# ANZASM National Report

2017-2018

(including a 10-year review)


Royal Australasian College of Surgeons

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

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

# CONTACT

**Royal Australasian College of Surgeons**

**Australian and New Zealand Audit of Surgical Mortality**

Address: 24 King William Street
Kent Town SA 5067
Australia

**Surgical Audits Manager**
Dr Helena Kopunic

**Research Officer**
Dr Lettie Pule

Telephone: +61 8 8219 0932

Email: **anzasm.racs@surgeons.org**

Website: http://www.surgeons.org

The information contained in this annual report has been prepared on behalf of the Royal Australasian College of Surgeons, Australian and New Zealand Audit of Surgical Mortality Steering 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

# LIST OF TABLES

# LIST OF FIGURES

# CHAIR'S REPORT

The ANZASM National Report again provides interesting and important observations regarding the care of surgical patients within the Australian community.

The ANZASM audit is a large, complex and expensive collection of data from all states and territories within Australia, gained with the support of the various jurisdictions in which surgical care is delivered. The Royal Australasian College of Surgeons co-ordinates and oversees the activity of the ANZASM audits and surgical participation is at 99% at the end of 2018. This engagement of the surgeons within this process makes the data generated of enormous value and relevance to the care of the patients managed by the Australian Surgical Community.

This report provides some overview of the last 10 years to see trends that have occurred during this time.

Deaths following emergency admissions have slightly decreased, however there has been a corresponding increase in elective surgery mortality.

The ASA grade of >4 has moved from 59% in 2009 through to 63.6% in 2018, reflecting on the difficult population undergoing surgical interventions leading to mortality.

The inappropriate use of DVT prophylaxis has stabilised at about 2%, which is almost a halving of that found in 2009.

There has been further improvement in the management of fluid balance and an overall reduction in death from patients with postoperative complications.

Of concern is the challenge faced with inter-hospital transfer problems due to delays, which has been stubbornly fixed at about 11% over the entire decade. How this can be best managed and remedied needs further research and is likely to be the product of a number of publications over the next 12 months.

Overall, second line assessments are being performed on 15% of cases, although variation does appear between various jurisdictions and this will need further evaluation going forward.

Maintaining and delivering an effective Audit of Australian Surgical Mortality is a challenge and the high quality of the data rests with the outstanding teams located in each state and territory, as well as the Clinical Directors who provide direction, oversight and guidance to the audit activities. These surgeons are constantly called on to deal with challenging bureaucracies, difficult colleagues and a changing landscape of risk, audit and jurisdictional requirements. These challenges are certainly not diminishing and there will be ongoing debate about the role of Qualified Privilege for the data that is collected and how to best manage outliers that may, from time to time, become apparent and need further assessment and investigation. The Royal Australasian College of Surgeons has an obligation to provide leadership in assessing death within surgical care but in a fair, constructive and educational fashion, designed not to police but to improve outcomes for patients cared for by surgeons of the College.

Any feedback or observations based on this report will always be gratefully received and responded to.

**Professor Guy Maddern**
Chair
Australian and New Zealand Audit of Surgical Mortality (ANZASM)

# ABBREVIATIONS

| | |
|---|---|
| ACT | Australian Capital Territory |
| ACTASM | Australian Capital Territory Audit of Surgical Mortality |
| ANZASM | Australian and New Zealand Audit of Surgical Mortality |
| ASA | American Society of Anesthesiologists |
| ASM | Audit of Surgical Mortality |
| CHASM | Collaborating Hospitals Audit of Surgical Mortality |
| CRP | C-reactive protein |
| CT | computed tomography |
| DVT | deep vein thrombosis |
| ERAS | enhanced recovery after surgery |
| FLA | first-line assessment |
| ICU | intensive care unit |
| INR | International normalised ratio |
| IV | Intravenous |
| MDT | Multidisciplinary team |
| NBM | Nil by mouth |
| NGT | nasogastric tube |
| NSW | New South Wales |
| NT | Northern Territory |
| NTASM | Northern Territory Audit of Surgical Mortality |
| QASM | Queensland Audit of Surgical Mortality |
| QLD | Queensland |
| RAAS | Research, Audit and Academic Surgery |
| RACS | Royal Australasian College of Surgeons |
| RANZCOG | The Royal Australian and New Zealand College of Obstetricians and Gynaecologists |
| SA | South Australia |
| SAASM | South Australian Audit of Surgical Mortality |
| SCF | surgical case form |
| SLA | second-line assessment |
| TAS | Tasmania |
| TASM | Tasmanian Audit of Surgical Mortality |
| VASM | Victorian Audit of Surgical Mortality |
| VIC | Victoria |
| WA | Western Australia |
| WAASM | Western Australian Audit of Surgical Mortality |

# EXECUTIVE SUMMARY

## Background

The Australian and New Zealand Audit of Surgical Mortality (ANZASM) is an independent, external peer review of surgical mortality in all states and territories of Australia.

The audit of surgical mortality in each state or territory – Australian Capital Territory Audit of Surgical Mortality (ACTASM), Northern Territory Audit of Surgical Mortality (NTASM), Queensland Audit of Surgical Mortality (QASM), South Australian Audit of Surgical Mortality (SAASM), Tasmanian Audit of Surgical Mortality (TASM), Victorian Audit of Surgical Mortality (VASM) and Western Australian Audit of Surgical Mortality (WAASM) – is funded by its respective department of health.

The Collaborating Hospitals Audit of Surgical Mortality (CHASM) in New South Wales (NSW) runs a comparable audit program and collects similar data to ANZASM. CHASM is independently managed by the Clinical Excellence Commission of NSW. CHASM data was not available to ANZASM at the time of this report; thus, NSW data is not included in the ANZASM national data in this report.

By identifying clinical management issues via independent peer-review assessments, the audit aims to ensure the highest standards of safe and comprehensive surgical care to actively improve patient safety.

## Surgeon participation

Surgeon participation in the audit had reached 99.0% by the end of 2018.

## Hospital participation

All public and private hospitals in Australia participated in the audit except for NSW.

## Analysis and audit numbers

This report contains a comparative analysis of cases reported to ANZASM from 1 January 2009 to 31 December 2018 to illustrate changes over time. The data from 2009 to 2018 has been updated from the previous report (2016)[1] by adding cases completed for the current audit period, 1 January 2017 to 31 December 2018. This reflects the continuous nature of data collection and reporting requirements of the audit. A total of 7,242 cases completed the audit process during this audit period (1 January 2017 – 31 December 2018). Cases still under review will be captured in the next report.

From 1 January 2009 to 31 December 2018, a total of 42,412 notifications of death associated with surgical care were reported to ANZASM. Of these, 77.3% (32,803/42,412) had completed the audit process by the census date of 31 March 2019. The remaining 22.7% (9,609/42,412) were unable to be included in the audit due to the following reasons:

- The case was admitted for terminal care (4,812), inappropriately attributed to surgery (1,345), lost to follow-up (1,679), or treated by surgeons who are either not participating in the audit, not Fellows of the Royal Australasian College of Surgeons (RACS) or are members of other colleges not participating in ANZASM (1,516).

- The case had not completed the full surgical audit process at census date (257).

Other data were unavailable due to incomplete information provided in surgical case forms (SCFs), and this is noted in the text when relevant. The clinical information from all completed cases provides the patient profiles described in this report.

## Demographic profile of audited cases

Between 2009 and 2018 the median age for the 32,803 fully audited cases was 77 years (interquartile range [IQR] 66–85), ranging from 1 day to 105 years. Males represented 55.9% (18,342/32,798) of cases (sex unavailable n = 5).

## Risk profile of audited cases

More than three-quarters (85.5%; 27,805/32,507) of audited deaths occurred in patients admitted as emergency cases with acute life-threatening conditions, and 89.8% (28,997/32,277) of patients had at least one significant coexisting illness.

## Risk management

The use of deep vein thrombosis (DVT) prophylaxis was recorded for 78.7% (25,029/31,793) of cases. First- and second-line assessors concluded that the DVT prophylaxis management was inappropriate in only 2.3% (810/35,312) of cases over the entire audit period (2009–2018).

According to treating surgeons, critical care support was deemed necessary in 64.0% (19,717/30,800) of cases; however, in 7.4% (738/9,215) of cases in which patients received no critical care, reviewers felt that the patient may have benefited from it. The current audit dataset does not enable identification of the reasons why critical care support may have been of benefit.

## Profile of operative intervention

In total, 79.6% (26,064/32,763) of patients underwent a surgical procedure. A total of 33,148 separate surgical episodes were recorded for these patients, demonstrating that an individual patient can have more than one visit to the operating theatre during a single admission. The consultant surgeon made the decision to operate in 94.5% (32,114/33,982) of cases and performed the surgery in 69.5% (23,631/33,982) of cases.

Of the patients who had surgery, 16.1% (4,061/25,174) had an unplanned return to the operating theatre because of complications.

## Patient transfers

Despite some improvement, there are still issues involving the transfer of patients to other hospitals. Between 1 January 2009 and 31 December 2018, 11.0% (867/7,867) of transfer issues were related to transfer delay, 6.0% (473/7,910) to inappropriateness of transfer, 5.1% (394/7,694) to insufficient clinical documentation and 2.8% (217/7,712) to inappropriate level of care. Insufficient clinical documentation is an issue of concern, given the necessity of all involved clinicians having a complete clinical history of a patient upon presentation.

## Peer-review outcomes

In total, 15.0% (4,924/32,730) of audited cases were referred for second-line assessment (SLA) during the audit period. The referral rate for SLA varied among audit of surgical mortality (ASM) regions. Referral for SLA is not a reliable measure of the incidence of clinical issues, as referral may be due to inadequate information in the SCF. Inadequate information was the reason for referral to SLA in 69.5% (3,418/4,916) of audited cases referred for SLA.

The 2 most common criticisms made by assessors were operative management issues and delays in implementing definitive treatment. Of the total delays, 45.0% (1.012/2,248) were attributed to the surgical team. This finding has led each state and territory ASM to develop and deliver a series of educational programs aimed at surgeons and junior and senior hospital staff to address the various facets of delay and communication.

Clinical management issues (CMI) were reported in 33.0% (12,051 /36,556) of patients. Of these, 12.7% (1,527/12,051) were classified as adverse events in patient care.

## Comparison of data between the 2009 to 2018 audit periods

| Table 1: National comparison, 2009 to 2018 audit periods | | | | | |
|---|---|---|---|---|---|
| | Calendar years | | | | |
| **Areas for national comparison** | **2009–2010** | **2011–2012** | **2013–2014** | **2015–2016** | **2017–2018** |
| Closed cases | 5,243 | 6,017 | 6,986 | 7,315 | 7,242 |
| Admissions: Emergency | 87.2% | 87.0% | 84.4% | 84.8% | 85.0% |
| Elective | 12.8% | 13.0% | 15.6% | 15.2% | 15.0% |
| Gender: Male | 54.5% | 55.8% | 55.7% | 56.1% | 57.0% |
| Female | 45.5% | 44.2% | 44.3% | 43.9% | 43.0% |
| Median age (IQR*): Male | 76(20) | 76(21) | 76(20) | 76(20) | 75(21) |
| Female | 81(18) | 81(19) | 80(20) | 79(20) | 78(21) |
| ASA** grade ≥4 | 58.8% | 59.9% | 60.2% | 60.9% | 63.6% |
| Admitted with one or more comorbidities | 91.2% | 89.8% | 90.0% | 89.7% | 88.9% |
| Cases with perceived risk of death considerable or expected, as perceived by surgeon | 64.6% | 64.2% | 61.7% | 61.7% | 61.4% |
| DVT^ prophylaxis use assessed as inappropriate by assessor | 3.6% | 2.5% | 1.9% | 1.9% | 2.1% |
| Issues with fluid balance | 9.1% | 7.1% | 6.8% | 8.0% | 7.7% |
| Patients who had at least one procedure∞ | 73.1% | 74.6% | 77.6% | 82.2% | 82.4% |
| Consultant deciding to operate | 94.5% | 94.6% | 94.7% | 94.6% | 94.2% |
| Patients with unplanned return to theatre | 15.7% | 16.2% | 16.6% | 16.1% | 15.8% |
| Patients with postoperative complications | 35.6% | 35.1% | 35.2% | 33.3% | 31.8% |
| Patients with anaesthetic-related issues | 7.7% | 7.9% | 6.7% | 8.1% | 7.7% |
| Surgical procedures abandoned | 5.4% | 5.7% | 5.0% | 5.0% | 5.7% |
| Patients transferred | 28.0% | 27.4% | 25.4% | 26.4% | 26.1% |
| Interhospital transfer problems due to delays | 11.7% | 11.3% | 10.3% | 10.8% | 11.2% |
| Clinically significant infections† | 23.6% | 34.6% | 33.9% | 34.2% | 34.3% |
| Request for second-line assessment | 15.0% | 13.4% | 14.3% | 15.7% | 16.5% |
| Areas of concern and adverse events | 16.9% | 14.3% | 13.7% | 15.1% | 15.7% |

*Interquartile range
**American Society of Anesthesiologists physical status classification system
^ Deep vein thrombosis
∞ Patient underwent an episode of surgery during final admission or within 30 days prior to death
† ANZASM started collecting data on infections from 2012
Note: Apparent increases in some categories (e.g. clinically significant infections, incidence of falls) reflect improvements to data collection methods from 2010 rather than absolute increases.

## Recommendations and key points

The recommendations and key points are as follows:

- ANZASM audit staff to continue encouraging active participation in the audit of surgeons and hospitals, now close to 100% for surgeons and at 100% for public and private hospitals (not including NSW).

- ANZASM audit staff to continue identifying emerging trends in mortality and address where possible through ongoing education and interactive seminars.

- ANZASM to prepare and deliver the National Case Note Review Booklet themed on topical issues such as the impact of obesity on surgery, issues around anticoagulation, delay in patient care, and transfer issues.

- Clinical information upon handover, delays in transfer, and procedure-related sepsis are ongoing issues that need to be addressed. Improving patients' management records and communication between surgeons and their junior staff, between disciplines, and between nursing and medical staff will enhance the quality and effectiveness of communication.

- To improve the quality of care and patient safety, all health professionals should increase their awareness of the greater risks for patients experiencing shared care. The audit revealed that the risk of surgical emergencies, especially those arising from transfer delays and clinical handover between teams, is greater for patients where care is shared: for example, where a patient is transferred from a nursing home to a public hospital.

- Delays in the decision to operate remain an ongoing issue. In complex cases there needs to be clear demonstrable leadership in patient management. There should be regular team meetings with all disciplines involved to ensure the treatment plan is understood by all. Consultants should continue to be actively involved in the care of their patients, especially in the decision-making process.

- Continued improvement in postoperative management. Patients should be discharged to the ward with comprehensive orders, including preventative measures for reducing complications. Instructions must be provided for further management when patients are discharged from a clinical or surgical team. Potential outcomes from a probable clinical diagnosis must be considered when developing a treatment plan.

- Patients should be transferred to a medical unit if elderly (age 65 years and above), high risk or if medical issues are assessed as being the prominent clinical factor during the admission episode, provided that surgical postoperative care can be performed appropriately in that setting.

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

- Periodic review of the SCF to reduce 'form fatigue', without detracting from the value of the data collection.

- Closer collaboration with respective state and territory departments of health following the release of the ANZASM Clinical Governance Report. The report uses audit data to provide departments of health and hospitals (public and private) with a trending analysis of clinical management events both within their hospitals and compared to state and national data.

- Continual review of surgical mortality rates to ascertain whether the audit process has contributed to the reduction of surgical mortality across the country. Audit review could identify trends and areas in which further perioperative improvements can be made in collaboration with the departments of health.

# 1. INTRODUCTION

| KEY POINTS |
|---|
| • ANZASM is an independent, external, surgeon-led, peer-review audit of patient deaths that have occurred under surgical care.<br>• This report is a review of all deaths notified during the period 1 January 2009 to 31 December 2018.<br>• This report is an analysis of the 32,803 cases that underwent the full audit process. |

## 1.1 Background

The Royal Australasian College of Surgeons (RACS) assumed responsibility for the management of the Western Australian Audit of Surgical Mortality (WAASM) in 2005. WAASM was modelled on the Scottish Audit of Surgical Mortality, which had operated since 1988. Under the umbrella of ANZASM, RACS expanded the program to all other Australian states and territories.

This report includes fully audited cases for the period 1 January 2009 to 31 December 2018 from Western Australia, South Australia, Tasmania, Victoria and Queensland; however, the Australian Capital Territory and the Northern Territory joined the program in 2010.

## 1.2 Objectives

The principal aims of the audit are to inform, educate, facilitate change and improve quality of practice within surgery. The primary mechanism is peer review of all deaths associated with surgical care. The audit process is designed to highlight system and process errors, and to identify trends in surgical mortality. It is intended as an educational rather than a punitive process.

## 1.3 Structure and governance

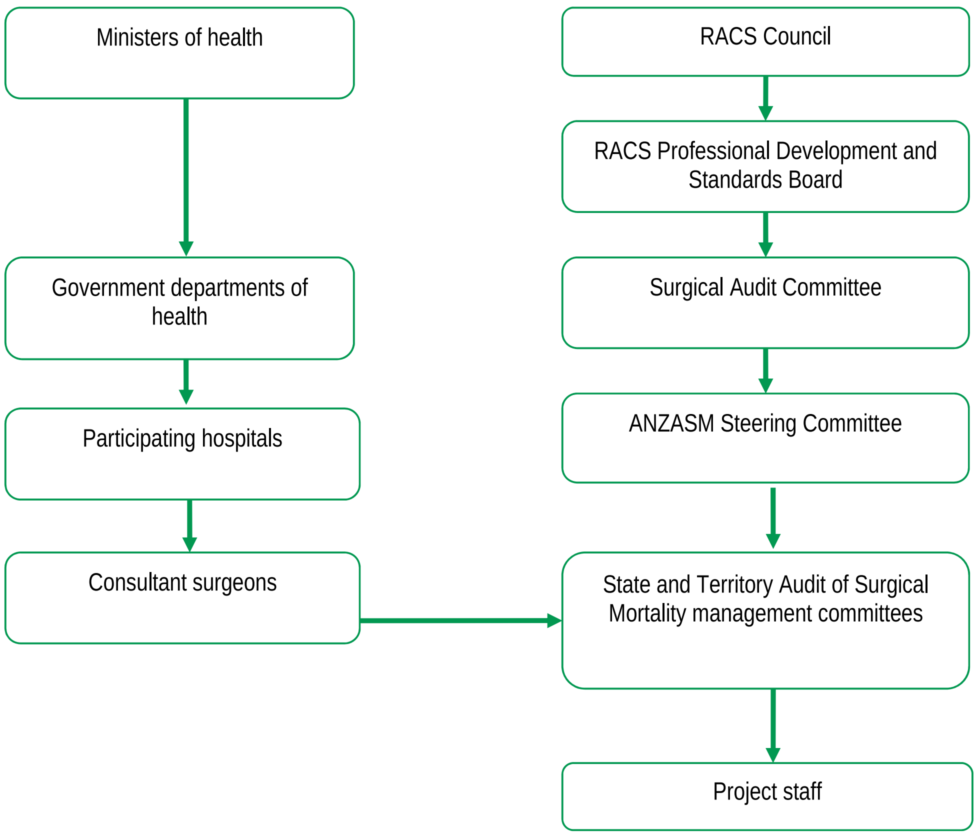
ANZASM is managed by the Research, Audit and Academic Surgery in the Fellowship Engagement Portfolio of RACS. ANZASM oversees the implementation and standardisation of each state and territory audit to ensure consistency in audit processes and governance structure across all jurisdictions (Figure 1).

The individual state and territory audits are funded by their respective departments of health. RACS provides infrastructure support and oversight to the project.

Participation by surgeons has been mandated as part of the RACS Continuing Professional Development (CPD) program since January 2010 and by the Australian Orthopaedic Association (AOA) since 2017.

ANZASM receives protection under the Commonwealth Qualified Privilege Scheme, Part VC of the Health Insurance Act 1973 (gazetted 25 July 2016).

**Figure 1: Governance structure of the Australian and New Zealand Audit of Surgical Mortality (ANZASM)**




RACS: Royal Australasian College of Surgeons; ANZASM: Australian and New Zealand Audit of Surgical Mortality.

## 1.4 Methodology

Individual state and territory audits of surgical mortality are notified of in-hospital deaths associated with surgical care. The method of notification varies by ASM region. Notifications can come from the departments of health, hospitals, or surgeons can self-report a death. All cases in which a surgeon was responsible for, or had significant involvement in, the care of a patient is included in the audit, whether or not the patient underwent a surgical procedure.

Clinical details pertaining to the management of each case are recorded on a standard, structured SCF that is completed by the consultant or treating surgeon associated with the case. The completed SCF is returned to the appropriate audit of surgical mortality (ASM) office, where it is de-identified and sent for first-line assessment (FLA) by a surgeon of the same surgical specialty but from a different hospital. De-identification means the first-line assessor is unaware of the name of the deceased, the treating surgeon or the hospital in which the death occurred.

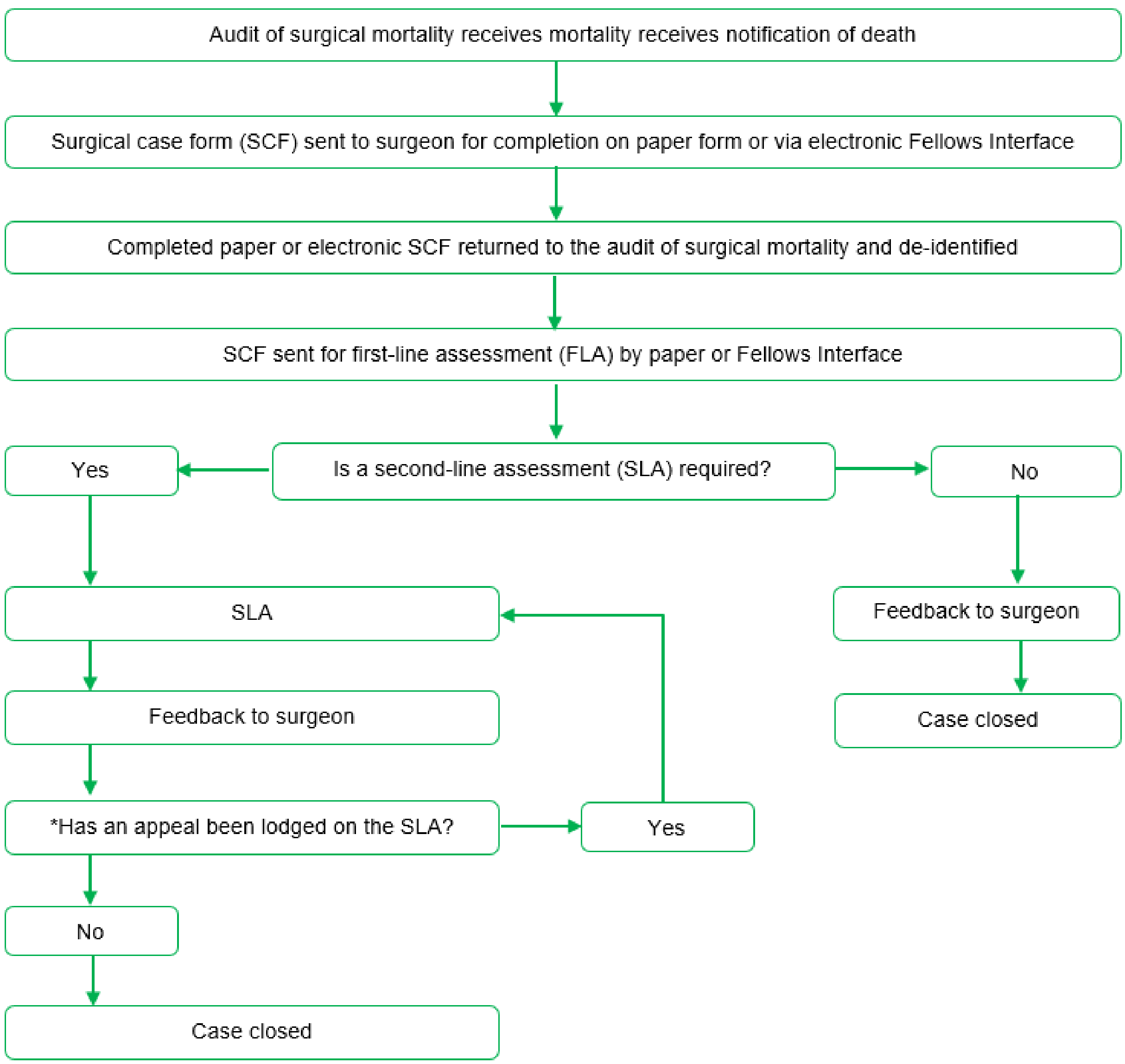
There are 2 possible outcomes of an FLA:

- Information provided by the treating surgeon is adequate to reach a conclusion on the case and to identify any issues of management, if present.
- Further in-depth assessment (second-line assessment, or SLA) is necessary for one of 2 reasons:
  - clarification of patient management issues identified or suspected by the first-line assessor
  - inadequate information provided by the treating surgeon to reach a conclusion.

Where an SLA is deemed necessary, the assessor is selected using the same criteria as for first-line assessors (review by a surgeon of the same surgical specialty but from a different hospital). The audit process is outlined in Figure 2.

The clinical information from these deaths provides the patient profiles described in this report. It forms the denominator in all analyses pertaining to outcomes from the audit. Where data are presented pertaining to assessment outcomes in this report they refer to the highest-level assessment for each patient, unless otherwise indicated. That is, if an SLA has been conducted, data from the SLA are presented here in preference to that from the FLA. Where an SLA was not deemed necessary for a given patient, data from the FLA are presented here, unless otherwise indicated.

**Figure 2: The audit process**




SCF: Surgical Case Form. * If an SLA appeal is lodged, a second independent SLA is obtained and feedback is provided to the surgeon.

## 1.5 Provision of feedback

Education is one of the primary aims of ANZASM and participation in the audit is a mandatory component for surgeons completing CPD with RACS or AOA. Commentary obtained during the audit process is provided directly to the treating surgeon. Continuing education is also achieved by highlighting lessons learned from de-identified cases in National or State/Territory Case Note Review Booklets.

Several case reviews are included within this report and these form part of the feedback process seen as essential in the quality improvement processes of the surgical mortality audits. The cases in this report are from a variety of specialties and authors, which have been chosen to highlight aspects of patient care that have been identified in this report as needing improvement (case reviews have been edited for brevity and clarity).

## 1.6 Reporting conventions

### 1.6.1 Reporting clinical incidents

The structured SCF requires the surgeon to document whether any clinical incidents occurred during the care of the patient. If a clinical incident or event took place, the surgeon is asked to provide more information on the incident based on the following assessment matrix:

- Report on the perceived impact by stating whether the incident:
  - made no difference to the outcome
  - may have contributed to death
  - caused the death of a patient who would otherwise have been expected to survive.
- Report on perceived preventability, using the following categories:
  - definitely preventable
  - probably preventable
  - probably not preventable
  - definitely not preventable.
- Indicate the clinical area most responsible for the incident or event, being:
  - audited surgical team
  - another clinical team
  - hospital
  - other.

First- and second-line assessors also complete the same assessment matrix.

### 1.6.2 Analysis of clinical incidents

A primary objective of the ASM peer-review process is ascertaining whether death was a direct result of the disease process alone, or if aspects of patient management might have contributed to the outcome. Where there is a perception that clinical management may have contributed to death, ANZASM specifies the following definitions of clinical management issues for use by assessors:

- **Area for consideration.** An area of care could have been improved or done differently, but this could be debatable.
- **Area of concern.** An area of care should have been better.
- **Adverse event.** An unintended injury or event was caused by the management of the patient rather than by the disease process and was sufficiently serious that it led to prolonged hospitalisation or contributed to or caused death. (Specific complications, for example, pulmonary embolus and anastomotic leak are, by definition, adverse events but may not be preventable.)

### 1.6.3 Data analysis

The 2017/2018 national report covers deaths reported to ANZASM from 1 January 2009 to 31 December 2018 (census date 31 March 2019). The current report therefore reports the cumulative total of cases closed by including the additional cases closed between 1 January 2017 and 31 December 2018 (7,242) to the total cases that were closed at the end of 2016. The full audit process takes an average of 3 months from notification of death to completion. Some cases were still under review at the census date so these outcomes were unavailable for this report and will be featured in the next report. Patients admitted for terminal care are excluded from the full audit process.

For collating data for the national report, data are encrypted and stored in a central Structured Query Language server database with a reporting engine. All transactions are time stamped. All changes to audit data are recorded in an archive table, enabling a complete audit trail for each case. An integrated workflow rules-based engine supports the creation of letters, reminders and management reports.

Data were sorted, analysed and visualised using the pandas package (version 1.0.5) for the Python programming language (version 3.7.6), and the R environment for statistical computing and graphics (version 3.6.3) with RStudio 1.2

Numbers in parentheses (n) in the text or footnote represent the number of cases with missing data, and (N) the total number of cases analysed. As not all data points were completed, the total number of cases used in each analysis varies. The total numbers of cases (N) included in individual analyses are provided in all tables and figures throughout the report.

Data for the years 2009 to 2018 have been grouped in some tables and figures for clarity. It should be noted that where there was no apparent difference between groups only overall summaries are provided.

# 2. AUDIT PARTICIPATION

| KEY POINTS |
| --- |
| • Nationally in 2018, 99.0% (4,909/4,958) of surgeons participated in the audit.<br>• The SCF return rate at census date for participating surgeons was 92.0%.<br>• 100% of all public and private hospitals currently participate in the audit program (not including NSW). |

## 2.1 Audit numbers

During the period 1 January 2009 to 31 December 2018, ANZASM received 42,412 notifications of deaths associated with surgical care.

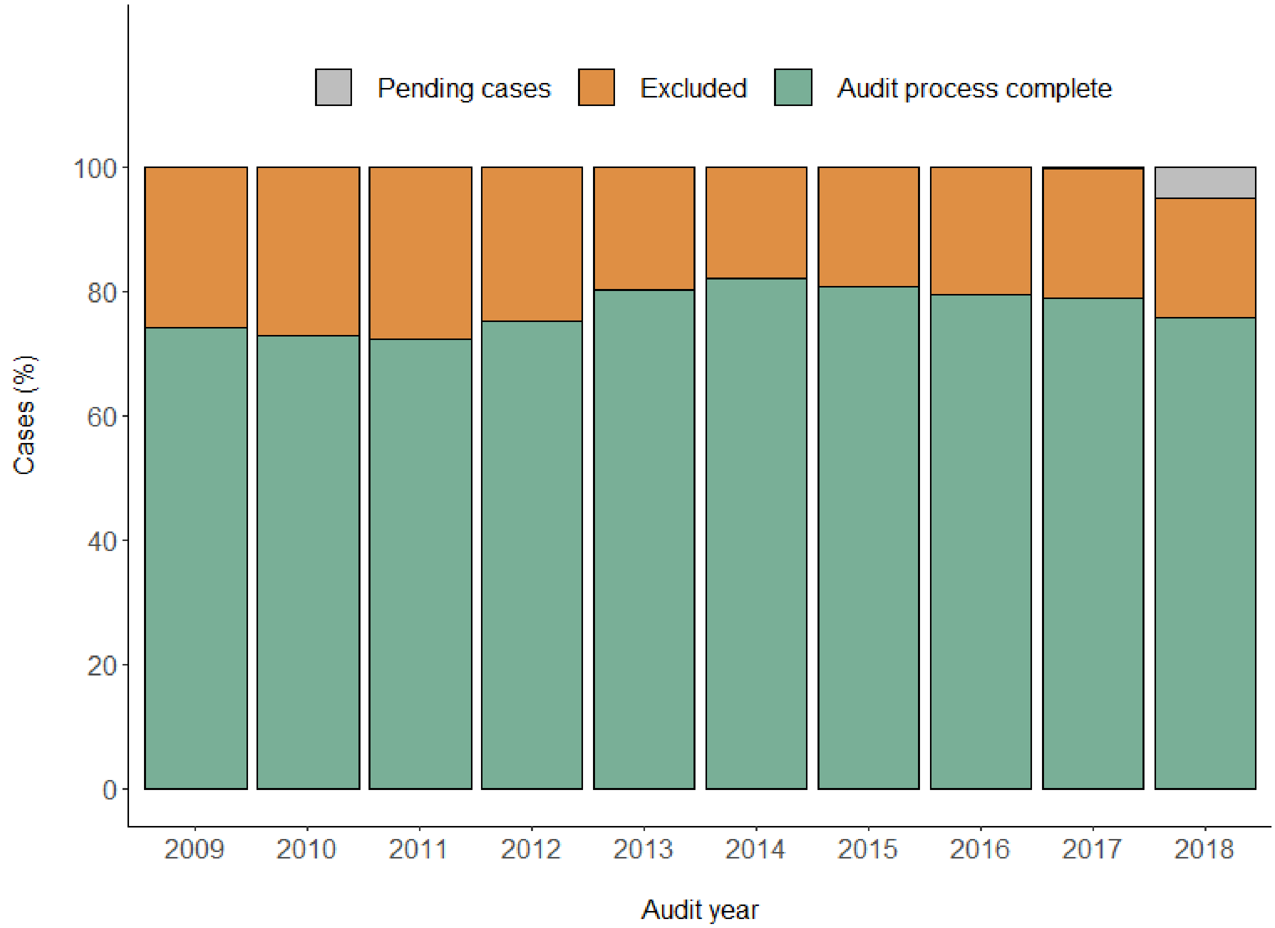
A total of 77.3% (32,803) of reported cases had completed the audit process by the census date. The clinical information from these deaths provides the patient profiles described in this report and is the denominator in all analyses pertaining to outcomes from the audit, unless stated otherwise.

The remaining 22.7% (9,609) of cases were not included in the audit for the following reasons:

- The case was admitted for terminal care, inappropriately attributed to surgery, lost to follow-up or treated by surgeons who are either not participating in the audit, not RACS Fellows or are members of other colleges (9,352).
- The case had not completed the full audit process at the census date (257).

Figure 3 shows the proportion of cases with completed forms over the different audit years. While the 2018 audit year has a higher number of pending cases, it is expected that this number will decrease to align with earlier years as additional cases are finalised. The audit process relies not only on the participation of surgeons but also on their timely and accurate completion of SCFs and assessment forms.

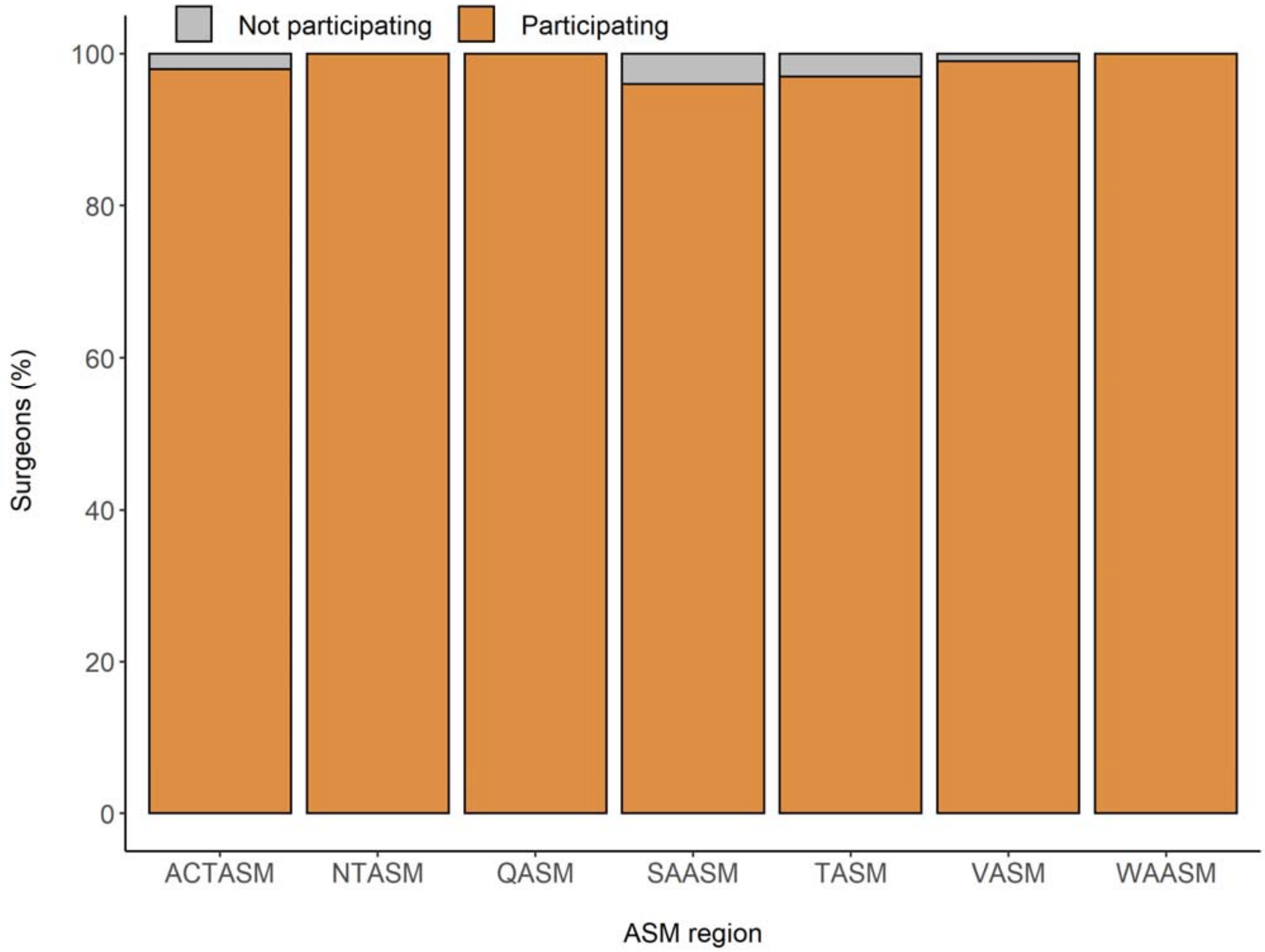
**Figure 3: Audit status of reported cases at census date**




Note: Excluded cases comprise non-surgical, surgeon non-participant, lost to follow-up or terminal care cases. N = 42,412.

Figure 4 shows the absolute numbers of surgeons who have indicated their willingness to participate in the audit by ASM region at the end of 2018 (N = 4,958).

Figure 4: Surgeons who have indicated their willingness to participate in the audit by ASM region




Note: Not participating indicates that a Fellow has not responded to the invitation to participate in the audit. N = 4,958. ASM: Audit of Surgical Mortality

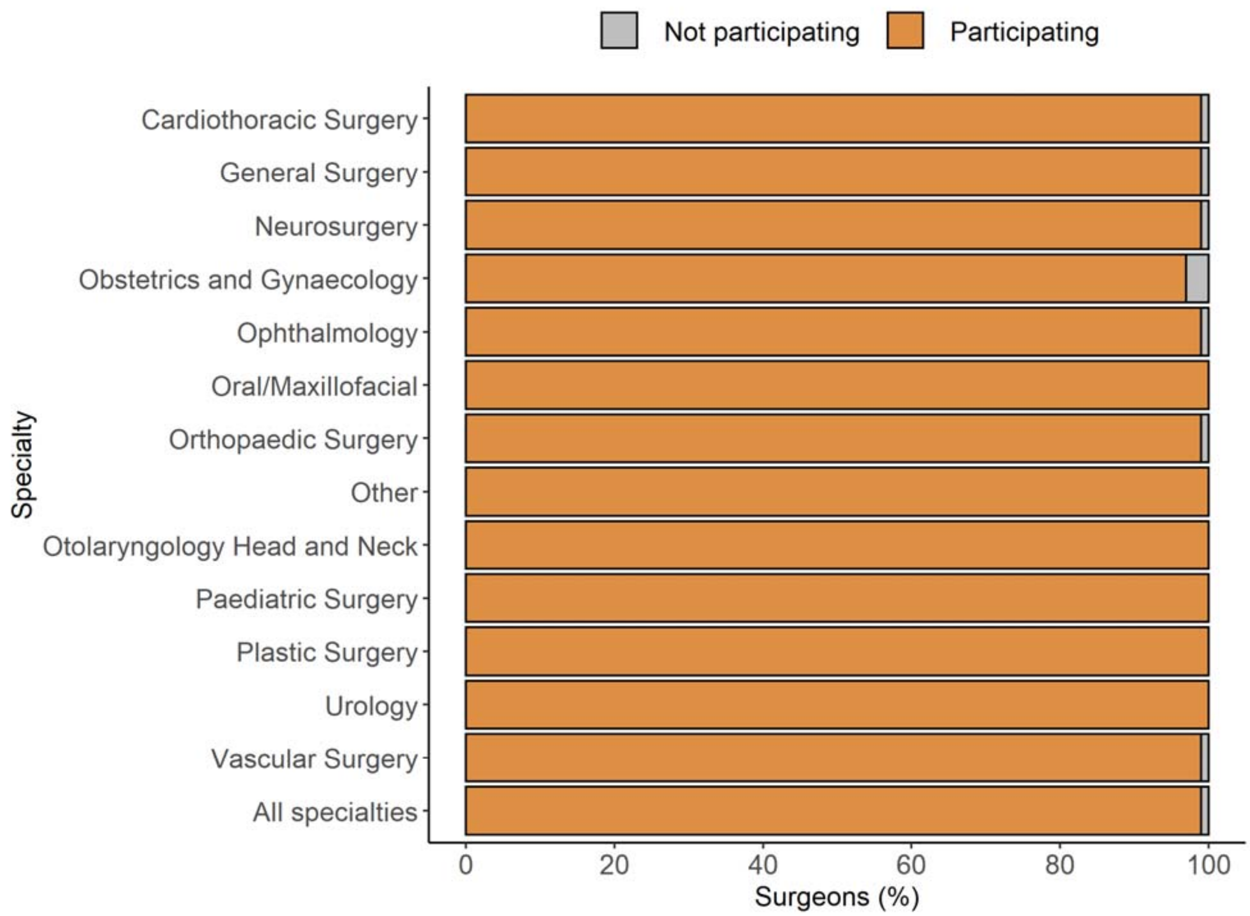
By the end of 2018, 99.0% (4,909/4,958) of surgeons nationally had agreed to participate in the audit (Figure 4). This increase in surgeon participation from 60.0% in 2009 to 99.0% in 2018 can be largely attributed to the ongoing rollout of the program, Fellows appreciating the value of the audit, and RACS mandating participation in the mortality audit process in January 2010. Participation is an essential component of the RACS CPD program and is necessary for re-certification. Nationally, ANZASM aims for 100% participation of surgeons and hospitals.

Reasons given for surgeon non-participation include refusal to participate in the audit before 2010, potential participation in other CPD programs, and working in private hospitals that, as at the end of 2014, were not yet participating in the audit. Surgeons who had departed overseas to continue their Fellowship or who were not in clinical practice were also excluded from the audit. Some Fellows have retired from clinical practice and others have temporarily relocated overseas.

There is increasing use of the ANZASM electronic interface (Fellows Interface) for surgeons to enter data directly. Of participating surgeons who had cases, at least 93.3% used the Fellows Interface, compared with 60.2% (3,017/5,013) stated in the 2016 report.[1] Use of the Fellows Interface is encouraged as it is easy to use and provides both time and process efficiencies. Increased use of the Fellows Interface could be the reason that SCF return by surgeons has increased.

A breakdown of surgical participation by specialty is shown in Figure 5.

**Figure 5: Surgeons who have indicated their willingness to participate in the audit by surgical specialty**




Note: Gynaecologists formally started participating in the audit process in December 2011. 'Other' includes trauma, transplant, thoracic medicine and ophthalmology. N = 4,958.

Participation rates vary among the different specialties (Figure 5).

A total of 596 gynaecologists have agreed to participate in the ANZASM audit process. Participation for the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) surgeons is voluntary under their CPD program. Gynaecologists formally started participating in the audit process in December 2011. Similarly, The Royal Australian and New Zealand College of Ophthalmologists (RANZCO) and The Royal Australian College of dental Surgeons (RACDS) surgeons also participate on a voluntary basis.

## 2.2 Hospital participation

All public and private hospitals in which surgery is performed were participating in the audit program by the end of 2018. This does not include NSW data.

Recruitment drives targeting the private sector occurred in 2016. In general, the private sector's response to the opportunity to participate in the audit has been positive. Overall, private hospital participation rose from 92% in 2016 to 100% in 2018.

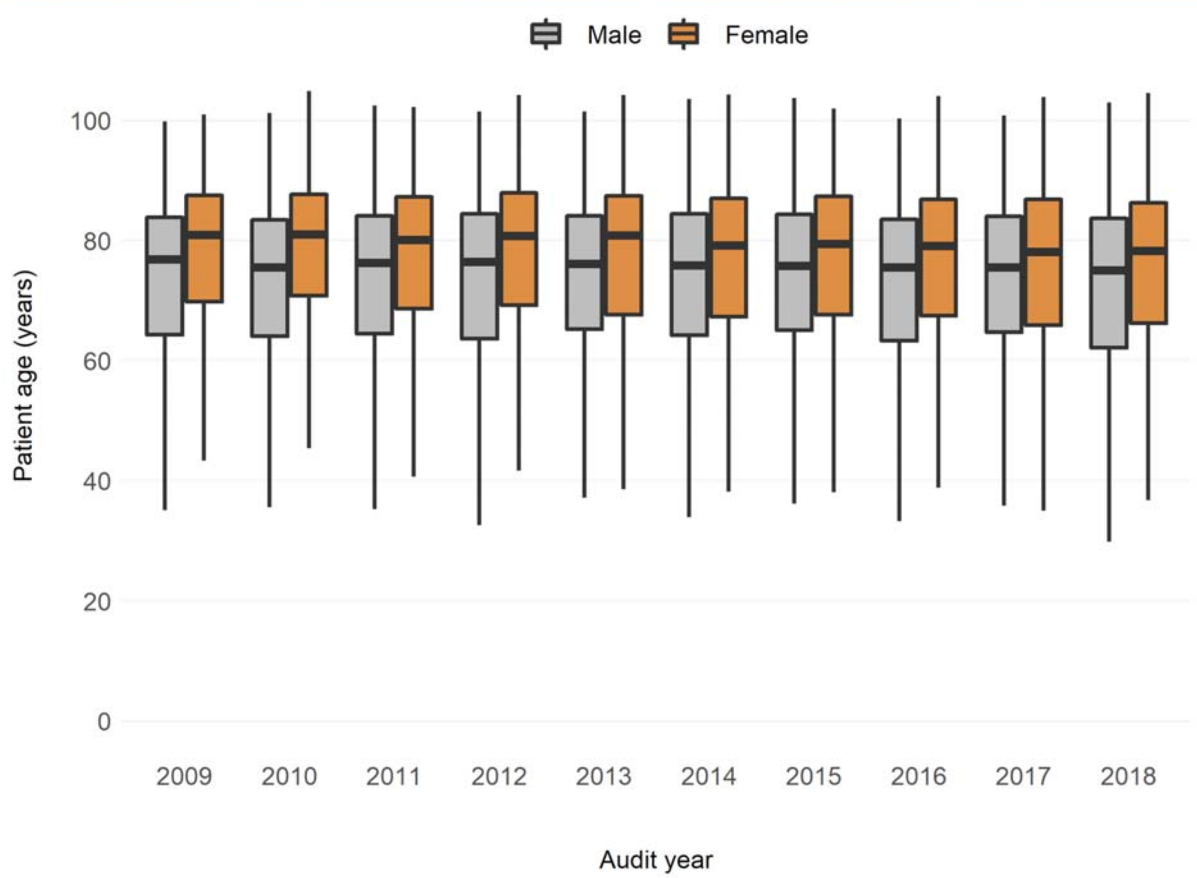
# 3. DEMOGRAPHIC PROFILE OF AUDITED CASES

| KEY POINTS |
| --- |
| • Patients admitted as emergencies with acute life-threatening conditions comprised 85.5% (27,805/32,507) of audited deaths.<br>• The median age and spectrum of comorbidity indicates that surgical mortality predominantly occurs in sick and elderly patients with major pre-existing comorbidities.<br>• One or more pre-existing medical conditions or comorbidities were reported in 89.8% (28,997/32,277) of the patients in this audit period.<br>• An American Society of Anesthesiologists (ASA) physical classification grade of 3 or higher was reported in 91.7% (27,502/29,989) of patients. |

## 3.1 Age and sex

The age distribution of deaths by sex and audit year, sex and ASM region, and surgical specialty are presented by box and whisker plots shown in Figures 6, 7 and 8 respectively.

**Figure 6: Distribution of patient age at death by audit year and sex**

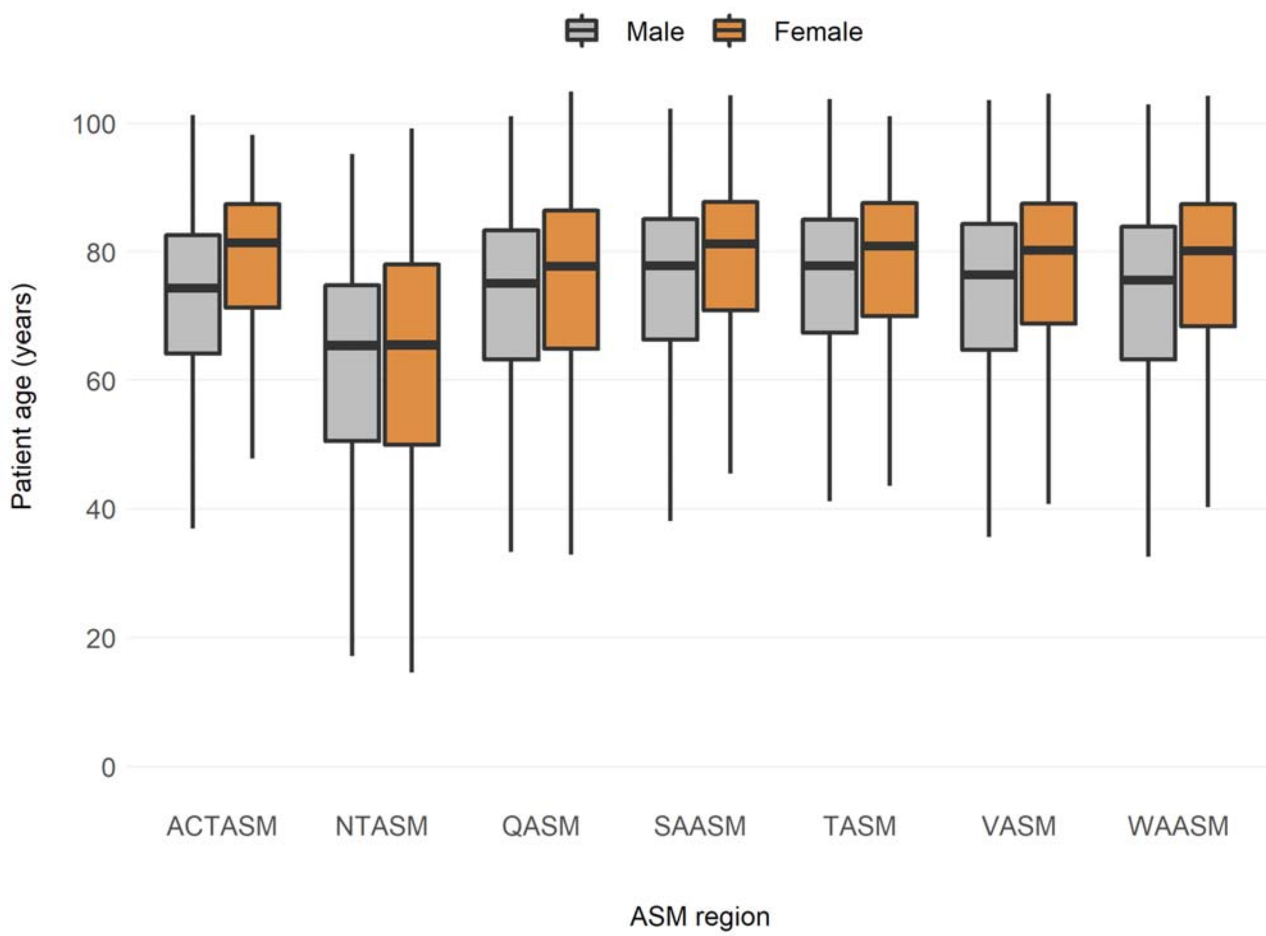



Note: Central box represents values from lower to upper quartile (25th to 75th percentiles); middle line represents median value; vertical line extends from minimum value to maximum value, excluding extreme values for clarity. Data not available: n = 9 (<1%); N = 32,794.

The age and sex distribution of the audited deaths was similar over the audit reporting years (Figure 6).

The stable distribution of age and sex across the 10 years of the audit means that any trends identified are not due to a change in population demographics.

**Figure 7: Distribution of patient age at death by ASM region and sex**

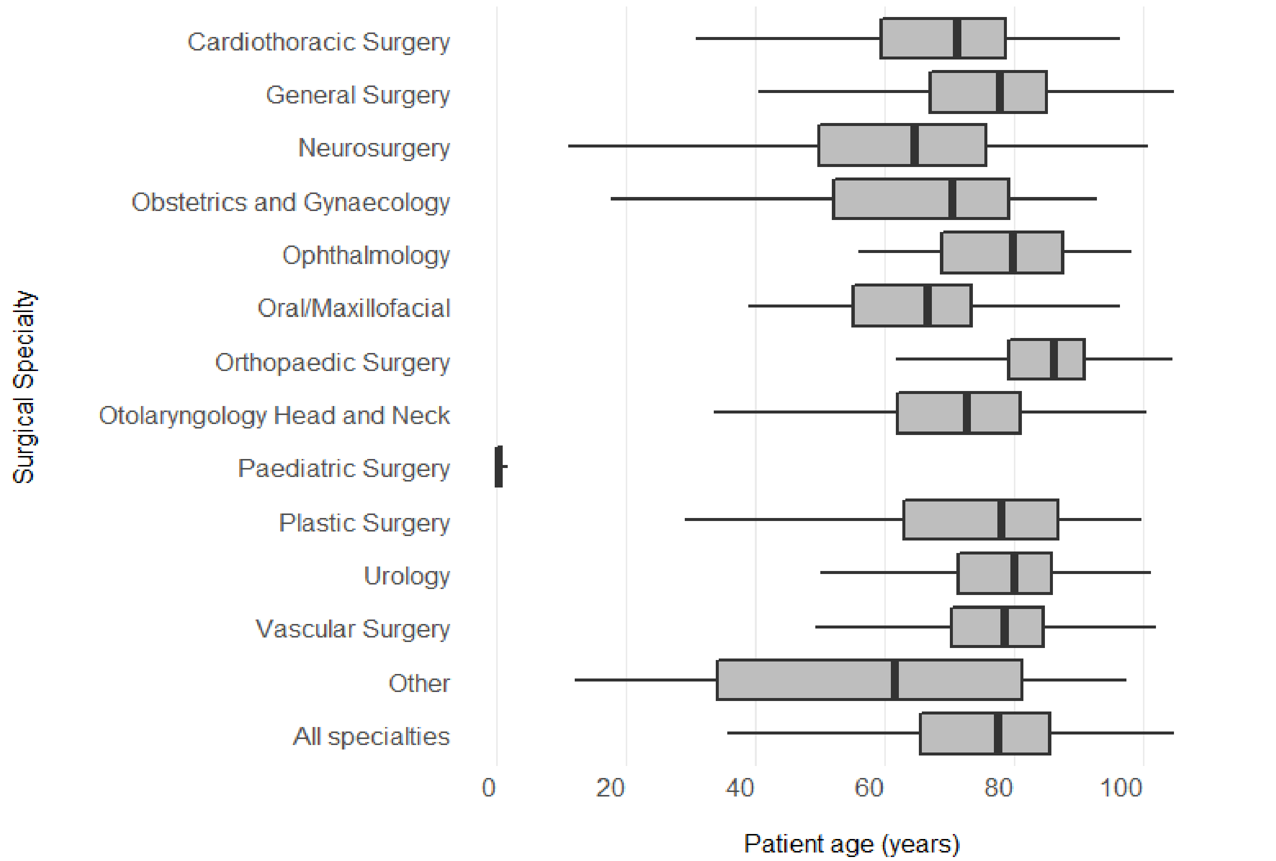



Note: Central box represents values from lower to upper quartile (25th to 75th percentiles); middle line represents median value; vertical line extends from minimum value to maximum value, excluding extreme values for clarity. Data not available: n = 9 (<1%); N = 32,794. ASM: Audit of Surgical Mortality

The sex distribution of audited deaths was similar across all ASM regions with the exception of the age distribution in Northern Territory (Figure 7). The Northern Territory had a lower median age of death for males and females compared with the other territory and all states.

According to the Australian Bureau of Statistics (June 2016 data), the median age in the Northern Territory was 32.4 years—the lowest of all states and territories—compared to 41 years for Australia overall.[2]

**Figure 8: Distribution of patient age at death grouped by surgical specialty**



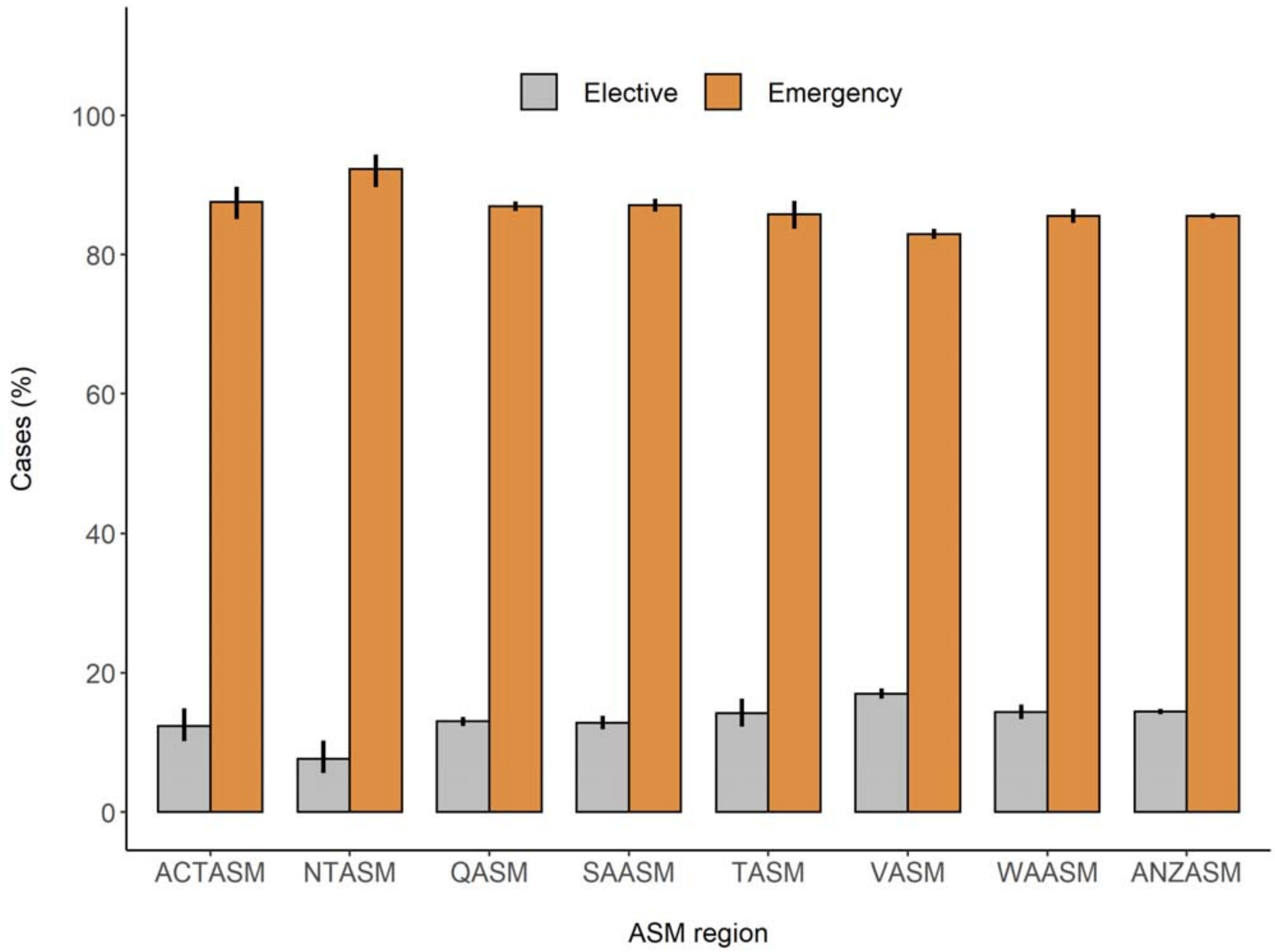

Note: Central box represents values from lower to upper quartile (25th to 75th percentiles); middle line represents median value; vertical line extends from minimum value to maximum value, excluding extreme values for clarity, with the exception of those relating to paediatric surgery.
Data not available: n = 9 (<1%); N = 32,794.
'Other' specialties listed by the treating surgeon include trauma and transplant, otology, general practitioner and gynaecology.

The median age at death may reflect the underlying disease process in individual surgical specialties.

## 3.2 Admission status of audited cases

The admission status of audited cases indicates whether patients were admitted electively or as emergencies. The distribution of admission status by ASM region, and ASM region and age are presented in Figure 9 and 10.

**Figure 9: Admission status of cases by ASM region**



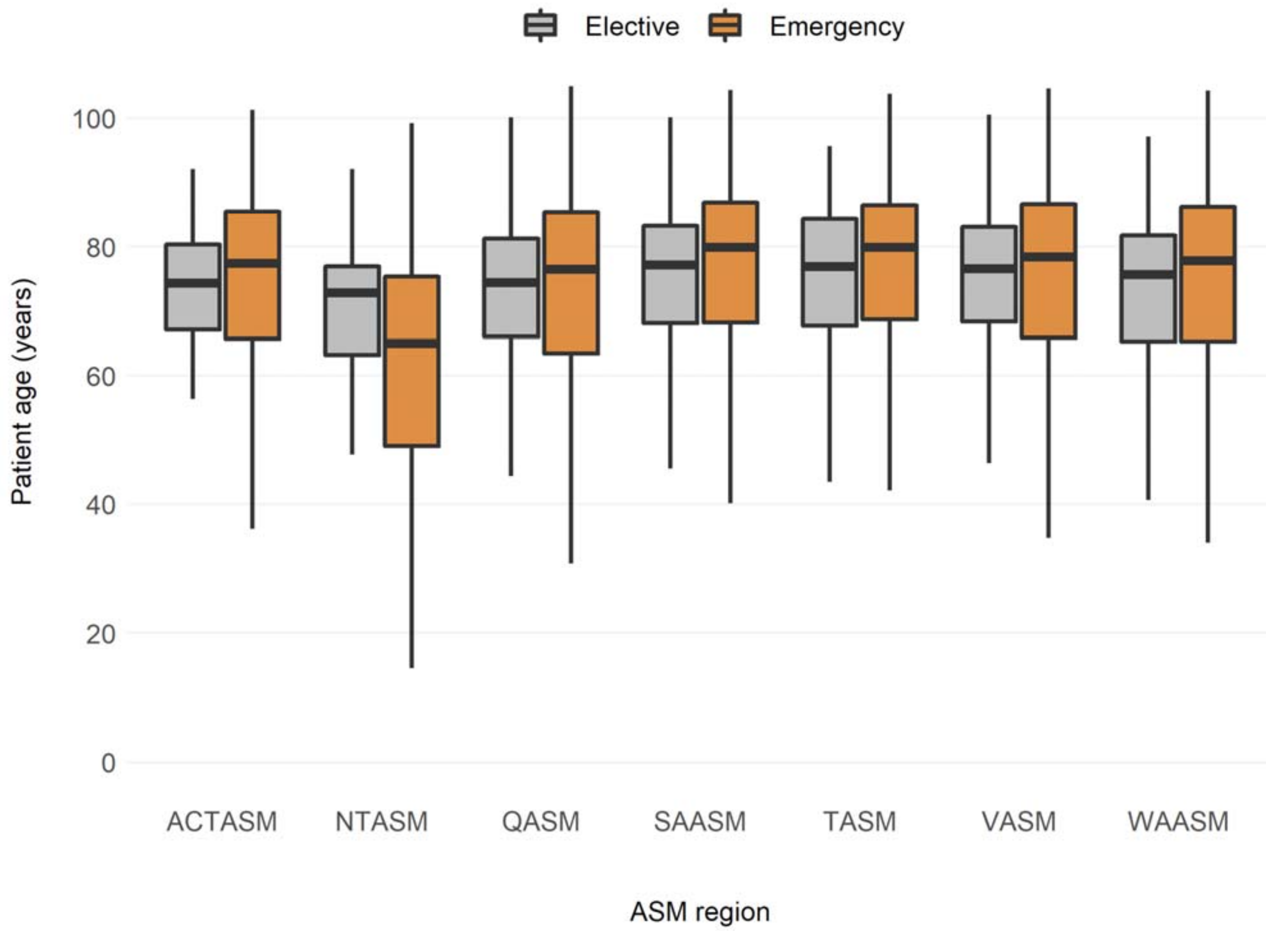

Note: Error bars show 95% confidence intervals. Data not available: n = 296 (<1%); N = 32,507. Each ASM region has its own unique case mix and surgical population. ASM: Audit of Surgical Mortality

Patients admitted as emergencies for acute life-threatening conditions comprised 85.5% (27,805/32,507) of audited deaths (Figure 9).

Most patients were emergency admissions 85.5% (27,805/32,507). Only a small percentage were elective admissions (14.5%; 4,702/32,507), and 296 cases (<1.0%) had no admission status recorded. These percentages do not consider the 296 cases with no admission status recorded (<1.0%; 296/32,803).

These findings are similar to those in the 2016 report.[1]

**Figure 10: Distribution of patient age at death by ASM region and admission status**




Note: Central box represents values from lower to upper quartile (25th to 75th percentiles); middle line represents median value; vertical line extends from minimum value to maximum value, excluding extreme values for clarity. Data not available: n = 300 (<1%); N = 32,503. Each ASM region has its own unique case mix and surgical population. ASM: Audit of Surgical Mortality

Generally, patients who had an emergency admission (2009–2018) were older than those who had an elective admission (Figure 10). The median age of patients who had emergency admissions was 78 years and those who had elective admissions was 76 years. However, in the NT those patients who had elective admissions were much older than patients with emergency admissions (median age 73 years vs 65 years).

## 3.3 Risk profile of audited cases

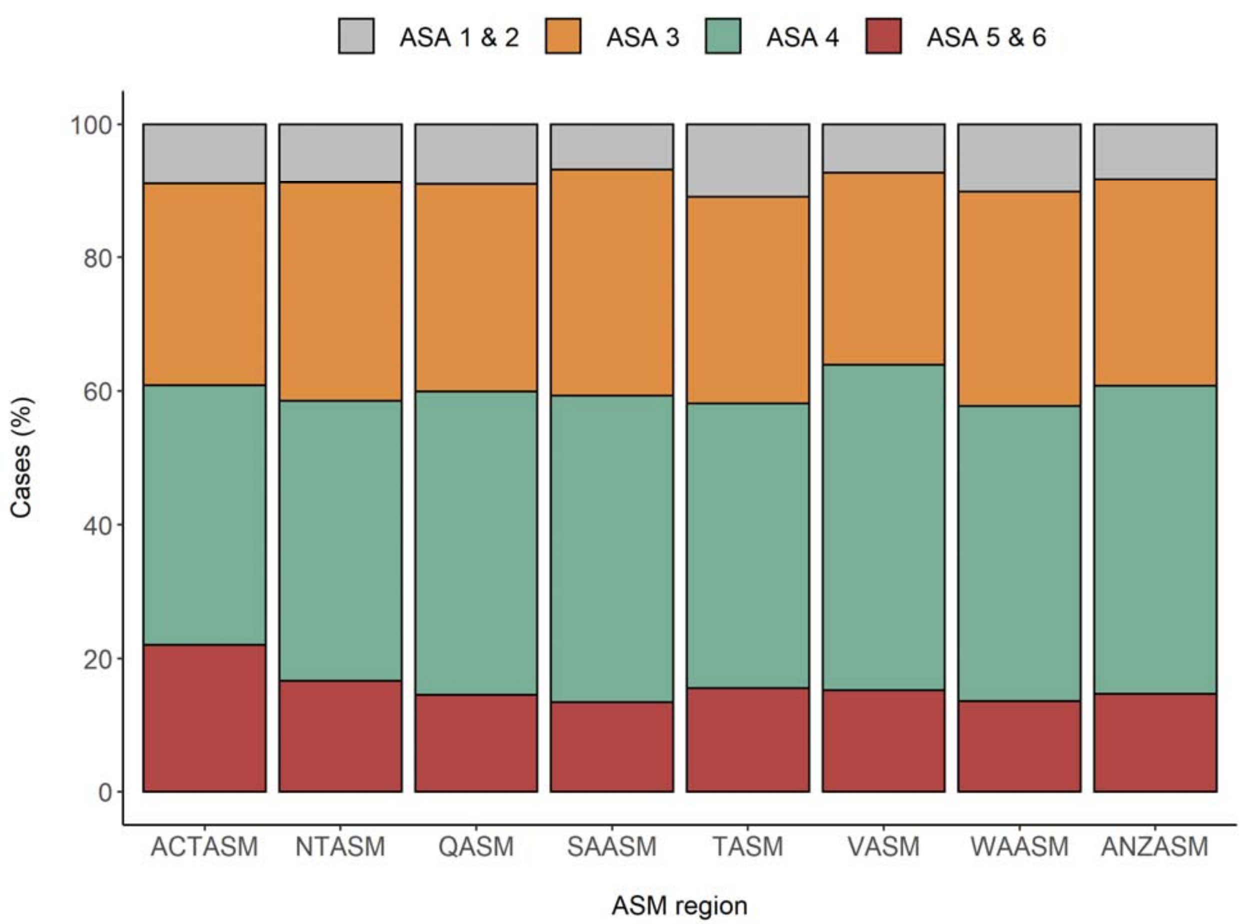
### 3.3.1 ASA grade

The American Society of Anesthesiologists (ASA) grade is an international measure of patient physiological reserve used by anaesthetists.[3,4] The ASA grades and their characteristics are:

1. normal healthy patient
2. patient with mild systemic disease
3. patient with moderate systemic disease
4. patient with severe systemic disease that is a constant threat to life
5. moribund patient unlikely to survive 24 hours, who is not expected to survive without an operation
6. patient declared brain-dead, whose organs are being removed for donor purpose.

The distribution of ASA grades according to ASM region, audit year, surgical specialty and admission status are provided in Figures 11, 12, 13 and 14, respectively.

**Figure 11: Patient ASA grade by ASM region according to treating surgeon**

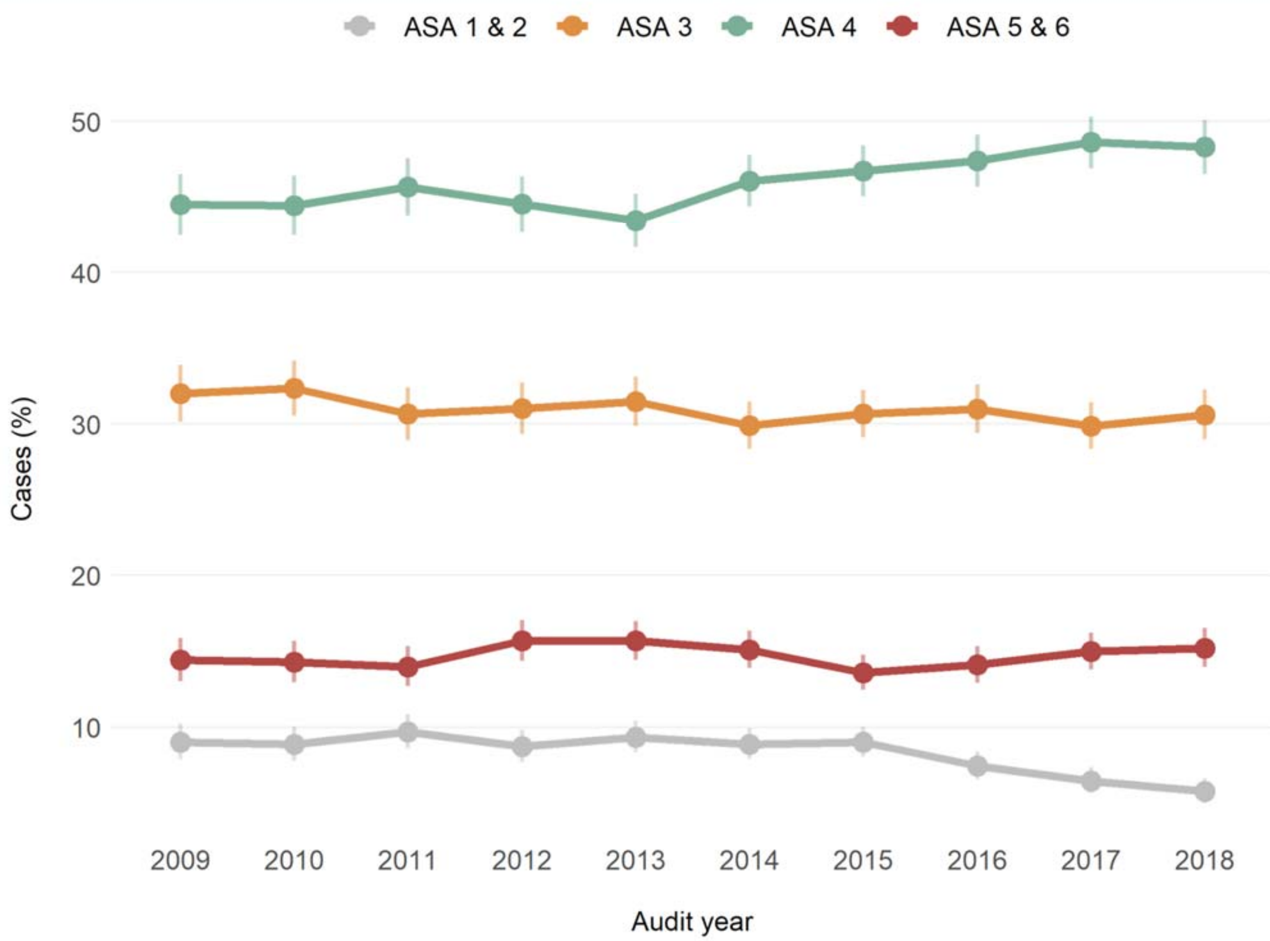



Note: ASA: American Society of Anesthesiologists. ASM: Audit of Surgical Mortality. Data not available: n = 2,814 (9%); N = 29,989.
Each ASM region has its own unique case mix and surgical population.

An ASA grade of 3 or higher was observed in 91.7% (27,502/29,989) of patients, indicating that moderate to severe systemic disease was present in the majority of patients at the time of treatment (Figure 11).

The risk and physical status of patients, as indicated by the ASA grade, was similar in all ASM regions.

**Figure 12: Patient ASA grade by audit year according to treating surgeon**




Note: ASA: American Society of Anesthesiologists. Error bars show 95% confidence intervals. Data not available: n = 2,814 (9%); N = 29,989. Each ASM region has its own unique case mix and surgical population.

The number of patients with an ASA grade of 3 or higher was similar across the years.

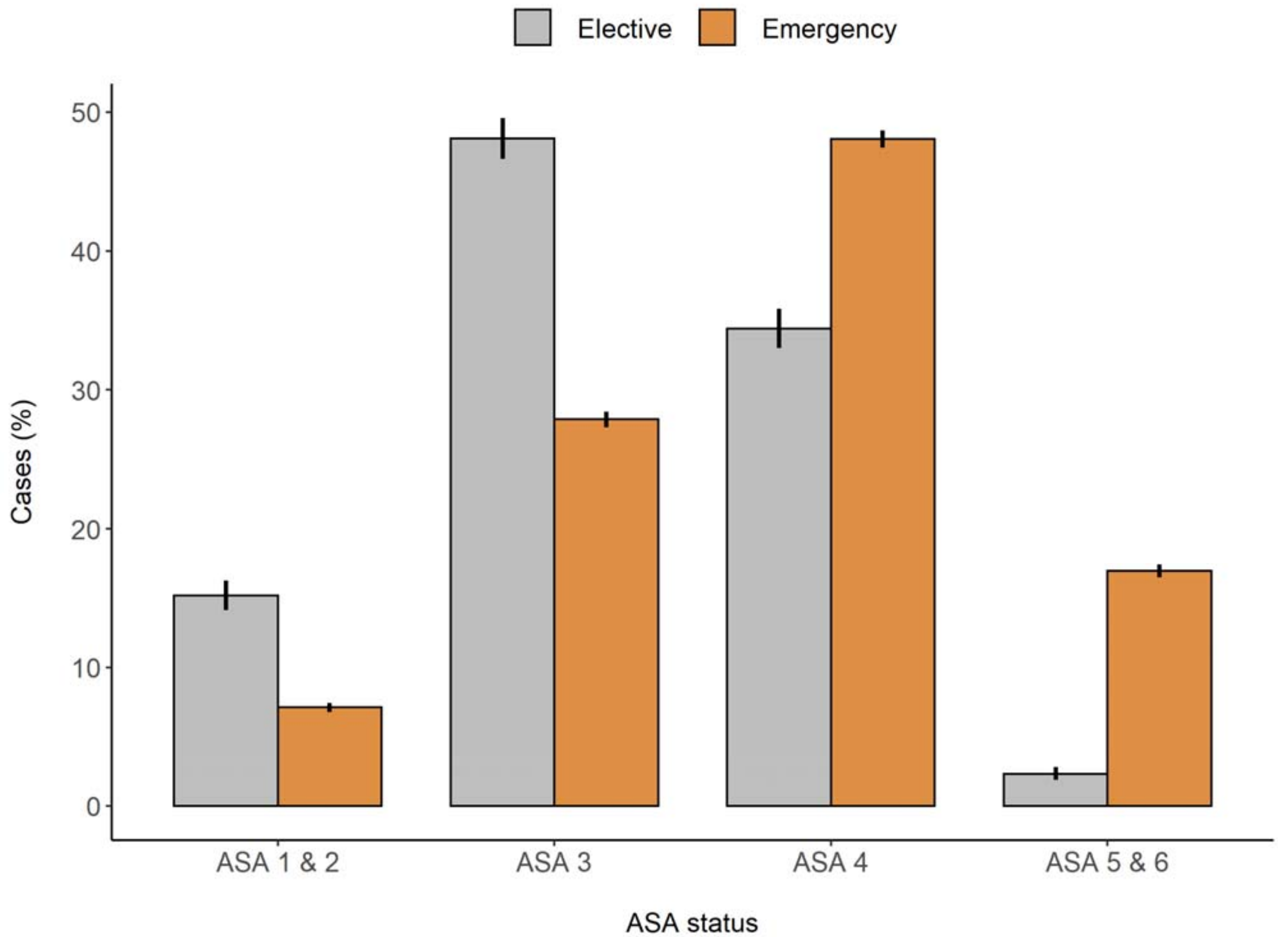
From 2013 to 2018, the number of patients with an ASA grade of 4 has been slightly increasing. The number of patients who had an ASA of 1 - 2 have slightly decreased from 2016 till 2018, compared to minimal variations across the audit years for those with ASA grade of 3 or 4 and ASA grade of 5 and 6.

**Figure 13: Patient ASA grades by surgical specialty**


Note: ASA: American Society of Anesthesiologists. Data not available: n = 2,814 (9%); N = 29,989.
Colorectal surgery is included within General Surgery group.
'Other' specialties listed by the treating surgeon include anaesthesia, intensive care, oncology, thoracic medicine and trauma. Includes cases where multiple specialties were involved in a single case.

Variation in ASA grades may reflect the case mix of the different surgical specialties (Figure 13). The larger number of cases of ASA 1 and 2 seen in Neurosurgery may be a reflection of the paediatric patients that this specialty also engages with. In gynaecology, the patients also generally tend to be younger.

**Figure 14: Patient ASA grade by admission status**



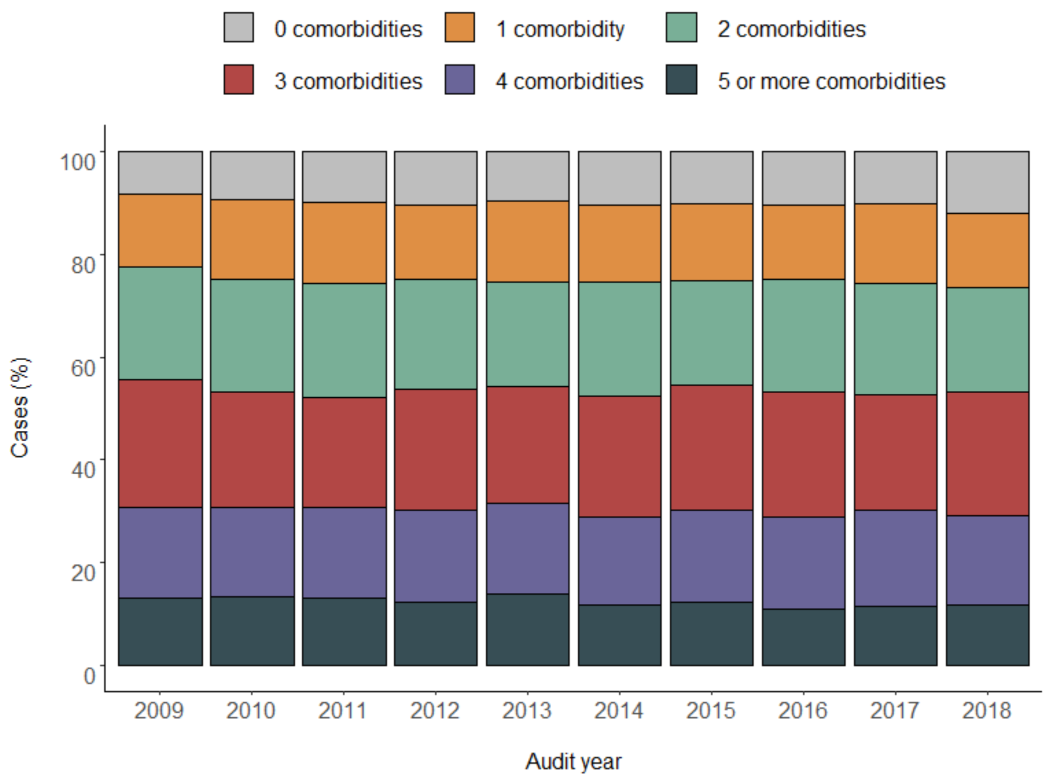

Note: ASA: American Society of Anesthesiologists. Error bars show 95% confidence intervals.
Data not available: n = 3,049 (9%); N = 29,754.

The majority of emergency (92.9%; 23,508/25,309) and elective (84.8%; 3,771/4,445) patients had an ASA grade of 3 or higher. This is a slight increase in the proportion of ASA ≥3 emergency (91.6%) and elective (82.3%) surgery cases from the 2016 report.[1]

### 3.3.2 Comorbidity

Surgeons were asked to record all known comorbidities in addition to the primary medical (presenting) problem. Frequency of multiple comorbidities in patients by audit period is provided in Figure 15. Previous research indicated that comorbidity was a stronger predictor of mortality than was the type of surgery.[5]

**Figure 15: Number of comorbidities in individual patients by audit year**



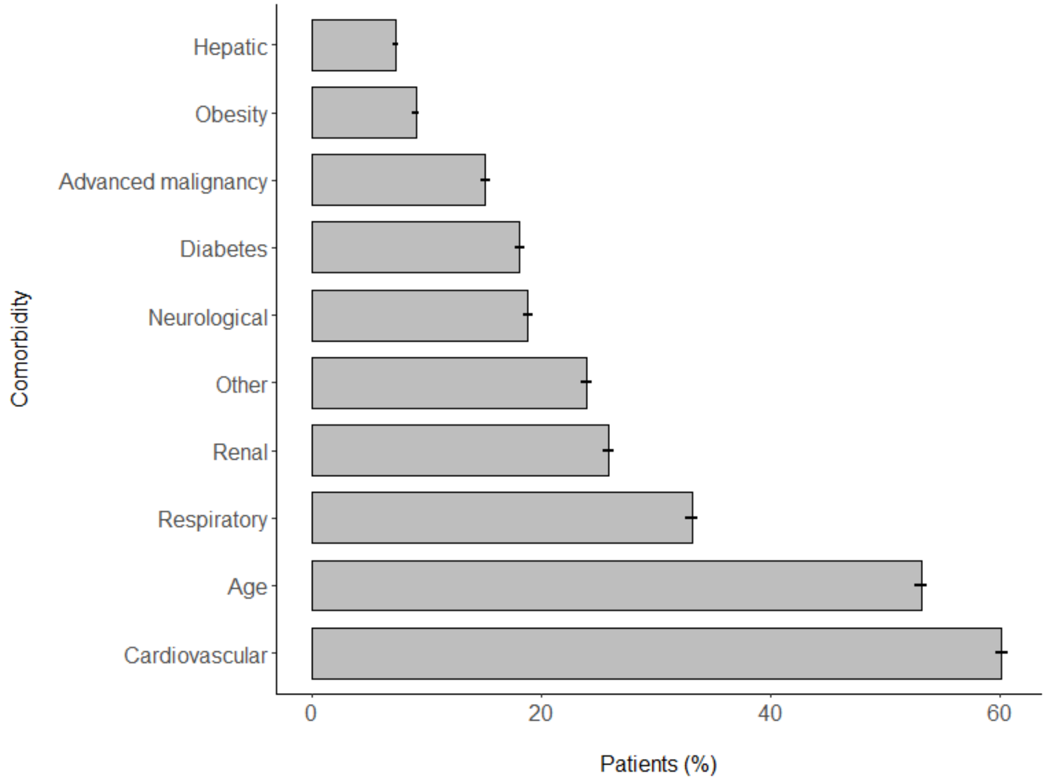

Note: Data not available: n = 526 (2%); N = 32,277.

One or more comorbidities were reported in 89.8% (28,997/32,277) of audited cases between 2009 and 2018 (Figure 15). A total of 74.9% (24,163/32,277) of cases had 2 or more comorbidities, emphasising the high-risk profile of this group of patients.

The pattern of comorbidities was reasonably consistent across the audit years.

Information on the specific types of comorbidities present in audit patients is provided in Figure 16.

Figure 16: Percentage of specific comorbidities




Note: Error bars show 95% confidence intervals. Data not available: n = 526 (2%); n = 85,559 comorbidities in N = 29,997 patients. Categories are not mutually exclusive i.e. a single patient can potentially have multiple comorbidities.
'Other' category includes a wide range of comorbidities such as alcohol abuse, anaemia, anticoagulation, bowel ischaemia, cachexia, cellulitis, coagulopathy, dementia, human immunodeficiency virus/acquired immunodeficiency syndrome, malnutrition, motor neurone disease, polymyalgia rheumatica, rheumatoid arthritis, sepsis and systemic lupus erythematosus.

The 3 most common comorbidities—cardiovascular disease, age and respiratory —had similar incidences in both male and female patients (data not shown) (Figure 16).

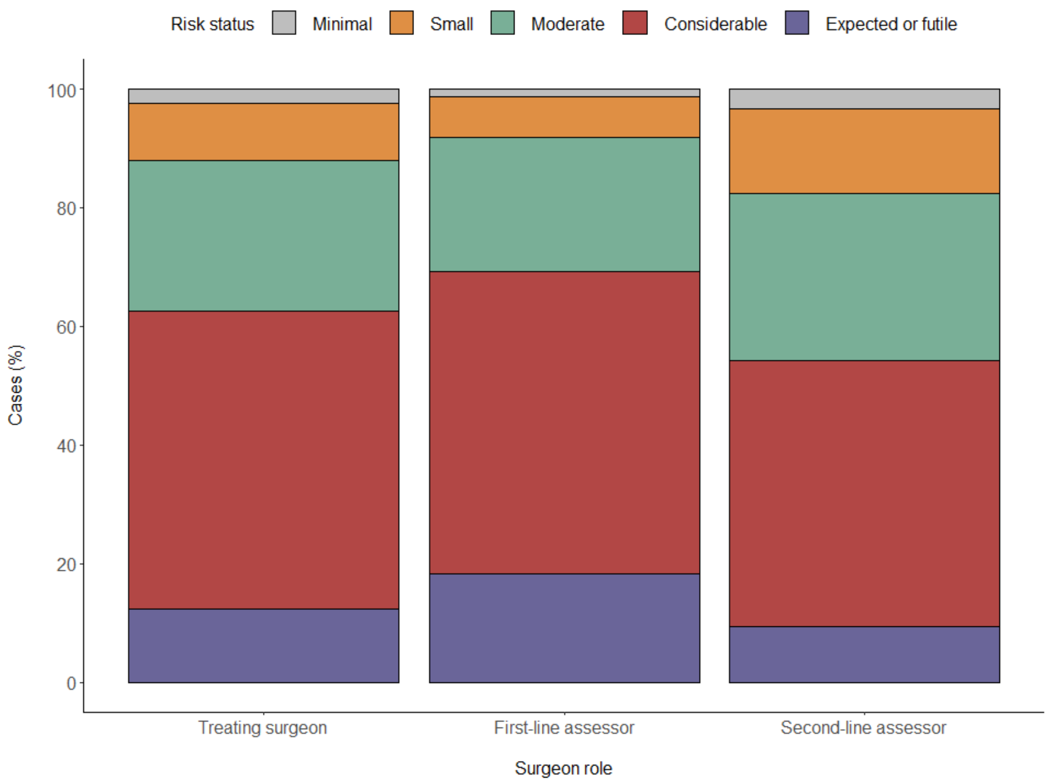
There were no major differences in the distribution of comorbidities between the 10 audit years (data not shown).

The pattern of the most common comorbidities has remained consistent through the audit years.

### 3.3.3 Surgeon perception of risk status

Treating surgeons and assessors were asked to record the patient's perceived risk of death at the time of treatment (Figure 17).

**Figure 17: Perceived risk of death according to treating surgeon**




Note: N = 25,558; first-line assessor (n = 30,815); second-line assessor (n=4,787).

The perceived risk of death, as reported by surgeons, was considerable or expected in 62.5% (15,973/25,558) of cases and small or minimal in 12.1% of cases (3,090/25,558). By comparison, the risk of death was perceived to be considerable or expected in 69.3% of cases (21,348/30,815) by first-line assessors and 54.3% of cases (2,598/4,787) by second-line assessors. This is further evidence of the high-risk profile of this patient group, as suggested by mean age, ASA score and associated comorbidity.

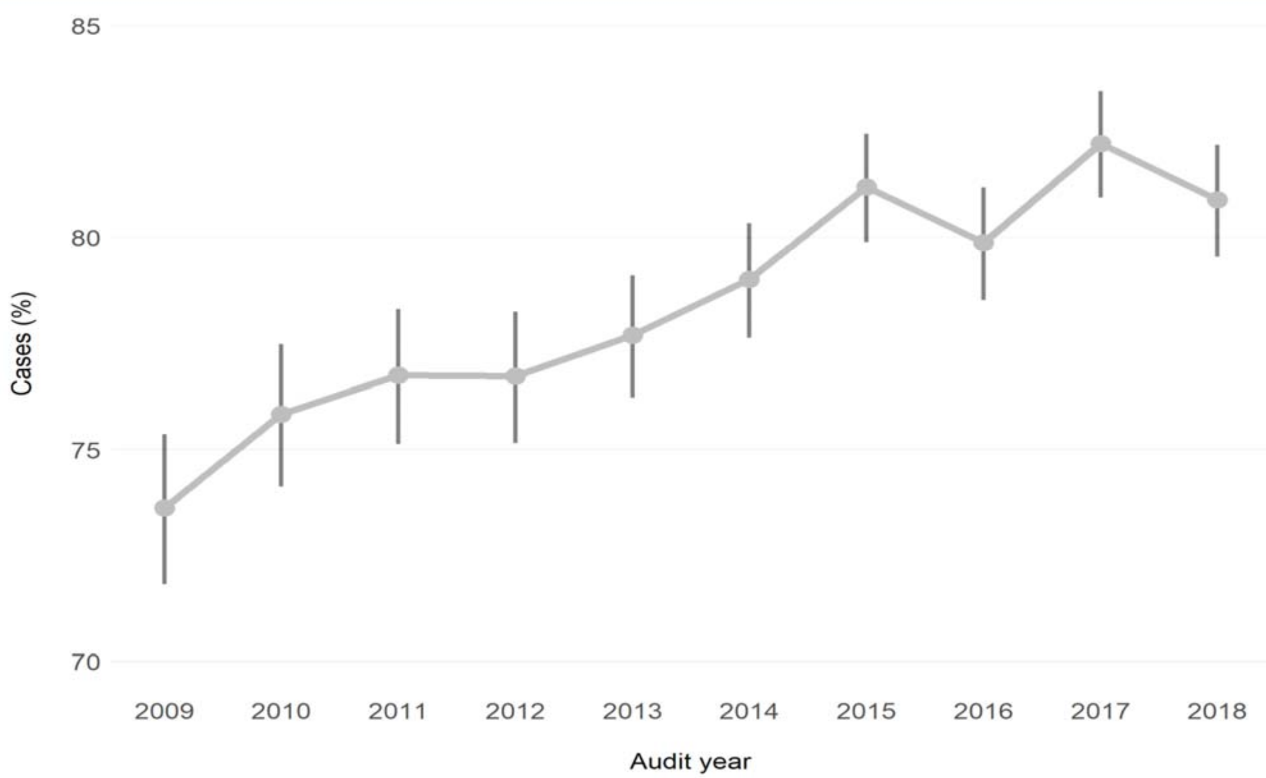
# 4. RISK MANAGEMENT STRATEGIES

| KEY POINTS |
| --- |
| • Use of deep vein thrombosis (DVT) prophylaxis was recorded in 78.7% (25,029/31,793) of cases in which patients underwent a surgical procedure.<br>• In only 2.3% (810/35,312) of cases did the first- and second-line assessors conclude that the DVT prophylaxis management was inappropriate.<br>• In most instances, patients who required critical care support did receive it. The review process suggested that 7.4% (738/9,953) of patients who did not receive treatment in a critical care unit would most likely have benefited from it.<br>• Fluid balance in the surgical patient is an ongoing challenge and 7.3% (2,298/31,313) of patients were perceived to have received poor fluid balance management. |

## 4.1 Prophylaxis for deep vein thrombosis

The treating surgeon was asked to record whether DVT prophylaxis was provided and, if so, the type of prophylaxis used (Figures 18 and 19). If DVT prophylaxis was not given, the treating surgeon was asked to record why it was withheld. Assessors were asked to review the appropriateness of the use or non-use of DVT prophylaxis.

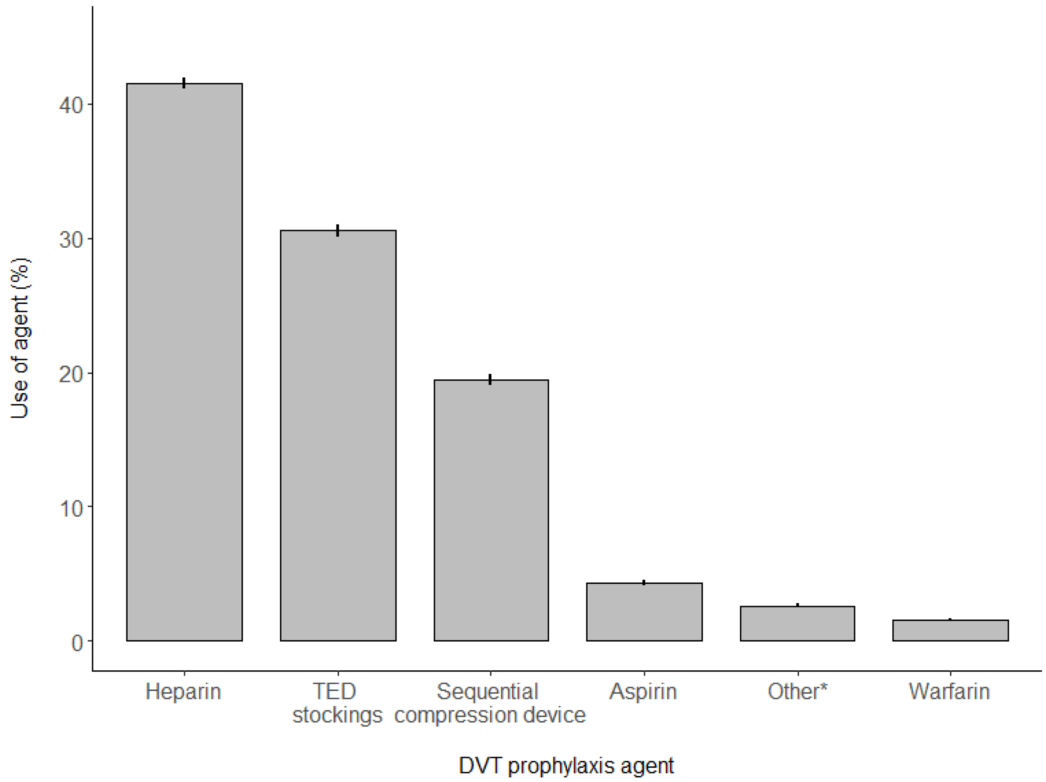
**Figure 18: DVT prophylaxis use according to the treating surgeon by audit year**




Note: DVT = deep vein thrombosis. Error bars show 95% confidence intervals. Data not available: n = 1,010 (3%); N = 31,793.

Between 2009 and 2018, DVT prophylaxis was used in 78.7% (25,029/31,793) of cases in which patients underwent an operation. Across the audit years DVT prophylaxis use varied from 74% to 81% of cases.

**Figure 19: Type DVT prophylaxis agents used**




Note: DVT = deep vein thrombosis, TED = thromboembolic deterrent. A single patient may have multiple agents administered. Error bars show 95% confidence intervals. Data not available: n = 1,010 (3%); n = 45,412 instances of DVT use in N = 25,029 patients.
*Other includes Clexane, clopidogrel, danaparoid, early mobilisation, Fragmin, inferior vena cava filter and lepirudin.

The most frequently used prophylaxis agents were heparin (41.5%) and thromboembolic deterrent (TED) stockings (30.5%) (Figure 19).

DVT prophylaxis use by ASM region is shown in Table 2.

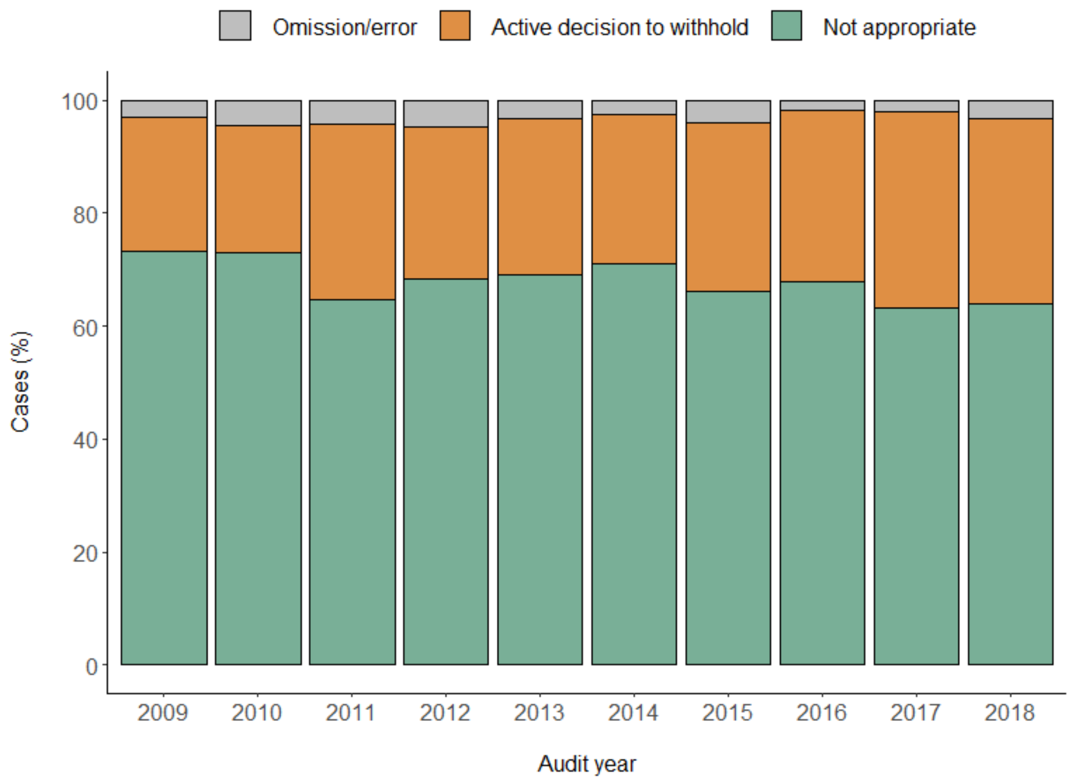
| Table 2: DVT prophylaxis used by ASM region | | | | | | | |
|---|---|---|---|---|---|---|---|
| **DVT prophylaxis agent** | **SA** | **QLD** | **WA** | **TAS** | **VIC** | **ACT** | **NT** |
| **Heparin (any form)** | 46% (2,704/5,887) | 36% (5,102/14,055) | 42% (2,383/5,634) | 40% (665/1,680) | 45% (6,065/13,546) | 43% (490/1,134) | 43% (266/42,550) |
| **Warfarin** | 2% (115/5,887) | 2% (244/14,055) | 1% (67/5,634) | 1% (22/1,680) | 1% (189/13,546) | 2% (20/1,134) | 1% (7/42,550) |
| **Aspirin** | 4% (234/5,887) | 5% (699/14,055) | 4% (212/5,634) | 5% (86/1,680) | 4% (579/13,546) | 4% (43/1,134) | 6% (34/42,550) |
| **Sequential compression device** | 18% (1,036/5,887) | 22% (3,031/14,055) | 18% (994/5,634) | 24% (397/1,680) | 18% (2,497/13,546) | 22% (251/1,134) | 17% (105/42,550) |
| **TED stockings** | 28% (1,658/5,887) | 33% (4,648/14,055) | 33% (1,850/5,634) | 28% (468/1,680) | 28% (3,802/13,546) | 27% (304/1,134) | 30% (187/42,550) |
| **Other*** | 2% (140/5,887) | 2% (331/14,055) | 2% (128/5,634) | 3% (42/1,680) | 3% (414/13,546) | 2% (26/1,134) | 2% (15/42,550) |

Note: TED = thromboembolic deterrent, DVT = deep vein thrombosis. Data not available: n = 1,010 (3%); n = 45,412 instances in N = 25,029 patients.
*Other includes Clexane, clopidogrel, danaparoid, early mobilisation, Fragmin, inferior vena cava filter and lepirudin.

Between 2009 and 2018, DVT prophylaxis use varied across the ASM regions, ranging from 74.4% of cases in TAS to 85.8% of cases in ACT (data not shown).

Choice of DVT prophylaxis varied across the ASM regions, with sequential compression device and heparin showing the greatest state and territory differences in use (Table 2).

**Figure 20: Reasons for non-use of DVT prophylaxis by audit year according to treating surgeon**

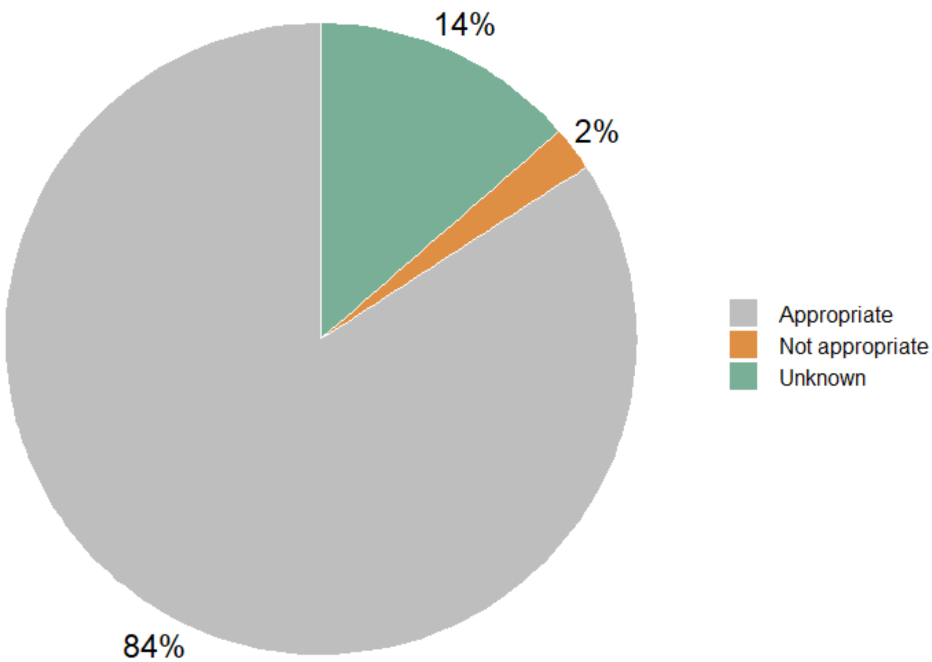



Note: DVT = deep vein thrombosis. Data not available: n = 752 (11%); N = 6,012 patients who received no DVT prophylaxis.

Between 2009 and 2018, non-use of DVT prophylaxis was due to error or omission in only 3.3% (200/6,012) of cases (Figure 20). In most instances the treating surgeon actively withheld prophylaxis for 28.8% of patients (4,081/6,012).

Assessors' perceptions of the appropriateness of DVT prophylaxis management is shown in Figure 21.

**Figure 21: Appropriateness of DVT prophylaxis management as perceived by assessors**




Note: DVT = deep vein thrombosis. Data not available: n = 2,320 (6%); N = 35,312 assessors, audit period 2009–2018.

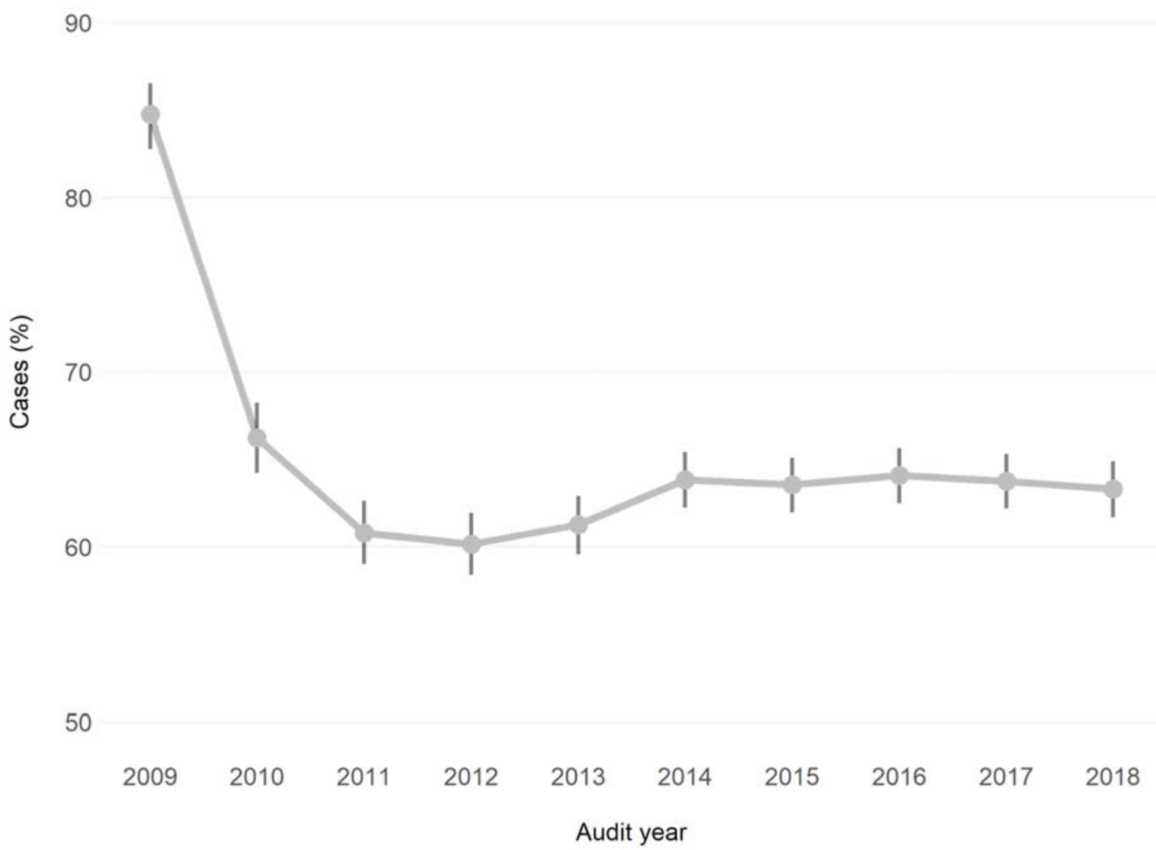
Assessors concluded that DVT prophylaxis was appropriate in most instances (84.1%; 29,716/35,312) where the patient underwent a surgical procedure (Figure 21). Only in 2.3% of cases (810/35,312) was DVT prophylaxis management considered inappropriate. In 13.6% of cases (4,786/35,312) the perception of appropriateness was unknown.

## 4.2 Provision of critical care support to patients

The treating surgeon was asked to record whether or not a patient received critical care support in an intensive care or high dependency unit during admission (Figure 22). First- and second-line assessors then reviewed the appropriateness of the use or non-use of critical care support. It is recognised that this is a subjective assessment of needs and potential benefit.

The SCF was revised in early 2014 to collect data on the reasons why patients did not receive critical care support and to rectify the large amount of unavailable data in this section. It is hoped that this revision will encourage surgeons to fully complete the questions, ensuring that this area of care can be appropriately analysed.

**Figure 22: Provision of critical care support by audit year according to treating surgeon**




Note: Error bars show 95% confidence intervals. Data not available: n = 2,003 cases (6%); N = 30,800 patients.

Between 2009 and 2018, 64.0% (19,717/30,800) of audit patients received critical care support (Figure 22).

A patient not receiving critical care does not necessarily indicate a lack of critical care facilities.

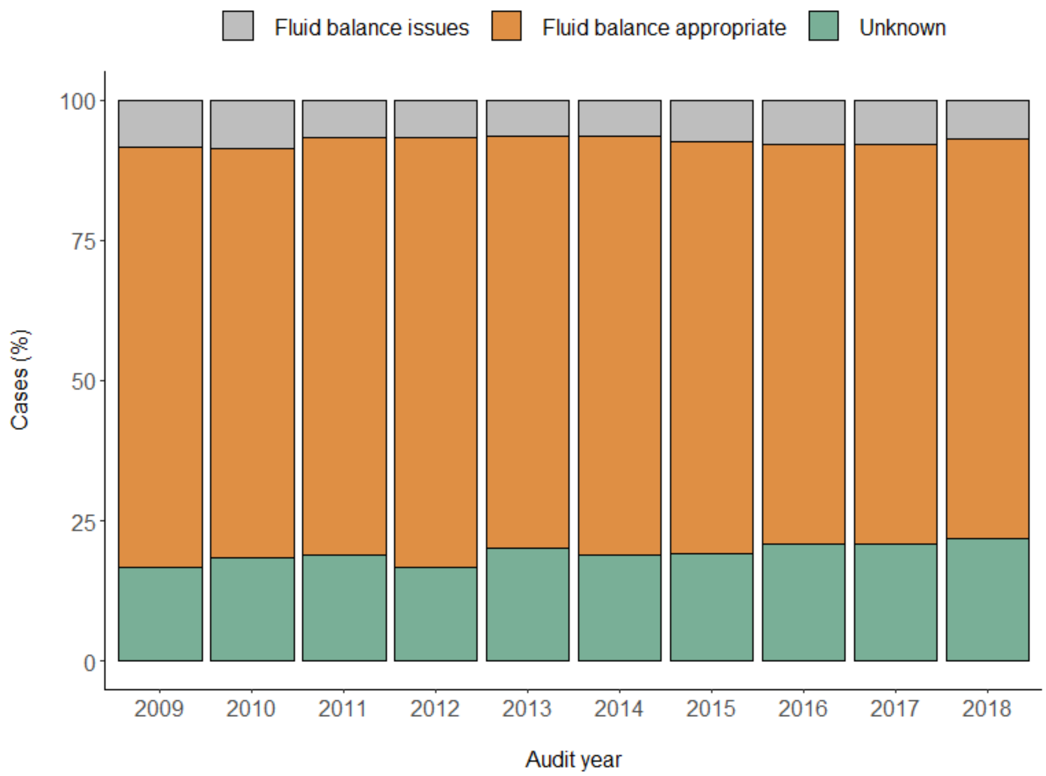
Assessors perceived that 7.4% (738/9,215) of patients who did not receive critical care support might have benefited from it (data not shown).

Between 2009 and 2018, there was a drop in the proportion of unavailable data regarding the provision of critical care support, from 26% in the 2016 report to 6% in this report. This reduction is a result of revising the SCF in 2014 to improve reporting for this question. The increase in available data allows for more meaningful analysis.

## 4.3 Fluid management

This section examines the appropriateness of fluid balance management in the audited cases (Figure 23).

**Figure 23: Appropriateness of fluid balance management as viewed by assessors**




Note: Data not available: n = 1,490 (5%); N = 31,313.

Assessors concluded that fluid balance was appropriate in most instances (73.3%) where the patient underwent a surgical procedure (Figure 23). Only in 7.3% (2,298/31,313) of cases did the assessors feel that there was an issue with fluid balance.

In 19.4% (6,079/31,313) of cases the assessors indicated that the evidence provided was inadequate to support a conclusion regarding fluid balance.

### 4.3.1 A case study demonstrating the importance of appropriate postoperative fluid maintenance/management regimens

**Postoperative management – unsatisfactory fluid balance and aspiration secondary to ileus after elective colorectal surgery**

**Case summary:**

A 72-year-old male underwent an elective laparoscopic right hemicolectomy for a spot-marked right colon cancer. The patient was noted to have a low urine output on day 1, despite being net fluid positive. On day 2, he started to become progressively distended and nauseated, so a nasogastric tube (NGT) was inserted, which drained minimal amounts over the next couple of days. On day 3, the patient was still distended despite little output from the NGT (40 ml total). The surgical team asked for the NGT to be manipulated. It is unclear whether this was done, but that night the patient vomited, dislodging the tube. The surgical team elected to leave the NGT out and noted that the patient seemed better the following morning (day 4). That night, the patient was found unresponsive and covered in faeculent vomit. He had sustained an asystolic cardiac arrest, presumed to be due to aspiration. Cardiopulmonary resuscitation failed to revive him.

**Discussion:**

According to the surgeon's note, this case was discussed at the multidisciplinary team (MDT) meeting, suggesting appropriate staging was performed; however, the MDT record and staging CT findings were unavailable.

The main area of concern with the care of this patient is that nasogastric decompression was unsatisfactory from the start and was not rectified. He clearly had a large volume of stomach contents, given that he was vomiting faeculent material even with an NGT inserted. It is likely that the tube was misplaced or blocked. Early replacement of the NGT may have prevented the aspiration event.

Other areas of consideration include elements of postoperative care that are usually managed within an enhanced recovery after surgery program (ERAS). It is unclear if this hospital has a comprehensive ERAS program. The issues of total opioid use and IV fluid management are particularly pertinent with regard to the risk of postoperative ileus.

Total opioid use is the single biggest modifiable risk factor for postoperative ileus. The patient had 8 mg of morphine plus 480 µg of fentanyl on day zero and 20 mg of oxycodone plus 420 µg of fentanyl on day 1. While he was on paracetamol and nonsteroidal anti-inflammatory medication, there was little in the way of other opioid-sparing analgesia. Current standard of care would include TAPP/rectus sheath local anaesthetic block and other opioid-sparing adjuncts such as tramadol or pregabalin. Total opioid use is a common issue in the absence of a comprehensive local ERAS guideline and should be addressed.

Regarding IV fluid management, the patient was 1.9 L positive on day zero, 3.1 L positive on day one, 0.5 L positive on day 2, 1.8 L positive on day 3, and 1.2 L positive on day 4. While some of this was accounted for by the ileus (invisible intraluminal loss), the reliance on replacement rather than maintenance fluid regimens – with basically no potassium supplementation – may have been a risk factor for both ileus and arrhythmia. This is a common issue and one that deserves more education and attention.

**Clinical lessons:**

This patient likely arrested after a significant aspiration event related to postoperative ileus. While mortality after elective colorectal resection is uncommon (1%), aspiration pneumonia secondary to postoperative ileus is the most common documented cause.

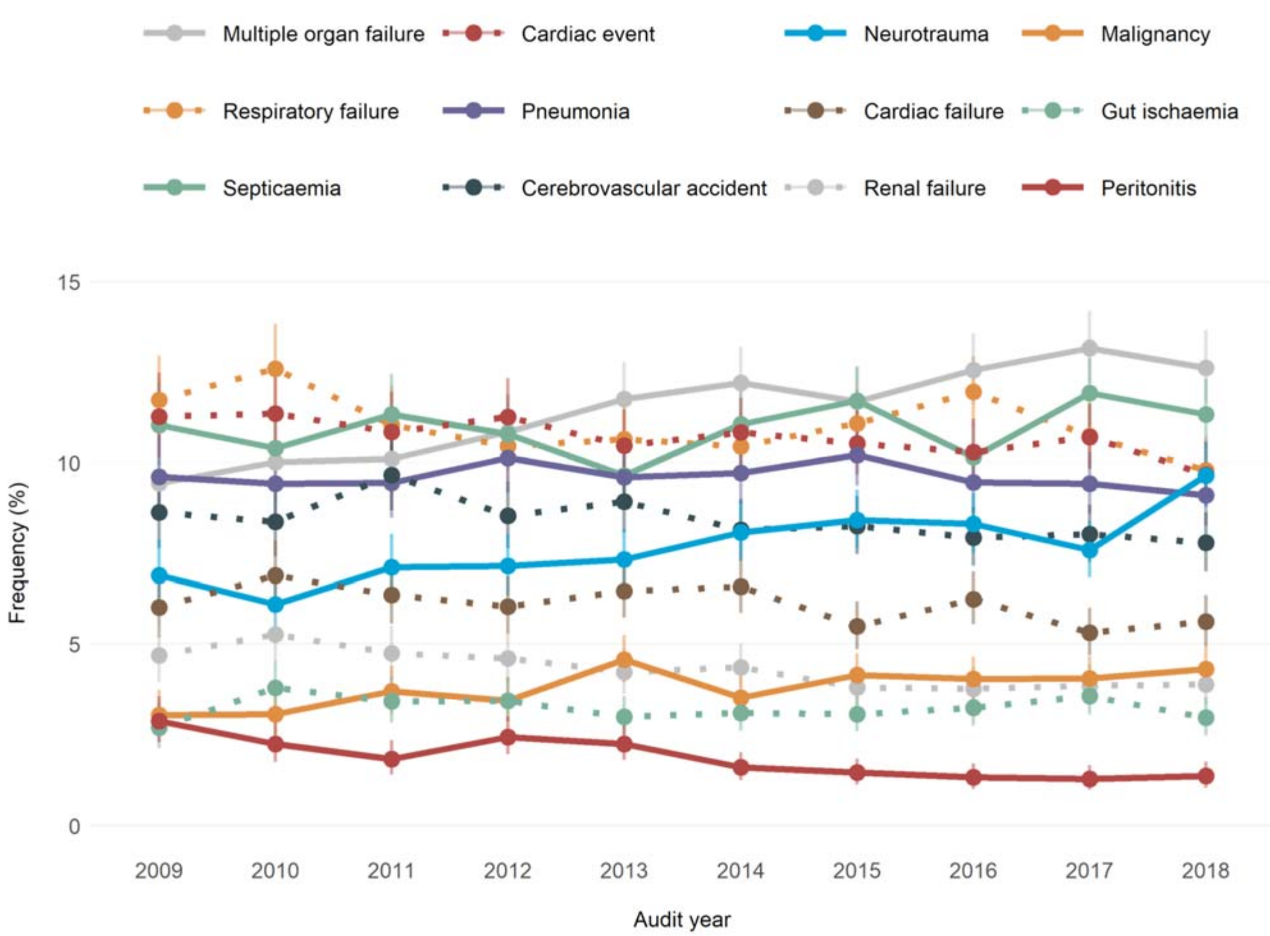
# 5. CAUSE OF DEATH

## 5.1 Frequency of causes of death reported in audited cases

| KEY POINTS |
|---|
| • Overall, the 4 most frequent causes of death were multiorgan failure, respiratory failure, septicaemia and cardiac events.<br>• Causes of death were consistent over the entire audit period. |

The most frequent causes of death reported in during the audit period 2009–2018 are shown in Figure 24.

**Figure 24: The top 12 most frequent causes of death**



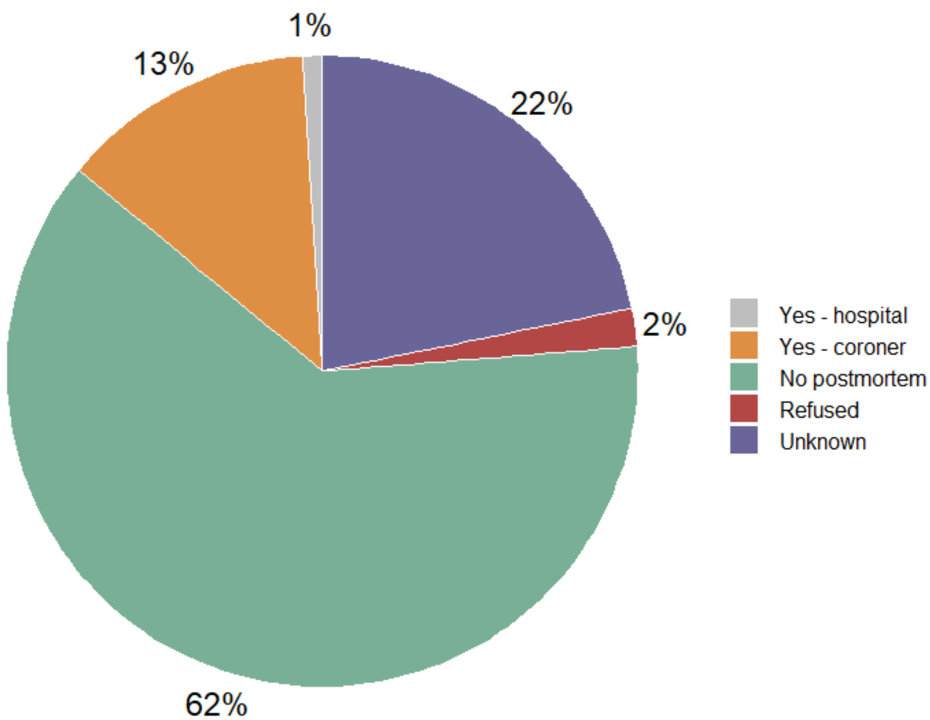

Note: Percentages show the proportions of each specific cause of death from the total number of deaths. Data not available: n = 102 cases (<1%); n = 78,394 causes of death recorded for N = 32,701 patients.
Neurotrauma includes diffuse brain injury, head injury, intracerebral haemorrhage, subarachnoid haemorrhage and subdural haematoma.

There has been a slight decrease in deaths related to acute respiratory problems compared with the 2016 report, where it was the second most common cause of death (Figure 24).[1]

## 5.2 Establishing cause of death

The cause of death recorded by the treating surgeon is based on the clinical course of the patient and any relevant supporting evidence from investigations. Where doubt exists around the circumstances leading to death, the case may be referred to the coroner. In other instances, where the cause of death is unclear, a postmortem examination may be requested. An overview of postmortems performed is shown in Figure 25 and Table 3.

**Figure 25: Overview of postmortems performed over the audit period 2009 – 2018**




Note: Data not available: n = 963 cases (3%); N = 31,840.

The majority of the cases were not referred to the coroner (Figure 25).

**Table 3: Overview of postmortems performed by ASM region, 2009–2018**

| Postmortem status | SA | QLD | WA | TAS | VIC | ACT | NT |
|---|---|---|---|---|---|---|---|
| Yes – hospital | <1% (16/4,912) | 1% (124/9,577) | 1% (45/4,253) | 1% (22/1,224) | 1% (89/10,555) | 1% (11/776) | 2% (8/543) |
| Refused | 1% (25/4,912) | 2% (173/9,577) | 2% (88/4,253) | 2% (29/1,224) | 3% (279/10,555) | 2% (17/776) | 1% (6/543) |
| Yes – coroner | 13% (620/4,912) | 7% (711/9,577) | 12% (517/4,253) | 11% (133/1,224) | 18% (1,894/10,555) | 25% (191/776) | 14% (77/543) |
| Unknown | 29% (1,433/4,912) | 17% (1,651/9,577) | 21% (898/4,253) | 22% (265/1,224) | 23% (2,416/10,555) | 25% (190/776) | 17% (90/543) |
| No | 57% (2,818/4,912) | 72% (6,918/9,577) | 64% (2,705/4,253) | 63% (775/1,224) | 56% (5,877/10,555) | 47% (367/776) | 67% (362/543) |

Note: data not available: n = 963 cases (3%); N = 31,840. Each ASM region has its own unique casemix and surgical population.

The need for coronial input varied among ASM regions, with the highest percentage of cases recorded in the Australian Capital Territory (Table 3).

A coronial postmortem was performed in only 13.0% (4,143/31,840) of audited cases between 2009 and 2018. In some of the ASM regions the numbers were low, which could impact interpretation of the data.

In 87.0% (27,697/31,840) of cases a postmortem was not performed, or permission was refused, or it is unknown whether a postmortem was conducted.

There were no significant changes in trends during the audit period (data not shown).

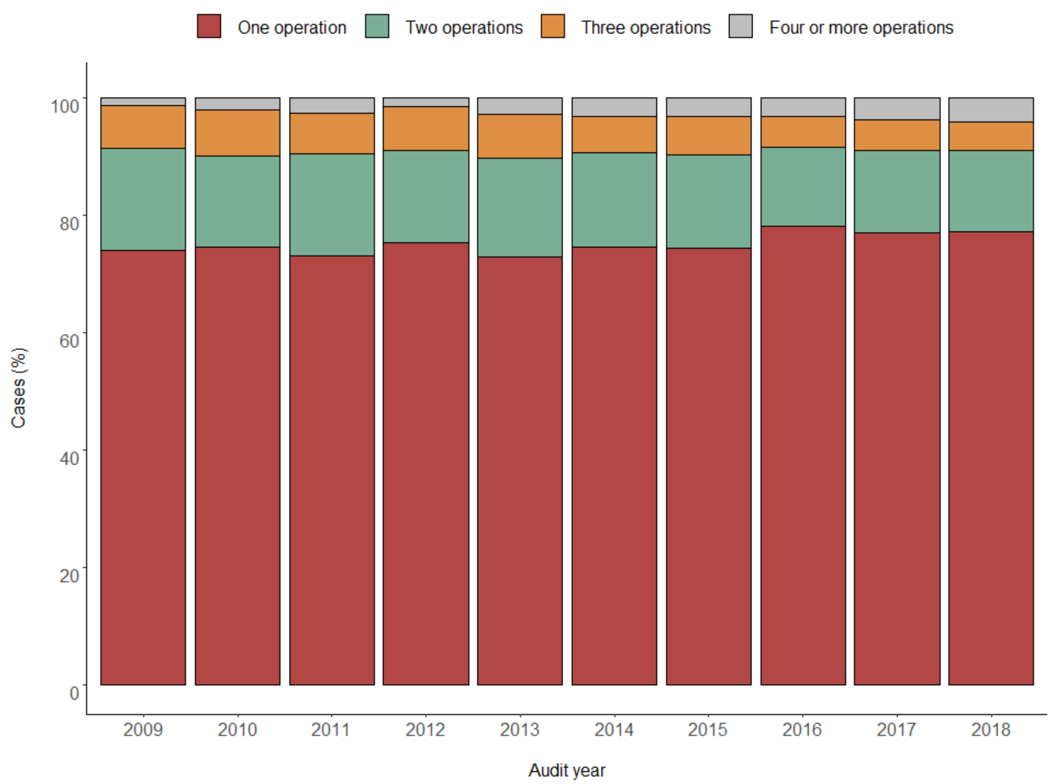
# 6. PROFILE OF OPERATIVE INTERVENTION

| KEY POINTS |
|---|
| • A surgical procedure was performed on 79.6% (26,064/32,763) of patients. More than one visit to the operating theatre was required for 24.7% (6,443/26,064) of patients during their hospital stay.<br>• A consultant surgeon made the decision to operate in 94.5% of instances (32,114/33,982) and performed 69.5% (23,631/33,982) of the operations.<br>• The rate of subsequent (unplanned) returns to theatre was 16.1% (4,061/25,224), with some patients requiring multiple episodes of surgery.<br>• The most common postoperative complications were postoperative bleeding, procedure-related sepsis and tissue ischaemia. |

## 6.1 Operative rate

The frequency of patients undergoing operation and the total number of operations done during the audit period are shown in Figure 26.

**Figure 26: Percentage of patients undergoing one or more operations by audit year**



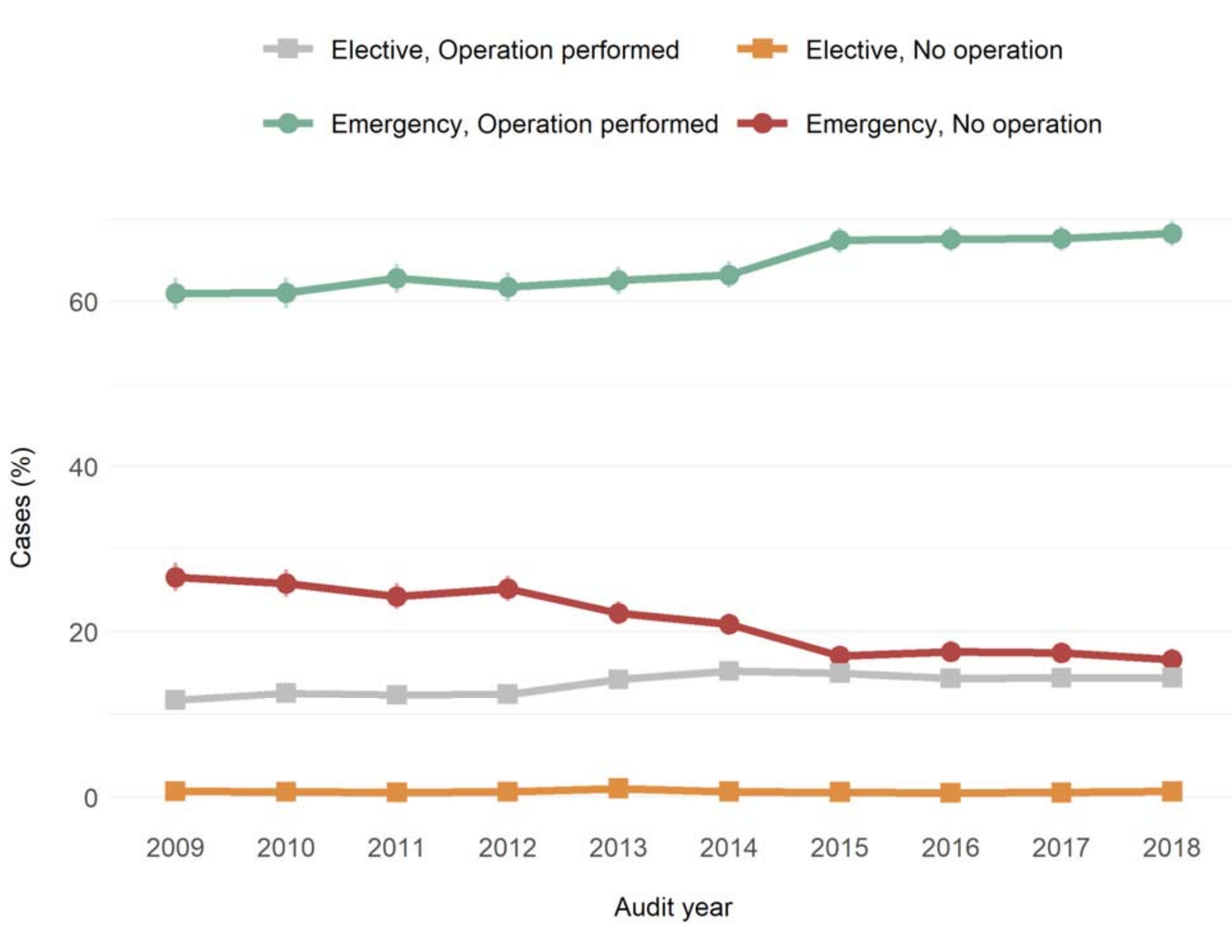

Note: Data not available: n = 31,840; N = 26,064.

Between 2009–2018:

- 79.6% (26,064/32,763) of audit patients underwent an episode of surgery either during their last admission or within 30 days prior to death (Figure 26).
- 20.4% (6,699/32,763) of patients had no surgery during their final admission.
- A total of 36,607 operative episodes were undertaken on the 26,064 patients who had surgery, indicating that an individual patient can have more than one episode of surgery during admission.
- 75.3% (19,621/26,064) of patients had just one operation.
- 24.7% (6,443/26,064) of patients had more than one operation.
- There has been relatively little change in the frequency of multiple operations between 2009 and 2018.

Operative and non-operative cases by admission status and audit year are shown in Figure 27.

**Figure 27: Percentage of operative and non-operative patients by audit year**



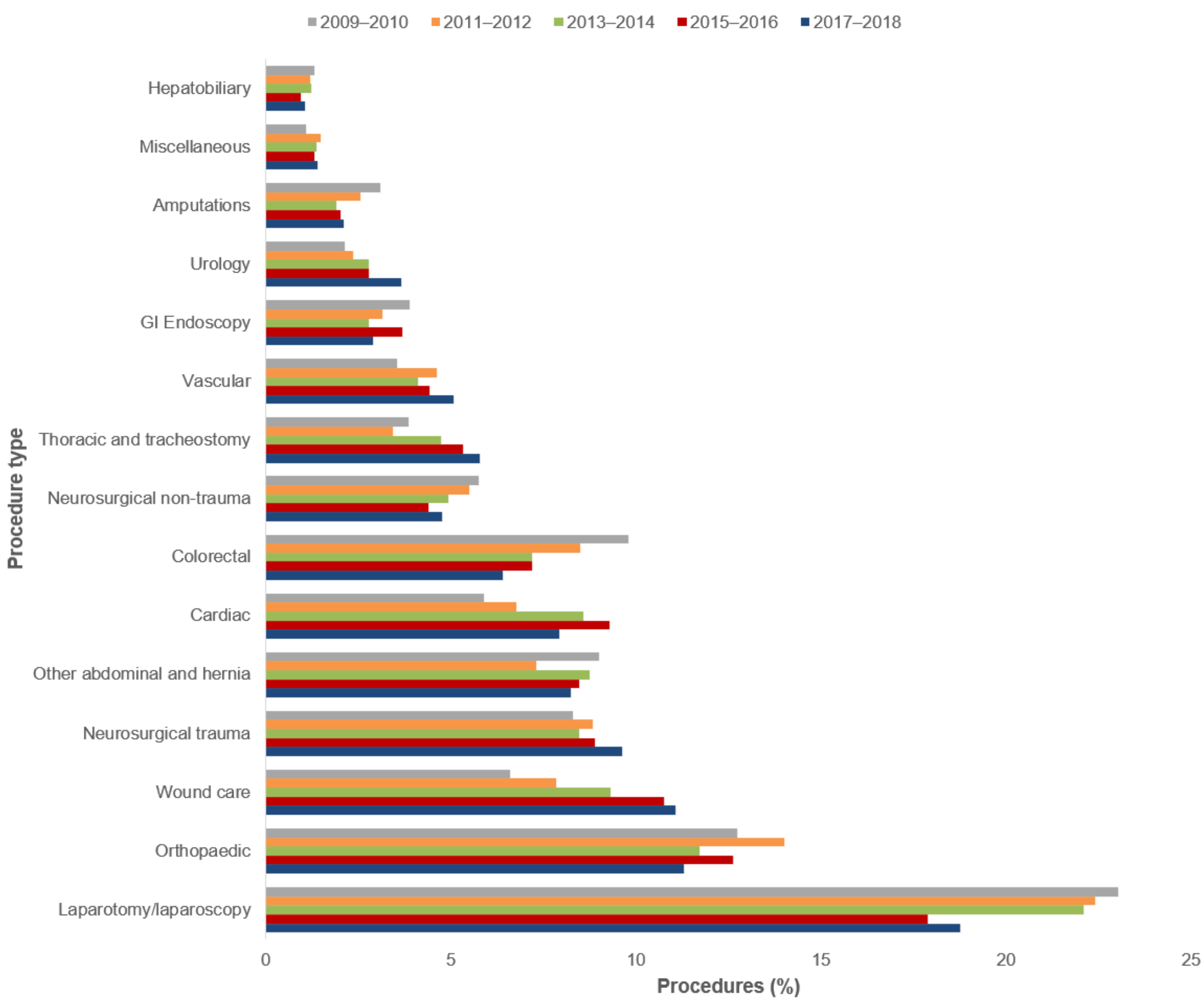

Note: Error bars show 95% confidence intervals. Data not available: n = 335 (1%); N = 32,468 patients.

Between 2009 and 2018, 4.6% (217/4,698) of elective admission patients and 24.5% (6,793/27,770) of emergency admission patients did not undergo an operation prior to death (Figure 27). The decision not to operate was generally an active decision to palliate an irretrievable situation.

## 6.2 Frequency of operative procedures

The frequency of operative procedures in audit patients is shown in Figure 28. A patient can undergo multiple procedures during the same admission and during the same surgical episode.

**Figure 28: The most frequent types of operative procedures**



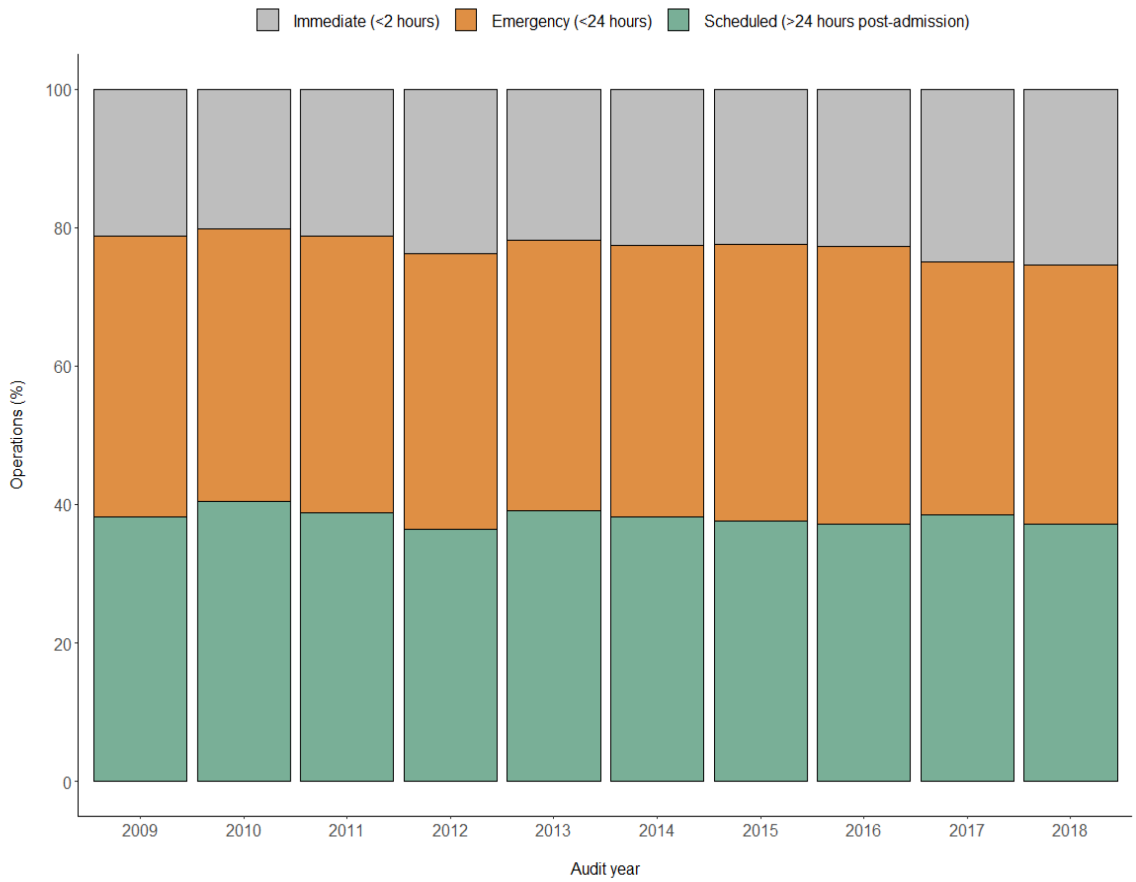

Note: n = 66,296 procedures for N = 26,064 patients.
Neurosurgical procedures include clipping of aneurysm of cerebral artery, craniotomy (evacuation of non-trauma injuries, tumour resection, excision or drainage of abscess) and posterior fossa craniotomy for infarct.
Laparotomy group includes all abdominal procedures not specified in other sections (e.g. colorectal procedures).

The total number of procedures for each type of operation has been increasing generally over the audit years, with laparotomy/laparoscopy and orthopaedic operation groups being the most frequent procedures (Figure 28). The distribution of types of procedures has remain consistent over the audit years.

## 6.3 Timing of emergency episodes

The timing and urgency of operations during the audit period is shown in Figure 29.

**Figure 29: Timing of emergency surgical episodes**




Note: Data not available n = 55 cases (<1%); n = 25,491 operations in N = 19,372 patients.

Timing and urgency of operations has remained relatively consistent across the years (Figure 29). The urgency (time-critical nature) of a patient's condition predicts the timing of any surgery.

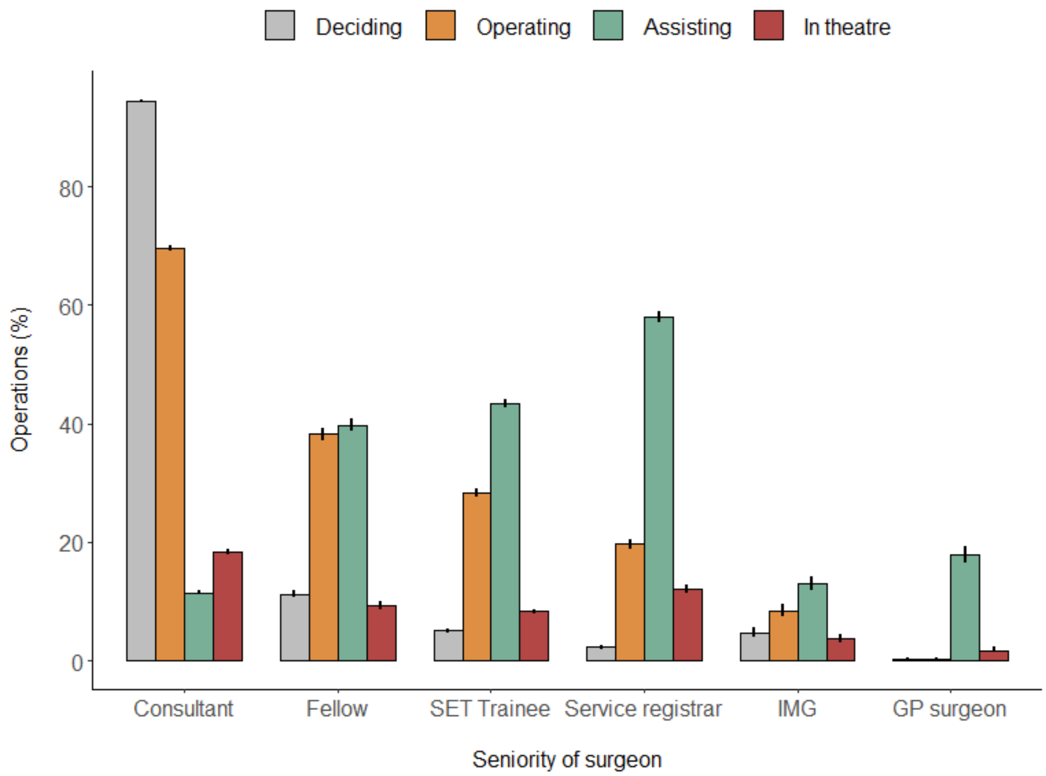
Between 2009 and 2018, 38.1% (9,705/25,491) of all emergency admissions to a surgical unit were deemed necessary within 24 hours of admission, with 61.9% (15,786/25,491) classified as necessary for emergency or immediate surgery.

Across the reporting periods, most of the emergency surgery was performed in the public sector (data not shown).

### 6.3.1 Seniority of surgeon performing surgery

The surgeon completing the SCF was asked to record the seniority of the surgeon who made the clinical decision to operate and the seniority of the surgeon who performed the surgery (Figures 30). Furthermore, consultants' involvement in surgery was compared between ASM regions and the results shown in Figure 31.

**Figure 30: Seniority of surgeon making the decision to operate and performing the surgery**



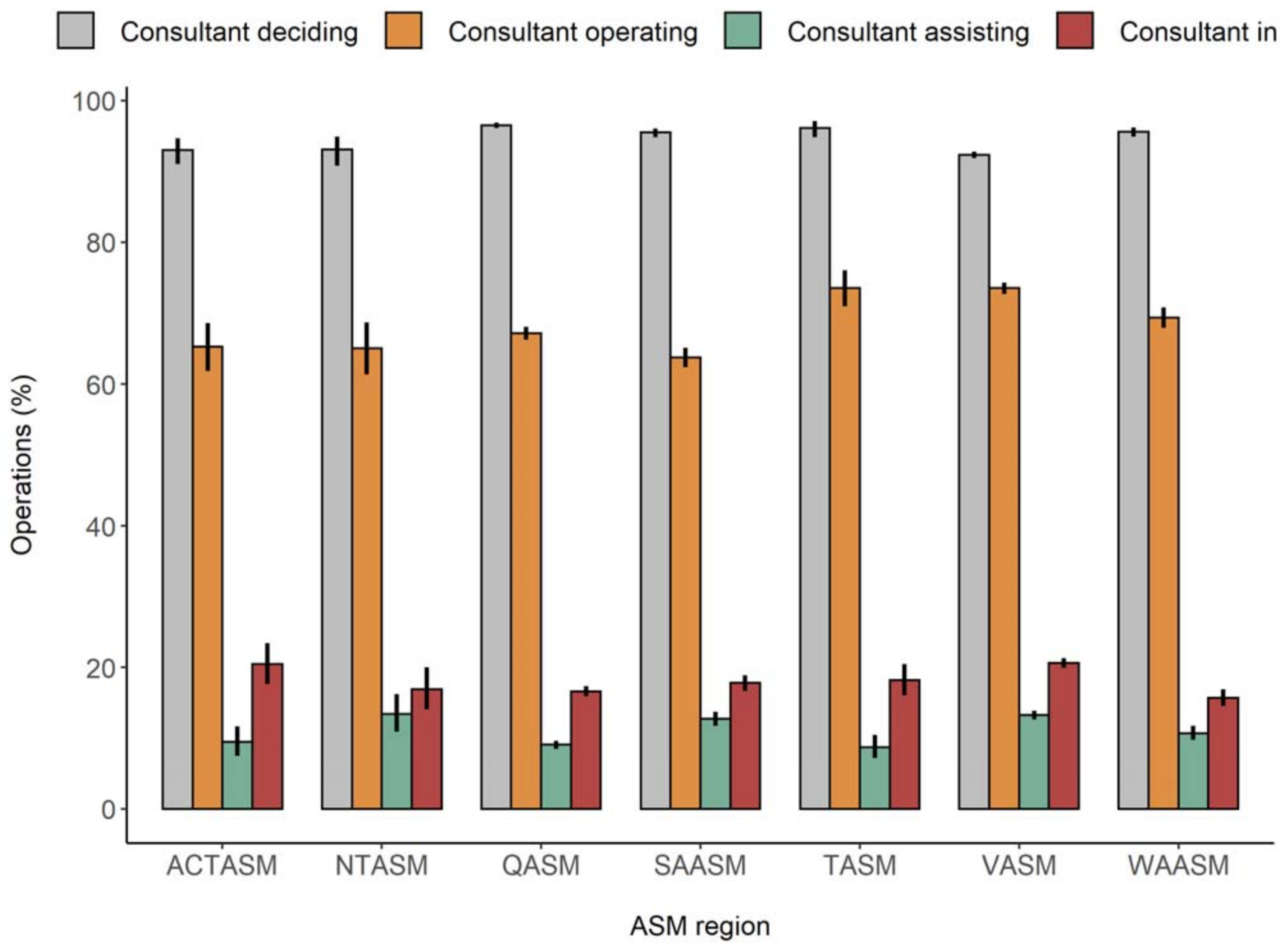

Note: Error bars show 95% confidence intervals. Data not available: n = 960 cases (2.6%); n = 35,640 operations in N = 25,734 patients. SET: surgical education and training; IMG: International Medical Graduate; GP: general practitioner.

Input from consultant surgeons was high. In 94.5% (32,114/33,982) of cases the consultant surgeon made the decision to operate (Figure 30).

For each surgical episode, more than one grade of surgeon may have been deciding, operating, assisting or present in theatre.

Between 2009 and 2018, there was an increase in the proportion of surgical episodes in which consultant surgeons made the decision to operate (from 87% to 94.5%) and little change in the proportion of surgical episodes where surgeons performed the operation (data not shown).

**Figure 31: Consultant involvement in surgery by ASM region**




Note: Error bars show 95% confidence intervals. Data not available: n = 1,324 (5%); n = 33,982 operations in N = 24,740 patients.

There was little variation across ASM regions in terms of consultant involvement in surgery (Figure 31). Minor differences may reflect local approaches to surgical training and staffing levels.

## 6.4 Unplanned return to theatre

The treating surgeon was asked to indicate whether there was an unplanned return to the operating theatre following the initial operative procedure (Table 4).

**Table 4: Percentage of patients with unplanned return to theatre**

| Return to theatre status | 2009–2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| No return to theatre | 84% (8,789/10,509) | 83% (2,315/2,779) | 83% (2,524/3,041) | 84% (2,488/2,949) | 84% (2,579/3,057) | 84% (2,418/2,889) |
| Return to theatre | 16% (1,696/10,509) | 16% (458/2,779) | 17% (510/3,041) | 16% (457/2,949) | 16% (474/3,057) | 16% (466/2,889) |
| Do not know | <1% (24/10,509) | <1% (6/2,779) | <1% (7/3,041) | <1% (4/2,949) | <1% (4/3,057) | <1% (5/2,889) |

Note: Data not available: n = 840 (3%), N = 25,224.

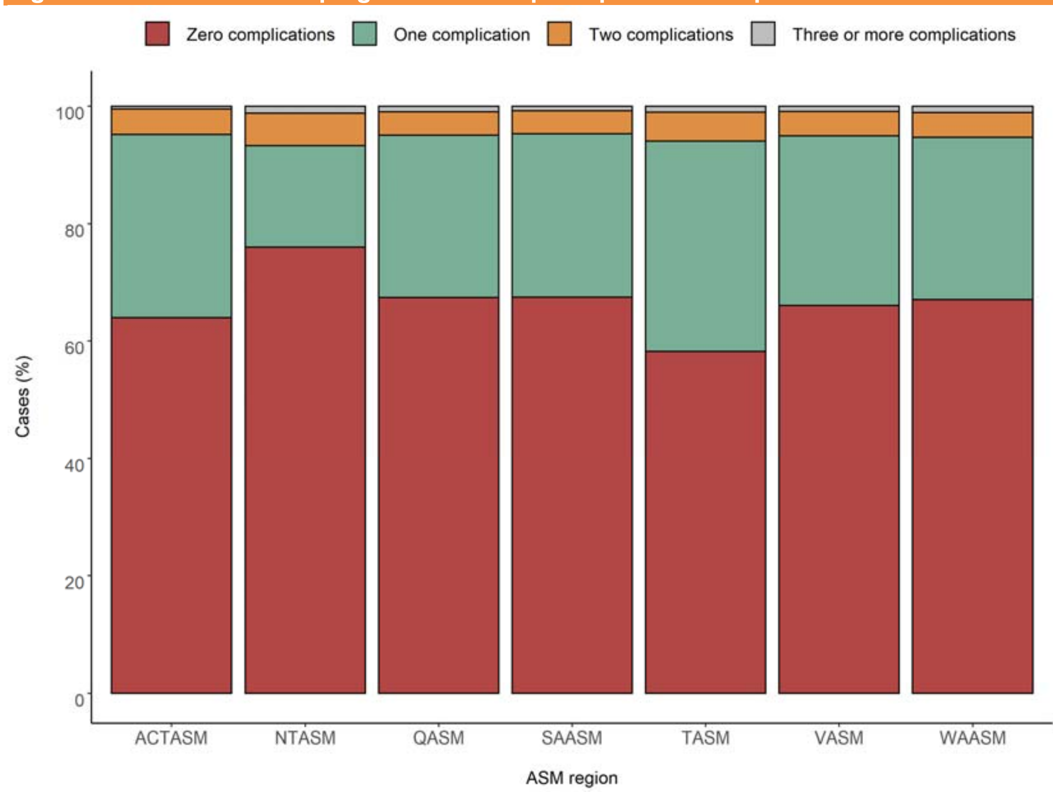
Between 2009 and 2018, 16.1% (4,061/25,224) of patients who underwent a surgical procedure had an unplanned return to theatre (Table 4).

The proportion of patients requiring a return to theatre was relatively unchanged during the audit period.

## 6.5 Postoperative complications

The treating surgeon was asked to record any complications that occurred following a surgical procedure (Figure 32).

**Figure 32: Patients developing one or more postoperative complications**




Note: Each ASM region has its own unique casemix and surgical population. n = 10,007 complications in N = 25,338 patients, audit period 2009–2018.

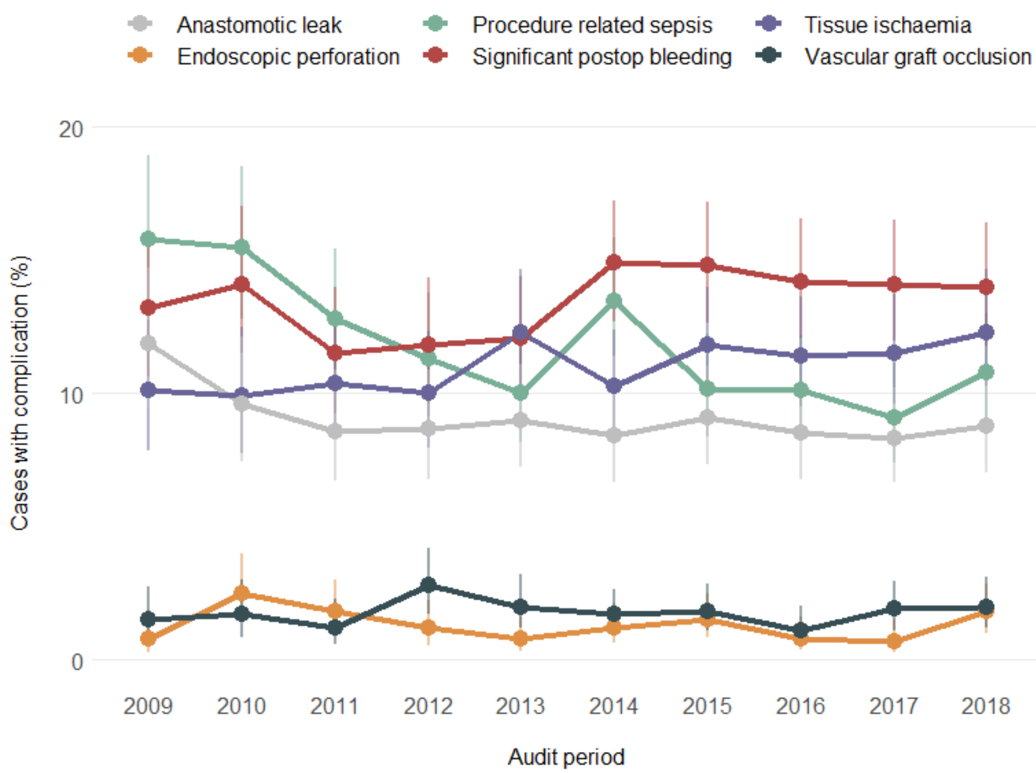
Between 2009 and 2018, postoperative complications were reported in 33.3% (8,448/25,338) of audit patients who underwent a surgical procedure (Figure 32).

Significance of complications in relation to the eventual outcome is unknown – significance varies from minor (no effect on outcome) to major (led to death).

Some variation exists in the number of complications between ASM regions, with a slightly larger proportion of patients presenting with 2 or more complications in the Northern Territory compared to other ASM regions.

The 6 most common postoperative complications reported by the treating surgeon are shown in Figure 33.

**Figure 33: The most common postoperative complications by audit year according to treating surgeon**




Note: Error bars show 95% confidence intervals. n = 10,007 complications recorded in N = 25,338 patients.
Other postoperative complications included cardiac failure, intrapulmonary haemorrhage, intracerebral bleed, postoperative hypoxia, acute or chronic renal failure, paraplegia, liver failure, pneumonia, perforated viscus, pulmonary embolism, pyelonephritis, respiratory failure, seizure, sepsis, stroke and wound haematoma.

Between 2009 and 2018, the most common postoperative complications were postoperative bleeding, procedure-related sepsis and tissue ischaemia (Figure 33).

Some of the more common postoperative complications (e.g. anastomotic leak) decreased between 2009 and 2018.

## 6.6 Anaesthetic problems

A general anaesthetic in a critically ill elderly patient with comorbidities is a dangerous event, even more so in an emergency where there is insufficient time to optimise the patient's state. Drug reactions, cardiac and respiratory complications may occur. According to the opinion of the treating surgeons, only 7.6% (1,922/25,263) of audit cases were thought to have an anaesthetic component to the death.

Anaesthesia was probably a significant factor in the death of 1.7% (418/25,263) of patients who had a surgical procedure. Anaesthesia was possibly involved in the outcome in 6.0% (1,504/25,263) of cases.

The proportion of deaths for which anaesthetic issues were raised was relatively unchanged between 2009 and 2018.

Audit cases in which anaesthesia appeared to play a major role are referred to the appropriate state and territory anaesthetic mortality review committee, where available. These cases have often already been detected by the anaesthetic group.

## 6.7 Operative procedure abandoned

The treating surgeon was asked to record whether a surgical procedure was abandoned on finding a terminal condition. Such a decision was made in 5.4% (1,768/32,970) of audited operations.

The proportion of abandoned operations was largely unchanged between 2009 and 2018.

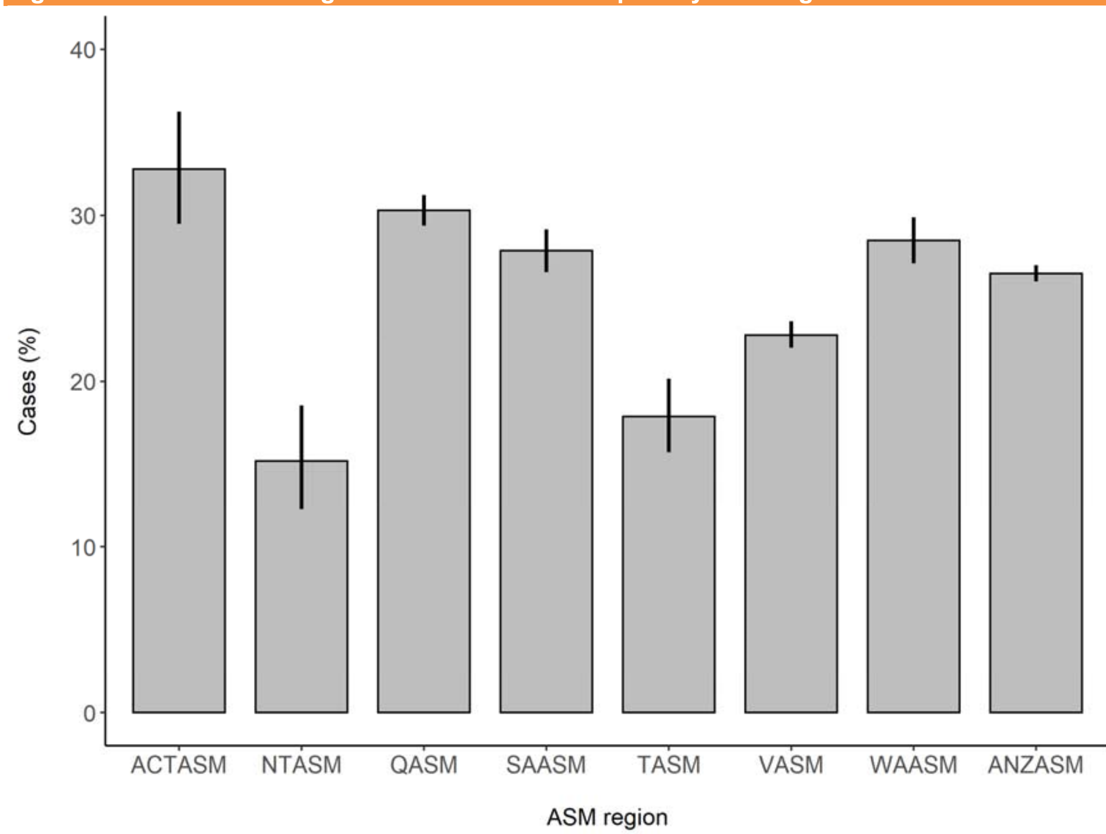
# 7. PATIENT TRANSFER ISSUES

| KEY POINTS |
| --- |
| • Transfer between hospitals was required in 26.5% (8,426/31,749) of audited cases.<br>• Between 2009 and 2018, 11.0% (867/7,867) of transfer issues related to delays, 6.0% (473/7,910) to inappropriate transfer, 5.1% (394/7,694) to insufficient clinical documentation and 2.8% (217/7,712) to inappropriate level of care. |

## 7.1 Frequency of need for transfer

The audit process examines transfers between hospitals. A transfer typically occurs because of the need for a higher level of care or specific expertise. Figure 34 shows a state and territory breakdown of cases in which a transfer occurred.

**Figure 34: Patients needing transfer to another hospital by ASM region**




Note: Error bars show 95% confidence intervals. Data not available: n = 1,054 (3%); N = 8,426. Each ASM region has its own unique casemix and surgical population. ASM: Audit of Surgical Mortality

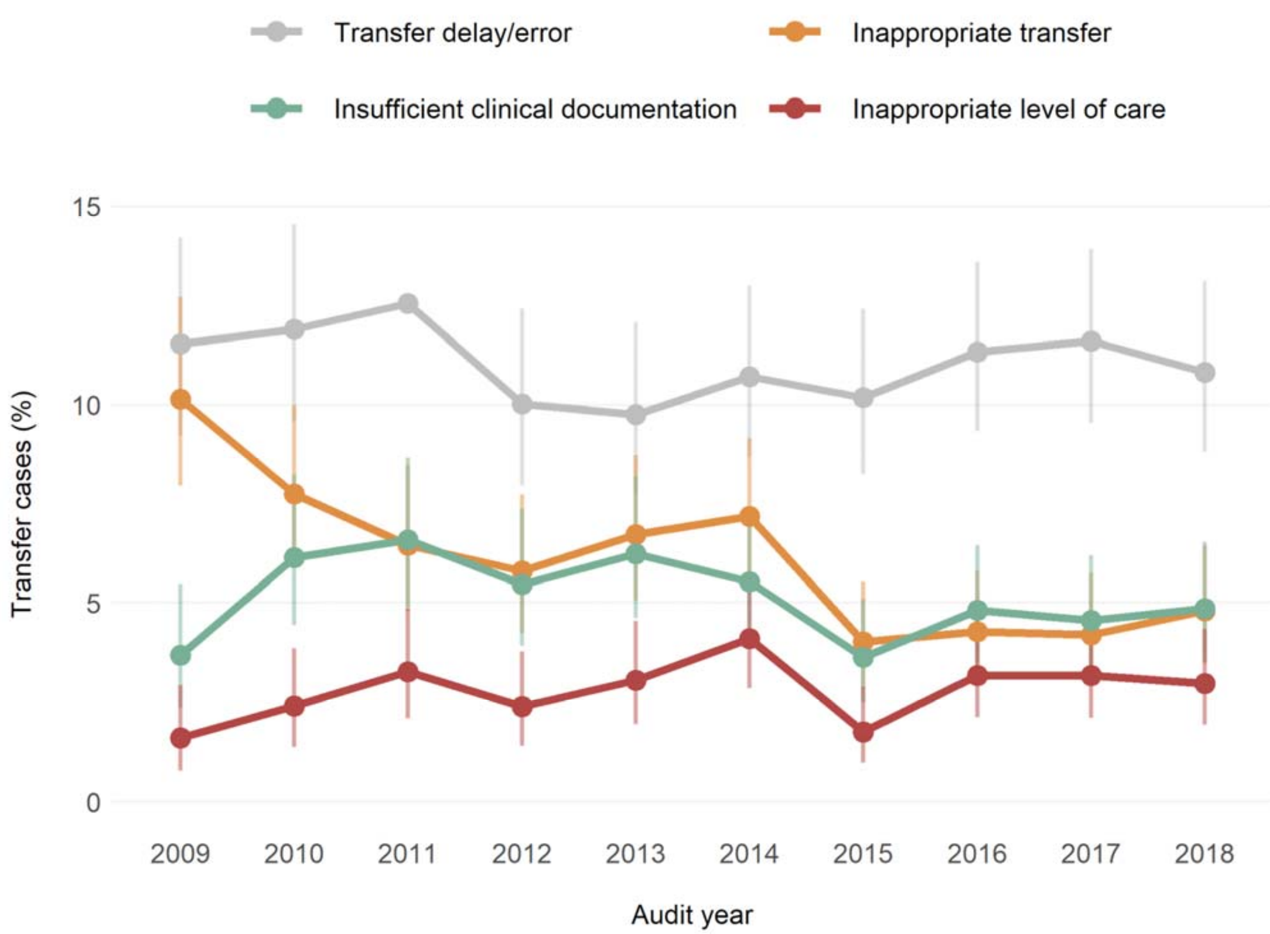
Between 2009 and 2018, 26.5% (8,426/31,749) of audited cases involved a transfer between hospitals (Figure 34).

The need for transfer varied among the ASM regions, probably reflecting the geographical distribution of available healthcare facilities. More of the patients who required transfer were initially admitted to Queensland and the Australian Capital Territory (ACT) hospitals.

## 7.2 Issues associated with patient transfer

The treating surgeon was asked to record any issues associated with the transfer of a patient between hospitals (Figure 35).

**Figure 35: Types of issues associated with patient transfer**




Note: Error bars show 95% confidence intervals. Data not available: n = 816 cases (10%); n = 1,951 issues in N = 8,426 transferred patients. Issues are not mutually exclusive; multiple issues can occur for a single transferred patient.

Issues related to transfer were raised by the treating surgeon in 23.2% (1,951/8,426) of cases involving patient transfer (Figure 35). Under the audit's current legal framework, specific case information cannot be provided to the ambulance service or referring hospital.

Between 2009 and 2018, 11.0% (867/7,867) of audit issues related to transfer delay, 6.0% (473/7,910) to appropriateness of transfer, 5.1% (394/7,694) to insufficient clinical documentation and 2.8% (217/7,712) to inappropriate level of care.

Insufficient clinical documentation is a concern that could be readily improved. Good communication ensures that all clinicians involved have full knowledge of a patient's health status.

### 7.2.1 A case study demonstrating how numerous delay issues contributed to the death of a patient.

**Delay in diagnosis, transfer and surgical washout/debridement**

**Case summary:**

A 73-year-old female presented to a regional hospital (hospital 1) with signs and symptoms of periprosthetic joint infection of her right knee. The patient had a total knee replacement in 2013, which was revised for infection. She had multiple medical comorbidities including type 2 diabetes and atrial fibrillation, for which she was taking dabigatran.

The patient presented at 19:25 with a one-day history of knee pain and difficulty weight bearing. The attending doctor was unsure of the diagnosis but considered an infected joint. The patient was tachycardic on presentation but had no other signs of sepsis. Blood tests showed acute kidney injury (urea 20 mmol/L, creatinine 124 µmol/L), neutrophilia (white cell count 14.4 x$10^9$/L), and C-reactive protein (CRP) of 134 mg/L. An X-ray of the knee was normal. The joint replacement was not aspirated, presumably due to concerns regarding sterility in the setting of a joint replacement.

The patient was admitted to the short stay unit. Dabigatran did not cease. An ultrasound performed on the morning of the following day showed a complex collection in the knee. At this point, patient management was discussed with Orthopaedics at hospital 2, who advised transfer to them for an aspirate. Later that morning, the patient became febrile, hypotensive and tachycardic. Blood cultures were taken and intravenous (IV) flucloxacillin commenced. The patient was declared nil by mouth (NBM) and moved to the high dependency unit while awaiting transfer. Transfer to hospital 2 did not occur until 20:30 that evening.

The following morning the patient was assessed by Orthopaedics. The consultant reviewed the patient and aspirated the joint in the emergency department, obtaining 20 ml of fluid. The patient was kept NBM pending results of the aspirate. It is possible there was a reluctance to take the patient to theatre because of dabigatran administration the previous day. Consultation with Haematology advised a delay of 48–72 hours before proceeding with surgery. The haematologist also mentioned prothrombinex-VF as an option. There was no documentation regarding arranging polyethylene exchange of implants at the time of surgery. It is unclear when the patient was last fed because she did not go to theatre on the day of presentation at hospital 2. The patient had multiple medical emergency team calls throughout the evening for hypotension and was transferred to the intensive care unit (ICU).

The following day at 16:30 the patient was taken to theatre for a washout. By now, this was almost 3 days from the time of initial presentation. Copious frank pus was found in the knee. Polyethylene exchange was not performed. The patient remained in ICU and the wound continued to ooze. A repeat washout was performed 5 days after the previous washout. No frank pus was seen.

The patient's condition failed to improve. Infective endocarditis was suspected but was not proven on transthoracic echocardiogram. A transoesophageal echocardiogram was planned but this was postponed when the patient developed an upper gastrointestinal bleed. The patient continued to deteriorate, and she died 14 days following admission. The cause of death was stated to be upper gastrointestinal bleed secondary to *Staphylococcus* sepsis and endocarditis.

**Discussion:**

Given the constellation of signs, symptoms and investigations at presentation, a diagnosis of periprosthetic joint infection was extremely likely. Preparations – including ceasing dabigatran – should have been made at this point to have the patient transferred to hospital 2 for surgery.

When the patient became hypotensive, the receiving orthopaedic team could have advised the treating team to aspirate the knee prior to commencing IV antibiotics. Concerns regarding introducing infection are outweighed at this point by the need to obtain an organism prior to antibiotic therapy.

The patient was not taken to theatre on the day of presentation to hospital 2, possibly due to concerns regarding bleeding on the background of dabigatran. A very high suspicion of infection should have been present at this stage given the patient's previous history of infected knee replacement and signs of sepsis. This should outweigh concerns of bleeding in most circumstances.

When washing out a joint replacement for infection it is routine practice to exchange components that can be easily removed, allowing a more thorough debridement and source control.

**Clinical lessons:**

This patient endured a lengthy period of time from presentation to source control of sepsis due to a combination of delays in diagnosis, transfer and surgical washout/debridement. The delayed debridement could have been optimised by polyethylene exchange.

The overall delay may have contributed to secondary infection such as endocarditis, which may have contributed significantly to the patient’s death.

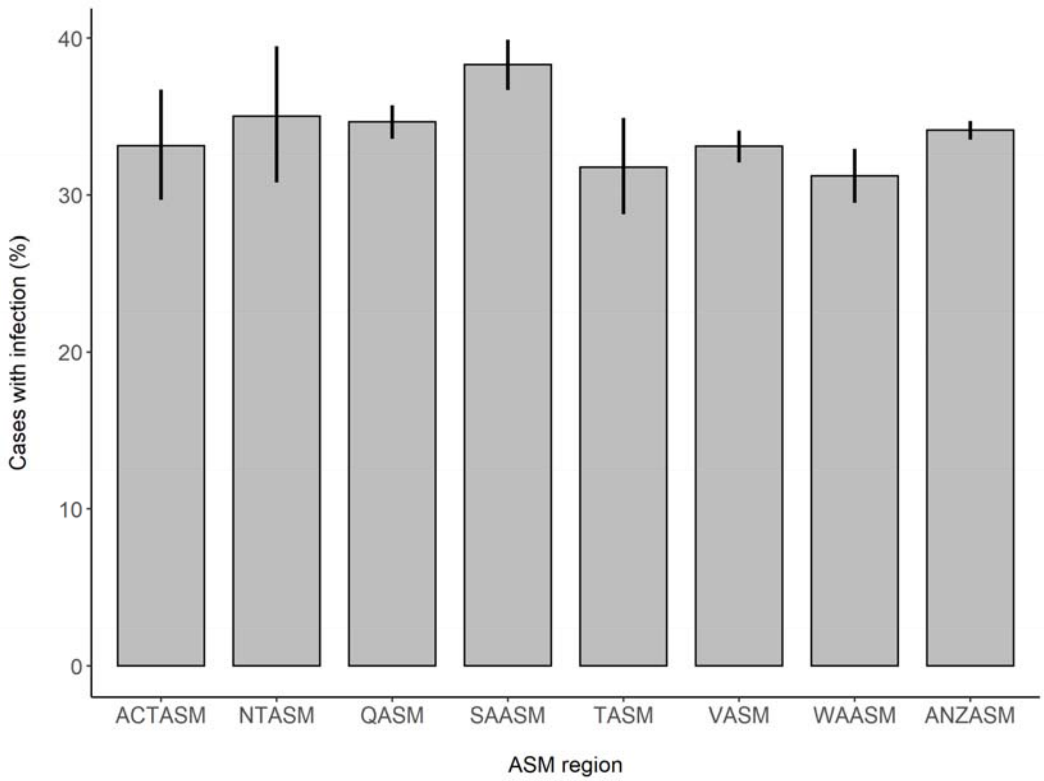
# 8. INFECTION AND TRAUMA

| KEY POINTS |
|---|
| • ANZASM started collecting data on infection and trauma cases in 2012. <br> • Between 2012 and 2018, 34.1% (8,321/24,375) of audited patients died with a clinically significant infection. <br> • Of the 5,210 documented traumatic events, 79.9% (4,162) were caused by falls, 13.1% (682) were caused by accidents and 4.3% (223) were associated with domestic, public or self-inflicted violence. |

## 8.1 Infections

In 2012, ANZASM started collecting data on infection in patients undergoing surgery. ANZASM is keen to monitor infection trends to ensure that strategies are implemented to prevent and minimise infections contracted prior to and during surgery (Figure 36). This data had been collected in all states and territories by the end of 2018.

**Figure 36: Patients who died with a clinically significant infection present by ASM region**



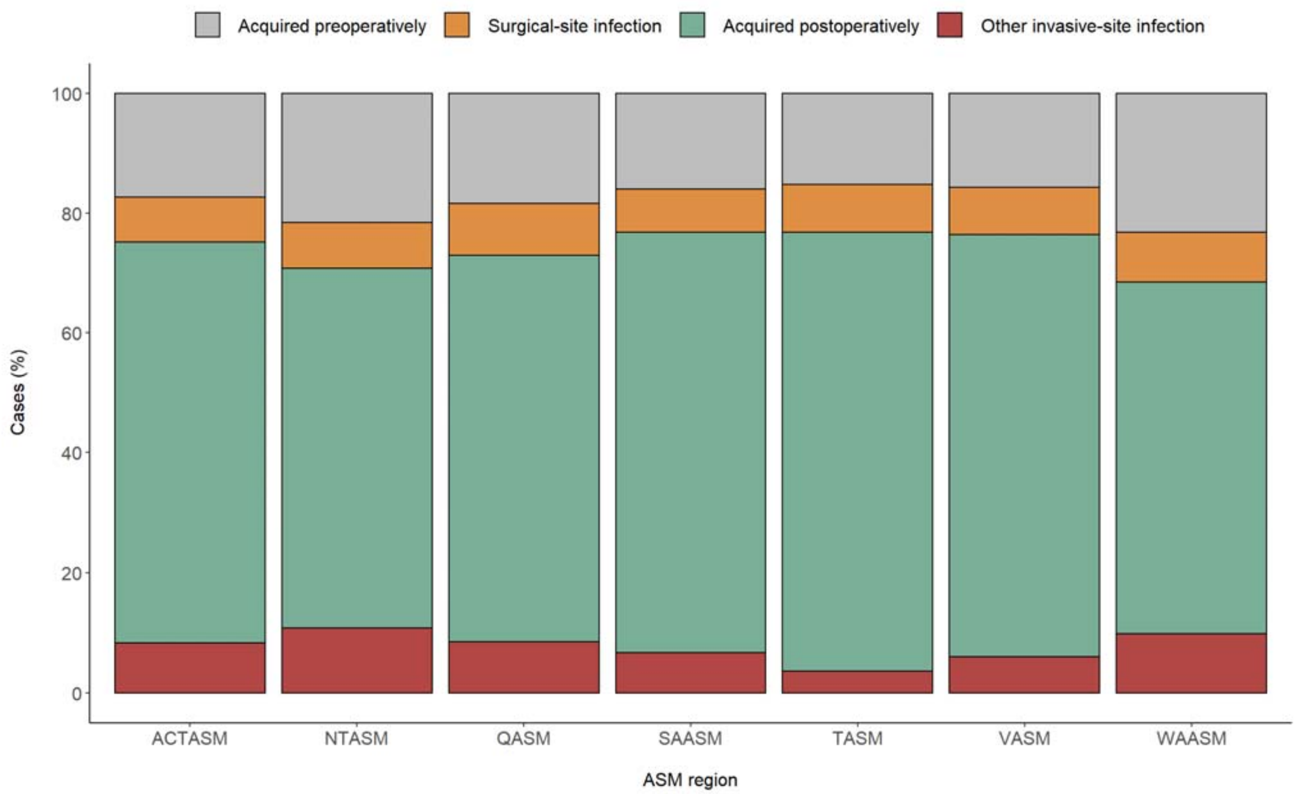

Note: Error bars show 95% confidence intervals. Data not available: n = 107 cases (<1%), n = 8,321 infections in N = 24,375 patients; period (2012–2018). Each ASM region has its own unique casemix and surgical population. ASM: Audit of Surgical Mortality

Between 2012 and 2018, 34.1 % (8,321/24,375) of patients died with a clinically significant infection (data not shown) (Figure 36).

Of the patients who died with a clinically significant infection, 57.9% (4,675/8,075) of the infections occurred during patients' admission

Timing of infections acquired during admission is shown in Figure 37.

**Figure 37: Timing of infections acquired during admission by ASM region**

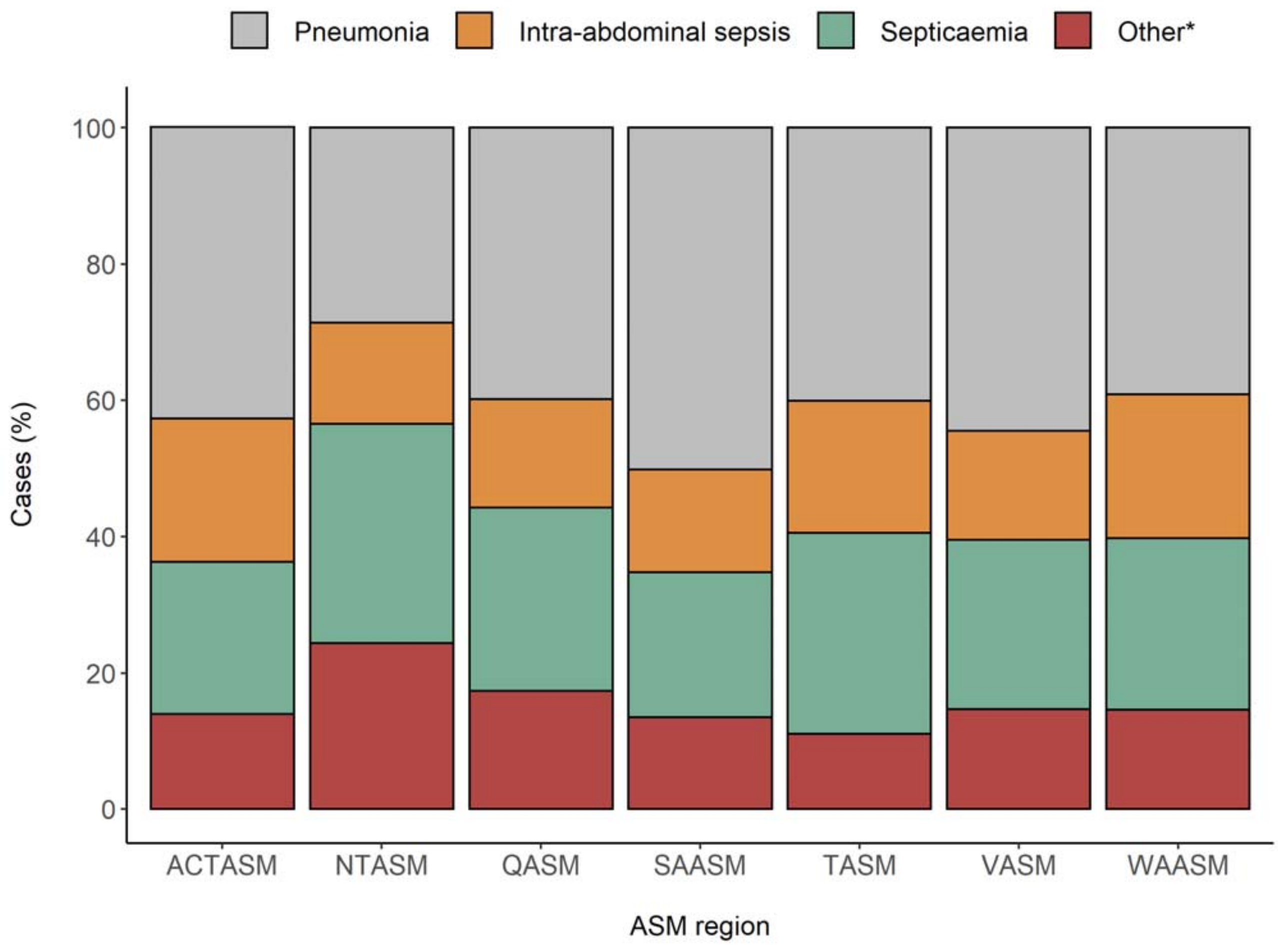



Note: Data not available: n = 228 cases (5%); N = 4,447 cases; period (2012–2018). Each ASM region has its own unique casemix and surgical population. ASM: Audit of Surgical Mortality

Of the patients who acquired an infection during admission, 67.4% (2,996/4,447) were acquired postoperatively, 17.4% (773/4,447) were acquired preoperatively, 8.0% (357/4,447) were surgical-site infections and 7.2% (321/4,447) were an invasive infection at a different site (Figure 37).

The type of infection acquired before or during admission is shown in Figure 38.

**Figure 38: Type of infection acquired before or during admission by ASM region**

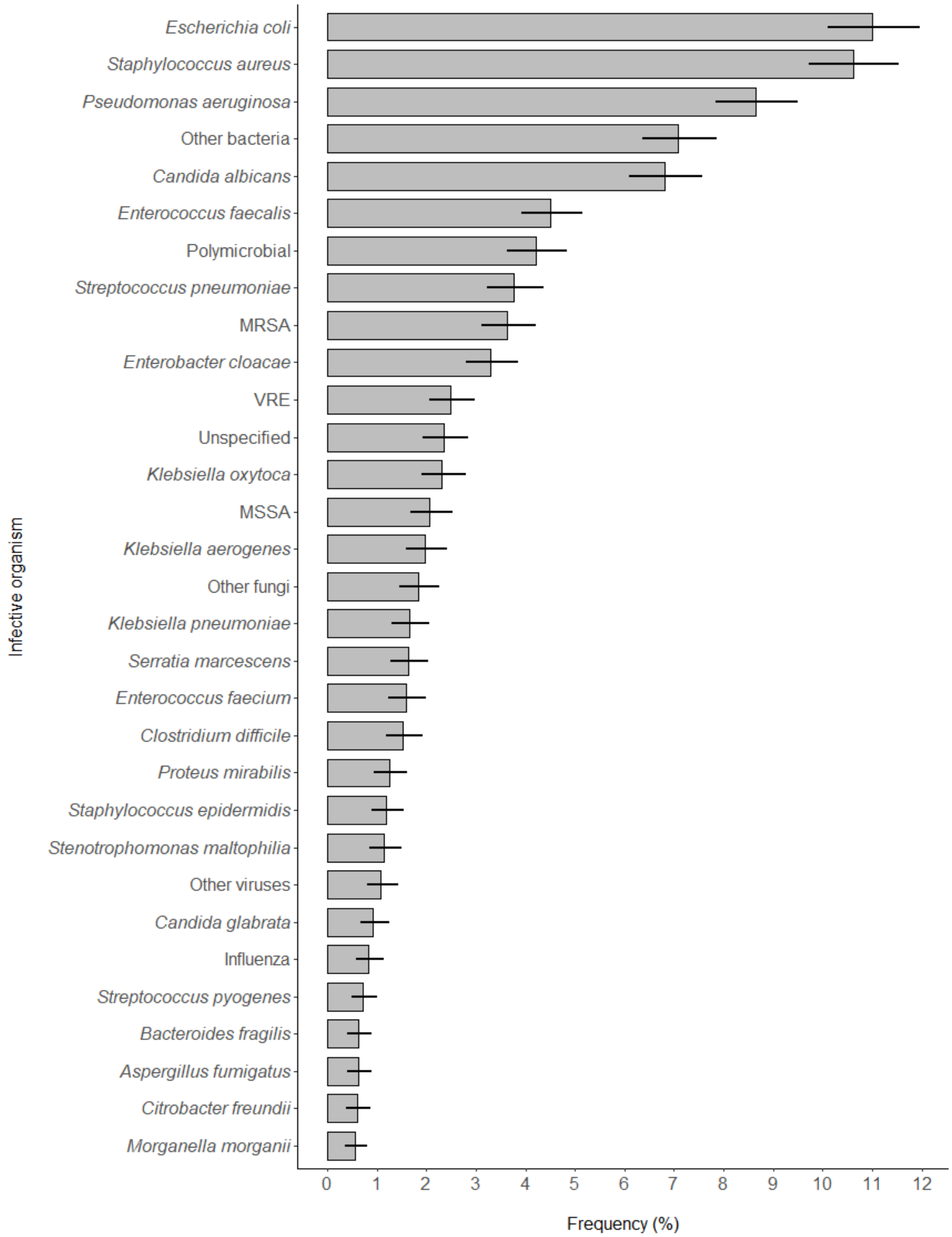



Note: Data not available n = 84 cases (1%); N = 8,237 cases with infection; period (2012–2018).
*Other category includes *Klebsiella*, *Clostridium difficile*, *Escherichia coli* and methicillin-resistant *Staphylococcus aureus*. Each ASM region has its own unique casemix and surgical population. ASM: Audit of Surgical Mortality

Of the infections acquired before or during admission over the 7-year period (2012–2018), 42.9% were cases of pneumonia (3,535/8,237), 25.1% were cases of septicaemia (2,069/8,237), 16.6% were cases of intra-abdominal sepsis (1,365/8,237) and 15.4% were other infections (1,268/8,237) (Figure 38).

Frequencies of the most commonly reported infective organisms according to the treating surgeon are shown in Figure 39.

**Figure 39: The most commonly reported infective organisms according to the treating surgeon**




Note: Error bars show 95% confidence intervals. Data not available n = 101 cases (3.0%); n = 4,543 total recorded organisms from N = 3,288 cases; period (2012–2018).
Only organisms reported with a frequency of 0.5% or greater are displayed. Categories are not mutually exclusive, meaning multiple organisms were often identified for a single patient.
Polymicrobial refers to cases where the infection involved 'mixed' or 'multiple' organisms, but the treating surgeon did not identify any single species.
Other bacteria, viruses and fungi are those instances where the microbial species was either not specified by the surgeon or was reported in a very small proportion of instances (<0.25%). Other bacteria include non-specified gram-negative organisms and non-specified enteric microbiota. Other fungi include non-specified yeast infections. Other viruses include adenovirus, enterovirus, hepatitis, herpes simplex virus (HSV), human immunodeficiency virus (HIV), norovirus, respiratory syncytial virus (RSV) and varicella zoster virus. Unspecified includes pneumonia and infections of unknown pathophysiology.
MRSA: methicillin-resistant *Staphylococcus aureus*; MSSA: methicillin-susceptible *Staphylococcus aureus*; VRE: vancomycin-resistant *Enterococcus*.

Between 2012 and 2018, the infective agent was positively identified in 39.5% (3,288/8,321) of the cases where the infection was acquired prior to or during admission.

*Escherichia coli* was the most frequently identified species, accounting for 11% (500/4,543) of recorded infective organisms (Figure 39); however, *Staphylococcus aureus*, when combined with MRSA and MSSA strains, represented the most frequently reported bacterial pathogen (16.3% or 741/4,543 total instances).

The most frequently reported fungal species was *Candida albicans* (6.8% or 309/4,543 instances) followed by *Candida glabrata* (0.9% or 42/4,543 instances).

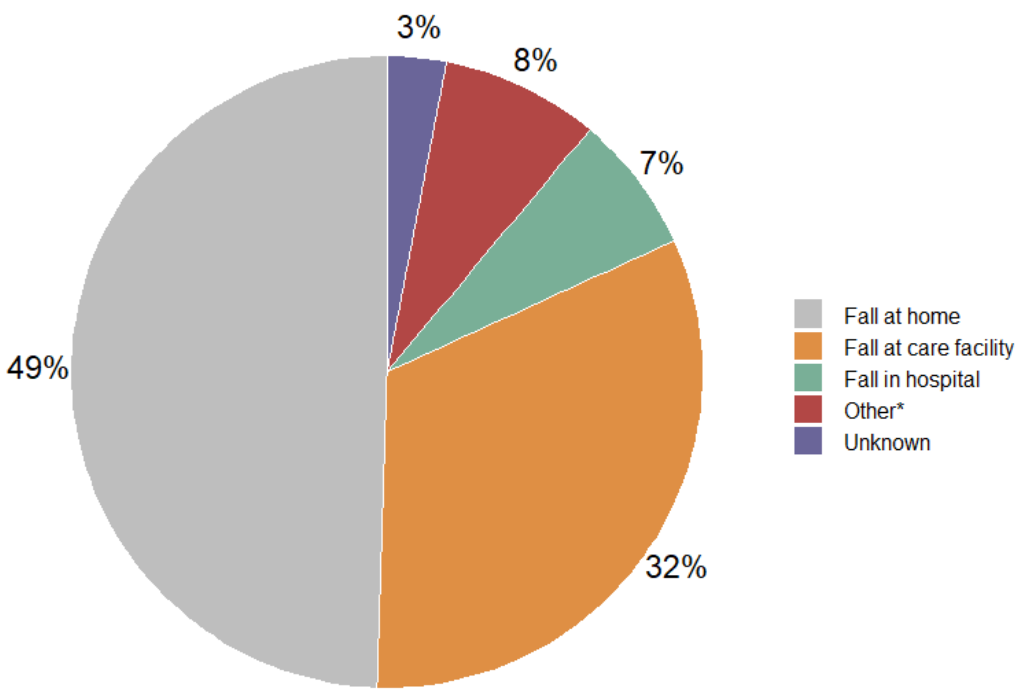
The most frequently reported viral infection was due to influenza viruses (0.8% or 38/4,543 instances), followed by the cytomegalovirus (0.4% or 19/4,543 instances).

## 8.2 Trauma

In 2012, ANZASM started collecting data on trauma cases in which severe bodily injury or shock had occurred in patients requiring surgery. The type of traumatic event leading to injury or shock varies, but may include falls, accidents or violence.

Between January 2012 and December 2018, 26.9% (5,210/19,350) of cases were attributed to a traumatic event (data not shown). Of the 5,210 traumatic events, 79.9% (4,162) were caused by falls. Figure 40 provides an overview of the locations associated with falls.

**Figure 40: Locations associated with falls between 2012–2018**



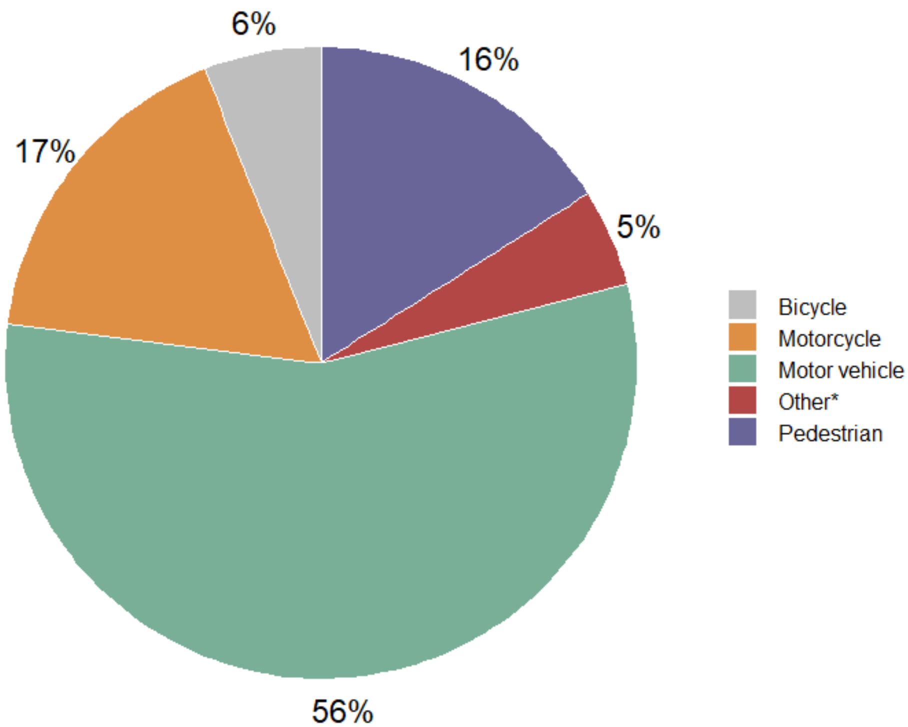

Note: Data not available: n = 44 (1%); N = 4,162.
*Other includes falls associated with sport/recreation, roads, workplace, farms and public venues.

Between 2012 and 2018, 48.6% (2,003/4,162) of falls occurred at home, 39.4% (1,622/4,162) occurred in a hospital or care facility and 12.0% (493) were unknown or occurred elsewhere (Figure 40).

Traffic accidents were associated with 13.1% (682/5,210) of trauma cases. An overview of the types of traffic accidents is provided in Figure 41. Due to the small amount of data currently, this should be interpreted with caution.

Domestic, public or self-inflicted violence was associated with 4.3% (223/ 5,210) of trauma cases.

Figure 41: Types of accidents associated with trauma between 2012–2018




Note: Data not available: n = 1 (<1%); N = 682.
*Other includes accidents associated with quad bikes, ultralight aircraft and in the workplace.

Motor vehicle accidents were associated with 7.3% (379/5,210) of cases where trauma was involved (Figure 41).

One-quarter of NTASM trauma cases were associated with motor vehicle accidents (data not shown). Published trauma data shows that fatalities in the Northern Territory due to motor vehicle accidents are nearly 3 times higher than they are in the rest of Australia.[6] Compared to other ASM regions, this difference is most likely due to death occurring at the accident scene rather than in hospital.

# 9. PEER-REVIEW OUTCOMES

| KEY POINTS |
| --- |
| • Between 2009 and 2018, an SLA was requested in 15.0% (4,924/32,730) of audited cases.<br>• The 2 most common criticisms by both first- and second-line assessors were operative management issues and delays in implementing definitive treatment.<br>• No CMIs were reported for 67.0% (24,505/36,556) of cases, and 33.0% (12,051 /36,556) of patients had a CMI.<br>• Of the CMIs reported, 12.7% (1,527/12,051) were classified as adverse events in patient care.<br>• In 3.4% (1,232/36,260) of cases audited, CMIs were perceived to have caused the death of the patient. |

## 9.1 Second-line assessments

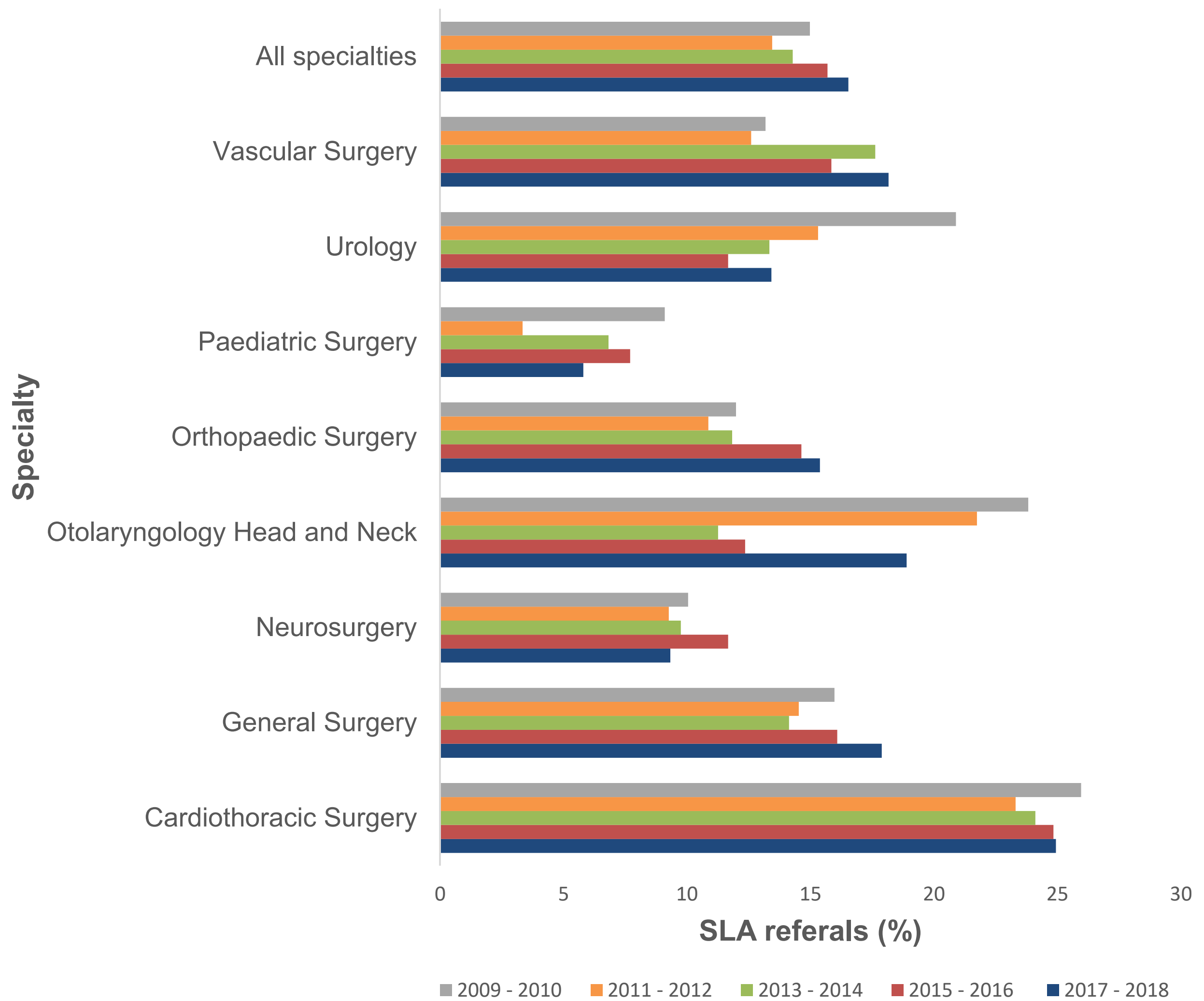
The peer-review process comprises a retrospective examination of the clinical management of patients who died while under the care of a surgeon. All assessors (first- and second-line) must decide whether the death was a direct result of the disease process alone or if aspects of the management of the patient may have contributed to the outcome.

A total of 32,730 cases underwent an FLA. The first-line assessor decides whether the treating surgeon has provided enough information to allow an informed decision on the appropriateness of the management of the case to be reached. If inadequate information was provided, the first-line assessor requests an SLA. Other triggers for requesting an SLA are:

- instances where a more detailed review of the case could better clarify events leading up to death and any lessons arising
- an unexpected death, such as that of a young and fit patient with benign disease, or a day surgery case.

The frequency with which cases were referred for SLA, by surgical specialty, is provided in Figure 42.

**Figure 42: Percentage of SLA referral by specialties and audit year**




Note: Colorectal surgery is contained within the General Surgery group.
SLA: second-line assessment.

There was some variation in the SLA rate among specialties and across the audit years. The request for SLA was the lowest for Paediatric Surgery and Neurosurgery across the audit years (Figure 42).

Between January 2009 and December 2018, an SLA was requested for 15.0% (4,924/32,730) of audited cases. Of all cases referred for an SLA, lack of adequate information in the SCF was the trigger in 69.5% (3,418/4,916) of audited cases (data not shown).

The need for an SLA can often be avoided if the surgeon completes the SCF properly and provides adequate information.

## 9.2 Clinical management issues

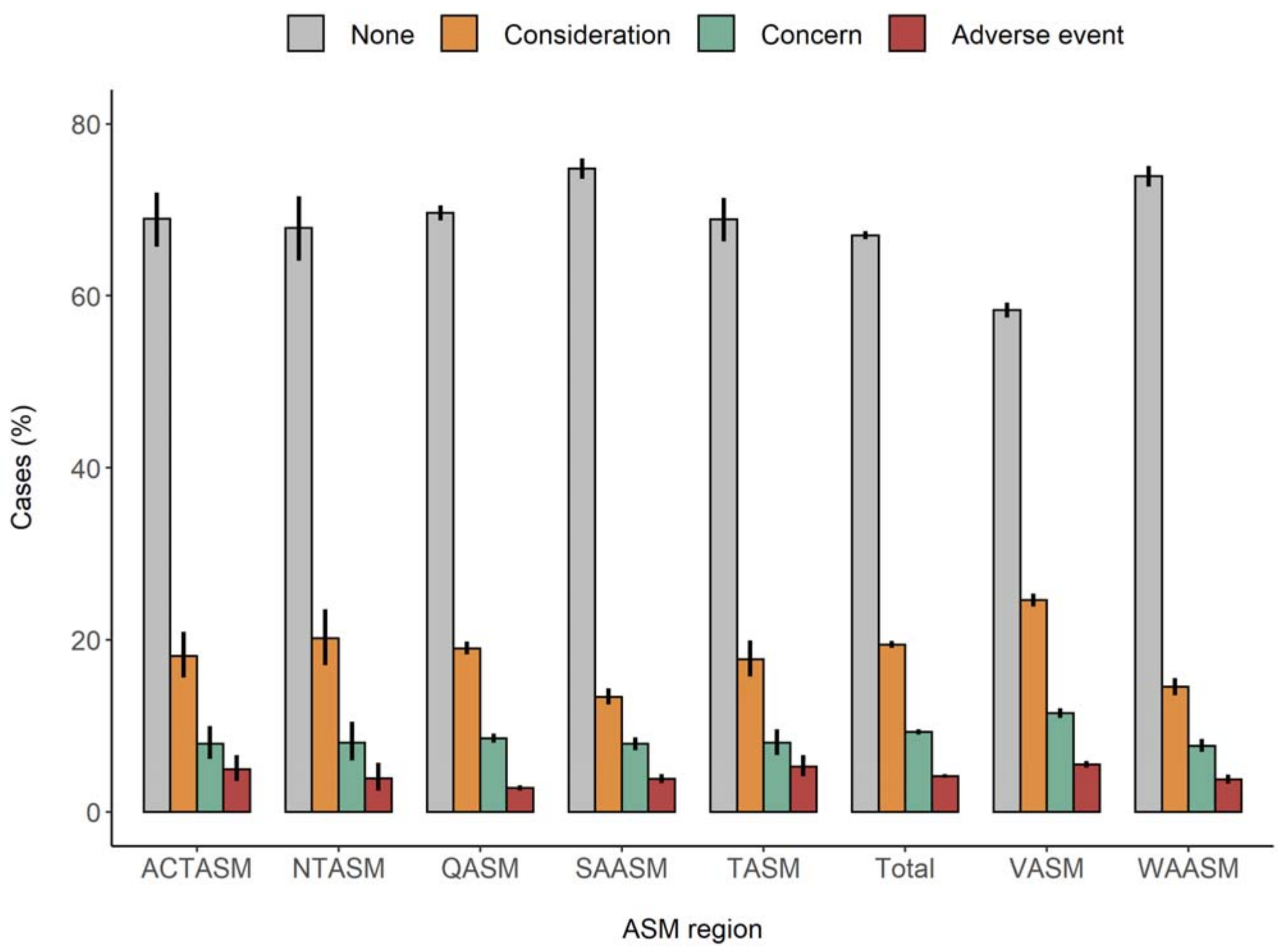
A primary objective of the peer-review process is to determine whether death was a direct result of the disease process alone, or if aspects of patient management might have contributed to that outcome.

There are 2 possible outcomes of the peer-review process. The first is that the death of the patient was a direct outcome of the disease process, with clinical management having no impact on the outcome. The second is that the assessor perceives that aspects of patient management may have contributed to the death of the patient.

In making an assessment of contributing factors, the assessor can identify if the CMIs were areas of consideration, areas of concern or an adverse event (Section 1.6.2).

Figure 43 demonstrates CMIs recorded per patient. Each patient can have more than one CMI recorded. CMIs recorded by the highest-level assessor have been tabulated. ANZASM primarily focuses on CMIs that are areas of concern and adverse events, although data is collected on areas of consideration.

**Figure 43: Clinical management issues identified by assessors, by ASM region**




Note: Error bars show 95% confidence intervals. Data not available: n = 1 case (<0.1%); n = 36,556 possible instances recorded in N = 32,788 patients, period (2009–2018).
Frequencies of different clinical management issues (consideration, concern, adverse event) are not mutually exclusive: multiple overlapping issues may be recorded for a single case.

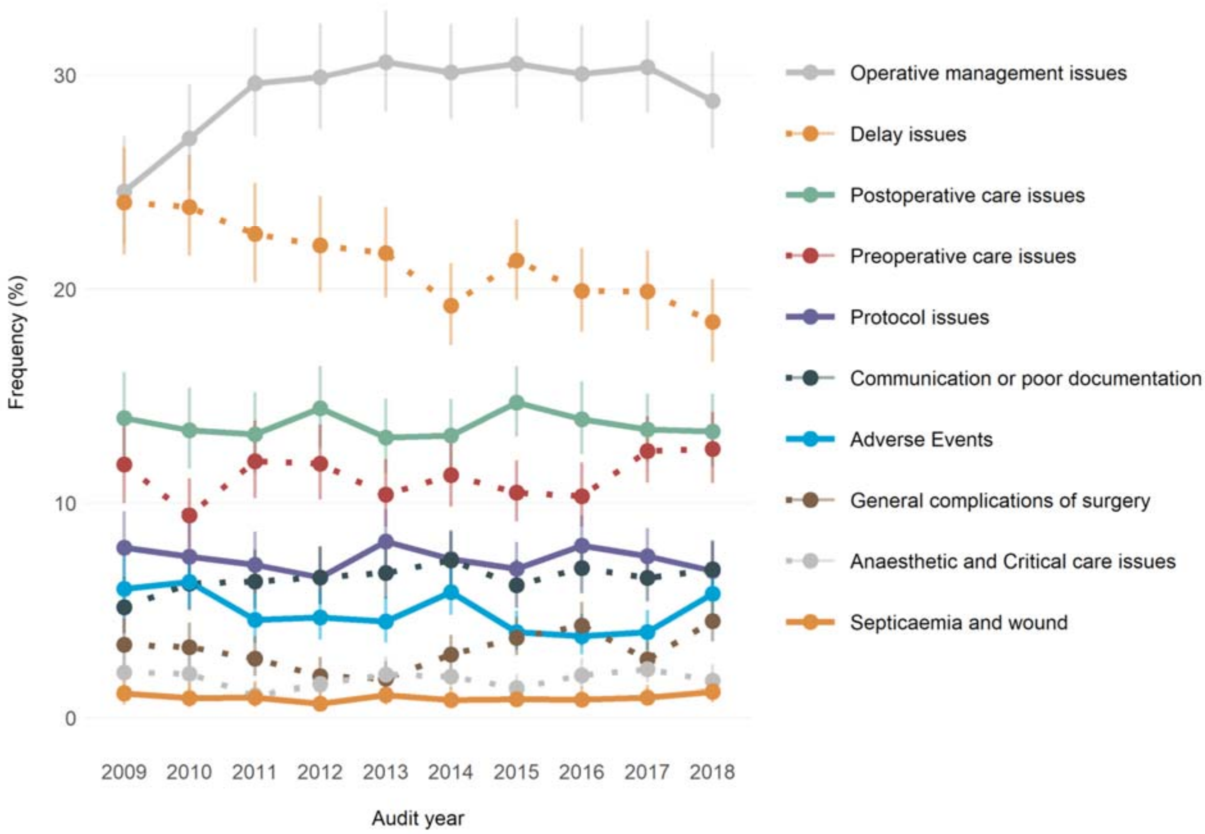
In 67.0% (24,505/36,556) of audited cases, the assessors felt that there were no CMIs (Figure 43). When combined with areas of consideration (19.5% of cases; 7,111/36,556), the total number of cases with no or minor criticism was 86.5% (31,616/36,556).

The identification of an area of concern or adverse event by an assessor denotes a greater degree of criticism of clinical management. An area of concern or adverse event occurred in 13.5% (4,940/36,556) of audited deaths.

Cases in which a patient experiences an adverse event are a key focus of the audit, when there is a perception by assessors that the treatment provided may have led to the patient's death. The proportion of cases with adverse events was 4.2% (1,527/36,556) over the entire audit period.

The distribution of specific classes of all clinical management issues (areas of consideration, concern and adverse events) is shown in Figure 44. In some patients more than one issue was identified.

**Figure 44: Most common clinical management issues according to the assessor**




Note: Clinical management issues that could not be categorised = 2,514; n = 15,089 instances in N = 37,632 first- and second-line assessments; period (2009–2018).
Management issues include adverse events related to treatment guidelines or protocols, unsatisfactory medical management, and treatment not conforming to guidelines.

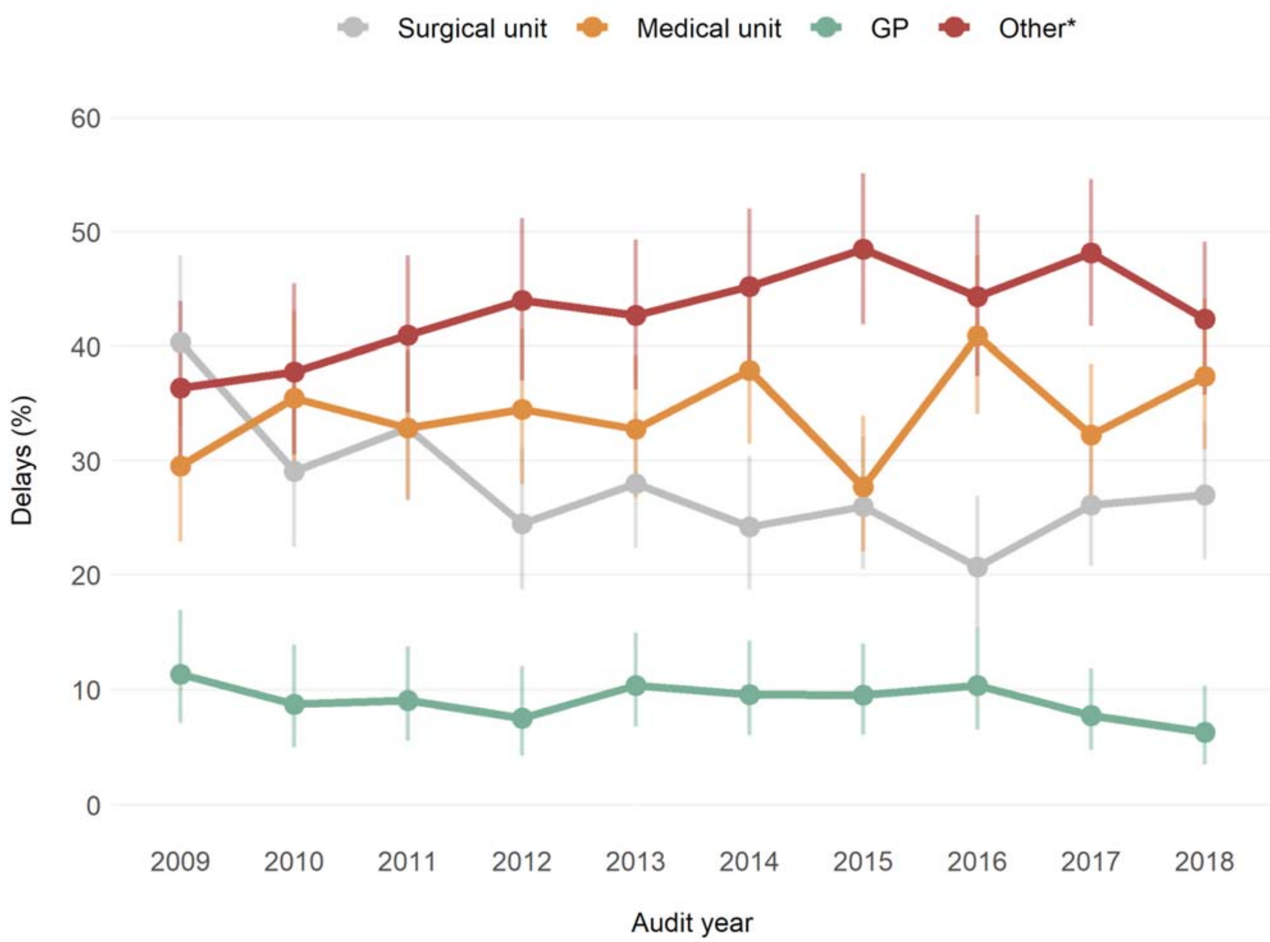
Operative management issues and delays in implementing definitive treatment remain the most frequent clinical management issues (Figure 44). These issues can be due to several factors and not all are the responsibility of the treating surgeon. Reasons for delays include geographical issues, diagnostic problems in the emergency department, inappropriate diagnosis, need for transfer, availability of theatre and communication issues.

Postoperative and preoperative care issues are also high on the list of clinical management issues.

Good communication among those involved in patient care is essential to ensure the treatment plan is properly understood and coordinated. Poor communication accounted for 6.5% (984/15,089) of the specific issues identified in the audit period.

Between 2009 and 2018, a delay in the implementation of definitive treatment was perceived in 21.1% (3,183/15,089) of clinical management issues. The attribution of responsibility for treatment delays is shown in Figure 45. This data is derived from the SCF and reflects the view of the treating surgeon.

**Figure 45: Attribution of responsibility for treatment delays by audit year according to treating surgeon**




Note: Error bars show 95% confidence intervals. Data not available: n = 816 (27.9%); N = 2,110 episodes of delay.
Delay responsibilities are not mutually exclusive: a single episode of delay can be associated with more than one cause.
*Other category includes emergency department, radiology department, other hospitals and patient-related factors.
GP: general practitioner

The surgical unit was deemed responsible for 40.3% (71/176) of treatment delays in 2009 and 27.0% (60/222) in 2018 (Figure 45).

Other clinical areas, medical units or general practitioners were deemed responsible for 84.4% (1,824/2,110) of delays over the entire audit period.

More than one team may be responsible for any perceived delays in treatment.

### 9.2.1 A case study demonstrating unsatisfactory management of a surgical patient and poor communication

**Unsatisfactory medical management and communication failure after elective knee surgery**

**Case summary:**

A 70-year-old male underwent elective right-side knee replacement surgery for osteoarthritis. The patient was identified as being of high perioperative risk due to a complex medical history of diabetes mellitus and rheumatoid heart disease, with mitral valve surgery at the age of 28 years. Associated cardiac complications included mitral valve stenosis with regurgitation, ischaemic heart disease with previous myocardial infarction causing left ventricular dysfunction, and previous coronary artery bypass surgery. Records indicated that the patient had suffered supraventricular tachycardia and renal insufficiency. The cardiac valvular conditions required lifelong anticoagulation therapy with warfarin and clopidrogel. The complex balance of dual anticoagulation therapy played an important part in the patient’s deterioration perioperatively.

Preoperatively, the patient was placed on bridging low-molecular-weight heparin therapy (60 mg twice daily) to transition from warfarin in anticipation of the elective knee surgery. From day 2 postoperatively, the patient was again placed on multitherapy anticoagulation with low-molecular-weight heparin plus reintroduction of warfarin and continuation of clopidrogel.

Repeated notations during the postoperative ward rounds recorded persistent wound collection and ooze at the operative site, likely attributable to the complex anticoagulation therapy. In most cases scaling down or temporarily halting anticoagulation therapy would be considered but understandably this was not favoured with this patient due to the risk that ceasing anticoagulation could cause significant cardiac complications. The international normalised ratio (INR) also remained high postoperatively, and it is possible that the patient’s renal impairment allowed effective anticoagulation at a level significantly higher than intended.

With ongoing discharge from the surgical site, concern for infection remained. By one week postoperatively, the surgical-site wound discharge was changing colour to brownish and the CRP was elevated. The patient appeared to be suffering multiple system complications, as a pulmonary effusion was found and drained a few days later, with cholecystitis also diagnosed.

Three days after this, there was worsening multiple systems failure and ongoing concerns about the operative site being the focus of an infected haematoma due to persistent ooze, it was decided to take the patient to theatre for a wound washout and articular poly liner exchange. The procedure was delayed by one day due to high INR and an anaesthetic risk assessment grading of ASA 4E (i.e. an emergency admission for a patient who is considered to have severe systemic disease that is a constant threat to life).

After this secondary procedure, the patient failed to demonstrate improvement in multiple system failure and required prolonged intubated ICU support. The patient’s condition was discussed with the next of kin and one week after this operation the decision was made to change the treatment goal to ‘palliative care’ and active treatments were withdrawn.

The patient was transferred to palliative care 2 days later and the patient passed away.

**Discussion:**

This was an unfortunate outcome for a very high-risk patient. No surgical or medical adverse events were identified in reviewing the notes. The risks were identified in advance, assessed, and informed consents obtained. No areas of concern were identified in the case note review; however, the following areas of possible consideration are suggested.

A more involved and active role from the cardiology and haematology departments could have been sought to try to balance the anticoagulation to the least aggressive level possible. Ongoing anticoagulation therapy with multiple agents likely led to persistent surgical-site bleeding and uncontrolled ooze, leading to possible infective change cascading into multiple organ failure.

Persistent surgical-site bleeding/ooze beyond day 5 to 7 post-surgery is always a reason for concern. It is debatable whether an earlier attempt at washout and surgical evacuation of haematoma could have averted worsening, possibly infectious, multiple organ failure. This is contentious in retrospect; in real time the decision to take a bleeding wound for further surgical washout while anticoagulation is being management is difficult.

There are notes suggesting that there were conflicts within the patient's family and disagreements regarding the goals of treatment. The notes also suggest that when the patient was eventually transferred to the palliative care team, that there was confusion between the home team and the palliative care team about the goals for the patient's outcome. The patient's family also expressed some dissatisfaction with this decision and the way it was communicated. While the case notes from the nursing staff and ICU indicate that the family dynamics seemed complex, clearer documentation of communication and decisions by the home team, the palliative team and family meetings would have been valuable.

**Clinical lessons:**

Balancing anticoagulation therapy in the scope of elective arthroplasty surgery is always a difficult task, especially when multiple agents are being used in the presence of renal impairment.

### 9.2.2 Perceived impact of clinical management issues

First- and second-line assessors were asked to indicate:

1. what impact any perceived issues of patient management might have had on the clinical outcome
2. whether or not these issues were preventable
3. which clinical team was responsible for the issues.

Assessors were asked to select a response for questions 1 and 2 above from a 3- or 4-part Likert scale. First- and second-line assessors may identify more than one issue of clinical management for each patient under review. Tables 5, 6, 7, 8 and 9 present data that is incident focused rather than patient focused.

**Table 5: Clinical management issues by specialty and severity according to the assessor**

| Specialty | Adverse events | Concern | Consideration | No issues |
|---|---|---|---|---|
| Cardiothoracic Surgery | 7.4% (262/3,559) | 15.2% (542/3,559) | 30.3% (1,079/3,559) | 47.1% (1,676/3,559) |
| General Surgery | 4.8% (702/14,735) | 10.9% (1611/14,735) | 20.6% (3,029/14,735) | 63.7% (9,393/14,735) |
| Neurosurgery | 2.3% (120/5,146) | 5.6% (287/5,146) | 11.4% (588/5,146) | 80.7% (4,151/5,146) |
| Obstetrics & Gynaecology | 7.8% (11/141) | 14.2% (20/141) | 37.6% (53/141) | 40.4% (57/141) |
| Ophthalmology | 0.0% (0/29) | 13.8% (4/29) | 41.4% (12/29) | 44.8% (13/29) |
| Oral/Maxillofacial | 12.5% (2/16) | 12.5% (2/16) | 43.8% (7/16) | 31.3% (5/16) |
| Orthopaedic Surgery | 2.2% (152/6,944) | 5.5% (384/6,944) | 16.3% (1,130/6,944) | 76.0% (5,278/6,944) |
| Other | 0.0% (0/19) | 5.3% (1/19) | 5.3% (1/19) | 89.5% (17/19) |
| Otolaryngology Head and Neck Surgery | 5.4% (23/425) | 7.8% (33/425) | 20/9% (89/425) | 66% (280/425) |
| Paediatric Surgery | 4.6% (11/239) | 3.8% (9/239) | 10.9% (26/239) | 80.8% (193/239) |
| Plastic and Reconstructive Surgery | 3.1% (21/679) | 7.1% (48/679) | 20.9% (142/679) | 68.9% (468/679) |
| Urology | 4% (60/1,386) | 8.9% (124/1,386) | 23.2% (322/1,386) | 63.5% (880/1,386) |
| Vascular Surgery | 5.0% (163/3,238) | 10.7% (348/3,238) | 19.5% (633/3,238) | 64.7% (2,094/3,238) |
| All cases | 4.2% (1,527/36,556) | 9.3% (3,413/36,556) | 19.5% (7,111/36,556) | 67.0% (24,505/36,556) |

Note: Data not available: n = 127 case (2%); n = 36,556 events in N = 32,788 patients; period (2009–2018).
*Other includes anaesthesia, intensive care unit, oncology, thoracic medicine, trauma and transplant.

There is a difference in the percentage of adverse events between specialties (Table 5). The reason for this is not readily apparent but may reflect the proportion of high-risk surgical procedures. For example, there are very few minor operations in cardiothoracic surgery: many are complex procedures with high-risk patients, which may explain the higher number of adverse events.[7]

| Table 6: Impact of clinical management issues on clinical outcomes according to the assessor | | |
|---|---|---|
| **Impact of clinical management issues on clinical outcome** | **Number of patients** | **% of clinical issues** |
| No issues of management identified | 24,505 | 67.6 |
| Made no difference | 3,381 | 9.3 |
| May have contributed to death | 7,142 | 19.7 |
| Caused the death of a patient otherwise expected to survive | 1,232 | 3.4 |
| Total | 36,260 | 100 |

Note: Data not available: n = 674 cases with clinical management issues (2%); N = 36,260; period (2009–2018).

In 3.4% (1,232/36,260) of cases the perceived issues of clinical management were felt to have probably caused the death of the patient (Table 6).

| Table 7: Perceived preventability of clinical management issues according to the assessor | | |
|---|---|---|
| **Perceived preventability of clinical management issues** | **Number of clinical issues** | **% of clinical issues** |
| No issues of management identified | 24,505 | 68.3 |
| Definitely preventable | 2,294 | 6.4 |
| Probably preventable | 4,738 | 13.2 |
| Probably not | 3,826 | 10.7 |
| Definitely not | 520 | 1.5 |
| Total | 35,883 | 100 |

Note: N = 35,883; period (2009–2018).

The assessors felt that 6.4% (2,294/35,883) of the clinical incidents were definitely preventable (Table 7).

| Table 8: Assessor perception of clinical team responsible for clinical issue | | |
|---|---|---|
| **Clinical team felt to be responsible** | **Number of clinical issues** | **% of clinical issues** |
| Surgical team | 7,174 | 57.7 |
| Other clinical team | 3,478 | 28.0 |
| Hospital issue | 869 | 7.0 |
| Other* | 903 | 7.3 |
| Total | 12,424 | 100 |

Note: N = 12,424; period (2009–2018).
*Other includes transferring hospital, blood bank or transfusion service, emergency department, general practitioner or referring doctor, ambulance service, remote geographic area or insufficient staff.

In 57.7% (7,174/12,424) of perceived clinical issues, the assessors indicated that the surgical team was responsible (Table 8).

# 10. ABORIGINAL AND TORRES STRAIT ISLANDER PATIENTS REPORT

| KEY POINTS |
|---|
| • Aboriginal and Torres Strait Islander surgical patients were younger than those in the non-Indigenous surgical population.<br>• Younger Aboriginal and Torres Strait Islander surgical patients had a much higher rate of serious comorbidities than younger non-Indigenous patients; however, frequencies of reported CMIs for Aboriginal and Torres Strait Islander patients were not statistically different to those for non-indigenous patients. |

At the last Australian census in 2016, it was estimated that there were 798,101 Aboriginal and Torres Strait Islander patients living in Australia[8], distributed as follows:

- 33.4% (265,685) New South Wales
- 27.7% (221,276) Queensland
- 12.6% (100,512) Western Australia
- 9.3% (74,546) Northern Territory
- 7.2% (57,767) Victoria
- 5.3% (42,265) South Australia
- 3.6% (28,537) Tasmania
- 0.9% (7,513) Australian Capital Territory

## 10.1 Aboriginal and Torres Strait Islander patients and surgery-related deaths

Between 2009 and 2018, at least 2.7% (645/22,987) of the audited deaths were patients of Aboriginal and Torres Strait Islander descent.

Surgical deaths of Aboriginal and Torres Strait Islander patients occurred in all states and territories, but reporting was not uniform, explaining the large proportion of missing data for this variable. Of those who identified as Aboriginal and Torres Strait Islander, most deaths occurred in Queensland (36%; 232/645), the Northern Territory (32%; 204/645) and South Australia (13%; 83/645). This could be due to the differences in reporting and data collection methods between ASM regions. The remainder (126 deaths) related to cases in other ASM regions.

## 10.2 Aboriginal and Torres Strait Islander patients and age

Aboriginal and Torres Strait Islander patients who died in the perioperative period were younger than non-Indigenous patients (Table 9).

**Table 9: Age at death in Aboriginal and Torres Strait Islander patients and non-Indigenous patients**

| | Age at death in Aboriginal and Torres Strait Islander patients (n = 645) | Age at death in non-Indigenous patients (n = 22,342) |
|---|---|---|
| Median<br>(IQR) | 56 years<br>(44–66) | 78 years<br>(66–86) |
| Minimum | 0 | 0 |
| Maximum | 100 | 105 |

Note: Data not available: n = 9,814 cases (30%); N = 22,987; IQR: interquartile range.

There was a 22-year difference in median age of death for Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients (Table 9). There has been a decrease in the age gap between the 2016 ANZASM report[1] and this report (2017–2018).

At the end of 2015, the age gap was reported as 25 years; in 2016, the age gap was 23 years, compared to 22 years in the current audit period (2009 and 2018).

## 10.3 Aboriginal and Torres Strait Islander patients and comorbidities

The prevalence of comorbidities, particularly in younger patients, presents a problem for the surgical care of Aboriginal and Torres Strait Islander patients.

When patient age was capped at 50 years or younger, a considerable difference in prevalence of comorbidity emerged between Aboriginal and Torres Strait Islander patients and non-Indigenous patients (Table 10).

**Table 10: Prevalence of comorbidities in Aboriginal and Torres Strait Islander patients and non-Indigenous patients age 50 years or younger**

| | Cases (n) | Comorbidities present (%) |
|---|---|---|
| Aboriginal and Torres Strait Islander patients | 172 | 71.4 |
| non-Indigenous patients | 1,206 | 58.5 |

Note: N = 241 Aboriginal and Torres Strait Islander patients, N = 2,063 non-Indigenous patients.

However, when the overall population was examined (i.e. not just those younger than 50 years), the audit data showed that serious comorbidities were present at similar rates in both populations (Table 11).

**Table 11: Prevalence of comorbidities in Aboriginal and Torres Strait Islander and non-Indigenous patients**

| | Cases (n) | Comorbidities present (%) |
|---|---|---|
| Aboriginal and Torres Strait Islander patients | 555 | 86.3 |
| non-Indigenous patients | 19,955 | 89.6 |

Note: N = 643 Aboriginal and Torres Strait Islander patients, N = 22,259 non-Indigenous patients.

As shown in Table 10, when patient age was capped at 50 years or younger, younger Aboriginal and Torres Strait Islander patients are at higher risk of comorbidities than are younger non-Indigenous patients, corresponding to a statistically significant risk ratio of 1.22 (95% confidence interval 1.12 to 1.33) for comorbidities in younger Aboriginal and Torres Strait Islander patients compared with younger non-Indigenous patients.

Similar findings were reported in a publication exploring health-related behaviours as predictors of mortality and morbidity in Australian Aboriginal and Torres Strait Islander patients.9

## 10.4 Aboriginal and Torres Strait Islander patients and operations

The rate of operations in the audit was similar between the 2 groups, with 78.4% (506/645) of Aboriginal and Torres Strait Islander patients undergoing an operation compared with 80.9% (18,061/22,333) of non-Indigenous audit patients.

## 10.5 Aboriginal and Torres Strait Islander patients and risk of death

The risk of death of Aboriginal and Torres Strait Islander patients compared to non-Indigenous patients, as perceived by the treating surgeon, is shown in Table 12.

**Table 12: Risk of death as perceived by the treating surgeon**

| Death risk | Aboriginal and Torres Strait Islander patients (n = 499) | non-Indigenous patients (n = 17,880) |
|---|---|---|
| Minimal | 1.4% (7/499) | 2.5% (451/17,880) |
| Small | 6.4% (32/499) | 10.0% (1,785/17,880) |
| Moderate | 23.8% (119/499) | 25.9% (4,626/17,880) |
| Considerable | 51.5% (257/499) | 49.5% (8,857/17,880) |
| Expected | 16.8% (84/499) | 12.1% (2,161/17,880) |

Note: Data not available: n = 188 cases (1%).

A higher proportion of Aboriginal and Torres Strait Islander surgical patients had a death risk of expected compared to non-Indigenous patients. There were statistically significant differences in small and expected death risk between the 2 groups (results not shown).

## 10.6 Aboriginal and Torres Strait Islander patients and clinical management

In most areas of care, there was little difference in clinical management indicators between Aboriginal and Torres Strait Islander surgical patients and non-Indigenous patients (Tables 13 and 14). (Differences between the 2 groups in all areas of clinical management were not statistically significant).

A recent publication looking at patients in the Northern Territory showed that surgical care as measured by accepted indicators was generally equivalent in both groups.[6]

| Table 13: Percentage of specific clinical management issues according to the treating surgeon | | | |
|---|---|---|---|
| **Clinical management issue** | **Aboriginal and Torres Strait Islander patients (n = 683)** | **non-Indigenous patients (n = 23,677)** | **Risk ratio (95% CI)** |
| Delay | 6.7% (46/683) | 5.3% (1,250/23,677) | 0.78 (0.59–1.04) |
| Operative management | 5.4% (37/683) | 5.1% (1,203/23,677) | 0.94 (0.68–1.29) |
| Postoperative care | 2.0% (14/683) | 2.4% (557/23,677) | 1.15 (0.68–1.94) |
| Protocol | 2.0% (14/683) | 2.0% (474/23,677) | 0.98 (0.58–1.65) |
| Preoperative management | 1.0% (7/683) | 1.7% (402/23,677) | 1.66 (0.79–3.48) |
| Adverse events | 1.2% (8/683) | 1.2% (293/23,677) | 1.06 (0.53–2.12) |
| Communication | 1.6% (11/683) | 1.1% (259/23,677) | 0.68 (0.37–1.24) |
| General complications | 0.4% (3/683) | 0.8% (196/23,677) | 1.88 (0.60–5.88) |
| Anaesthetic and critical care | 0.4% (3/683) | 0.3% (79/23,677) | 0.76 (0.24–2.40) |
| Septicaemia and wound | 0.1% (1/683) | 0.2% (43/23,677) | 1.24 (0.17–8.99) |

Note: CI = confidence interval (statistically significant difference between the 2 groups at the $p < 0.05$ level).

There were no statistically significant differences in clinical management issues between the 2 groups (Table 13).

| Table 14: Postoperative care issues according to assessors | | | |
|---|---|---|---|
| **Postoperative care issue** | **Aboriginal and Torres Strait Islander patients (n = 618)** | **non-Indigenous patients (n = 21,765)** | **Risk ratio (95% CI)** |
| Postoperative complications detected | 26.6% (133/500) | 33.7% (6,041/17,924) | 0.79 (0.68–0.91)* |
| Use of DVT prophylaxis | 74.0% (469/633) | 80.2% (17,620/21,969) | 0.92 (0.88–0.97)* |
| Unplanned return to theatre | 15.8% (100/633) | 13.1% (2,892/22,029) | 1.20 (1.00–1.45) |
| Unplanned readmission | 2.4% (15/629) | 3.1% (688/21,903) | 0.76 (0.46–1.26) |
| Fluid balance problems | 7.4% (46/625) | 8.6% (1,876/21,940) | 0.86 (0.65–1.14) |
| Communication | 6.9% (43/627) | 4.1% (908/21,948) | 1.66 (1.23–2.23)* |
| Treated in critical care unit | 75.2% (483/642) | 62.9% (14,004/22,276) | 1.20 (1.14–1.25)* |
| Unplanned ICU admission | 19.6% (123/627) | 18.0% (3,962/21,958) | 1.09 (0.93–1.28) |
| Different action by surgeon | 18.1% (112/618) | 14.6% (3,173/21,765) | 1.24 (1.05–1.47)* |

Note: *Statistically significant. DVT: deep vein thrombosis; ICU: intensive care unit.

Table 14 shows that there were statistically significant differences in the postoperative care categories of: use of DVT prophylaxis, postoperative complications detected, communication, being treated in critical care unit and different action taken by surgeon.

Aboriginal and Torres Strait Islander patients were less likely to receive DVT prophylaxis and more likely to be treated in critical care units.

Postoperative complications and fluid balance issues were fewer in Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients.

Assessors were more likely to identify communication issues and 'different action by surgeon' as issues in the care of Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients.

## 10.7 Aboriginal and Torres Strait Islander patients and clinical incidents

The differences in the proportion of Aboriginal and Torres Strait Islander patients who have areas of consideration, areas of concern and adverse events compared with non-Indigenous patients is shown in Table 15.

**Table 15: Clinical incidents according to the assessor**

| Clinical incident | Aboriginal and Torres Strait Islander patients (n = 177) | non-Indigenous patients (n = 5,747) | Risk ratio (95% CI) |
|---|---|---|---|
| Area of consideration | 68.4% (121/177) | 65.8% (3,783/5,747) | 1.04 (0.94–1.15) |
| Area of concern | 20.9% (37/177) | 20.5% (1,177/5,747) | 1.02 (0.76–1.37) |
| Adverse event | 10.7% (19/177) | 13.7% (787/5,747) | 0.78 (0.51–1.20) |

There were no significant differences in the distribution of clinical incidents in Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients (Table 15). (Definitions for clinical incidents categories are in section 1.6.2).

# 11. CONCLUSIONS

The audits of surgical mortality are uniquely positioned to use the extensive information learned during the evaluation process to promote safer healthcare practices. The continued participation of surgeons and the opportunity to enhance and expand the existing data on surgical mortality provides significant value to the Australian health consumer as a quality assurance activity.

There has been a significant improvement in audit participation among both surgeons and hospitals across most of ASM regions. As the audit continues to grow and develop, the ability to identify trends across Australia will further add to the ongoing knowledge of the participants, potentially leading to better outcomes for all surgical patients.

**Achievements:**
The audit has achieved widespread acceptance, with a 99.0% participation rate from surgeons (not including NSW).

The audit process is becoming more unified/standardised, with ANZASM now producing National Case of the Month and National Case Note Review Booklet, contributing to the improvement of patient care and outcomes.

ANZASM Clinical Governance Reports have been released annually to hospitals that have 3 or more operating surgeons (to ensure participants are not identifiable). These reports use ANZASM state and national audit data to inform hospitals and government departments of health of trend analyses of clinical management events within their hospitals and compared to other similar hospitals.

Peer-review feedback has been provided directly to individual surgeons via assessors' comments on individual cases. Feedback is an essential component of the audit process as it provides specific, targeted information on a case-by-case basis.

ASM regions continued to hold seminars and webinars and produced clinical governance reports to share the learnings from the audits with surgical communities and the public.

**Future directions:**
**Surgeons need to consider using DVT prophylaxis in all patients scheduled for surgery**
There was a slight decrease in the use of DVT prophylaxis from 84.2% at the end of 2016 compared to 78.7% by the end of 2018; however, the reasons for the decrease in the use of DVT prophylaxis are not clear. In addition, assessors concluded that DVT prophylaxis use was inappropriate in 2.3% (810/35,312) of the patients.

**Surgeons need to address the fluid balance issue**
Fluid balance in the surgical patient is an ongoing challenge, with 7.3% (2,298/31,313) of patients perceived to have had poor management of their fluid balance.

**Increase the use and appropriateness of critical care support**
In the majority of instances, those patients who were expected to benefit from critical care support did receive that support. The review process suggested that 7.4% of patients who did not receive treatment in a critical care unit would most likely have benefited from it.

**Decrease the proportion of operative management issues and reduce the delays in providing definitive treatment.**
Operative management is still the most frequent clinical management issue identified by assessors followed by delays in implementing definitive treatment. These issues need to be improved.

**Improve communication within clinical teams**
The quality and effectiveness of communication within the clinical team and with other teams involved in the care of patients was identified as an area for future improvement and education.

A greater national awareness of the audit and acknowledgment of its value among health professionals should see both increased surgical participation and a greater level of detail provided on audit forms. This, in turn, will enable further in-depth trend analysis and informative reporting.

RACS and the state and territory departments of health can be proud of this important initiative to promote best surgical practice across the nation.

# 12. REFERENCES

1. Royal Australasian College of Surgeons, 2016. Australian and New Zealand Audit of Surgical Mortality National Report, Adelaide: Royal Australasian College of Surgeons.
   Available from: https://issuu.com/entegy/docs/racs_anzasm_national_report_2016_-_

2. Australia Bureau of Statistics, 2016. Regional Population by Age and Sex, Australia. Viewed 29 June 2020.
   Available from: 3235.0 - Population by Age and Sex, Regions of Australia, 2016 (abs.gov.au)

3. American Society of Anesthesiologists (ASA), 2020. ASA Physical Status Classification System. Viewed 9 July 2020.
   Available from: https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system

4. Mayhew D, Mendonca V, Murthy BVS. A review of ASA physical status – historical perspectives and modern developments. *Anaesthesia*. 2019;74(3): 373–379.
   Available from: https://pubmed.ncbi.nlm.nih.gov/30648259/
   DOI: 10.1111/anae.14569

5. McNicol L, Story DA, Leslie K, *et al*. Postoperative complications and mortality in older patients having non-cardiac surgery at three Melbourne teaching hospitals. *MJ Aust.* 2007;186(9): 447–52.
   Available from: http://www.ncbi.nlm.nih.gov/pubmed/17484705
   DOI: 10.5694/j.1326-5377.2007.tb00994.x

6. Treacy PJ, North JB, Rey-Conde T, *et al*. Outcomes from the Northern Territory Audit of Surgical Mortality: Aboriginal deaths. *ANZ J Surg.* 2015;85: 11–15.
   Available from: https://onlinelibrary.wiley.com/doi/pdf/10.1111/ans.12896
   DOI: 10.1111/ans.12896

7. Vinluan J, Retegan C, Chen A, *et al*. Clinical management issues vary by specialty in the Victorian Audit of Surgical Mortality: a retrospective observational study. *BMJ Open.* 2014;4(6): e005554.
   Available from: http://bmjopen.bmj.com/content/4/6/e005554.abstract?eaf
   DOI:10.1136/bmjopen-2014-005554

8. Australian Bureau of Statistics, 2013. Estimates of Aboriginal and Torres Strait Islander Australians. Viewed 29 June 2020.
   Available from: http://www.abs.gov.au/ausstats/abs@.nsf/mf/3238.0.55.001.

9. Burke V, Zhao Y, Lee AH, *et al*. Health-related behaviours as predictors of mortality and morbidity in Australian Aborigines. *J Prev Med.* 2007;44(2): 135–142.
   Available from: http://www.sciencedirect.com/science/article/pii/S0091743506003781
   DOI: http://dx.doi.org/10.1016/j.ypmed.2006.09.008

# 13. ACKNOWLEDGEMENTS


ANZASM would like to acknowledge the support and assistance of those individuals and institutions that have helped in the continuation and development of this project, including:

- participating surgeons
- first-line assessors
- second-line assessors
- hospital medical records departments
- state and territory departments of health for funding the project
- State and territory departments of health for their continual commitment and support to ANZASM
- Royal Australasian College of Surgeons for their infrastructure and oversight of the project
- ANZASM project managers.

**ANZASM Steering Committee**

**Members:** Professor Guy Maddern (Chair, ANZASM), Associate Professor Philip McCahy (VASM), Dr David Robinson, (CHASM), Mr Tony Sparnon (Councilor), Mr James Aitken (WAASM), Mr Anthony Pohl (SAASM), Dr Cathy, Ferguson (Perioperative Mortality Review Committee representative, NZ), Dr John North (QASM/ NTASM), Mr Rob Bohmer (TASM), Dr John Tharion (ACTASM), Dr Sue Valmadre (RANZCOG Representative), Reverend Anthony Taylor (Consumer Representative).

**ANZASM Management and state and territory staff**

**Management**: Associate Professor Wendy Babidge (General Manager, Research Audit and Academic Surgery Division (RAAS)), Dr Helena Kopunic (Manager Surgical Audit, RAAS), Ms Andrea Gledhill (Project Manager, ACTASM), Ms Jenny Allen (Project Manager, QASM/NTASM ), Ms Lisa Lynch (Project Manager, TASM), Mr Andrew Chen (Project Manager, VASM), Dr Franca Itotoh (Project Manager, WAASM), Dr Nathan Procter (Project Lead, SAASM).

**State and territory staff:** Dr Ryan Maloney, Dr Lettie Pule (ANZASM); Mr Dylan Hansen, Mr Ushan Vithanage, Ms Jessele Vinluan (VASM); Dr Nathan Procter (SAASM); Ms Natalie Zorbas-Connell, Mr Andrew Lukman (WAASM); Ms Kyrsty Webb, Ms Sonya Faint, Ms Candice Postin, Ms Therese Rey-Conde (QASM).

ANZASM would also like to thank Associate Professor Wendy Babidge, Dr Helena Kopunic, Dr Lettie Pule, Dr Ryan Maloney and Dr Kristin Weidenbach from the Surgical Audits Department at RACS for their contribution and support in preparing the report.