The Western Australian Audit of Surgical Mortality: advancing surgical accountability

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ABSTRACT

Objective: To describe the peer review process of the Western Australian Audit of Surgical Mortality (WAASM), selected outcomes and recommendations.

Study design: Prospective audit using peer review of all cases of patients who died while under the care of a Western Australian surgeon between 1 January 2002 and 30 June 2004. Audit reviews were current to 30 September 2004.

Participants and setting: 194 of 202 surgeons participated after a patient died under their care.

Main outcome measures: Surgeon participation, deficiencies of care, deep vein thrombosis (DVT) prophylaxis, futile surgery, postmortem reviews, proportion of operations performed by consultant surgeons.

Results: The audit process was complete for 896 of 1647 reported deaths (54%), while a further 503 (31%) were still under review at 30 September 2004. Twenty deaths associated with terminal care were excluded from analysis. Median patient age was 80 years, and 799 of the 876 patients who died (91%) had significant comorbidities that increased the risk of death. Deficiencies of care were reported in 179/876 (20%). In 45/876 deaths (5%) the deficiency of care was assessed to have caused the death, and 15 deaths were considered preventable. The risk of a deficiency of care was 1.9 times higher in elective admissions than emergency admissions. Autopsy was undertaken in 83/768 (11%) deaths with complete data. Changes in practice were noted in some areas targeted by WAASM, such as improved DVT prophylaxis. A problem with fluid management was recorded.

Conclusion: Most patients who died were elderly, had complex comorbidities and were treated appropriately. The WAASM has helped to change surgical practice and emphasises the importance of ongoing systematic audit. The participation of surgeons demonstrates their commitment to accountability and supports the intention of the Royal Australasian College of Surgeons to extend the process throughout Australia and New Zealand.

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Safety and quality of health care is a major issue worldwide and a high priority in Australia.[1-4] Clinicians, hospital administrators and health-policy makers are now being held more closely accountable for the care provided. Patients and consumer organisations are demanding a framework of accountability for improving patient safety.[5-7] Clinical audit by peer review is an important component of this process and is a requirement for ongoing professional accreditation by the Royal Australasian College of Surgeons (RACS). Its importance has been highlighted in the recommendations of the Bristol Royal Infirmary Inquiry[8] in the United Kingdom and reports arising from formal inquiries of poor patient safety in Australian hospitals: the King Edward Memorial Hospital Inquiry,[9] the Quality in Australian Health Care Study,[1,10] and the Inquiry into Campbelltown and Camden Hospitals.[11,12]

There is a substantial body of evidence suggesting that 10%–17% of hospitalised patients have an adverse event, and that a small proportion of these result in permanent or major disability and death.[1,13-15] While establishing a process to review all adverse events is a formidable undertaking, death is a clear clinical endpoint. Australia has no process that coordinates and integrates the review of surgical mortality, despite recommendations from national and international inquiries.[9,10,16] While many hospitals provide basic audits of in-hospital mortality, they do not provide external peer review, lack standardisation and, at the population level, are of limited value in the evaluation and comparability of surgical care.

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The Western Australian Audit of Surgical Mortality (WAASM) was established in 2001 to independently peer review all surgery-related deaths in Western Australia (WA). It was developed within the WA Safety and Quality of Surgical Care Project,[17] a collaborative initiative of the School of Population Health at the University of WA, the RACS (WA Branch) and the WA Department of Health. The WAASM was piloted in five hospitals in Perth, and then extended to all public and private surgical hospitals in WA from 1 November 2001. It was modelled on the Scottish Audit of Surgical Mortality and modified for clinical practice in WA.[18-20] Participation is voluntary and is covered by qualified privilege under the relevant state and Commonwealth legislations. We describe here the peer review process, selected outcomes and recommendations.

METHODS

The WAASM is notified by hospitals of all patients who have died while under the care of a surgeon ("surgery-related deaths"). The surgeon is sent a semi-structured proforma which is completed and returned to the

WAASM. It is de-identified, coded and entered into the WAASM database. It is then assessed by a first-line surgeon assessor, who either completes the assessment or recommends a more detailed review. In the latter case, a second-line assessor from the relevant specialty who does not practise at the hospital at which the death occurred is selected by the WAASM to review the case notes. The second-line review is returned to the WAASM, which forwards it to the treating surgeon.

The first or second-line assessor classifies potential deficiencies of surgical care into three categories:

- *consideration,* when care could have been improved or could have been different, but may be an area of debate;
- *concern,* when care should have been better; and
- *adverse event,* when there is an unintended injury caused by medical management rather than by disease process, which was sufficiently serious to lead to prolonged hospitalisation, or temporary or permanent impairment or disability of the patient at the time of discharge, or which contributed to or caused death.[20]

The latter two categories (areas of concern and adverse events) are defined as *deficiencies of care*.

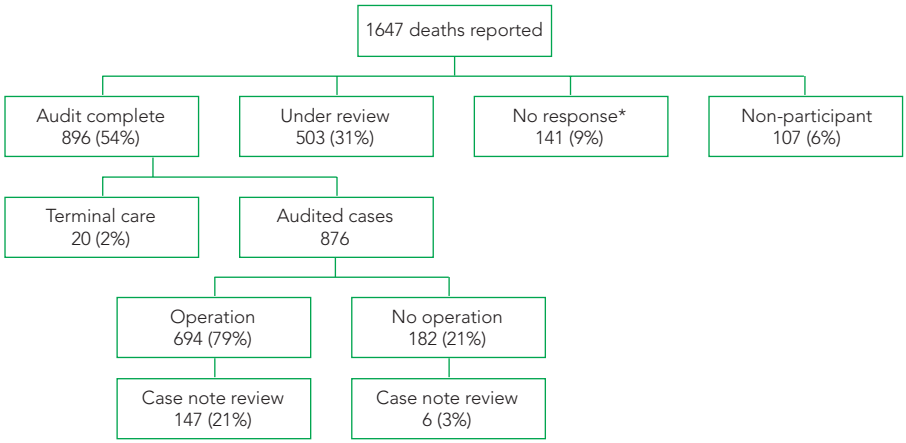
Aggregate data, including an annual report, are disseminated to surgeons, the RACS (at state and national levels), hospital administrators, health-policy makers (including the Director General of Health) and the Health Consumers' Council of WA. The audit does not include hospital and day-case centres where surgical procedures are either not done or are performed using local anaesthesia.

Statistical analysis

Data are analysed at the individual, hospital, and specialist-group level. Here we report grouped results for the period 1 January 2002 to 30 June 2004. Descriptive statistics were obtained directly from the WAASM database software and included frequencies of categorical variables, and medians of continuous variables and their interquartile range.

More detailed analyses were carried out with SPSS version 12.0.1 (SPSS Inc, Chicago, Ill) and SAS version 8.2 (SAS Institute Inc, Cary, NC) statistical software. This included cross-tabulations and Pearson χ^2 statistics, relative risk and 95% confidence intervals, and the Cochrane–Armitage test for linear trend. All statistical tests used the 5% level of significance, and all *P* values were two-sided.

1 Surgery-related deaths reported and audited between 1 January 2002 and 30 June 2004



* Proformas not returned after 2 years or more by 30 September 2004 from surgeons participating in the audit. ◆

2 Demographic characteristics of audited deaths by surgical specialty (*n* = 876)

Surgical specialty*	No. of deaths (%)	Median age in years (IQR)	% Male
General	369 (42.1%)	79 (69–85)	57%
Orthopaedics	213 (24.3%)	86 (80–91)	42%
Vascular	119 (13.6%)	79 (75–86)	66%
Cardiothoracic	63 (7.2%)	73 (67–78)	54%
Urology	49 (5.6%)	79 (71–83)	78%
Plastic	25 (2.9%)	53 (30–70)	44%
Neurosurgery	16 (1.8%)	57 (46–74)	69%
Ear nose and throat	12 (1.4%)	78 (68–82)	83%

* Other audited deaths were in obstetrics and gynaecology (7), ophthalmology (1), paediatrics (1), and oral maxillofacial surgery (1). IQR = interquartile range. ◆

Ethical approval

The WAASM was established within the WA Safety and Quality of Surgical Care Project as part of a National Health and Medical Research Council grant, with ethical approval from the University of WA Human Research Ethics Committee and the Confidentiality of Health Information Committee (WA Department of Health).

RESULTS

The WAASM was notified of 1647 surgery-related deaths between 1 January 2002 and 30 June 2004. Of these cases, 896 (54%) had been through a complete audit process by 30 September 2004, and 503 (31%) were still under review (Box 1). Terminal care accounted for 20 of the 896 audited cases (2%), and these were excluded from analyses. We report on the remaining 876 deaths, 153 (18%) of which had a second-line assessment.

The median age of patients whose cases were audited was 80 years (interquartile range, 72–86 years; Box 2). Significant co-existing factors that increased the risk of death were reported in 799 of the 876 cases (91%). The four main comorbidities were cardiovascular, respiratory, renal and psychiatric disease. The most common admission diagnosis was a fractured neck of femur (145/876; 17%).

Deficiencies of care

Deficiencies of care were reported in 179 of the 876 audited deaths (20%). In 45 of the 876 (5%), assessors considered that the deficiency of care caused the death. Fifteen deaths (2%) were considered preventable.

Emergency and elective admissions

Of the 876 deaths, 669 (76%) followed an emergency admission, compared with 207 (24%) an elective admission (Box 3). The

proportion of deaths with a deficiency of care was significantly higher in elective admissions (67/207; 32%) compared with emergency admissions (112/669; 17%) ($P < 0.0001$; Box 3). The risk of deficiency of care was 1.9 times higher in elective admissions than in emergency admissions (95% CI, 1.5–2.5). Of the 207 people who had an elective admission, 198 (96%) had an operative procedure, compared with 496/669 (74%) of those admitted as an emergency ($P < 0.0001$).

Operative and non-operative deaths

The proportion of deaths associated with deficiencies of care was significantly greater where one or more operations were performed than where no operation was performed (167/694 [24%] versus 12/182 [7%]; $P < 0.0001$). The proportion associated with deficiencies of care increased significantly as the number of operations increased ($P < 0.0001$, Box 4). The proportion of operations in teaching hospitals with a consultant as the primary surgeon was not higher when the patient underwent a second or third procedure (Box 5).

In 52 (7%) of the 694 audited deaths where an operation was performed, the surgeon reported that the operation was abandoned on finding a terminal situation. In 91 (54%) of the 168 cases where no operation was performed, an active decision was made not to operate (Box 6).

Use of DVT prophylaxis

Surgeons indicated whether deep vein thrombosis (DVT) prophylaxis was used and, if not, the reason it was withheld. In turn, assessors indicated whether the surgeons' decisions were appropriate. There was a significant increasing linear trend over time in the appropriate use of DVT prophylaxis as determined by assessors ($P = 0.001$, Box 7).

3 Deficiencies of care associated with 876 surgery-related deaths

Deficiency of care*	Type of admission	
	Emergency ($n = 669$)	Elective ($n = 207$)
None	557 (83%)	140 (68%)
Technical errors of surgery (eg, anastomotic leak, injury to organ, perioperative bleeding after open surgery)	26 (4%)	35 (17%)
Delays (eg, delay to surgery, in recognising complications, transfer to a tertiary hospital)	24 (4%)	6 (3%)
General complications (eg, aspiration pneumonia, wound infection, septicaemia)	15 (2%)	10 (5%)
Failure to use facilities (eg, failure to use DVT prophylaxis or ICU/HDU beds)	9 (1%)	1 (0.5%)
Incorrect or inappropriate therapy (eg, unsatisfactory fluid balance, operation should not have been performed)	8 (1%)	7 (3%)
Patient factors (eg, injury caused by fall in hospital)	6 (0.9%)	-
Diagnosis-related problems (eg, diagnosis missed by surgeons/physicians, diagnosis missed by referring hospital)	6 (0.9%)	-
Communication failures (eg, poor documentation, failure to communicate with senior staff)	4 (0.6%)	-
Drug-related problem (eg, complication)	3 (0.4%)	2 (1%)
Staff problems (eg, surgeon too junior, shortage of staff)	3 (0.4%)	1 (0.5%)
Transfer problems (eg, problems during transfer, transfer necessary to obtain ICU bed)	3 (0.4%)	-
Other	5 (0.7%)†	5 (2%)‡

* Deficiencies of care comprise areas of concern (where care should have been better) and adverse events (an unintended injury caused by medical management rather than by the disease process, which was sufficiently serious to lead to prolonged hospitilisation, to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributed to or caused death).
In cases with more than one deficiency of care, the most important deficiency of care is reported.
† Including resuscitation problems (2), anaesthesia-related problems (1), problems with blood/blood products (1), monitoring problems (1).
‡ Including assessment problems (3) and patient factors (2).
ICU = intensive care unit. HDU = high dependency unit. DVT = deep vein thrombosis. ◆

Autopsies

Postmortem examinations were performed in 83 of 768 (11%) cases with complete data: 16 were hospital autopsies and 67 coronial. In another 69 of 768 cases (9%), surgeons indicated that they would have preferred a postmortem examination where none was done. For 35 of the 83 cases with a postmortem examination (42%), surgeons indicated that they had read the postmortem report. This provided additional information in seven of the 35 cases (20%).

DISCUSSION

The WAASM demonstrated that most patients who died were elderly, had complex comorbidities that increased the risk of death, and were treated appropriately. Media reports — often of isolated cases reported in a sensationist manner — must not be allowed to obscure this essential and reassuring observation, which requires wide dissemination. A key finding was that the overall proportion of deaths associated with a deficiency of care has progressively fallen since the WAASM was established.[19,20]

It is generally accepted that many errors are the result of system failure. However, surgeons have an unusually personal role in patient care, and it is of note that technical errors were the largest single deficiency of care found by the WAASM.

The WAASM was established by the WA Safety and Quality of Surgical Care Project as an independent, external, peer-review process to audit surgery-related deaths. Its principal aim is to improve surgical care through education. This initial analysis suggests the WAASM has been successful in this. Data from the Scottish Audit of Surgical Mortality clearly show that this method of peer review has influenced clinical and non-clinical care in Scotland.[7] A number of findings identified by the WAASM have previously been reported and acted upon through the Scottish audit.[6,7,18] As a result, the WAASM has been able to learn from the Scottish audit experience and "fast-track" processes that address these issues and help change surgical practice.

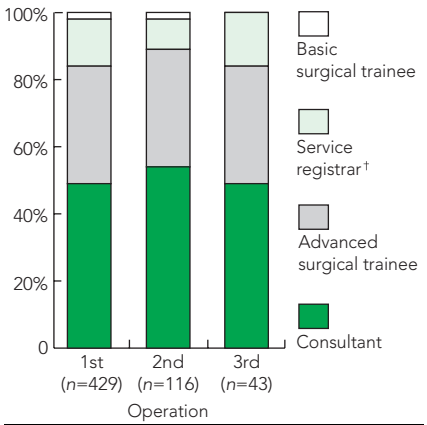
For example, the detrimental effect of delays (eg, from admission to surgery, in recognising complications, and in transfer to a surgical unit) was an early observation in UK audits (the Scottish audit and the National Confidential Enquiry into Patient Outcome and Death).[18,21] This was strongly emphasised by the WAASM in its communications to surgeons, and there has been a subsequent reduction in delays

4 Relationship between number of operations and deficiency of care (DoC)

Number of operations*	Total cases	Cases with DoC†
0	182	12 (7%)
1	508	87 (17%)
2	123	45 (37%)
3 or more	63	35 (56%)
Total	876	179 (20%)

* Number of operations during the index admission in which the death occurred.
† There was a significant increase in the proportion of cases with DoC as the number of operations increased ($P < 0.0001$; Cochrane–Armitage trend test). ◆

5 Grade of primary surgeon performing 1st, 2nd and 3rd operations during the index admission*



* Teaching hospitals only. A consultant may have assisted at some operations, but data on assistants are currently incomplete.
† Junior registrar in a non-training position. ◆

6 Reasons for no operation in 168 audited deaths where no operation was performed*

Reason	No. of cases
Consultant decision not to operate	91 (54%)
Not a surgical problem	34 (20%)
Patient refused operation	22 (13%)
Rapid death†	21 (13%)

* Data were available for 168 of the 182 cases where an operation was not performed.
† Patient died before reaching operating table (eg, severe trauma, leaking aneurysm — died in ward before operation). ◆

resulting from deficiencies of care from 2002 to 2004.[20]

Failure to use adequate DVT prophylaxis was a deficiency of care recognised early by the WAASM. This finding was disseminated to surgeons through seminars, regular case-note review booklets, newsletters and reports on individual management relative to that of their de-identified peers. Two symposia were held specifically addressing this issue. The data show a significant linear trend over time in the proportion of cases in which use of DVT prophylaxis was assessed as appropriate. This mirrors the change seen in Scotland.[7] The WAASM has also shown that, while the intentions of surgeons have improved, the practice within hospitals is inconsistent.[20] This emphasises the importance of an ongoing system-wide audit.

Surgical training is a major issue being addressed by the RACS. The WAASM data show that the consultant surgeon was the primary surgeon in less than 50% of the surgical procedures in teaching hospitals that were associated with surgical deaths. This proportion changed only slightly if the patient underwent a second or third operation during the index admission. The WAASM is exploring obtaining additional data to investigate this issue more comprehensively. The lack of full-time surgeons, pressure on theatre time and availability of senior staff are some of the practical issues that affect the provision of emergency and elective surgery. These results are consistent with the UK mortality studies.[5,18] Many UK hospitals now provide dedicated daytime emergency theatres staffed by senior surgeons who have been freed of all other commitments.[21,22]

The WAASM has identified other matters that have been simple to address. Surgeons are progressively taking a more active role in advising patients and relatives against further or continued surgical intervention when they consider this intervention unlikely to improve the patient's condition. This reduction in so called "futile" procedures addresses a concern expressed by the Health Consumers' Council of WA.[23]

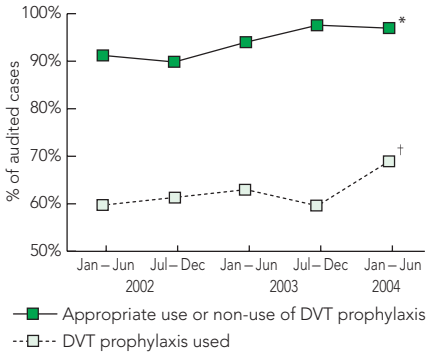
Autopsies were performed after only 11% of surgery-related deaths, despite their important educational role in the quality process.[5,24] In keeping with many other studies, about 20% of these autopsies revealed new information that, if known, would have changed management. In other cases, the assessor considered that the cause of death was unclear, and that an autopsy would have provided more accurate information. There seems to be a clear case for at least a limited autopsy on some patients who die postoperatively.

Results of autopsies, particularly coronial autopsies, were often delayed and are not routinely sent to the surgeon. This problem, which could be easily addressed, contributed to less than half the reports being read by the surgeon. Following publication of the WAASM's first annual report, the Health Consumers' Council of WA held a half-day symposium to emphasise to the community the value and importance of autopsies.[23] In the UK, the National Confidential Enquiry into Patient Outcome and Death has announced its intention to audit the standard of coronial postmortem examinations.[21] Their previous audit of hospital autopsies revealed significant deficiencies. This is a further example of a system-wide surgical audit extending well beyond the surgeons.

The audit process is not immediate, and it is important to allow the audit cycle sufficient time. During its first year, the WAASM noted that fluid management problems were recurring in the audited deaths. From November 2003, an additional question was included in the proforma which demonstrated that fluid management was an important issue in more than 10% of cases. The WAASM believes this figure probably underestimates the extent of this problem, which is not confined to surgical patients. The WAASM is investigating this further. It was the repeated occurrence of postoperative problems that led the Scottish Audit of Surgical Mortality to work with the Scottish Intercollegiate Guideline Network to produce a detailed guideline document for postoperative care.[25]

The strengths of the WAASM study are that surgeon participation was high, that the process was by systematic, independent and external peer review. Performance data were reported to individual surgeons, and aggregate data to hospitals, health-policy makers and consumers. The weaknesses of the study were that, in contrast to the Scottish audit, attending anaesthetists do not participate, as there is a mandated anaesthetic mortality audit, and that some surgeons did not audit all their cases or did not participate at all. Some surgeons remain concerned that participation may place them at risk of medical litigation despite legal protection through state and Commonwealth legislation. In a recent 10-year review, the Scottish audit reported complete audits on 91% of reported deaths, which provides a benchmark for the WAASM.[7]

7 Use of deep vein thrombosis (DVT) prophylaxis and appropriateness of use or non-use (6-monthly groups)



*Significant linear trend ($P = 0.001$).
†No significant linear trend ($P = 0.27$).
(Both tested by Cochrane–Armitage trend test.) ◆

While both the WAASM and Scottish Audit of Surgical Mortality have voluntary participation, there are three important differences. Firstly, the culture of peer-review surgical audit is well established in Scotland compared with Australia. Secondly, Australia has a more aggressive medicolegal environment. Finally, but very importantly, Scottish surgeons are allocated protected time for professional development, which includes audit participation. Such protected time has not been provided in Australia, and, until it is, quality activities will always take second place to clinical workload. Qualified privilege was essential to the establishment of the WAASM, while not required in Scotland. If full participation in the WAASM is not achieved, then it will strengthen the argument that the WAASM should be mandatory.

During 2004, an independent evaluation of the WAASM by surgeons and hospital executives demonstrated that 73% of surgeons participating in the WAASM had changed their clinical practice in at least one way, 23% were aware of changes in hospital practice, and 11% were aware of changes in a colleague's practice.[20] Forty-seven per cent of hospital executives were aware of changes to hospital practices that had been prompted by the WAASM.[20] Undoubtedly, there are other improvements that are too subtle to measure, but their incremental impact will be an improvement in care for all patients, not just those who might have otherwise died.

The benefits of the WAASM have been recognised by the National Executive Council of the RACS, which has endorsed the WAASM as the basis for a binational model for Australia and New Zealand, and by state and national consumer groups, and most state health departments. The process has already begun in Tasmania and South Australia. The challenge for WAASM and other state initiatives will be to maintain the educational focus for individual surgeons, while providing adequate resources to support implementation of the recommendations by the RACS, hospital administrators and clinical governance units, and health-policy makers.

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COMPETING INTERESTS

None identified.

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