Royal Australasian
College of Surgeons

Victorian Audit of Surgical Mortality

REPORT 2014

VASM
Victorian Audit of Surgical Mortality

Front cover

“Tree of solitude” (2015) by Jessele Vinluan.

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The death of a patient can be a learning experience.

This is the seventh report since data collection for the Victorian Audit of Surgical Mortality (VASM) which commenced on 1 July 2007. In this report we present the outcomes of the review of 4,905 deaths from 1 July 2007 to 31 June 2014. During this period seven case note review booklets have been disseminated that, together with the aggregate report, have proven to be a popular tool with the surgical readership. Publications in the peer-reviewed literature have also promoted awareness of the audit internationally.

Audit participation

Audit participation has reached 100% across public and private health services. A total of 1,087 (97%) of the eligible 1,124 Victorian surgical Fellows are currently participating in the audit. The increase in participation from 60% in 2007–2008 to 97% in 2013–2014 is encouraging and anticipated due to the educational component provided and the compulsory status of Australian and New Zealand Audit of Surgical Mortality (ANZASM) for CPD compliance introduced in 2012.

Exciting developments in the VASM include the inclusion of our Gynaecological colleagues into ANZASM with a steadily increasing number of participants. Currently 267 (65%) of the 401 gynaecological specialists invited to participate since August 2012 have enrolled in the VASM audit, an increase of 40% since the last report.

The Royal Australasian College of Surgeons (RACS) continues to place increased emphasis on participation in VASM/ANZASM as part of CPD by revising policies and procedures and requiring 100 per cent CPD compliance, stating that failure to comply will be dealt with as a breach of the Code of Conduct. As a parallel process, the Medical Board of Australia has determined that 'audits of random samples of practitioners from all professions will occur periodically throughout the year'. This will require the 'provision of evidence of the CPD activities Fellows have undertaken to meet the requirements of the Board's standard'. This ensures that the College will discharge its CPD duties properly and should lead to sustained participation rates.

Clinical outcomes

The trends relating to clinical risk management show overall improvements in patient surgical care. Deep vein thromboembolism (DVT) prophylaxis to reduce the likelihood of pulmonary embolus, use of critical care facilities, fluid balance management and patient operative profile will remain crucial areas to monitor in order to improve further and implement additional educational strategies from the lessons learned in this audit.

Our stakeholder education program aims to address deficiencies in clinical management identified through the VASM and it is encouraging to note the decrease of areas of concern and adverse events as progressive reports are published.

However, along with other jurisdictions, the following clinical risk management issues remain the areas for ongoing improvement:

- diagnosis-related problems;
- delay in implementation of definitive care;
- operative management issues; and
- poor communication between health professionals, particularly regarding the coordination of patient care.

The Royal Australasian College of Surgeons and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists encourage participating stakeholders such as health services and surgeons to improve their leadership approaches to patient care and to focus on:

- taking action on evidence of clinical deterioration;
- clinical management in the perioperative stages;
- better documentation of clinical events;
- infection control;
- improving communication between health professionals; and
- improving awareness of shared care requirements.

This report contains a section on specific diseases associated with mortality that are regularly encountered by clinicians. This report looks at abdominal wall hernia, a common condition that is deserving of a review into the factors associated with mortality.

It remains of concern that despite intensive educational efforts, some of the errors appear year after year, albeit in the presence of steadily increasing numbers of patients who die without identifiable clinical management issues. The patients are generally elderly with multiple comorbidities and are admitted as emergencies, but delay to treatment and inappropriate or futile surgery are top of the list again this year. These issues will be at the forefront of our educational efforts.

The success of the VASM is dependent upon participating surgeons and health services, and a highly efficient, motivated and hard-working team at the Royal Australasian College of Surgeons. Their attention to detail and adherence to protocol is the solid foundation on which the audit is built.

With their help, and the support we receive from many others, I remain confident about the future of the VASM, which has been so expertly nurtured from its embryonic state to the well-oiled machine it now is.

The VASM would like to acknowledge the support of the following organisations: the Victorian State Government, the Victorian Department of Health and Human Services (DHHS), the Victorian Surgical Consultative Council (VSCC), the Australian Health Practitioner Regulation Agency, the Australian Commission on Safety and Quality in Health Care, and the Victorian Managed Insurance Authority (VMIA).

VASM will continue to identify, assess and review factors associated with surgical mortality and will continue to develop action plans, educational programs and recommendations for further patient care improvements in Victoria. This activity remains unique in that it is an independent, peer-reviewed surgical mortality audit that is now widely supported by the vast majority of surgeons and gynaecologists in Victoria.

Yours sincerely,

Mr Barry Beiles MB.BCh, FRACS (Vasc)

Clinical Director, VASM

SHORTENED FORMS

ANZASM	Australian and New Zealand Audit of Surgical Mortality
AAA	abdominal aortic aneurysm
ASA	American Society of Anesthesiologists
CCU	critical care unit
CI	confidence interval
COPD	chronic obstructive pulmonary disease
CPD	Continuing Professional Development
DHHS	Department of Health and Human Services
DVT	deep vein thromboembolism
ENT	Ear, Nose and Throat
FI	Fellows Interface
FLA	first-line assessment
GI	gastrointestinal
HDU	high dependency unit
HMO	hospital medical officer
IV	intravenous
OR	operating room
RAAS	Research, Audit and Academic Surgery Division
RACS	Royal Australasian College of Surgeons
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SCF	surgical case form
SD	standard deviation
SLA	second-line assessment
TED	thromboembolic deterrent
VAED	Victorian Admitted Episodes Dataset
VASM	Victorian Audit of Surgical Mortality
VSCC	Victorian Surgical Consultative Council
VMIA	Victorian Managed Insurance Authority

ACKNOWLEDGMENTS

The VASM would like to acknowledge the support and assistance of the many individuals and institutions that have helped in the development of this project, including:

- participating Victorian health services;
- participating Victorian Fellows and International Medical Graduates;
- the dedicated and specialty-specific first- and second-line assessors;
- hospital health information departments;
- the Victorian Surgical Consultative Council;
- Western Australian Audit of Surgical Mortality;
- Australian Capital Territory Audit of Surgical Mortality;
- Northern Territory Audit of Surgical Mortality;
- Tasmanian Audit of Surgical Mortality;
- National Coronial Information System;
- South Australian Audit of Perioperative Mortality;
- Queensland Audit of Surgical Mortality;
- Collaborating Hospitals' Audit of Surgical Mortality;
- Royal Australasian College of Medical Administrators;
- Victorian DHHS, for project funding;
- Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University;
- RACS, for infrastructure and oversight of this project.

VASM Management Committee

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EXECUTIVE SUMMARY

Audit participation and processes

From its inception on 1 July 2007 to 30 June 2014, the end of the current audit period, the VASM received 8,971 notifications of deaths associated with surgical care. As of the census date, 55% of the deaths had been fully audited and the outcomes of the peer review process for the completed cases form the basis of this report. Outcomes still pending in 10% of cases will form part of future audit reports. A process backlog is the reason the most recent reporting period (2013–2014) has the highest number of pending cases. The remaining 34% were not included for the following reasons: excluded due to admission for terminal care, inappropriately attributed to surgical care and treated by non-participating surgeons. Our target is to audit 100% of cases that meet the audit inclusion criteria by 2016.

All public and private health services with relevant surgical activity continue to provide notification of deaths associated with surgery. Full uptake of the audit in the private sector in 2013–2014 is commendable.

There has been increasing participation in the VASM by the RACS Victorian Fellows, from 60% in 2007–2008 to 97% in 2013–2014. The participation rate appears to have reached a steady level and is similar to other jurisdictions. The submission and return of surgical case forms (SCFs), a pivotal step in the audit process, has reached 92%. The target participation rate by RACS and RANZCOG Fellows is 100% with completion of case records within three months of the death.

Figures 1 and 2 provide a visual representation of the VASM audit process. The VASM audit process is a retrospective examination of the clinical management of patients who died while under the care of a surgeon. All cases that meet the VASM inclusion criteria undergo first-line assessment (FLA) and select cases are referred for second-line assessment (SLA), also known as a case note review. Both first- and second-line assessors must consider whether the patient's death was a direct result of the disease process, or whether aspects of the management of the patient may have contributed to the outcome.

In 70% of the cases referred for SLA the reason for referral was failure by the treating surgeon to provide sufficient clinical information. The need for a SLA was similar among surgical specialties and between metropolitan and rural health services. Importantly, the rate of SLA referral has decreased from 20% in the 2007–2010 audit period to 10% in 2013–2014, and this rate is similar to other jurisdictions.[1]

Inaccurate or incomplete clinical information decreases the overall quality of audit and hampers the accurate identification of trends. Data quality in respect of completing the mandatory data fields, has improved, although further improvement is required. By the end of 2015 there will be mandatory reporting via the web-based Fellow's Interface in line with the College's online information technology strategy and this will accelerate the VASM feedback process. Online reporting and the use of mandatory fields will also improve the accuracy and completeness of the clinical information reported and ultimately published by the VASM.

The treating consultant, rather than a junior member of the team, usually provides the information on the reported cases to VASM. This indicates an ongoing high level of personal involvement by participating surgeons. There has been an improvement in the quality of the sections relating to clinical risk management in the data collection forms.

The Victorian Admitted Episodes Dataset (VAED) indicates that from 1 July 2013 to 30 June 2014, 663,768 patients underwent surgical procedures in both the public and private sector. Death was the outcome in only 0.3% of procedures recorded by the VAED. There has been a significant reduction in the mortality rate identified over the past seven years, from 1 January 2008 to 30 June 2014 (a reduction from 0.4% to 0.3%). These findings are similar to the national findings and latest scientific publications and reports released from the Western Australian Audit of Surgical Mortality.[1-3]

It is useful to consider these deaths with some perspective by reviewing the number of surgical procedures performed in Victoria over the full audit period from 1 July 2007 to 30 June 2014. The VAED indicates that 3,969,898 patients received surgical care in Victorian public and private health services during the full audit period, and 0.2% of these patients resulted in reported mortalities to VASM.

Comparison of the number of deaths reported to the VASM in 2013–2014 with the VAED figures for surgical separations resulting in mortality indicates that the VASM is currently capturing 86% of the mortality recorded in the VAED. This represents an increase in 10% from the previous audit period and the VASM aims to achieve 100% notification of surgical mortality. The VASM is investigating the reasons of the 14% gap to address the matter.

The majority of hospital deaths occur in the public sector. This is not a reflection on the quality of care provided in the public sector. Instead it reflects the casemix of patients cared for in the private hospital sector, which tends to be of lower complexity than that of the public hospital sector.

Demographic and operative profile

The demographic and surgical risk profiles of the audited cases are similar to those identified in previous reports published by the VASM. The majority of surgical deaths (85%) have occurred in elderly patients with underlying health problems who have been admitted via emergency with an acute life-threatening condition. Causes of death were often linked to their pre-existing health status. In these cases death was almost always assessed by the review process as not preventable, or as being a direct result of the disease processes rather than the treatment. The most common causes of death were cardiac and respiratory failure; this is congruent with the most common comorbidities in this series of patients and was similar to the national audit findings.

No operative intervention was performed in 18% of the 4,905 cases that completed the audit process. In general, the lack of an operative intervention was due to an active decision not to proceed and usually occurred in patients admitted as emergencies for irretrievable clinical problems. A total of 5,668 separate episodes of surgery were performed across 4,028 patients. The most frequent operative procedures performed were for trauma or acute abdominal pathology. This reflects the high percentage of patients admitted as emergencies (85% in this audit series). A consultant performed the surgery in 67% of procedures and made the decision to proceed to surgery in 87% of cases. In these high risk patient groups, the VASM support these levels of consultant involvement, and the fact that the trends remain consistently high in the last few years of the audit period is commendable.

Clinical risk management

As with the previous report, three areas of clinical priority were considered and a number of other issues were identified relating to clinical care or management (see below). These are provided to inform clinical risk management strategies to surgeons and health services as part of the VASM's continuing performance improvement quality audit cycle.

The audit considered three important areas of clinical priority:

1. Deep vein thromboembolism (DVT) prophylaxis to reduce the likelihood of pulmonary embolus,
2. Use of critical care facilities, and
3. Fluid balance management.

These areas are crucial to analyse and monitor over time in order to continue educational dissemination of findings and recommendations from the audit until the VASM findings reflect perpetual improvement in these areas.

For these areas of clinical priority the VASM recommends health services review relevant sections of their individual clinical governance reports provided by the VASM in November 2014 to identify if further focus is needed for improvements within their organisation.

Deep vein thromboembolism

Prophylaxis was provided in over two-thirds of audited deaths. A conscious decision to withhold prophylaxis was the reason given for non-provision for most of the remaining cases. This was generally necessitated by some clinical contraindication to prophylaxis. Inadvertent omission of prophylaxis was rare, only occurring in 4% of audited cases; a decrease of 0.4% since 2012-13. When the appropriateness of withholding prophylaxis was reviewed there was generally agreement by assessors that the decision was correct. However in 2% of cases where prophylaxis was withheld (a decrease from 2.5% in 2012-13), the assessors felt the decision was questionable although the decision did not affect the final outcome. Close working relationships between the surgical and critical care teams is essential to reduce omission rates further.

Use of critical care facilities

Critical care is essential to support acute medical admissions that are typical of the VASM patient characteristics, as they represent the most seriously ill group of patients. During the audit period (2007–2014) a total of 58% of cases received critical care support during the course of their hospital stay. There was a rise in the utilisation of critical care support that increased steadily from 45% in 2007–2008 to 61% by 2014. In only a small percentage of cases not receiving critical care (2%), the assessors felt that this may have been inappropriate. This has decreased from 2.5% in 2013; however the VASM would like to encourage hospitals to keep monitoring their critical care support for acute medical admissions and aim for all appropriate referrals in this group of seriously ill group patients.

Fluid balance during treatment

There was a perception that fluid balance may have been an issue of management in only 28 (3%) of cases reviewed. This is an improvement from 6% since the audit inception. Deciding on the optimal amount of intravenous fluids to be administered to surgical patients and the best rate at which to give them can be complex. The surgical consultants and clinical teams should be able to optimise fluid management in all cases and continue to maintain the high level of care noted in this year's report.

Clinical care and system management factors

Assessors use a standard spectrum of criticism to review the appropriateness of surgical care. In 84% of the 4,905 audited cases there were no or minor issues of patient management. Areas of concern were identified in 9% of patients. In 6% of patients the assessors felt that the clinical issues were serious enough to be categorised as adverse events. The incidence of serious criticisms of clinical care is similar among the surgical specialties. These results are consistent with the national audit findings.(1)

There is no clear evidence that specific health services or surgical specialties attract higher rates of criticism than others. Criticisms of clinical care are not always attributable to the surgical team, with one third of all identified issues attributed to other areas.

VASM monitors trends in commonly avoidable factors to ensure adequate education programs are delivered to stakeholders. The most common avoidable factors among the 3,455 clinical management issues (areas of consideration, areas of concern, adverse events) identified were:

- inappropriate operation (27%);
- delay in definitive treatment in (26%);
- issues associated with preoperative care (13%);
- issues associated with management or protocol (13%); and
- issues associated with postoperative care (10%).

There has been an increase of 5% for inappropriate operations and 6% delay in definitive treatment identified since last year's findings. Ongoing recommendations for improvements in these areas are provided in the "Recommendations for the VASM clinical stakeholders" section of this report.

Return to operating room

Some complications following complex surgery are to be expected due to a patient's pre-existing comorbidity profile, surgical risk status and the nature of the disease being treated. This notwithstanding, a high rate of returns to the operating room (OR) can be an indication that improvements in care are required. One of the VASM's goals is to see strategies implemented by health services in order to see a decrease in trends relating to unplanned return to the OR.

There was an unplanned return to the OR in 15% (619/4,028) of patients who underwent a surgical procedure. Direct consultant involvement in cases requiring an unplanned return to the OR has risen consistently during the audit period. This trend is to be commended, and the VASM would like to see this increase to continue.

Managing demand for emergency surgery

Managing the demand for emergency surgery remains a significant issue for the hospital system, particularly the demand for time in the operating rooms. Treating surgeons have consistently reported a low rate of postoperative complications throughout the audit. Of the 4,028 operative cases that were audited, 66% (2,645) had no complications while 29% (1,171) of patients had one complication.

Delay in interhospital transfers

Interhospital transfers are a critical part of the high risk surgical care treatment plan and treatment plans should give consideration to the timeliness and appropriateness of patient transfer. An interhospital transfer occurred in 23% of audited cases and was generally related to the need for a higher level of care. The level of care provided during the transfer was considered appropriate in 68% (623) of cases involving a transfer. Delays in interhospital transfers, which are associated with risks and challenges for the patient and clinical teams, were identified in 11% (100) of cases. The safety of patient care during the transfers could be improved by better communication and better coordination of patient care.

Abdominal wall hernia patient care management

Patients with abdominal wall hernias are at high risk of mortality. It is critical that any deficiencies in the care provided to these patients be identified and subsequently addressed. SLA referral occurred in 24% (17/72) of cases involving patients with an abdominal wall hernia, and this rate was 13% higher than that for all audit patients.

A clinical management issue was identified in 53% (38/72) of hernia diagnostic cases, and this rate was 10% higher than the rate for all audit patients. A hernia repair is ideally diagnosed by the referring general practitioner and performed as an elective surgical procedure. Hernia repairs performed as an elective procedure, rather than an emergency procedure, have fewer complications and the mortality rate is lower.

The VASM data suggests that elderly patients admitted as emergencies with an ASA score greater than or equal to three and at least one comorbidity, and who require hernia surgery, should be operated on by a senior consultant as a high priority. Prioritisation of these patients will help prevent complications as well as reduce mortality.

RECOMMENDATIONS FOR VASM CLINICAL STAKEHOLDERS

1. Improved leadership in patient care

- In complex cases there must be clear and demonstrable leadership in patient management.
- The treatment plan for each patient should be understood by all involved in their care.
- The lead clinician must be accountable, responsive, prepared for challenges and must focus on optimal patient care.
- During lengthy operations there should be a low threshold for seeking assistance from colleagues to avoid fatigue.

2. Better documentation of care plans and clinical events

- The case record is an essential tool for identifying clinical sequence and an appropriate clinical management plan. A recurring issue identified by reviewers is the lack of adequate and legible documentation.
- The case record must contain clear and accurate documentation of events and plans.

3. Action on evidence of clinical deterioration

- Clinical deterioration is an issue that is recognised throughout Australia and internationally.
- When clinical deterioration occurs and no clear cause is identified consideration, should be given to causes outside the treating surgeon's specialty or expertise.
- Clinical findings must be considered alongside the results of investigations.
- Clinical deterioration must be acted on as well as recorded.

4. Improved preoperative management

- The potential outcomes from the probable clinical diagnosis must be considered when developing a treatment plan
- Appropriate preoperative preparation and management decreases operative complications and promotes successful recovery. Delayed or unnecessary preoperative investigations can have fatal consequences.
- Preoperative preparation and management should include:
  - evaluation of both physical and psychological preparation;
  - complete medical history and physical examination procedures;
  - consent for the surgery and discussion of potential outcomes; and
  - appropriate documentation and communication of findings with clinical and surgical teams.

5. Improved postoperative management

- The patient should be discharged to the ward with comprehensive orders.
- Preventative measures should be implemented for reducing complications.
- Instructions must be given regarding further management when a patient is discharged from a clinical or surgical team.
- A transfer to a medical unit should be facilitated for patients who are elderly, high-risk, and for whom medical issues are likely to be the most prominent clinical factor during their admission, providing that appropriate surgical postoperative care can be performed in a medical unit setting.

6. Improved awareness of surgical emergencies and sharing of care

- Patients admitted as surgical emergencies are at greater risk where care is shared. All health professionals should increase their awareness of this risk and take active steps to address these risks to improve the quality and safety of patient care.

7. Infection control

- Surgical patients, particularly those with comorbidities, are at increased risk of developing infection and stringent infection control care should be considered. Improvements can be achieved by focusing on flexibility of patient transfers to adequate control facilities, strengthening of current guidelines of infection control procedures, especially hand washing, revision of stringent training and adherence to patient care protocols.

8. Improved communication

- All health professionals and institutions should actively collaborate and communicate to effectively support an appropriate interchange of information and coordination of patient care at all stages during the admission episode.[4]

VASM OBJECTIVES FOR 2015

Many of the VASM objectives from previous reports have been implemented, as outlined in the VASM performance review section of this report. Collaboration between the DHHS, VSCC, Coroner's Office and health services continue to facilitate the VASM's progress.

The VASM objectives for the coming year are:

- continue to improve the return rate of SCFs and targeting 100% compliance;
- continue to collaborate with the VSCC and other agencies, such as the Coroner's Office, to ensure that there are no gaps in mortality reporting or the peer-review process;
- continue to disseminate important information and lessons arising from the audit through publications, workshops and seminars;
- continue to improve the data collection forms and processes;
- continue to coordinate and collaborate in educational seminars;
- contribute to the national mortality audit report;
- attain full uptake of the Fellows electronic interface;
- improve the structure of the database and the quality of data submissions;
- facilitate communication and information sharing with other state mortality audits;
- enhance analysis techniques;
- enhance reporting methods for hospital accreditation processes;
- facilitate an independent external evaluation process by Aspex Consulting on the VASM audit.

1. INTRODUCTION

1.1 Background

The Victorian Audit of Surgical Mortality (VASM) is funded by the Victorian Department of Health and Human Services to review all deaths associated with surgical care and ascertain adverse outcomes which are preventable. Collaboration between the Department of Health and Human Services, the Victorian Surgical Consultative Council and the Royal Australasian College of Surgeons contributes to the VASMs accomplishments. The VASM audit contributes to the Australian and New Zealand Audit of Surgical Mortality (ANZASM); a bi-national network of regionally-based audits of surgical mortality that aim to ensure the highest standard of safe and comprehensive surgical care.

1.2 Objectives

The primary objective of the VASM is to identify factors associated with surgical mortality, including those that may have contributed to the patient's death as well as those factors that may have been preventable. Primarily a patient safety and quality initiative the audit is designed to highlight system issues and trends in deficiencies of care, so that they can be addressed through education and performance improvement initiatives.

The audit includes deaths that occur in a Victorian hospital or that occur within 30 days of discharge from a Victorian hospital. It includes deaths where:

- an operation was performed by a surgeon, regardless of who admitted the patient; or
- the patient was under the care of a surgeon and no operation was performed.

Cases that do not meet the inclusion criteria are excluded from the audit by the hospital or by audit staff. Deaths identified by the reporting surgeon as terminal care cases are recorded by the audit but excluded from further assessment.

Morbidity-only cases are not included in the VASM, as the high volume of cases would render the audit process unfeasible. While not directly included in the VASM, morbidity cases do benefit from the audit as the issues identified through the review of mortality cases are also applicable to morbidity patients.

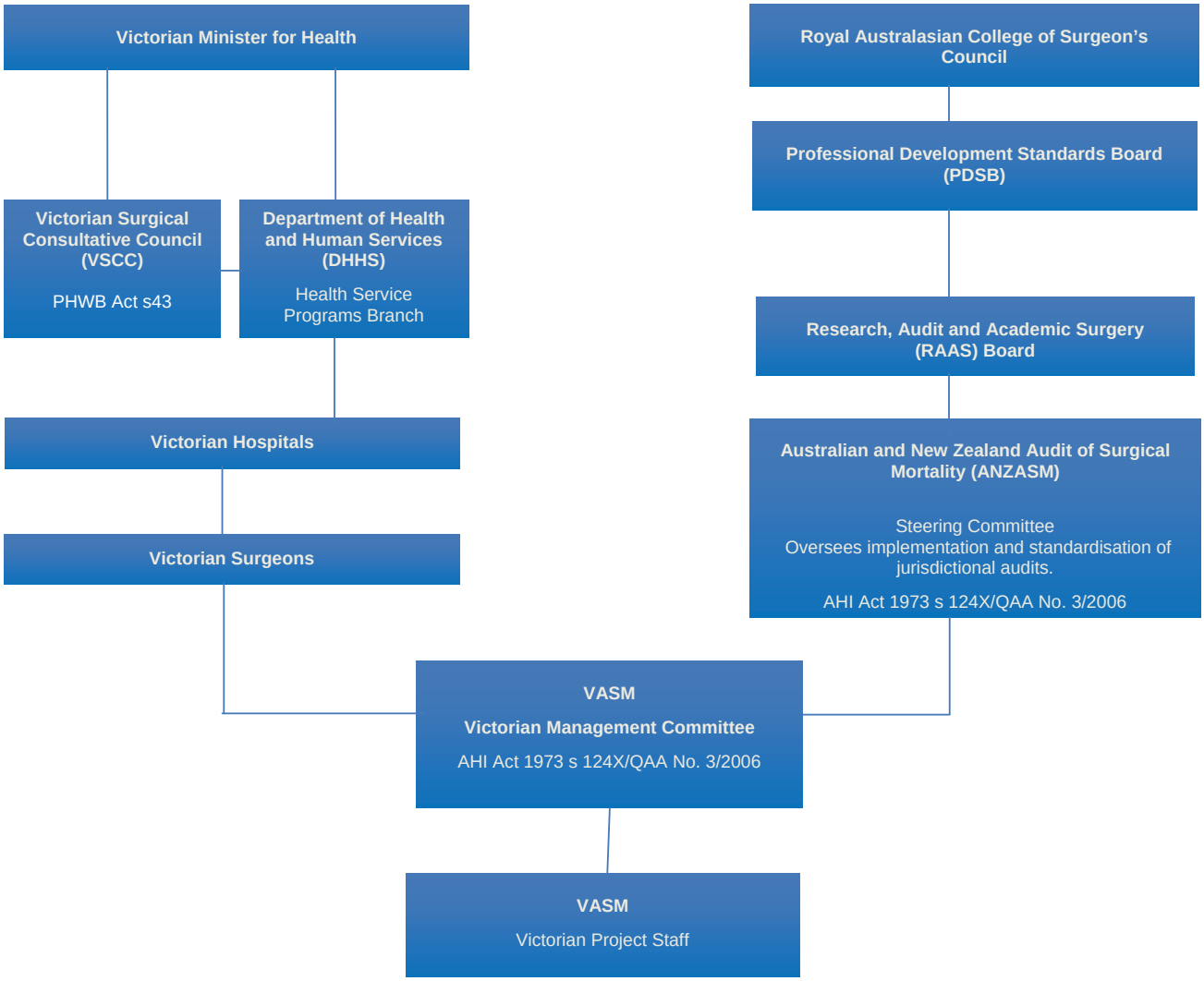
1.3 VASM structure and governance

ANZASM is managed by the RAAS division of RACS and is supported and funded by state and territory governments. ANZASM oversees the implementation and standardisation of each regional (jurisdictional) audit to ensure consistency in audit processes and governance.

Figure 1 represents the governance structure of VASM. RACS manages the VASM audit on behalf of the Victorian DHHS and provides infrastructure support and oversight of the project. The VASM works closely with the VSCC to improve surgical care in Victoria and provides regular reports to ANZASM, VSCC, RANZCOG, health services, surgeons and the Victorian DHHS.

The VSCC, established by the Victorian government in 2001 and provides advice and recommendations on avoidable mortality and morbidity associated with surgery to the Minister for Health, Department of Health and Human Services and the health service sector. The VASM project team informs the VSCC of trends in surgical mortality and assists with the development of strategies to enable the surgical community and other healthcare providers to address system issues. The VSCC considers reports from the VASM summarising all cases reviewed.

Figure 1: Victorian Audit of Surgical Mortality (VASM) project governance structure.



1.4 Audit process

Individual regional audits of surgical mortality are notified of in-hospital deaths and 30 day mortality (where available) associated with surgical care. The mortality notifications in Victoria are submitted by health services, coroner e-depositions or directly from the treating surgeon. All cases in which a surgeon was responsible for, or had significant involvement in, the care of a patient are within the scope of the audit, regardless of whether the patient underwent a surgical procedure.

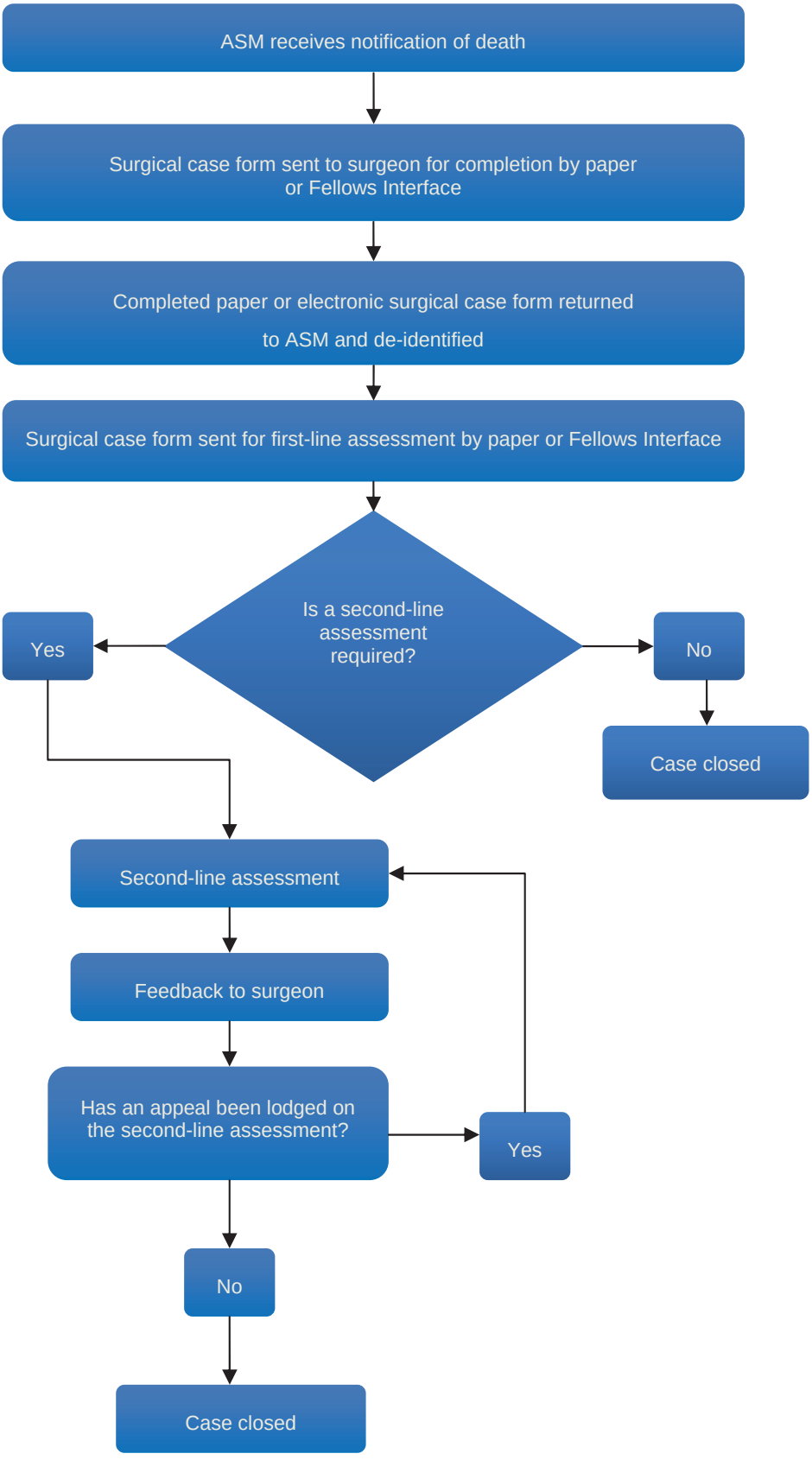
Clinical details pertaining to the management of each case are recorded on a standard, structured SCF by the consultant or treating surgeon associated with the case. The completed SCF is submitted to the audit office and the information is de-identified and sent for first-line assessment (FLA) to a randomly selected surgeon of the same surgical specialty but who is from a different hospital to the treating surgeon. De-identification of the information means that first-line assessor is not aware of the name of the deceased, the name of the treating surgeon or the hospital in which the death occurred.

There are two possible outcomes of the FLA:

- the information provided by the treating surgeon enables the assessor to reach a conclusion about the case and identify any issues of clinical management; or
- the case is referred for a second, in-depth assessment in the form of a SLA (case note review). A SLA may be requested as a result of:
  - the need to clarify issues of patient management identified or suspected by the first-line assessor; or
  - the treating surgeon providing insufficient information on the SCF, preventing the first-line assessor from reaching a conclusion about the case.

In cases for which a SLA is deemed necessary the assessor is selected using the same criteria as that used for the first-line assessor.

Figure 2: The Victorian Audit of Surgical Mortality (VASM) audit



2. AUDIT PARTICIPATION AND AUDIT PROCESSES

2.1. Audit numbers

The VASM received 8,971 notifications of deaths associated with surgical care during the period 1 July 2007 to 30 June 2014.

It is beneficial to put these deaths into some perspective by reviewing the total number of surgical procedures performed in Victoria over this period. The VASM interrogated the Victorian Admitted Episode Dataset (VAED) and during the audit period a total of 3,969,898 patients underwent surgical procedures in Victoria.

A small percentage of reported deaths were associated with private health services. Across all years of the audit (July 2007 to June 2014) 19% of the total cases audited were associated with private health services (949/4,905). This was not surprising given the differences in casemix seen in the private and public hospital sectors.

Table 1: Audit numbers over sequential audit periods.

Case status	2007-2011	2011-2012	2012-2013	2013-2014	Audit period
Closed	2,497 (59%)	893 (58%)	929 (59%)	585 (35%)	4,905 (55%)
Non participant	819 (19%)	243 (16%)	150 (10%)	135 (8%)	1,347 (15%)
Reported in error	192 (5%)	46 (3%)	40 (3%)	48 (3%)	326 (4%)
Terminal care	314 (7%)	171 (11%)	177 (11%)	181 (11%)	843 (9%)
Lost to follow-up	388 (9%)	128 (8%)	60 (4%)	8 (<1%)	584 (7%)
Pending cases* (SCF / FLA / SLA)	8 (<1%)	56 (4%)	212 (13%)	691 (42%)	966 (10%)
All cases	**4,218 (100%)**	**1,537 (100%)**	**1,568 (100%)**	**1,648 (100%)**	**8,971 (100%)**

Note: n=8,971.
SCF: surgical case form; FLA: first-line assessment; SLA: second-line assessment.
Pending cases from 2007-2013 are cases awaiting medical records from hospitals or to finalise the peer review process.

Comments:

- The VASM aims to review all mortality cases within three months of notification. The specialties with the highest casemix were General Surgery, Orthopaedic Surgery, Neurosurgery, Vascular Surgery and Cardiothoracic Surgery.
- Clinical information and completed assessment reviews were available for 55% (4,905/8,971) of reported cases. Cases were excluded, or could not be included, in the audit for a number of reasons:
  - 9% (843) of cases were excluded from the audit as they were terminal care admissions.
  - 4% (326) of cases were wrongly attributed to the surgical unit.
  - 7% (584) of cases were deemed lost to follow-up as
  - a result of the surgeon moving interstate or abroad, or retiring, or the medical records being unavailable.
- 15% (1,347) of cases could not be audited as the treating surgeon had elected not to participate. The rate of non-participant cases has declined, from 19% in 2007–2011 to 8% in 2013–2014. VASM anticipates that the number of non-participant cases will decline further, as participation in VASM is now a mandatory component of CPD recertification.
- Deaths for which the peer review process is complete are the focus of this report. The outcomes were still pending in 10% of cases (966) and these cases will form part of future audit reports. The time frame given for each step of the audit process (SCF, FLA and SLA return) is 21 working days. This process backlog is the reason the most recent reporting period (2013–2014) has the highest number of pending cases (42%).

2.2. Verification of audit numbers

The audit process relies on receiving notifications of deaths from participating health services. Each hospital is required to submit a list of deaths that have occurred while the patient was under the care of a surgeon. While most cases that meet the VASM inclusion criteria will have a discharging unit that is surgical, in some instances a patient who received surgical care was not under the care of a surgeon at the time of death. As a result, the attribution of care to surgery or another clinical specialty is not exact.

Comparison of the VASM mortality data with the VAED data relating to surgical diagnosis related groups was undertaken to identify gaps in hospital mortality reporting, as shown in Table 2.

Table 2: Comparison of mortalities reported to VAED with VASM.

Audit period	Total surgeries	VAED reported mortalities	VASM reported mortalities
2007–2010	1,434,824	5,397	2,706
2010–2011	608,069	2,182	1,512
2011–2012	628,628	2,026	1,537
2012–2013	634,609	1,997	1,523
2013–2014	663,768	1,924	1,648
Total	3,969,898	13,526	8,926

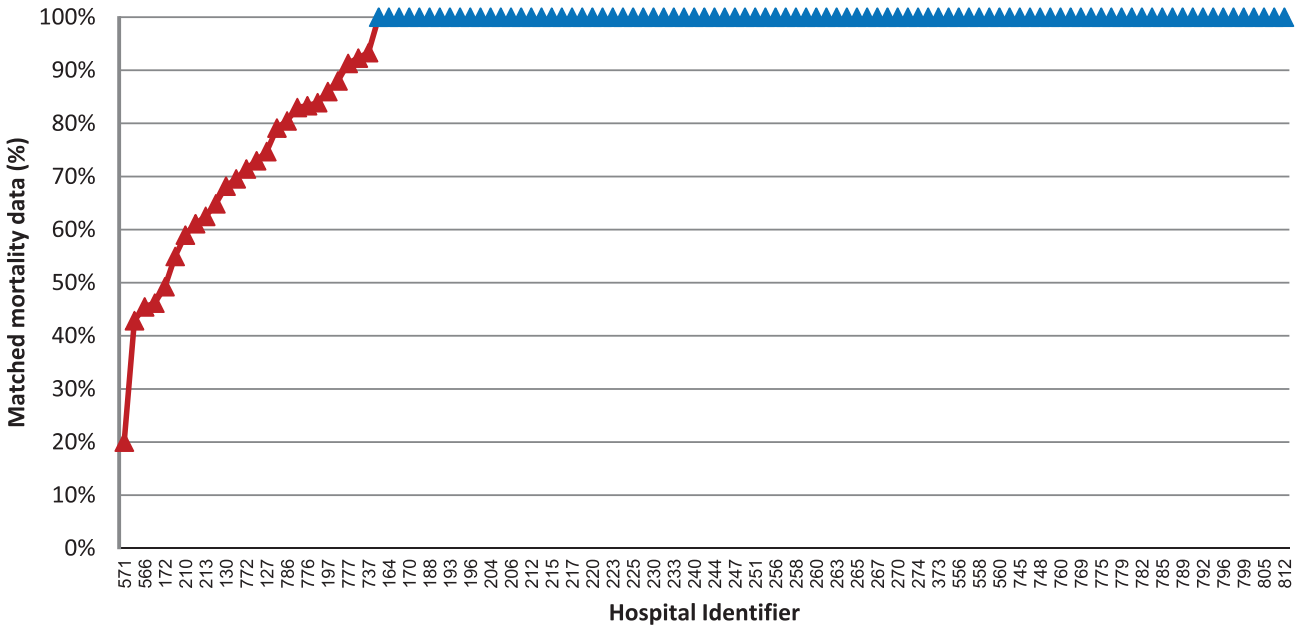
VAED: Victorian Admitted Episode Dataset; VASM: Victorian Audit of Surgical Mortality.
Note: the VASM audit period commenced on the 1 July 2007.

Comments:

- According to the VAED, 3,969,898 patients received surgical care in Victorian public and private health services during the audit period.
- The VASM and the VAED data are collected for different purposes and the two databases should be considered complementary rather than parallel.
- Based on the VAED data there has been a decrease in surgical mortality from 0.4% to 0.3% over the last six years. This is highly statistically significant ($p<0.0001$).

Figure 3 below shows a comparison of data collected between 1 July 2013 and 30 June 2014 on 1,648 deaths reported to VASM.

Figure 3: Matched mortality VASM data against VAED data by hospital.



VASM: Victorian Audit of Surgical Mortality; VAED: Victorian Admitted Episodes Dataset.

Comments:

- The VAED indicates that in a single year (2013–2014) 663,768 patients received surgical care in the Victorian public and private hospital sector. Of these 0.3% (1,924) resulted in mortalities.
- The match between the VASM and the VAED data for surgically-related deaths was 86% in the 2013-2014 audit periods, with the VASM recording 1,648 deaths and the VAED recording 1,924 surgical deaths. The match between the VASM and the VAED data relating to surgical mortality has increased by 10% since the previous audit period and the VASM goal is to attain a full match in the years to come.
- Private health services were associated with 22% (369) of the VASM cases. The audit has been fully taken up by the private sector only since the end of 2012 therefore the VASM anticipates the private sector match with the VAED data will be higher by 2015.
- Some gaps can be attributed to the relatively recent inclusion of gynaecological surgical Fellows into the VASM audit.
- Health services with less than 90% compliance should revise their reporting approaches to the VASM and to review relevant sections of their individual clinical governance reports provided by the VASM in November 2014 to identify if further focus is needed for improvements within their organisation.
- Health services where no mortalities occurred or where deaths have not been reported have been excluded from further analysis.

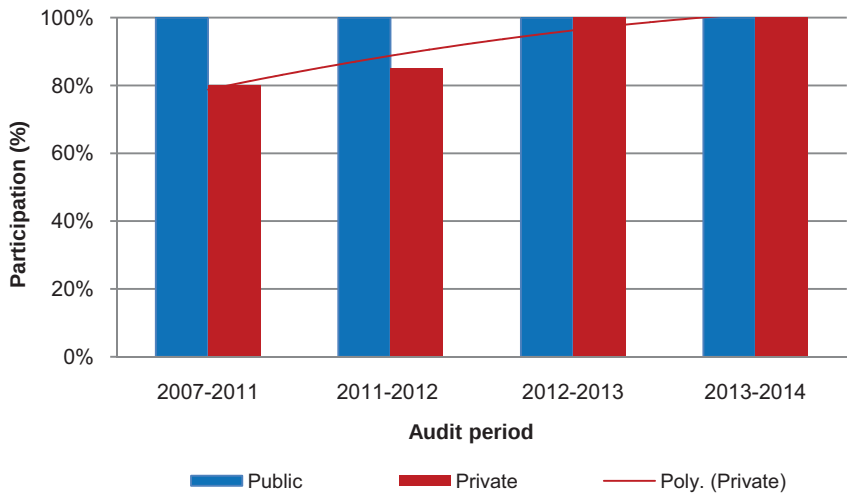
2.3. Audit participation rates

To comply with the audit process, surgeons must not only agree to participate but also return completed SCFs and assessment forms in a timely, accurate and complete manner.

The health services in which they work must provide notification of deaths on a regular basis, as this is the main trigger for the audit process to begin.

2.4. Hospital participation

Figure 4: Health services participating in the audit.



Note: The polynomial trend shows the rise and comparison of private hospital and public hospital enrolments. The graph also indicates the period of their participation in the audit.

Comments:

- All Victorian public and private health services providing relevant surgical services are now participating in the audit.
- At the audit's inception in 2007 only 31% of public health services were participating, however participation continued to increase and 100% public hospital participation was achieved in 2010. Similarly, private hospital participation has grown from 43% in 2010, when private health services first joined the audit, to 100% participation by 2012.

2.5. Participation by Fellows

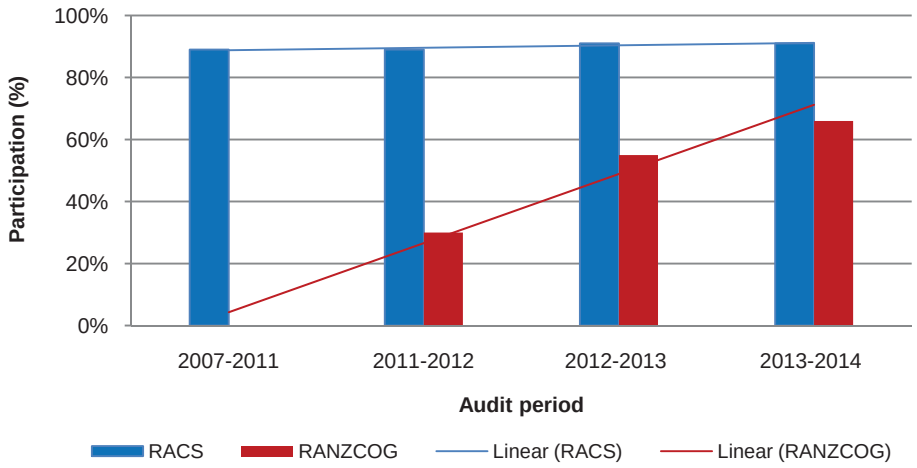
RACS continues to show strong ongoing support for ANZASM. Participation in the audit by surgeons has been a compulsory component of the RACS CPD program since January 2010 and is required for surgeon CPD recertification.

As part of the standard CPD program 7% of all participating Fellows have their CPD activities verified annually. It is anticipated that all surgeons will undergo verification of their audit participation in the near future.

As recently as August 2012 the RANZCOG Board approved formal collaboration with ANZASM. The participation rate of RANZCOG Fellows in the audit is lower than that for RACS Fellows, although it is increasing.

The VASM audit is notified of all deaths occurring after a gynaecological surgical procedure. Maternal, perinatal and paediatric deaths in Victoria are reviewed separately by the Consultative Council on Obstetric and Paediatric Mortality and Morbidity.

Figure 5: Surgeon agreement to participate.

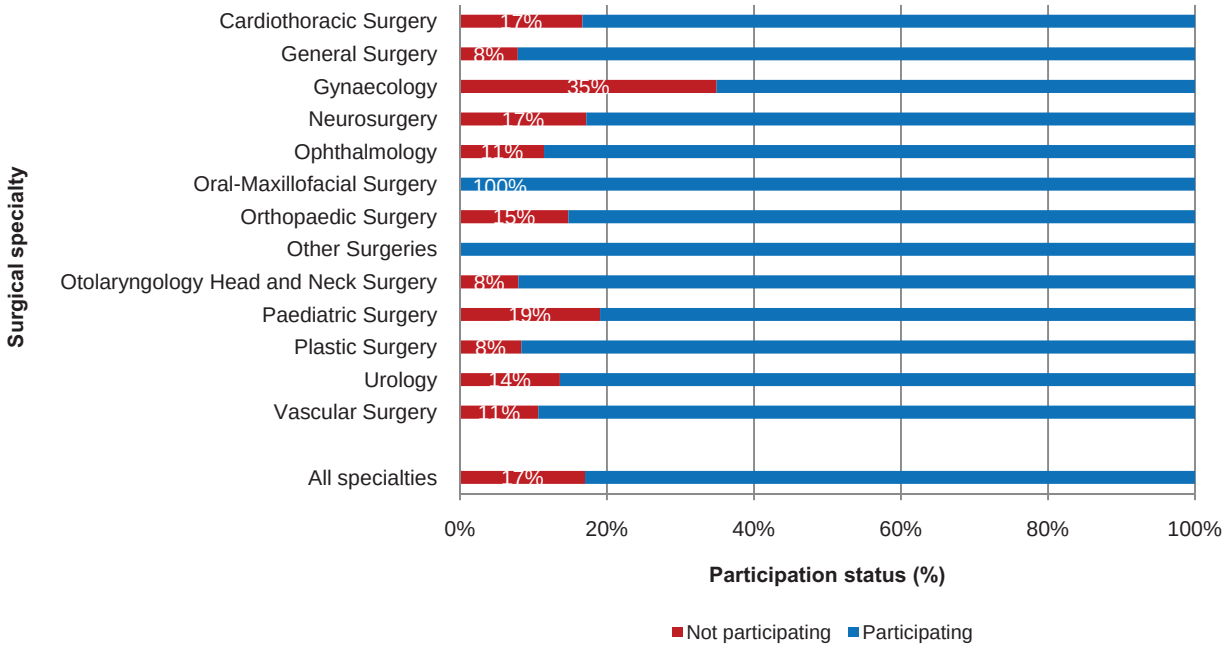


RACS: Royal Australasian College of Surgeons; RANZCOG: Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

Comments:

- 97% (1,087/1,124) of eligible Victorian RACS Fellows are currently participating. The increase in participation rate from 60% in 2007–2008 to the current level of 97% in 2013–2014 is encouraging.
- 67% (267/401) of the obstetrics and gynaecological specialists invited to participate in the audit since August 2012 enrolled.
- Almost half of RACS and RANZCOG Fellows perform assessments as first- or second-line assessors.
- 67% (724) of enrolled RACS and RANZCOG Fellows submit data electronically. The electronic interface offers a paperless process with timely reporting and obligatory complete data submission; therefore this will be the only method of data submission envisaged during 2015.

Figure 6: Surgeon agreement to participate by surgical specialty.

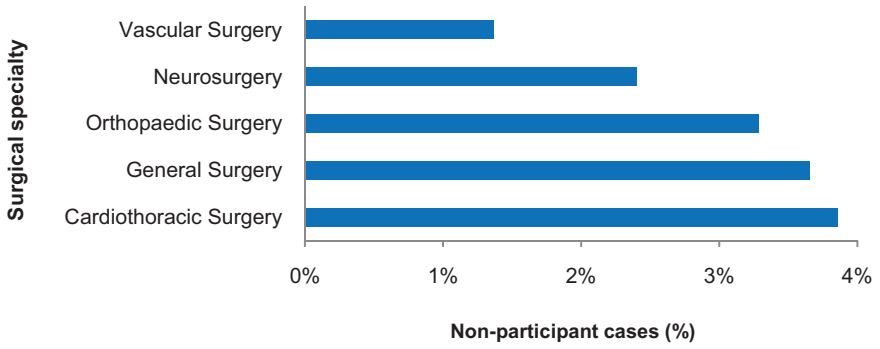


Note: total n=1,625.
Other surgeries include: Trauma, Transplant and Oncology.

Comments:

- The lower participation rate for gynaecology surgeons is due to their relatively recent inclusion in the audit. The proportion of RANZCOG members who do not practice gynaecology is currently unknown. It is expected that registration of participants will increase further.

Figure 7: Cases by specialty that could not be reviewed due to non-participation.

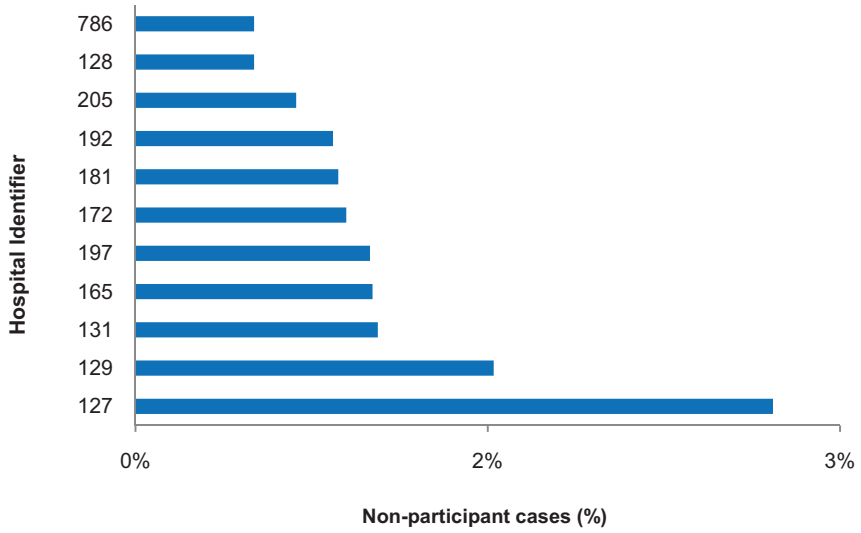


Note: n=1,347.

Comments:

- As shown in Figure 7 the specialties with the highest number of cases in 2013–2014 that could not be reviewed due to non-participation were Cardiothoracic Surgery, General Surgery, Orthopaedic Surgery, Neurosurgery and Vascular Surgery. These specialties have larger volumes of operative procedures compared with other specialties. Non-participation in the audit by surgeons meant that 15% of deaths could not be audited.
- The return rate of SCFs by all specialties in Victoria is 75% and in other states and territories varies between 75% and 100%.[1]
- The audit process relies on active and ongoing participation of surgeons. The introduction of mandatory participation for CPD compliance since January 2010 is hoped to lead to the full participation of treating surgeons.

Figure 8: Hospital origin of cases that could not be reviewed due to non-participation by treating surgeon.



Note: n=1,347.
Only health services with 10 or more non-participant cases have been included in this analysis.

Comments:

- Surgeons electing not to participate in 2013–2014 are concentrated in a small number of health services and with the introduction of mandatory participation in ANZASM for CPD requirements, it is envisaged that this will not be an issue in the next audit period.
- In each instance the hospital has agreed to participate in the audit however the treating surgeon has not returned the SCF.
- The VASM rolled out the Hospital Clinical Governance Reports in November 2014 with de-identified and aggregated data to enable benchmarking and monitoring of clinical management trends within a hospital and compare it against other participating peer-grouped health services, both within the region and nationally. The Clinical Governance Reports can be presented and discussed at hospital Clinical Governance Committee meetings, VASM Management Committee meetings, with the Local Health Network (or similar) representative as well as with Hospital Quality Managers and Department of Health and Human Services representatives.

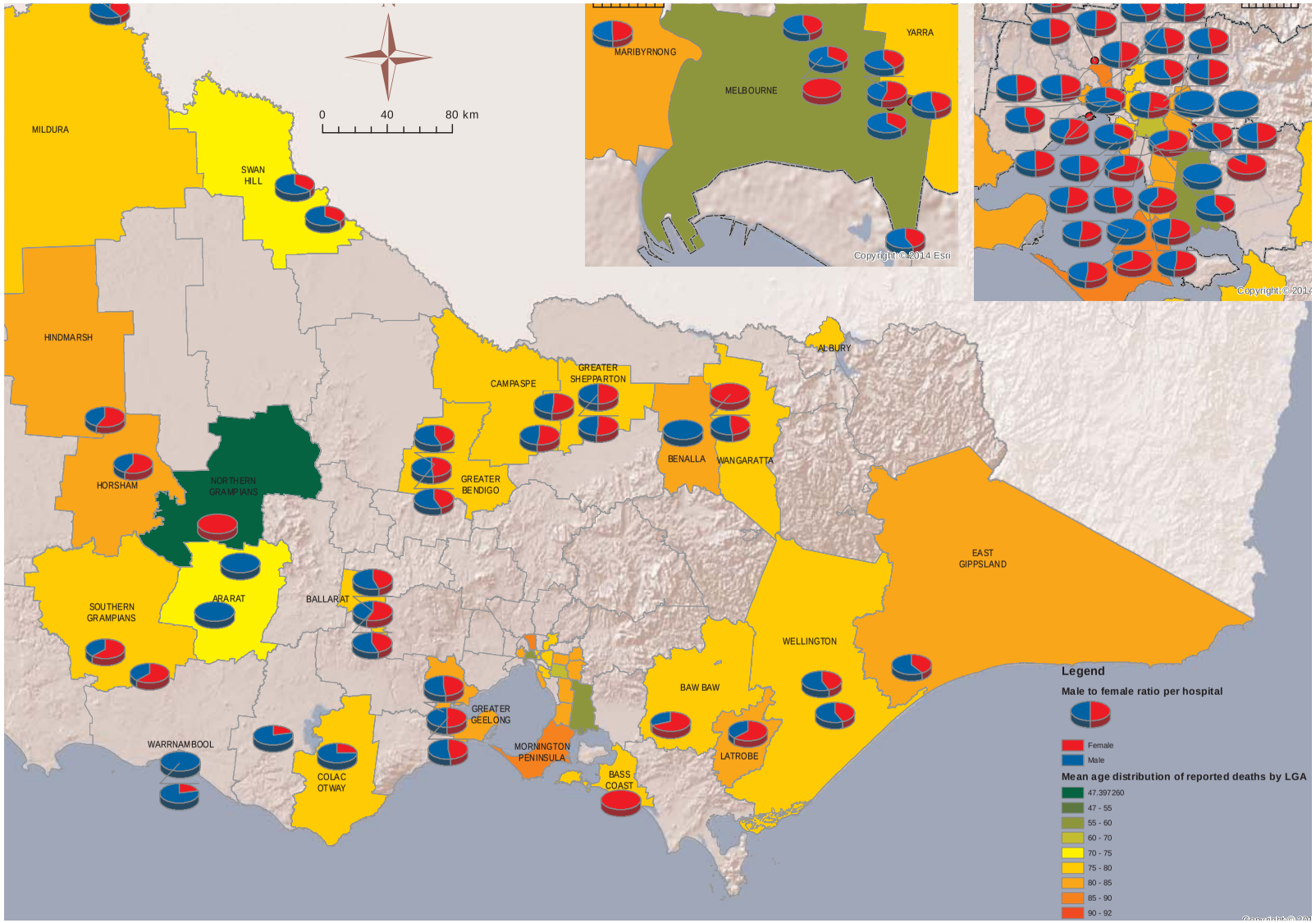
2.6. Demographics and characteristics of audited deaths

Table 3: Characteristics of audited deaths.

Number of audited deaths	**4,905**
Mean age (range)	79 years (1 day to 104 years)
Gender (Male: Female)	54%: 46%
Admission status (Emergency: Elective)	85%: 15%
ASA scores	ASA 1-2: 8%
	ASA 3: 30%
	ASA 4: 46%
	ASA 5-6: 16%
Risk of death prior to surgery	Expected: 12%
	Considerable: 51%
	Moderate: 25%
	Small: 9%
	Minimal: 3%
Most common comorbidities	Cardiovascular: 23%
	Age: 20%
	Respiratory: 13%
	Renal: 10%
	Neurological/Psychiatric: 9%
	Diabetes: 6%
	Advanced Malignancy: 5%
	Obesity: 3%
	Hepatic: 3%
Most common surgical diagnoses	Fracture of neck of femur: 20%
	Carcinoma: 14%
	Intracranial haemorrhage: 11%
	Intestinal obstruction: 9%
	Coronary artery disease: 6%
	Aortic aneurysm: 5%
Operative procedures performed	≥3: 8%
	2: 13%
	1: 61%
	0: 18%

Note: n=4,905 from audited period 1/7/2007 to 30/6/2014.
Comorbidities describe coexisting medical conditions or disease processes that are additional to the primary diagnosis.
ASA: American Society of Anesthesiologists. The ASA physical status is an international measure of patient risk used by anaesthetists.(5)

Figure 9: Age and gender of deceased by local government area



Note: total n=4,905; time frame: 1/7/2007 to 30/6/2014.
LGA: local government area

Comments:

Figure 9 is a pictorial demographic representation of the gender and mean age distribution of reported deaths by local government area. The points displayed represent the male to female ratio of deaths per hospital and are located in the local government area in which the death occurred.

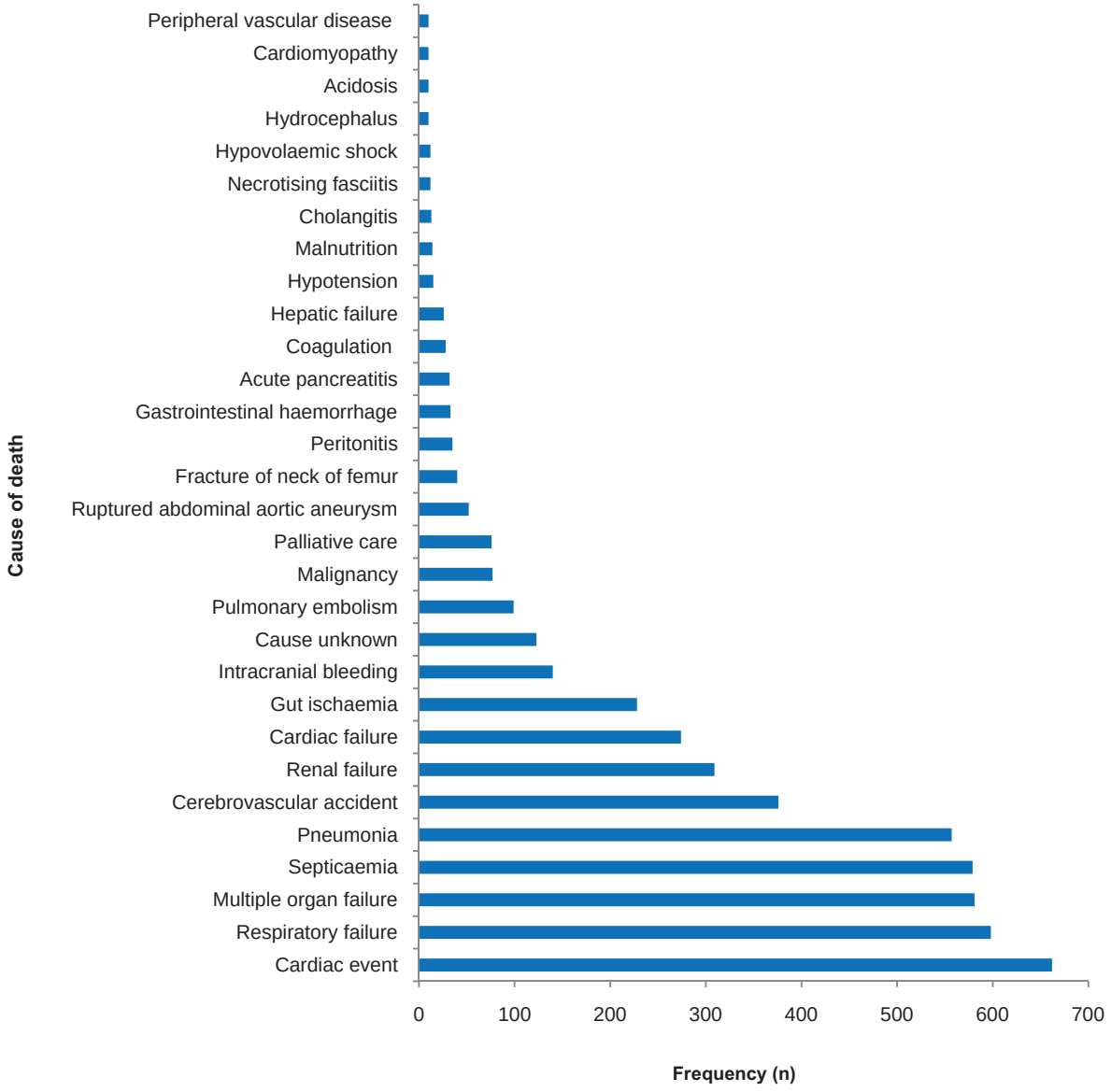
Individual points do not indicate the number of surgical procedures performed. Different patient demographics such as advanced age and multiple comorbidities can add additional complexities to the health services providing surgical services.

2.7. Establishing the cause of death

The cause of death recorded by the treating surgeon is based on the clinical course of the patient and any relevant supporting evidence from coronial or in-hospital investigations. A case will be referred to the coroner in instances where doubt exists around the circumstances leading to death.

A postmortem examination may be requested in cases where the cause of death is not clear, although requests for postmortems are decreasing.

Figure 10: Frequency of reported causes of death.



Note: n=5,031 causes of death reported for 4,905 patients.
A cause of death has been included in this graph if it was recorded for 10 or more patients.

Comments:

- Across 4,905 patients there were 5,031 conditions that were perceived to be responsible for death.
- The most frequently cited causes of death were:
  - cardiac events (13%; 662 cases). This category included heart failure, cerebrovascular incident, ischaemic heart disease, cardiorespiratory failure and cardiac event;
  - respiratory failure (12%; 598 cases);
  - multiple organ failure (11%; 581 cases)
  - septicaemia (12%; 579 cases);
  - pneumonia (11%; 557 cases).
- When combined, the five most frequently cited causes of death detailed above were responsible for the patient's death in over half the cases (2,977/4,905) and similarly in a recent Australian study it was found that "potentially modifiable comorbidities are associated with poorer postoperative outcomes".[6]
- The number of postmortems performed, including coronial requested postmortems, was 16% (789) instances in 4,905 cases. This rate remained constant during the full audit period and the reasons for the low postmortem referrals are unknown. Referral to the Coroner or request for postmortem was 22% (160) in elective and 15% (628) in emergency cases. Postmortems are deemed to provide educational information and valuable insights, therefore these referral rates are of concern.[7-10]

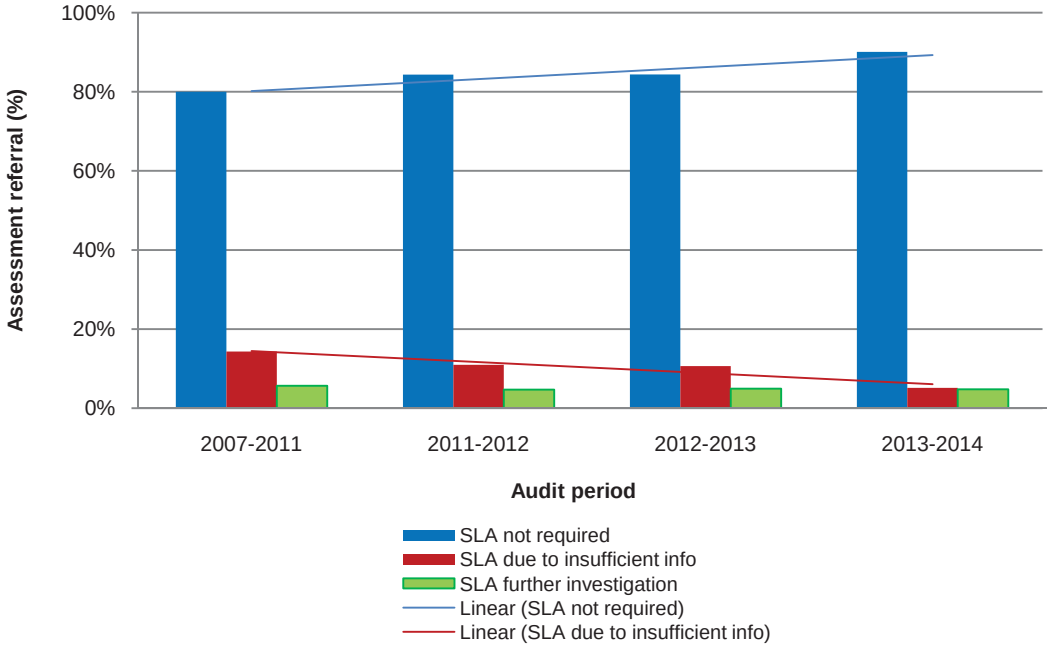
2.8. Peer review process

The VASM peer review process is a retrospective examination of the clinical management of patients who died while under the care of a surgeon. All assessors (first- and second-line) must decide if the death was a direct result of the disease process alone, or if aspects of the management of the patient may have contributed to the outcome. FLAs were completed in 4,905 cases. Each first-line assessor had to decide if the treating surgeon had provided adequate information to allow a conclusion to be reached. If the information is deemed inadequate then a SLA or case note review is requested. Other triggers for requesting a SLA are:

- A more detailed review of the case is required, which could better clarify events leading up to death and any lessons emanating from the case under review.
- Death is unexpected, for example in a young, fit patient with benign disease or a day surgery case.
- Insufficient information provided by the treating surgeon.

The number of SLAs required due to a lack of information provided in the case record form is an indirect measure of surgeon compliance in the audit process. SLAs required for the other triggers are more likely to represent suspected issues of clinical management. This has decreased since the beginning of the audit but still requires improvement. The reasons given for SLA referral are provided in Figure 11.

Figure 11: Reason for referral for second-line assessment.

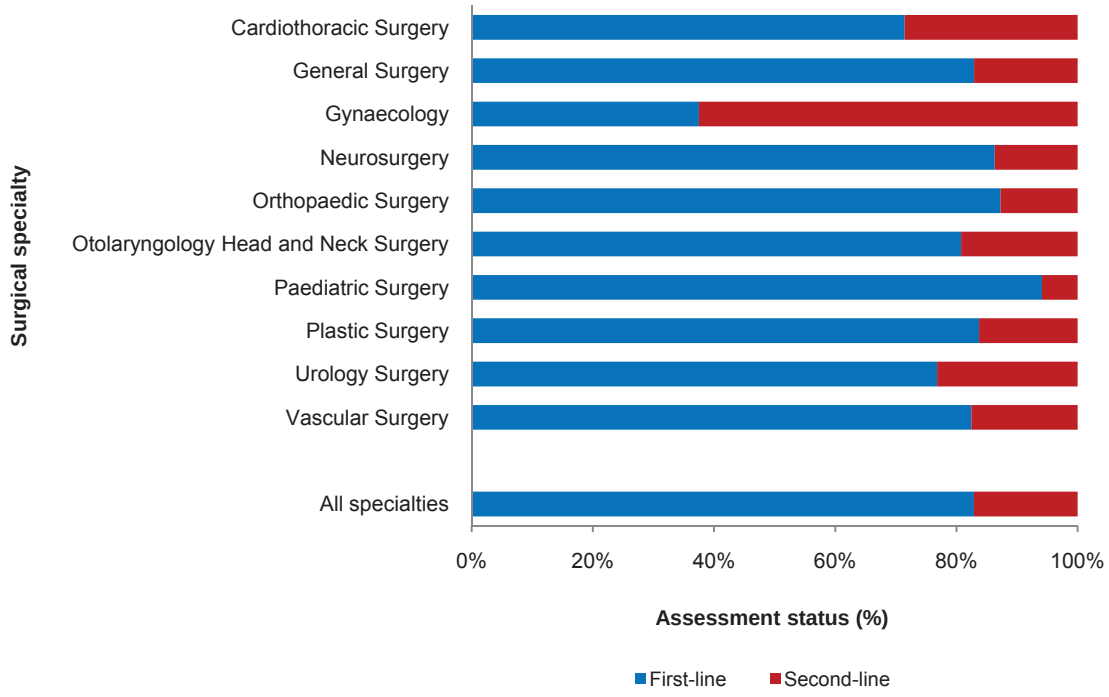


Note: total n=4,905.
Missing data: n=1 (<1%).
SLA: second-line assessment.

Comments:

- The need for SLA has decreased over time, in part because the quality of the information provided in SCFs returned by treating surgeons has improved. The percentage of cases referred for SLA has dropped significantly from 21% in the 2007–2011 audit period to 10% in 2013–2014. Cases with an American Society of Anesthesiologists (ASA) grade greater than or equal to 4 were significantly more likely to be referred for SLA ($p<0.001$) (data not shown in this graph).
- 83% (4,062/4,905) of audited cases were not referred for SLA, however 17% required in-depth review and of those 843 cases, 69% (585) were due to the provision of insufficient information. Despite this, there are improvements in this area, as evidenced by the decreasing trend in SLAs resulting from insufficient clinical information, from 14% in 2007-2008 to 5% in 2013-2014.
- Perceived issues of management were the referral trigger for the remaining 30% (257/843) of cases which underwent SLA.
- While the overall quality of data provided to the VASM continues to improve, there are ongoing issues with the quality of data provided by some treating surgeons. Surgeons who provided an appropriate level of information are to be commended, as proper attention to detail benefits not just the audit, but the surgical colleagues who have agreed to act as first- and second-line assessors. Greater attention to detail on the part of the treating surgeon also benefits quality assurance and medical records departments at collaborating health services.
- At least one aspect of the medical record was considered unsatisfactory in 28% (236/843) of the cases that underwent SLA. Criticisms of the medical records included poor medical admission notes, poor follow-up records, and unsatisfactory descriptions of surgical procedures.
- Hospital case notes are a vital record of the treatment received by patients. Poor and inaccurate clinical notes exacerbate the difficulties associated with managing patients in a complex hospital environment, particularly when there is an increasing lack of continuity in the care provided to patients.

Figure 12: Frequency of need for second-line assessment by surgical specialties.



Note: n= 4,905
Missing data: n=13 (<1%).

Comments:

- The need for SLA referral varied between specialties (see Figure 12). No inferences have been made regarding Gynaecology as it is a new specialty recruited only in 2013 and only eight (<1%) cases completed the SLA.
- Smaller specialties such as the Oral and Maxillofacial Surgery, Ophthalmology, Oncology and Trauma Surgery (7, <1%) were excluded from Figure 12 due to small numbers.
- The need for referral for SLA was similar in metropolitan and rural regions (data not shown).

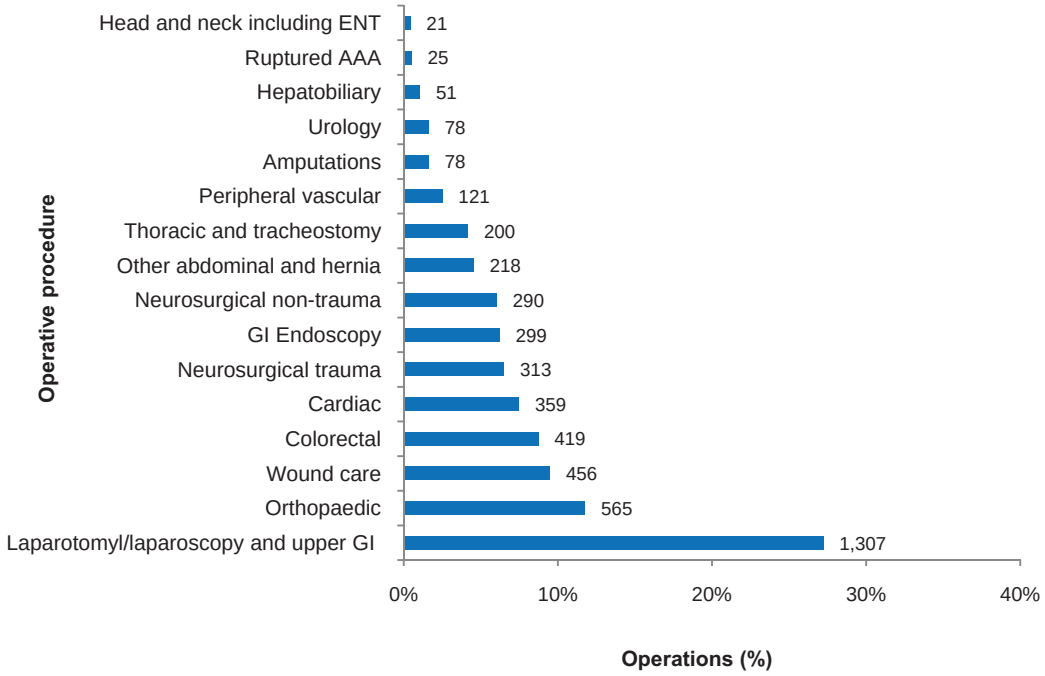
3. CLINICAL RISK MANAGEMENT

3.1. Profile of operative procedures

The following section examines the frequency and timing of surgical procedures, the seniority of the surgeon performing the procedure, and the need for reoperation.

The treating surgeon is responsible for the overall success of the operation. This includes ensuring that the operation proceeds smoothly and with the lowest possible risk of complications or an unplanned return to theatre.

Figure 13: Frequency of individual surgical procedures reported.



Note: n=4,028 patients who underwent 5,668 separate surgical procedures.
Missing data: n=488 (11%).
Figure includes operative procedures with frequency >10.
AAA: abdominal aortic aneurysm; GI: gastrointestinal; ENT: Ear, Nose and Throat.

Comments:

- Figure 13 shows operative procedures by category. Detailed information on procedure classification is provided in Section 10.6.
- 4,028 of the 4,905 (82%) audit patients underwent operative treatment.
- A patient can undergo multiple procedures during the same admission and during the same surgical session. A total of 5,668 separate procedures were performed on audit patients.
- Laparotomy, laparoscopy and upper GI were the likely patient group with multiple procedures. Orthopaedic pathologies was the other operative category with the highest number of recorded procedures.

Table 4: Operative mortality frequency by specialty.

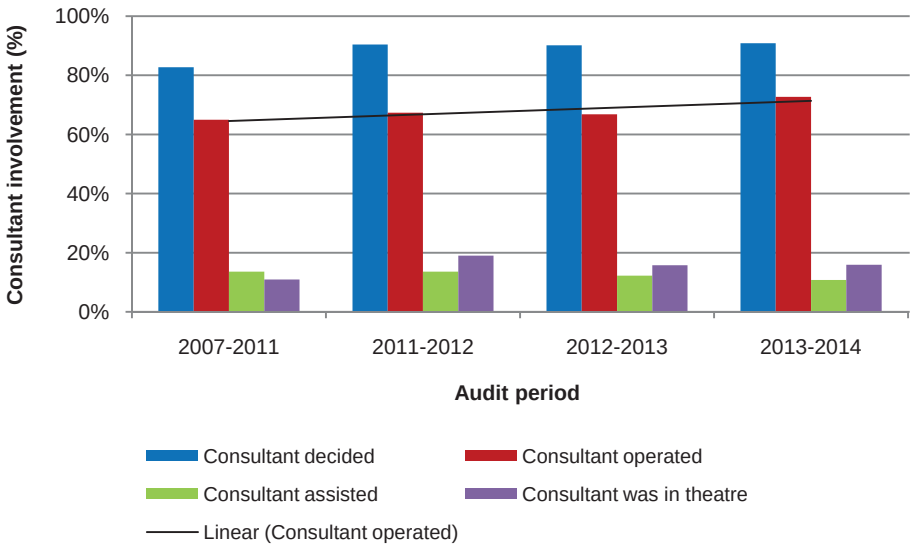
Specialty	Frequency (%)
General Surgery	1,654 (41%)
Orthopaedic Surgery	787 (20%)
Neurosurgery	482 (12%)
Cardiothoracic Surgery	412 (10%)
Vascular Surgery	350 (9%)
Urology	154 (4%)
Plastic and Reconstructive Surgery	81 (2%)
Otolaryngology Head and Neck Surgery	48 (1%)
Paediatric Surgery	45 (1%)
Gynaecology	8 (<1%)
Other	7 (<1%)
Total	**4,028 (100%)**

Note: n=4,028 patients who underwent 5,668 separate surgical procedures.
Missing data: n=488 (11%).

Comments:

- There is great variation by specialty in the rate of operative intervention over the audit period, attributable to the casemix and risk group of patients in each specialty. Only eight gynaecology patients are included in this year's report.
- 98% (738) of elective patients who subsequently died had an operative intervention, compared with 79% (4,154) of patients admitted as emergencies ($p<0.001$). This was not unexpected, as most elective admissions to a surgical unit are for an operative procedure.
- Where the extent of the disease process is such that a patient has no prospect of even short-term survival a surgeon may, while in surgery, decide to discontinue the procedure. The decision to abandon a procedure was rare, occurring in only 5% (291) of audited cases.
- Deaths without operative intervention occurred were more frequently associated with emergency admissions (856, 21%) and in such cases there was usually an active decision not to operate.

Figure 14: Seniority of surgeons deciding on and performing surgery.

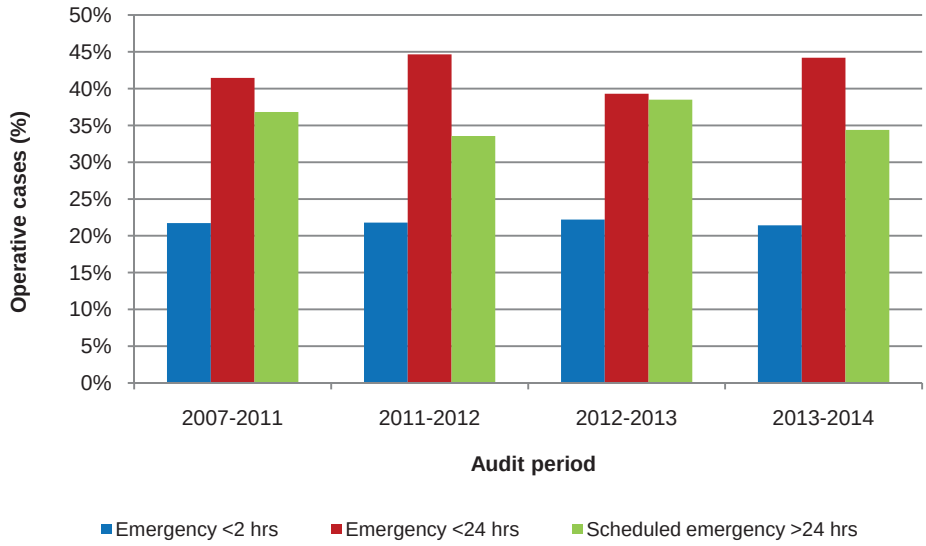


Note: n=5,668 surgical episodes in 4,028 patients.

Comments:

- A consultant surgeon performed the surgery in 67% of cases, and made the decision to proceed to surgery in 87% of cases. The 10% increase in active participation by consultants was statistically significant over the audited period ($p<0.001$). This increase is appropriate when consideration is given to the risk profile of audited cases and VASM would like to see a further increase in the level of consultant involvement.
- It should be noted that poor data accuracy in this section of the SCF means that there is potential to introduce bias in the figures relating to the seniority of surgeons deciding on and performing surgery. This will be corrected when the electronic interface is universally adopted in 2015.
- An anaesthetist was present in 96% (3,844/4,028) of cases in which an operative procedure was performed.

Figure 15: Timing of operative procedures in emergency admissions.



Note: n=5,668 surgical episodes of those 3,297 emergency cases in 4,028 patients.
Missing data: n=232 (8%).
Hrs: hours.

Comments:

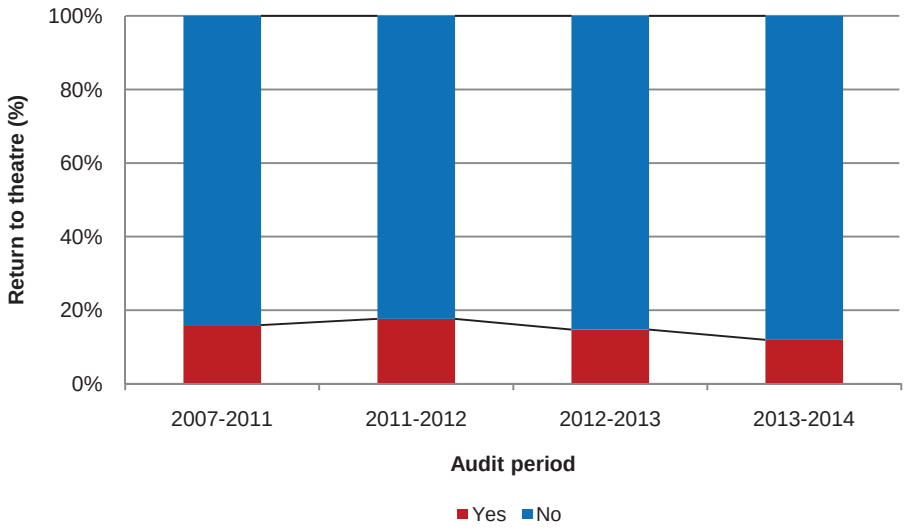
- The time criticality of a patient's condition predicts the timing of emergency surgery. Across the audit period, in emergency admissions who underwent surgery 64% (2,515/3,945) required surgery within 24 hours of admission; 22% (860) had surgery within two hours of admission, 42% (1,655) had surgery within 24 hours of admission and 36% (1,430) had surgery more than 24 hours after admission.
- Strategies to address the associated scheduling problems are being implemented by government, surgeons and health services.[11-13]

3.1.1 Unplanned return to the operating room

An unplanned return to the operating room (OR) is usually necessitated by the development of a complication requiring further operative intervention. Some complications following complex surgery are to be expected due to the patient's pre-existing comorbidity profile, surgical risk status and the nature of the disease being treated.

However, a high rate of return to the OR can indicate that improvements in care are needed. One of the VASM's goals is to assist with the identification and implementation of strategies designed to lower the rate of return to the operating room.

Figure 16: Unplanned return to the operating room.



Note: n=5,668 surgical episodes in 4,028 patients.
Missing data: n=43 (<1%).

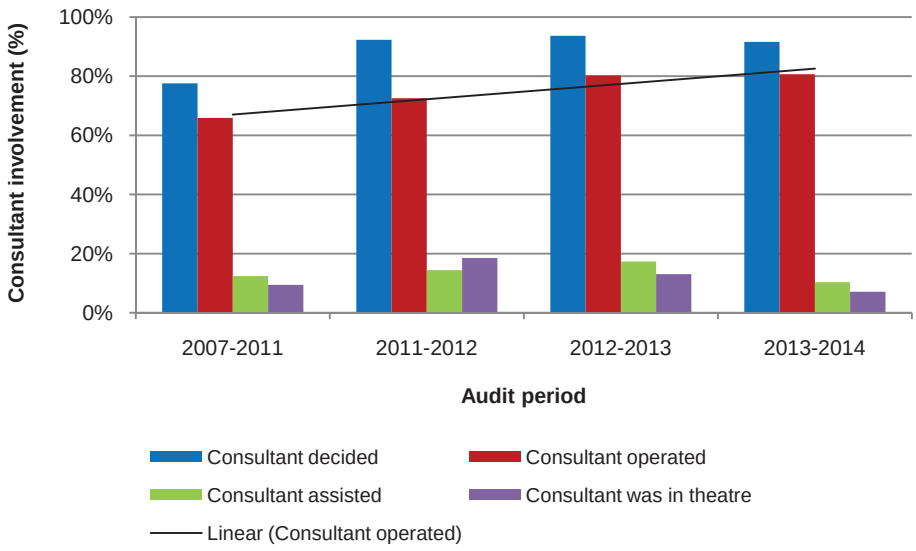
Comments:

- An unplanned return to the OR was reported in 15% (619/4,028) of cases in which a surgical procedure was performed. These figures are similar to the national mortality audit findings in 2014.
- Across the audit periods the trend in the frequency of unplanned returns to the OR has varied. The frequency of unplanned returns to the OR dropped from 16% (312) in the 2007-2011 audit period to 12% (59) in the 2013-2014 audit period. While the change is not statistically significant, a decrease in the frequency of unplanned returns to theatre is a positive outcome.

As shown in Figure 17 there has been a trend towards consultants performing procedures during unplanned returns to the OR.

The trend towards senior involvement is appropriate given the surgical risk profiles and operative complications of audit patients and is to be commended.

Figure 17: Seniority of surgeons performing surgery at unplanned return to the operating room.



Note: n=5,668 surgical episodes in 4,028 patients.
Missing data: n=43 (<1%).
The consultant operated exponential trend line highlights considerable rise in consultant involvement.

Comments:

- Active consultant participation was exponentially higher in cases requiring an unplanned return to the OR ($p<0.001$). The higher level of active consultant participation was appropriate given that these cases are challenging and tend to be associated with greater risks.
- The frequency of an unplanned return to the OR by surgical specialty reflects the risk profiles inherent in the casemix of the different specialties. A higher risk of complications is associated with some surgical specialties. (Fig. 20).
- There were no major differences in the rate of unplanned return to the OR between metropolitan and rural regions. The seniority of surgeons operating was also similar in rural and metropolitan regions (data not shown).

3.1.2 Postoperative complications

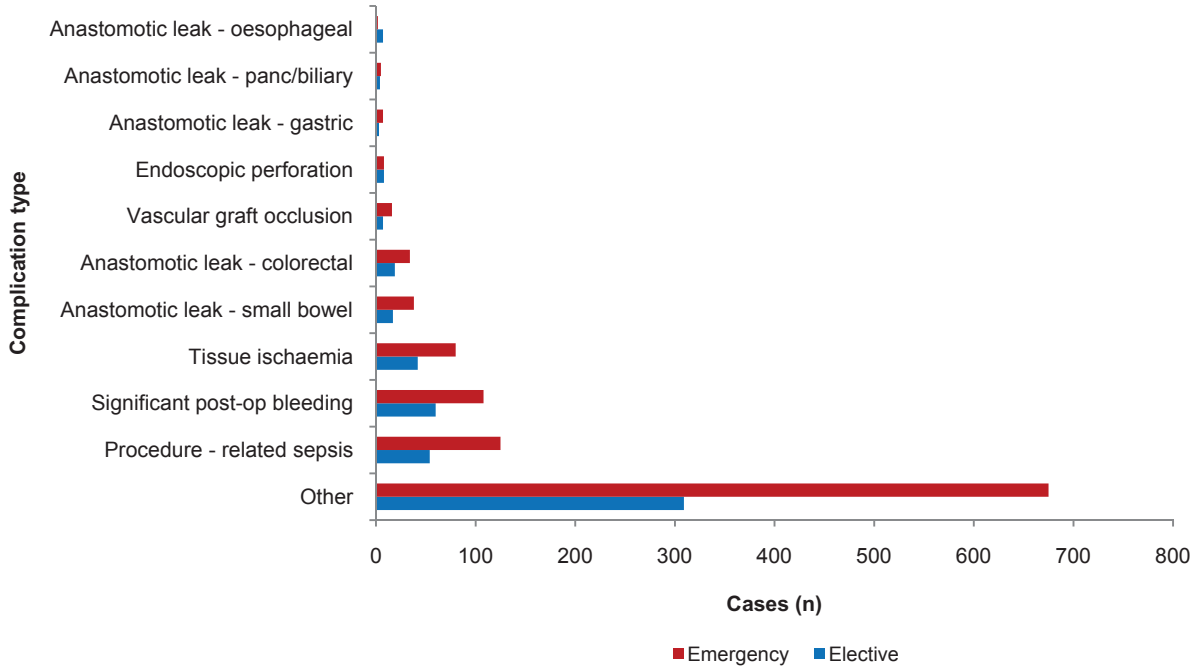
Figure 18: Postoperative complications recorded by treating surgeon.

Note: n=4,028.

Comments:

- The low rate of postoperative complications reported by treating surgeons has remained constant throughout the audit period. Of the 4,028 operative cases audited, 66% (2,645) had no complications while 29% (1,171) had only one recorded complication.

Figure 19: Frequency of specific postoperative complications by urgency status.

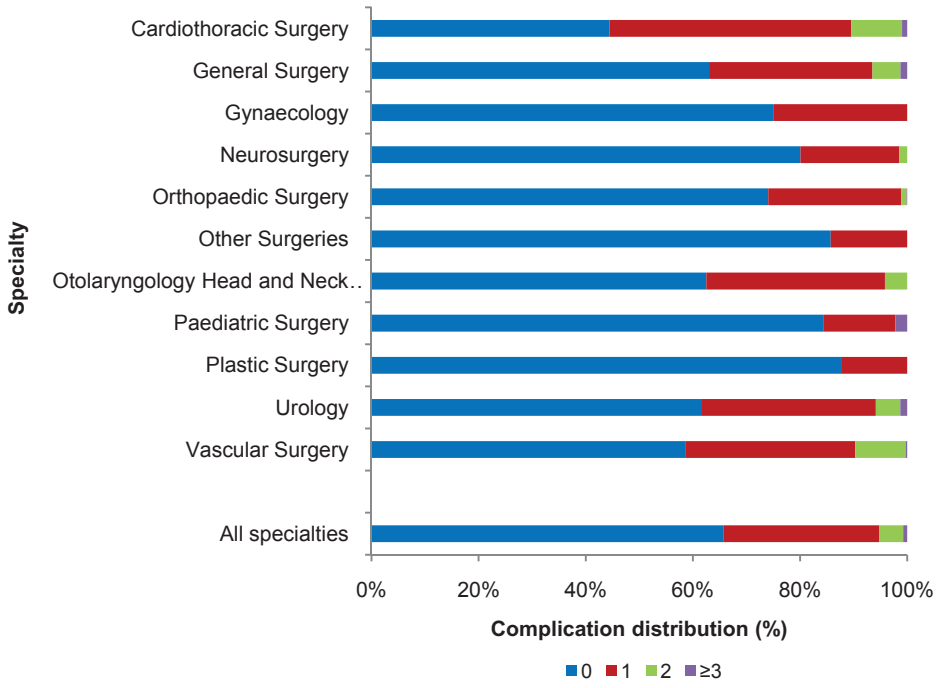


Note: n=1,628 complications in 5,668 surgical episodes for 4,028 patients.
Missing data: n=4 (<1%).
Other complications n=984.
Panc: pancreatic; Post-op: postoperative.

Comments:

- Emergency cases were likely to have complications. The audit pool contains 67% cases admitted as emergencies and emergency cases do highlight a higher risk of complications during surgical procedures (data not shown).
- A total of 984 other complications were identified. They included cardiac failure, intrapulmonary haemorrhage, intracerebral bleed, postoperative hypoxia, acute or chronic renal failure, paraplegia, liver failure, pneumonia, perforated viscus, pulmonary embolism, pyelonephritis, respiratory failure, seizures, sepsis, stroke and wound haematoma.

Figure 20: Postoperative complications by specialty.



Note: n=4,028 patients having operative treatment.
Other surgeries include Oral and Maxillofacial, Ophthalmology, Trauma, Transplant and Oncology.

Comments:

- There were differences in the rate of postoperative complications amongst the specialties.
- Only eight gynaecology and 45 paediatric cases were reported to the VASM and included in this year's report.
- The most common postoperative complications over the audit period were postoperative bleeding, procedure-related sepsis and tissue ischaemia (data not shown).

3.2 Clinically significant infections

The VASM started collecting data points on clinically significant infections in 2012 using available retrospective mortality data to monitor trends of infections at health services. The VASM focus is placed on specific surgical issues for perioperative infection prevention.

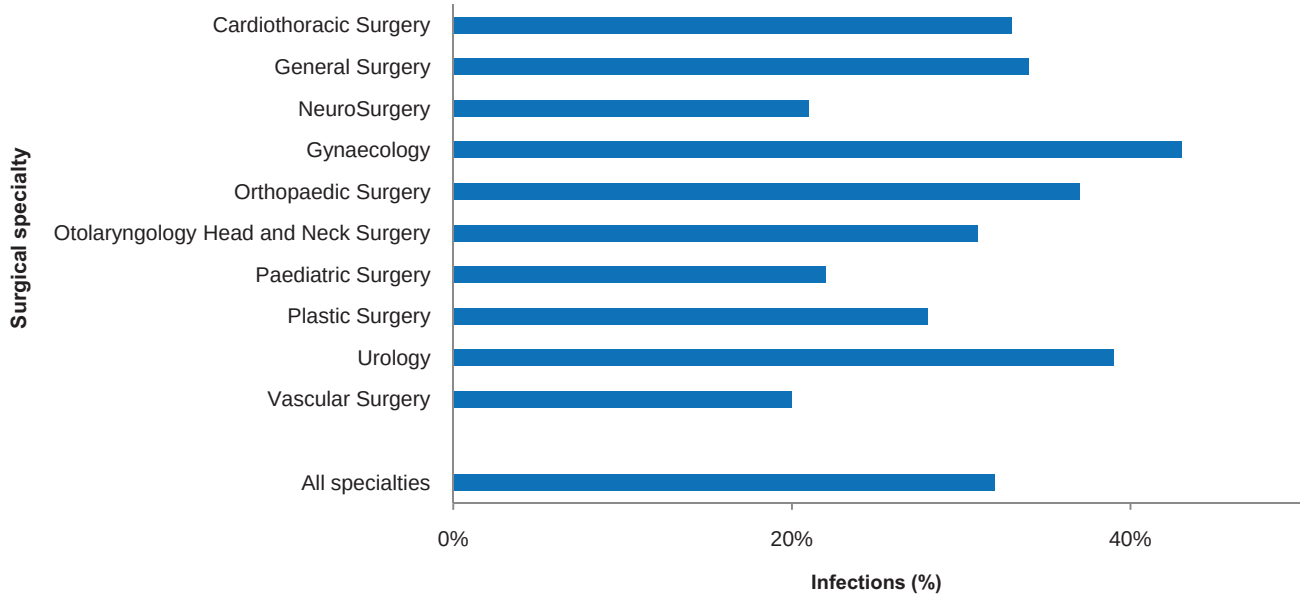
It is envisaged that future the VASM trending will show a reduction of clinically significant infections in this group of high risk patients once appropriate measures and management strategies are implemented and monitored.

Table 5: Clinically significant infections type.

Infection type	Frequency	Percent
Pneumonia	308	(49%)
Systemic infection	72	(11%
Septicaemia	171	(27%)
Other*	84	(13%)
Total	635	(100%)

Note: n=638 patients during the audited period from 1/7/2012 to 1/7/2014.
Missing data: 3 (<1%).
*The infective organisms identified were: Clostridium difficile, Candida albicans, Escherichia coli, Enterobacter aerogenes, Enterococcus, Klebsiella, Lactobacillus, Methicillin-resistant Staphylococcus aureus, Methicillin-sensitive Staphylococcus aureus, Staphylococcus haemolyticus, Staphylococcus pyogenes, Staphylococcus aureus, Varicella, yeast and mixed organisms.

Figure 21: Clinically significant infections by specialty.



Note: n=638 patients during the audited period from 1/7/2012 to 1/7/2014.
Missing data: 3 (<1%)

Table 6: Timeframe when the clinically significant infection was acquired.

Infections	2011-2012 Frequency (%)	2012-2013 Frequency (%)	2013-2014 Frequency (%)	Audit period Frequency (%)
Acquired preoperatively	14 (12%)	37 (22%)	14 (17%)	65 (18%)
Acquired postoperatively	72 (64%)	113 (68%)	63 (76%)	248 (69%)
Surgical-site infection	11 (10%)	7 (4%)	4 (5%)	22 (6%)
*Other invasive site type infection	16 (14%)	9 (6%)	2 (2%)	27 (7%)
Total	113 (100%)	166 (100%)	83 (100%)	362 (100%)

Note: n=638 patients with 362 incidences of noted infections.
Missing data 3 (<1%).
*The infective organisms identified were: Clostridium difficile, Candida albicans, Escherichia coli, Enterobacter aerogenes, Enterococcus, Klebsiella, Lactobacillus, Methicillin-resistant Staphylococcus aureus, Methicillin-sensitive Staphylococcus aureus, Staphylococcus haemolyticus, Staphylococcus pyogenes, Staphylococcus aureus, Varicella, yeast and mixed organisms.

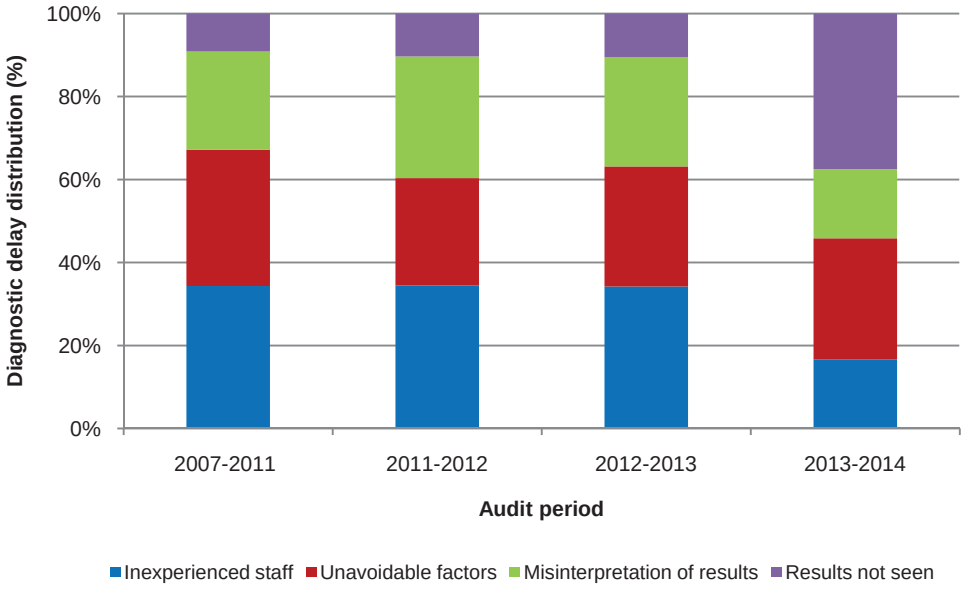
Comments:

- An infection was reported in 27% (638/2,408) of current year audited cases in 2013-2014. The infection rate was 32% for both emergency and elective admission patients.
- 75% (479/638) of patients with a recorded infection had either pneumonia or septicaemia.
- Of the 638 cases, the infection was acquired during hospital in 59% (376) cases and pre-admission in 38% (240) cases; in 3% (22) cases it was unknown when the infection was acquired.
- The infection rate across specialties varied reflecting the casemix of individual specialties and comorbidity profile of the patient.

3.3. Delay in diagnosis

Treating surgeons were asked to record any perceived delays associated with establishing a diagnosis and proceeding to definitive treatment.

Figure 22: Perceived delays in establishing a diagnosis.



Note: n=251 issues identified in 4,905 audited cases.

Comments:

- The treating surgeons identified delays in establishing diagnosis in 5% (251/4,905) of audited cases. This rate has remained relatively constant across audit periods.
- The assessor-identified incidence of perceived delay in patient care was in 26%. This was higher than the incidence of perceived delay in patient care identified by the treating surgeon (5%).
- Delay in establishing a diagnosis is one facet of the concerning rate of delay in implementing definitive treatment. Delays in implementing definitive treatment are discussed further in section 3.9.2.
- It is important to note that delay in establishing a diagnosis are not always attributable to the surgical team. A recent review of care received by elderly patients undergoing surgery in the United Kingdom found that delay between admission and operation was related to risk assessment and that the risk assessment "should include input from senior surgeons [or] anaesthetists."[14]

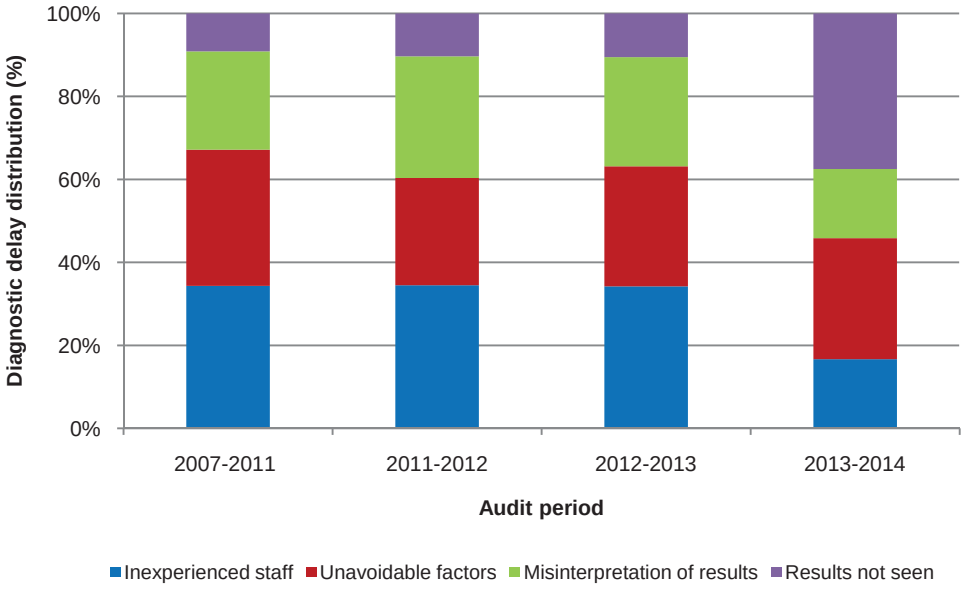
3.4. Prophylaxis for deep vein thromboembolism

This section analyses the use of strategies designed to treat against the formation of deep vein thromboses, and subsequent pulmonary embolisms, in patients at risk. Despite the availability of effective preventative treatments, deep vein thromboembolism (DVT) remains a major cause of patient mortality in Australian health services. Current recommendations regarding the use of DVT prophylaxis are provided in the Clinical practice guideline for the prevention of venous thromboembolism in patients admitted to Australian health services.[15,16]

Recommendations contained within the guideline are based on the available evidence, and are designed to assist clinicians in their decision making regarding the use of DVT prophylaxis.

The treating surgeon has to record whether DVT prophylaxis was given, and in cases where it was provided, the type of prophylaxis used. Reasons for a treating surgeon not providing DVT prophylaxis are also recorded.

Figure 23: DVT prophylaxis use during the audit period.

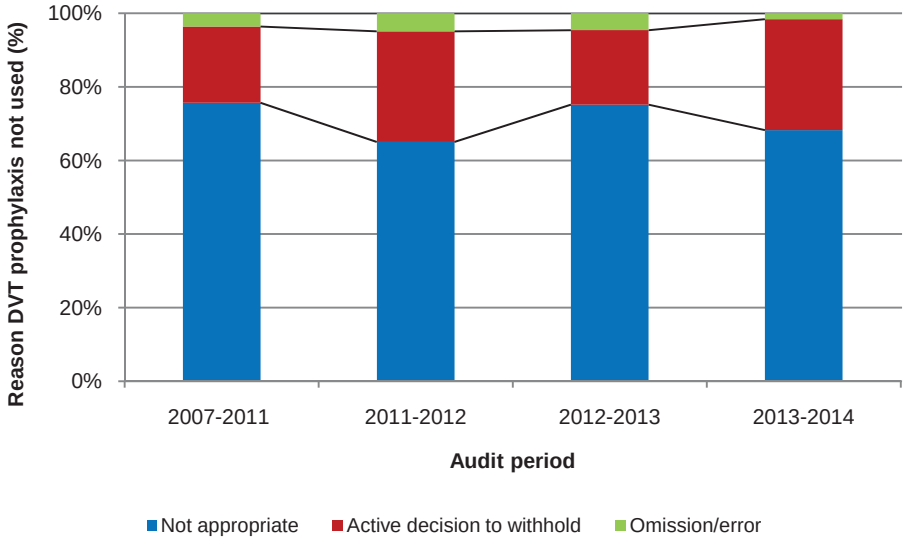


Note: n=4,028 operative cases.
Missing data: n=77 (2%) in 4,028 operative cases.
DVT: deep vein thromboembolism.

Comments:

- The use of DVT prophylaxis has risen slightly from 78% in the 2007–2011 period to 85% in the 2013–2014 audit period p<0.05).
- The VASM data suggests that the use of DVT prophylaxis is similar for both elective and emergency cases (data not shown in Figure 23).

Figure 24: Type of DVT prophylaxis used.

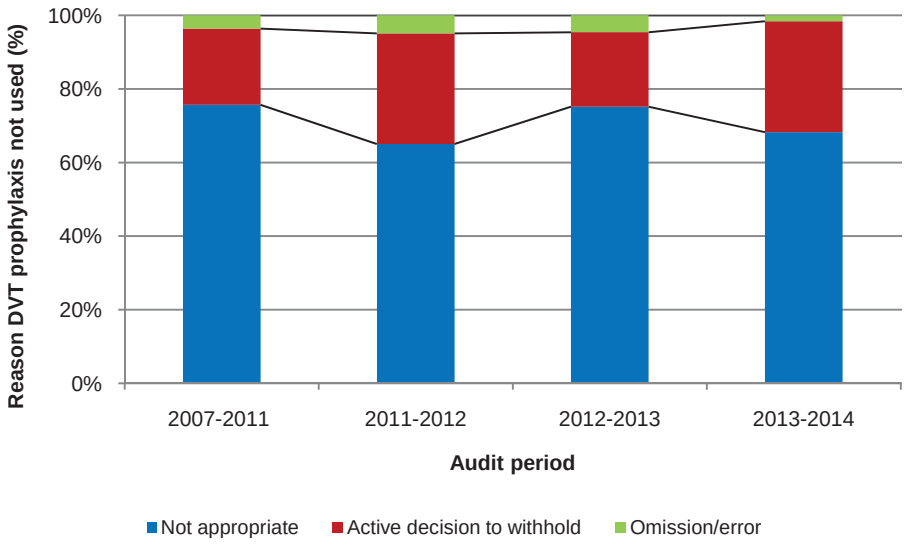


Note: n=5,262.
Missing data: n=77 (2%) in 4,028 operative cases.
Multiple types of prophylaxis can be used when treating patients.
Other types of prophylaxis included: calf stimulators, Clexane, Fragmin, clopidogrel, enoxaparin, epidural, full anticoagulation for non-ST segment elevation myocardial infarction, and inferior vena cava filter and infusion.
TED: thromboembolic deterrent stockings; DVT: deep vein thromboembolism.

Comments:

- The spectrum of DVT prophylaxis used has been consistent over time.
- The type of prophylaxis used for a patient is subject to the judgement of the treating clinician.

Figure 25: Reasons given by treating surgeon for not providing DVT prophylaxis.



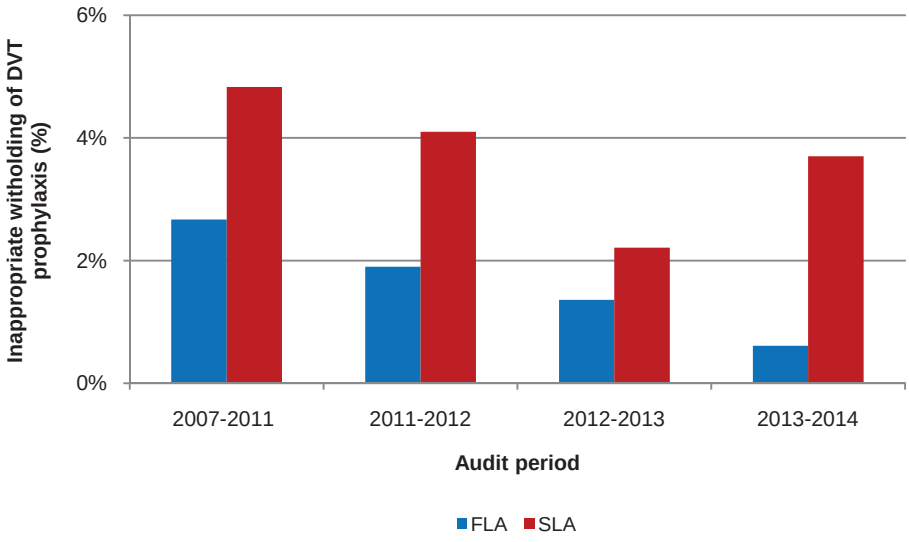
Note: n=721 patients not receiving prophylaxis in 4,028 operative cases in 4,905 patients.
Missing data: n=77 (2%) in 4,028 operative cases.
DVT: deep vein thromboembolism.

Comments:

- DVT prophylaxis was not provided to 15% (721/4,905) of audit patients. This was a conscious decision by the treating team in the majority of cases.
- The errors and omissions decreased 3% over the audited period.

Assessors were asked to comment on the appropriateness of withholding prophylaxis (see Figure 26).

Figure 26: Assessor perception of the appropriateness of the decision to withhold DVT prophylaxis.



Note: n=839 patients not receiving prophylaxis in 4,028 operative cases in 4,905 patients.
Missing data: n=77 (2%) in 4,028 operative cases.
DVT: deep vein thromboembolism; FLA: first-line assessment; SLA: second-line assessment.

Comments:

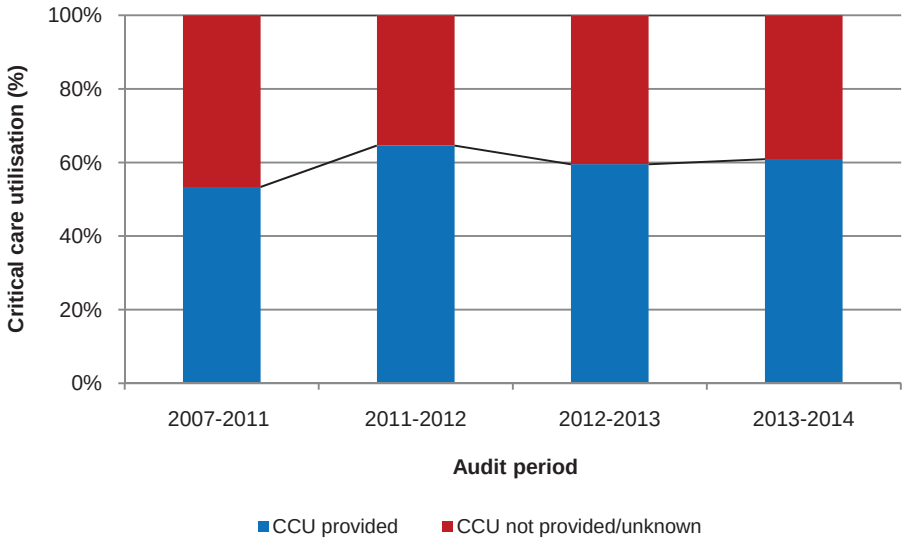
- Assessors felt that the decision to withhold DVT on clinical grounds was appropriate 418 cases.
- Assessors felt that the provision of DVT prophylaxis may have been beneficial in 2% (19/839) of the cases in which DVT prophylaxis was withheld. Insufficient information meant that assessors could not accurately assess the appropriateness of the decision to withhold DVT prophylaxis in 12% (60) of cases.
- The tendency of second-line assessors to be more critical of clinical management events is predictable as the second-line assessor has access to the patient medical records as well as information on the SCF.

3.5. Adequacy of provision of critical care support to patients

The care provided by a critical care unit is often beneficial for acute medical admissions. Although not all surgical patients require the support of critical care, a close working relationship between the surgical and critical care teams is essential.

The treating surgeon was asked to record whether their patient received critical care support before or after surgery. First- and second-line assessors were asked to review the appropriateness of the use of critical care facilities for patients.

Figure 27: Provision of critical care support during the audit period.

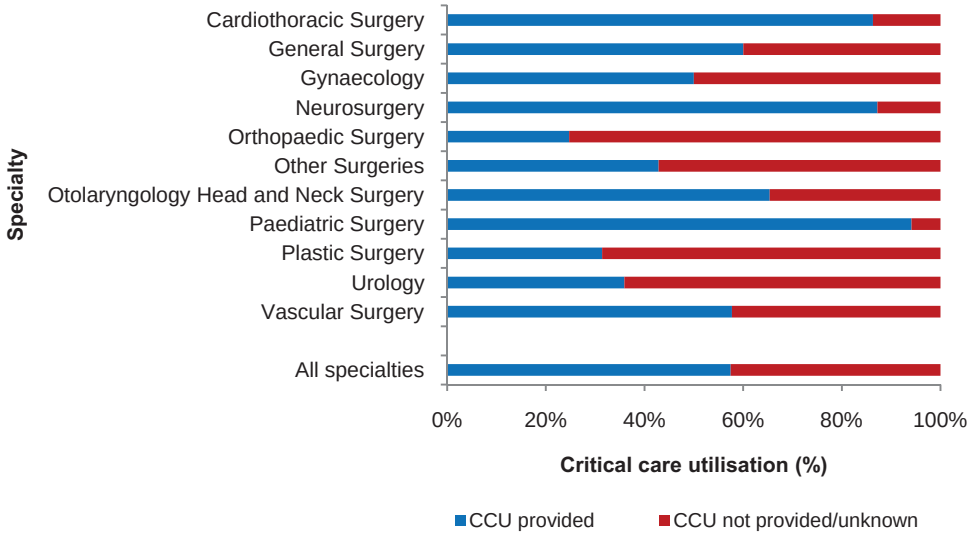


Note: n=4,905 operative cases.
CCU: critical care unit.

Comments:

- This question was reframed in 2010 to make it more informative and reduce the amount of missing data. The data collected from 2007 to 2010 has been remapped to the current data format.
- 58% (2,819/4,905) of audit patients received critical care support during their inpatient stay.
- The utilisation of critical care support where reviewed across the whole audit period has steadily increased, from 46% in 2008 to 61% in 2013–2014. Emergency cases have greater need for, and a higher use of, critical care facilities (data not shown).
- It should be recognised that not all health services have critical care services.
- Assessors believed that 2% (98/4,028) of patients who did not receive critical care support may have benefitted from receiving care in a critical care unit.

Figure 28: Provision of critical care support to patients by specialty.



Note: n=4,028 operative cases.
Other surgeries include Oral and Maxillofacial, Ophthalmology, Trauma, Transplant and Oncology.
CCU: critical care unit.

Comments:

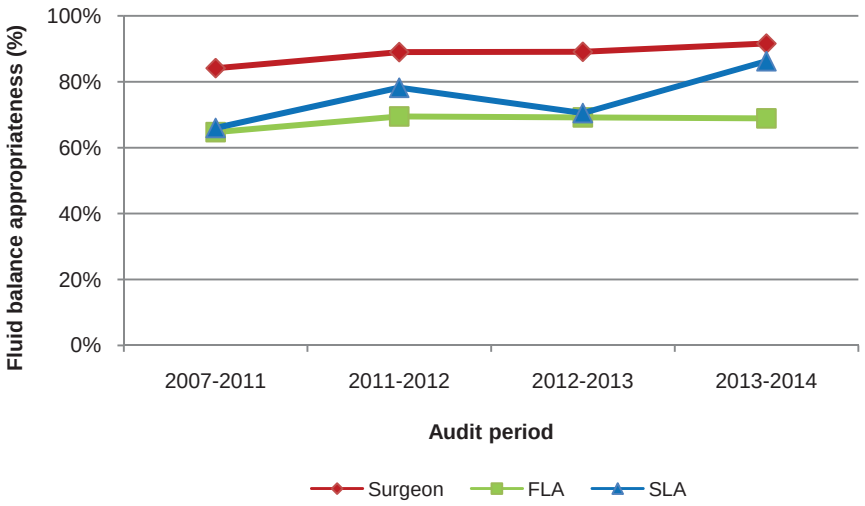
- Orthopaedic patients have a low referral rate for critical care support. This is thought to be due to a high number of elderly patients with fractured neck of femur admitted from high-level care institutions who are cared for on the ward.
- In less than 1% of cases the treating surgeon perceived that the lack of critical care support may have been an issue.

3.6. Issues with fluid balance

Administering the optimal amount of intravenous fluid at the most appropriate rate can be complex, and treatment decisions must be made based on careful assessment of patient needs. The aim is to provide the patient with enough fluid and electrolytes to meet losses, maintain normal status of body fluid compartments and enable renal excretion of waste products.

Both the treating surgeon and assessors were asked to comment on the appropriateness of the fluid balance management.

Figure 29: Perception of fluid balance appropriateness.



Note: n=4,028.
Missing data: n=220 (5%).
FLA: first-line assessor; SLA: second-line assessor.

Comments:

- Across the audit period 2007–2014, in 85% (3,426) of the audited cases the treating surgeon felt that fluid balance had been managed appropriately by their clinical team.
- Fluid balance was considered inappropriate by either the first- or second-line assessor, in 3% (28/839) of the cases that had a SLA.
- A recent study on the interaction between fluid balance and the disease severity of critically ill patients found that "early adequate fluid resuscitation together with conservative late fluid management may provide better patient outcomes".[17]
- The VASM believes that the mortality data is a useful monitoring tool of fluid balance management as it remains an important clinical care issue.

3.7. Trauma

The VASM began collecting data on trauma cases in 2012. Trauma cases are those in which severe bodily injury or shock, for example from a fall, accident or violence, occurred in patients that required surgery (see Table 7).

The VASM is keen to monitor trends, especially in falls, to ensure strategies are implemented to prevent and minimise future harm from falls.

Table 7: Trauma causes.

Trauma causes	2011-2012 Frequency (%)		2012-2013 Frequency (%)		2013-2014 Frequency (%)		Audit period Frequency (%)	
Fall at home	51	(42%)	89	(41%)	61	(43%)	201	(42%)
Fall in a care facility	28	(23%)	87	(40%)	44	(31%)	159	(33%)
Fall in hospital	11	(9%)	8	(4%)	8	(6%)	27	(6%)
Fall type unknown	2	(2%)	3	(1%)	3	(2%)	8	(2%)
Fall other*	7	(6%)	13	(6%)	12	(8%)	32	(7%)
Road accident	18	(15%)	12	(6%)	9	(6%)	41	(9%)
Violence	5	(4%)	4	(2%)	5	(4%)	14	(3%)
Total	**122**	**(100%)**	**216**	**(100%)**	**142**	**(100%)**	**482**	**(100%)**

Note: n=482.
Missing data: n=2 (<1%).
*Includes roads and public venues.

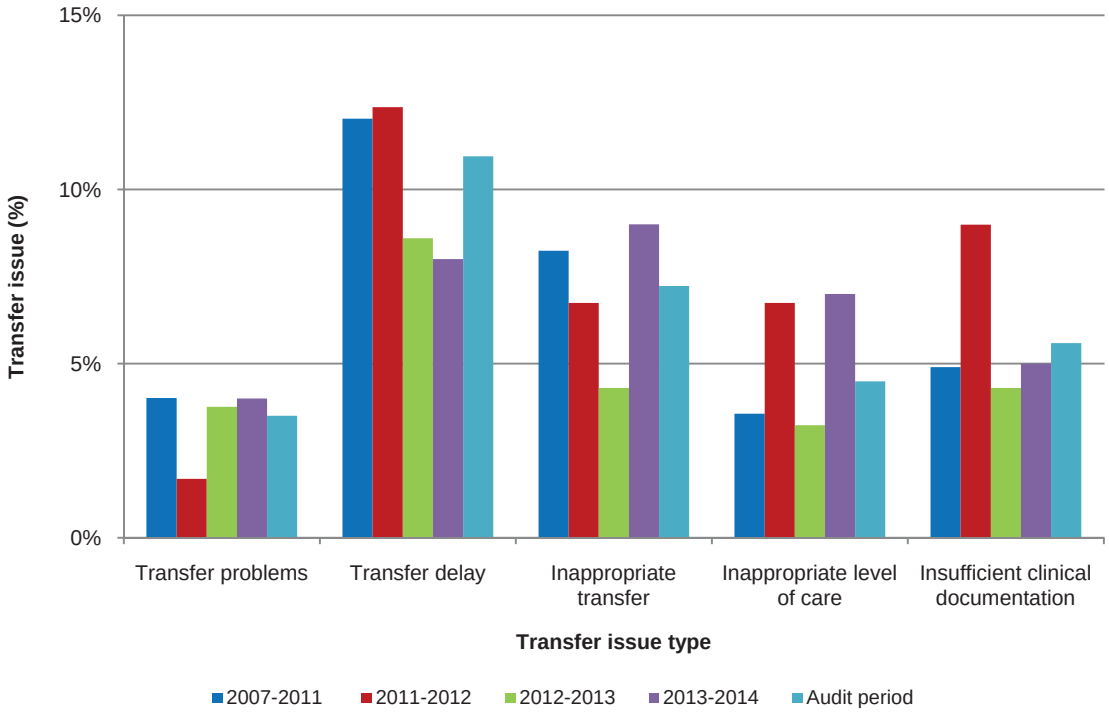
Comments:

- 20% (482/2,408) of the cases reported since January 2012 were attributed to traumatic events.
- 89% (427) of the traumatic events were caused by falls while 9% (41) were caused by traffic accidents and 3% (13) were caused by violence.
- Falls were associated with a range of location. Of the 427 falls, 44% (189) occurred in a hospital or care facility, 47% (201) occurred at home and 9% (40) occurred elsewhere.
- The VASM surgical population is at an increased risk of falls due to the presence of life threatening pre-existing conditions, comorbidities and frailty associated with advanced age.
- Health services and care facilities should continue to take all reasonable precautions to prevent falls. This is a similar finding to a review of care received by elderly patients undergoing surgery in United Kingdom.[14]
- The VASM future analysis of trauma trends could provide greater insight into strategies for improvement and improved recommendations especially for falls that occurred in a care facility and in hospital.[18] A recent study found a reduction in postoperative falls in patients who participated in a preoperative education program.[19] Therefore, the VASM aim is to encourage use of similar educational strategies across the Victorian health care facilities.

3.8. Patient transfer issues

The treating surgeon was asked to provide information on patients who required an interhospital transfer as part of their care. Information relating to the transfer included the timeliness and appropriateness of transfer, as well as any perceived clinical issues.

Figure 30: Interhospital transfer issues.



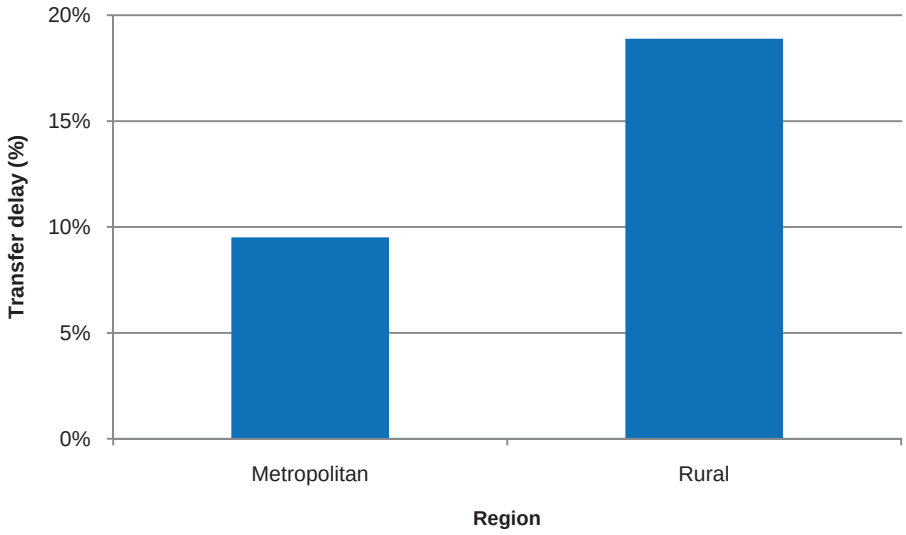
Note: n=290 transfer issues.
Missing data: n=0 (<1%).

Comments:

- Audit patients underwent a hospital transfer in 23% (913/4,028) of operative cases and 17% (151/876) of nonoperative cases.
- The frequency of patients requiring transfer for definitive care has remained similar throughout the audit period.
- Various issues of care related to patient transfers were identified in 32% (290/913) of the patients requiring transfer. This rate has been constant over time. Figure 30 demonstrates the spectrum of all issues identified by surgeons.
- Inappropriate level of care during transfer was identified as a problem in 5% (41/913) of the cases involving a transfer.
- Inadequate clinical information and documentation was perceived to have been provided to the receiving hospital in 6% (51/913) of the cases involving a transfer.
- The transfer was perceived to have occurred inappropriately late in the course of the patient's illness in 11% (100/913) of the cases involving a transfer.
- Transfer delays and problems increase the risks to patients and are one of the challenges associated with shared care. The transfer of patients remains an area in which further improvements are required, particularly around communication between patient care teams, to ensure patient safety.
- In 2015 the VASM will revise the data collection points relating to the types of transfer issues to enhance the quality of data collected in this area-the "transfer problem" data field is too non-specific.

3.8.1 Transfer delays by region

Figure 31: Perceived delays in transfer of patients to another hospital.



Note: n=913 in 4,028 operative cases.
Missing data: n=39 (4%).

Comments:

- A major reason for transfer is to provide the patient with a higher level of care, such as support in a critical care unit. It is expected that rural health services will have a greater number of transfer needs. However, RACS supports the Rural Doctors Association of Victoria's recommendations to provide greater support and round the clock availability of well-trained rural doctors to ensure that appropriate patient care is provided to the patient prior transfer.[20]
- Transfer delays were significantly more frequent in rural regions compared with metropolitan areas ($p<0.001$).

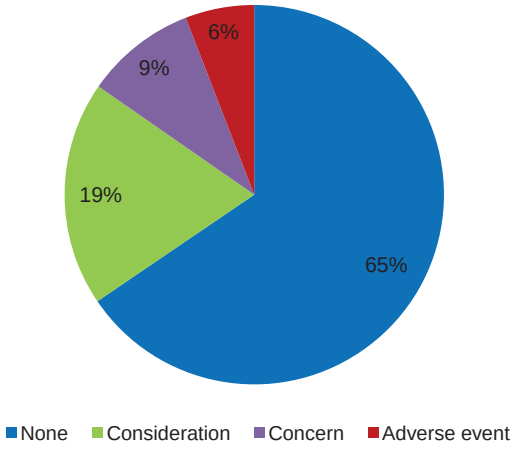
4. OUTCOMES OF THE PEER REVIEW

One of the primary objectives of the VASM peer review process is to ascertain whether death was a direct result of the disease process alone, or if aspects of patient management might have contributed to the outcome. An overview of the audit process is provided in section 1.4.

There are two possible outcomes of the peer review process: that death was a direct outcome of the disease process (categorised as probably and definitely preventable) and the clinical management had no impact on the outcome process (categorised as probably and definitely not preventable), or that there was the perception that aspects of patient management may have contributed to the death of the patient. Where an assessor perceives that clinical management of the patient may have contributed to death, they are asked to select from the following spectrum of criticism.

- An area for consideration: the assessor believes an area of care could have been improved or different, but recognises that the issue is perhaps debatable. It represents very minor criticism.
- An area of concern: the assessor believes that an area of care should have been better.
- An adverse event: an unintended injury or event that was caused by the medical management of the patient rather than by the disease process, and which was sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient at the time of separation, or which contributed to or caused death.

Figure 32: Clinical management issues as identified by assessors.



Note: n= 4,905.
Missing data: n=13 (<1%).

Comments:

- 84% (4,142/4,905) of audit cases were identified as having no or minor issues (areas of consideration) of patient management.
- 9% (462/4,905) of audit cases were identified as having an area of concern.
- 6% (288/4,905) of audit cases were identified as having an adverse event.
- 1% (13/4905) accounts for missing data.

4.1 Areas of clinical incidents

Table 8 shows the severity of criticism of perceived clinical management issues while Table 9 shows the frequency of clinical management issues.

Table 8: Severity of criticism of perceived clinical management issues.

	Less severe ◄			► Most severe
Areas of clinical incidents	None detected	Consideration	Concern	Adverse event
Outcome of incidents	N/A	Did not affect clinical outcome	May have contributed to death	Probably contributed to death
Preventable incidents	N/A	Probably not	Probably	Definitely
Association of incidents	N/A	Hospital	Clinical team	Surgical team

Table 9: Frequency of clinical management issues.

Degree of criticism of patient management	Total occurrences (n=6,659 in 4,905 cases)	Patients affected by clinical issues (n=4,905)
No issues identified	3,204	3,204 (65%)
Area of consideration	2,107	938 (19%)
Area of concern	924	462 (9%)
Area of adverse event	376	288 (6%)
Missing data	48	13 (<1%)
Total	6,659	4,905 (100%)
Perceived impact on patient outcome	**Total occurrences (n=6,659 in 4,905 cases)**	**Patients affected by clinical issues (n=4,905)**
No issues of management identified	3,204	3,204 (65%)
Did not affect clinical outcome	801	398 (8%)
May have contributed to death	2,186	997 (20%)
Probably contributed to death	305	248 (5%)
Missing data	163	58 (1%)
Total	6,659	4,905 (100%)
Perceived preventability of clinical issues	**Total occurrences (n=6,659 in 4,905 cases)**	**Patients affected by clinical issues (n=4,905)**
No issues identified	3,204	3,204 (65%)
Definitely preventable	403	292 (6%)
Probably preventable	1,387	641 (13%)
Probably not preventable	1,197	594 (12%)
Definitely not preventable	119	72 (1%)
Missing data	349	102 (2%)
Total	6,659	4,905 (100%)
Clinical team responsible for management issue	**Total occurrences (n=6,659 in 4,905 cases)**	**Patients affected by clinical issues (n=4,905)**
No issues identified	3,204	3,204 (65%)
Surgical team	1,997	1097 (22%)
Other clinical team	997	301 (6%)
Hospital issue	266	63 (1%)
Other factors*	250	63 (1%)
Missing data	444	177 (4%)
Total	7,158	4,905 (100%)

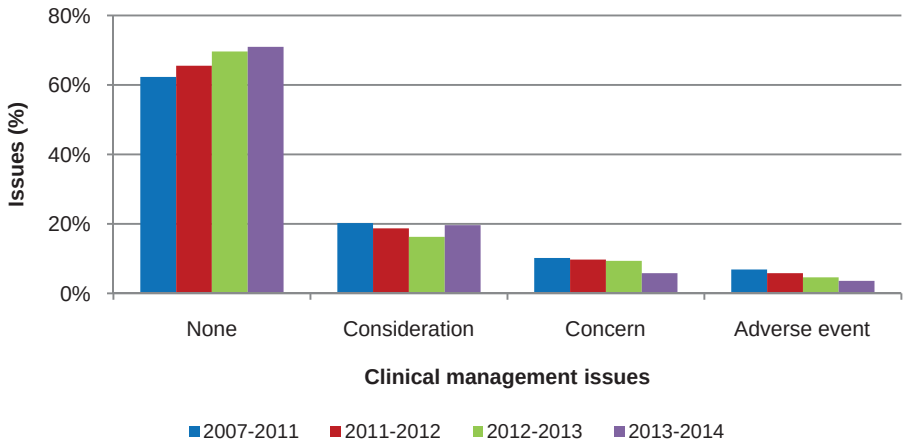
Note n=6,659 in 4,905 cases during the audit period from 1/7/2007 to 30/6/2014.
*Other factors can include issues such as staffing levels, patient transfer, patient refusal, ambulance care, anaesthetic care and availability or quality of critical care support.

Comments:

Audited cases can have more than one clinical management issue identified for each patient. The important measure is the percentage of patients affected.

- Patients often require input from multiple clinical teams during their course of treatment. A management issue can be attributed to any of the teams involved in the care of a patient.
- 34% (1,688/4,905) of cases in this audited series were perceived by assessors as having a clinical management issue.
- 22% (1,097/4,905) of cases in this audited series had a management issue that was attributed to the surgical team. The management issue was attributable to other clinical teams (such as medical and emergency departments) in 6% of cases.
- Hospital issues were associated with 1% of cases, while 1% of cases were attributable to other factors. In 4% of cases the assessor did not specify a responsible team.
- Assessors believed that clinical management issues probably contributed to death in 5% (248) of patients. In the remaining cases with perceived management issues. There was uncertainty regarding the impact of the clinical management issues on patient outcomes for the remaining cases with perceived issues.
- 19% of clinical management issues were considered probably or definitely preventable.
- These clinical management criticism findings are similar to the 2014 national audit results.(1)

Figure 33: Trends in clinical management issues.



Note: n= 4,905.
Missing data: n=13 (<1%).

Comments:

- There has been a reduction in the rate of clinical issues over the seven-year audit period.
- There has been a significant increase in the number of audit patients with no identified clinical management issues, rising from 62% of patients in the 2007–2010 audit period to 71% of patients in the 2013–2014 audit period ($p<0.001$).
- Assessors identified more clinical issues than treating surgeons over the seven-year audit period. The ratio of issues identified by the treating surgeon compared with the first-line assessor was 24%:33%, while the gap between the treating surgeon compared with the second-line assessor widens at 44%:74%.

These results highlight the importance and the value of an independent peer review assessment.

- The prevalence of areas of concern and adverse events identified by assessors was similar among the specialties.

4.2 Frequency of clinical management issues

The frequency of specific clinical management issues is shown in Table 10. As the frequency of a clinical management issue increases so too does the need to implement strategies to improve surgical care in that area.

Table 10: Frequency of clinical management issues across the audit series (2007-2014).

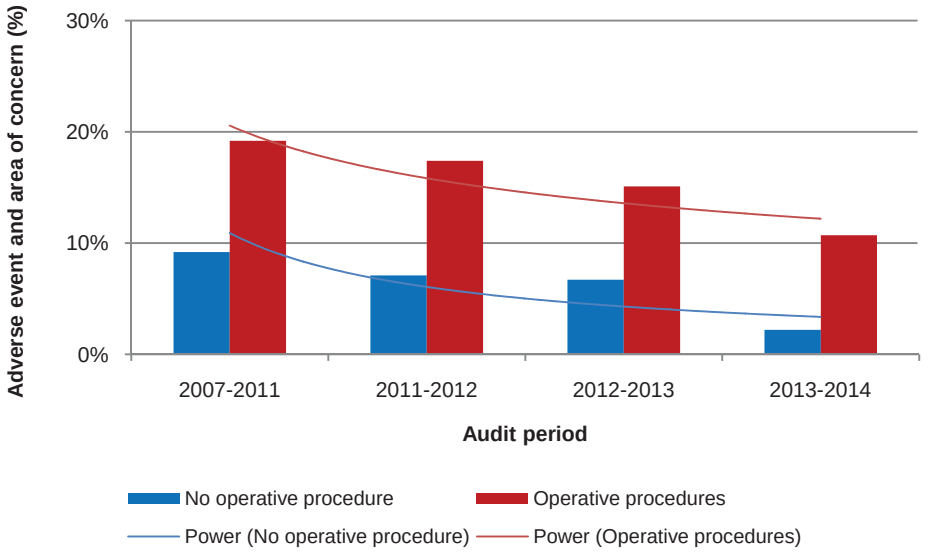
Clinical management issues	Current audit period Frequency (%)
Operation inappropriate	1,025 (27%)
Delay in definitive treatment	970 (26%)
Preoperative care issues	500 (13%)
Management or protocol issues	478 (13%)
Postoperative care issues	370 (10%)
General complications after surgery	83 (2%)
Communication or poor documentation	177 (5%)
Adverse events	91 (2%)
Critical care issues	48 (1%)
Septicaemia and wound	28 (1%)
Transfer problems	19 (<1%)

Note: n=3,789 clinical management issues arising from 1,688 cases.
More than one clinical management issue can be attributed to a case.
The clinical issues were re-categorised and detailed in the section 10.7 of this report.

Comments:

- Inappropriate operation (27%) and delay in implementing definitive treatment (26%) were the most common clinical management issues. There were 1,995 instances in which an inappropriate operation was performed or a delay in definitive treatment occurred. These findings of inappropriate operation highlight the necessity of acting on, and not just recording, clinical deterioration.
- The delay in definitive treatment category included delays in transfer, establishing diagnosis and starting treatment. The VASM's findings are similar to a number of studies on hip fracture patients which found that delay to surgery was attributable to patient factors such as age[21],comorbidities[22], ASA status, gender, day of surgical admission relating to delay to surgery[23], waiting times[13, 24, 25] and reduction of theatre changeover time.[26]
- Delays were attributed to: delay in patient care, delay in diagnosis, delay in fully investigating the patient, delay in patient presenting, delay in recognising complications, delay in transfer to surgical unit, delay in transfer to tertiary hospital, delay in starting medical treatment, delay to operation caused by missed diagnosis and delay to surgery where earlier operation was desirable.
- Criticisms of the choice of operation included a failure to adequately consider or perform less extensive procedures on sicker patients with multiple comorbidities. Also criticised was the use of open versus laparoscopic procedures, which carry a higher incidence of anastomotic leaks and transfusion.[27]

Figure 34: Frequency of adverse events and areas of concern by operative status.

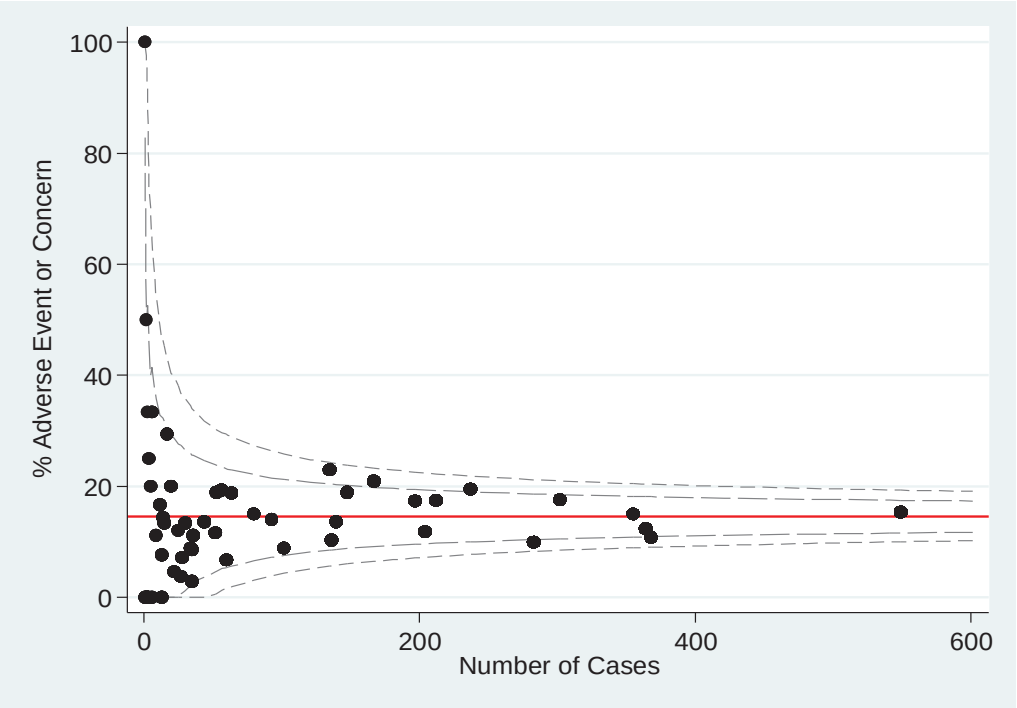


Note: n=750.
Missing data: n=13 (<1%).
The operative and non-operative power trend line indicates the decreased adverse event and areas of concern rates in both groups.

Comments:

- Audited cases with no operative procedures had a significantly lower rate ($p<0.001$) of areas of concern and adverse events identified (2%; 68 cases) compared with cases in which an operative procedure was performed occurred (11%; 682 cases) (2013-2014).
- There has been a significant reduction in the frequency of areas of concern and adverse events from 17% during the 2007–2010 audit period to 9% in the 2013–2014 audit period ($p<0.001$) (data not shown).
- Cases where the consultant surgeon had no involvement in the surgery (the consultant was not operating, deciding, assisting or present in theatre) had a similar rate of areas of concern and adverse events (18%) as those where a consultant was involved (17%).
- The physical absence of the consultant had minor impact on the outcome which may reflect the more complex cases where consultants decide to become directly involved. Accuracy of data for this data field remains a concern however.
- The identification of an area of concern or adverse event by an assessor represents a significant criticism of one or more aspects of a patient's care. Figures 35 and 36 look at the prevalence of this degree of criticism among health services and surgical specialties respectively. For cases which underwent both FLA and SLA only the SLA has been used.

Figure 35: Adverse events and areas of concern by hospital during the audit period.

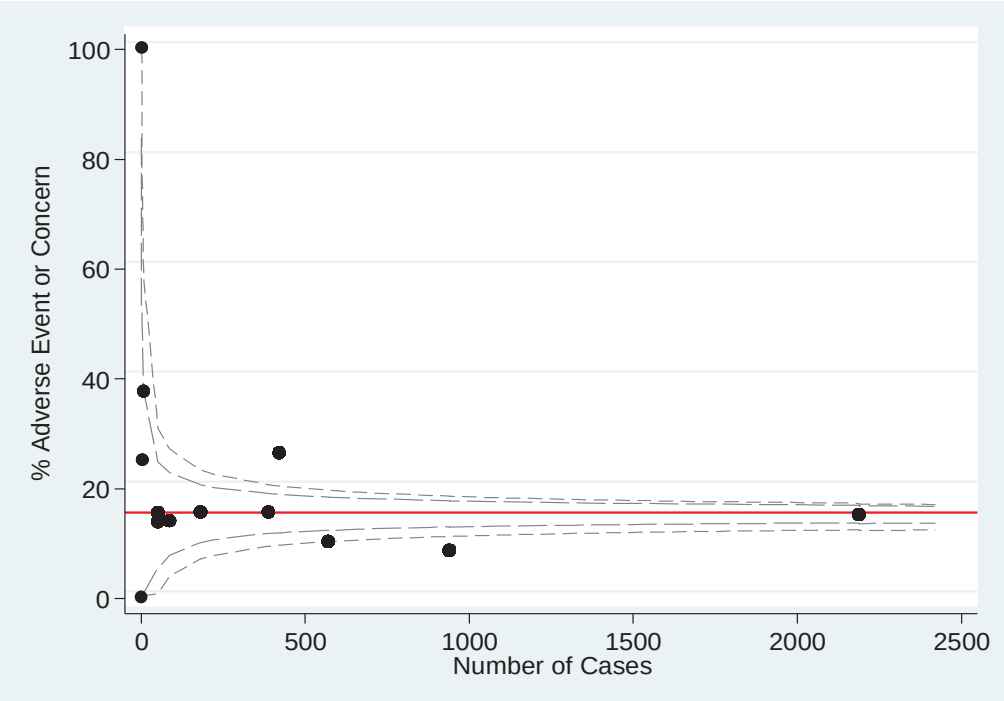


Note: n=4,905.
Missing data: n=13 (<1%).
Grey lines represent percentage grids 2 and 3 SD limits.
SD: standard deviation.

Comments:

- No hospital was outside the upper 3 SD limit during the audit period.

Figure 36: Adverse events and areas of concern by surgical specialty.



Note: n=4,905.
Missing data: n=13 (<1%).
Grey lines represent percentage grids 2 and 3 SD limits.
SD: standard deviation.

Comments:

- One specialty was outside the upper 3 SD limit; however, as it is not possible to stratify risk among the specialties, some of which encompass a very high-risk group of patients, no inference can be made.

4.3 Conclusion

Surgeons must assume leadership roles when providing patient care and ensure the clinical journey of the patient is accepted by the other clinical teams and the patient and this journey is acted correctly upon.[28]

VASM would like to encourage participating stakeholders to improve their leadership approaches[29] in patient care, to focus on better documentation of clinical events and to take action on evidence of clinical deterioration, focus on communication and improve awareness for shared care requirements, focus on improved pre-, intra- and postoperative management as outlined in the 'Emerging issues and recommendations to VASM clinical stakeholders' section of this report.

VASM will continue to identify, assess and review factors associated with surgical mortality and will place yearly a strong focus in developing action plans, educational programs and recommendations for further patient care improvements in Victoria.

5. SELECTED SUBANALYSIS: ABDOMINAL WALL HERNIA

Abdominal wall hernias are a subset of hernias. They involve the protrusion of intra-abdominal contents through a weakness in the abdominal wall, and can occur at any age. Intestine is usually contained in the sac of the defect and is prone to incarceration, intestinal obstruction or gangrene depending on the hernia's location and anatomy. Complications associated with an abdominal wall hernia can necessitate an emergency operation to relieve obstruction to the bowel or resect a gangrenous segment. Complications arising from abdominal wall hernias are associated with a higher risk of mortality, especially in the elderly.

The aim of this subanalysis was to identify management strategies relating to abdominal wall hernia that could be improved. As part of the analysis the VASM examined the demographics, operation profile, complications and areas of improvement identified by assessors for audit patients with hernias. Select comparisons were made between the hernia patient subgroup and all the VASM patients.

5.1 Characteristics of the sub-analysis group

Abdominal wall hernias were recorded for 2% of audit patients (72/4,905). Of the patients with an abdominal wall hernia, 93% had one operation (66) while 8% underwent more than one procedure.[6]

Table 11: Characteristics of the hernia subgroup of the audited deaths.

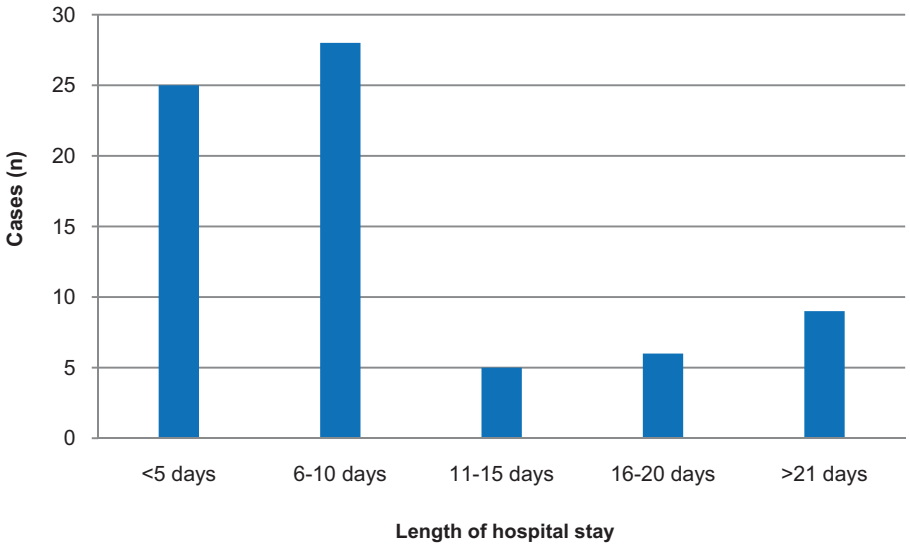
Number of audited deaths	72	
Mean age (range)	80 years	(<1 year to 104 years)
Gender (Male: Female)	54 % (77 years):	46% (84 years)
Admission status (Emergency: Elective)	16%:	84%
ASA grades	ASA 1-2:	9%
	ASA 3:	39%
	ASA 4:	43%
	ASA 5-6:	9%
Risk of death prior surgery	Expected:	10%
	Considerable:	45%
	Moderate:	29%
	Small:	13%
	Minimal:	3%
Most common comorbidities	Cardiovascular:	26%
	Age:	23%
	Respiratory:	16%
	Other* (patient related factors):	9%
	Renal:	8%
	Diabetes:	6%
	Neurological or psychiatric:	5%
	Obesity:	3%
	Advanced malignancy:	2%
	Hepatic:	2%

*Other comorbidities include cirrhosis, severe portal hypertension, chronic obstructive pulmonary disease (COPD), sepsis, stroke, known abdominal aortic aneurysm (AAA), peripheral vascular disease, dementia, malnutrition, smoking, Parkinson's disease, asthma, Prader-Willi syndrome, intellectual disability, alcohol abuse, schizophrenia, chronic pain syndrome and patient-related factors such as patient refusing treatment.

Comments:

- A hernia diagnosis was identified for 72 (2%) of the 4,905 patients whose cases were audited between 2007 and 2014. The average age was 80 years, 46% of patients were female (33) and 54% of patients were male (39).
- Gangrene was identified in 33% of patients (24).
- No bowel resection was performed in two patients; one patient was treated with just an oversew and one patient had missed necrotic bowel identified at a second laparotomy.
- Nine patients had a bowel resection without a diagnosis of bowel ischaemia, five patients had an incisional hernia and resection was performed due to coexistent bowel pathology, one patient had a massive paraumbilical hernia that contained so much bowel that a resection had to be done to allow repair. The other three patients had inguinal hernias and coexistent other pathology, including one instance of a proximal jejunal diverticular perforation consequent to the obstruction.
- Audit patients that had an inguinal, femoral or incisional hernia were generally elderly and had complex health risk factors.
- Patients in the hernia diagnostic group had an ASA score greater than or equal to 3 in 92% of cases. The ASA status was higher for these patients compared with all audited patients.
- 16% of cases were identified as having a minimal or small risk of death, 29% were considered to have a moderate risk of death and 45% had a considerable risk and 10% expected outcome of death.
- Comorbidities present in this group of patients included cardiovascular disease, age and respiratory. The comorbidities also included patient-related factors, such as alcohol abuse and refusal of treatment.
- 86% of patients had at least two comorbidities.

Figure 37: Length of stay of the hernia subgroup.



Comments:

- The length of hospital stay for the hernia patient group was short, reflecting the rapid progression of complications associated with the disease. The majority of patients were hospitalised for less than 10 days (74%; 53 cases), although a small number of patients were hospitalised for more than one 21 days (6%; 4 cases).

Table 12: Hernia type.

Admission diagnosis	Freq.	%
Inguinal hernia	28	(39%)
Incisional hernia	22	(31%)
Femoral hernia	14	(19%)
Umbilical hernia	6	(9%)
Incisional and inguinal hernia	1	(1%)
Epigastric hernia	1	(1%)
Total	**72**	**(100%)**

Note: n=72.
Missing data: n=0

Comments:

- The most common admission diagnosis for audit patients with hernias were for repair of inguinal (39%) and incisional hernias (31%).

Table 13: Operative profile.

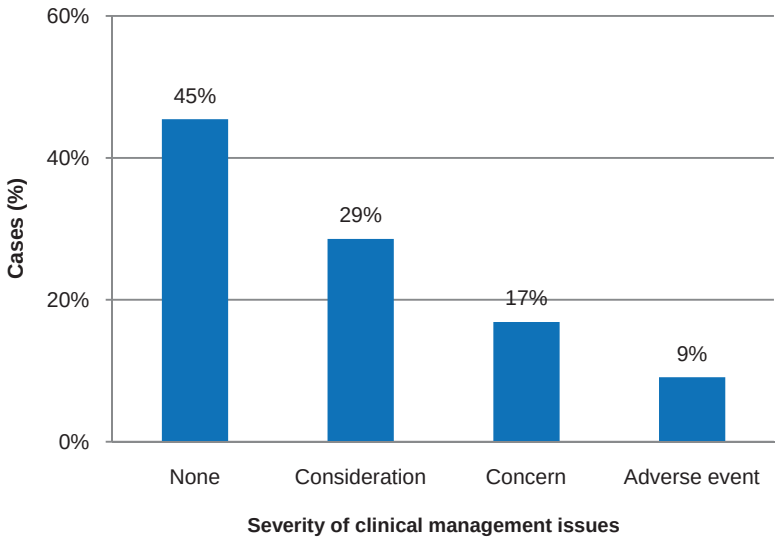
Operative profile	Freq.	%
Surgical procedure	67	(93%)
Procedure abandoned	1	(1%)
Consultant present	65	(97%)
No procedure	5	(7%)
Complications	32	(44%)
CCU care	51	(71%)

Note: n=82 operative procedures reported for 67 patients.
CCU: critical care unit.

Comments:

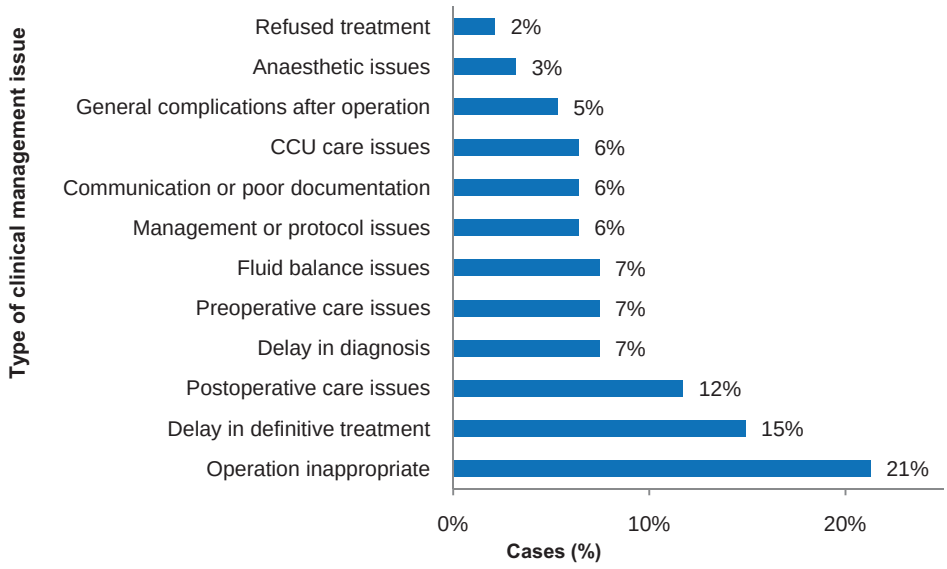
- 93% (67/72) of patients had an operative procedure to repair the hernia and 44% (32/72) of these patients had an operative complication.
- In 97% (65/67) of cases the consultant made the decision to operate or was present during the operative procedure.
- 19% (13/67) of patients had a follow-up operative procedure (data not shown).
- 71% (51/67) of patients received treatment in a critical care facility.
- Five patients did not undergo an operation due to the severity of their condition at presentation. Three patients received palliative care and two patients died prior to the hernia repair (data not shown).
- Patients with abdominal wall hernias are at high risk of mortality. It is critical that any deficiencies in the care provided to these patients be identified and subsequently addressed. SLA referral occurred in 24% (17/72) of cases involving patients with an abdominal wall hernia, and this rate was 13% higher than that for all audit patients.
- A clinical management issue was identified in 53% (38/72) of hernia diagnostic cases, and this rate was 10% higher than the rate for all audit patients.

Figure 38: Severity of clinical issues of management in hernia subgroup.



Note: n=151 clinical issues reported for 72 patients.

Figure 39: Frequency of clinical management issues in hernia subgroup.



Note: n=151 clinical issues reported for 72 patients.
Missing data: n=2 (<1%).
CCU: critical care unit.

Comments:

- Clinical management issues in patient management were identified in 53% patients who died, with some patients experiencing more than one adverse factor. Of the 151 issues reported, 2% (3) were considered definitively preventable and 11% (16) probably preventable events.
- The frequency of different types of clinical management issues suggests that there are several areas of the care provided to hernia patients that need improvement.
- The most frequent clinical management issues are outlined below.
  - Delays in definitive treatment and diagnosis (22%).
  - Inappropriate operation (21%). This included: inappropriate approach or failure to consider resection, better outcomes would have been achieved through gut manipulation, palliation would have been more appropriate, surgery performed in the presence of known contamination, diversion instead of colectomy.
  - Inadequate preoperative and postoperative care (19%). This included: drug-related complication, failure to use high dependency unit (HDU) postoperatively, unsatisfactory fluid balance, fluid overload and inadequate postoperative assessment.
- Poor or inadequate perioperative management is also an area of care that needs improvement in this group of patients, and there is a need for increased use of high dependency facilities.

5.2 Conclusion and recommendations for hernia audited subgroup

A hernia repair is ideally diagnosed by the referring general practitioner and performed as an elective surgical procedure. Hernia repairs performed as an elective procedure, rather than an emergency procedure, have fewer complications and the mortality rate is lower.

LeBlanc et al. indicated that “as always, careful and skillful technique should be performed. Despite excellent surgical skill, vast experience, and careful dissection, laparoscopic incisional and ventral hernia repair carries with it the risk of morbidity and mortality.”[30]

The VASM data suggests that elderly patients admitted as emergencies with an ASA score greater than or equal to three and at least one comorbidity, and who require hernia surgery, should be operated on by a senior consultant as a high priority. Prioritisation of these patients will help prevent complications as well as reduce mortality.

6. VASM PERFORMANCE REVIEW

Table 14: Project schedule and delivery status.

Schedule of key deliverables	Status
Key performance reviews 2007–2012	✓ Completed
VASM contract renewal 2013–2019	✓ Completed 12 August 2012
Enhancement of the Fellows electronic interface	✓ Completed 1 November 2013
Establishment of mortality audit at all Victorian public and private health services	✓ Completed 1 August 2013
Establishment of internal validation of the VASM audit processes 2013–2019 • First-line validation • Second-line validation	✓ Completed 12 August 2013
Provision of educational seminars to Fellows, hospital administrators and other healthcare professionals on: • 'Managing the deteriorating patient' in collaboration with VSCC and VMIA • 'Profiling the accreditation advantages of the Victorian Audit of Surgical Mortality' • 'Patient transfers - between health services and within health services' • 'Aviation error reduction strategies applied to surgery - how to conduct second-line VASM peer review assessments' • 'Surgical emergencies and shared care' • 'Understanding the literature and preparing for journal submission' • 'Perioperative care: how can we do better?'	✓ Completed 23 February 2012 ✓ Completed 30 October 2012 ✓ Completed 23 February 2013 ✓ Completed 18 October 2013 ✓ Completed 19 February 2014 ✓ Completed 1 May 2014 ✓ Completed 18 February 2015
Provision of educational publications; • Case note review booklet • Scientific papers • Aggregate report	✓ Completed 15 November 2013 ✓ Completed 15 October 2013 ✓ Completed 15 August 2014
Provision external evaluation by Aspex consulting of the VASM audit processes	✓ Stage 1 completed 27 December 2014 ✓ Stage 2 completed March 2015 ✓ Stage 3 completed July 2015
Enhancement of hospital reports for accreditation processes	✓ Completed 25 November 2014

7. AUDIT LIMITATIONS AND DATA MANAGEMENT

The data collected by the VASM is of high quality, with every case included in the audit subject to external peer review. It should be recognised, however, that the primary aim of the VASM data collection is to provide feedback to surgeons rather than for academic research.

The data is self-reported and a certain level of bias may be present, however the assessors are independent and blinded to the case and make their own judgements based on the facts presented.

Data quality is an essential component of all audits. Inaccurate and incomplete clinical information impairs the audit process and prevents identification of trends.[11]

The volume of missing data is highest in the following areas: fluid balance management (20%); operative section (11%); anaesthetic-related sections (20%); and critical care utilisation (15%). These questions in the surgical case record from are important if we are to identify and address adverse trends. Where data integrity issues are identified, it is important to review the format of the questions that will generate the data. ANZASM revised the surgical case record form to improve the quality of the audit data.

The VASM will enhance the data submission component of the Fellows electronic interface during 2015. This should expedite and simplify the data submissions and lead to improved data integrity in the future.

8. VASM EVALUATION SURVEY

With the release of each VASM report an evaluation survey is sent to surgeons and health services. The survey sought feedback on the perceived value of the aggregate reports, case note review booklets, the value of the personal feedback sent to treating surgeons as part of the peer review process and the value of the new Fellows electronic interface.

The survey included free text sections soliciting suggestions for improvement as well as topics that might be addressed in future educational seminars. Surgeons were also asked whether outcomes from the audit process had led to changes in their practice.

The majority of survey respondents agreed with the appropriateness of the VASM program.

Table 15: VASM Evaluation Hospital Survey Results 2007–2013.

The VASM surveyed 6% of hospital contacts (26/425) from the 127 health services with surgical services. This survey evaluated the value and impact of the VASM activities on their clinical settings. The 2013 data was compared to the evaluation from VASM's inception. The data were analysed using quantitative and qualitative methodologies. The results are as indicated below. The averages represent the Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The response on the survey item on the value of the VASM process represent a scale where 1=Yes and 0=No.

	2007–2012 (n=83)			2013 (n=26)			
VASM publication and electronic platform	**n**	**(%)**	**Ave**	**n**	**(%)**	**Ave**	**Trend**
The VASM Report is informative.	82	(99)	**4.2**	26	(100)	**4.0**	↓
The Case Note Review Booklet is a valid education tool.	82	(99)	**4.3**	26	(100)	**4.1**	↓
The VASM webpage is a useful resource about VASM.	65	(78)	**3.7**	26	(100)	**3.7**	**N/A**
VASM electronic publications would be valuable.	53	(64)	**3.8**	25	(96)	**3.6**	↓

	2007–2012 (n=53)			2013 (n=26)			
Educational value	**n**	**(%)**	**Ave**	**n**	**(%)**	**Ave**	**Trend**
The seminar held was educational.	18	(34)	**3.8**	9	(35)	**4.0**	↑
The VASM process helped improve surgical care at my institution or health service.	48	(91)	**0.6**	23	(88)	**0.8**	↑

	2007–2012 (n=53)		2013 (n=26)	
Topics	**n**	**(%)**	**n**	**(%)**
Delay in diagnosis.	19	(36)	8	(31)
Delay in transfer.	25	(47)	8	(31)
Fluid balance/resuscitation.	17	(32)	10	(28)
Communication issues.	27	(51)	15	(58)
Hospital accreditation tool.	16	(30)	11	(42)
Preoperative management.	25	(47)	10	(38)
Other topics suggested.	5	(9)	2	(8)

Themes about the impact of the VASM activities on their institution/health service	**Examples from respondents:**
Educational value.	"Valuable to nursing staff to highlight potential risk." "Provides valuable education." "Shared learning."
Improvement in quality of care and risk reductions.	"Team approaches to diagnosis and management." "In the past 3 months there has been a decrease in number of surgical deaths." "Ensured all are involved in surgical audit (that is surgeons)."
Meaningful feedback and recommendations.	"It would be useful if health services/units cooperate more when patients need transfer for higher level of care. This I feel is a major issue in Victoria and possibly nationally. Good overall activity." "Great initiative seminars relevant and practical." "Health services need to be provided detail of cases particularly when a 'hospital' issue has been identified."
Review of policies and procedures.	"Highlights management issues - they are brought up in surgical audit." "Causes reflection and assessment." "Note is made of your recommendations at our monthly audit meeting where all complications and mortality are discussed."
Value of electronic communication.	"Upload publications as these are useful tools in peri operative environment."
Value of VASM publications.	"Case reports led to review processes and improve. [The] Health Service would like to receive more copies of the case notes review booklets…to be widely circulated amongst all VMOs." "The note review booklet is a great tool to challenge staff to look at better ways to practice and prevent complications." "CNRB is fed back to visiting surgeons."

Table 16: VASM Evaluation Surgeon Survey Results 2007–2013.

The VASM surveyed 15% of Fellows (202/1,348). This survey evaluated the value and impact of the VASM activities on their clinical settings. The 2013 data was compared to the evaluation findings since the VASM's inception. The data were analysed using quantitative and qualitative methodologies. The results are as indicated below. In Table 16 the averages represent the Likert scale where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The response on the survey item on the value of the VASM process represent a scale where 1=Yes and 0=No.

	2007–2012 (n=651)			2013 (n=202)			
VASM publication and electronic platform	**n**	**(%)**	**Ave**	**n**	**(%)**	**Ave**	**Trend**
The VASM Report is informative.	647	(99)	**3.9**	202	(100)	**4.1**	↑
The Case Note Review Booklet is a valid education tool.	644	(99)	**4.0**	201	(100)	**4.1**	↑
The VASM Newsletter is informative.	356	(55)	**3.8**	200	(99)	**3.8**	**N/A**
The VASM webpage is a useful resource about VASM.	434	(53)	**3.4**	195	(97)	**3.5**	↑
The electronic platform, Fellows Interface is valuable.	493	(76)	**3.4**	151	(75)	**3.5**	↑
The assessor's comment from the feedback letter is valuable.	528	(81)	**4.1**	141	(70)	**4.0**	↓
VASM electronic publications would be valuable.	347	(53)	**3.5**	201	(100)	**3.3**	↓

	2007–2012 (n=359)			2013 (n=202)			
Educational value	**n**	**(%)**	**Ave**	**n**	**(%)**	**Ave**	**Trend**
The seminar held was educational.	121	(34)	**3.5**	54	(27)	**3.6**	↑
The VASM process helped improve surgical care at my institution/health service.	315	(88)	**0.5**	175	(87)	**0.6**	↑

	2007–2012 (n=651)		2013 (n=202)	
Workshop topics identified?	**n**	**(%)**	**n**	**(%)**
Delay in diagnosis.	125	(19)	55	(27)
Delay in transfer.	76	(12)	40	(20)
Preoperative management.	99	(15)	54	(27)
Fluid balance/resuscitation.	77	(12)	36	(18)
Guidelines for assessments.	86	(13)	48	(24)
Deteriorating patient.	147	(23)	78	(39)
Communication issues.	91	(14)	58	(29)
Other topics suggested.	19	(3)	6	(3)

Themes about the impact of the VASM activities on their institution/health service	Examples from respondents:
Educational value.	*"Presentation of many useful diagnostic pointers to promote awareness of possible complications. Alerting me to common clinical situations is helpful."* *"Always best to learn from the mistakes of others than make them yourself Improved documentation, decision making, patient transfers, timeliness of care. Useful to get independent review and feedback."* *"Highlighting the importance of proper pre-operation assessment of co-morbidity by colleagues - Group involvement."* *"My assessor role validates my teaching process VASM feedback is reviewed, changes made to protocols Keeps us informed and improves standards - sets the bar. Any review is useful."*
Meaningful feedback and recommendations.	*"Patients over the age of 85 with fractured neck of femur should be excluded from VASM (waste of resources/time)."* *"A self-reporting system may favour the surgeon writing their own report. A third party (e.g. History sent to RACS for perusal) would be more objective."* *"Can be a more refined process - needs to be more integral to the unit activity I note no ophthalmology rep on VASM Management Committee."* *"Limited value to orthopaedic surgeons. We audit deaths every 3 months in our unit (largely very elderly fractured neck of femur patients)."* *"Process is useful and well organised. I support it. It would be informative if the first and second line assessors received some feedback of the case/s they were involved in."*
Recommendations for future events and publications.	*"As an orthopaedic surgeon, I would appreciate any feedback regarding mortality in patients other than with femoral neck fractures."* *"Continued liaison with gynaecologists. More work on 'near miss'."* *"Main area of orthopaedic feedback is hip fractures; other less common cases would be welcome."*
Value of electronic communication.	*"Very practical having a physical booklet to read at a convenient time. Don't ever get around to doing things electronically."* *"I'm more likely to read paper publications!"* *"Keep up the succinct printed educational material which encourages reading across many specialties."* *"Hard copy is more likely to be read by older practitioners than electronic publications. As should be both - not either/or. All members should be encouraged to read the Victorian Coroners."* *"Electronic - don't waste paper."* *"Continued use of paper reports rather than electronic."*
Value of VASM publications.	*"I appreciated the inclusion of the positive outcomes section."* *"Don't use that positive assessment format again. No one will read it. The Report is of extremely high quality and very informative."* *"I believe that the 'Positive Assessment' booklet is valuable and highlights the need for a team approach to patient's care. This booklet also makes comment on alternative treatment. Team care may be easier to achieve in public health services than private."* *"Presentation of complicated cases in Private health services would be of value. Is there a difference?"*

9. VASM EDUCATIONAL ACTIVITIES

The VASM educational seminars commenced in 2012 and continued into early 2015 as collaboration between the VASM, DHHS, the VSCC and VMIA. Programs from past seminars can be downloaded from www.surgeons.org/VASM.

The following educational programs were offered:

- **Perioperative care: how can we do better?**
  The seminar was held on 18 February 2015 and presented jointly by the VASM, the VSCC, VMIA and DHHS.
  The seminar focused on improvements in preoperative and postoperative care of the surgical patient. The seminar was positively received with more than 100 attendees.
- **Understanding the literature and preparing for journal submission**
  The seminar was held on 1 May 2014 and presented jointly by the VASM, AHRDMA, and the Centre of Research Excellence in Patient Safety at Monash University.
  The seminar focused on how to conduct literature review, how to apply critical thinking and preparation of journal submissions. Opportunities to use the VASM data for future clinical research and publication were highlighted. The seminar was positively received with more than 60 attendees.
- **Surgical emergencies and shared care**
  The seminar was held on 19 February 2014 and presented jointly by the VASM, VSCC, VMIA and the DHHS.
  The seminar focused on current problem areas in the care of surgical emergencies, as revealed in the clinical audit. It looked at the risks and challenges posed by shared care, and how surgeons and trainees may improve the safety of patient care in such settings. The seminar was positively received with more than 140 attendees.
- **How to conduct second-line VASM peer-review assessments**
  The workshop was held on 18 October 2013 and was designed to increase attendee proficiency in the peer assessment process. The seminar was positively received with more than 30 attendees.
- **Patient transfers: between health services and within health services**
  The seminar was held on 21 February 2013 and was a joint presentation of the VASM, VSCC, VMIA and the DHHS.
  The seminar aimed to increase medical and nursing staff awareness of safety factors for interhospital transfers, particularly regarding emergency surgical patients. It was also designed to promote better accompanying information when patients move within health services and improve techniques for surgical patient handover between shifts or between wards. The seminar was positively received with more than 140 attendees.
- **Profiling the national accreditation advantages of the Victorian Audit of Surgical Mortality**
  The seminar was held on 30 October 2012 and focused on promoting the VASM as a quality assurance and accreditation tool. The emphasis was on the use of VASM to meet some of the accreditation standards based on the National Safety and Quality Health Service Standards (NSQHSS). NSQHSS address critical areas that require improvements.
  The seminar highlighted the usefulness of VASM in meeting a range of accreditation standards. In particular:
  - governance, review and reporting;
  - preventing and controlling healthcare associated infections;
  - clinical handover;
  - recognising and responding to clinical deterioration in acute health care;
  - preventing falls and harm from falls.

The seminar was positively received with 100 attendees. A survey of attendees indicated that 60% would consider making changes to their quality assurance processes based on seminar content.

Comments:

The seminars and workshops were intended for interns, HMOs, surgeons, nurse managers and educators, health specialists, administrators, CEOs, and quality and safety officers.

Feedback indicated that the seminars and publications were relevant and practical. They were viewed as great tools for challenging clinical staff to look for better ways to practice and prevent negative surgical outcomes. The seminars and publications also helped "rationalize the thought process, increase awareness [on] patient management [and] vigilance when dealing with the very sick patients".[31]

The feedback process identified several areas for the VASM to focus on in the future. These included the inclusion of each specialty cases in the editions of the VASM publications and educational events, strong presence at surgical conferences, development of hospital clinical governance reports and assisting stakeholders implement changes based on the audit findings and recommendations.

10. APPENDIX

10.1 Data management and statistical analysis

All deaths occurring in Victorian health services while the patient is under the care of a surgeon are audited once VASM has been notified of the death. Cases admitted for terminal care and deaths incorrectly attributed to surgery are excluded from the full audit process. This Report includes deaths reported to VASM since data collection commenced on 1 January 2007 up to 30 June 2014. As the multiple rate-limiting steps in the audit process result in a mean time to completion of three months, some deaths that occurred during the reporting period are still under review and are not included in this report.

Data is encrypted in the web database. This data is sent to, and stored in, a central Structured Query Language server database that includes a reporting engine. All transactions are time-stamped. All changes to audit data are written to an archive table, enabling a complete audit trail for each case.

An integrated workflow rules engine supports the creation of letters, reminders and management reports. This system is designed by Alcidion Corporation and supported by the College's Information Technology (IT) department. All communications are encrypted with Secure Sockets Layer certificates.

Data is downloaded from the secure database and then analysed using the statistical package Stata version 13.1 and Microsoft Office Excel (2007). Demographic data and summary statistics have been presented. Continuous variables have been compared using Student's t-test or the non-parametric Rank-sum test as appropriate. Categorical variables have been compared using Pearson's Chi-square test. Variables have also been tested for yearly trend. Concordance and kappa scores have been used as measures of agreement. Funnel plots have been used to explore heterogeneity and have been presented with upper and lower two and three standard deviation (SD) limits.

Numbers in the parentheses in the text (n) represent the number of cases analysed. The n values vary as not all data fields were completed by surgeons and assessors for each case.

10.2 Interpretation of Cohen,Gwet score and p values

The kappa score is used to understand the difference between agreement levels beyond chance where:

<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.

A p value <0.05 is considered statistically significant.

10.3 Interpretation of funnel plots

Funnel plots are a visual tool to investigate bias in meta-analysis. These have been modified for an easily visualised graph of health outcome data. They are scatter plots of the adverse outcome estimated from individual studies expressed as a percentage (y-axis), against a measure of study size (x-axis). On the scatter plot, 95% and 99% confidence limits are superimposed. The funnel plot is based on the precision in the estimation of the underlying treatment effect increasing as the sample size of component studies increases. This is why the smaller sized samples have wider confidence intervals.

10.4 Interpretations of geographic information system

Geographic Information System provides a common analytical framework in which data can be geographically displayed.

10.5 Exclusion of identifiable data

Labels and data that might identify surgical groups, patients, health services and extreme values have been excluded from this report.

10.6 Classification of operative procedures

- Cardiac: includes angiograms, bypass of coronary artery, exploratory median sternotomy, median sternotomy approach, replacement of aortic and mitral valve.
- Colorectal: includes anterior resection of rectum and anastomosis, colostomy, partial colectomy, hemicolectomy, ileostomy and reversal of Hartmann's procedure.
- GI endoscopy: includes colonoscopy, gastroscopy, endoscopic retrograde cholangiopancreatography and sigmoidoscopy.
- Laparotomy, laparostomy and upper GI: includes cholecystectomy, endoscopic division of adhesions of peritoneum, gastrectomy, ileostomy, jejunostomy, oversewing of small bowel and repair of inguinal hernia.
- Neurosurgical trauma: includes burrhole or burrholes for ventricular external drainage, craniectomy, craniotomy, evacuation of haematoma, insertion of cranial monitor, insertion of drainage system into bone and intracranial pressure monitoring evacuation.
- Orthopaedic: includes hip joint operations, hemiarthroplasty, fracture and internal fixation.
- Peripheral vascular: includes embolectomy of femoral artery and vein graft thrombectomy.
- Thoracic and tracheostomy: includes bronchoscopy, insertion of tube drain into pleural cavity, thoracotomy and tracheostomy.
- Urology: includes diagnostic cystoscopy and transurethral resection of male bladder.
- Wound care: includes debridement of bone, muscle and skin, drainage of septal abscess, dressing of wound and lavage of peritoneum.

10.7 Classification of clinical management issues

- Adverse events: includes anastomotic leak after open surgery, injury caused by fall in hospital, pulmonary embolus, secondary haemorrhage and transfer should not have occurred.
- Communication or poor documentation: includes communication failures due to poor case notes and poor communication between physician and surgeon.
- General complications after operation: includes aspiration pneumonia, general complications of treatment, postoperative bleeding after open surgery and septicaemia.
- Management or protocol issues: includes adverse events related to treatment guidelines or protocols, diagnosis-related complication, failure to use DVT prophylaxis, HDU not used postoperatively, patient-related factors and patient refusing treatment, surgeon too junior, treatment did not conform to guidelines and unsatisfactory medical management.
- Operation inappropriate: includes decision to operate and consideration to perform a different operation or operation should not have been done.
- Preoperative care issues: includes computed tomography scan should have been done, cardiac monitoring inadequate, failure to investigate or assess patient, failure to recognise severity of illness and inappropriate treatment prior to surgical referral.
- Postoperative care issues: includes drug-related complication, failure to use HDU postoperatively, fluid balance unsatisfactory, fluid overload and inadequate postoperative assessment.

10.8 Concordant validity considerations

Completion of all fields in the SCF by the treating surgeon requires some self-reflection. An example is where the treating surgeon is asked to nominate any areas of consideration, concern or adverse event emanating from their care of the patient. Such responses by the treating surgeon were compared to assessors' responses to the same question and the degree of concordance was estimated. Perhaps the treating surgeon is less objective in their assessment of the clinical management of patients. This is not an unexpected finding and supports the value of independent peer review. The tendency of second-line assessors to be more critical of clinical management events is foreseeable after the event than for the treating surgeon prior to the event. However, evaluating the quality of the decisions made by the treating surgeons allows preventative measures to be implemented during the peer review process and recommendations for improved surgical care to be delivered to the treating clinical teams. These results are shown in Tables 17, 18 and 19. Information on interpreting Cohen's kappa score and Gwet's AC1 score is provided in section 10.2.

Full concordance between the treating surgeon and assessor is not anticipated. There are various factors behind this. Among these, the information available to the first-line assessor relies heavily on the treating surgeon's account of the clinical events.

However, the second-line assessor has a de-identified copy of the patient's medical records and thus a relatively unbiased chronology of care as it happened. The highest level of concordance expected would therefore be between the treating surgeon and first-line assessor, as the first-line assessor only has access to the clinical information recorded by the treating surgeon. The lowest expected concordance is between the treating surgeon and second-line assessor, who have access to an independent description of the episode of care. For this reason, agreement between first and second-line assessors is also predicted to be weak.

Analysis of concordance is a method of studying interrater reliability in reporting all clinical management issues. Performing a full case note review on all reported deaths is not feasible for logistic reasons.

The outcomes of concordance analysis shown below are reassuring, as they mirror the predicted outcomes.

Gwet's AC1 provided a more stable interrater reliability coefficient than Cohen's kappa and appears less affected by prevalence and marginal probability and is represented in this report for better interpretation of interrater reliability analysis.

Table 17: Concordant validity between the treating surgeon and the first-line assessor.

Concord areas	n (%)	%Concord	Kappa score	95% CI	*p* value	Gwet's AC1 score	95% CI	*p* value
Risk of death	3911 (79.73%)	89.39%	0.61	0.60 - 0.61	<0.0001	0.82	0.81 - 0.83	<0.0001
ICU care benefit if not received	1024 (20.88%)	96.09%	0.12	0 - 0.25	<0.0001	0.96	0.95 - 0.97	<0.0001
HDU care benefit if not received	968 (19.73%)	92.67%	0.22	0.11 - 0.34	<0.0001	0.92	0.90 - 0.94	<0.0001
Fluid balance	4582 (93.41%)	68.53%	0.21	0.21 - 0.22	<0.0001	0.61	0.59 - 0.63	<0.0001
Preoperative management/preparation	3771 (76.88%)	87.59%	0.39	0.34 - 0.43	<0.0001	0.84	0.83 - 0.86	<0.0001
Intraoperative/technical management	3717 (75.78%)	93.27%	0.34	0.28 - 0.40	<0.0001	0.93	0.92 - 0.94	<0.0001
Decision to operate at all	3778 (77.02%)	88.96%	0.31	0.26 - 0.36	<0.0001	0.87	0.86 - 0.88	<0.0001
Choice of operation	3767 (76.80%)	93.31%	0.22	0.16 - 0.28	<0.0001	0.93	0.92 - 0.94	<0.0001
Grade/experience of surgeon deciding	3722 (75.88%)	98.41%	0.23	0.10 - 0.35	<0.0001	0.98	0.98 - 0.99	<0.0001
Grade/experience of surgeon operating	3722 (75.88%)	97.53%	0.23	0.13 - 0.33	<0.0001	0.97	0.97 - 0.98	<0.0001
Timing of operation	3758 (76.62%)	92.15%	0.47	0.41 - 0.52	<0.0001	0.91	0.90 - 0.92	<0.0001
Postoperative care	3660 (74.6%)	91.15%	0.36	0.31 - 0.42	<0.0001	0.9	0.89 - 0.91	<0.0001
Clinical management issues	4880 (99.49%)	77.66%	0.46	0.43 - 0.48	<0.0001	0.62	0.60 - 0.65	<0.0001

Note: a total of 4,905 surgical case forms and first-line assessments were available for analysis.
There were 4,028 patients who underwent 5,668 separate surgical procedures.
'Critical care not received' data was available in 2,623 audited cases (53%).
CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

Comments:

- There were high levels of concordance between the treating surgeon and first-line assessor.
- The areas with the lowest concordance between the surgeon and first-line assessor were fluid balance and clinical management issues.
- As outlined in the risk management section of this report fluid balance management requires further improvement.

Table 18: Concordant validity between the treating surgeon and the second-line assessor.

Concord areas	n (%)	%Concord	Kappa score	95% CI	*p* value	Gwet's AC1 score	95% CI	*p* value
Risk of death	729 (86.89%)	84.97%	0.51	0.48 - 0.52	<0.0001	0.73	0.70 - 0.76	<0.0001
ICU care benefit if not received	119 (14.18%)	86.55%	0.18	0 - 0.39	<0.0001	0.84	0.76 - 0.92	<0.0001
HDU care benefit if not received	115 (13.71%)	80.87%	0.18	0 - 0.35	<0.0001	0.76	0.65 - 0.87	<0.0001
Fluid balance	783 (93.33%)	70.37%	0.23	0.19 - 0.25	<0.0001	0.63	0.59 - 0.68	<0.0001
Preoperative management/preparation	701 (83.55%)	72.61%	0.27	0.20 - 0.35	<0.0001	0.57	0.51 - 0.63	<0.0001
Intraoperative/technical management	689 (82.12%)	81.71%	0.27	0.18 - 0.36	<0.0001	0.76	0.71 - 0.80	<0.0001
Decision to operate at all	701 (83.55%)	82.03%	0.16	0.07 - 0.25	<0.0001	0.77	0.73 - 0.81	<0.0001
Choice of operation	702 (83.67%)	81.62%	0.15	0.07 - 0.23	<0.0001	0.77	0.73 - 0.81	<0.0001
Grade/experience of surgeon deciding	685 (81.64%)	94.89%	0.04	0 - 0.14	<0.0001	0.95	0.93 - 0.96	<0.0001
Grade/experience of surgeon operating	683 (81.41%)	94.73%	0.23	0.07 - 0.39	<0.0001	0.94	0.93 - 0.96	<0.0001
Timing of operation	696 (82.96%)	78.30%	0.23	0.15 - 0.31	<0.0001	0.70	0.65 - 0.75	<0.0001
Postoperative care	682 (81.29%)	75.96%	0.18	0.10 - 0.26	<0.0001	0.66	0.61 - 0.72	<0.0001
Clinical management issues	833 (99.28%)	58.10%	0.21	0.21 - 0.26	<0.0001	0.19	0.12 - 0.26	<0.0001

Note: a total of 1,200 surgical case forms and second-line assessments were available for analysis.
CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

Comments:

Disagreement between the treating surgeon and second-line assessor was most marked in the following areas: preoperative management, fluid balance and clinical management issues.

Table 19: Concordant validity between the first-line assessor and the second-line assessor.

Concord areas	n (%)	%Concord	Kappa score	95% CI	*p* value	Gwet's AC1 score	95% CI	*p* value
Risk of death	751 (89.51%)	84.71%	0.49	0.44 - 0.55	<0.0001	0.73	0.70 - 0.76	<0.0001
ICU care benefit if not received	153 (18.12%)	54.90%	0.25	0.18 - 0.29	<0.0001	0.36	0.24 - 0.48	<0.0001
HDU care benefit if not received	233 (27.77%)	53.65%	0.28	0.27 - 0.34)	<0.0001	0.32	0.22 - 0.42	<0.0001
Fluid balance	748 (89.15%)	45.19%	0.12	0.07 - 0.14	<0.0001	0.23	0.18 - 0.29	<0.0001
Preoperative management/preparation	656 (78.19%)	59.60%	0.29	0.24 - 0.30	<0.0001	0.44	0.39 - 0.49	<0.0001
Intraoperative/technical management	640 (76.28%)	70.78%	0.39	0.30 - 0.40	<0.0001	0.62	0.57 - 0.67	<0.0001
Decision to operate at all	678 (80.81%)	68.58%	0.27	0.22 - 0.29	<0.0001	0.60	0.55 - 0.65	<0.0001
Choice of operation	665 (79.26%)	68.72%	0.30	0.28 - 0.32	<0.0001	0.60	0.55 - 0.65	<0.0001
Grade/experience of surgeon deciding	643 (76.64%)	80.87%	0.26	0.23 - 0.36	<0.0001	0.78	0.74 - 0.82	<0.0001
Grade/experience of surgeon operating	644 (76.76%)	80.75%	0.34	0.31 - 0.41	<0.0001	0.78	0.74 - 0.81	<0.0001
Timing of operation	648 (77.23%)	66.67%	0.32	0.31 - 0.35	<0.0001	0.56	0.51 - 0.61	<0.0001
Postoperative care	640 (76.28%)	57.19%	0.25	0.21 - 0.29	<0.0001	0.41	0.35 - 0.46	<0.0001
Clinical management issues	826 (98.45%)	70.10%	0.08	0.01 - 0.15	0.006	0.56	0.50 - 0.62	<0.0001

Note: a total of 1,200 surgical case forms and second-line assessments were available for analysis.
CI: confidence interval; HDU: high dependency unit;
ICU: intensive care unit.

Comments:

- Disagreement between first- and second-line assessors was greatest in the following areas: fluid balance, timing of the operation, decision to operate, preoperative, intraoperative and postoperative care, and the clinical management section. Second-line assessors perceived a greater number of issues than first-line assessors.

Key messages: concordant validity considerations

- In general, high levels of concordance percentages were observed with fair Cohen and substantial Gwet scores. The exception was the comparison between first- and second-line assessors, where often poor kappa and fair Gwet scores were obtained.
- As expected and potentially due to objectivity (surgeons' assessment) and availability of extra information such as the de-identified medical records for SLA the kappa scores generally tend to be low.

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