency admissions as grouped by hospital status (e.g. public, private or co-location).
<b>Data Notes:</b>	Table 13 is made up of four different tables with different variables from data collected in surgical case forms. Percentages in parts (b) and (c) relate to figures in part (a). Percentages in part (d) relate to part (b).
<b>Data Included:</b>	Part (a) includes all cases that have completed the audit process from 2008 to 2012. Part (b) includes all cases that have completed the audit process in which an operation was performed. Part (c) includes all cases that have completed the audit process in which an area of concern or adverse event was identified. Part (d) includes all cases that have completed the audit process in which both an operation was performed and in which an area of concern or adverse event was identified.
<b>Data Excluded:</b>	Terminal care cases were excluded overall (n=88). Missing data will account for differences in numbers. Missing data is as follows: Part (a) (n=49); part (b) (n=33); part (c) (n=5); part (d) (n=4).

<b>Table 14: Emergency admissions to public and private hospitals</b>	
<b>Definition:</b>	Counts and percentages of emergency admissions in public and private hospitals by specialty and reasons for non-operative cases.
<b>Data Notes:</b>	Table 14 is composed of different tables with different sets of data collected from the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012, where an emergency admission to a hospital was made.
<b>Data Excluded:</b>	Terminal care cases were excluded.

<b>Table 15: Emergency and elective admissions that were associated with areas of concern or adverse events</b>	
<b>Definition:</b>	Counts and percentages of clinical incidents by admission type.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88); missing data (n=48).



<b>Table 16: All areas of concern or adverse events associated with elective admissions</b>	
<b>Definition:</b>	Counts, percentages and descriptions of most common clinical incidents in elective admissions
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012, which were admitted to an elective unit and were associated with an area of concern or adverse event.
<b>Data Excluded:</b>	Terminal care cases were excluded. Data missing for 1 case.

<b>Table 17: All areas of concern or adverse events associated with emergency admissions</b>	
<b>Definition:</b>	Counts, percentages and descriptions of the most common clinical incidents in emergency admissions.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012, which were admitted to an emergency unit and were associated with an area of concern or adverse event.
<b>Data Excluded:</b>	Terminal care cases were excluded. Data missing for 1 case.

<b>Table 18: Operations performed</b>	
<b>Definition:</b>	Counts and percentages of operations performed in cases of surgical mortality
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012, in which an operation was performed.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88).

<b>Table 19: Operations abandoned, including patients undergoing one or more surgical procedures</b>	
<b>Definition:</b>	Counts and percentages of operations abandoned in cases of surgical mortality.
<b>Data Notes:</b>	Table 19 is composed of different tables with different sets of data collected from the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 in which an operation was undertaken.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88). Non-operative cases were also excluded (n=666).

<b>Table 20: Comparison of views of surgeons and assessors on preoperative risk of death in cases undergoing an operation</b>	
<b>Definition:</b>	Counts and percentages of pre-operative risk of death in cases of surgical mortality
<b>Data Notes:</b>	Only cases in which both the surgeon and assessor have completed the audit process can be included.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 in which an operation was undertaken.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88). Data missing for 754 cases.

<b>Table 21: Unplanned return to theatre</b>	
<b>Definition:</b>	Counts and percentages of reported unplanned returns to theatre in cases of surgical mortality.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 in which an operation was undertaken.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88). Non-operative cases were also excluded (n=666).

<b>Table 22: Deaths after surgery in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Counts and percentages of cases in which consultants were deciding, operating or assisting in Western Australian teaching hospitals.
<b>Data Notes:</b>	Table 22 is composed of different tables with different sets of data collected from the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 in which an operation was undertaken in a Western Australian teaching hospital.
<b>Data Excluded:</b>	Terminal care cases (n=88), non-operative cases (n=580) and cases associated with non-teaching hospitals (n=458) were excluded.


**Figure 2: Number of deaths reported to WAASM compared with surgical mortality rates per 100,000 population**

<b>Definition:</b>	Number of deaths reported to WAASM per year as a function of surgical mortality rates per 100,000 population.
<b>Data Notes:</b>	Population data compiled from the Australian Bureau of Statistics.
<b>Data Included:</b>	Total number of cases reported to WAASM from 2008-2012.
<b>Data Excluded:</b>	No exclusions.

**Figure 3 Proforma completion rates**

<b>Definition:</b>	Percentages of proforma completion rates as allocated by proforma status.
<b>Data Notes:</b>	'Returned' indicates a proforma that has been returned to the Audit office complete. 'Not returned' indicates a proforma that is in progress. 'No response' indicates proformas that have not been returned to the Audit office despite multiple reminders, proformas are labelled 'no response' 2 years after the date of death of the patient.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.

**Figure 4: Proforma status by specialty**

<b>Definition:</b>	Percentages of proforma completion rates as allocated by proforma status and surgical specialty.
<b>Data Notes:</b>	Surgical specialty 'other' includes otolaryngology, ophthalmology and plastic surgery.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	Data missing for 50 cases.

**Figure 5: Reported deaths of patients admitted for surgery in Western Australian Hospitals**

<b>Definition:</b>	Percentages of case completion rates as allocated by case status and participating hospital.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.

**Figure 6: Patients admitted to public or private hospitals**

<b>Definition:</b>	Proportion of cases admitted to public, private or co-location hospitals as allocated by year.
<b>Data Notes:</b>	'Co-location' indicates hospitals with both public and private health services.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012. Terminal care cases included (n=88).
<b>Data Excluded:</b>	Data missing for 1 case.

**Figure 7: Proportion of cases referred for second-line assessment**

<b>Definition:</b>	Percentage of proformas referred for second-line assessment by year.
<b>Data Notes:</b>	Figure 7 relates to data in Table 5 (p21).
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases excluded (n=88). Data missing for 3 cases.

**Figure 8: Age distribution by gender**

<b>Definition:</b>	Count of cases allocated by age groups, gender and year of death.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.

**Figure 9: Age distribution of audited patients**

<b>Definition:</b>	Box and whisker plot of ages by sorted gender and year of death.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.

**Figure 10: Age of audited patients by specialty**

<b>Definition:</b>	Box and whisker plot of age sorted by surgical specialty in cases of surgical mortality.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.



<b>Figure 11: ASA grades</b>	
<b>Definition:</b>	Count of ASA grades in all cases of surgical mortality.
<b>Data Included:</b>	All data collected from 2008 to 2012 included.
<b>Data Excluded:</b>	No exclusions.

<b>Figure 12: Comorbidity status in completed cases</b>	
<b>Definition:</b>	Percentage of cases associated with comorbidities, including more than one co-existing comorbid factor.
<b>Data Notes:</b>	Figure 12 was produced by collating data from multiple variables in the surgical case form. Total number of cases for each year is as follows: 2012 (n=230); 2011 (n=329); 2010 (n=354).
<b>Data Included:</b>	Completed cases from 2010 to 2012 in which comorbidity was indicated.
<b>Data Excluded:</b>	Terminal care and neurosurgery cases were excluded.

<b>Figure 13: Percentage of adverse events reported by surgeons and assessors</b>	
<b>Definition:</b>	Percentage of cases in which an adverse event was recorded by either the treating surgeon or the assessor.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care and neurosurgery cases were excluded.

<b>Figure 14: Cases associated with adverse events or areas of concern</b>	
<b>Definition:</b>	Percentages of cases associated with areas of concern/adverse events that caused death and that were preventable.
<b>Data Included:</b>	Completed cases from 2008 to 2012 in which a clinical incident was reported by the assessor.
<b>Data Excluded:</b>	Terminal care and neurosurgery cases were excluded.

<b>Figure 15: Percentage of elective admissions associated with an operation or no operation</b>	
<b>Definition:</b>	Percentage of elective admissions associated with operative or non-operative cases.
<b>Data Included:</b>	All cases associated with elective admissions which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases and cases associated with emergency admissions were excluded.

<b>Figure 16: Percentage of emergency admissions associated with an operation or no operation</b>	
<b>Definition:</b>	Percentage of emergency admissions associated with operative or non-operative cases.
<b>Data Included:</b>	All cases associated with emergency admissions which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases and cases associated with elective admissions were excluded.

<b>Figure 17: Cases associated with areas of concern or adverse events – emergency and elective admissions</b>	
<b>Definition:</b>	Percentages of cases associated with clinical incidents reported by assessors in elective and emergency admissions.
<b>Data Included:</b>	Completed cases from 2010 to 2012 in which a clinical incident was reported by the assessor.
<b>Data Excluded:</b>	Terminal care cases were excluded. Data missing for 7 cases.

<b>Figure 18: Operative cases associated with areas of concern or adverse events – emergency and elective admissions</b>	
<b>Definition:</b>	Percentages of cases associated with clinical incidents reported by assessors in elective and emergency admissions that underwent a surgical procedure.
<b>Data Included:</b>	Completed cases from 2008 to 2012 in which a operation was undertaken and a clinical incident was reported by the assessor.
<b>Data Excluded:</b>	Terminal care cases were excluded. Data missing for 5 cases.



<b>Figure 19: Number of operations by specialty</b>	
<b>Definition:</b>	Percentages of non-operative or operative cases allocated by surgical specialty.
<b>Data Notes:</b>	Surgical specialty 'other' includes otolaryngology, ophthalmology, paediatrics and plastic surgery. General surgery (n=871), Vascular surgery (n=198), Urology (n=77), Neurosurgery (n=329), Orthopaedic (n=435), Cardiothoracic surgery (n=128), Obs & Gynae (n=1), and Other (n=70).
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases were excluded (n=88). Data missing for 3 cases.

<b>Figure 20: Reasons for no operation</b>	
<b>Definition:</b>	Percentages of audited cases in which no operation was performed as sorted by reason for no operation.
<b>Data Notes:</b>	Reasons for no operation come directly from the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 in which no operation was performed.
<b>Data Excluded:</b>	Terminal care (n=88) and operative cases were excluded (n=1446).

<b>Figure 21: Cases associated with areas of concern or adverse events in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of audited cases associated with a clinical incident as reported by assessors in Western Australian teaching hospitals.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654) and in which a clinical incident was identified (n=193).
<b>Data Excluded:</b>	Terminal care (n=88), cases associated with non-teaching hospitals (n=458) and cases in which no significant clinical incidents were identified (n=1461).

<b>Figure 22: Cases associated with areas of concern or adverse events in Western Australian teaching hospitals by number of operations</b>	
<b>Definition:</b>	Percentage of audited cases associated with a clinical incident as reported by assessors in Western Australian teaching hospitals allocated by number of operations performed.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654) and in which a clinical incident was identified (n=193).
<b>Data Excluded:</b>	Terminal care (n=88), cases associated with non-teaching hospitals (n=458) and cases in which no significant clinical incidents were identified (n=1461).

<b>Figure 23: Grade of surgeon performing first operation in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of primary operations performed in Western Australian teaching allocated by grade of surgeon.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654).
<b>Data Excluded:</b>	Terminal care (n=88) and cases associated with non-teaching hospitals (n=458). Data missing for 813 cases.

<b>Figure 24: Grade of surgeon performing subsequent operations in return to theatre cases in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of return to theatre cases as allocated by grade of surgeon performing operation.
<b>Data Notes:</b>	Figure 24 was produced by collating data from multiple variables in the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654).
<b>Data Excluded:</b>	Terminal care (n=88) and cases associated with non-teaching hospitals (n=458). Data missing for 1325 cases.



<b>Figure 25: Consultant supervision in cases returned to theatre in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of cases in which consultants performed operations in returned to theatre cases in Western Australian teaching hospitals.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654).
<b>Data Excluded:</b>	Terminal care (n=88) and cases associated with non-teaching hospitals (n=458). Data missing for 1325 cases.

<b>Figure 26: Consultant surgeons involved in primary operations in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of audited cases in which consultants were involved in primary operations in Western Australian teaching hospitals.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654).
<b>Data Excluded:</b>	Terminal care (n=88) and cases associated with non-teaching hospitals (n=458).

<b>Figure 27: Consultant surgeons involvement in returns to theatre (RTT) in Western Australian teaching hospitals</b>	
<b>Definition:</b>	Percentage of cases in which consultants were involved in return to theatre case in Western Australian teaching hospitals.
<b>Data Notes:</b>	Figure 27 was produced by collating data from multiple variables in the surgical case form.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012 which were admitted to teaching hospitals (n=1654). Operative cases (n=1704).
<b>Data Excluded:</b>	Terminal care (n=88), cases associated with non-teaching hospitals (n=458) and non-operative cases (n=580).

<b>Figure 28: Use of DVT prophylaxis</b>	
<b>Definition:</b>	Percentage of cases in which DVT prophylaxis was used as reported by surgeons.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases (n=88) were excluded. Data missing for 359 cases.

<b>Figure 29: Cases where assessors noted that the use of DVT prophylaxis was appropriate</b>	
<b>Definition:</b>	Percentage of cases associated with appropriate use of DVT prophylaxis as indicated by assessors.
<b>Data Included:</b>	All cases which have completed the audit process from 2008 to 2012.
<b>Data Excluded:</b>	Terminal care cases (n=88) were excluded. Data missing for 614 cases.





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