



Royal Australasian College of Surgeons  
**Victorian Audit of Surgical Mortality**

Victorian Audit of Surgical Mortality (VASM)

# 2019 Annual report



Royal Australasian College of Surgeons  
**Australian and New Zealand  
Audits of Surgical Mortality**



Health  
and Human  
Services



Victorian Perioperative  
Consultative Council



The Royal Australian  
and New Zealand  
College of Obstetricians  
and Gynaecologists  
*Excellence in Women's Health*

---

## CONTACT DETAILS

Victorian Audit of Surgical Mortality (VASM)  
Royal Australasian College of Surgeons  
College of Surgeons' Gardens  
250–290 Spring Street  
East Melbourne VIC 3002

Web: [www.surgeons.org/VASM](http://www.surgeons.org/VASM)

Email: [vasm@surgeons.org](mailto:vasm@surgeons.org)

Telephone: +61 3 9249 1153

Facsimile: +61 3 9249 1130

Postal address:

Victorian Audit of Surgical Mortality

GPO Box 2821

Melbourne VIC 3001

Image on the front cover, “Day dreams” by Renata Retegan (acrylic painting, Jan 2019) as a tribute to Ms Claudia Retegan.

The information contained in this annual report has been prepared by the Royal Australasian College of Surgeons, Victorian Audit of Surgical Mortality Management Committee.

The Australian and New Zealand Audit of Surgical Mortality, including the Western Australian, Tasmanian, South Australian, Australian Capital Territory, Northern Territory, New South Wales, Victorian and Queensland Audits of Surgical Mortality, has protection under the Commonwealth Qualified Privilege Scheme under Part VC of the Health Insurance Act 1973 (gazetted 25 July 2016).

# Contents

Foreword from VPCC	4
Foreword from VASM	5
1 Abbreviations	6
2 Executive Summary	7
3 Introduction	8
4 Rapid statistics	9
5 National Safety and Quality Health Service Standards	10
6 Audit numbers	13
7 Audit compliance	14
8 Characteristics of audited deaths	16
9 Establishing the cause of death	17
10 Clinical risk management	18
11 Profile of operative procedures	26
12 Peer-review process	29
13 Outcomes of the peer-review	31
14 Preventable clinical management issue	35
15 Concordant validity considerations	44
16 Conclusion	47
17 Future goals for VASM	48
18 References	49

# List of Figures and Tables

Figure 1: National Safety and Quality Health Service Standards associated with the VASM	10
Figure 2: Compliance by return rate of SCF to VASM compared to the national data	15
Figure 3: Top 10 VASM causes of death	17
Figure 4: Top 10 VASM surgical diagnoses	18
Figure 5: Deaths with delay in surgical diagnosis compared to the national data	19
Figure 6: Deaths with delay in hospital transfer compared to the national data	20
Figure 7: DVT prophylaxis use compared to national data	20
Figure 8: Deaths with the use of CCU compared to national data	21
Figure 9: Deaths with unplanned admission to CCU compared to national data	22
Figure 10: Deaths with unplanned re-admission compared to national data	22
Figure 11: Deaths with a clinically significant infection compared to national data	23
Figure 12: Deaths with causes of trauma	25
Figure 13: Operation with the consultant surgeon present in theatre compared to national data	26
Figure 14: Proportion of elective admissions with elective surgery performed	27
Figure 15: Operative deaths with postoperative complications compared to national data	27
Figure 16: Operative deaths with unplanned return to theatre compared to national data	28
Figure 17: Proportion of audited VASM deaths that underwent a SLA compared to the national data	29
Figure 18: Assessor perspective on inappropriate DVT prophylaxis treatment	32
Figure 19: Assessor perspective on fluid balance issues compared to national data	33
Figure 20: Victorian hospital performance associated with preventable CMIs	42
Figure 21: Victorian hospital performance associated with preventable CMIs	42
<hr/>	
Table 1: Trend of mortalities identified by VAED and VASM	13
Table 2: Characteristics of audited deaths in Victoria compared to the national data	16
Table 3: Deaths with clinically significant infection acquired during admission	23
Table 4: Reasons for SLA referral	29
Table 5: Severity of criticism of perceived clinical management issues	33
Table 6: Areas of clinical management issues	34
Table 7: Complete series of preventable clinical management issues that contributed to death identified by the highest level of assessment	36
Table 8: Areas for surgical care improvements as identified by assessors at different phases of care	37
Table 9: Clinical management comparisons between VASM and national cumulative data	40
Table 10: Clinical management comparisons between VASM and national cumulative data	41
Table 11: Concordant validity between treating surgeon and first-line assessor	45
Table 12: Concordant validity between treating surgeon and second-line assessor	45
Table 13: Concordant validity between first-line assessor and second-line assessor	46

---

## Foreword from VPCC

On behalf of the Victorian Perioperative Consultative Council (VPCC), I congratulate Victorian Audit of Surgical Mortality (VASM) on this 12th annual report. This review of surgical mortality provides valuable quality improvement information to the health sector. The reported mortality rate of 2.45 per 1,000 interventional procedures is reassuringly low by international Organisation for Economic Co-operation and Development standards and attests to the safety and quality of perioperative care in Victorian hospitals. VASM has made a significant contribution to quality improvement since its launch in 2007.

The VPCC was established in October 2019 to oversee, review and monitor perioperative care, and to improve process and outcomes for patients before, during and after surgery.<sup>(1)</sup> It was born out of a significant review<sup>(2)</sup> and sector reform, replacing the former, somewhat siloed consultative councils for anaesthesia and surgery. Like our predecessors, we maintain strong protective powers under Victoria's Public Health and Wellbeing Act 2008<sup>(3)</sup> and report to the Minister for Health.

Another aspect that is unchanged is our support for VASM, which succeeds in engaging surgeons and hospitals to provide peer review and feedback to individual surgeons on case management. However, the VPCC also wants to address what a recent review found to be a disconnect between the VASM process and the information provided to the former Councils and health services.<sup>(4)</sup> While the annual hospital reports over the past three years have made a start in responding to this disconnect, we aim to further improve protected information sharing between VASM, the VPCC, Safer Care Victoria (SCV) and health services to promote education and quality improvement.

In this report, covering the 2018–19 year prior to the VPCC's establishment, emergency conditions caused 83.4% of mortality, with the vast majority of deaths occurring in comorbid and/or elderly patients. Two of the major causes of perioperative death were, as in previous years, persons suffering from fractured neck of femur or acute abdominal pathology. These conditions also cause significant morbidity and/or loss of function for the vast majority of patients who survive their surgery and anaesthesia, which is why the VPCC will encourage health services to participate in the Australian and New Zealand Hip Fracture Registry<sup>(5)</sup> and Emergency Laparotomy Audit.<sup>(6)</sup> These quality improvement registries address process of delivery and patient-related outcomes of care, with key performance indicators.

The VPCC also has an interest in the perioperative sector learning more from unplanned returns to theatre (URTTs), which occurred in 15.8% of the mortalities reviewed in this report. However, the vast majority of patients who require an URTT survive, and often URTT should not be viewed as a negative event; rather, it can be an essential contribution to a patient's survival, representing timely decision-making in response to deterioration during the postoperative period. URTT is listed as one of the Australian Commission on Safety and Quality in Health Care's hospital-acquired complications<sup>(7)</sup> and is due to be reported by the Victorian Agency for Health Information (VAHI) towards the end of 2020. Opportunities to learn from URTTs will include patients transferred who undergo a return to theatre.

Perioperative cardiovascular events also cause considerable morbidity and some mortality. They may occur across any stage of the perioperative period, often after discharge from hospital, and include stroke, myocardial infarction and pulmonary embolism. VPCC will be working with VASM and health services to identify opportunities to raise awareness, improve care, and reduce the incidence of these events. For example, in patients with pre-existing atrial fibrillation (AF) or who develop AF during their perioperative stay, the peak risk period for stroke is the first 30 days after surgery, highlighting the importance of managing AF and anticoagulation appropriately.

The VPCC looks forward to working with VASM in the coming year, a year that is proving to be unlike any we have previously experienced.



Professor David A Watters AM OBE  
Chair, Victorian Perioperative Consultative Council

---

## Foreword from VASM

Learning from surgical deaths is important – the perioperative mortality rate is one of the six core indicators for monitoring universal access to safe, affordable surgical care.<sup>(8)</sup> Australia and New Zealand have been world leaders in collecting such data<sup>(8)</sup>, and from the audit activity presented in this annual report it can be stated that surgery in Victoria is safe, with less than three deaths for every thousand procedures. This is comparable to the best data published in both Australasia and the developed world. The majority of these surgical deaths occur in elderly patients with multiple comorbidities, often undergoing emergency surgery. There are still a small number of cases where our assessors find adverse events that were probably preventable. Reassuringly, the data published here for the previous year suggests that the frequency of these cases is decreasing.

The annual report is a part of suite of measures VASM uses to disseminate the safety message including Case Note Review Booklets (the twelfth released in October 2020)<sup>(9)</sup>, a national on-line 'Case of the Month', an annual high profile seminar and regular workshops. The audits in Victoria and throughout Australia collect a vast array of data that is made available for researchers and enables multiple academic publications. The publications and details on how to apply for access are on the VASM website.<sup>(10)</sup>

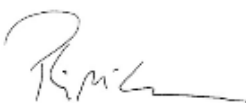
The diligent reader will notice changes in this annual report compared to its predecessors, and that there is no supplementary/technical publication. We hope that the report is easier to read and navigate, and if further details are required they can be provided from the VASM office. There will be future changes as we continue to work closely with SCV to improve the safety culture throughout the state health services.

The major change in the Victorian surgical landscape is the introduction of the new VPCC under the chair of Professor David Watters. The new Council will be reviewing many aspects of surgical care in the state and will be taking a multi-disciplinary view of both morbidity and mortality. The VASM will be working very closely with VPCC (to some extent being its mortality arm) though we hope that surgeons will not notice any difference in how surgical deaths are reviewed. If anything, we hope to streamline processes and reduce the number of reports associated with each death.

The world is a different place since the last VASM publication. The novel coronavirus pandemic has wreaked havoc with health services and economies internationally and will have lasting effects on how we conduct many aspects of our lives. For once 'unprecedented' is an apt descriptor. Australia and Victoria have, at the time of writing, managed the health crisis extremely well, with very few direct COVID19 deaths. There are concerns that indirect deaths may spike, due to either patients avoiding appropriate healthcare for fear of coronavirus infection or delay in diagnosis whilst excluding COVID19. The VASM will be closely monitoring this situation and include details in future reports.

The continuing success of the VASM is dependent upon participating surgeons and hospitals, and the highly efficient motivated, hard-working staff members at the Royal Australasian College of Surgeons (RACS). I would like to thank all surgeons for the seamless move to identified second-line assessments and for the support of the Qualified Privilege amendments which, after many years of work, have been submitted to the Commonwealth. The VASM is an ongoing collaboration with the Victorian Department of Health, SCV, VPCC, RACS, Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), and the Australian Orthopaedic Association (AOA). SCV provides the funding for the project and guidance through the complexities of the health systems.

The VASM team are particularly grateful to Claudia Retegan who, after preparing the early drafts of this report, moved on to pastures new early in 2020. We wish her well. Claudia had been with the audit since its inception and I am comforted that her vast knowledge and expertise is not totally lost as she serves on the surgical sub-committee of VPCC.



Associate Professor Philip McCahy, FRACS (Urology)  
VASM Clinical Director

---

# 1 Abbreviations

AF	Atrial fibrillation
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ANZCA	Australian and New Zealand College of Anaesthetists
AOA	Australian Orthopaedic Association
ASA	American Society of Anaesthesiologists
CCU	Critical care unit / critical care utilisation
CMI	Clinical management issue
CPD	Continuing professional development
DHHS	Department of Health and Human Services
DRG	Diagnosis-related group
DVT	Deep vein thrombosis
FLA	First-line assessment
GI	Gastrointestinal
Hrs	Hours
NOD	Notification of death
NSQHS	National Safety and Quality Health Service
PE	Pulmonary embolism
RACS	Royal Australasian College of Surgeons
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SCF	Surgical case form
SCV	Safer Care Victoria
SLA	Second-line assessment
TED	Thrombo-Embotic Deterrent
URTT	Unplanned returns to theatre
VAED	Victorian Admitted Episodes Dataset
VASM	Victorian Audit of Surgical Mortality
VCCAMM	Victorian Consultative Council on Anaesthetic Mortality and Morbidity
VPCC	Victorian Perioperative Consultative Council
VTE	Venous thromboembolism

---

## 2 Executive Summary

The audit was mandated by RACS in 2012 as part of the continuing professional development (CPD) program. Compliance with the audit is determined by the number of cases that have completed the audit process compared with the total number of surgical deaths in the audit period. Key findings are based on 926 peer-reviewed cases from the audit period of **1 July 2018 to 30 June 2019**.

The majority of surgical deaths (**83.4%**; 766/919) in this audit period occurred in elderly patients with underlying health problems who were admitted as an emergency with an acute life threatening condition requiring surgery.

### 2.1 Hospital admission and operative patient profile

The most frequent operative procedures described for VASM during the audit period (2012-2019), were for trauma or acute abdominal pathology. During the current audit period (2018-2019), the majority of patients (**90.2%**; 834/925) had at least one operation during their final hospital admission. Of the patients who had surgery, **15.8%** (132/833) had an unplanned return to the operating theatre due to complications. A consultant was present in theatre in **81.7%** (949/1,161) of operations compared to the national rate of **75.8%** (2,253/2,972). The presence of a consultant was appropriate due to the more challenging nature of emergency cases with greater risks.

Over the complete audit period (2012-2019), a consultant surgeon was present or performed the majority of operative procedures in theatre for **71.5%** (7,576/10,601) of operations compared with **66.8%** (18,123/27,148) nationally ( $p < 0.001$ ). This bias to senior operators is appropriate for this high-risk group of patients.

### 2.2 Clinical management issues

Clinical management issues identified in this audit show that more than one issue can occur during a patient's hospital stay (Section 13.3).

There were no criticisms of patient management in **73.2%** (675/922) of audited cases, whereas the peer-review process found faults in the management of the remaining **26.8%**. In **11.9%** of the total cases, the criticisms were mild and considered to be differences of opinion (areas of consideration). In **5.9%** of cases the assessments were more severe (classified as areas for concern), and in **8.9%** of cases the peer-review process concluded that adverse events had occurred.

Individual criticisms of clinical management issues for each case have been directed to the treating surgeons to allow feedback and reflection. It is important to note that not all clinical management issues are associated with the surgical team.

### 2.3 Potentially preventable clinical outcomes

In addition to identifying clinical management issues, clinical assessors also decide whether those issues were potentially preventable. The rate of preventability of adverse events or concerns has decreased from **18.2%** (239/1,312) in 2017—2018 to **15.5%** (143/922) in the current audit period, although this difference was not statistically significant (Section 14, Table 6). VASM distributes clinical performance reports to each participating site, allowing for healthcare services to examine their own de-identified potentially preventable outcomes.<sup>(10)</sup>

The key VASM recommendations in this report reflect six of the eight National Safety and Quality Health Service (NSQHS) Standards that can be used by hospitals and health professionals to improve clinical practice and patient safety. Overall, the goal is for the information that VASM collects to help all surgical Fellows and participating health organisations improve the quality of their service and safeguard high standards of care.



---

## 3 Introduction

The Victorian Audit of Surgical Mortality (VASM) forms part of the Australian and New Zealand Audit of Surgical Mortality (ANZASM)—a national network of regionally-based audits of surgical deaths that aim to ensure the highest standards of safe and comprehensive surgical care. VASM, like its national counterparts, monitors trends in surgical deaths via independent peer-review assessments. These assessments identify clinical management issues for which strategies can be developed to manage and improve patient safety.

This report presents key findings and recommendations for the period 1 July 2018 to 30 June 2019, with tables and figures providing information from 1 July 2012 to 30 June 2019 to illustrate changes over time. If data has not been provided to the VASM office, the case is excluded from analysis for the relevant section only. For this reason, the denominator varies for different results.

To further assess emerging trends, and to benchmark outcomes of surgical care, case comparisons have been made between VASM and ANZASM. The Collaborating Hospitals' Audit of Surgical Mortality (CHASM) in New South Wales runs a comparable audit methodology and collects similar data to ANZASM. CHASM is independently managed by the Clinical Excellence Commission of New South Wales and the data is inaccessible to VASM, thus ANZASM national data aggregate comparisons include all State and Territory audit outcomes except for New South Wales.

VASM has been externally audited three times (2011, 2015 and 2018 respectively) by Aspex Consulting to assess its functionality. Recommendations from the 2018 Aspex Consulting review<sup>(11)</sup> are presented in this report as part of the key findings.

The need for hospitals and surgeons to improve clinical management issues and preventable outcomes (identified in Section 13) represents a key recommendation from the current audit. Messages from the key findings are reiterated in Section 5 (National Safety and Quality Health Service Standard), with other areas of improvement for VASM outlined in Section 16 (Future Goals for the VASM). VASM audit findings could be utilised to meet National Safety and Quality Health Service (NSQHS) Standards.

VASM staff would like to acknowledge the support and assistance of the many individuals and institutions that have helped in the development and continual improvement of this project.

## 4 Rapid statistics

### Victoria has a good and safe healthcare system

The VASM works to ensure that a high standard of surgical care is maintained in Victoria and that patients receive the best care possible. The data below presents audited cases from 1 July 2018 to 30 June 2019.

### Demographics



Population	6.7 million
Procedures	709,906
Mortality rate	0.2%
Males	57.8%
Females	42.2%
Median age	78



#### Admission status

Elective	16.6%
Emergency	83.4%



#### Transfer

Patient transfer	16.6%
------------------	-------

### Risk



#### Preoperative risk of death

Expected	12.8%
Considerable	47.4%
Moderate	26.8%
Small	9.0%
Minimal	4.0%



#### Most common comorbidities

Cardiovascular	21.5%
Age	20.9%
Respiratory	11.1%
Renal	11.0%
Malignancy	7.5%



#### Most common causes of death

Multi-organ failure	14.6%	Cardiac arrest	6.0%
Septicaemia	11.7%	Heart failure	4.9%
Respiratory failure	8.5%		

### Key Findings



#### Preoperative risk of death

Decreased mortality	Decreased transfer delays
Decreased clinically significant infection	Decreased adverse events
Improved patient care	Improved DVT prophylaxis utilisation









#### Peer review outcomes

Adverse event	8.9%	Area for consideration	11.9%
Area of concern	5.9%	No issues	73.3%

# 5 National Safety and Quality Health Service Standards

This report can assist hospitals with accreditation for the following National Safety and Quality Health Service (NSQHS) Standards<sup>(12)</sup> highlighted in the Key Recommendations and the Clinical Risk Management sections. The data presented in this report shows the trends of key recommendations from 2012—2019.

**Figure 1: National Safety and Quality Health Service Standards associated with the VASM**

National Safety and Quality Health Service Standards	VASM Key Recommendations	
<b>Standard 1</b> Clinical Governance		<ul style="list-style-type: none"> <li>- To improve leadership in patient care.</li> </ul>
<b>Standard 2</b> Partnering with Consumers		<ul style="list-style-type: none"> <li>- To assess if the decision to operate is appreciate.</li> <li>- To consider quality of life and end-of-life care.</li> </ul>
<b>Standard 3</b> Preventing and Controlling Healthcare-Associated Infection		<ul style="list-style-type: none"> <li>- To control and manage infections with appropriate investigation, rapid administration of treatment, and timely involvement of expert teams.</li> </ul>
<b>Standard 5</b> Comprehensive Care		<ul style="list-style-type: none"> <li>- To improve perioperative management.</li> <li>- To improve awareness of surgical emergencies and shared care.</li> <li>- To involve patients in planning their treatment.</li> <li>- To reduce falls in hospitals and residential care</li> </ul>
<b>Standard 6</b> Communicating for Safety		<ul style="list-style-type: none"> <li>- To improve on documentation of care plans and clinical events.</li> <li>- To improve on communication amongst health professionals and their patients.</li> </ul>
<b>Standard 8</b> Recognising and Responding to Acute Deterioration		<ul style="list-style-type: none"> <li>- To act on evidence of clinical deterioration.</li> </ul>

The themes listed below are shared-learnings from different specialty-based cases from the audit. These cases can be used by hospitals and health professionals to address areas of clinical practice and patient safety needing improvement. The case studies are featured in VASM Case Note Review Booklets and “Cases of the Month”.<sup>(13)</sup>

### **5.1 Improved leadership in patient care**

NSQHS Standard 1 emphasises clinical leadership, improved governance and culture. Complex cases must have clear and demonstrable leadership in patient management, and treatment plans should be understood by all involved in each patient’s care. The lead clinician must be identifiable, accountable and responsive; must be prepared for challenges; and must focus on optimal patient care. The involvement of senior surgical colleagues should be encouraged, and their opinion sought when dealing with surgical complications. Collaboration should not be delayed, although the patient care team members have varying areas of expertise, they share similar goals, resources, and appreciate leadership support.

### **5.2 Futile surgery and end-of-life care**

NSQHS Standard 2 encourages partnership with consumers. NSQHS Standard 5 promotes the implementation of a comprehensive care plan in collaboration with the patient when considering surgery as part of end-of-life care. It was the opinion of a number of treating surgeons and VASM assessors that some of the surgical procedures performed during the audit were considered futile. Decisions about whether to continue with active treatment and surgery can be very complex in frail patients, particularly when the treatment has a high risk of death or the end of life is near.<sup>(14)</sup> Discussions and shared decision making about these difficult cases is important and must be adequately documented.

### **5.3 Transfer**

NSQHS Standard 1 highlights the need for leadership by senior clinicians, while Standard 6 outlines the importance of communication in improving patient care. Patient transfer is a vital facet of patient care that should be used to improve management, whether that is transfer within the same hospital for a diagnostic procedure or transfer to another hospital or health service with specialised advanced care. However, transferring deteriorating patients may induce various physiological alterations that may adversely affect the final outcome. Important elements to be considered for high-standard transfer include when to transfer (before or after surgery), appropriate communication, pre-transfer stabilisation and preparation, identification of the ideal mode of transfer, personnel to accompany the patient, monitoring equipment during transfer, and documentation and handover of the patient at the receiving facility. Transfers should be coordinated by the most senior team members on each site, not delegated to junior staff.

### **5.4 Infection control**

NSQHS Standard 3 promotes prevention and control of healthcare-associated infections. The audit shows that most infection occurs in the postoperative period. Key actions to be taken for infection control and management are timely recognition and involvement of expert teams, appropriate investigation, and rapid administration of treatment. VASM endorses the use of current hospital protocols and guidelines to reduce the incidence of infection.<sup>(15)</sup>

### **5.5 Improved perioperative management**

NSQHS Standard 5 outlines the implementation of a comprehensive care plans for the patients’ care and treatment. Comprehensive care plans must be adequately documented. Appropriate preoperative, intraoperative and postoperative preparation and management should aim to decrease operative complications and promote successful recovery. Delays in investigating or recognising complications can have fatal consequences.

## **5.6 Improved awareness of surgical emergencies and sharing of care**

NSQHS Standard 5 encourages improvements in shared care. The VASM audit reveals that patients admitted as surgical emergencies are at greater risk when care is shared or when there is no clear leadership in patient care (see 6.1). To improve the quality and safety of patient care all admitted patients need an agreed core treating consultant as the primary point of senior contact, and all health professionals should increase their awareness of this risk.

## **5.7 Improved communication**

NSQHS Standard 6 highlights better communication for clinical handover. Health professionals and institutions should collaborate and share information to coordinate patient care at all stages during admission. The line of communication is a vital component of any surgical team and this remains an important focus for RACS and SCV.

## **5.8 In-house falls prevention**

NSQHS Standard 5 outlines the implementation of a comprehensive care plan, and assessments to minimise patient harm from falls. The audit revealed that patients admitted as surgical emergencies have a greater risk of falling while in hospital. All health professionals should increase their awareness of this risk to improve the quality and safety of patient care. VASM endorses the use of current hospital protocols and guidelines to reduce the incidence of in-hospital falls.<sup>(16)</sup>

## **5.9 Better documentation of care plans and clinical events**

NSQHS Standard 6 outlines the importance of adequate documentation in the patient healthcare record to ensure patient safety. The case record is an essential tool for identifying the clinical sequence and documenting appropriate clinical management plans. The increasing use of hospital Electronic Medical Records (EMR) will be closely monitored and suggestions for enhancements proposed.

## **5.10 Action of evidence of clinical deterioration**

NSQHS Standard 8 highlights the need for action when clinical deterioration occurs. Clinical deterioration is an issue recognised throughout Australia and internationally. When it occurs, and no clear cause is identified, consideration should be given to causes beyond the treating surgeon's specialty, expertise or experience, and timely appropriate assistance sought. Clinical deterioration must be acted upon, not merely recorded. Clinical findings must be considered alongside the results of investigations. Futile surgery should be avoided.

---

## 6 Audit numbers

The VASM audit process depends upon receiving notifications of deaths from participating hospitals. Each hospital prepares and submits a list of deaths that have occurred when a patient was under the care of a surgeon. Thus, the discharging unit would usually be recorded as surgical, however in some instances a patient who has received surgical care may not be under the care of a surgeon at the time of death.

In parallel with the VASM audit process, hospitals must also submit data to the Victorian Admitted Episodes Dataset (VAED) maintained by the Department of Health and Human Services (DHHS), a robust database providing case-mix information required for hospital activity-based funding.<sup>(17)</sup> The information identifies individual patient-care episodes to diagnosis-related groups (DRGs) that are specialty specific. This provides an alternative source of mortality data. VAED data for procedural deaths of patients with surgical DRGs over the period 1 July 2018 to 30 June 2019 indicates that a total of 709,906 interventional procedures were provided to 564,242 patients in Victorian public and private hospitals. Of these, **0.4%** (1,989/564,242) resulted in auditable mortalities reported to VASM. Over the same time period, VASM received **1,767** direct notifications of deaths associated with surgical care.

**Table 1: Trend of mortalities identified by VAED and VASM, 2012—2019**

Audit period	Total interventional procedures	VAED reported interventional mortalities	VASM reported surgical mortalities	VASM report mortality per 1,000 interventional procedures
2012-2013	630,713	1,882	1,514	2.40
2013-2014	663,762	1,924	1,548	2.33
2014-2015	672,957	1,966	1,624	2.41
2015-2016	679,676	2,009	1,690	2.49
2016-2017	693,970	2,018	1,728	2.49
2017-2018	703,530	2,041	1,774	2.52
2018-2019	709,906	1,989	1,767	2.49
<b>Total</b>	<b>4,754,514</b>	<b>13,829</b>	<b>11,645</b>	<b>2.45</b>

---

## 7 Audit compliance

All hospitals providing surgical services are expected to participate with the audit requirements. Regular reporting of mortalities from hospitals launches the audit process but to comply with this, RACS Fellows must agree to participate and must return completed surgical case forms (SCF) and assessment forms in a timely and accurate manner. Thus, there is a difference between surgeon participation and compliance. Surgeons in Victoria completed the SCFs in **79.1%** (1,398/1,767) of the notified deaths in 2018—2019. The remainder of cases are still in progress and compliance for this period will be monitored by VASM.

Each step of the audit process—submission of the SCF, the First-Line Assessment (FLA) and Second-Line Assessment (SLA)—should be completed within 21 days. Obtaining medical records and documentation can take up to four months for complex cases. Select cases are forwarded to the VPCC to undergo a multi-disciplinary review.

Board members of RANZCOG, AOA and ANZCA have approved formal collaboration with ANZASM in the audit process, ensuring that a greater number of surgery-related cases are captured. The Consultative Council on Obstetric and Paediatric Mortality and Morbidity continues to separately review obstetric and neonatal deaths.

This report focuses on the clinical outcomes of the 926 closed cases that completed the audit process in the reporting period 1 July 2018 to 30 June 2019, and compares these outcomes to previous years. Pending cases from the previous audit period (2017—2018) that were sent for completion by the treating surgeon, have been included for analysis in the current audit period.

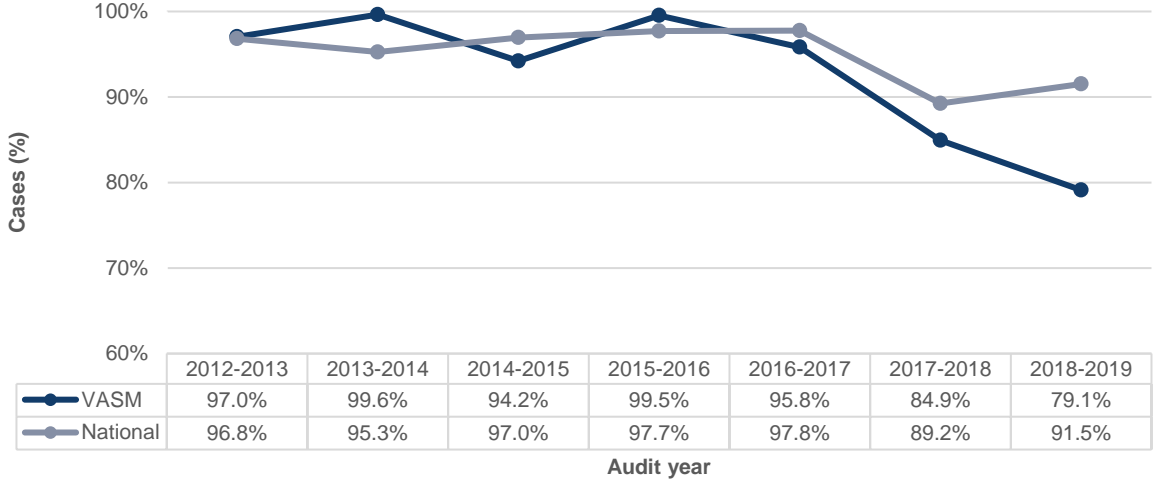
Of the reported mortalities in the current audit year, **16.8%** (297/1,767) were excluded from further analysis due to terminal care admissions and **0.2%** (3/1,767) were excluded as 'lost to follow-up' due to erroneous reporting to VASM or inaccurate attribution to surgical units; surgeon relocation interstate or abroad, retirement or non-compliance; or unattainable medical records. Assessments are underway for **9.8%** (172/1,767) of cases, with the remaining **20.9%** (369/1,767) of cases pending the return of the surgical case form. The peer assessment rate for 2018—2019 data will increase as pending cases undergo the full audit process, and will be reported in future publications.

The specialties with the most notifications in 2018—2019 were:

- 34.0%, General Surgery, including trauma and colorectal subspecialties
- 23.2%, Orthopaedic Surgery
- 12.1%, Cardiothoracic Surgery
- 11.5%, Neurosurgery
- 8.1%, Vascular Surgery

Figure 2 illustrates changes in the SCF return rate for surgeons in Victoria compared to surgeons nationally for the period 2012—2019. The Victorian rate for completed SCFs for this period is **93.2%** (14,261/15,295), which is lower than the national average of **95.0%** (29,022/30,545).

**Figure 2: Compliance by return rate of SCF to VASM compared to the national data, 2012—2019**



Notes:  
 n=14,261 surgical case forms returned out of 15,295 reported cases in Victoria from 1 July 2012 to 30 June 2019.  
 n=29,022 surgical case forms returned out of 30,545 reported cases reported nationally from 1 July 2012 to 30 June 2019,  
 Victorian data was excluded from the National data pool for the comparison.



## 8 Characteristics of audited deaths

Table 2 shows that the demographic data for Victoria was similar to the national data during the audit period. The risk of death classified as ‘considerable’ or ‘expected’ prior to surgery remains high at **60.2%** (499/829) in Victoria and **65.5%** (863/1,317) nationally, and this variation between the Victorian and national dataset has reached statistical significance (<0.0001).

**Table 2: Characteristics of audited deaths in Victoria compared to the national data, 2018—2019**

		VASM (%)	National (%)
<b>Number of audited deaths</b>		n=926	n=2,678
<b>Median age of patient in years (IQR)</b>		78 (66-86)	77 (65-86)
<b>Operative cases</b>		90.1	80.6
<b>Gender</b>	Male	57.8	58.5
	Female	42.2	41.5
<b>Admission status</b>	Elective	16.6	13.6
	Emergency	83.4	86.4
<b>ASA grades</b>	ASA 1-2	6.8	7.1
	ASA 3	28.5	29.9
	ASA 4	48.5	48.4
	ASA 5-6	16.2	14.6
<b>Risk of death prior to surgery</b>	Expected	12.8	12.1
	Considerable	47.4	53.5
	Moderate	26.8	23.4
	Small	9.0	8.9
	Minimal	4.0	2.2
<b>Most common comorbid factors</b>	Cardiovascular	21.5	21.5
	Age	20.9	21.0
	Respiratory	11.1	11.3
	Renal	11.0	10.3
	Other	8.4	8.4
	Advanced Malignancy	7.5	7.8
	Diabetes	7.2	7.3
	Neurological	6.3	6.8
	Obesity	3.8	3.3
	Hepatic	2.3	2.4
<b>Number of operative procedures performed</b>	3 or more	6.9	6.6
	2	12.4	10.4
	1	70.7	63.6
	0	9.9	19.4

**Notes:**

The American Society of Anaesthesiologists ASA grade is an international measure of patient risk used by anaesthetists.<sup>(18)</sup>

Comorbidities describe coexisting medical conditions or disease processes additional to the primary diagnosis.

Unavailable data was excluded from analysis, accounting for differences in the denominator (VASM n=926, national n=2,678).

Each audited case can have more than one operation.

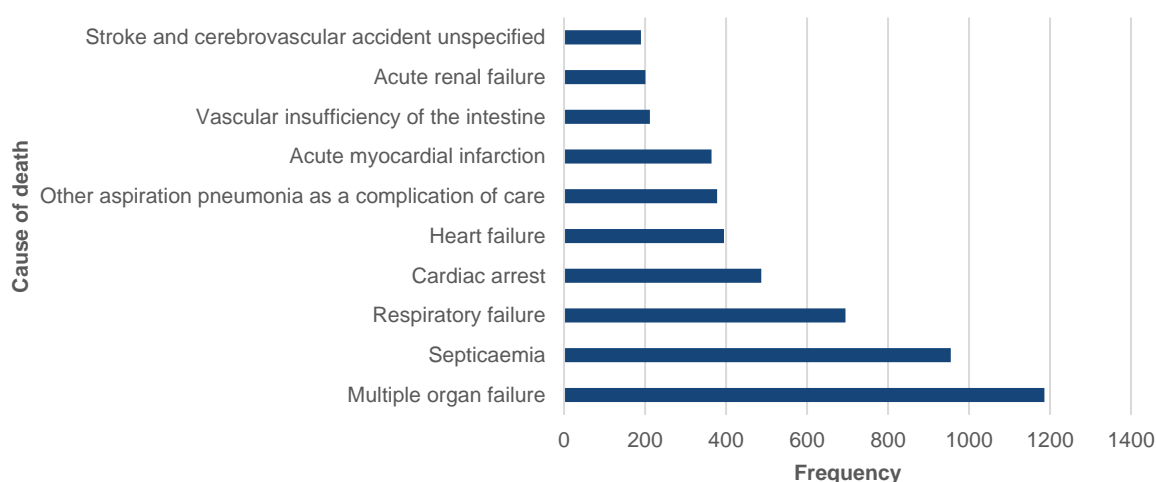
Victorian data was excluded from the National data pool for the comparison.

## 9 Establishing the cause of death

Cause of death as recorded by the treating surgeon is based on the clinical course of the patient and any relevant supporting evidence acquired from investigations. A patient can have multiple causes of death associated with the final demise. From 1 July 2012 to 30 June 2019, there were 1,224 conditions perceived to have caused death across 8,135 cases. The most frequently cited were:

- 14.6%, Multi-organ failure
- 11.7%, Septicaemia
- 8.5%, Respiratory failure
- 6.0%, Cardiac arrest
- 4.9%, Heart failure

**Figure 3: Top 10 VASM causes of death, 2012—2019**



**Notes:**

n=11,774 causes of death associated with 8,135 Victorian patients from 1 July 2012 to 30 June 2019.

Top ten causes account for 43.0% (5,063/11,774) of causes of death.

Contributory factors such as palliative care (n=111), hypotension (n=32) and hypoxaemia (n=16) are excluded from the cause of death count as in many cases these reflect the terminal event and not the underlying pathology. The cause of death can be related to existing comorbidities that will contribute to the final outcome.<sup>(19-23)</sup>

Where doubt exists around the circumstances leading to death, the case is referred to the coroner. Coronial investigations and VASM peer-review assessment have different purposes. Both data sources add value to quality assurance activities to improve surgical care, but to avoid erroneous interpretations they should be considered complementary rather than parallel assessment tools.

In the current audit period, **19.1%** (172/900) of VASM cases received a coronial post-mortem, compared with an average rate of **19.6%** (1,385/7,076) over the years (2012-2018). During the full audit period (2012-2019), the post-mortem rate distributes into **30.9%** (439/1,419) of elective cases and **17.1%** (1,112/6,500) of emergency cases. The cause of death identified by the coroner's office and by VASM had 82% agreement when the coronial finding is used as the gold standard.<sup>(24)</sup>

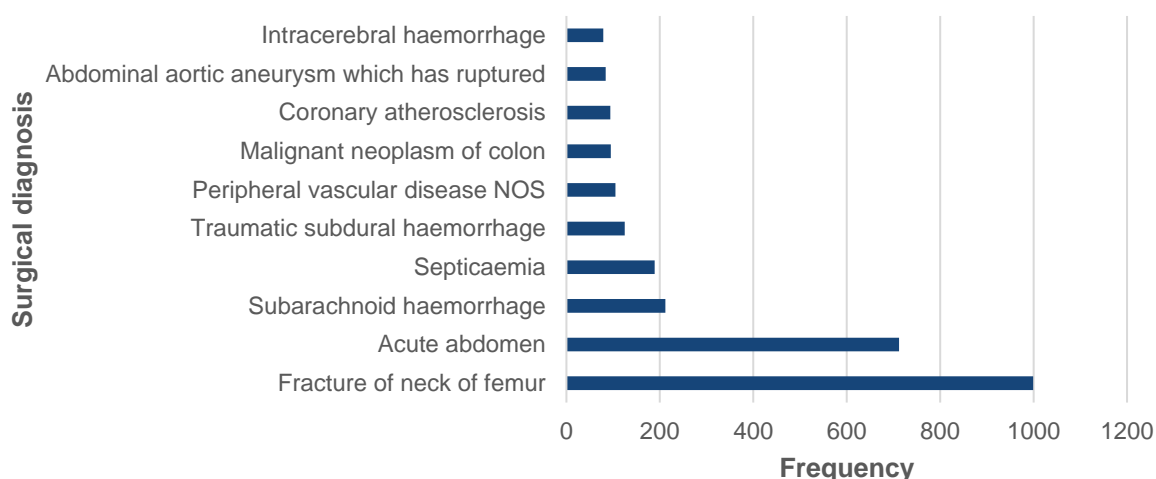
An Australian study examining clinicians' understanding of reportable death to the Victorian coroner highlights that post-mortems provide valuable educational information and provide insights for clinical management issues.<sup>(25)</sup> The continuing low rates of referral for post-mortem are of concern.

## 10 Clinical risk management

### 10.1 Establishing the surgical diagnosis

Establishing a surgical diagnosis after review of test results, operations and any post-mortems can indicate a patient's condition prior to surgery. Patients can have multiple surgical diagnosis codes associated with their death. From 2012 to 2019, the top five most frequent surgical diagnoses were: fracture of the neck of the femur (**12.3%**; 999/8,135), intestinal obstruction (**4.5%**; 368/8,135), vascular insufficiency of the intestine (**2.9%**; 237/8,135), subarachnoid haemorrhage (**2.6%**; 212/8,135) and septicaemia (**2.3%**; 189/8,135). The surgical diagnoses have been consistent over the years.

**Figure 4: Top 10 VASM surgical diagnoses, 2012—2019**



**Notes:**

n=10,984 surgical diagnoses associated with 8,135 patients from 1 July 2012 to 30 June 2019.

Top ten diagnoses account for 24.5% (2,694/10,984) of the total surgical diagnoses.

In the current audit period, the proportion of cases with malignancies identified as part of comorbidities remained stable at **19.9%** (184/926) relative to **19.8%** (260/1,313) for the previous audit year (2017—2018).

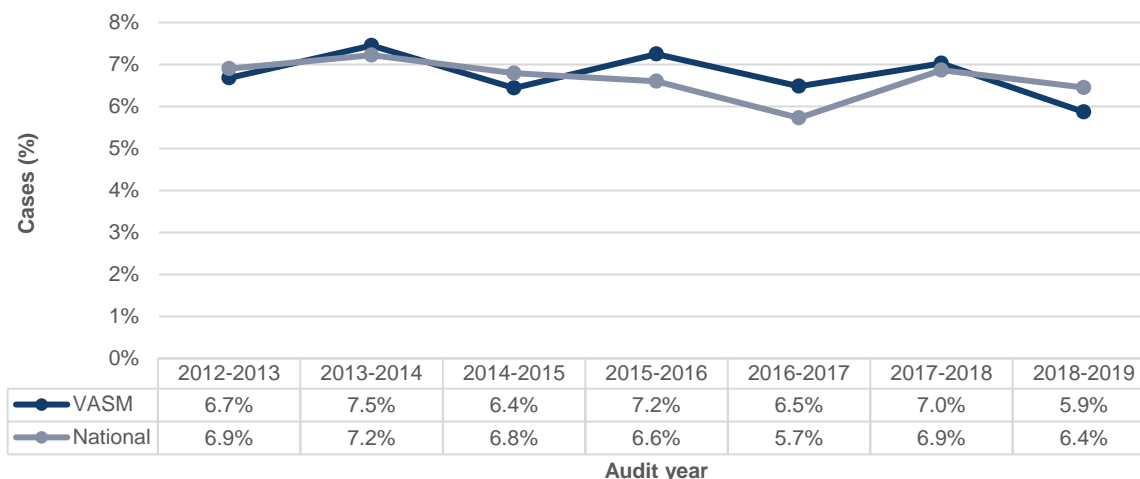
### 10.2 Delay in surgical diagnosis

Early diagnosis is critical in preventing surgical complications or deterioration, particularly in a frail population. Delays in treatment are known to increase the risk of death.<sup>(26)</sup> Treating surgeons are asked to reflect and then record any perceived delays in establishing a diagnosis and proceeding to definitive treatment.

For the current audit period the rate of delays in establishing a diagnosis was **5.9%** (54/920). In the previous audit period (2017—2018), Victorian surgeons reported delays in diagnosis in **6.3%** (52/830) of operative cases in which the patient underwent at least one operation. For the total period 2012 to 2019, diagnostic delays were identified by the treating surgeons in **6.8%** (548/8,094) of audited deaths in Victoria, comparable to the national finding of **6.7%** (1,580/23,752).

It is important to note that delays are not always attributable to the surgical team. Examples of these delays include late referral to specialist and the patient presenting late.

**Figure 5: Deaths with delay in surgical diagnosis compared to the national data, 2012—2019**



**Notes:**

n=548 out of 8,094 Victorian patients with delays in surgical diagnosis from 1 July 2012 to 30 June 2019. Data not available: n=41.  
 n=1,580 cases out of 23,752 national patients with delays in surgical diagnosis from 1 July 2012 to 30 June 2019. Data not available: n=279.  
 From 12 March 2015, data collection changed from gathering data on both delay and errors in surgical diagnosis, to focus only on delay.  
 Victorian data was excluded from the national data pool for the comparison.

**10.3 Delay in transfer to a hospital**

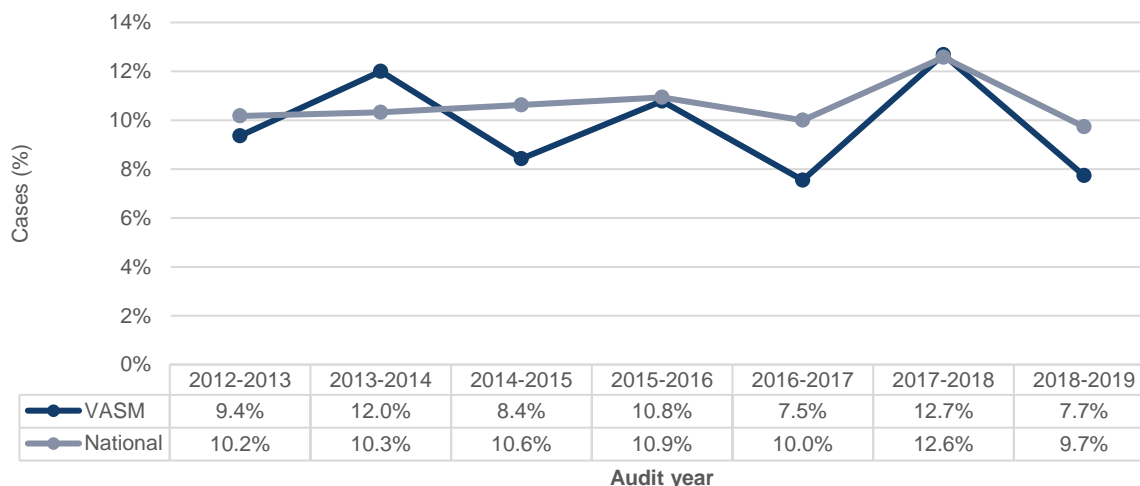
Delays and problems in transfer can cause risks and challenges for shared surgical care. In the current audit period a small proportion of patients requiring preoperative transfer to another hospital experienced delays, inappropriate transfer or inappropriate care. In 2018-2019, 194 patients were transferred between hospitals and **7.7%** (15/194) of them were reported to have had delays in the transfer (see Figure 6).

From 2012 to 2019, **23.0%** (1,829/7,952) of Victorian patients were transferred to another hospital prior to a surgical procedure. This rate has been constant throughout the audit. There is still a need to improve the safety of patient care in such settings and to implement clear communication channels between relevant patient care teams. An inappropriate level of care during transfer was identified for **3.6%** (61/1,694) of Victorian transfer cases. The rate of inappropriate transfers was **5.1%** (87/1,714), while inadequate clinical information and documentation was provided to the receiving hospital in **4.9%** (83/1,694) of transfer cases. In the current audit period, Victoria appears to have had slightly fewer pre-treatment transfer delays (**7.7%**; 15/194) compared to the national findings (**9.7%**; 61/627).

A major reason for transfer is to provide a higher level of care, such as access to critical care support, and it is expected that rural hospitals will have a greater need to transfer patients. The trend over the period 2012-2019 shows that transfer problems were more frequently seen in rural regions (**20.6%**; 51/247) than in metropolitan areas (**14.1%**; 223/1,581). RACS recognises the need for clinical support in rural areas, where appropriate care and availability of well-trained doctors is often limited.<sup>(27)</sup> RACS is currently investigating improvements to the surgical training program by assisting rural hospitals to meet training standards designed for metropolitan training hospitals; more highly trained surgeons to relocate and practice in rural settings.<sup>(28)</sup>

The audit will be exploring issues with postoperative transfers in future reports.

**Figure 6: Deaths with delay in hospital transfer compared to the national data, 2012—2019**



**Notes:**

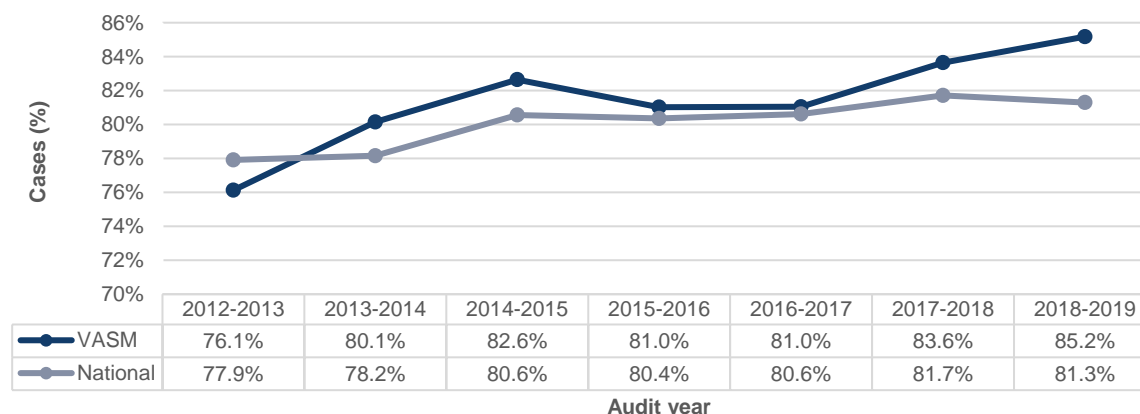
n=168 out of 1,705 Victorian patients with delays in transfer from 1 July 2012 to 30 June 2019. Data not available: n=124.  
 n=601 out of 5,631 national patients with delays in transfer from 1 July 2012 to 30 June 2019. Data not available: n=434.  
 Victorian data was excluded from the national data pool for the comparison.

### 10.4 Deep vein thrombosis prophylaxis

Pulmonary emboli (PE) remains a major cause of death in hospital patients across Australia despite the availability of effective pharmacological and mechanical DVT prophylaxis options. The appropriate use of DVT prophylaxis is outlined in the Clinical Practice Guidelines for the Prevention of Venous Thromboembolism in Patients Admitted to Australian Hospitals<sup>(29)</sup>, which is reviewed and updated periodically to facilitate best available care to patients. Clinicians are advised to refer to the guidelines, subject to individual clinical judgement and patient preferences.

The use of DVT prophylaxis is reported to VASM by the treating surgeon (see Figure 7). From 2012 to 2019, **81.5%** (6,504/7,985) of Victorian cases involved use of DVT prophylaxis, similar to the national data (**80.1%**; 18,801/23,472) for the same period. In Victoria, there was a slight increase in the use of DVT prophylaxis from **83.6%** (1,074/1,284) in 2017—2018 to **85.2%** (770/904) in 2018—2019.

**Figure 7: DVT prophylaxis use compared to national data, 2012—2019**



**Notes:**

n=6,504 out of 7,985 Victorian patients had DVT prophylaxis from 1 July 2012 to 30 June 2019. Data not available: n=150.  
 n=18,801 out of 23,472 national patients had DVT prophylaxis from 1 July 2012 to 30 June 2019. Data not available: n=559.  
 Victorian data was excluded from the national data pool for the comparison.

A total of 11,415 DVT prophylaxis agents were used in audited Victorian cases over the period 2012—2019. Heparin was the most frequently prescribed at **44.2%** (5,040/11,415), followed by Thrombo-Embolitic Deterrent (TED) stockings at **27.4%** (3,133/11,415), and sequential compression at **20.0%**

(2,286/11,415), with the remainder (8.4%; 956/11,415) being other agents including warfarin and aspirin. The use of heparin increased slightly from 43.7% (849/1,945) in 2017—2018 to 45.3% (615/1,358) in 2018—2019. Aspirin has been shown to be a valid therapeutic agent in thromboprophylaxis<sup>(30)</sup> but was the least utilised prophylactic at 4.2% (482/11,415). The choice of prophylaxis is subject to the judgement of clinicians caring for individual patients.

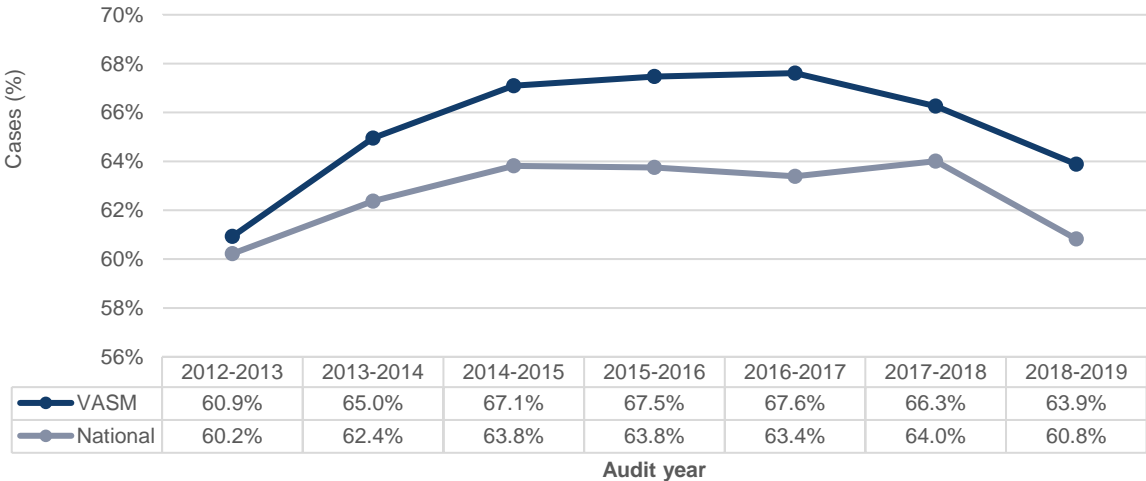
### 10.5 Adequacy of provision of critical care support to patients

Acute medical admissions represent the most seriously ill group of patients, for whom critical care support is essential. However, not all hospitals have critical care services so patients should be triaged accordingly. A close working relationship between the surgical team and the critical care unit is essential, even though not all surgical patients require critical care support.

Treating surgeons were asked to record if their patients received critical care support before or after surgery. First- and second-line assessors reviewed the appropriateness of the use of critical care facilities, with the audit outcome shown in Figure 8.

From 2012 to 2019, audited deaths without any use of critical care support in Victoria was 34.3% (2,784/8,115) compared to 37.2% (8,870/23,819) nationally. The proportion of patients not admitted to CCU has increased from 33.7% (443/1,313) in 2017—2018 to 36.1% (333/922) in 2018—2019. Assessors (both first- and second-line) reported that 7.8% (192/2,476) of patients who did not receive critical care support were likely to have benefited from it. This number, although small, is more than triple that identified by the treating surgeon. The treating surgeon perceived that a lack of critical care support was potentially an issue in only 2.4% (60/2,534) of cases.

**Figure 8: Deaths with the use of CCU compared to national data, 2012—2019**



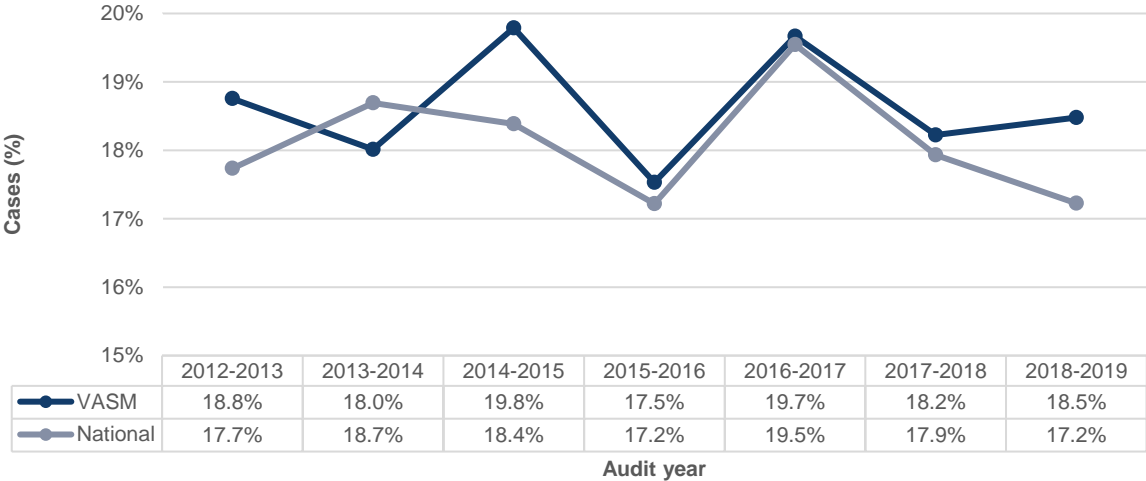
Notes:  
 n=5,331 out of 8,115 Victorian patients received critical care support from 1 July 2012 to 30 June 2019. Data not available: n=20.  
 n=14,949 out of 23,819 national patients received critical care support from 1 July 2012 to 30 June 2019. Data not available: n=212.  
 Victorian data was excluded from the national data pool for the comparison.

### 10.6 Unplanned Admission to Critical Care Unit

Critical care management is an important area of clinical priority that the audit had been monitoring. A seriously ill patient can be admitted to a CCU unexpectedly, which can indicate that the care being provided needs to be addressed. Figure 9 illustrates Victorian and national CCU management over time.

In the period 2012—2019, surgeons reported an unplanned admission to CCU in 18.6% (1,500/8,045) of audited deaths in Victoria, comparable to the national data (18.1%; 4,256/23,461). For the same period, unplanned re-admission to a CCU in Victoria—specifically for operative patients—was 19.3% (1,430/7,407), comparable to the national findings of 19.9% (3,789/18,996).

**Figure 9: Deaths with unplanned admission to CCU compared to national data, 2012—2019**



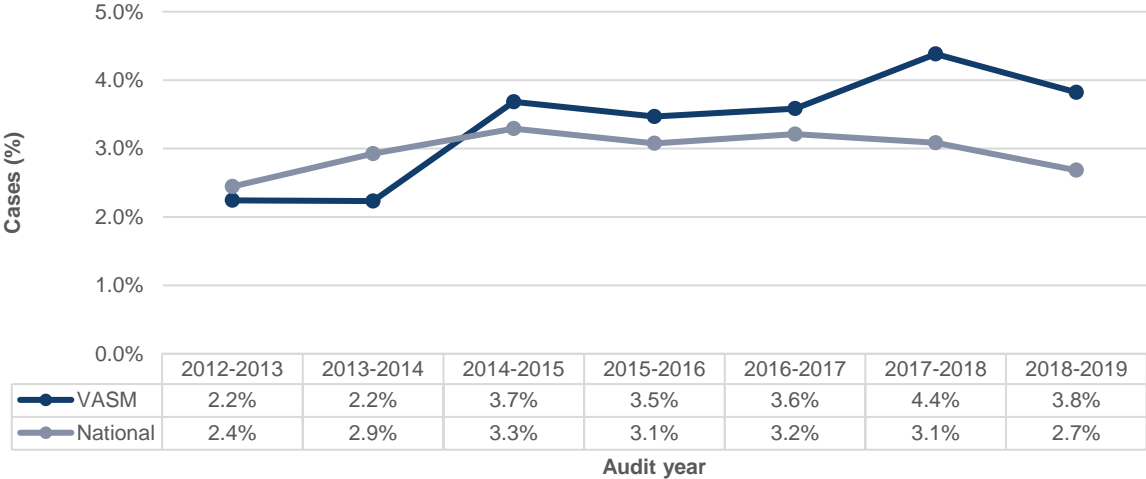
Notes:  
 n=1,500 out of 8,045 Victorian patients had an unplanned admission to CCU from 1 July 2012 to 30 June 2019. Data not available: n=90.  
 n=4,256 out of 23,461 national patients had an unplanned admission to CCU from 1 July 2012 to 30 June 2019. Data not available: n=570.  
 Victorian data was excluded from the national data pool for the comparison.

**10.7 Unplanned Re-admission to hospital**

An unplanned re-admission to hospital within 30 days of surgery can indicate a complication or further surgical intervention. For the period 2012—2019, surgeons reported unplanned re-admissions in an average of **3.4%** (272/8,020) of cases in Victoria, which is slightly higher than the national rate over the same period (**3.0%**; 698/23,398) (see Figure 10).

In 2018—2019, the rate increased to **3.8%** (35/916) for Victorian patients, consistently higher than the national findings of **2.7%** (71/2,647). For the operative patients specifically, the overall finding of **3.5%** (262/7,383) is similar to the national data (**3.2%**; 603/18,943). VASM will monitor the higher Victoria rates seeking ways to reduce the rate of re-admission, leading to better patient outcomes, increased quality of life and more effective utilisation of limited health system resources.

**Figure 10: Deaths with unplanned re-admission compared to national data, 2012—2019**



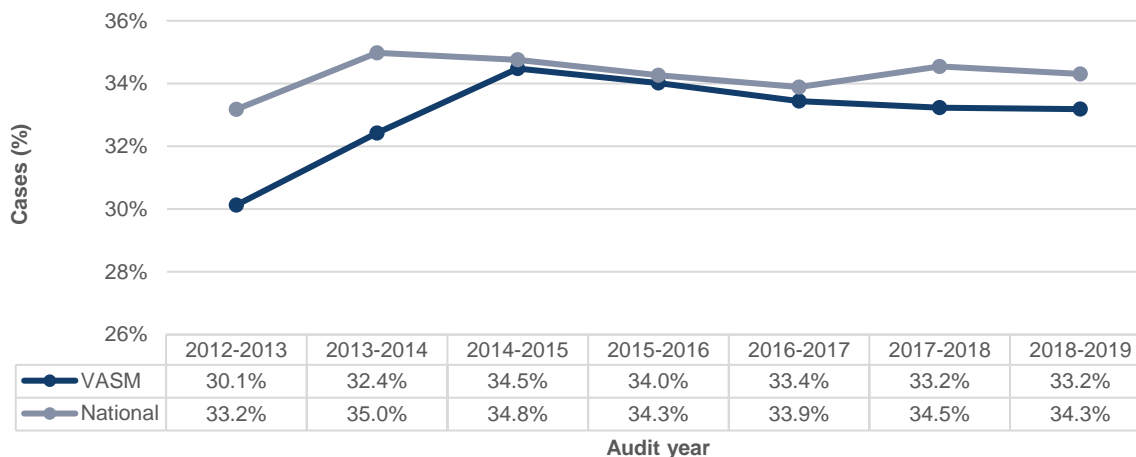
Notes:  
 n=272 out of 8,020 Victorian patients had an unplanned re-admission from 1 July 2012 to 30 June 2019. Data not available: n=115.  
 n=698 out of 23,398 national patients had an unplanned re-admission from 1 July 2012 to 30 June 2019. Data not available: n=633.  
 Victorian data was excluded from the national data pool for the comparison.

## 10.8 Clinically significant infection

At the time of death, a patient can have an infection associated with an intervention provided by the hospital. Surgeons are asked to report on this clinical risk.

For the period 2012—2019, surgeons reported a clinically significant infection in **33.1%** (2,633/7,955) of audited deaths in Victoria (Figure 11). In the current audit period 2018—2019, **33.2%** (300/904) of patients in Victoria had a clinically significant infection, slightly lower than the national figure of **34.3%** (907/2,644).

**Figure 11: Deaths with a clinically significant infection compared to national data, 2012—2019**



**Notes:**

n=2,633 out of 7,955 Victorian patients had a clinically significant infection from 1 July 2012 to 30 June 2019. Data not available: n=180.  
n=7,994 out of 23,302 national patients had a clinically significant infection from 1 July 2012 to 30 June 2019. Data not available: n=729.  
Victorian data was excluded from the national data pool for the comparison.

Details of audited deaths with clinically significant infection acquired during admission is outlined in Table 3. Most reported infections in the current audit period were acquired postoperatively. In Victoria this accounted for **68.6%** (116/169) of infection cases, compared with **70.3%** (345/491) nationally.

**Table 3: Deaths with clinically significant infection acquired during admission, 2012—2019**

Infection acquired	VASM 2012-2018	National 2012-2018	VASM 2018-2019	National 2018-2019
Acquired postoperatively	71.1% (944/1,327)	67.5% (2,567/3,805)	68.6% (116/169)	70.3% (345/491)
Acquired preoperatively	15.9% (211/1,327)	17.6% (668/3,805)	16.6% (28/169)	16.5% (81/491)
Other invasive-site infection	5.4% (71/1,327)	7.0% (267/3,805)	6.5% (11/169)	6.5% (32/491)
Surgical-site infection	7.6% (101/1,327)	8.0% (303/3,805)	8.3% (14/169)	6.7% (33/491)

**Notes:**

n=2,633 out of 7,955 Victorian patients had a clinically significant infection from 1 July 2012 to 30 June 2019. Data not available: n=180.  
n=7,994 out of 23,302 national patients had a clinically significant infection from 1 July 2012 to 30 June 2019. Data not available: n=729.  
Victorian data was excluded from the national data pool for the comparison.  
Data collection on clinically significant infections commenced in 2011—2012.

Combined, pneumonia and sepsis comprised **64.9%** (192/296) of the reported cases of infection. The infective organism was identified in **43.2%** (124/287) of the infection cohort. Strategies for reducing surgical-site infections have been implemented overseas and in Australia<sup>(31)</sup> and guidelines should be followed. Antibiotic prophylaxis is a good infection control measure in surgery and should be considered. The timeframe in which the infection was acquired can play a role in patient recovery following the surgical procedure.



The infection rate varied across individual specialties, reflecting their differing case mix. Plastic Surgery had the highest reported infection rate at **43.0%** (116/270) followed by Urology at **40.9%** (138/337), General Surgery, including trauma and colorectal subspecialties at **39.7%** (1,114/2,803), and Otolaryngology Head and Neck at **36.4%** (32/88).

The average rate of surgical-site infections for patients in Victoria for the period 2012—2018 was **7.6%** (101/1,327). This increased to **8.3%** (14/169) in the current audit period but did not reach statistical significance ( $p=0.5$ ). The national findings show a decrease from **8.0%** (303/3,805) to **6.7%** (33/491) over the same time periods.<sup>(32-34)</sup>

## 10.9 Trauma

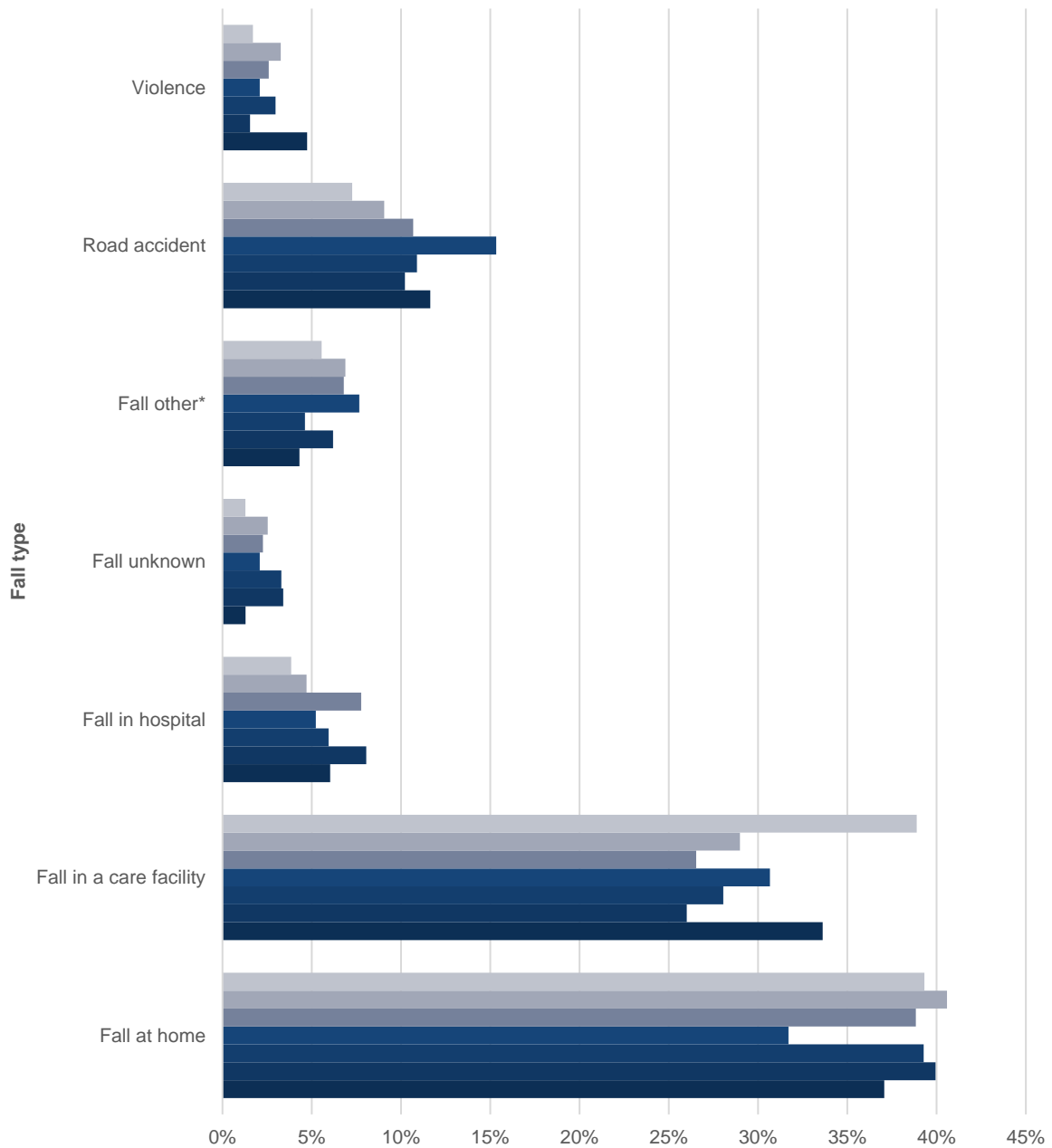
Trauma cases are those in which a patient received severe bodily injury or shock from a fall, accident or violence. VASM started collecting data on trauma cases in 2012 (see Figure 12) to monitor trends and ensure strategies are implemented to prevent and minimise future harm.

From 2012 to 2019, **24.5%** (1,964/8,009) of mortalities reported in Victoria were attributed to trauma. Of the traumatic events, **82.6%** (1,622/1,964) were caused by falls, **10.8%** (212/1,964) were caused by traffic accidents and **2.6%** (52/1,964) were associated with violence.

The VASM surgical population is elderly and frail and is at increased risk of falls due to the extent of life-threatening pre-existing conditions, comorbidities and frailty associated with advanced age. Of the total falls, **43.6%** (707/1,622) occurred in hospitals or care facilities, **46.2%** (749/1,622) occurred at home and only **10.2%** (166/1,622) occurred elsewhere. Falls in hospital are monitored because of the possible need for further surgical or medical intervention and because they should be preventable. The **43.6%** (707/1,622) of falls occurring in hospital or care facilities requires educational strategies to improve patient care in these facilities.<sup>(35-36)</sup> A review of patient care received by elderly patients undergoing surgery in the United Kingdom had similar findings.<sup>(26)</sup>

Future trend analysis of falls will help inform strategies for improvement in this aspect of patient care, especially falls in care facilities or in hospitals.<sup>(37)</sup> VASM will include such strategies in its educational programs. A study found a reduction in postoperative falls in patients who participated in a preoperative education program.<sup>(38)</sup> Reviewing falls in trauma and orthopaedic cases can be a powerful tool to unite institutions to minimise risk and address the issues.

**Figure 12: Deaths with causes of trauma, 2012—2019**



	Fall at home	Fall in a care facility	Fall in hospital	Fall unknown	Fall other*	Road accident	Violence
■ 2012-2013	39.3%	38.9%	3.8%	1.3%	5.6%	7.3%	1.7%
■ 2013-2014	40.6%	29.0%	4.7%	2.5%	6.9%	9.1%	3.3%
■ 2014-2015	38.8%	26.5%	7.8%	2.3%	6.8%	10.7%	2.6%
■ 2015-2016	31.7%	30.7%	5.2%	2.1%	7.7%	15.3%	2.1%
■ 2016-2017	39.3%	28.1%	5.9%	3.3%	4.6%	10.9%	3.0%
■ 2017-2018	39.9%	26.0%	8.0%	3.4%	6.2%	10.2%	1.5%
■ 2018-2019	37.1%	33.6%	6.0%	1.3%	4.3%	11.6%	4.7%

Audit year

**Notes:**

n=1,964 trauma cases in 8,009 Victorian patients from 1 July 2012 to 30 June 2019. Data not available: n=126.

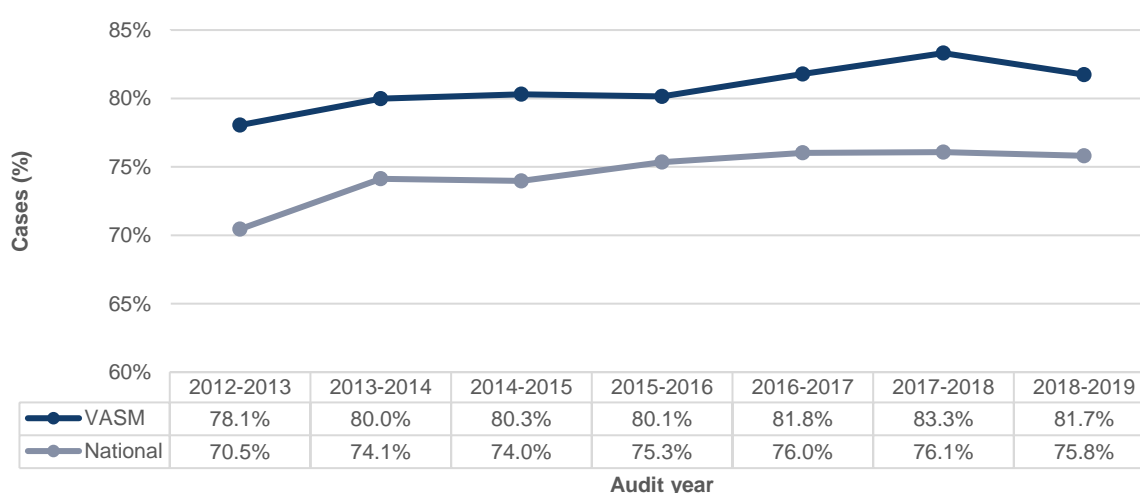
\*Includes roads and public venues.

## 11 Profile of operative procedures

It is the role of the treating surgeon to take responsibility for the overall success of an operation. He or she must ensure that the operation proceeds smoothly with the lowest possible risk of complications, including the appropriate use of DVT prophylaxis, antibiotics and intensive care facilities; appropriate fluid balance; minimal unplanned returns to theatre; and appropriate involvement of the senior consultant, especially in a training environment.

Figure 13 shows the frequency of a consultant being present in theatre or being the most senior surgeon performing the procedure. For the period 2012—2019, a consultant surgeon was present in theatre, either operating, assisting or supervising, in **80.9%** (8,574/10,601) of audited operations in Victoria. This rate remained relatively stable over the years and was higher than the national average of **74.6%** (20,255/27,148).

**Figure 13: Operation with the consultant surgeon present in theatre compared to national data, 2012—2019**



**Notes:**

n=10,601 operative episodes in 7,471 Victorian patients from 1 July 2012 to 30 June 2019.

n=27,148 out of 19,287 national patients from 1 July 2012 to 30 June 2019.

Victorian data was excluded from the national data pool for the comparison.

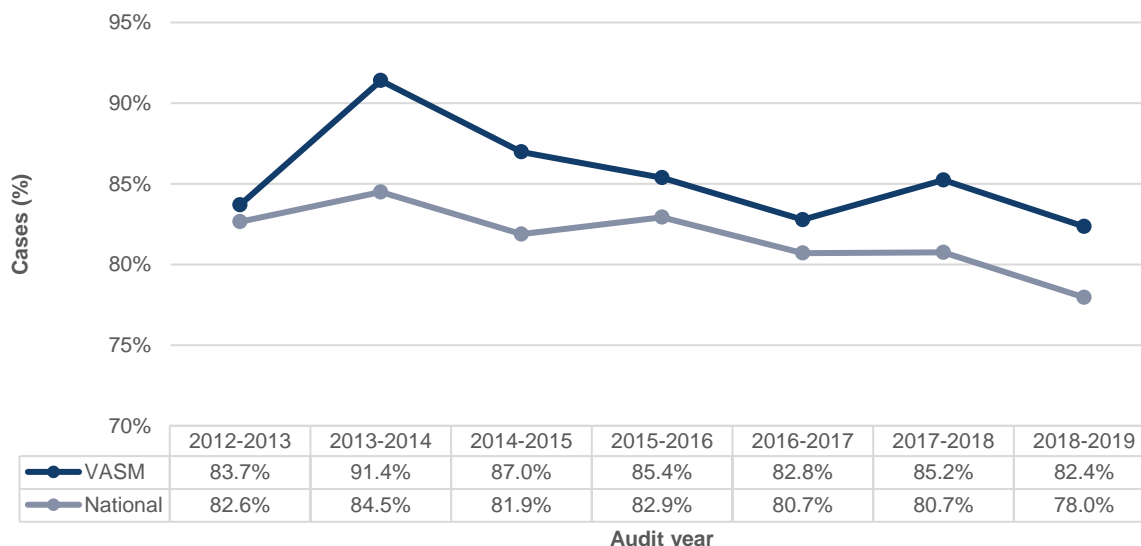
One patient can undergo multiple procedures during the same admission and at the same surgical session, thus a total of 10,601 separate procedures or operations were performed on 7,471 Victorian patients over the period 2012—2019. Of these 7,471 patients, 5,869 were admitted as emergencies and 5,504 of this subgroup had emergency surgery (immediate, emergency, or scheduled emergency) as their first operation. In the current audit period (2018—2019), **90.2%** (834/925) of patients had at least one operative procedure.

For Victorian patients admitted through emergency departments over the period 2012—2019, **22.4%** (1,313/5,869) of surgeries occurred within two hours of admission, **39.3%** (2,309/5,869) occurred within 24 hours, and **32.1%** (1,882/5,869) occurred more than 24 hours after admission. In the current audit period, there was a slight increase in the number of emergency admissions to a surgical unit requiring surgery within 24 hours from **60.1%** (582/968) in 2017—2018 to **60.9%** (401/658) in 2018—2019. Strategies to address the associated scheduling problems are a priority for the government with surgeons and hospitals working on improvement strategies.<sup>(39)</sup>

### 11.1 Elective surgery performed as planned

Elective surgical procedures are those scheduled in advance that do not involve an immediate medical emergency. In 2018—2019, Victorian patients had elective surgery performed as planned in **82.4%** (126/153) of cases, a slight decrease from the previous year (**85.2%**; 202/237).

**Figure 14: Proportion of elective admissions with elective surgery performed, 2012—2019**



**Notes:**

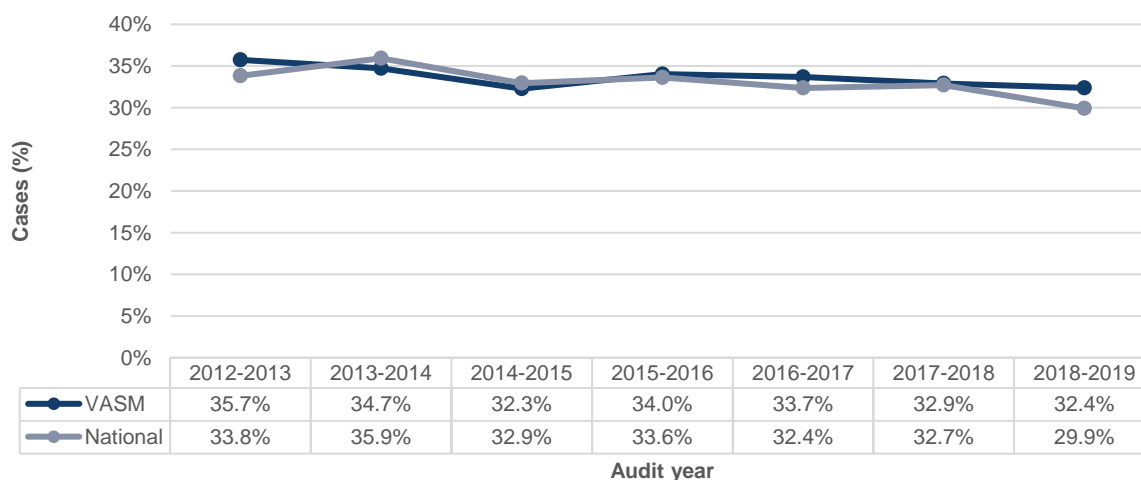
n=1,237 out of 1,448 patients had elective admissions from 1 July 2012 to 30 June 2019. Data not available: n=211.  
 n=2,910 out of 3,558 national patients had elective admissions from 1 July 2012 to 30 June 2019. Data not available: n=648.  
 Victorian data was excluded from the national data pool for the comparison.

**11.2 Postoperative Complications**

Complications can be expected following complex surgery due to the pre-existing comorbidity profile, surgical risk status and the nature of the disease being treated. Over the period 2012—2019, **66.4%** (4,915/7,403) of audited Victorian patients who underwent operative treatment had no complications. In the current audit year, **67.6%** (560/828) of audited Victorian patients had no complications, which is lower than the national rate in the same year (**70.1%**; 1,502/2,143).

In 2018—2019, surgeons reported postoperative complications in **32.4%** (268/828) of audited operative deaths in Victoria, compared with the national findings of **29.9%** (641/2,143). Surgeons reported delays in recognising postoperative complications in **6.5%** (151/2,324) of deaths over the period 2012—2019 (data not available: n=164).

**Figure 15: Operative deaths with postoperative complications compared to national data, 2012—2019**



**Notes:**

n=2,488 out of 7,403 Victorian patients had postoperative complications from 1 July 2012 to 30 June 2019. Data not available: n=68.  
 n=6,314 out of 19,069 national patients had postoperative complications from 1 July 2012 to 30 June 2019. Data not available: n=218.  
 Victorian data was excluded from the national data pool for the comparison.

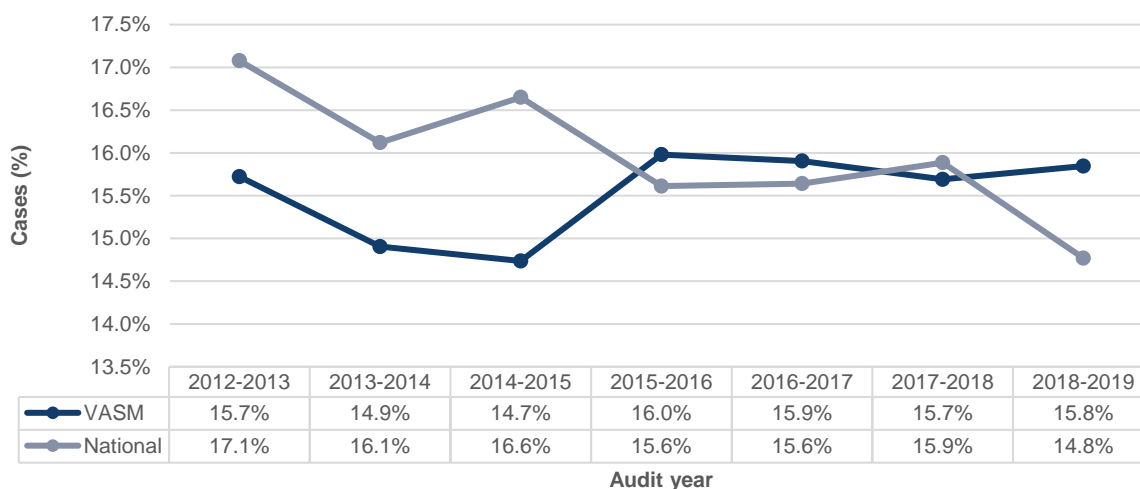
### 11.3 Unplanned Return to Theatre

Some complications following complex surgery can be expected. A high rate of return to theatre can reflect timely recognition, intervention, and escalation of care for complications on the ward. However, it can also indicate that the care being provided could be improved. Figure 16 shows operative deaths following an unplanned return to theatre. It is an overall goal of VASM with SCV and DHHS to see this trend decline over future audit periods.

Victorian surgeons identified that an average of **15.5%** (1,157/7,444) of patients had an unplanned return to the operating room over the period 2012—2019. In the current audit year, surgeons reported a similar rate of **15.8%** (132/833) of patients in Victoria, slightly higher than the national rate of **14.8%** (318/2,153).

Cardiothoracic surgery reported the highest rate of unplanned returns to theatre at **25.4%** (269/1,058) of audited operative deaths in Victoria.

**Figure 16: Operative deaths with unplanned return to theatre compared to national data, 2012—2019**



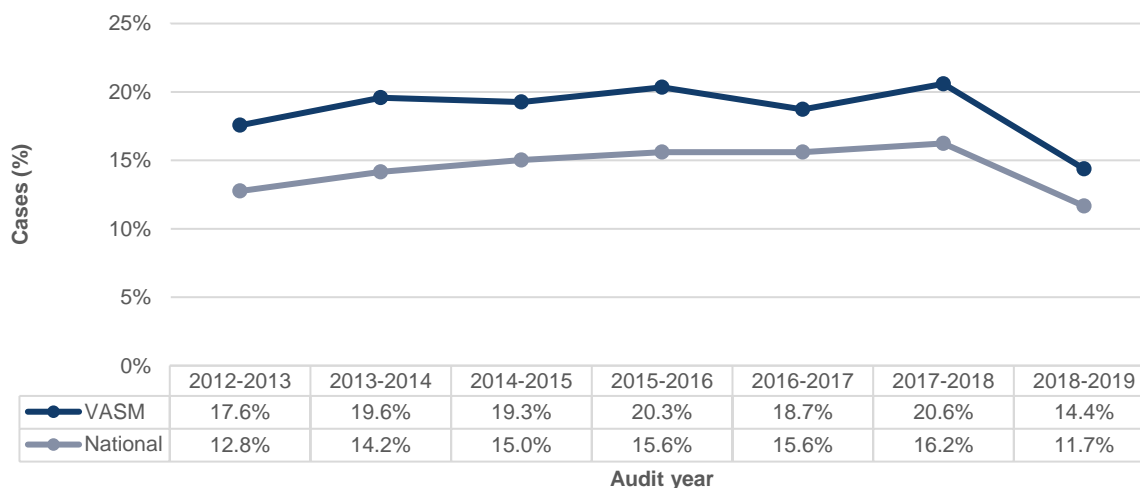
**Notes:**

n=1,157 out of 7,444 Victorian patients had an unplanned return to theatre from 1 July 2012 to 30 June 2019. Data not available: n=27.  
 n=3,047 out of 19,073 national patients had an unplanned return to theatre from 1 July 2012 to 30 June 2019. Data not available: n=214.  
 Victorian data was excluded from the national data pool for the comparison.

## 12 Peer-review process

FLAs were completed for 8,135 VASM cases, with **18.8%** (1,533/8,135) of those cases requiring an in-depth SLA during the audit period (2012—2019). The reduction in SLA referral rate for the current audit period is due to more complex cases still undergoing review (Figure 17). The data for these cases will be included in the next report under 2018-2019.

**Figure 17: Proportion of audited VASM deaths that underwent a SLA compared to the national data, 2012—2019**



**Notes:**

n=1,533 cases out of 8,135 Victorian patients referred for SLA peer review from 1 July 2012 to 30 June 2019.

n=3,504 cases out of 24,028 national patients referred for SLA peer review from 1 July 2012 to 30 June 2019.

SLA: Second-line assessment.

Victorian data was excluded from the national data pool for the comparison.

Each first-line assessor was asked to indicate if the treating surgeon had provided adequate information to allow a conclusion to be reached. A SLA was requested if the information provided was deemed inadequate. SLAs are also requested if a more detailed case review is required, which could provide better clarification of events leading up to death, or if death was unexpected, for example a day surgery case or death of a young fit patient with benign disease. These may represent suspected issues of clinical management.

Information provided in the SCFs has increased since audits began, but improvement is still needed. Reasons given for referral for SLA are provided in Table 4.

**Table 4: Reasons for SLA referral, 2012—2019**

Reason for SLA	VASM	National
SLA not required	6,602 (81.2%)	20,524 (85.4%)
SLA due to insufficient information	1,072 (13.2%)	2,425 (10.1%)
SLA due to further investigation	458 (5.6%)	1,071 (4.5%)
<b>Total</b>	<b>8,132 (100.0%)</b>	<b>24,020 (100.0%)</b>

Victorian data was excluded from the national data pool for the comparison.

At SLA, criticisms are also addressed for poor medical admission notes; missing reports, imaging, transfer notes or follow-up records; and unsatisfactory descriptions of the surgical procedure. Comprehensive and legible hospital case notes are an important record of what has occurred during a patient's treatment. In the current audit year (2018—2019), over half (**68.2%**; 90/132) of VASM cases were sent for second-line peer review due to insufficient information and/or further investigation. This was a decrease from **71.1%** (192/270) in 2017—2018. In the current audit year, **31.8%** (42/132) of SLA requests arose from the need for a more detailed review of perceived issues of management. Overall,

in the current audit year, major clinical management issues were identified in only **14.4%** (133/925) of cases, whereby the FLA assessor sought a SLA.

Greater attention to detail in completing the SCF would help reduce the workload of colleagues who have agreed to act as first- and second-line assessors.

---

## 13 Outcomes of the peer-review

The VASM peer-review process is a retrospective examination of the clinical management of patients who died whilst 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 patient management may have contributed to the outcome. In cases where it is thought that clinical management may have contributed to the death, VASM requires the assessor to attribute a level of severity, as outlined below:

- An area for consideration exists. The assessor believes an area of care **could** have been improved or done differently but recognises that this issue is debateable. It represents very minor criticism
- An area of concern exists. The assessor believes that an area of care **should** have been better
- An adverse event occurred. This is defined as an unintended injury or event **caused** by the medical management of the patient rather than by the disease process, which was sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient, or which directly contributed to or caused death

### 13.1 Use of DVT prophylaxis

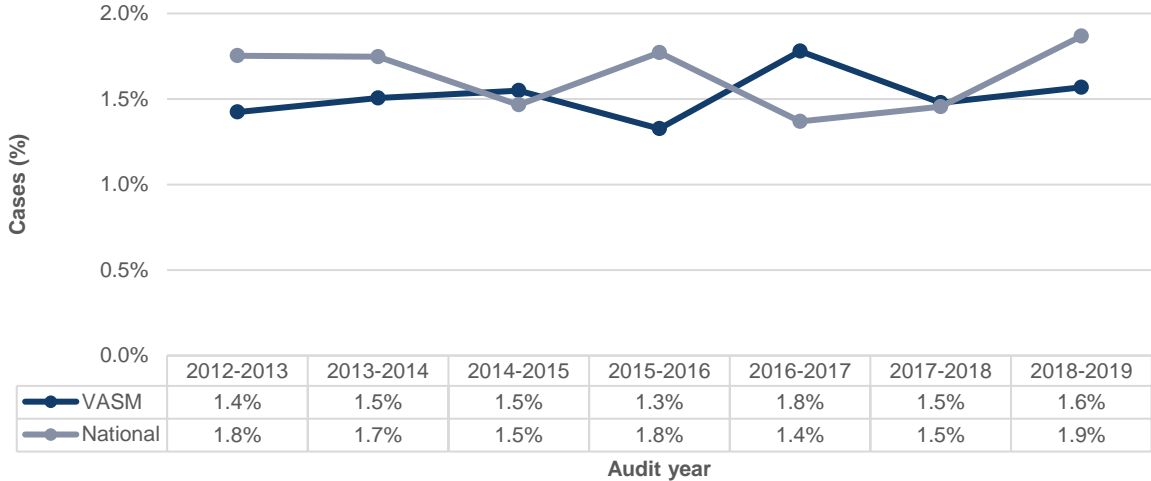
The assessor's perspective of inappropriate DVT prophylaxis treatment is outlined in Figure 18. In the current audit year, less than 2% of cases were found by the assessors to have received inappropriate DVT prophylaxis and this has been a consistent finding. In the period 2012—2019, **17.0%** (1,253/7,356) of patients who had an operative procedure received no prophylaxis. This decision was made by the treating team in most cases.

A decision by the treating team to actively withhold DVT prophylaxis within the operative pool of Victorian patients decreased from **36.8%** (64/174) in 2017—2018 to **21.8%** (22/101) in 2018—2019. From the Victorian peer reviews, the assessors agreed with the use or non-use of DVT prophylaxis in **87.5%** (725/829) of cases, an increase from **85.0%** (1,035/1,218) in 2017—2018.

Assessors could not accurately assess the appropriateness of the decision to withhold DVT in 103 of the cases due to insufficient evidence in the audit documentation.



**Figure 18: Assessor perspective on inappropriate DVT prophylaxis treatment, 2012—2019**



Notes:  
 n=112 out of 7,368 operative Victorian patients associated with inappropriate prophylaxis from 1 July 2012 to 30 June 2019. Data not available: n=103.  
 n=303 out of 18,721 operative national patients associated with inappropriate prophylaxis from 1 July 2012 to 30 June 2019. Data not available: n=564.  
 DVT: deep vein thrombosis.  
 Victorian data was excluded from the national data pool for the comparison.

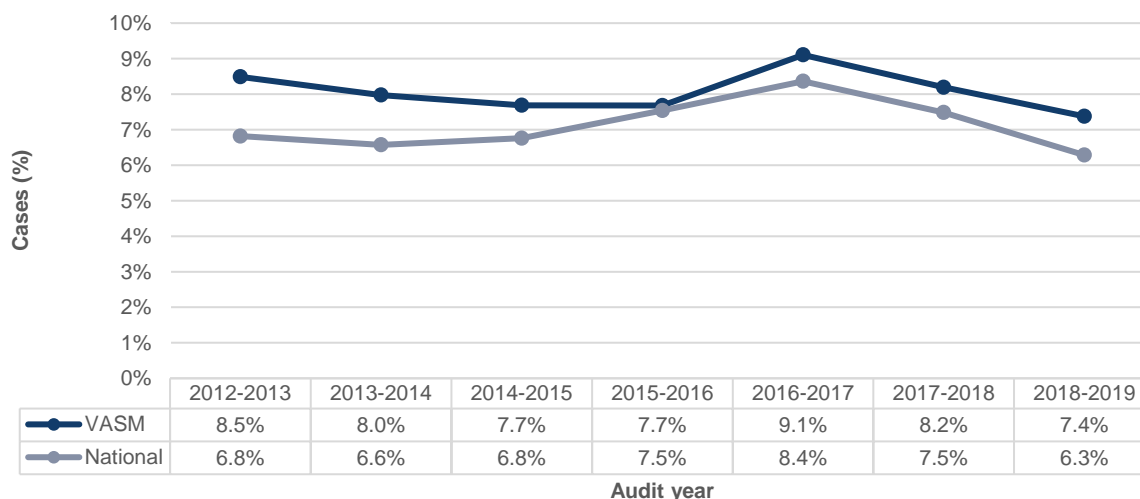
**13.2 Issues with fluid balance**

When a patient undergoes surgery, fluid balance must be maintained at optimum levels for the body to function at its normal state. Deciding on the optimum amount of intravenous fluids to be administered to surgical patients and the best rate at which to give them can be complex. Treatment decisions must be based on careful assessment of each patient’s individual needs, with the overall goal being the provision of sufficient fluid and electrolytes to meet losses, maintain the normal status of body fluid compartments, and enable renal excretion of waste products. For the critically ill patient it is known that “early adequate fluid resuscitation together with conservative late fluid management may provide better patient outcomes”.<sup>(40)</sup>

Surgical consultants and clinical teams should be competent in fluid management strategies. The treating surgeon and all assessors were asked to comment on the appropriateness of fluid balance during the episode of care.

Figure 19 shows cases relating to fluid balance issues. Over the period 2012—2019, assessors reported issues with fluid balance in **8.1%** (650/8,035) of cases in Victoria, which is higher than the national audit findings of **7.2%** (1,657/23,146). In 2018—2019, assessors reported that **7.4%** (68/922) of audited deaths in Victoria had fluid balance issues.

**Figure 19: Assessor perspective on fluid balance issues compared to national data, 2012—2019**



**Notes:**

n=650 out of 8,035 Victorian patients associated with fluid balance issues from 1 July 2012 to 30 June 2019. Data not available: n=99.  
 n=1,657 out of 23,146 national patients associated with fluid balance issues from 1 July 2012 to 30 June 2019. Data not available: n=881.  
 Victorian data was excluded from the national data pool for the comparison.

**13.3 Clinical management issues**

Patients may have more than one clinical management issue associated with the care that ultimately led to their death. A weighting system (from less severe to most severe) accounting for criticisms identified per patient, is used to analyse deficiencies in clinical care (see Table 5).

Audited cases may have multiple clinical management issues identified per patient. The percentage of patients affected is the important measure. Details about the issues identified are presented in Table 6.

**Table 5: Severity of criticism of perceived clinical management issues**

	Less severe	←————→		Most severe
<b>Areas of clinical incidents</b>	None detected	Consideration	Concern	Adverse event
<b>Outcomes of incidents</b>	Not applicable	Did not affect clinical outcome	May have contributed to death	Probably contributed to death
<b>Preventable incidents</b>	Not applicable	Probably not	Probably	Definitely
<b>Association of incidents</b>	Not applicable	Hospital	Clinical team	Surgical team

The causes of clinical management issues and associated trends are monitored closely by VASM and remain the focus of reports and educational events.

Assessors perceived that clinical management issues occurred in **26.8%** (247/922) of cases within the audited patient pool. Minor issues (areas of consideration) of patient management were perceived to have occurred in **11.9%** (110/922) of cases, and areas of concern were identified in **5.9%** (54/922) of cases in the current audit year. In the same year, **8.9%** (82/922) of cases were categorised as an adverse event. Preventable adverse events or concerns have decreased from **18.2%** (239/1,312) in 2017—2018 to **15.5%** (143/922) in 2018—2019.

**Table 6: Areas of clinical management issues**

Characteristics	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
No issues identified	70.8% (704/994)	67.5% (732/1,084)	69.0% (854/1,237)	69.1% (882/1,277)	70.1% (883/1,259)	69.1% (906/1,312)	73.2% (675/922)
Area of consideration	17.4% (173/994)	20.7% (224/1,084)	17.6% (218/1,237)	16.4% (210/1,277)	14.7% (185/1,259)	15.1% (198/1,312)	11.9% (110/922)
Area of concern	7.8% (78/994)	7.9% (86/1,084)	7.8% (97/1,237)	9.8% (125/1,277)	8.8% (111/1,259)	8.2% (108/1,312)	5.9% (54/922)
Adverse event	3.7% (37/994)	3.7% (40/1,084)	5.0% (62/1,237)	4.2% (54/1,277)	5.9% (74/1,259)	7.5% (99/1,312)	8.9% (82/922)
Preventable issues	15.3% (152/994)	17.0% (184/1,084)	16.7% (207/1,237)	16.6% (212/1,277)	17.1% (215/1,259)	18.2% (239/1,312)	15.5% (143/922)
Adverse event or concern that was preventable	9.0% (89/994)	9.0% (98/1,084)	9.5% (117/1,237)	11.0% (141/1,277)	11.2% (141/1,259)	12.0% (158/1,312)	11.0% (101/922)
Adverse event or concern that was preventable that contributed to the death	1.8% (18/994)	2.7% (29/1,084)	2.1% (26/1,237)	2.7% (34/1,277)	3.3% (42/1,259)	3.0% (39/1,312)	3.3% (30/922)

---

## 14 Preventable clinical management issue

Table 7 lists the most severe clinical management issues (areas of concern or adverse events), and their possible prevention, identified by assessors in 2018—2019.

Delays in patient care include issues related to diagnosis, full investigation of the patient, patient presentation, recognition of complications, transfer to surgical unit, transfer to tertiary hospital and commencement of medical treatment. Delays to operation include those caused by missed diagnoses and delays to surgery where an earlier operation was desirable.

Operative management issues relate to the decision to operate, timing of the operation, choice of operation or procedure, iatrogenic injury, competence of the surgical team, failure to stop haemorrhage, wrong approach used, and incorrect or inappropriate therapy.

Futile surgery on frail patients with multiple comorbidities has become a prominent clinical issue. Recommendations from peers suggest alternative treatment with other less extensive procedures or conservative management of patients to reduce postoperative complications.<sup>(14)</sup>

A number of studies on patients with hip fractures found that delay to surgery was attributable to patient factors such as age<sup>(41)</sup>, comorbidities<sup>(42)</sup>, ASA status and gender; day of surgical admission relating to delay to surgery<sup>(43)</sup>, waiting times, and reduction of theatre changeover time.<sup>(44)</sup>

The Targeting Zero report, the Aspex evaluation and the VPCC committee recommended that VASM produce an improved and transparent categorisation of preventable clinical management issues. These categories are outlined in Table 7. Of the 922 patients audited in 2018—2019, 30 patients had at least one preventable clinical management issue, with a total of 33 issues among the 30 patients. The most common preventable clinical management issues were iatrogenic injury at **24.2%** (8/33), followed by aspiration pneumonia at **12.1%** (4/33).

Assessors perceived more clinical issues when compared to those raised by treating surgeons, highlighting the importance and value of an independent peer-reviewed assessment.

The prevalence of areas of concern and adverse events identified by assessors was similar among the specialties. Some specialties with fewer mortalities reported, or those that recently commenced participating in the audit process, may skew the data.

**Table 7: Complete series of preventable clinical management issues that contributed to death identified by the highest level of assessment, 2018—2019**

Individual case identification	Adverse event area	Adverse event preventable	Adverse event
53815	Concern	Possibly preventable	Decision to operate
54642	Concern	Possibly preventable	Delay in diagnosis
55353	Concern	Preventable	Delay in diagnosis
53815	Concern	Preventable	Decision to operate
54795	Concern	Preventable	Inappropriate treatment prior to surgical referral
54320	Adverse event	Possibly preventable	Iatrogenic injury
53473	Adverse event	Possibly preventable	Aspiration pneumonia
54199	Adverse event	Possibly preventable	Aspiration pneumonia
54280	Adverse event	Possibly preventable	Iatrogenic injury
54614	Adverse event	Possibly preventable	Aspiration pneumonia
55168	Adverse event	Possibly preventable	General complications of treatment
55220	Adverse event	Possibly preventable	Iatrogenic injury
55480	Adverse event	Possibly preventable	Aspiration pneumonia
55670	Adverse event	Possibly preventable	Iatrogenic injury
55861	Adverse event	Possibly preventable	Anastomotic leak after open surgery
55888	Adverse event	Possibly preventable	Anastomotic leak related to laparoscopic operation
55956	Adverse event	Possibly preventable	Iatrogenic injury
56433	Adverse event	Possibly preventable	Pulmonary embolus
57805	Adverse event	Possibly preventable	Failure to communicate with senior staff
57097	Adverse event	Possibly preventable	Wrong surgical approach used
57206	Adverse event	Possibly preventable	Iatrogenic injury
57513	Adverse event	Possibly preventable	General coagulopathy related to laparoscopic operation
57513	Adverse event	Possibly preventable	Preoperative assessment inadequate
57574	Adverse event	Possibly preventable	Postoperative bleeding related to endoscopic operation
58518	Adverse event	Possibly preventable	Iatrogenic injury
53646	Adverse event	Preventable	Delay in transfer to a tertiary hospital
53646	Adverse event	Preventable	Blood/blood products complication
53943	Adverse event	Preventable	Haemorrhage
54012	Adverse event	Preventable	Inadequate surgical assistance
54408	Adverse event	Preventable	Over anticoagulation
56246	Adverse event	Preventable	Injury caused by fall in hospital
56364	Adverse event	Preventable	Anastomotic leak after open surgery
56977	Adverse event	Preventable	Iatrogenic injury

## 14.1 Assessors consideration if management of surgical care could have been improved

Table 8 shows the point of surgical care at which assessors considered that care management could have been improved. This allows for better understanding of improving surgical care in Victoria and nationally.

In Victoria, management issues regarding the decision to operate at all, preoperative management/preparation, choice of operation, timing of operation, intraoperative/technical management of surgery, and postoperative care considerations have all been greater than the national figures but have all improved statistically during the current year. This suggests that surgical care in the state is improving and indicates that assessors have used an unbiased clinical review process.

**Table 8: Areas for surgical care improvements as identified by assessors at different phases of care**

### Preoperative management/preparation

Year	VASM	National	p value
2012-2013	8.6% (84/976)	7.3% (214/2,947)	0.1693
2013-2014	9.4% (101/1,069)	8.8% (294/3,344)	0.5130
2014-2015	10.5% (126/1,198)	9.0% (308/3,409)	0.1307
2015-2016	11.3% (142/1,259)	9.8% (347/3,542)	0.1353
2016-2017	11.5% (143/1,247)	9.5% (327/3,448)	<b>0.0455</b>
2017-2018	11.3% (147/1,301)	9.3% (328/3,543)	<b>0.0342</b>
2018-2019	8.4% (77/912)	7.5% (192/2,568)	0.3479
<b>Total</b>	<b>10.3% (820/7,962)</b>	<b>8.8% (2,010/22,801)</b>	<b>0.0001</b>

### Decision to operate at all

Year	VASM	National	p value
2012-2013	7.2% (70/979)	6.6% (195/2,952)	0.5560
2013-2014	10.3% (111/1,075)	8.4% (281/3,354)	0.0504
2014-2015	9.9% (119/1,199)	7.9% (271/3,414)	<b>0.0015</b>
2015-2016	9.9% (126/1,269)	8.6% (305/3,564)	0.1411
2016-2017	10.7% (134/1,248)	8.4% (289/3,453)	<b>0.0122</b>
2017-2018	10.6% (139/1,306)	8.5% (303/3,551)	<b>0.0234</b>
2018-2019	9.1% (83/914)	7.6% (195/2,571)	0.1515
<b>Total</b>	<b>9.8% (782/7,990)</b>	<b>8.0% (1,839/22,859)</b>	<b>&lt;0.0001</b>

### Choice of operation

Year	VASM	National	p value
2012-2013	5.0% (49/975)	4.1% (122/2,954)	0.2346
2013-2014	6.0% (65/1,075)	4.7% (157/3,353)	0.0745
2014-2015	5.6% (67/1,202)	3.8% (129/3,414)	<b>0.0079</b>
2015-2016	5.5% (70/1,265)	4.8% (170/3,558)	0.2884
2016-2017	6.2% (77/1,248)	4.5% (154/3,452)	<b>0.0167</b>
2017-2018	5.4% (70/1,304)	4.2% (150/3,547)	0.0909
2018-2019	5.6% (51/913)	4.4% (113/2,569)	0.1458
<b>Total</b>	<b>5.6% (449/7,982)</b>	<b>4.4% (995/22,847)</b>	<b>&lt;0.0001</b>

#### Timing of operation (too late, too soon, wrong time of day)

Year	VASM	National	p value
2012-2013	6.7% (65/973)	5.5% (163/2,944)	0.1865
2013-2014	5.0% (53/1,066)	5.0% (168/3,344)	0.9459
2014-2015	6.5% (78/1,198)	5.6% (191/3,411)	0.2471
2015-2016	7.9% (99/1,261)	6.5% (231/3,555)	0.1023
2016-2017	6.8% (85/1,247)	5.7% (195/3,444)	0.1404
2017-2018	7.1% (93/1,303)	6.0% (213/3,540)	0.1552
2018-2019	5.0% (46/911)	4.9% (126/2,562)	0.8753
<b>Total</b>	<b>6.5% (519/7,959)</b>	<b>5.6% (1,287/22,800)</b>	<b>0.0042</b>

#### Intraoperative/technical management of surgery

Year	VASM	National	p value
2012-2013	5.8% (56/973)	3.7% (109/2,945)	0.1986
2013-2014	5.5% (59/1,070)	4.4% (145/3,333)	0.1152
2014-2015	6.0% (71/1,183)	4.4% (149/3,387)	<b>0.0266</b>
2015-2016	5.0% (63/1,253)	4.5% (157/3,528)	0.4017
2016-2017	5.7% (70/1,234)	4.6% (157/3,422)	0.1293
2017-2018	6.7% (86/1,290)	4.4% (156/3,521)	<b>0.0017</b>
2018-2019	4.0% (36/902)	3.8% (98/2,551)	0.8416
<b>Total</b>	<b>5.6% (441/7,905)</b>	<b>4.3% (971/22,687)</b>	<b>&lt;0.0001</b>

#### Grade/experience of surgeon deciding

Year	VASM	National	p value
2012-2013	0.8% (8/971)	1.0% (29/2,946)	0.6539
2013-2014	1.0% (11/1,069)	0.8% (28/3,334)	0.5657
2014-2015	0.9% (11/1,184)	1.0% (33/3,387)	0.8909
2015-2016	0.8% (10/1,257)	0.8% (29/3,540)	0.9360
2016-2017	0.8% (10/1,239)	0.7% (25/3,425)	0.7874
2017-2018	0.8% (10/1,290)	0.7% (25/3,524)	0.8120
2018-2019	0.7% (6/901)	0.7% (19/2,547)	0.8077
<b>Total</b>	<b>0.8% (66/7,911)</b>	<b>0.8% (188/22,703)</b>	0.9583

#### Grade/experience of surgeon operating

Year	VASM	National	p value
2012-2013	1.1% (11/970)	1.0% (28/2,942)	0.6202
2013-2014	1.3% (14/1,069)	1.5% (49/3,333)	0.7006
2014-2015	1.5% (18/1,185)	1.4% (46/3,386)	0.6858
2015-2016	1.0% (12/1,257)	0.9% (33/3,535)	0.9468
2016-2017	1.3% (16/1,240)	1.2% (41/3,421)	0.8010
2017-2018	0.9% (12/1,291)	1.1% (40/3,521)	0.5392
2018-2019	0.9% (8/900)	1.0% (25/2,543)	0.8031
<b>Total</b>	<b>1.2% (91/7,912)</b>	<b>1.2% (262/22,681)</b>	0.9714

## Postoperative care

Year	VASM	National	p value
2012-2013	7.6% (74/974)	5.6% (166/2,939)	<b>0.0280</b>
2013-2014	8.0% (85/1,063)	6.1% (202/3,324)	<b>0.0276</b>
2014-2015	7.9% (93/1,175)	6.1% (207/3,371)	<b>0.0349</b>
2015-2016	6.8% (85/1,255)	5.8% (205/3,534)	0.2149
2016-2017	7.5% (93/1,235)	6.5% (223/3,420)	0.2265
2017-2018	8.1% (104/1,286)	6.1% (215/3,513)	<b>0.0154</b>
2018-2019	4.8% (43/902)	4.7% (121/2,551)	0.9768
<b>Total</b>	<b>7.3% (577/7,890)</b>	<b>5.9% (1,339/22,652)</b>	<b>&lt;0.0001</b>

Bold entries indicate significant results ( $p < 0.05$  statistically significant using chi-squared tests).  
Victorian data was excluded from the national data pool for the comparison.

To encourage improvement, the audit office actively disseminates problems identified from the data to clinicians and healthcare services via educational events, hospital forums, committee meetings, individual feedback letters to the treating surgeon, hospital governance reports, scientific papers and newsletters.

It is envisaged that in 2020 VASM will provide a de-identified summary of the above cases to VPCC for a decision on whether to request a case review from the relevant hospital, when to perform a multidisciplinary review, and how to interact with that health service about the findings. These additional VASM and VPCC processes will increase educational and learning opportunities for surgeons, anaesthetists and all those involved in perioperative care. Health services will be encouraged to increase their level of perioperative mortality and morbidity review, thus providing better opportunities to address system issues affecting the safety and quality of services provided.

### 14.2 VASM and national trends in areas of clinical management issues

VASM outcomes and national trends in areas of clinical management issues can be a catalyst for clinical governance management in surgical health services as per the NSQHS Standards. Victorian findings in clinical management issues are compared with national data in Tables 9 and 10. Victorian consultant surgeons were present in **80.9%** (8,574/10,601) of operations compared to **74.6%** (20,255/27,148) nationally.



**Table 9: Clinical management comparisons between VASM and national cumulative data, 2012—2019**

Variable	VASM	National	p value
Audited deaths with delay in surgical diagnosis	6.8% (548/8,094)	6.7% (1,580/23,752)	0.7126
Audited deaths with delay in transfer	9.9% (168/1,705)	10.7% (601/5,631)	0.3330
Audited deaths without use of intensive care (ICU) or high dependency unit (HDU)	34.3% (2,784/8,115)	37.2% (8,870/23,819)	<b>&lt;0.0001</b>
Inappropriate DVT prophylaxis treatment as viewed by the assessor	1.6% (125/7,995)	1.8% (408/23,076)	0.2247
Proportion of elective admissions with elective surgery performed	85.4 (1,237/1,448)	81.8% (2,910/3,558)	<b>0.0019</b>
Operation with the consultant surgeon present in theatre	80.9% (8,574/10,601)	74.6% (20,255/27,148)	<b>&lt;0.0001</b>
Audited operative deaths with postoperative complications	33.6 (2,488/7,403)	33.1% (6,314/19,069)	0.4414
Audited operative deaths with unplanned return to theatre	15.5% (1,157/7,444)	16.0% (3,047/19,073)	0.3860
Audited deaths with unplanned admission to intensive care (ICU)	18.6% (1,500/8,045)	18.1% (4,256/23,461)	0.3124
Audited deaths with unplanned re-admission	3.4% (272/8,020)	3.0% (698/23,398)	0.0681
Audited deaths with fluid balance issues	8.1% (650/8,035)	7.2% (1,657/23,146)	<b>0.0060</b>
Audited deaths with a clinically significant infection	33.1% (2,633/7,955)	34.3% (7,994/23,302)	<b>0.0497</b>

Notes:

Audit period 1 July 2012 to 30 June 2019.

Denominator varies due to different criteria for each row.

Bold entries indicate significant results (p<0.05 statistically significant using chi-squared tests).

Victorian data was excluded from the national data pool for the comparison

**Table 10: Clinical management comparisons between VASM and national cumulative data, 2018—2019**

Variable	VASM	National	p value
Audited deaths with delay in surgical diagnosis	5.9% (54/920)	6.4% (172/2,667)	0.5327
Audited deaths with delay in transfer	7.7% (15/194)	9.7% (61/627)	0.4017
Audited deaths without use of intensive care (ICU) or high dependency unit (HDU)	36.1% (333/922)	39.2% (1,046/2,670)	0.0996
Inappropriate DVT prophylaxis treatment as viewed by the assessor	1.4% (13/919)	2.0% (51/2,570)	0.2692
Proportion of elective admissions with elective surgery performed	82.4% (126/153)	78.0% (283/363)	0.2611
Operation with the consultant surgeon present in theatre	81.7% (949/1,161)	75.8% (2,253/2,972)	<b>&lt;0.0001</b>
Audited operative deaths with postoperative complications	32.4% (268/828)	29.9% (641/2,143)	0.2015
Audited operative deaths with unplanned return to theatre	15.8% (132/833)	14.8% (318/2,153)	0.4610
Audited deaths with unplanned admission to intensive care (ICU)	18.5% (170/920)	17.2% (457/2,653)	0.3895
Audited deaths with unplanned re-admission	3.8% (35/916)	2.7% (71/2,647)	0.0804
Audited deaths with fluid balance issues	7.4% (68/922)	6.3% (162/2,578)	0.2511
Audited deaths with a clinically significant infection	33.2% (300/904)	34.3% (907/2,644)	0.5401

Notes:

Audit period 1 July 2018 to 30 June 2019.

Denominator varies due to different criteria for each row.

Bold entries indicate significant results (p<0.05 statistically significant using chi-squared tests).

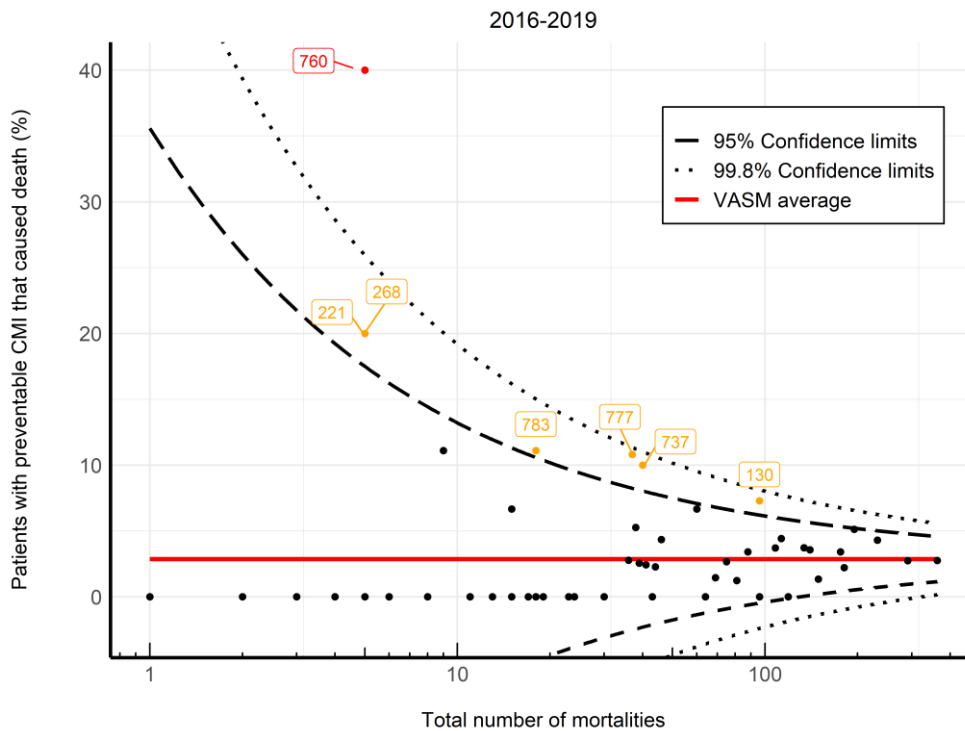
Victorian data was excluded from the national data pool for the comparison.

### 14.3 Continuous performance monitoring

Figures 20 and 21 show individual performance on preventable clinical management issues (as identified by VASM's independent peer-review assessment process), for hospitals with five or more deaths. It displays the number of closed cases for which the highest-level assessor believed there was at least one clinical management issue that was either definitely or probably preventable and which caused the death of a patient who would otherwise be expected to survive.

This analysis enables benchmarking and monitoring of clinical management trends within a hospital, and compares them against other participating peer-grouped hospitals, regionally and nationally. For educational purposes, VASM disseminates state and national Case Note Booklets with selected de-identified cases featuring clinical issues for improvement. VASM holds educational seminars to highlight important quality and safety issues identified through the audit, and imminent clinical areas requiring immediate improvements.

**Figure 20: Victorian hospital performance associated with preventable CMIs, 2016—2019**



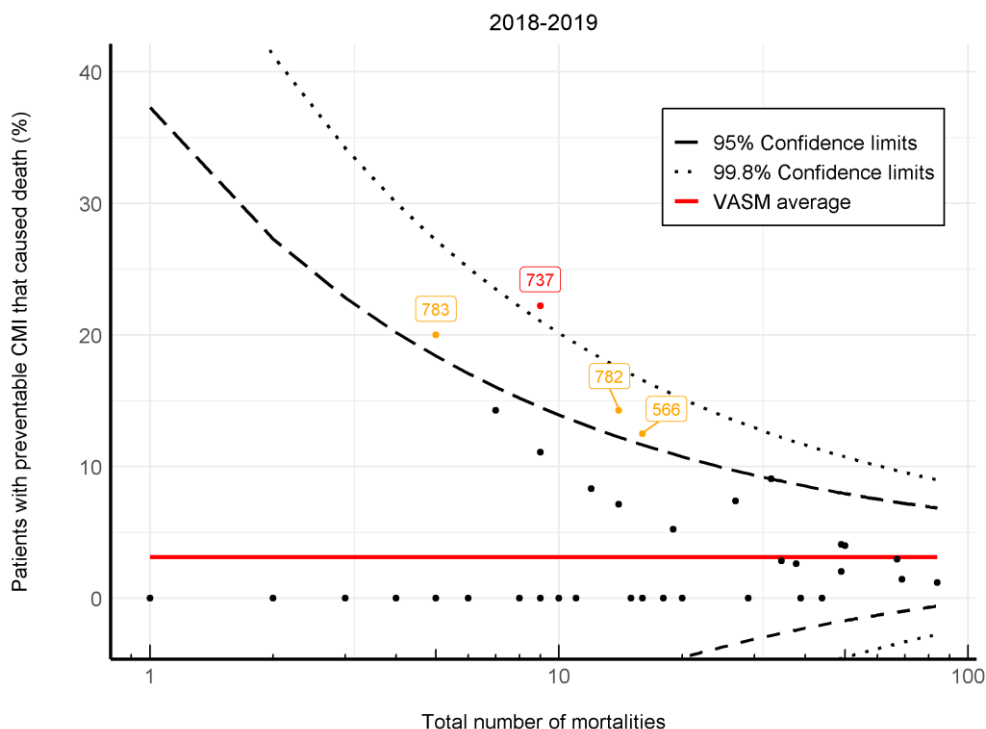
**Notes:**

Audit period 1 July 2016 to 30 June 2019.

IDs of outlier hospitals requiring monitoring of their surgical performance have been identified in orange and red. Orange hospital IDs fall outside the 95% confidence limit of the Victorian average for preventable CMIs. Red hospital IDs fall outside the 99.8% confidence limit of the Victorian average for preventable CMIs.

CMI: clinical management issue.

**Figure 21: Victorian hospital performance associated with preventable CMIs, 2018—2019**



**Notes:**

Audit period 1 July 2018 to 30 June 2019.

IDs of outlier hospitals requiring monitoring of their surgical performance have been identified in orange and red. Orange hospital IDs fall outside the 95% confidence limit of the Victorian average for preventable CMIs. Red hospital IDs fall outside the 99.8% confidence limit of the Victorian average for preventable CMIs.

CMI: clinical management issue.

In the current audit period, there was a decrease in the number of hospitals requiring monitoring of their surgical performance. Four hospitals having cases with preventable clinical management issues were

identified (one standard deviation above the Victorian mean), compared to seven hospitals identified in the period 2016—2019.

Hospitals identified in this quality assurance analysis and review have been advised to further investigate their surgical care based on the specific clinical management issues identified at their site. Most sites that were flagged in the 2016—2019 period have improved their surgical care in the current audited period. VASM and VPCC will closely monitor the outlying sites in 2019—2020 to ensure improvement strategies are implemented.

VASM's primary objective is the review of surgical deaths and assessment of surgical treatment provided. The audit is a dynamic ongoing educative and performance-monitoring process. If the assessment suggests that treatment was less than optimal, feedback is provided directly to the treating surgeon. A secondary objective is the identification of systemic issues and adverse trends in surgical care, such as DVT prophylaxis, management of the deteriorating patient, shared care, communication issues and shared care in surgical emergencies. Transfers will be the focus of further work in the future.

---

## 15 Concordant validity considerations

Completion of all fields in the SCF by the treating surgeon requires some self-reflection, such as where the treating surgeon is asked to nominate any areas of consideration, concern or adverse events emanating from his or her care of the patient. Such responses are compared to assessors' responses to the same question, and the degree of concordance calculated. Responses from first- and second-line assessors are also compared and the degree of concordance calculated.

Analysis of concordance is a method of studying inter-rater reliability in reporting on clinical management issues. Performing a full case note review on all reported deaths is not feasible for practical or logistical reasons. Gwet's AC1 score is presented in this report for better interpretation of inter-rater reliability analysis.<sup>(45)</sup> The Gwet score provides a more stable inter-rater reliability coefficient than does Cohen's Kappa and appears less affected by prevalence and marginal probability.

Outcomes of the concordance analyses are reassuring because they mirror the predicted outcomes. Disagreement between first- and second-line assessors was most marked in the areas of fluid balance; timing of the operation; decision to operate; preoperative, intraoperative and postoperative care; and clinical management. Second-line assessors perceived more issues than first-line assessors. This tendency of second-line assessors to be more critical of clinical management events was foreseeable, as they have access to an independent description of the episode of care.

The question of whether a particular patient should have surgery is complex and may have broader implications for surgical decision making.<sup>(46)</sup>

The following tables (Tables 11—13) present the level of agreement between the treating surgeon and the peer reviewers. The Gwet AC1 score is used to understand the difference between agreement levels beyond chance where:

- <0 = no agreement
- 0.00-0.19 = 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

High concordance levels were achieved between the treating surgeon and first-line assessor (Table 11), except for in clinical management issues. This was an expected finding and supports the value of independent peer review.

**Table 11: Concordant validity between treating surgeon and first-line assessor, 2012—2019**

Concordance area	n	Concordance	Gwet's AC1 score	95% CI	p value
ICU care benefit if not received	2,045	97.26%	0.97	0.96 - 0.92	<0.001
HDU care benefit if not received	1,979	92.27%	0.92	0.90 - 0.93	<0.001
Fluid balance	5,624	93.60%	0.92	0.91 - 0.93	<0.001
Clinical management issues	7,826	78.53%	0.65	0.63 - 0.66	<0.001
Preoperative management/preparation	7,282	89.18%	0.87	0.86 - 0.88	<0.001
Decision to operate at all	7,341	88.05%	0.86	0.85 - 0.87	<0.001
Choice of operation	7,331	93.37%	0.93	0.92 - 0.93	<0.001
Timing of operation	7,276	93.42%	0.93	0.92 - 0.93	<0.001
Intraoperative/technical management	7,185	94.25%	0.94	0.93 - 0.94	<0.001
Grade/experience of surgeon deciding	7,198	98.54%	0.99	0.98 - 0.99	<0.001
Grade/experience of surgeon operating	7,204	98.26%	0.98	0.98 - 0.99	<0.001
Postoperative care	7,130	92.50%	0.91	0.91 - 0.92	<0.001

## Notes:

A total of 8,145 surgical case forms and first-line assessments were available for analysis.

Audit period from 1 July 2012 to 30 June 2019.

CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

Clinical management issues were also the area of most disagreement between the treating surgeon and the second-line assessor (Table 12). It may be that treating surgeons are less objective when it comes to assessing the clinical management received by their own patients. This was an expected finding and supports the value of independent peer review.

**Table 12: Concordant validity between treating surgeon and second-line assessor, 2012-2019**

Concordance area	n	Concordance	Gwet's AC1 score	95% CI	p value
ICU care benefit if not received	215	88.37%	0.87	0.81 - 0.92	<0.001
HDU care benefit if not received	210	79.52%	0.73	0.65 - 0.82	<0.001
Fluid balance	1,260	83.25%	0.78	0.74 - 0.81	<0.001
Clinical management issues	1,515	54.52%	0.11	0.08 - 0.14	<0.001
Preoperative management/preparation	1,436	72.84%	0.59	0.55 - 0.63	<0.001
Decision to operate at all	1,447	78.99%	0.72	0.69 - 0.75	<0.001
Choice of operation	1,442	84.12%	0.81	0.78 - 0.83	<0.001
Timing of operation	1,435	82.65%	0.77	0.74 - 0.80	<0.001
Intraoperative/technical management	1,411	83.35%	0.79	0.76 - 0.82	<0.001
Grade/experience of surgeon deciding	1,414	96.75%	0.97	0.96 - 0.98	<0.001
Grade/experience of surgeon operating	1,416	96.05%	0.96	0.95 - 0.97	<0.001
Postoperative care	1,396	77.72%	0.69	0.65 - 0.72	<0.001

## Notes:

A total 1,533 surgical case forms and second-line assessments were available for analysis.

Audit period from 1 July 2012 to 30 June 2019.

CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

The Concordant validity between first- and second-line assessors is shown in Table 13. Disagreement was most marked in the use of the critical care unit (CCU/HDU), postoperative care, appropriate DVT prophylaxis and decision to operate at all. Second-line assessors perceived more issues than did first-line assessors. The tendency of second-line assessors to be more critical of clinical management was foreseeable, as they have the benefit of medical case notes.

Assessors evaluating the quality of decisions made by the treating surgeon during the course to patient death enables preventative measures to be implemented for prospective cases. It also allows for recommendations for improved surgical care to be delivered to the treating clinical teams.

**Table 13: Concordant validity between first-line assessor and second-line assessor, 2012-2019**

Concordance area	n	Concordance	Gwet's AC1 score	95% CI	p value
ICU care benefit if not received	139	84.17%	0.79	0.69 - 0.88	<0.001
HDU care benefit if not received	144	64.58%	0.39	0.23 - 0.55	<0.001
Appropriate DVT prophylaxis use	1,374	68.27%	0.52	0.47 - 0.57	<0.001
Fluid balance	663	82.05%	0.75	0.70 - 0.79	<0.001
Clinical management issues	1,321	73.20%	0.62	0.57 - 0.66	<0.001
Preoperative management/preparation	2,684	83.79%	0.71	0.68 - 0.74	<0.001
Decision to operate at all	1,257	72.87%	0.57	0.53 - 0.62	<0.001
Choice of operation	1,238	76.17%	0.65	0.61 - 0.69	<0.001
Timing of operation	1,193	76.03%	0.64	0.60 - 0.68	<0.001
Intraoperative/technical management	1,157	78.74%	0.68	0.64 - 0.72	<0.001
Grade/experience of surgeon deciding	1,166	93.31%	0.93	0.91 - 0.94	<0.001
Grade/experience of surgeon operating	1,176	92.09%	0.91	0.89 - 0.93	<0.001
Postoperative care	1,126	71.14%	0.51	0.46 - 0.56	<0.001

Notes:

A total of 1,533 cases with first-line assessments sent for second-line assessment were available for analysis.

Audit period from 1 July 2012 to 30 June 2019.

CI: confidence interval; DVT: deep vein thrombosis; HDU: high dependency unit; ICU: intensive care unit

---

## 16 Conclusion

In this report, VASM has demonstrated trends in clinical management issues related to surgical deaths over the last 10 years of the audit. Although it is positive to see a reduction in the number of identified preventable clinical management issues, the identified issues highlight ongoing opportunities for system-wide improvements.

The number of hospital outliers has decreased, with fewer hospitals being highlighted because of high rates of preventable issues. This further indicates that appropriate measures are being taken by individual hospitals to improve their performance and their overall management of surgical patients.

VASM, together with the support of the VPCC and Victorian hospitals, will continue to monitor preventable clinical management issues as a helpful measure for ensuring the highest standard of safe and comprehensive surgical care in Victoria.



---

## 17 Future goals for VASM

Over the past 12 years there has been a great deal of progress in quality and safety monitoring across Victoria. One of the most significant changes during this period occurred after several neonatal deaths raised questions about the health system's capacity to successfully monitor adverse events causing harm to Victorians.

SCV was established to achieve this objective and minimise avoidable harm that could occur across the Victorian public health care system. A key mandate of SCV is to make better use of existing information—including information arising from VASM—to guide improvements in patient care.

Many of the core objectives of SCV are already aligned to the work of the audit. VASM has developed successful partnerships with clinicians to review and respond to episodes of surgical deaths across the state. However, potential improvements to the VASM audit process were identified, and implementation of these improvements commenced during 2019.

Recommendations made following the recent Aspex Evaluation of VASM are presented here as our new goals, which we see as strengthening the capacity of VASM. We anticipate further stakeholder collaboration, with educational events and contributions to the quality and safety improvements of surgical interventions across the Victorian health sector. The new goals are:

- Improved collaboration with SCV for information-sharing in Victoria
- Presentation of VASM information to consumers
- Development of a fast-tracking method for cases having potentially preventable adverse events
- Reporting of information about the care pathway identified in the peer-reviewed feedback to individual surgeons, hospitals and other stakeholders
- Identification of changes in clinical management to be implemented by the treating surgeon and the shared-care team in response to the peer-reviewed outcome of a case, based on evaluation surveys received from the treating surgeon once feedback is provided
- Development of a system for expediting and triaging mortality cases flagged for urgent multidisciplinary panel review by the new VPCC

---

## 18 References

1. Safer Care Victoria. The Victorian Perioperative Consultative Council. Available from: <https://www.bettersafecare.vic.gov.au/about-us/about-scv/councils/vpcc>.
2. Duckett SJ, Cuddihy M, Newnham H. Targeting zero. Review of Hospital Safety and Quality Assurance in Victoria 2016. Available from: <https://www.dhhs.vic.gov.au/publications/targeting-zero-review-hospital-safety-and-quality-assurance-victoria>.
3. State of Victoria. Public Health and Wellbeing Act 2008 (in force amendment dated 17/5/20). Available from: <https://www.legislation.vic.gov.au/in-force/acts/public-health-and-wellbeing-act-2008/040>.
4. Watters DA, Scott D. The Victorian Perioperative Council Report, May 2019. Available from: <https://www.bettersafecare.vic.gov.au/reports-and-publications/the-victorian-perioperative-consultative-council-report>.
5. Australian and New Zealand Hip Fracture Registry. ANZ Guideline for Hip Fracture Care. Available from: <https://anzhfr.org/guidelines-and-standards/>.
6. Royal Australasian College of Surgeons. Australian and New Zealand Emergency Laparotomy Audit – Quality Improvement. Available from: <https://www.surgeons.org/research-audit/morbidity-audits/morbidity-audits-managed-by-racs/anz-emergency-laparotomy-audit-quality-improvement>.
7. Australian Commission on Safety and Quality in Health Care. Hospital-acquired complications. Available from: <https://www.safetyandquality.gov.au/our-work/indicators/hospital-acquired-complications>.
8. Meara JG, Leather AJ, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386(9993):569-624
9. Victorian Audit of Surgical Mortality. Case Note Review Booklet Melbourne: *Royal Australasian College of Surgeons*; 2016. Available from: <https://www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm/vasm/#CNRB>.
10. Victorian Audit of Surgical Mortality. Reports and publications: Annual Reports Melbourne: *Royal Australasian College of Surgeons*; 2019. Available from: [https://www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm/vasm/#Reports\\_and\\_Publications](https://www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm/vasm/#Reports_and_Publications).
11. Aspex Consulting. Review of the Victorian Audit of Surgical Mortality Melbourne: *Royal Australasian College of Surgeons*; 2018. Available from: <https://www.surgeons.org/media/25748546/2018-12-06-aspex-final-report.pdf>.
12. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards: Second edition Sydney: *Australian Commission on Safety and Quality in Health Care*; 2019. Available from: <https://www.safetyandquality.gov.au/wp-content/uploads/2017/12/National-Safety-and-Quality-Health-Service-Standards-second-edition.pdf>.
13. Victorian Audit of Surgical Mortality. Case Note Review Booklet Melbourne: *Royal Australasian College of Surgeons*; 2019. Available from: <https://www.surgeons.org/for-health-professionals/audits-and-surgical-research/anzasm/vasm/#CNRB>.
14. Royal Australasian College of Surgeons. End of life care Melbourne: *Royal Australasian College of Surgeons*; 2017. Available from: [https://www.surgeons.org/media/24971463/2017-07-28\\_pos\\_fes-pst-057\\_end\\_of\\_life\\_care.pdf](https://www.surgeons.org/media/24971463/2017-07-28_pos_fes-pst-057_end_of_life_care.pdf).
15. Australian Commission on Safety and Quality in Health Care. Australian Guidelines for the Prevention and Control of Infection in Healthcare 2010 Sydney: *Australian Commission on Safety and Quality in Health Care*; 2016. Available from: <http://www.safetyandquality.gov.au/our-work/healthcare-associated-infection/national-infection-control-guidelines/>.

16. Australian Commission on Safety and Quality in Health Care. Preventing Falls and Harm from Falls in Older People: Best Practice Guidelines 2009 Sydney: *Australian Commission on Safety and Quality in Health Care*; 2016. Available from: <http://www.safetyandquality.gov.au/our-work/falls-prevention/falls-prevention-resources/>.
17. Department of Health & Human Services. Victorian Admitted Episodes Dataset: 2017-18 VAED manual State of Victoria: *Department of Health & Human Services*; 2017. Available from: <https://www2.health.vic.gov.au/hospitals-and-health-services/data-reporting/health-data-standards-systems/data-collections/vaed>.
18. American Society of Anesthesiologists (ASA). *ASA Physical Status Classification System* Park Ridge, Illinois. 2017. Available from: <http://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>.
19. Carpenter B , Tait G, Jonsson L, Peschl H, Naylor C, Bermudez-Ortega A. The role of coronial autopsies in a context of decreasing hospital autopsies: an investigation of the issues. *J Law Med.* 2010;18(2):402-12.
20. Zardawi I. Coronial autopsy in a rural setting. *J Forensic Leg Med.* 2013;20(7):848-51.
21. Neate S, Bugeja L, Jelinek G, Spooner H, Ding L, Ranson D. Non-reporting of reportable deaths to the coroner: when in doubt, report. *MJA.* 2013;199(6):402-5.
22. Sutherland G, Kemp C, Bugeja L, Sewell G, Pirkis J, Studdert DM. What happens to coroners' recommendations for improving public health and safety? Organisational responses under a mandatory response regime in Victoria Australia: *BioMed Central*; 2014. Available from: <http://www.biomedcentral.com/1471-2458/14/732>.
23. Pham C, Gibb C, Field J, Gray J, Fitridge R, Marshall V, et al. Managing high-risk surgical patients: modifiable co-morbidities matter. *ANZ J Surg.* 2014;84(12):925-31.
24. Hansen D, Retegan C, Woodford N, Vinluan J, Beiles CB. Comparison of the Victorian Audit of Surgical Mortality with coronial cause of death. *ANZ J Surg.* 2015;86(6).
25. Charles A, Cross W, Griffiths D. What do clinicians understand about deaths reportable to the Coroner? *J Forensic Leg Med.* 2017;51:76-80.
26. Wilkinson K, Martin IC, Gough MJ, Stewart JAD, Lucas SB, Freeth H, et al. An Age Old Problem: A review of the care received by elderly patients undergoing surgery. *National Confidential Enquiry into Patient Outcome and Death* [Internet]. 2010:[1-17 pp.]. Available from: [http://www.ncepod.org.uk/2010report3/downloads/EESE\\_fullReport.pdf](http://www.ncepod.org.uk/2010report3/downloads/EESE_fullReport.pdf).
27. Rural Doctors Association of Victoria [Internet]. Retrieval: Victorian rural emergency retrieval Victoria: *Rural Doctors Association of Victoria*; 2011 [updated 20 May 2008; cited 2011 28 November 2011]. Available from: <http://www.rdav.com.au/>.
28. Royal Australasian College of Surgeons. Rural Surgery Melbourne. The Royal Australasian College of Surgeons; 2019. Available from: <https://www.surgeons.org/member-services/interest-groups-sections/rural-surgery>.
29. National Health and Medical Research Council. *Clinical practice guideline for the prevention of venous thromboembolism in patients admitted to Australian hospitals*. Melbourne: National Health and Medical Research Council 2009.
30. Azboy I, Kheir M, Huang R, Parvizi J, Aspirin provides adequate VTE prophylaxis for patients undergoing hip preservation surgery, including periacetabular osteotomy, *Journal of Hip Preservation Surgery*, 2018; 5(2):125–130.
31. Worth LJ, Bull AL, Spelman T, Brett J, Richards MJ. Diminishing surgical site infections in Australia: time trends in infection rates, pathogens and antimicrobial resistance using a comprehensive Victorian surveillance program, 2002-2013. *Infect Control Hosp Epidemiol.* 2015;36(4):409-16.
32. Royal Australasian College of Surgeons. Prevention of Healthcare Associated Infection in Surgery Melbourne: *Royal Australasian College of Surgeons*; 2015. Available from:

33. Worth LJ, Spelman T, Bull AL, Richards MJ. A major reduction in hospital-onset Staphylococcus aureus bacteremia in Australia: a question of definition. *Clin Infect Dis*. 2014;59(12):1808-9.
34. Worth LJ, Spelman T, Bull AL, Richards MJ. Staphylococcus aureus bloodstream infection in Australian hospitals: findings from a Victorian surveillance system. *Med J Aust*. 2014;200(5):282-4.
35. Tarrant SM, Balogh ZJ. Low-energy falls. *ANZ J Surg*. 2015;85(4):202-3.
36. Victoria State Government. Falls prevention in hospital. Available from: <https://www2.health.vic.gov.au/hospitals-and-health-services/patient-care/older-people/falls-mobility/falls/falls-preventing>.
37. Cunningham J WD, Robinson KM and Paul L,. A comparison of state and national Australian data on external cause of injury due to falls. *Health Information Management Journal*. 2013;42(3).
38. Clarke HD, Timm VL, Goldberg BR, SJ H. Preoperative Patient Education Reduces In-hospital Falls After Total Knee Arthroplasty. *Clin Orthop Relat Res*. 2012;470(1):244-9.
39. NHMRC Centre for Research Excellence in Patient Safety (CREPS), National E-Health Transition Authority (NEHTA), Monash University. Operating Principles and Technical Standards for Australian Clinical Quality Registries. *Australian Commission on Safety and Quality in Health Care*.; 2008.
40. Shum HP, Lee FMH, Chan KC, Yan WW. Interaction between fluid balance and disease severity on patient outcome in the critically ill. *J Crit Care*. 2011;26(6):613-9.
41. Shiga T, Wajima Z, Ohe Y. Is operative delay associated with increased mortality of hip fracture patients? Systematic review, meta-analysis, and meta-regression. *Can J Anaesth*. 2008;55(3):146-54.
42. Hauck K, Zhao X, Jackson T. Adverse event rates as measures of hospital performance. *Health Policy*. 2011.
43. Ricci WM, Brandt A, McAndrew C, Gardner MJ. Factors Affecting Delay to Surgery and Length of Stay for Hip Fracture Patients. *J Orthop Trauma* [Internet]. 2014 Sep 2. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25186844>.
44. Soliman BAB, Stanton R, Sowter S, Rozen WM, Shahbaz S. Improving operating theatre efficiency: an intervention to significantly reduce changeover time. *ANZ J Surg*. 2012;83:545-8.
45. Wongpakaran N, Wongpakaran T, Wedding D, Gwet KL. A comparison of Cohen's Kappa and Gwet's AC1 when calculating inter-rater reliability coefficients: a study conducted with personality disorder samples. *BMC Medical Research Methodology*. 2013;13(61):1-7.
46. Kruser J, Pecanac KE, Brasel KJ, Coper Z, Steffens NM, McKneally MF, et al. "And I Think That We Can Fix It": Mental models used in high-risk surgical decision making. *Ann Surg*. 2015;261(4):678-84.





Royal Australasian College of Surgeons  
**Victorian Audit of Surgical Mortality**

