



Royal Australasian
College of Surgeons



Western Australian Audit of Surgical Mortality

Annual Report 2014

Contact

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CHAIRMAN'S REPORT

Good surgeons know how to operate, better surgeons know when to operate, and the best surgeons know when not to operate. I suggest that poor doctors run away from their errors, good doctors acknowledge and learn from them, and the best doctors not only acknowledge and learn from their error, but journey with the patient through the pain they've created. Richard Smith, *BMJ*, 14 June 2014

Historically surgical safety and quality has been left to the profession to manage. Over the last 20 years there have been numerous reports from within Australia and overseas that have clearly shown the profession has not always managed such self-regulation consciously. Certainly there have been individual pioneers who have been beacons of excellence, but overall the surgical profession has frequently not discharged its obligations well. It is not that adverse events happen. That is inevitable. It is the failure of the profession to routinely record, monitor, act and learn from errors that is the concern.

After the publication of the 1998 enquiry into paediatric cardiac deaths in Bristol, Richard Smith, then editor of the *British Medical Journal*, wrote an editorial 'All changed, changed utterly'. The moment of change is arriving in Australia, and faster than the medical profession appears to appreciate. In the United Kingdom, Robert Francis QC, Chairman of the Mid Staffordshire NHS Foundation Trust Public Inquiry has asked why the government and public should continue to be tolerant of self-regulation by a profession with a rate of adverse events that if it were an airline 'planes would fall out of the sky all the time' (1). In Australia, the National Health and Hospital Reforms Commission reported that adverse events in hospitals resulted in 4,550 deaths and this was equated to 13 jumbo jets every year (2). Government and the public will be even less tolerant of a profession that does not appear to be meaningfully addressing the problems they create. This applies to both the employer (airline, health department or hospital) and employee (pilot or clinician).

The College and, perhaps even more importantly, its Fellows have two options. The first is to do nothing. This will not be acceptable to the Government, the regulators, the public and most importantly patients. Self-regulation will end and the profession will have no control of the process that replaces it, nor the manner in which the data obtained is used. The second is to recognise the inevitable and to become openly accountable and publicly document our outcomes.

It is no coincidence that in both his first and second President's Perspective in *Surgical News* the new president, Michael Grigg, emphasized the importance of the College and its Fellows recognising that 'if we do not self-regulate effectively, then external agencies or Government will fill that void, with a "glint in their eyes and with relish."

The Australian and New Zealand Audit of Surgical Mortality (ANZASM) is the College's first step in acknowledging its responsibility. In only a few years the College has transformed a maverick experiment in the 'wild west' (that is us!) to a national audit that is publishing papers in high impact medical and surgical journals and is attracting serious interest from other countries. Those in the ANZASM national office in Adelaide who have achieved this deserve high praise.

Good though this is, it does not address some of the key demands of government. ANZASM is now starting to address these demands and Fellows would be wise to recognise this and discharge their obligations. By linking ANZASM participation and CPD returns the College has made it crystal clear that the only acceptable standard is proper completion of every proforma. Those who fail to participate will now fall foul of both the College and Australian Health Practitioner Regulation Agency (AHPRA). The online database has been a huge step forward for both the surgeons, many of whom have acknowledged the ease of recording, and also ANZASM that is now receiving much higher quality data.

The dissemination of this data is being refined and, in particular, hospitals are very keen to receive institutional reports. ANZASM has such a document in the advanced stages of development. Hospitals will then be able to compare themselves against their peers. However, their data will only be as good as the surgeons return and consultants can expect that hospitals and their credentialing committees will be taking a keen interest in their participation.

Audit is not only recognising our errors, but also learning from both others and ourselves. Being a first- and second-line assessor is an important part of that learning process and not being prepared to do so will soon not be acceptable.

ANZASM is only the first step. The College has a number of other audits that have faced the same problems as ANZASM. Those who doubt that full participation in these audits will be required only need to look to the



United Kingdom to appreciate where the future lies. NHS England now has ongoing audits in nine surgical specialties and without full participation hospitals do not get paid.

Here in lies a major difference between the United Kingdom and Australia. In the NHS England the government has made the return of complete and accurate data an obligation that is linked to payment. The Australian government has not yet made that step. It will (2). At the 2014 Annual Scientific Meeting both Keith Willet (President's lecture) and Sir Bruce Keogh, Medical Director of the NHS England, presented data showing that linking payment to the achievement of evidence-based standards improved outcome. This would be a cheap way for Australian Health Departments, Medicare, Health Funds and hospitals to improve outcome.

The College is a Fellowship. Council members, who Fellows elected to guide the College, have recognised that the profession is, rapidly, entering a new era. The College will not be able to deliver what is required without the active support of its Fellows. If Fellows do not support their College they will have only themselves to blame when matters are taken out of their hands.

RJ Aitken

WAASM Chairman

- 1 Robert Francis QC, Chairman, Mid Staffordshire NHS Foundation Trust Public Inquiry
- 2 A Healthier Future for all Australians (Final Report 2009), National Health and Hospital Reforms Commission



SHORTENED FORMS

AE	adverse event
AHPRA	Australian Health Practitioner Regulation Agency
BMJ	British Medical Journal
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
NHS	National Health Service
NOS	not otherwise specified
RACS	Royal Australasian College of Surgeons
RTT	return to theatre
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 protection under Federal legislation. This report covers the period 2009 to 2013.

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. Once returned, the 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 there are areas of concern, adverse events may have occurred, or where it is thought 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

From 2009 to 2013, 2,903 deaths were reported to WAASM from 30 hospitals. In 2013, 546 deaths were reported to WAASM from 17 hospitals. The number of deaths per 100,000 reported to WAASM has decreased from 27 in 2009 to 21 in 2013, a decrease of 20%.

Consultant participation

The WAASM database indicates that there are 477 surgeons in Western Australia. Of these, 473 (99%) are participating in the audit and the remaining four new consultants have been sent recruitment documentation and the WAASM office is awaiting the return of the signed forms. Of the participating surgeons, 425 (89%) have agreed to be first-line assessors and 429 (90%) have agreed to be second-line assessors.

Analysis of completed cases

Data analysed for this report covers cases reported to WAASM from 1 January 2009 to 31 December 2013 and who had completed audit processes by 31 March 2014. Areas of concern or adverse events ascribed to cases by first- or second-line assessors were analysed. Where cases were associated with more than one incident, the most serious incident was included in the analysis.

For 2013, 235 cases had completed the entire audit process by 31 March 2014 (43%). A further 131 (24%) completed WAASM proformas were returned and are awaiting first- or second-line assessment. Overall, this accounts for 67% of cases reported in 2013.

Case assessments

The proportion of cases referred for second-line assessment (case note review) in 2013 was 40 (7%) out of 235 completed cases (excluding terminal care cases).

Patient sample demographics

Of the 2,926 cases reported between 2009 and 2013, the median age was 77 years, with an interquartile range of 65–85. A total of 54% of cases were male. In over 70% of cases, multiple comorbidities contributed to the death of the patient. The main causes of death in patients aged 70 years or less were septicaemia, intra-cerebral haemorrhage and multiple organ failure. The main causes of death in patients 70 years or older were septicaemia, multiple organ failure and acute myocardial infarction.

Areas of concern and adverse events

The proportion of cases associated with areas of concern or adverse events has decreased since 2009. Overall, assessors indicated that an adverse event caused the death of a patient in 3% of the 1,577 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 (84%) was significantly greater than the proportion in public hospitals (57%). Thirteen per cent of all operative cases were associated with areas of concern or adverse events.



Operative and non-operative deaths

In 36% of the 1,949 audited deaths from 2009 to 2013, no operation was performed. In 5% of cases the operative procedure was abandoned. Sixty-four per cent of cases underwent an operation, and 6% underwent three or more operations. In 14% of cases from 2009 to 2013, surgeons reported an unplanned return to theatre.



RECOMMENDATIONS

Audit management

- Actively pursue consultant recruitment to Fellows Interface with a view to move towards a paperless audit process for surgical case form and first-line assessment completion. WAASM aims to have recruited at least 50% of WA Fellows to Fellows Interface by the start of 2015. Recruitment strategies include mail outs, electronic and telephone communications.
- Encourage high level of proforma completion to reduce amount of missing data and improve assessment process and data integrity in line with ANZASM initiative of completion of compulsory fields in surgical case forms.

Reporting and audit data

- Continue to collate data on communication issues, clinically significant infections and trauma to ensure that sufficient data is available for a two-year trend analysis in the 2015 WAASM Annual Report.
- Evaluate data quality and completeness following one year of use of Fellows Interface.
- Develop Hospital site level reports to support patient safety initiatives and the reporting of adverse events to safety and quality representatives and stakeholders in WA hospitals.

Clinical management

- Collaborate to initiate an investigation of all returns to theatre in a hospital setting as a pilot study in one tertiary teaching hospital over a period of three months to collect data and information that may help to reduce returns to theatre.



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 2009 to 31 December 2013, as audited on 31 March 2014.
- WAASM's main role is to provide information to surgeons to educate, facilitate change and improve quality of practice.

1.1 Background

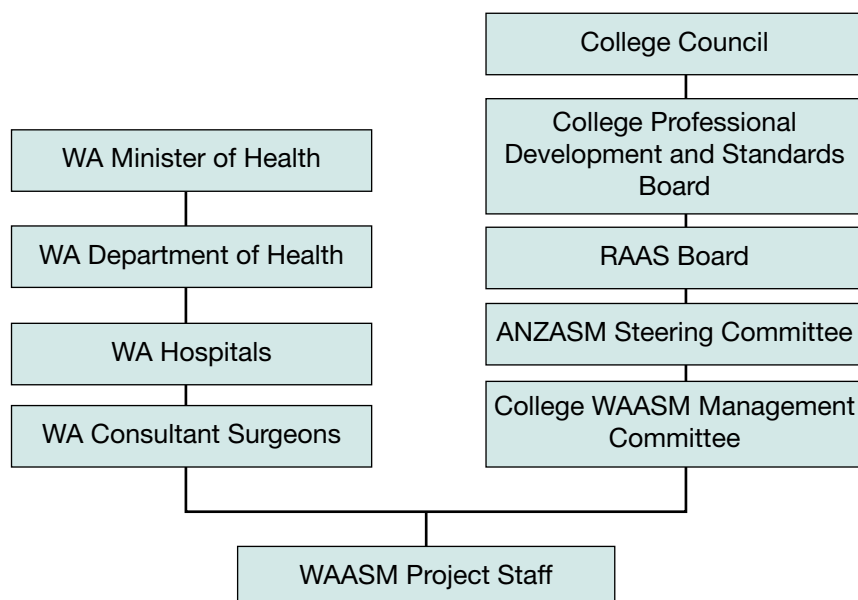
The Western Australian Audit of Surgical Mortality (WAASM) is an external, independent, peer-reviewed audit of the process of care associated with surgically-related deaths in WA. The project is funded by the WA Department of Health and its methodology is based on the Scottish Audit of Surgical Mortality.¹

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 reports²⁻¹⁰ 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 arising from clinical care of the patient are thought to warrant 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 first-line assessors, but they work in the same specialty. Like the first-line assessors, these surgeons work in a different hospital to that in which the death occurred.

2.2 Providing feedback

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

2.3 Reporting conventions

2.3.1 Reporting clinical incidents

In the structured proforma, the surgeon is asked to document whether there were any clinical incidents during the care of the patient. 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 considered 'less serious events' as they have little impact on the overall care of the patient; they are generally excluded from the analysis because they make no difference to the outcome.



2.4 Data analysis

WAASM audits all deaths occurring in WA hospitals while the patient is under the care of a surgeon; however, terminal care cases are excluded from the full audit process. The 2014 Annual Report covers deaths reported to WAASM from 1 January 2009 to 31 December 2013, censored on 31 March 2014. 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 the Bi-National Audit System database version 3.3.5 and analysed using the Statistical Package for Social Sciences versions 19.0 and 22.0, 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.

2.5 Performance review

Recommendations were included in the 2013 WAASM Annual Report.¹² An important measure of the success of WAASM is whether these recommendations have been addressed or achieved. A list of recommendations and improvements against these are listed in Section 5 of this report.



3. AUDIT PARTICIPATION AND ASSESSMENT

KEY POINTS

- Participation in WAASM is now a mandatory College requirement for Continuing Professional Development.
- There was a progressive decrease in the number of deaths reported between 2009 and 2011, with a slight increase in 2012, followed by a further decrease in 2013.
- Overall, 67% of cases for the 2009 to 2013 period completed the entire audit process.

3.1 Deaths reported to WAASM

Tables 1 and 2 and Figure 2 summarise the deaths reported to WAASM from 1 January 2009 to 31 December 2013. Percentage participation is calculated on the completion and return of the proformas by 31 March 2014. 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 1 January 2009 and 31 December 2013

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Total deaths reported	602	592	571	601	560	2,926
Excluded error ^a	0	0	1	8	14	23
Total deaths falling within WAASM criteria	602	592	570	593	546	2,903
Audit process complete ^b	463 (77)	419 (71)	423 (74)	409 (69)	235 (43)	1,949 (67)
Proforma complete, awaiting assessment ^c	0 (0)	0 (0)	3 (<1)	27 (5)	131 (24)	161 (6)
Proforma not returned ^d	0 (0)	0 (0)	0 (0)	10 (2)	157 (29)	167 (6)
Terminal care cases	16 (3)	28 (5)	18 (3)	17 (3)	21 (4)	100 (3)
Lost to follow-up ^e	91 (15)	102 (17)	93 (16)	108 (18)	2 (<1)	396 (14)
Cases associated with non-participation ^f	32 (5)	43 (7)	33 (6)	22 (4)	0 (0)	130 (4)

^a Cases reported as WAASM deaths but that do not fall within WAASM inclusion criteria are labelled as 'excluded error'.

^b Percentages refer to total deaths falling within WAASM criteria.

^c Case awaiting first- or second-line assessment.

^d Proformas are considered 'not returned' if they have not been received by the WAASM office within two years of the notification of death.

^e Cases are considered 'lost to follow-up' if forms have not been returned two years after the date of death or are associated with consultants who are no longer working in Western Australia and did not complete cases prior to moving.

^f Non-participants are surgeons who have indicated that they do not wish to participate in the WAASM.

Refer to Appendix B.3 for further information on data.



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

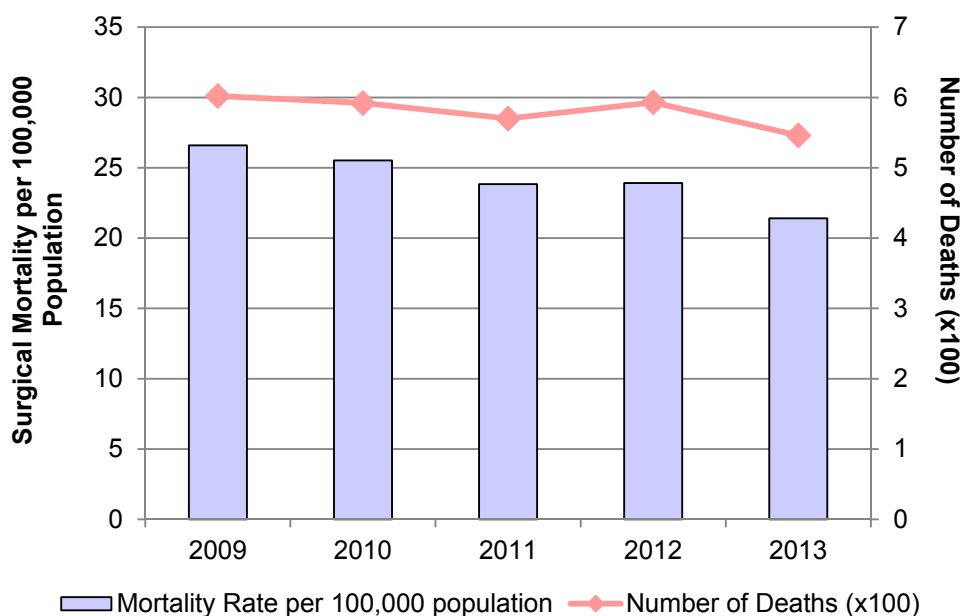


Table 2 Number of surgically-related deaths per 100,000 population

Year	Number of deaths reported to WAASM per year ^a	Estimated WAASM-reported surgical mortality rate per 100,000 population ^b
2009	602	27
2010	592	26
2011	570	24
2012	593	24
2013	546	21

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

^b Population data compiled from the Australian Bureau of Statistics.¹³

Comment:

The process of notification of surgical mortality to WAASM occurs through WA hospitals and the WA Department of Health, 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 27 in 2009 to 21 in 2013; this is a decrease of 22% (Figure 2; Table 2). This has occurred in a population that is progressively aging and by implication will include a greater number with medical co-morbidities.



Figure 3 Case completion rates as allocated by case status

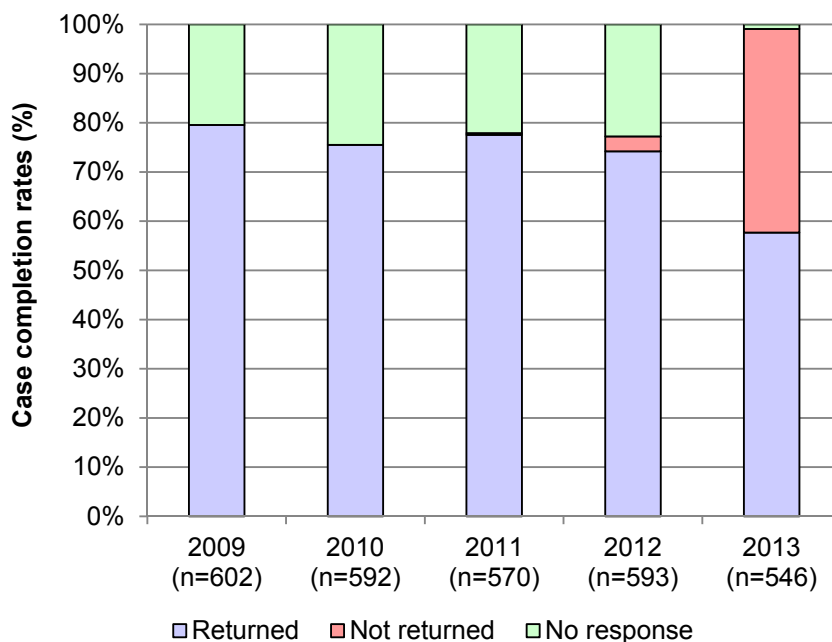
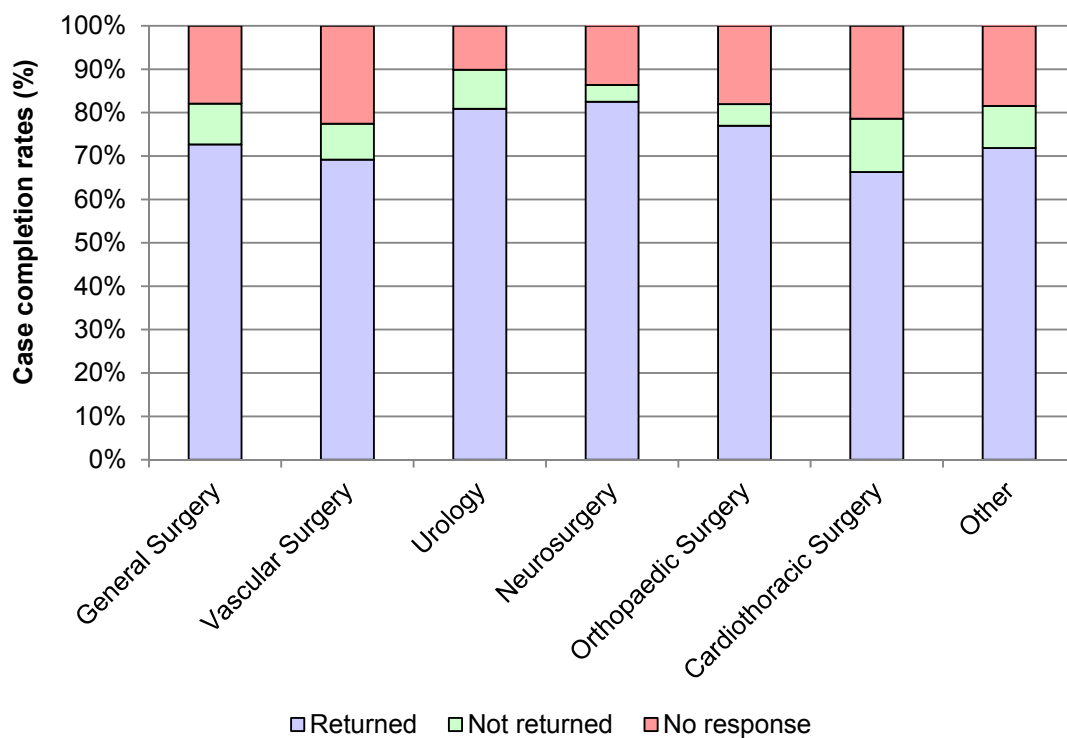


Figure 4 Case statuses by specialty



Note: 'Other' surgery includes the specialties of otolaryngology, ophthalmology, paediatric, obstetrics and gynaecology, and plastic surgery. Refer to Appendix B.4 for further information on data.

Comment:

Figure 3 represents a summary of the case completion rates by the status of the cases in the audit process. Figure 4 gives a breakdown of the overall case status by surgical specialty. Urology and neurosurgery have the highest rates of proforma returns while the cardiothoracic speciality has the lowest (Figure 4).



3.2 Participation in WAASM

KEY POINTS

- Proforma returns have decreased from 80% in 2009 to 71% in 2013.
- In 2013, none of the non-participants were associated with a surgical mortality. This may be because the mortality audit is now compulsory for continuing professional development.

Table 3 Surgeon participation

Year	Number of Cases (%)				
	2009	2010	2011	2012	2013
Reported deaths	602	592	571	601	560
Total deaths falling within WAASM criteria	602	592	570	593	546
Number of surgeons associated with reported deaths	154	151	162	164	163
Proforma returned ^a	479 (80)	447 (76)	444 (78)	453 (76)	387 (71)
Case statistics of surgeons associated with three or more deaths (%)					
Number of surgeons associated with three or more deaths	76 (49)	71 (47)	73 (45)	75 (46)	66 (40)
Total deaths related to surgeons associated with three or more deaths	492 (82)	478 (81)	461 (81)	486 (82)	425 (78)
Number of cases in progress	0 (0)	0 (0)	2 (<1)	14 (3)	216 (51)
Number of cases in which forms were not returned ^b	91 (18)	102 (21)	93 (20)	113 (23)	5 (1)
Number of cases associated with non-participants ^c	32 (7)	43 (9)	33 (7)	22 (5)	0 (0)

Refer to Appendix B.3 for further information on data.

^a Includes terminal care cases; percentages refer to total deaths as per WAASM criteria.

^b Includes cases lost to follow-up and cases which were not returned in a two year period.

^c Cases in which a surgeon refused to participate.

Comment:

Table 3 indicates the number of surgeons associated with deaths reported to WAASM. The number of surgeons associated with deaths reported to WAASM has remained relatively constant from 2009 to 2013.

As of 2013, there are no WAASM cases associated with non-participants. This is due to the College making participation in the mortality audit compulsory for the purposes of CPD.

Proforma returns have decreased from 80% in 2009 to 71% in 2013 (Table 3). While proforma returns may be delayed due to lack of access to medical records, which may impinge on the time taken to complete forms, this does not account for the delays in returning the majority of proformas sent out.

The WAASM office is happy to assist in any way to facilitate proforma completions and would welcome any information relating to cases that have been delayed so that appropriate notes can be made in the case files. This is also important so that any relevant system-related issues delaying proforma returns are identified and resolved so that the audit process can be improved for participants.

It is expected that the recent introduction and usage of the online Fellows Interface system will improve the turnaround of forms to the audit office.



3.3 Hospital participation

KEY POINTS	
•	85% of audited deaths occurred in public hospitals.
•	10% of audited deaths occurred in private hospitals.
•	5% of audited deaths occurred in a hospital with both public and private facilities (co-location).
•	Overall, 21% of cases were transferred from one hospital to another.

Figure 5 shows the number of reported deaths of patients from 2009 to 2013 admitted for surgery in WA hospitals, and the related case statuses (returned versus not returned) for each hospital. The case statuses indicated in Figure 5 refer to the completion status of a case relating to the consultant surgeon; therefore hospitals which show cases that are classified as “refused” indicate that one or more non-participants that work in those hospitals have refused to complete cases. Thirty hospitals were associated with the 2,926 cases reported between 1 January 2009 and 31 December 2013.

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

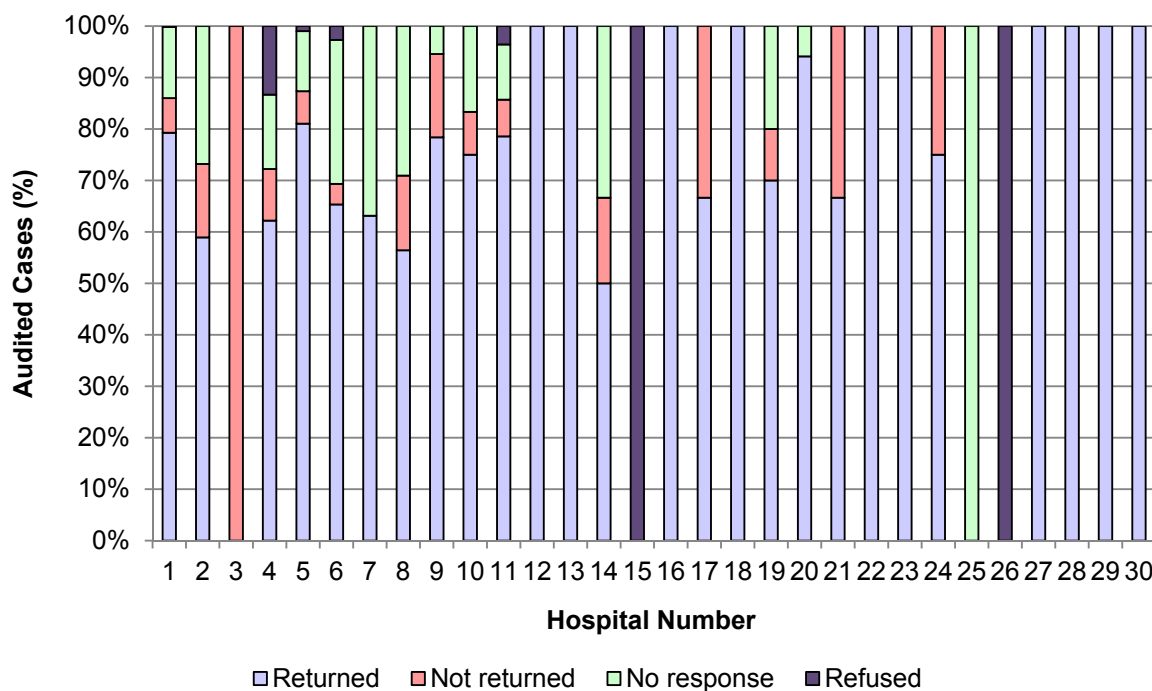


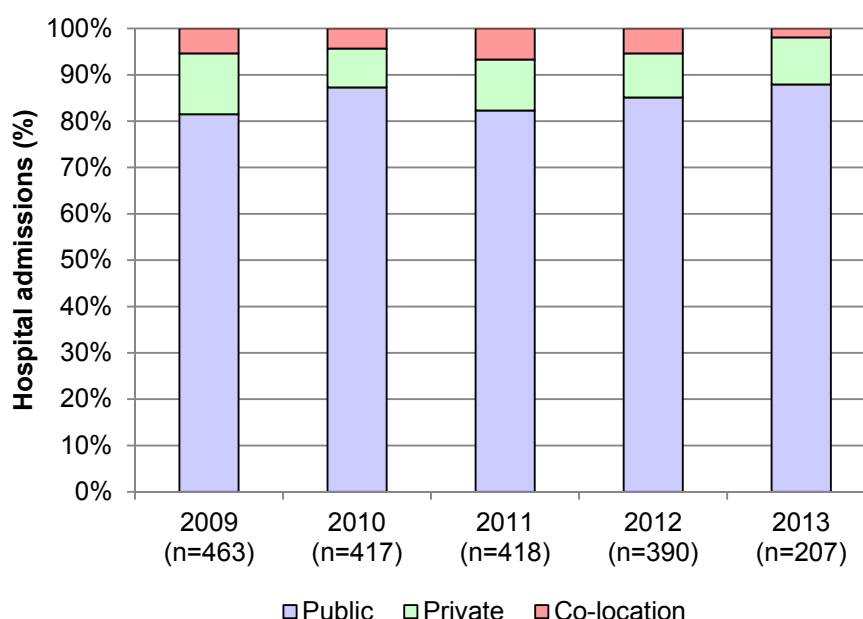
Table 4 Cases where the patient was transferred from one hospital to another hospital

Year	Number of Transferred Cases (%)					Total
	2009	2010	2011	2012	2013	
Completed cases	463	419	423	409	235	1,949
Patients transferred	94 (20)	92 (22)	93 (22)	90 (22)	41 (17)	410 (21)

Refer to Appendix B.3 for further information on data.

Comment:

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 relatively stable between 2009 and 2012, with a drop of 5% in transfers in 2013.

**Figure 6 Cases admitted to public or private hospitals****Comment:**

There has been a 5% increase in deaths occurring in public hospitals since 2009. Eighty-five per cent of deaths occurred in public hospitals, 10% of deaths in private hospitals and 5% of deaths involved co-locations (Figure 6). This is in keeping with WAASM's previous observation that emergency and high risk patients are being increasingly managed in public hospitals.

3.4 Case assessments**KEY POINTS**

- 60% of cases successfully completed the compulsory first-line assessment process.
- Request for second-line assessments remained consistent throughout the audit period; 11% of cases were referred for second-line assessments.

Table 5 First-line assessments (FLA)

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Total deaths falling within WAASM inclusion criteria	602	592	570	593	546	2,903
Total number of cases completed	463 (77)	419 (71)	423 (74)	409 (69)	235 (43)	1,949 (67)
FLA returned	380 (63)	363 (61)	351 (62)	382 (64)	258 (47)	1,734 (60)
FLA pending	0 (0)	0 (0)	0 (0)	15 (3)	97 (18)	112 (4)
FLA lost to follow-up	83 (14)	95 (16)	87 (15)	97 (16)	2 (0)	364 (13)

Comment:

The overall proportion of first-line assessments returned to the WAASM office has remained consistent at an average of 63% from 2009 to 2012 (1476 returns from 2357 cases falling within WAASM criteria). The proportion of first-line assessments completed and returned to the WAASM office in 2013 was lower at 47% (Table 5). Recovering the completion rates of first-line assessments will improve the overall completion rate for cases.

Thirteen per cent of cases are lost to follow-up at the first-line assessment stage of the audit process. It is important that all first-line assessments are completed and returned to the WAASM office so that the peer review process reaches its full potential in identifying any areas for improvement in perioperative surgical care.

It is anticipated that with the move to electronic notification and the requirements for CPD compliance FLA returns will substantially improve.



Table 6 Status of cases referred for second-line assessments (SLA)

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Number of deaths within WAASM inclusion criteria	602	592	570	593	546	2,903
Total number of cases closed	463 (77)	419 (71)	423 (74)	409 (69)	235 (43)	1,949 (67)
Total number of cases referred to SLA	72 (12)	63 (11)	65 (11)	65 (11)	40 (7)	305 (11)
Cases referred to SLA where the audit process has been completed*	66 (92)	57 (90)	57 (88)	45 (69)	9 (23)	234 (78)
Cases referred to SLA that were lost to follow-up*	6 (8)	6 (10)	6 (9)	8 (12)	0 (0)	26 (9)

*Percentages based on total number of cases referred to SLA.

Comment:

The proportion of cases referred for second-line review has remained relatively stable over the last five years.

On average, 9% of cases referred to second-line review are lost to follow-up every year. Second-line reviews may be labour intensive, a possible contributing factor to those cases lost to follow-up (Table 6).

Second-line reviews may not be necessary if the consultant completes the WAASM proforma in full with all relevant information, letters and documentation. As first-line assessments are based purely 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 and hence improve the rate of second-line assessments lost to follow-up.

Cases are deemed lost to follow-up two years after the date of death. As such, 2013 cases will remain open until 2015. Until that time, the WAASM office will pursue the return of first- and second-line cases with reminder letters and phone calls.

4. ANALYSIS OF AUDIT DATA

4.1 Overview and patient sample demographics

KEY POINTS

- 54% of all patients were male and the median age of patients was 77 years (76 and 80 years for males and females, respectively).
- Cases of surgical mortality were most frequent for males aged between 61 and 70 years of age, and females aged between 81 and 90.

4.1.1 Age and gender distribution

Table 7 shows the median age and sex of audited patients. Figures 7 and 8 look at the distribution of age by gender. Figure 9 reports on age by specialty.

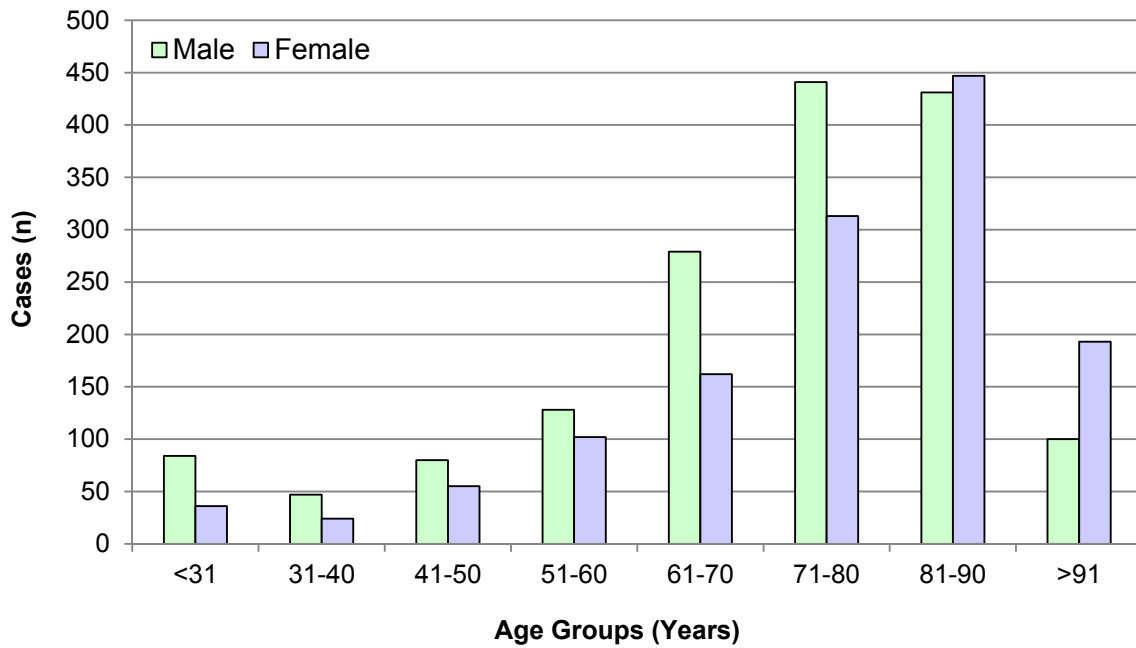
Table 7 Median age by gender, 2009 to 2013

	Number of Cases	Median Age (Years)	Interquartile Range (Years)
All Patients	2,926	77	65–85
Male	1,590	76	63–83
Female	1,332	80	68–87

Refer to Appendix B.3 for further information on data.



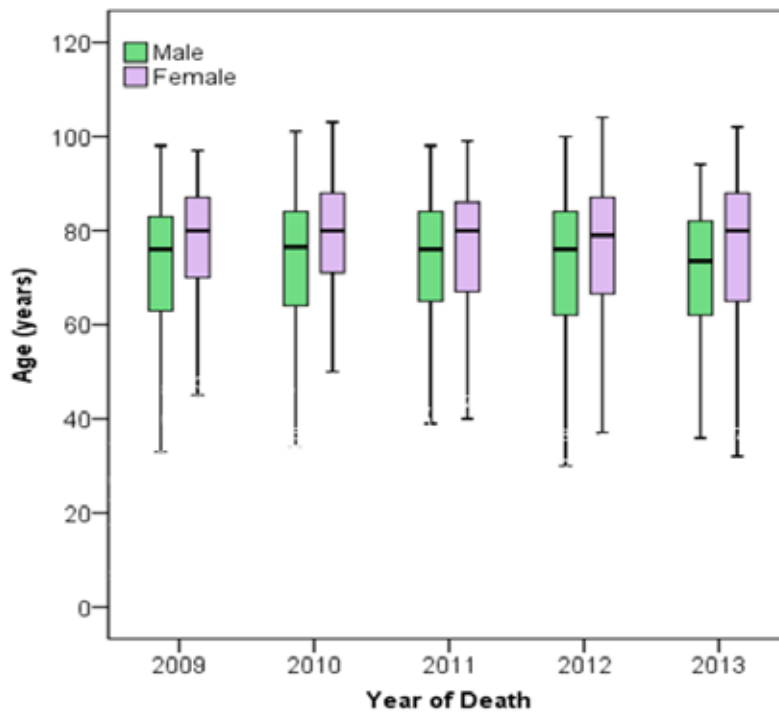
Figure 7 Age distribution by gender



Comment:

Figure 7 shows that the gender trend changes as age increases. Males predominate in the first six age categories, while females predominate in the 81–90 and >91 year age range. This is likely due to the longer average life expectancy of women.

Figure 8 Age distribution of audited patients

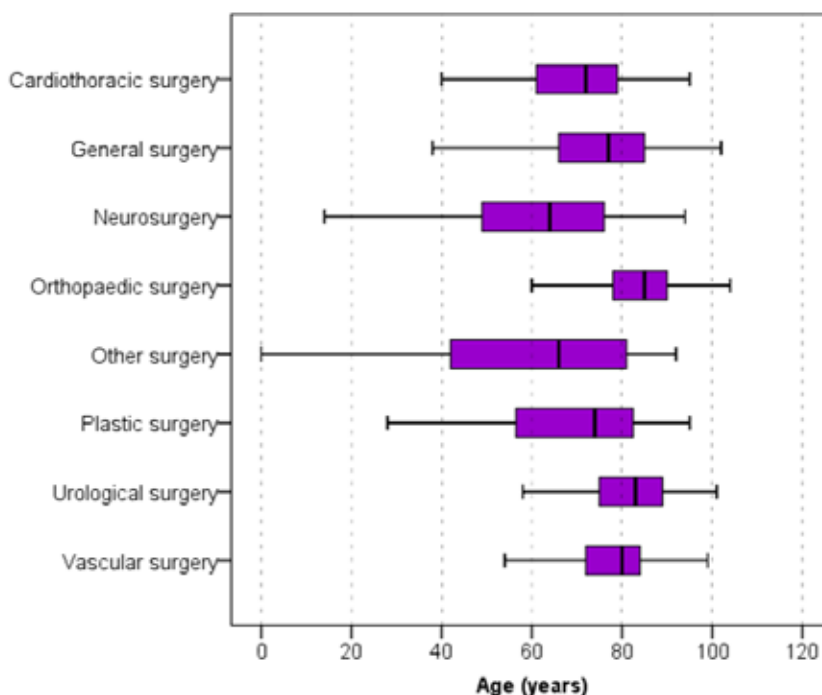


Comment:

The median age of females is higher than that of males in cases of surgical mortality in each year from 2009 to 2013 (Figure 8).



Figure 9 Age of audited patients by speciality



Note: 'Other surgery' includes ophthalmology, otolaryngology and plastic surgery.

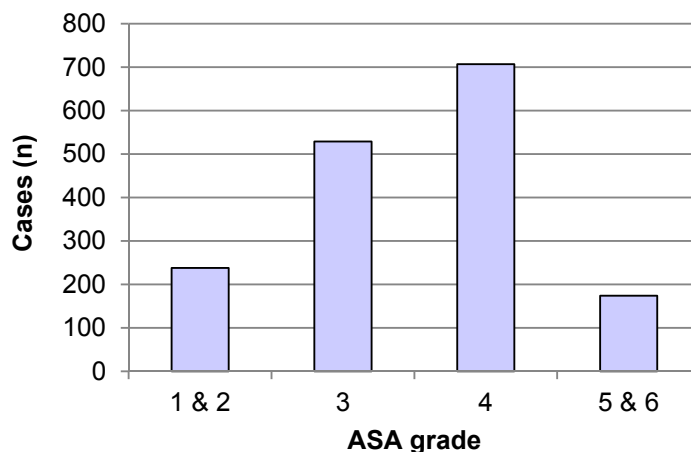
Comment:

The age distribution of patients in different surgical specialties indicates that the orthopaedic cases predominantly involved patients over the age of 80. The largest distribution of ages occurs in neurosurgical cases. As 'other surgery' includes several different specialties, the age distribution has a large range and the data is skewed for this category (Figure 9).

4.1.2 American Society of Anaesthesiologists (ASA) grades

The American Society of Anaesthesiologists grades are an internationally recognised classification of preoperative physical status. The definition of ASA grades can be found in Appendix B.1.

Figure 10 Frequencies of ASA grades assigned to WAASM cases by treating surgeons



Refer to Appendix B.4 for further information on data.

**Comment:**

Eighty per cent of patients were assigned an ASA grade of either 3 or 4, indicating that they were assessed as either having a moderate or severe degree of systemic disease upon admission to hospital (Figure 10).

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 401 forms (21%) returned to WAASM during the 2009 to 2013 reporting period. The ASA grade question in the surgical case form will become a compulsory component of surgical case form completion; this will reduce the large volume of missing data from this important measure of comorbidity.

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 septicaemia and intra-cerebral haemorrhage. In those older than 70 years, the main causes of death were septicaemia and multiple organ failure (Table 8).

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

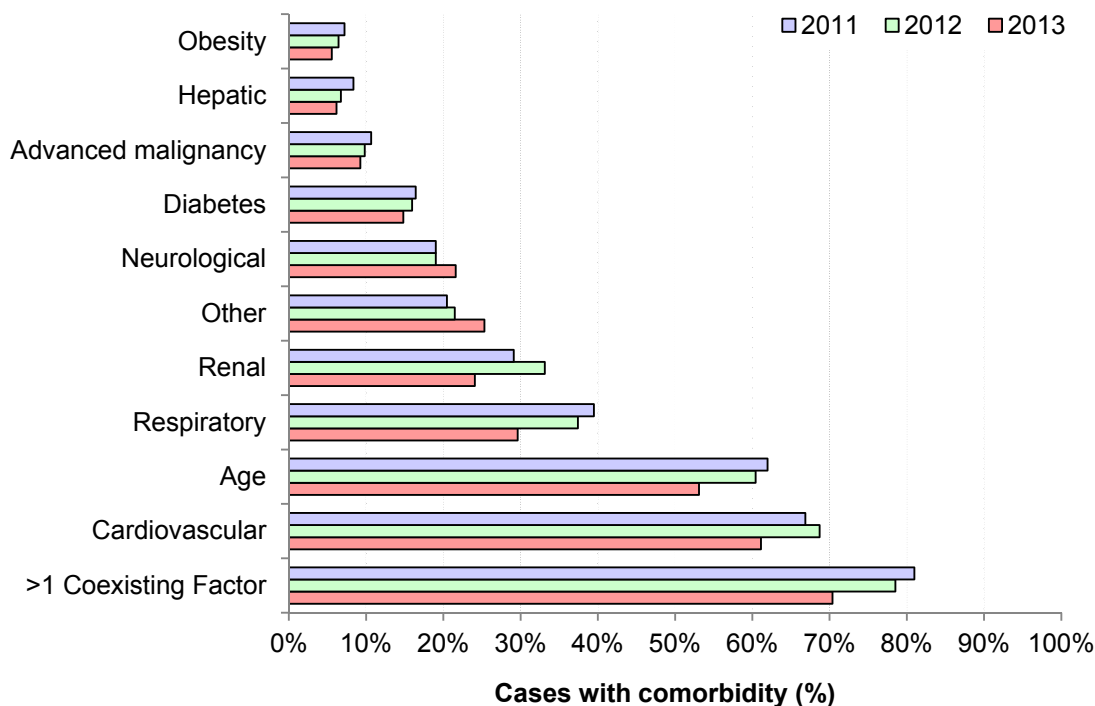
Causes of Death					
Cases <70 years (n=578)	n	%	Cases ≥ 70 years (n=1359)	n	%
Septicaemia	45	8%	Septicaemia	100	7%
Intra-cerebral haemorrhage	40	7%	Multiple organ failure	95	7%
Multiple organ failure	32	6%	Acute myocardial infarction	80	6%
Subarachnoid haemorrhage	27	5%	Pneumonia	72	5%
Severe head injury	23	4%	Aspiration pneumonia	62	5%
Acute myocardial infarction	20	3%	Respiratory failure	61	4%
Respiratory failure	20	3%	Heart failure	49	4%
Cardiac arrest	17	3%	Vascular insufficiency of the intestine	44	3%
Stroke and cerebrovascular accident unspecified	13	2%	Cardiac arrest	44	3%
Other aspiration pneumonia as a complication of care	13	2%	Stroke and cerebrovascular accident	34	3%



4.1.4 Comorbidity

Surgeons are asked to indicate if there are any significant comorbidities associated with each case (see Figure 11). Neurosurgeons do not complete this question in their form and are therefore excluded from this analysis.

Figure 11 Comorbidity statuses in completed cases



Refer to Appendix B.4 for additional information.

'Other' refers to comorbidities other than the ones listed on the surgical case form and may include the presence of other chronic illnesses, haematological or drug-related conditions, vasculopathy, hypertension, dementia, malnutrition, alcoholism and cachexia.

Comment:

In the last three years of the audit, the percentage of patients with more than one coexisting comorbidity has decreased from 81% in 2011 to 70% in 2013 (Figure 11). Surgical risk increases based upon the pre-existing patient condition.

4.1.5 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 Table 9).

Table 9 Use of DVT prophylaxis in cases of surgical mortality

Surgeon-reported use of DVT Prophylaxis						
Year of death	2009	2010	2011	2012	2013	Total
Number of cases	380	353	339	316	164	1552
Number of cases in which DVT prophylaxis was used	305 (80)	277 (78)	263 (78)	253 (80)	128 (78)	1226 (79)
Peer reviewed analysis of use of DVT Prophylaxis						
Year of death	2009	2010	2011	2012	2013	Total
Number of cases in which DVT prophylaxis was assessed	211	224	224	211	112	982
DVT prophylaxis use appropriate (assessor reported)	199 (94)	207 (92)	210 (94)	196 (93)	101 (90)	913 (93)

**Comment:**

The importance of DVT prophylaxis has consistently been highlighted in previous annual reports and symposiums. Use of DVT prophylaxis remained relatively consistent across the audit period with treating surgeons reporting use of prophylaxis in 79% of WAASM cases (Table 9). Through the peer-review process assessors indicated that DVT prophylaxis was used appropriately in 93% of cases. The use of DVT prophylaxis in surgical cases and its appropriateness as reported by assessors remains consistently high.

4.1.6 Critical care allocations in cases of surgical mortality

Table 10 shows the actual use of critical care units (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 10 Actual use, and assessor opinion of use, of a critical care unit

Year of death	Number of cases (%)					Total
	2009	2010	2011	2012	2013	
Number of cases	383	359	347	326	162	1,577
Treated in critical care	184 (48)	169 (47)	165 (48)	147 (45)	74 (46)	739 (47)
Assessor's opinions on usage of critical care facilities (ICU or HDU)						
ICU should have been used	3 (1)	10 (3)	9 (3)	4 (1)	1 (1)	27 (2)
HDU should have been used	19 (5)	13 (4)	13 (4)	1 (0)	5 (3)	51 (3)

Comment:

Critical care (HDU and ICU) facilities were used in 47% of surgical deaths reported to WAASM (Table 10).

As outlined in previous reports, there continues to be a proportion of cases (5%) 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**

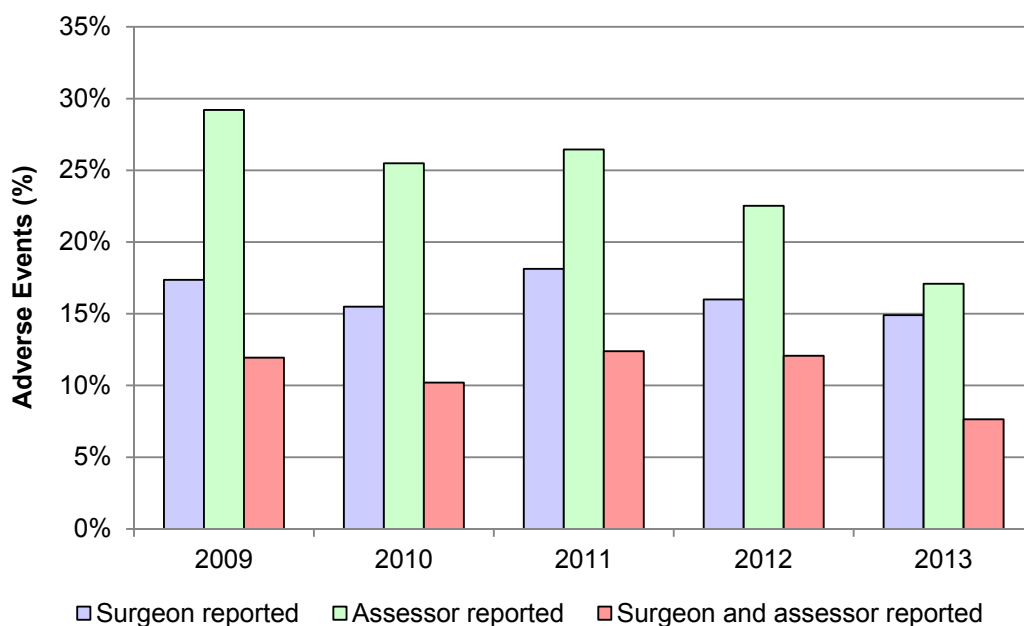
- Assessors reported more areas of concern or adverse events than surgeons.
- The number of adverse events reported by assessors has fallen from 5% of cases in 2009 to 1.5% of cases in 2012.
- The concordance of reporting areas of concern or adverse events between treating surgeons and case assessors is improving.

Incidents reported by the surgeons and assessors are compared in Table 11. Data is reported from 2009 to 2013. The number of assessor-reported adverse events has fallen from 5% of cases in 2009 to 1.5% of cases in 2012. Data presented for 2013 may not be complete, as cases remain active for another year prior to being classified 'lost to follow-up'; 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 11 Surgeons' and assessors' views on performance

YEAR	SURGEON	ASSESSOR				Total
		Consideration	Concern	Adverse event	No event	
2009	Consideration	8	6	2	16	32
	Concern	4	10	3	5	22
	Adverse event	1	4	7	0	12
	No event	37	14	13	333	397
	Total	50	34	25	354	463
2010	Consideration	17	5	2	12	36
	Concern	2	3	1	3	9
	Adverse event	0	5	3	5	13
	No event	25	17	15	304	361
	Total	44	30	21	324	419
2011	Consideration	11	6	2	12	31
	Concern	3	6	1	3	13
	Adverse event	3	2	9	2	16
	No event	32	8	6	317	363
	Total	49	22	18	334	423
2012	Consideration	15	3	3	10	31
	Concern	3	8	2	3	16
	Adverse event	2	0	1	1	4
	No event	24	4	0	330	358
	Total	44	15	6	344	409
2013	Consideration	5	2	1	9	17
	Concern	1	1	0	3	5
	Adverse event	1	0	1	0	2
	No event	10	3	2	196	211
	Total	17	6	4	208	235

**Figure 12 Adverse events reported by surgeons and assessors****Table 12 Level of agreement between surgeons' and assessors' views on performance**

Year	Kappa score (95% confidence interval)	Interpretation of Kappa score
2009	0.317 (0.243-0.391)	Fair agreement
2010	0.317 (0.225-0.409)	Fair agreement
2011	0.391 (0.297-0.486)	Fair agreement
2012	0.471 (0.365-0.576)	Moderate agreement
2013	0.371 (0.159-0.475)	Fair agreement
Overall	0.364 (0.319-0.409)	Fair agreement

Comment:

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 is presented in Table 12. The interpretation of Kappa scores can be found in Appendix B.2

Figure 12 compares the proportion of adverse events reported by surgeons and assessors for the same cases. Each year, assessors report more adverse events than the treating surgeons.

In previous reports, there was a trend of surgeons' under-reporting events that the assessors believed represented 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 Figure 12). In the last two years, in particular, the level of agreement between surgeons and assessors on areas of concern or adverse events has improved, with 2012 showing the highest level of concordance between surgeon and assessor views on clinical incidents with the two groups showing moderate levels of agreement (Table 12). In 2013, surgeons' and assessors' views on performance reverted to 'fair agreement'.



4.3 Clinical events

KEY POINTS

- Assessors reported that preventable adverse events caused death in 12 (1%) cases throughout the 2009–2013 audit period.

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

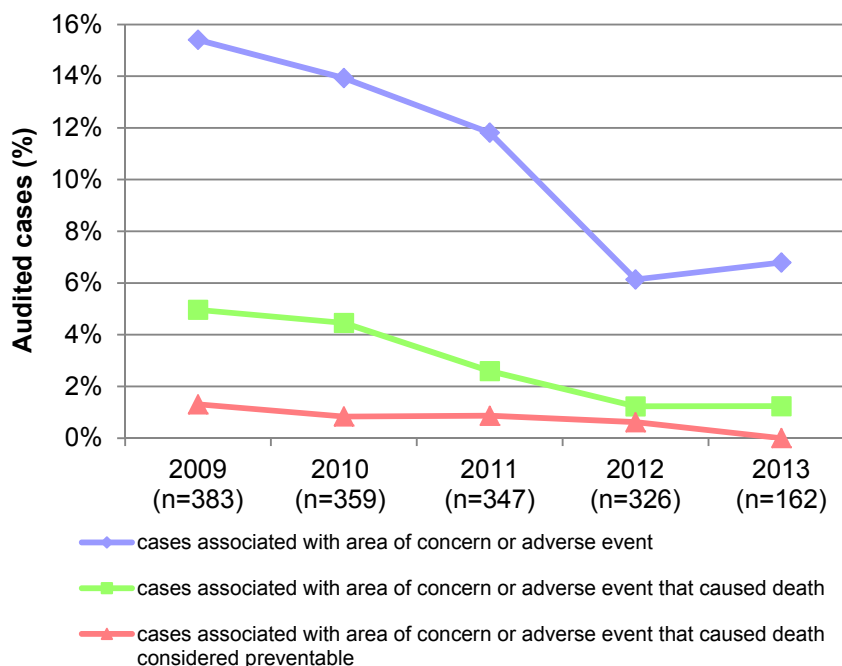
Areas for consideration, areas of concern, and adverse events related to audited cases are compared in Table 13.

Table 13 Audited deaths associated with areas for consideration, areas of concern or adverse events, as reported by assessors

Year of Death	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Total number of cases	383	359	347	326	162	1,577
Area for consideration	49 (13)	41 (11)	48 (14)	44 (13)	16 (10)	198 (13)
Area for concern	34 (9)	30 (8)	22 (6)	15 (5)	6 (4)	107 (7)
Adverse event (AE)	25 (7)	19 (5)	19 (5)	5 (2)	5 (3)	73 (5)
AE that caused death	17 (4)	13 (4)	9 (3)	3 (1)	2 (1)	44 (3)
AE that caused death, considered definitely preventable	4 (1)	3 (1)	3 (1)	2 (1)	0 (0)	12 (1)

Comment:

Areas of concern or adverse events were reported by assessors in 180 (12%) cases since 2009. Two cases (1%) in 2013 were associated with an adverse event that caused death, neither of which was associated with an event that was considered ‘definitely preventable’ (Table 13). The percentage of audited cases associated with adverse events or areas of concern (2009 to 2013) is provided in Figure 13. This shows a small increase in 2013 in the percentage of audited cases associated with a clinical incident; however, in the same time period, a decrease was seen in clinical incidents that caused death but were considered preventable (Figure 13).

**Figure 13 Cases associated with clinical incidents**

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 14).

KEY POINTS

- Over the period 2009–2013, 85% of cases were admitted to public hospitals, 10% were admitted to private hospitals, and 5% were admitted to both private and public hospitals.
- Of the 1,575 cases admitted to public hospitals, 10% were elective admissions.
- Of the 190 cases admitted to private hospitals, 42% were elective admissions.
- The proportion of cases associated with a clinical incident in elective admissions (20%) was significantly more than those associated with a clinical incident in emergency admissions (8%).



Table 14 Elective and emergency admissions to public and private hospitals

		Number of Cases (%)		
	Hospital admissions	Elective	Emergency	Total
(a) All audited cases	Private	80 (42)	110 (58)	190 (10)
	Public	165 (10)	1,410 (90)	1,575 (85)
	Co-location	9 (10)	85 (90)	94 (5)
	Total	254 (14)	1,605 (86)	1,859 (100)
(b) Cases that underwent an operation	Private	77 (96)	92 (84)	169 (89)
	Public	148 (90)	807 (57)	955 (61)
	Co-location	8 (89)	55 (65)	63 (67)
	Total	233 (92)	954 (59)	1,187 (64)
(c) Cases associated with an area of concern or adverse event	Private	18 (23)	8 (7)	26 (14)
	Public	31 (19)	107 (8)	138 (9)
	Co-location	2 (22)	11 (13)	13 (14)
	Total	51 (20)	126 (8)	177 (10)
(d) Cases that underwent an operation that were associated with an area of concern or adverse event	Private	18 (23)	7 (8)	25 (15)
	Public	31 (21)	90 (11)	121 (13)
	Co-location	2 (25)	8 (15)	10 (16)
	Total	51 (22)	105 (11)	156 (13)

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 B.3 for further information on data.

Comment:

An analysis of relationships between admissions data was undertaken using Pearson’s Chi-Squared Test. The significance of relationships between hospital status, admission type, clinical incidents and the operative status of cases was tested. It was found that:

- Of emergency cases admitted to public hospitals, 57% underwent an operation compared to 84% of emergency cases admitted to private hospitals ($p < 0.0001$) (Part (b) Table 14).
- Elective admissions that underwent an operation in public admissions (90%) were not significantly different to the number undergoing operations in private admissions (96%) ($p = 0.100$) (Part (b) Table 14).
- The proportion of cases associated with an area of concern or adverse event in elective admissions (20%) was significantly more than those associated with a clinical incident in emergency admissions (8%) ($p < 0.0001$) (Part (c) Table 14).
- The proportion of operative cases associated with an area of concern or an adverse event was not significantly different between private and public hospitals ($p = 0.392$) (Part (d) Table 14).

**Table 15 Emergency admissions to private and public hospitals**

Number of emergency admissions (%)			
	Admissions to private hospitals (n=110)	Admissions to public hospitals (n=1410)	Admissions at co-location (n=85)
Underwent operation	92 (84)	807 (57)	55 (65)
Emergency admissions where no operation was performed (%)			
Reason for no operation	Admissions to private hospitals (n=19)	Admissions to public hospitals (n=613)	Admissions at co-location (n=31)
Active decision not to operate	11 (58)	233 (38)	12 (39)
Not a surgical problem	3 (16)	86 (14)	6 (19)
Patient refused operation	3 (16)	47 (8)	7 (23)
Rapid death	1 (5)	49 (8)	1 (3)
Missing data	1 (5)	198 (32)	5 (16)

Refer to Appendix B.3 for further information on data.

Comment:

In private hospitals 84% of emergency admissions underwent an operation as did 57% of emergency admissions in public hospitals (Table 15).

In cases where an operation was not undertaken in emergency admissions, the primary reason for no operation was an active decision not to operate, this occurred in 58% of admissions in private hospitals, 38% of admissions in public hospitals and 39% at hospitals with both private and public facilities (co-location) (Table 15).

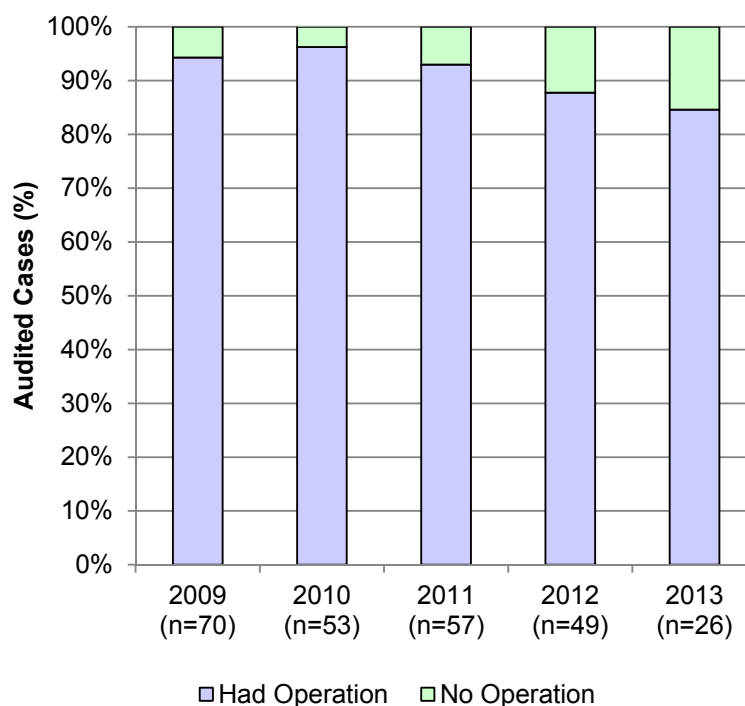
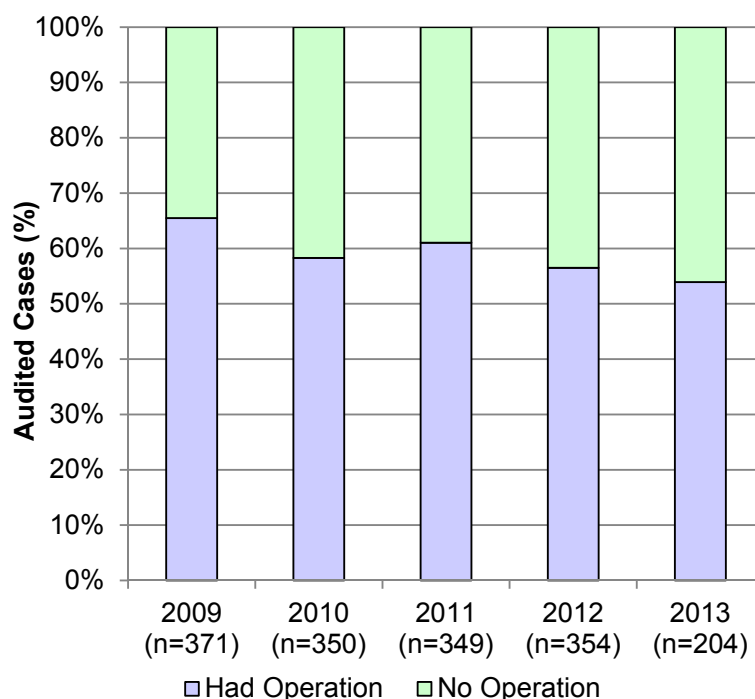
Figure 14 Elective admissions associated with an operation or no operation



Figure 15 Emergency admissions associated with an operation or no operation



Comment:

A decreasing trend in emergency patients who underwent an operation is observed from 2011 to 2013, and is displayed in Figure 15. The avoidance of futile surgery has been noted by WAASM in previous reports, and may continue to be an explanation for this trend.

4.4.2 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 16 and Figures 16 and 17. Details of areas of concern or adverse events in elective and emergency admissions are given in Tables 17 and 18 respectively.

Table 16 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	52 (20)	204 (80)	256 (13)
Emergency	127 (8)	1,524 (92)	1,651 (87)
Total	179 (9)	1,728 (91)	1,907

Comment

Some 52 of 256 (20%) elective cases had an incident of concern or adverse event where as only 127 of 1651 (8%) emergency cases had an incident of concern or adverse event. Given that elective cases would be expected to be low risk this suggests that deaths following elective surgery should be scrutinised as a matter of course.



Figure 16 Cases associated with areas of concern or adverse events in emergency and elective admissions

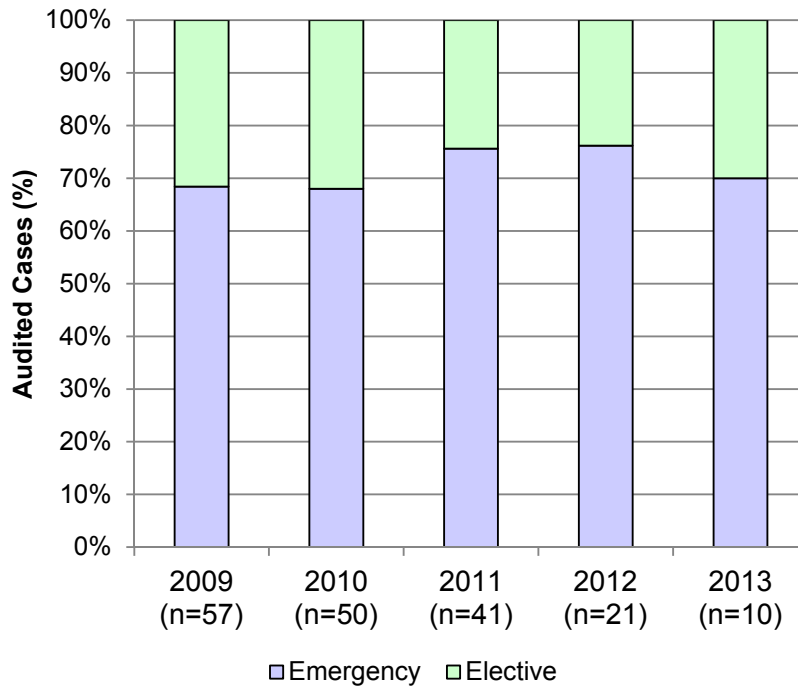
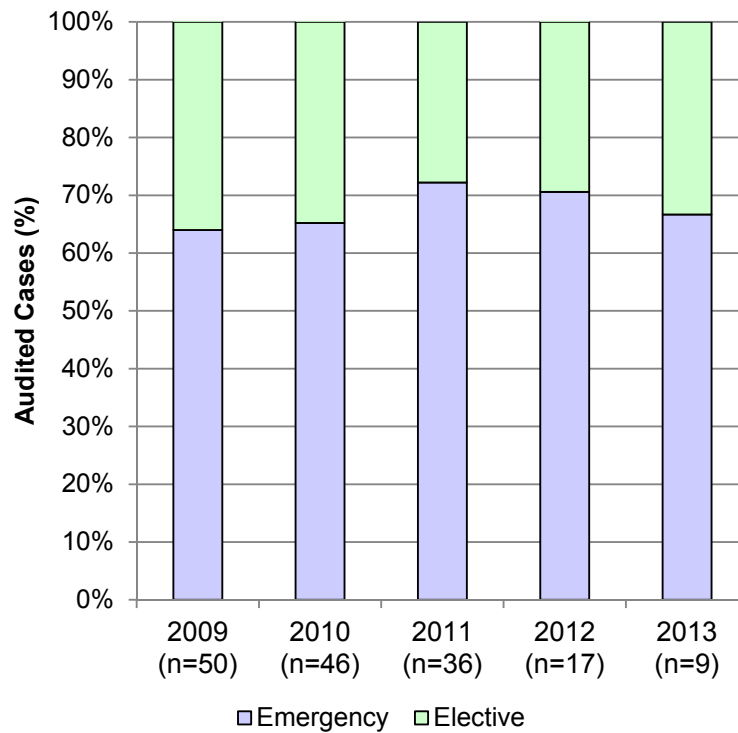


Figure 17 Operative cases associated with areas of concern or adverse events – emergency and elective admissions



Comment:

In emergency admissions there has been an increase of 8% in cases associated with clinical incidents from 68% in 2009 to 76% in 2012 (Figure 16). Similarly, an increase in operative cases associated with clinical incidents in emergency admissions from 64% in 2009 to 71% in 2012; this is an increase of 7% (Figure 17).



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

Elective admissions associated with an adverse event (n=52)		
Adverse event	n	%
Related to open surgery	11	21%
General complications	11	21%
Related to delays	5	10%
Related to laparoscopic surgery	2	4%
Related to endoscopic surgery	3	6%
Assessment/diagnosis related issues	6	12%
Drug-related issues	1	2%
Communication failures	3	6%
Unsatisfactory medical management	9	17%
Missing data	1	2%
Total	52	100%

Table 18 All areas of concern or adverse events associated with emergency admissions

Emergency admissions associated with an adverse event (n=127)		
Adverse events	n	%
Related to delays	39	31%
Unsatisfactory medical management	35	28%
General complications of treatment	10	8%
Related to endoscopic surgery	9	7%
Staff related issues and communication failures	6	5%
Related to open surgery	5	4%
Injury caused by fall in hospital	5	4%
Related to transfers	4	3%
Related to assessments	4	3%
Related to diagnosis	2	2%
Related to drugs	2	2%
Failure to use facilities	2	2%
Related to radiological operation	1	1%
Missing data	3	2%
Total	127	100%

Comment:

For elective admissions, the most common areas of concern or adverse events were related to open surgery, general complications and delays (Table 17). In emergency admissions, delays were the leading cause of areas of concern or adverse events, followed by unsatisfactory medical management and general complications of treatment (Table 18).



4.5 Operative and non-operative cases

KEY POINTS

- In 36% of cases, an operation was not performed.
- Of the 1,231 cases in which an operation was performed, 5% were abandoned.

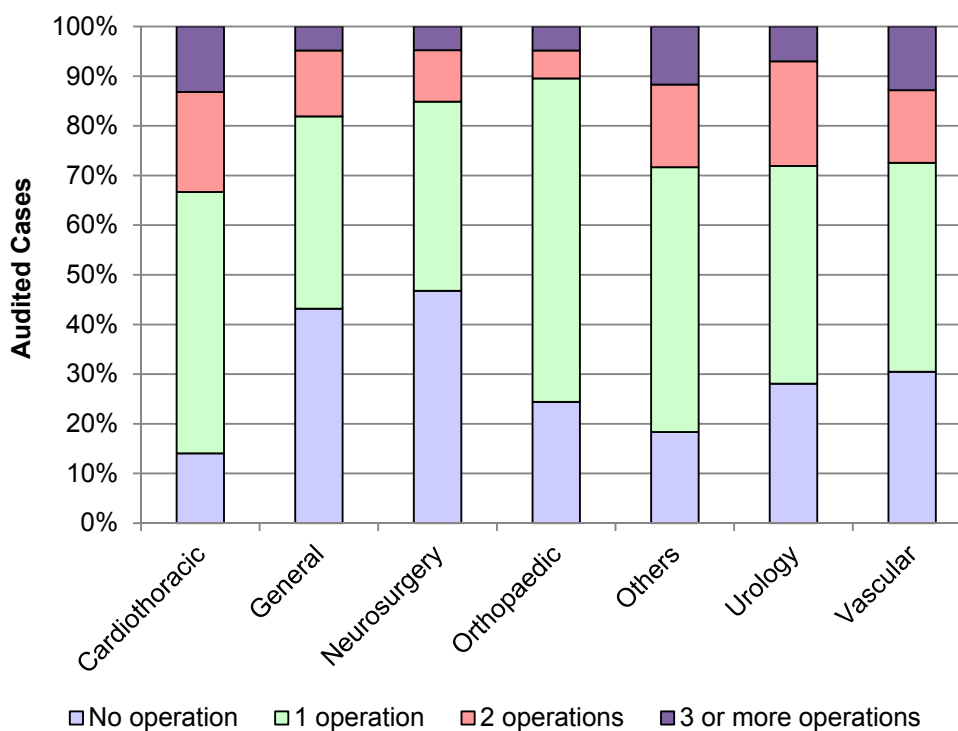
4.5.1 Operative cases

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

Table 19 Operations performed

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Completed cases	458	412	413	407	234	1,924
Total operative cases	317 (69)	261 (63)	272 (66)	245 (60)	136 (58)	1,231 (64)
No operation performed	141 (31)	151 (37)	141 (34)	162 (40)	98 (42)	693 (36)
1 operation performed	224 (49)	181 (44)	174 (42)	185 (45)	108 (46)	872 (45)
2 operations performed	68 (15)	43 (10)	63 (15)	43 (11)	16 (7)	233 (12)
3 or more operations performed	24 (5)	35 (8)	34 (8)	17 (4)	12 (5)	122 (6)

Figure 18 Operations by specialty



Refer to Appendix B.4 for further information on data.

Surgical specialty 'other' includes otolaryngology, ophthalmology, paediatrics, obstetrics and gynaecology and plastic surgery.

Comment:

Deaths after surgery have progressive fallen. The sudden drop in 2013 needs to be reviewed with caution until further years are included. The majority of patients (45%) had one operation, while 12% had a second operation. 6% of cases underwent three or more operations, while 36% of patients did not undergo an operation (Table 19).



Table 20 Operations abandoned

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Number of operative cases	317	261	272	245	136	1,231
Total number of cases in which an operation was abandoned	12 (4)	17 (7)	14 (5)	12 (5)	6 (4)	61 (5)

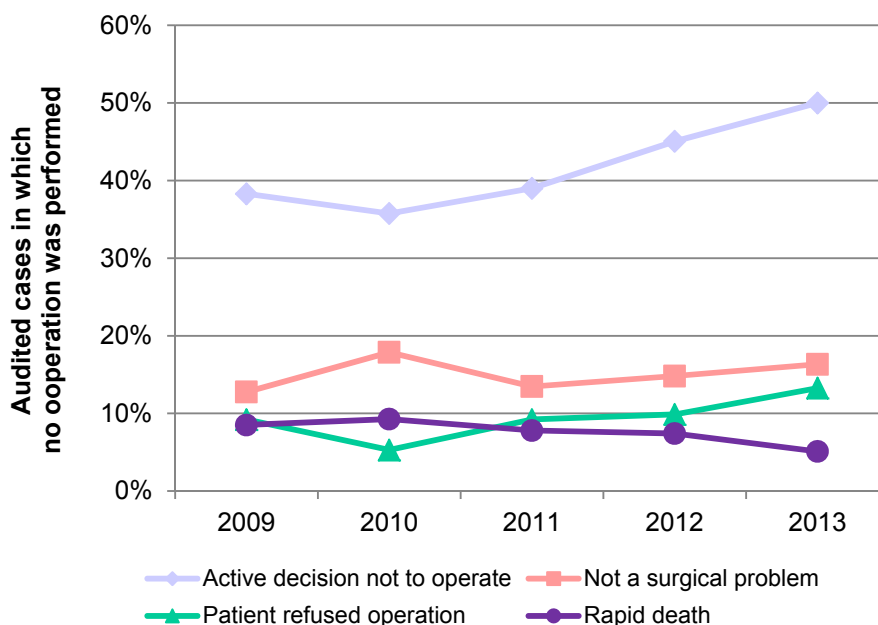
Comment:

The proportion of operative cases abandoned upon finding a terminal situation has remained constant from 2009 to 2013. Overall, 5% of operations were abandoned over the reporting period (Table 20).

4.5.2 Non-operative cases

Data on non-operative cases appears below in Figure 19.

Figure 19 Reasons for no operation



Comment:

The proportion of cases in which an active decision was made not to operate has increased steadily by 12% from 2009 to 2013. This illustrates a consistent trend towards an active decision on the part of the surgeon, patient and/or next of kin not to operate. This may reflect an increasing aged population. The proportion of patients refusing an operation also increased over the reporting period from 9% in 2009 to 13% in 2013 (Figure 19).

Additionally, the proportion of cases in which the rapid death of a patient was reported has decreased by 4% from 2009 to 2013 (Figure 19).



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 21).

Table 21 Comparison of views of surgeons and assessors on preoperative risk of death in cases undergoing an operation

Number of Cases (%)				
Surgeon's view of risk				
Assessor's view of risk	Minimal/small	Moderate	Considerable/expected	Total
Minimal/small	45 (5)	25 (3)	6 (1)	76 (8)
Moderate	36 (4)	99 (11)	82 (9)	217 (24)
Considerable/expected	27 (3)	122 (14)	458 (51)	607 (67)
Total	108 (12)	246 (27)	546 (61)	900

Refer to Appendix B.3 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 20 and 21.

Figure 20 Areas of concern or adverse events in WA teaching hospitals

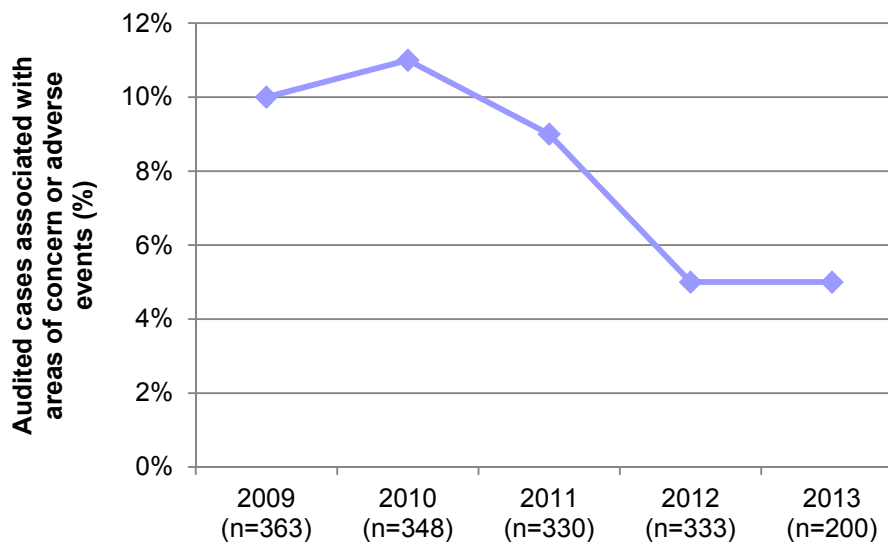
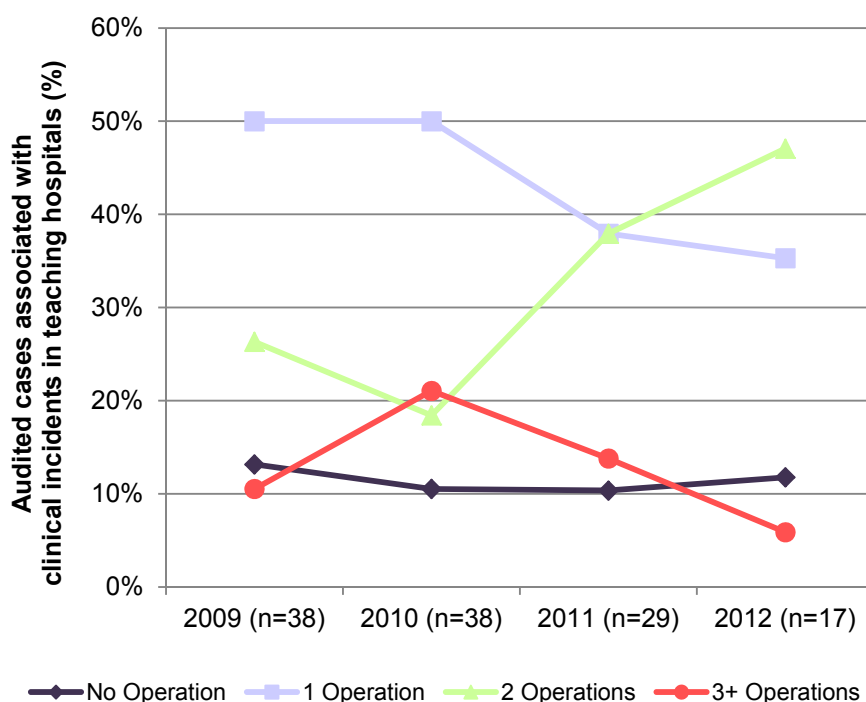




Figure 21 Areas of concern or adverse events in WA teaching hospitals, by number of operations performed



Comment:

In tertiary teaching hospitals the overall proportion of cases associated with an area of concern or adverse event decreased from 10% in 2009 to 5% in 2013 regardless of whether an operation was performed or not (Figure 20).

Figure 21 demonstrates the proportion of clinical incidents (areas of concern or adverse events) related to operative and non-operative cases from 2009 to 2012. Data was available for 10 cases in 2013, however due to the small number of cases the proportions of adverse events were skewed and the outliers could not be plotted on the graph. WAASM data for 2013 deaths will not be closed until 2015, as such this data is subjected to significant change as cases continue to be returned, assessed and closed during the course of 2014 – this data will be much more accurate in the 2015 Annual Report.

Ten per cent of patients in teaching hospitals did not undergo an operation yet were associated with a clinical incident (Figure 21). Cases in which only one operation was performed showed a decrease over the reporting period in the number of clinical incidents identified in teaching hospitals (Figure 21). In audited cases where two operations were performed, an increasing trend of associated clinical incidents was observed. The proportion of clinical incidents associated with three or more operations decreased over the reporting period.

4.5.5 Unplanned return to theatre

Unplanned return to theatre cases are given in Table 22.

Table 22 Unplanned returns to theatre

Unplanned returns to theatre	Year					Total
	2009	2010	2011	2012	2013	
Number of cases in which at least one operation was performed	317	261	272	245	136	1,231
Cases where surgeons reported an unplanned return to theatre (%)	43 (14)	39 (15)	38 (14)	30 (12)	17 (13)	167 (14)

Comment:

The proportion of patients dying after an unplanned return to theatre (14%) has remained relatively consistent from 2009 to 2013 (Table 22).



4.6 Consultant involvement in operative cases

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. Table 23 and Table 24 examine consultant involvement in operative cases.

Table 23 Consultants deciding, operating, assisting and supervising in theatre

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Number of operative cases	317	261	272	245	136	1,231
Consultant deciding	259 (82)	222 (85)	222 (82)	197 (80)	96 (71)	996 (81)
Consultant deciding, also operating	185 (58)	143 (55)	165 (61)	149 (61)	63 (46)	705 (57)
Consultant deciding, also assisting or in theatre	49 (15)	60 (23)	53 (19)	62 (25)	30 (22)	254 (21)

Comment:

The number of consultants involved in decision-making has remained constant from 2009 to 2013. The number of consultants who operated as well as made decisions in operative cases increased from 58% in 2009 to 61% in 2012 (Table 23). These trends are also reflected in cases of surgical mortality in teaching hospitals (Table 24).

Table 24 Deaths after surgery in Western Australian teaching hospitals

Year	Number of Cases (%)					Total
	2009	2010	2011	2012	2013	
Number of operative cases in teaching hospitals	233	210	197	190	110	940
Consultant deciding	177 (76)	171 (81)	149 (76)	143 (75)	71 (65)	711 (76)
Consultant deciding, also operating	112 (48)	101 (48)	105 (53)	100 (53)	43 (39)	461 (49)
Consultant deciding, also assisting or in theatre	38 (16)	50 (24)	44 (22)	45 (24)	23 (21)	200 (21)



5. PERFORMANCE REVIEW

This section reviews progress made on each of the recommendations of the 2013 WAASM annual report.

Align WAASM with other state audits by using the standardised national surgical case form and web-based operational system

WAASM launched the standard national surgical case form and web-based operational system (Fellows Interface) concurrently in July 2013. The standard national surgical case form aligns WAASM data collection with data collected by other audits of surgical mortality in Australia. WAASM now also collects data on communication issues, trauma and clinically significant infections.

Complete data migration to the Bi-National Audit System (BAS) by September 2013

The migration from the Access database to the BAS and Fellows Interface online system was completed in July 2013.

Implement online data entry by launching Fellow's Interface. Promote and evaluate the uptake of Fellow's Interface

WAASM launched Fellows Interface in October 2013. Thirty per cent of participants indicated their agreement and preference to use Fellows Interface prior to its launch in October 2013. Currently, 45% of participants are using Fellows Interface to enter and submit surgical case forms and first-line assessments to the WAASM office.

Fellows interface has been in use for six months. During this time, the response rates and legibility of surgical case forms has improved. Additionally, the quality and volume of data returned has also improved.

Fellows Interface is continually promoted to the participants who have indicated a preference for hard copy surgical case forms over online submissions.

Encourage high-level proforma completion to reduce the amount of missing data and improve the assessment process and data integrity by having compulsory fields as part of data entry for consultants

As part of the last stage of case form submission in Fellows Interface, a reminder pop-up window is generated which indicates to the consultant which data fields have not been filled out. This functionality has contributed to an improvement of the data quality received from online submissions.

The ANZASM Clinical Directors have determined which fields of the surgical case forms will be made compulsory in the next upgrade of Fellows Interface. The completion of these mandatory fields (comprising 85% of the surgical case form) will be enforced. Online submission will not be possible until these fields are complete.

The planned launch date of the next version of Fellows Interface is August 2014.

Reporting and Audit Data

Provide individual hospital reports to all participating hospitals in WA for comparison of clinical incidences with other participating hospitals

ANZASM is working in collaboration with a number of stakeholder groups to determine the best design and data presentation for ANZASM Clinical Governance Reports. Work is also currently being done to ensure that hospitals are compared to other hospitals in their respective peer groups. It is anticipated that the development and design of hospital reports will be completed by the middle of 2014 as part of a pilot study in Victoria and South Australia, before being expanded nationally.

Review the format of the WAASM Annual Report to ensure understanding among readers

A data dictionary was added to the Annual Report in 2013 to clarify data inclusions, exclusions and missing data. Additionally, the trend analysis now spans the last five, rather than 12, years of data due to the overwhelming volume of information previously presented. The aim of these changes, which will be retained for all future reports, is to provide readers with additional clarity.



Continue to review falling surgical mortality rates to ascertain whether the audit process has contributed to the reduction of surgical mortality in WA

The falling surgical mortality rates will continue to be reviewed in the annual report through the analysis of retrospective surgical mortality data. Further research into this area has been undertaken and has demonstrated that WAASM initiatives have contributed to the reduction of surgical mortality in Western Australia.

Clinical Management

Investigate clinically significant infections in surgical mortality

Information on clinically significant infections in cases of surgical mortality has only started being collected in WA from July 2013. As of the 31 March 2014 censor date, preliminary analysis of this data since July has indicated that further data collection is necessary to determine meaningful trend analysis relating to this area.

Investigate communication issues in cases of surgical mortality at any stage of treatment

Information on communication issues in cases of surgical mortality has only started being collected in WA from July 2013. Further data collection is needed in this area to produce meaningful analysis on trends and deficiencies relating to communication issues in WAASM cases. This will be reflected in next year's report.

Investigate return to theatre cases by comparing WA data with national data

Investigations on returns to theatre are being undertaken in a clinical setting. This data may be compared with retrospective data on incidents of return to theatre in cases of surgical mortality.

Continue to monitor critical care allocations to determine if allocation practices have improved as per WAASM recommendations

Data on critical care allocations and their usage is collected within the surgical case and assessment forms. An analysis of critical care allocations has been undertaken as part of this annual report.



6. 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
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- 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 and Gynaecologist, Obstetrics and Gynaecology representative
 - Mr Rasa Subramaniam Consumer representative

- WAASM staff:
 - Dr Diana Azzam WAASM Project Manager
 - Dr Franca Itotoh WAASM Senior Project Officer
 - Ms Natalie Zorbas-Connell WAASM Project Officer

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 - Professor Guy Maddern Chair, RAAS; Chair ANZASM Steering Committee
 - A/Prof Wendy Babidge Director, RAAS Division
 - Ms Pip Coleman Business and Development Manager, Project Office
 - Mr Gordon Guy ANZASM Manager



APPENDIX A: WAASM assessor-reported adverse events

Details of adverse events as reported by assessors, in 380 of 2903 cases reported to WAASM between 2009 and 2013

INCORRECT OR INAPPROPRIATE TREATMENT	119
Decision to operate	52
Better to have done different operation or procedure	16
Unsatisfactory/adverse medical management	10
Post-operative care unsatisfactory	9
Incorrect/inappropriate therapy	5
Care unsatisfactory (not otherwise specified)	5
Better to have had more extensive surgery	3
Timing of operation	2
Operation should not have been done or was unnecessary	2
Inappropriate surgical admission	2
Premature discharge from hospital	2
Operation should have been done	1
Duration of operation too long	1
Adverse events related to treatment guidelines/protocols	1
Treatment did not conform to guidelines/protocols	1
Unsatisfactory management of coagulopathy	1
Inappropriate treatment prior to surgical referral	1
More aggressive treatment of infection needed	1
Hospital admission to wrong ward or specialty	1
Resuscitation inadequate	1
Nasogastric tube not used	1
Poor terminal care management	1

DELAYS	83
Delay to surgery (i.e. earlier operation desirable)	36
Delay in diagnosis	14
Delay in transfer to tertiary hospital	6
Delay in transfer to surgeon by physicians	4
Delay in recognising complications	4
Delay starting medical treatment	3
Delay in transfer to surgical unit	2
Delay to surgery while obtaining a CT scan	2
Delay in recognising anastomotic leak	2
Delay in investigating the patient	2
Delays	1
Earlier operation desirable – no theatre available	1
Delay to operation caused by missed diagnosis	1
Delay to ERCP	1
Delay in recognising a bleeding complication	1
Delay in transferring patient to ITU	1
Delay to re-operation	1
Delay starting antibiotics	1



GENERAL COMPLICATIONS OF TREATMENT	42
Aspiration pneumonia	9
Pulmonary embolus	3
Wound-related complications	3
DVT	3
Sepsis related to an intravenous line	3
Septicaemia – cause unspecified	3
General complications of treatment	2
Complications of general anaesthesia	2
Blood-related complications	2
Liver-related complications	2
Displacement of tracheostomy tube	2
Complications relating to hip prosthesis	2
Pneumonia as a general complication of treatment	1
Other abdominal complication	1
Post-operative pancreatitis	1
Renal failure	1
Arterial or venous complication	1
Technical complications of recent ileostomy	1

OPEN SURGERY RELATED	30
Post-operative bleeding after open surgery	9
Anastomotic leak following open surgery	8
Open surgery organ related technical	3
CVA following open surgery	2
GI complication of open surgery	2
Lung complication of open surgery	1
Perforation of small bowel during open surgery	1
Vascular complication of open surgery	1
Wound infection after open surgery	1
Peri-operative bleeding problems after open surgery	1
Intra-operative bleeding during open surgery	1

COMMUNICATION FAILURES	18
Poor documentation	8
Surgeon too junior	2
No protocol for DVT prophylaxis	2
Problems with appropriate staffing	1
Failure of junior surgeon to seek advice	1
Inadequate anaesthetic assistance	1
Failure to communicate with senior staff	1
Poor communication between physician and surgeon	1
Poor communication from transferring to receiving hospital	1



ASSESSMENT PROBLEMS	17
Inadequate pre-operative assessment	11
Failure to investigate or assess patient fully	4
Assessment problems	1
Failure to recognise severity of illness	1

DRUG-RELATED	13
Failure to use DVT prophylaxis	6
Reaction to drugs	3
Anticoagulation causing post-operative bleeding	1
Over-anticoagulation	1
Over-anticoagulation before admission	1
Overdose of narcotics	1

ENDOSCOPIC OPERATIONS	12
Perforation of colon during endoscopic operation	5
Stomach complication related to endoscopic operation	2
Injury to heart during endoscopic operation	1
Extension of ischaemia after endoscopic operation	1
Arterial bleeding after endoscopic operation	1
Peri-operative bleeding related to endoscopic operation	1
Post-operative bleeding related to endoscopic operation	1

PATIENT-RELATED FACTORS	11
Injury caused by fall in hospital	6
Patient refused treatment	3
Patient-related factors	1
Patient unfit for surgery and anaesthesia	1

FLUID BALANCE ISSUES	9
Fluid balance unsatisfactory	5
Post-operative fluid balance unsatisfactory	3
Fluid and electrolyte resuscitation inadequate	1

RELATED TO TRANSFER	7
Transfer should not have occurred	3
Problems during transfer	1
Transfer should have occurred	1
Transfer necessary to obtain ITU bed	1
Lack of hospice beds	1

FAILURE TO USE FACILITIES	5
Failure to use HDU post-operatively	3
Failure to use ITU, Post-operatively	2



DIAGNOSIS RELATED	4
Diagnosis missed by surgeons	2
Diagnosis missed – unspecified	1
Diagnosis missed by medical unit	1
Diagnosis missed by referring hospital	1

EQUIPMENT-RELATED ISSUES	4
Equipment not available	1
Accidental disconnection of equipment	1
ERCP not used or not available	1
Other, equipment related complication	1

LAPROSCOPIC OPERATIONS	4
Postoperative bleeding after laparoscopic operation	1
Perforation of oesophagus during laparoscopic operation	1
Perforation of small bowel during laparoscopic operation	1
Anastomotic leak from small bowel after laparoscopic operation	1

RADIOLOGICAL OPERATION	1
Gall bladder complication of radiological operation	1



APPENDIX B: Data definitions

Appendix B.1 Definition of 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

Appendix B.2 Interpretation of Kappa Scores

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

Appendix B.3 Tables

Table 1: Deaths reported to WAASM between 1 January 2009 and 31 December 2013

Definition:	Count of deaths reported to WAASM and subset data relating to audit processes.
Data Notes:	Total numbers of deaths reported to WAASM, separated by case and proforma status, excluding error, terminal care cases, lost to follow-up, and cases associated with non-participation.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	No data excluded.

Table 2: Number of surgically-related deaths per 100,000 population

Definition:	Number of deaths reported to WAASM per year as a function of surgical mortality rates per 100,000 population.
Data Notes:	Population data compiled from the Australian Bureau of Statistics.
Data Included:	Total number of cases reported to WAASM from between 2009 and 2013.
Data Excluded:	No exclusions.

Table 3: Surgeon participation

Definition:	Counts of surgical mortality data in relation to consultant involvement in cases.
Data Notes:	Table 3 is made up of composite data collected by WAASM in surgical case forms.
Data Included:	Data used in Table 1 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.
Data Excluded:	No exclusions.

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

Definition:	Percentage of cases in which a transfer from one hospital to another occurred. This data was calculated based on completed cases. Neurosurgical cases (where the question was not on the neurosurgical proforma) have been excluded.
Data Notes:	Table 4 is composed of data from Table 1 and data on transfers.
Data Included:	Data on transfers includes all completed cases, including terminal care cases.
Data Excluded:	Data on transfers excludes neurosurgical cases (n=367).



Table 5: First-line assessments (FLA)	
Definition:	All cases are referred to first-line assessments. Table provides counts and percentages of first-line assessments that have been completed, are pending or have been lost to follow-up.
Data Included:	Data on first-line assessments from cases between 2009 and 2013.
Data Excluded:	No exclusions.

Table 6: Status of cases referred for second-line assessments (SLA)	
Definition:	Counts and percentages of cases referred to second-line assessments and a breakdown of cases referred to second-line assessments that have completed the audit process or that have been lost to follow-up.
Data Notes:	Table 6 includes data from Table 1.
Data Included:	Total number of deaths that fall within the WAASM criteria and data on second-line assessment referrals between 2009 and 2013.
Data Excluded:	No data was excluded.

Table 7: Median age by gender, 2009 to 2013	
Definition:	Average age separated by gender for all cases from 2009 to 2013.
Data Included:	All data collected between 2009 and 2013.
Data Excluded:	No exclusions; in 4 cases the gender was unknown.

Table 8: Most common causes of death in cases of surgical mortality	
Definition:	Ten most common causes of death in patients aged <70 and those ≥70 in cases of surgical mortality.
Data Notes:	Only the ten most common causes of death are displayed in table.
Data Included:	All data collected from completed cases between 2009 and 2013 included.
Data Excluded:	No exclusions.

Table 9: Use of DVT prophylaxis in cases of surgical mortality	
Definition:	Counts and percentages of cases in which the use and the appropriateness of use of DVT prophylaxis was reported.
Data Notes:	This table is made of several different variables. Surgeon-reported use of DVT prophylaxis and assessor-reported appropriateness of use of DVT prophylaxis in closed cases are indicated in this table.
Data Included:	Closed cases in which use of DVT prophylaxis was reported (n=1226) and closed cases in which DVT prophylaxis use was assessed (n=982).
Data Excluded:	Cases in which DVT prophylaxis was not used (n=326) and data missing for surgeon-reported use of DVT prophylaxis (n=397). Data missing for assessor-reported appropriateness of use of DVT prophylaxis (n=244)

Table 10: Actual use, and assessor opinion of use, of a critical care unit	
Definition:	Counts and percentages of use of critical care facilities (consisting of intensive care and high dependency units).
Data Notes:	Table 9 is comprised of data from a number of different variables.
Data Included:	All cases which have completed the audit process between 2009 and 2013 (n=1949).
Data Excluded:	Neurosurgical cases (n=367); data missing for 5 cases.

Table 11: Surgeons' and assessors' views on performance	
Definition:	Clinical incidents reported by treating surgeons as compared to those reported by assessors. Data is separated by year.
Data Notes:	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.
Data Included:	All completed cases between 2009 and 2013 (n=1949).
Data Excluded:	No exclusions.



Table 12: Level of agreement between surgeons' and assessors' views on performance	
Definition:	Agreement on clinical incidents between surgeons and assessors that have completed proformas for the same case.
Data Notes:	Only cases in which both the surgeon and assessor have completed the audit process can be included.
Data Included:	All cases which have completed the audit process between 2009 and 2013.
Data Excluded:	None.

Table 13: Audited deaths associated with areas for consideration, areas of concern or adverse events, as reported by assessors	
Definition:	Counts and percentages of cases in which clinical incidents were reported.
Data Notes:	Data in this table is compiled from multiple data sets. In cases where a clinical incident was recorded, only the most significant event was counted.
Data Included:	All cases which have completed the audit process between 2009 and 2013.
Data Excluded:	Neurosurgery cases (n=372) were excluded.

Table 14: Elective and emergency admissions to public and private hospitals	
Definition:	Counts and percentages of elective or emergency admissions as grouped by hospital status (i.e. public, private or co-location).
Data Notes:	Table 14 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).
Data Included:	Part (a) includes all cases that have completed the audit process between 2009 and 2013. 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.
Data Excluded:	Missing data will account for differences in numbers. Missing data is as follows: Part (a) (n=90); part (b) (n=113); part (c) (n=90); part (d) (n=113).

Table 15: Emergency admissions to public and private hospitals	
Definition:	Counts and percentages of emergency admissions in public and private hospitals by specialty and reasons for non-operative cases.
Data Notes:	Table 15 is composed of different tables with different sets of data collected from the surgical case form.
Data Included:	All cases which have completed the audit process between 2009 and 2013, where an emergency admission to a hospital was made.
Data Excluded:	No exclusions.

Table 16: Emergency and elective admissions that were associated with areas of concern or adverse events	
Definition:	Counts and percentages of clinical incidents by admission type.
Data Included:	All cases which have completed the audit process between 2009 and 2013.
Data Excluded:	Data missing for 42 cases.

Table 17: All areas of concern or adverse events associated with elective admissions	
Definition:	Counts, percentages and descriptions of most common clinical incidents in elective admissions
Data Included:	All cases which have completed the audit process between 2009 and 2013, which were admitted to an elective unit and were associated with an area of concern or adverse event.
Data Excluded:	Emergency admissions.



Table 18: All areas of concern or adverse events associated with emergency admissions	
Definition:	Counts, percentages and descriptions of the most common clinical incidents in emergency admissions.
Data Included:	All cases which have completed the audit process between 2009 and 2013, which were admitted to an emergency unit and were associated with an area of concern or adverse event.
Data Excluded:	Elective admissions.

Table 19: Operations performed	
Definition:	Counts and percentages of operations performed in cases of surgical mortality.
Data Included:	All cases completed between 2009 and 2013.
Data Excluded:	Data missing for 29 cases.

Table 20: Operations abandoned	
Definition:	Counts and percentages of cases in which an operation was abandoned on the finding of a terminal situation.
Data Included:	Completed cases between 2009 and 2013 in which an operation was performed.
Data Excluded:	Non-operative cases (n=693). Data missing for 25 cases.

Table 21: Comparison of views of surgeons and assessors on preoperative risk of death in cases undergoing an operation	
Definition:	Counts and percentages of pre-operative risk of death in cases of surgical mortality.
Data Notes:	Only cases in which both the surgeon and assessor have completed the audit process can be included.
Data Included:	All cases which have completed the audit process between 2009 and 2013 in which an operation was undertaken.
Data Excluded:	No exclusions. Data missing for 331 cases.

Table 22: Unplanned returns to theatre	
Definition:	Counts and percentages of reported unplanned returns to theatre in cases of surgical mortality.
Data Included:	All cases which have completed the audit process between 2009 and 2013 in which an operation was undertaken.
Data Excluded:	Non-operative cases were excluded (n=693).

Table 23: Consultants deciding, operating, assisting or in theatre	
Definition:	Counts and percentages of consultants making decisions, operating, assisting and supervising in theatre in cases of surgical mortality.
Data Included:	All cases completed between 2009 and 2013 in which an operation was performed.
Data Excluded:	Cases in which no operation was performed were excluded (n=693). Data missing for 25 cases.

Table 24: Deaths after surgery in Western Australian teaching hospitals	
Definition:	Counts and percentages of consultants making decisions, operating, assisting or present in theatre in operative cases in teaching hospitals.
Data Included:	Completed cases in which an operation was performed in teaching hospitals between 2009 and 2013.
Data Excluded:	Non-operative cases (n=693) and cases in non-teaching hospitals (n=375) were excluded.



Appendix B.4 Figures

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

Definition:	Number of deaths reported to WAASM per year as a function of surgical mortality rates per 100,000 population.
Data Notes:	Population data compiled from the Australian Bureau of Statistics.
Data Included:	Total number of cases reported to WAASM between 2009 and 2013.
Data Excluded:	No exclusions.

Figure 3: Case completion rates as allocated by case status

Definition:	Percentages of case completion rates as allocated by case status.
Data Notes:	'Returned' indicates a case that has been returned to the audit office complete. 'Not returned' indicates a case that is in progress. 'No response' indicates cases that have not been returned to the audit office despite multiple reminders; cases are labelled 'no response' two years after the date of death of the patient.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	No exclusions.

Figure 4: Case status by specialty

Definition:	Percentages of case completion rates as allocated by case status and surgical specialty.
Data Notes:	Surgical specialty 'other' includes otolaryngology, ophthalmology, paediatrics, obstetrics and gynaecology and plastic surgery.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	Data missing for 42 cases.

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

Definition:	Percentages of case completion rates as allocated by case status and participating hospital. Returned includes proforma and first-line complete, as well as closed and terminal care cases. Not returned includes proforma, first- and second-line pending as well as proforma and first-line incomplete. No response includes lost to follow-up, no response extended and proforma rejected. Refused indicates a non-participating consultant.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	Excluded error cases.

Figure 6: Cases admitted to public or private hospitals

Definition:	Proportion of cases admitted to public, private or co-location hospitals as allocated by year.
Data Notes:	'Co-location' indicates hospitals with both public and private health services.
Data Included:	All cases which have completed the audit process between 2009 and 2013.
Data Excluded:	Data missing for 54 cases.

Figure 7: Age distribution by gender

Definition:	Count of cases allocated by age groups and gender.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	No exclusions; in 4 cases gender was unknown.

Figure 8: Age distribution of audited patients

Definition:	Box and whisker plot of ages clustered by gender and year of death.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	No exclusions; in 4 cases gender was unknown.

Figure 9: Age of audited patients by specialty

Definition:	Box and whisker plots of age sorted by surgical specialty in cases of surgical mortality.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	Data missing for 42 cases.



Figure 10: Frequencies of ASA grades assigned to WAASM cases by treating surgeons	
Definition:	Count of ASA grades in all cases of surgical mortality.
Data Included:	All data collected between 2009 and 2013 included.
Data Excluded:	No exclusions.

Figure 11: Comorbidity status in completed cases	
Definition:	Percentage of cases associated with comorbidities, including more than one co-existing factor.
Data Notes	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: 2013 (n=162); 2012 (n=326); 2011 (n=347).
Data Included:	Completed cases between 2009 and 2013 in which comorbidity was indicated.
Data Excluded:	Terminal care and neurosurgery cases were excluded.

Figure 12: Percentage of adverse events reported by surgeons and assessors	
Definition:	Percentage of cases in which an adverse event was recorded by either the treating surgeon or the assessor. Percentages are calculated based on total number of adverse events reported per year.
Data Included:	All cases which have completed the audit process between 2009 and 2013 (n=1949).
Data Excluded:	Neurosurgery cases (n=372) were excluded.

Figure 13: Cases associated with clinical incidents	
Definition:	Percentages of cases associated with areas of concern and adverse events that caused death and that were preventable.
Data Included:	Completed cases between 2009 and 2013 in which the assessor reported a clinical incident.
Data Excluded:	Neurosurgery cases (n=372) were excluded.

Figure 14: Elective admissions associated with an operation or no operation	
Data Included:	All completed cases associated with an elective admission.
Data Excluded:	Completed cases associated with emergency admissions were excluded. Data missing for 1 case.

Figure 15: Emergency admissions associated with an operation or no operation	
Definition:	Percentage of emergency admissions associated with operative and non-operative cases.
Data Included:	All completed cases between 2009 and 2013 associated with emergency admissions.
Data Excluded:	Cases associated with elective admissions (n=298) were excluded. Data missing for 23 cases.

Figure 16: Cases associated with areas of concern or adverse events in emergency and elective admissions	
Definition:	Percentages of cases associated with clinical incidents reported by assessors in elective and emergency admissions.
Data Included:	All completed cases between 2009 and 2013 in which the assessor reported a clinical incident.
Data Excluded:	Data missing for 4 cases.

Figure 17: Operative cases associated with areas of concern or adverse events – emergency and elective admissions	
Definition:	Percentages of cases associated with clinical incidents reported by assessors in operative cases in both elective and emergency admissions.
Data Included:	Completed cases between 2009 and 2013 in which an operation was performed and the case assessor reported a clinical incident.
Data Excluded:	Data missing for 3 cases.



Figure 18: Operations by specialty	
Definition:	Percentages of non-operative or operative cases allocated by surgical specialty.
Data Notes:	Surgical specialty 'other' includes otolaryngology, ophthalmology, paediatrics, obstetrics and gynaecology and plastic surgery. Cardiothoracic (n=114), general (n=790), neurosurgery (n=357), orthopaedics (n=373), others (n=60), urology (n=57), vascular (n=164).
Data Included:	All cases which have completed the audit process between 2009 and 2013.
Data Excluded:	Data missing for 30 cases.

Figure 19: Reasons for no operation	
Definition:	Percentages of audited cases in which no operation was performed, as sorted by reason for no operation.
Data Notes:	Reasons for no operation come directly from the surgical case form.
Data Included:	All cases which have completed the audit process between 2009 and 2013 in which no operation was performed.
Data Excluded:	Operative cases (n=1231) were excluded. Data missing for 25 cases.

Figure 20: Areas of concern or adverse events in WA teaching hospitals	
Definition:	Percentage of audited cases associated with a clinical incident as reported by assessors in Western Australian teaching hospitals.
Data Included:	All cases which have completed the audit process between 2009 and 2013 which were admitted to teaching hospitals (n=1574) and in which a clinical incident was identified (n=132).
Data Excluded:	Cases associated with non-teaching hospitals (n=375) and cases in which no significant clinical incidents were identified (n=324).

Figure 21: Areas of concern or adverse events in WA teaching hospitals, by number of operations performed	
Definition:	Percentage of audited cases associated with a clinical incident as reported by assessors in Western Australian teaching hospitals.
Data Included:	All cases which have completed the audit process between 2009 and 2013 which were admitted to teaching hospitals (n=1574) and in which an operation was performed (n=940) and where a clinical incident was identified (n=117).
Data Excluded:	Cases associated with non-teaching hospitals (n=375) and cases in which no significant clinical incidents were identified.



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