Royal Australasian
College of Surgeons

Australian and New Zealand Audit of Surgical Mortality

ANZASM NATIONAL REPORT 2019–2020

(including a 10-year review 2011–2020)

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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).

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CHAIR’S REPORT

This most recently compiled report of the Audit of Surgical Mortality within Australia provides reassuring results over the period 2019–2020. Ten years of data, covering the period from 2011–2020 has been compared annually. It shows a trend of improvement over time with a strong level of participation from all surgeons within Australia.

The majority of the deaths occurring are through emergency admissions with relatively high risk patients being the predominant group.

Over the decade observed, DVT prophylaxis has increased and indicates the value of providing information from the audits of surgical mortality back to the surgical community.

Overall, multiple surgical procedures preceding death have decreased with time, indicating perhaps the improvement in avoiding futile surgery.

The report highlights information on infection and transfers, as well as the incidence of trauma leading to mortality.

Overall, the audit highlights the wide level of acceptance it has obtained over the last decade and the value of providing individual surgeons with feedback on cases with which they were involved.

We have also obtained Qualified Privilege for the next five years of the audit, providing a safe and secure environment in which surgeons can make frank and insightful reports.

It is important to acknowledge the staff involved in all states and territories of Australia who are providing the scrutiny and oversight of the Audit of Surgical Mortality and, in particular, the Clinical Directors in each region.

Any constructive feedback is always most welcome.

Guy Maddern

Chair, 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
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), Collaborating Hospitals Audit of Surgical Mortality (CHASM), 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.

CHASM is independently managed by the Clinical Excellence Commission of NSW. CHASM data were not available at the time of this ANZASM national report, and therefore NSW data are not included.

By identifying clinical management issues (CMIs) 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 98.8% by the end of 2020.

Hospital participation

All public and private hospitals in Australia participated in the audit, except for NSW (private hospitals not fully participating).

Analysis and audit numbers

This report contains a comparative analysis of cases reported to ANZASM from 1 January 2011 to 31 December 2020 to illustrate changes over time. The data from 2011 to 2020 have been updated from the previous report (2018)[1] by adding cases (6,505 completed for the current 2-year audit period of 1 January 2019 to 31 December 2020). This reflects the continuous nature of data collection and reporting requirements of the audit. Cases still under review will be captured in the next report.

From 1 January 2011 to 31 December 2020, a total of 44,365 notifications of death associated with surgical care were reported to ANZASM. Of these, 34,311 had completed the audit process by the census date of 31 March 2021. The remaining 10,054 were not included in the audit due to the following reasons:

- case admitted for terminal care (5,748)
- inappropriately attributed to surgery (1,439)
- lost to follow-up (1,190)
- treated by surgeons not participating in the audit or not Fellows of the Royal Australasian College of Surgeons (RACS) (872)
- case had not completed the full surgical audit process at census date (805).

Other data were unavailable due to incomplete information provided in surgical case forms (SCFs). 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 2011 and 2020 the median age for the 34,311 fully audited cases was 77 years (interquartile range [IQR] 65–85), ranging from 1 day to 106 years. Males represented 56.7% of cases and females 43.3% (sex unavailable n = 3).

Risk profile of audited cases

More than three-quarters (85.4%) of audited deaths occurred in patients admitted as emergency cases with acute life-threatening conditions; 89.1% of patients had at least one significant coexisting illness.

Risk management

The use of deep vein thrombosis (DVT) prophylaxis was recorded for 79.9% of cases. First- and second-line assessors concluded that the DVT prophylaxis management was inappropriate in only 1.8% of cases over the entire audit period (2011–2020).

According to treating surgeons, critical care support was deemed necessary in 62.6% of cases; however, in 7.3% 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 deemed beneficial.

Profile of operative intervention

In total, 80.0% of patients underwent a surgical procedure. A total of 38,537 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 94.4% of cases and performed the surgery in 70.4% of cases.

Of the patients who had surgery, 15.8% 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 2011 and 31 December 2020, 10.6% of transfer issues were related to transfer delay, 4.8% to appropriateness of transfer, 4.8% to insufficient clinical documentation and 2.8% to inappropriate level of care. Insufficient clinical documentation is an issue of concern, given the necessity of all involved clinicians having a patient's complete clinical history upon presentation.

Peer-review outcomes

In total, 14.5% of audited cases were referred for second-line assessment (SLA) during the audit period. The referral rate for SLA varied among audit 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 SLA referral in 21.3% of audited cases.

The 2 most common criticisms made by assessors were operative management issues and delays in implementing definitive treatment. Of the total delays, 26.2% were attributed to the surgical team. This finding has led each state and territory audit of surgical mortality to develop and deliver a series of educational programs aimed at surgeons, as well as junior and senior hospital staff to address the various facets of delay and communication.

CMIs were reported in 23.9% of patients. A total of 12,287 CMIs were identified in 8,137 patients. Of these, 13.4% were classified as adverse events in patient care.

Recommendations and key points

Key points

- All public and private hospitals and 98.8% of surgeons currently participate in ANZASM. At least 90.2% of participating surgeons use the electronic Fellows Interface to enter SCF data directly.
- Patients admitted as emergencies with acute life-threatening conditions comprise 85.4% of audited deaths; 89.1% of patients had at least one pre-existing medical condition or comorbidity; 92.2% of patients were classified ASA grade 3 or higher.
- Use of deep vein thrombosis (DVT) prophylaxis was recorded in 79.9% of cases in which patients underwent a surgical procedure and in almost all cases assessors concluded that the DVT prophylaxis management was appropriate.
- Patients who required support in a critical care unit (CCU) received it in most instances. The assessment process found that only 7.3% of patients who would likely have benefited from treatment in CCU did not receive it; 7.1% of patients received poor fluid balance management.
- A surgical procedure was performed on 80.0% of patients, with more than one visit to the operating theatre necessary for 24.0% of patients during their admission; 15.8% of patients had an unplanned return to theatre.
- A consultant surgeon made the decision to operate in 94.4% of instances and performed 70.4% of the operations.
- Transfer between hospitals was required in 26.0% of audited cases.
- Among the 33.6% of patients who died with a clinically significant infection, 57.3% of the infections occurred during admission, most of which (67.2%) were acquired postoperatively.
- One quarter (26.9%) of ANZASM cases were admissions due to a traumatic event, 79.5% of which were caused by falls occurring at various locations, most often at home (49.8%) or at a hospital or care facility (39.0%).
- Operative management issues and delays in implementing definitive treatment were found by assessors to be the most common criticisms of patient care, with 23.9% of patients having at least one clinical management issue (CMI) recorded; 20.1% of reported CMIs were believed to be definitely preventable, 13.4% were classified as adverse events and 10.5% were felt to have probably caused the death of the patient.
- A second-line assessment (SLA) was requested in 14.5% of audited cases, with one-fifth (21.3%) of these requests due to inadequate information provided in the surgical case form (SCF).

Recommendations

- ANZASM to continue encouraging active participation in the audit by surgeons and hospitals; surgeons to spread awareness of the audit within the surgical community.
- ANZASM to continue identifying emerging trends in mortality and address where possible via ongoing educational campaigns and interactive seminars.
- Surgeons to strive to improve communication within and between clinical teams, which will help to reduce problems associated with patient handover between teams and delays in transfer.
- Health professionals to increase their awareness of the greater risk of surgical emergencies for patients experiencing shared care and/or transfer between residential or medical facilities.
- Surgeons to remain vigilant regarding optimum infection control, particularly in the postoperative period.
- ANZASM to periodically review the surgical case form to reduce 'form fatigue' without detracting from the value of the data collected.
- State and territory departments to work closely with ANZASM to promote best surgical practice nationally following the release of the ANZASM Clinical Governance Report.

1 INTRODUCTION

KEY POINTS
• ANZASM is an independent, external, surgeon-led, peer-review audit of patient deaths that have occurred under surgical care. • This report is a review of all deaths notified during the period 1 January 2011 to 31 December 2020. • This report is an analysis of the 34,311 cases that underwent the full audit process.

1.1 Background

The Royal Australasian College of Surgeons (RACS) assumed responsibility for 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 the Australian and New Zealand Audit of Surgical Mortality (ANZASM), RACS expanded the program to all other Australian states and territories.

This report includes fully audited cases for the period 1 January 2011 to 31 December 2020 from Western Australia, South Australia, Tasmania, Victoria, Queensland, the Australian Capital Territory and the Northern Territory. No NSW data were available at the time of this report.

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 via 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

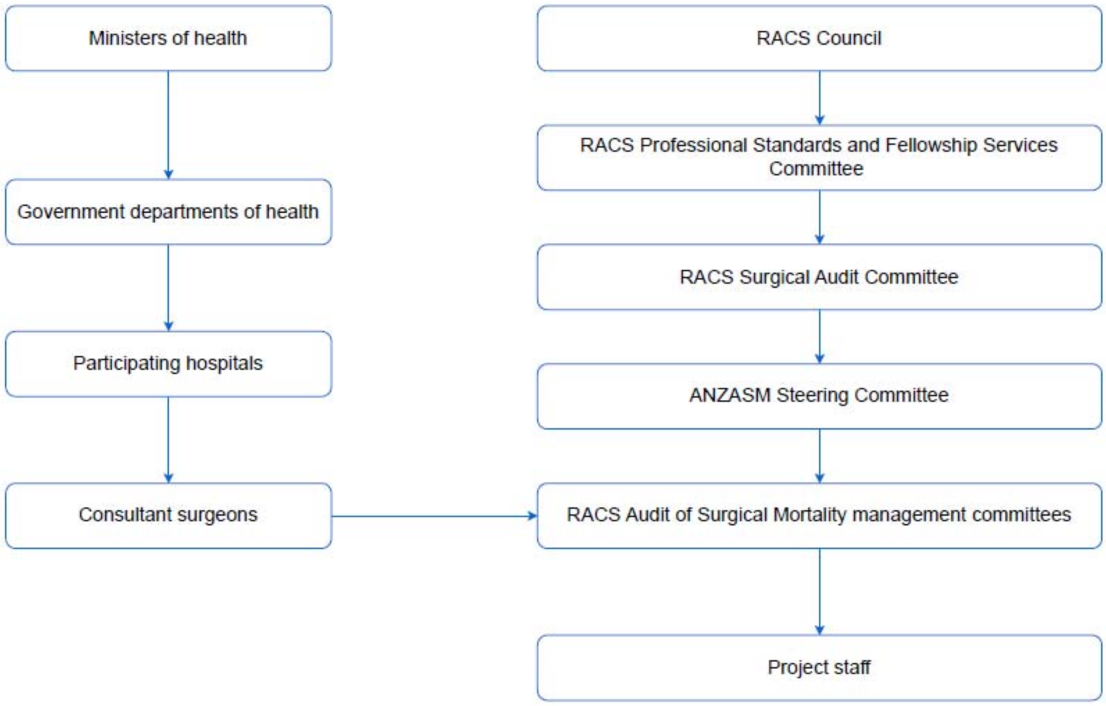
ANZASM is managed by Research, Audit and Academic Surgery (RAAS) of the Fellowship Engagement Portfolio, RACS. ANZASM oversees the implementation and standardisation of each state and territory audit to ensure consistency in audit processes and governance structures across all jurisdictions (Figure 1).

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 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 audit of surgical mortality (ASM) region. Notifications can arise from departments of health or hospitals, or surgeons can self-report a patient death. All cases in which a surgeon was responsible for, or had significant involvement in, the care of a patient are 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 surgical case form (SCF), which is completed by the consultant or treating surgeon associated with the case. The completed SCF is returned to the appropriate 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.

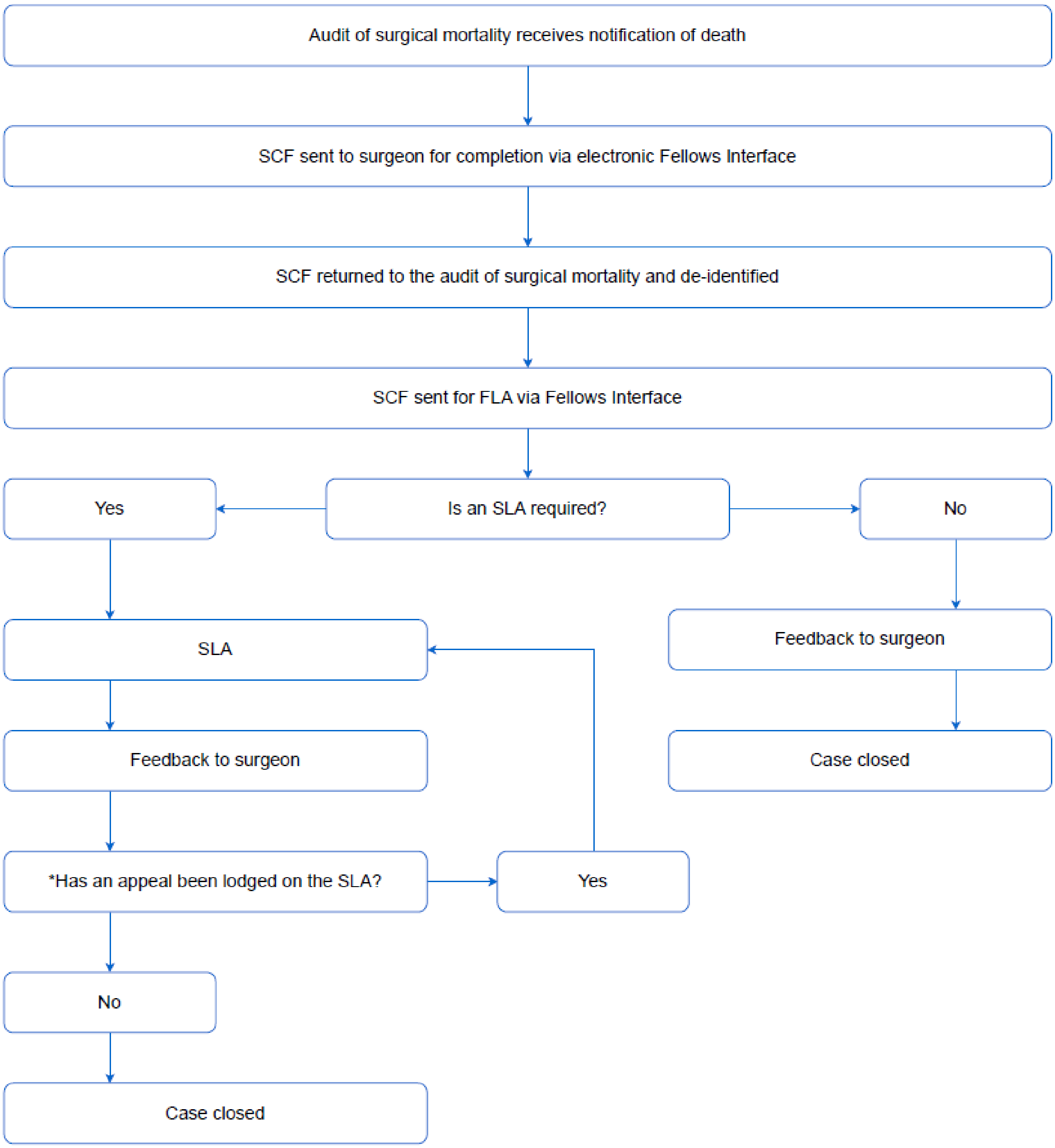
There are 2 possible outcomes of an FLA:

- 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 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 a second-line assessment (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.

Clinical information from these deaths provides the patient profiles described in this report and forms the denominator in all analyses pertaining to outcomes from the audit. Data for assessment outcomes in this report refer to the highest-level assessment for each patient, unless otherwise indicated (i.e. data from an FLA are presented unless an SLA was conducted, in which case, data from the SLA are presented instead).

Figure 2: Audit process



FLA: first-line assessment; SCF: surgical case form; SLA: second-line assessment. * 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. Commentary obtained during the audit process is provided directly to the treating surgeon. Participation in the audit is a mandatory component for surgeons completing CPD with RACS or AOA. Continuing education is also achieved by highlighting lessons learned from de-identified cases in the National 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. They 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, those 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 (CMIs) for use by assessors:

- **Area for consideration.** An area of care that could have been improved or done differently, but this could be debatable.
- **Area of concern.** An area of care that should have been better.
- **Adverse event.** An unintended injury or event caused by the management of the patient rather than by the disease process and sufficiently serious that it led to prolonged hospitalisation or contributed to or caused death.

1.6.3 Data analysis

The 2019–2020 national report provides the cumulative total of all deaths reported to ANZASM from 1 January 2011 to 31 December 2020 (census date 31 March 2021). This includes the 6,605 cases closed between 1 January 2019 and 31 December 2020. Some cases remained 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.

Data for the national report 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 Stata statistical software version 16, and the R environment for statistical computing and graphics (version 3.6.3) with RStudio 1.2

The total numbers of cases (N) included in individual analyses is provided in all tables and figures throughout the report, along with the number of cases with missing data (n). As not all data points were completed, the total number of cases used in each analysis varies.

In some tables and figures, data for the years 2011 to 2020 have been grouped for clarity. Where there was no apparent difference between groups, only overall summaries are provided.

2 AUDIT PARTICIPATION

KEY POINTS
• Nationally in 2020, 98.8% of surgeons participated in the audit. • 100% of all public and private hospitals currently participate in the audit program (data not included for NSW).

2.1 Audit numbers

From 1 January 2011 to 31 December 2020, ANZASM received 44,365 notifications of death associated with surgical care.

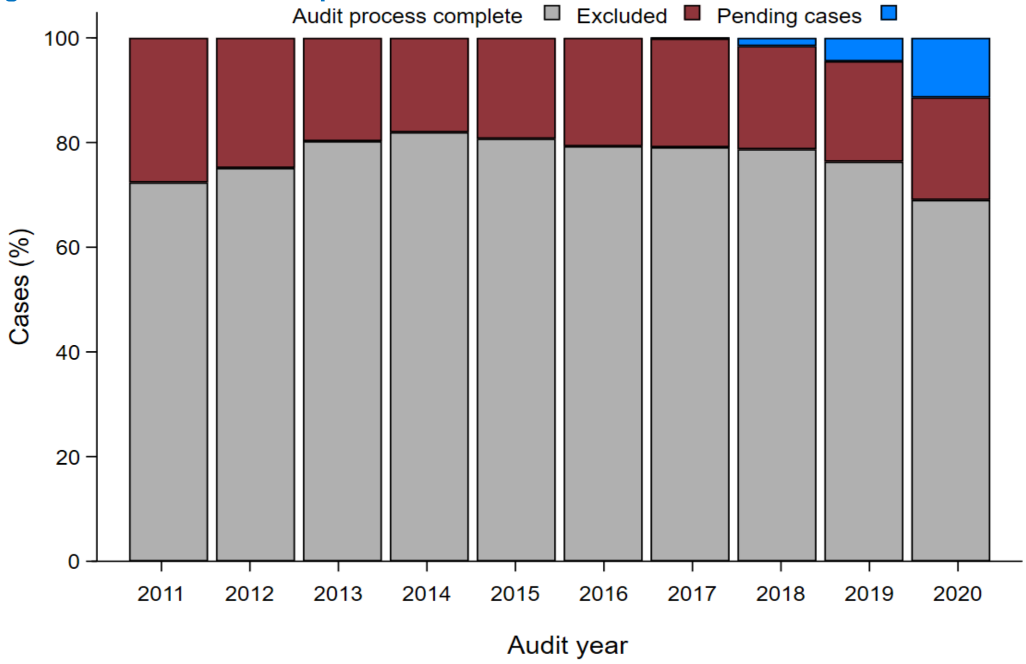
A total of 77.3% (34,311) of reported cases had completed the audit process by the census date. The clinical information from these deaths provides the patient profiles described in this report and is the denominator in all analyses pertaining to outcomes from the audit, unless stated otherwise.

The remaining 22.7% (10,054) of cases were not included in the audit for the following reasons:

- admitted for terminal care
- inappropriately attributed to surgery
- lost to follow-up
- treated by surgeons not participating in the audit or not Fellows of the Royal Australasian College of Surgeons (RACS)
- not completed the full surgical audit process by census date.

Figure 3 shows the proportion of cases with completed forms over different audit years. While the 2020 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.

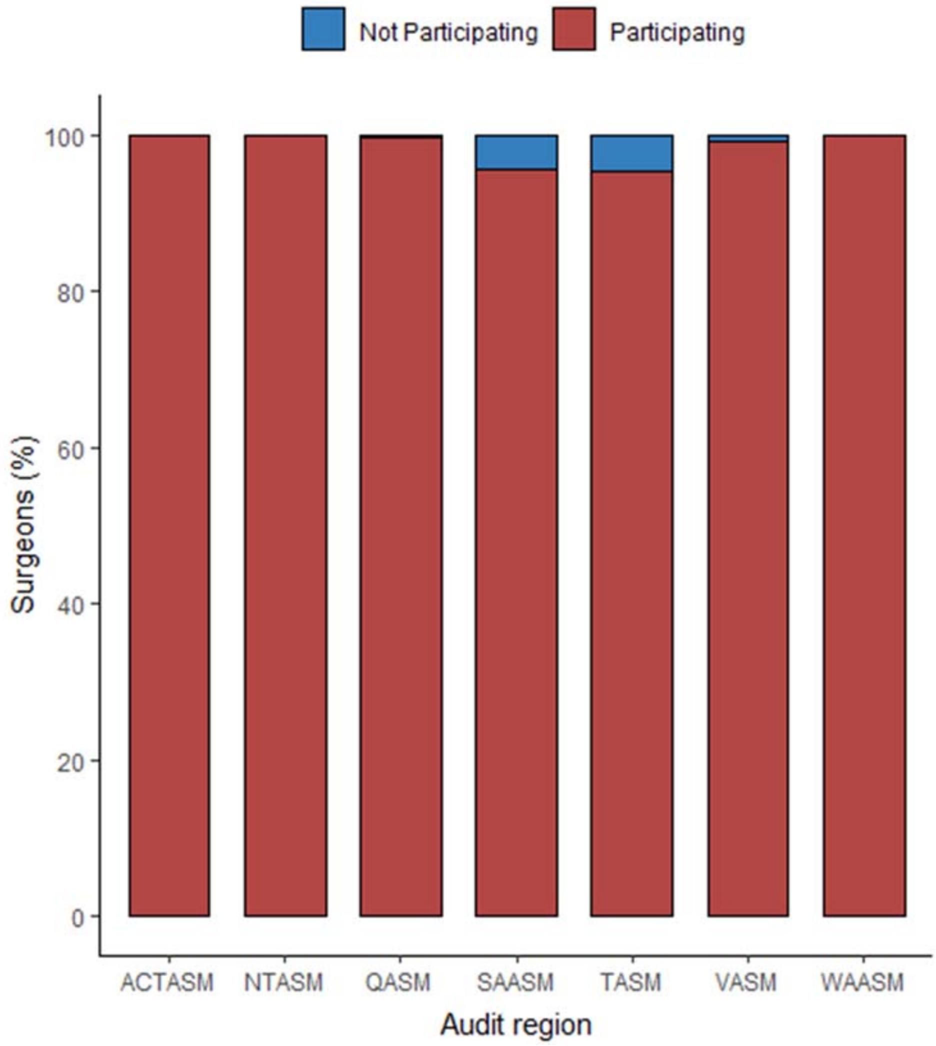
Figure 3: Audit status of reported cases at census date



Note: Excluded cases comprise non-surgical, surgeon non-participant, lost to follow-up or terminal care; (N = 44,365).

By the end of 2020, 98.8% of surgeons nationally (N = 4,532) had agreed to participate in the audit (Figure 4).

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



Note: Not participating indicates that a Fellow has not responded to the invitation to participate in the audit or has not had a case over the entire audit period (2011–2020). (N = 4,532).

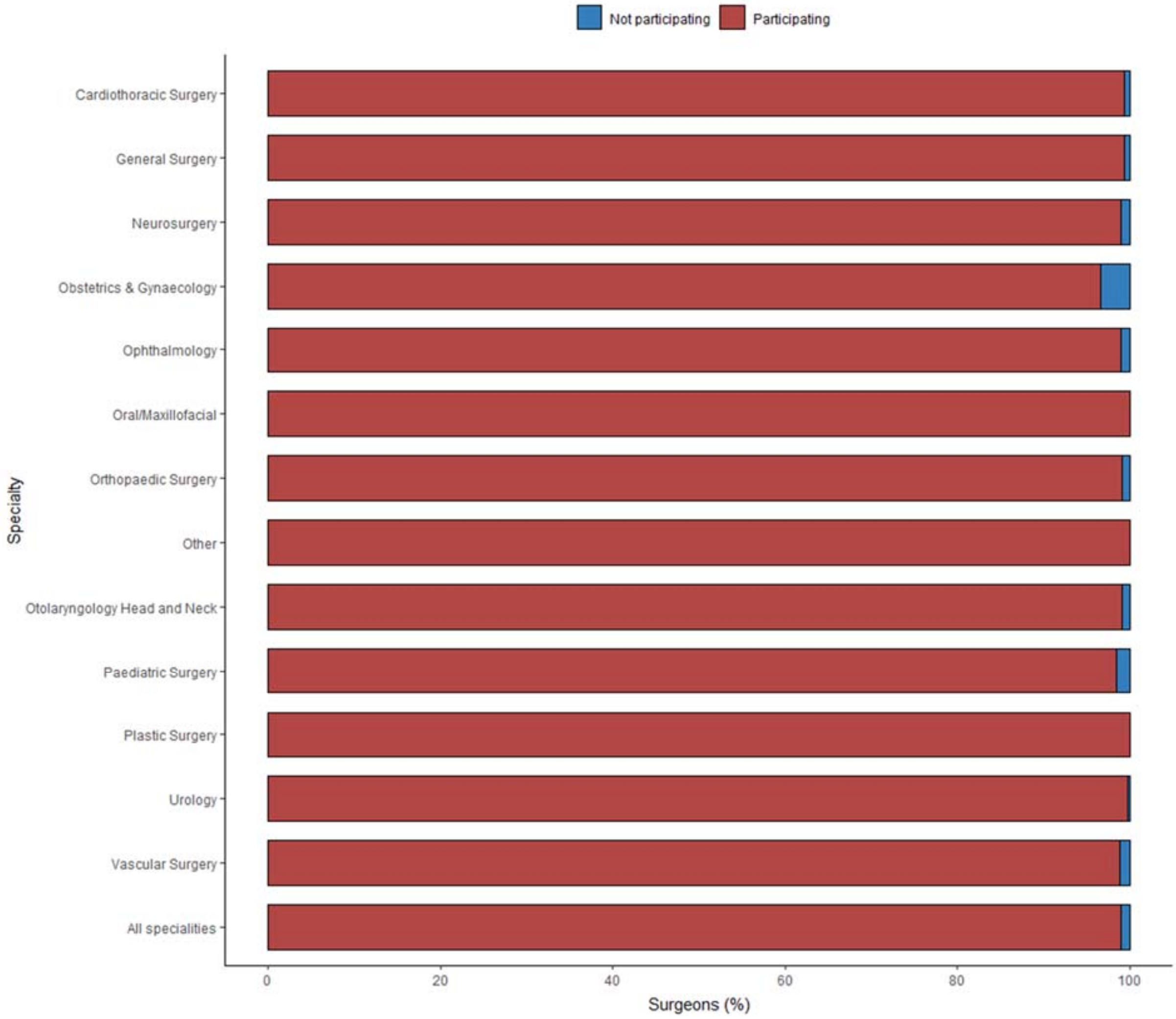
The increase in surgeon participation from 60.0% in 2009 to 98.8% in 2020 can be largely attributed to the following reasons: ongoing rollout of the program, Fellows appreciating the value of the audit and RACS mandating participation in the mortality audit process in January 2010. Participation is an 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 of 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 in the audit, at least 90.2% used the Fellows Interface, compared with 60.2% in 2016 according to the 2017–2018 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 shows that participation rates vary among the different surgical specialties (Figure 5).

Figure 5: Surgeons who have indicated willingness to participate in the audit, by specialty



Note: Not participating indicates that a Fellow has not responded to the invitation to participate in the audit or has not had a case over the entire audit period (2011–2020). (N = 4,532).
'Other' includes trauma, transplant, thoracic medicine and ophthalmology.

A total of 596 gynaecologists agreed to participate in the ANZASM audit process. Participation for 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.

2.2 Hospital participation

All public and private hospitals in which surgery is performed were participating in the audit program by the end of 2020 (NSW data not including).

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 remained at 100% from 2018 to the end of 2020.

3 DEMOGRAPHIC PROFILE OF AUDITED CASES

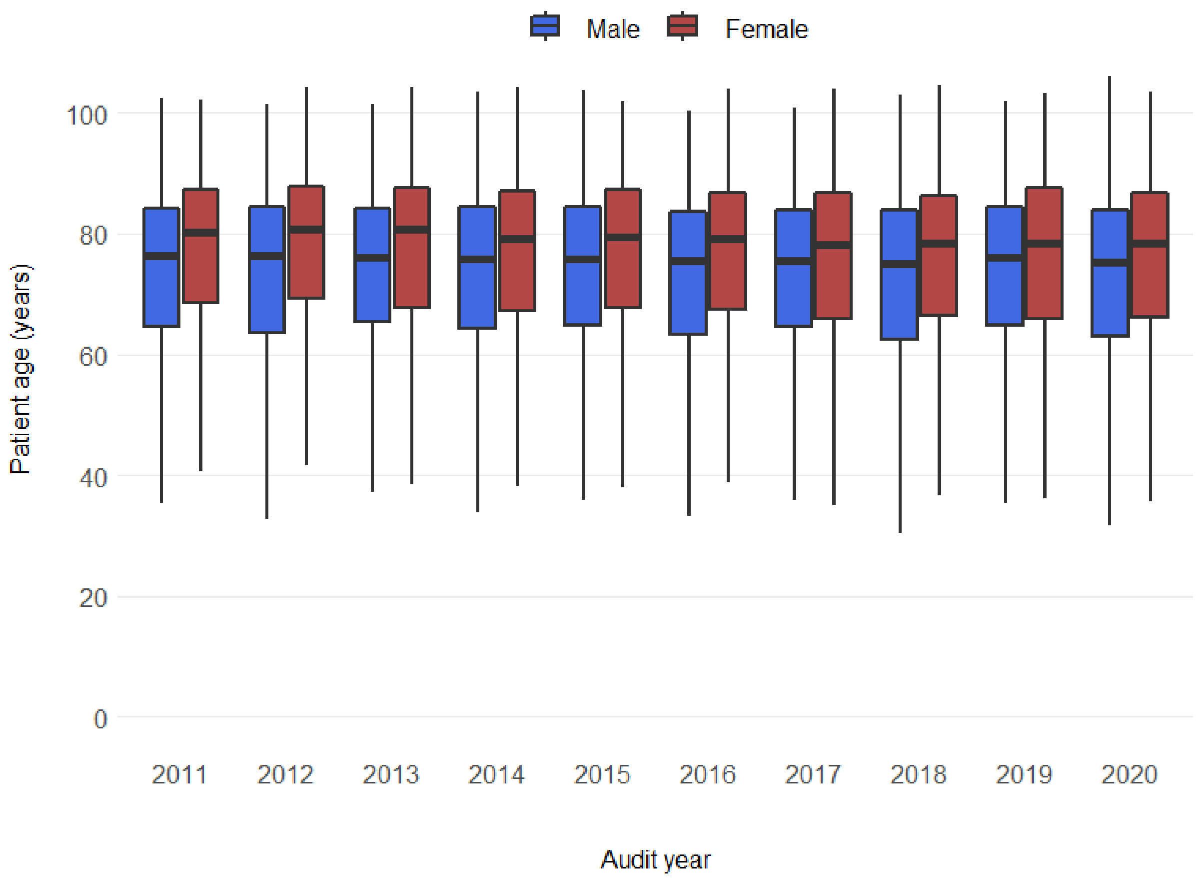
KEY POINTS
• Patients admitted as emergencies with acute life-threatening conditions comprised 85.4% of audited deaths. • The median age and spectrum of comorbidity indicates that surgical mortality predominantly occurs in sick and elderly patients with major pre-existing comorbidities. • One or more pre-existing medical conditions or comorbidities was reported in 89.1% of patients in this audit period. • American Society of Anesthesiologists (ASA) grade 3 or higher was reported in 92.2% of patients.

3.1 Age and sex

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

The age and sex distributions of deaths were 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.

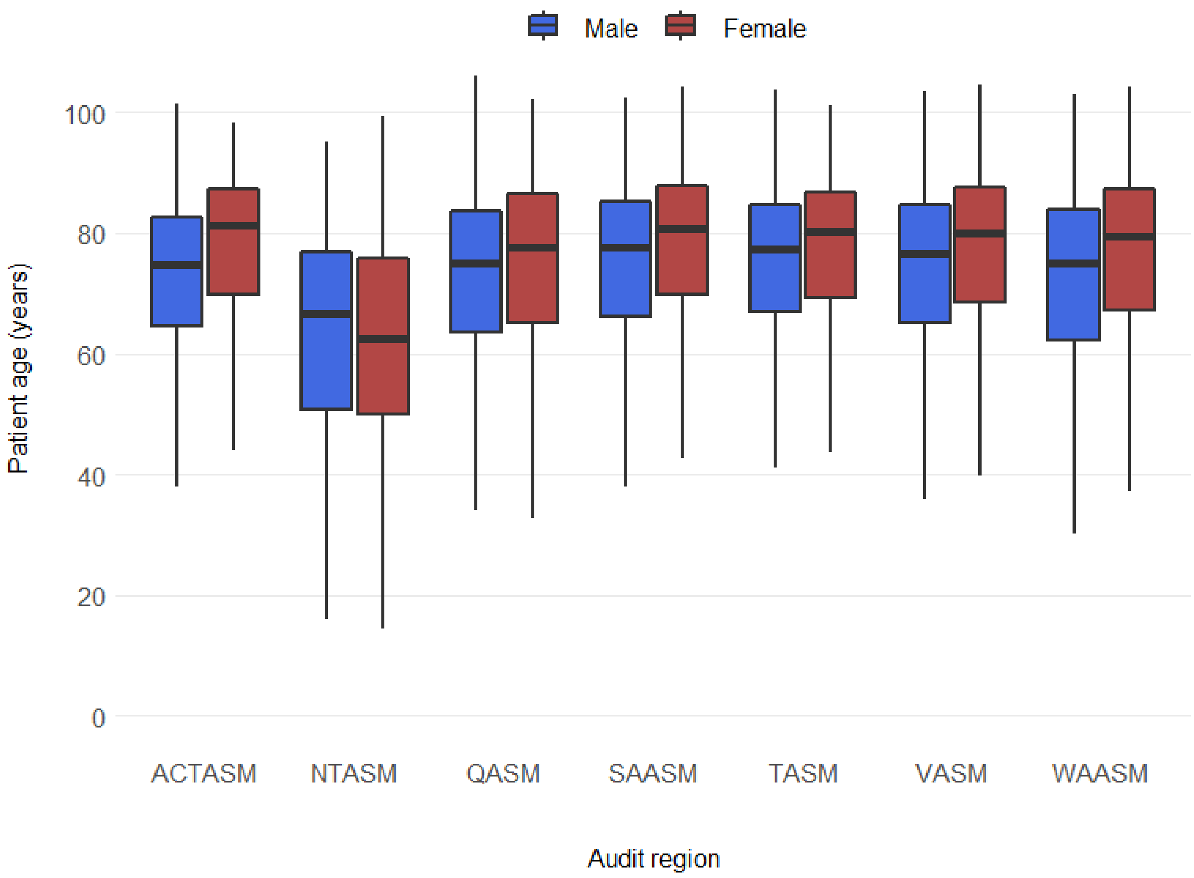
Figure 6: Distribution of patient age at death, by audit year and sex



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 = 4 (<1%); (N = 34,307).

The sex distribution of audited deaths was similar across all audit regions, except the Northern Territory, which had a lower median age of death for both males and females (Figure 7). According to Australian Bureau of Statistics data (2021), the median age in the Northern Territory was 33 years years—the lowest of all states and territories—compared to 38 years for Australia overall.[2]

Figure 7: Distribution of patient age at death, by audit region and sex

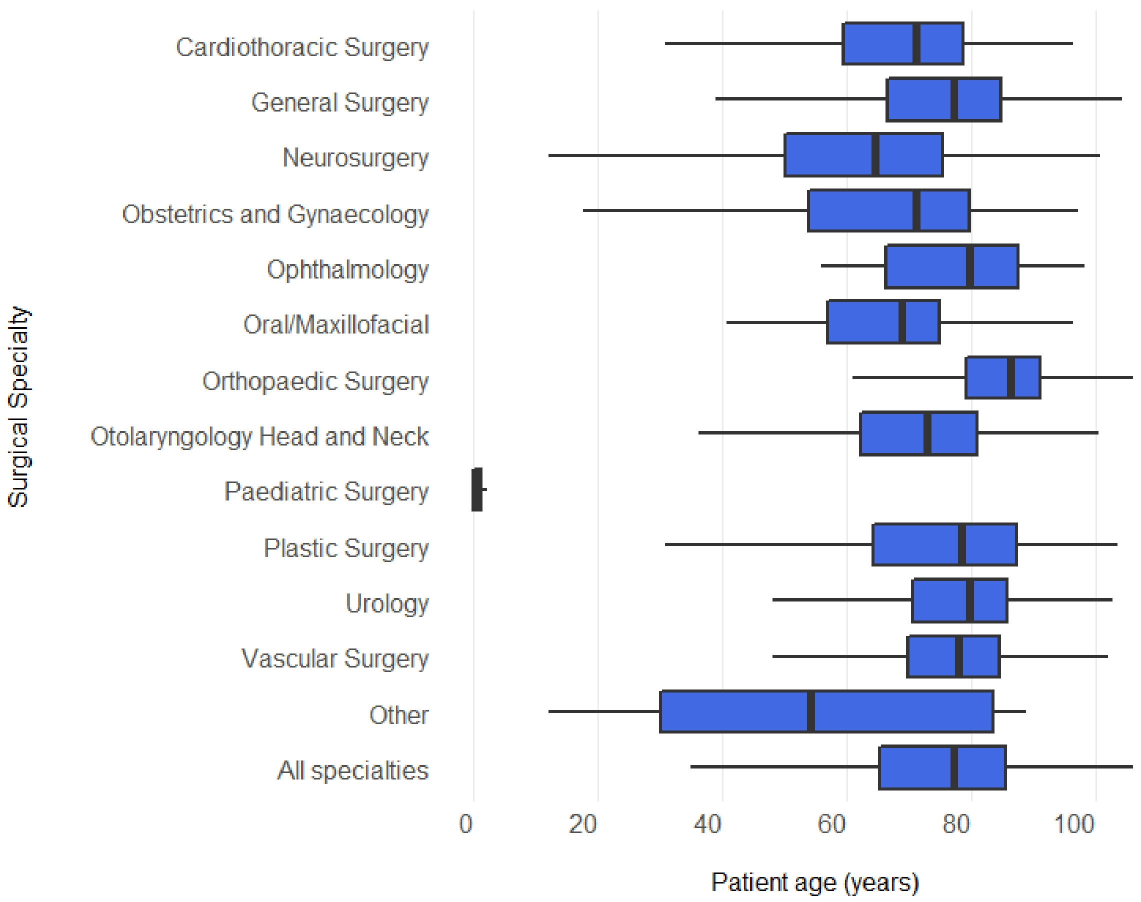


Note: Central box represents values from lower to upper quartile (25th to 75th percentiles); middle line represents median value; vertical line extends from minimum value to maximum value, excluding extreme values for clarity.
Data not available: n = 4 (<1%); (N = 34,307); audit period 2011–2020.

Neurosurgery patients had the lowest median age at death (64.5 years) compared to all other specialities. The median age at death was the highest for Orthopaedic Surgery (86.3 years) (Figure 8).

The median age at death may reflect the underlying disease or condition treated by individual surgical specialties.

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 = 4 (<1%); (N = 34,307); audit period 2011–2020.
'Other' specialties listed by the treating surgeon include trauma and transplant, otology, general practitioner and gynaecology.

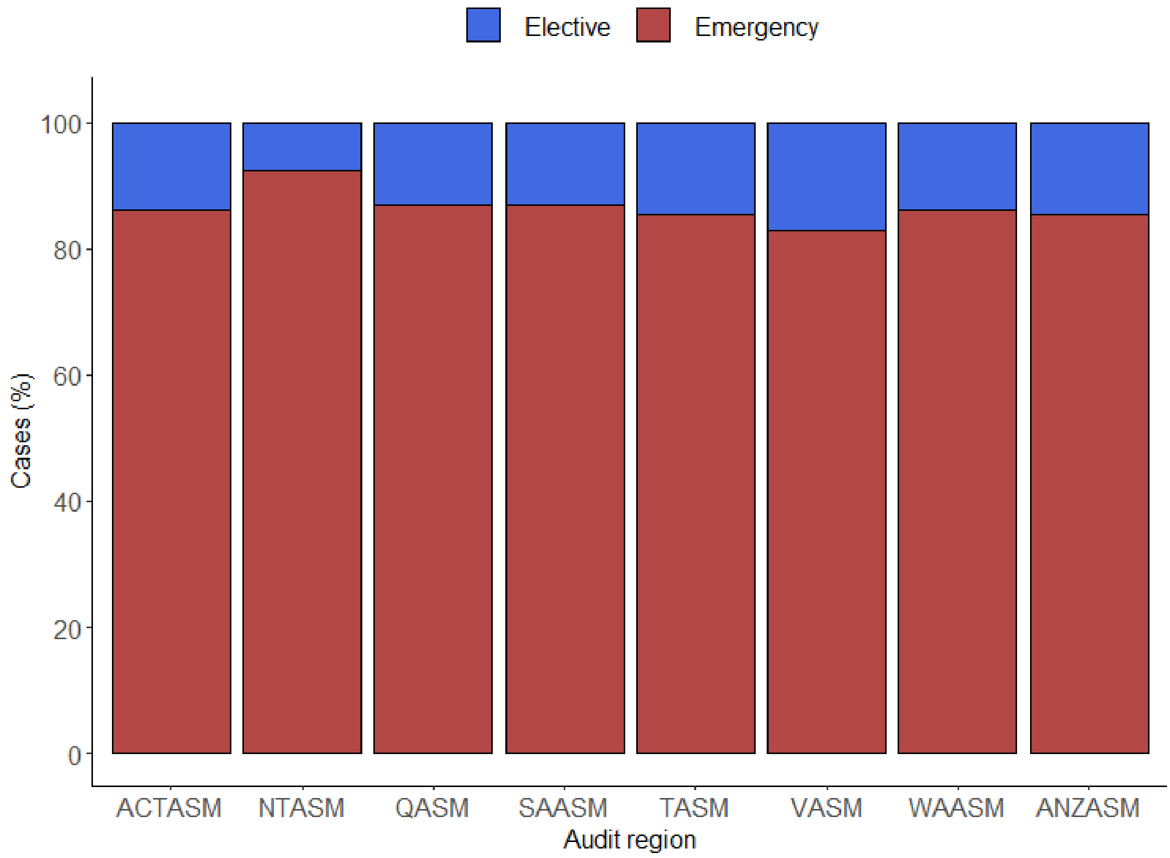
3.2 Admission status of audited cases

The admission status of audited cases indicates whether patients were admitted electively or as emergencies. Patients admitted as emergencies for acute life-threatening conditions comprised 85.4% of audited deaths (Figure 9).

Only a small percentage of cases were elective admissions (14.6%). These percentages do not consider the 247 cases (<1.0%) with no admission status recorded.

These findings are similar to those in the 2017–2018 report.[1]

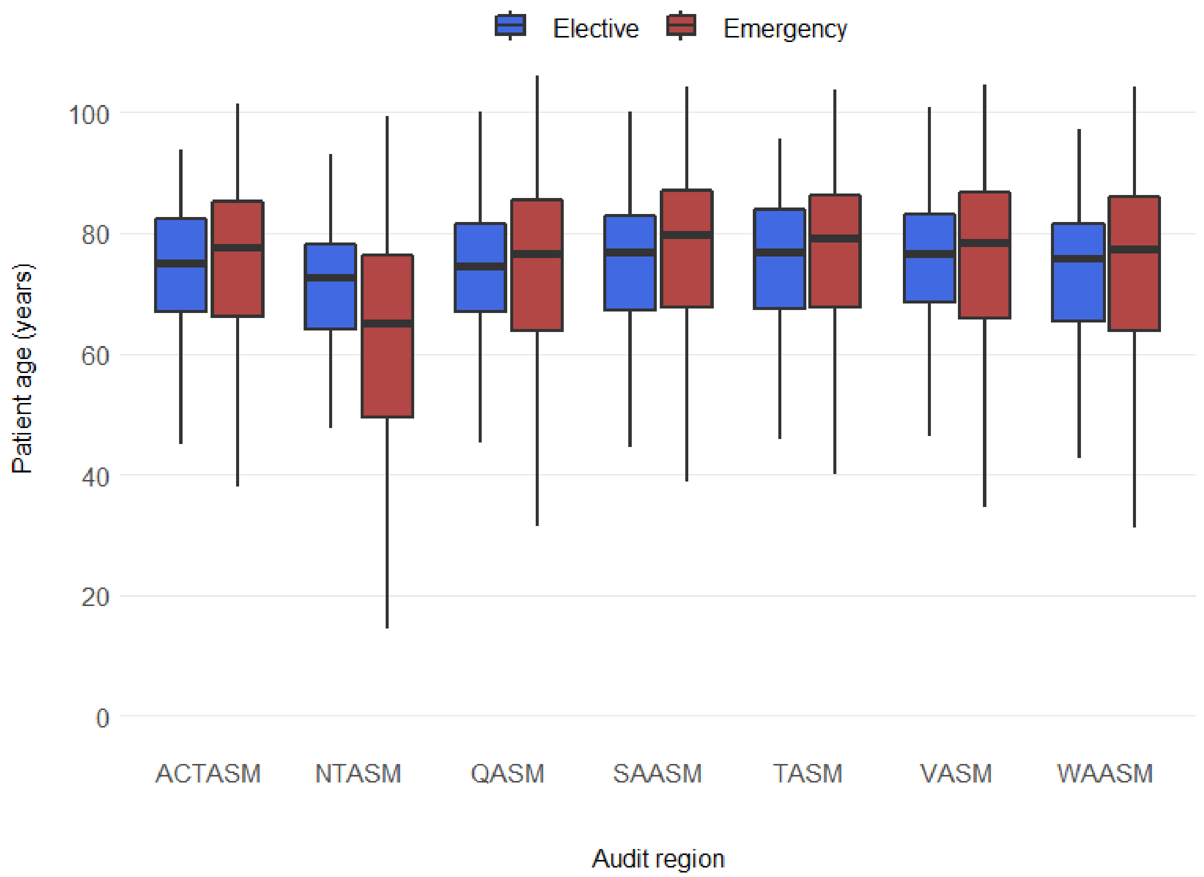
Figure 9: Admission status of cases, by audit region



Data not available: n = 247 (<1%); (N = 34,064); audit period 2011–2020.

Generally, patients who had an emergency admission (2011–2020) were older than those who had an elective admission (Figure 10). The median age of patients who had an emergency admission was 78 years and those who had an elective admission was 76 years. However, in the NT, patients who had an emergency admission were much younger than patients who had an elective admission (median age 65 years vs 73 years).

Figure 10: Distribution of patient age at death, by audit 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 = 4 (<1%); (N = 34,307); audit period 2011–2020.
Each audit region has its own unique case mix and surgical population.

3.3 Risk profile of audited cases

3.3.1 ASA grade

The American Society of Anesthesiologists (ASA) physical classification system is an international measure of patient physiological reserves used by anaesthetists.[3,4] ASA grades and their characteristics are shown in Table 1.

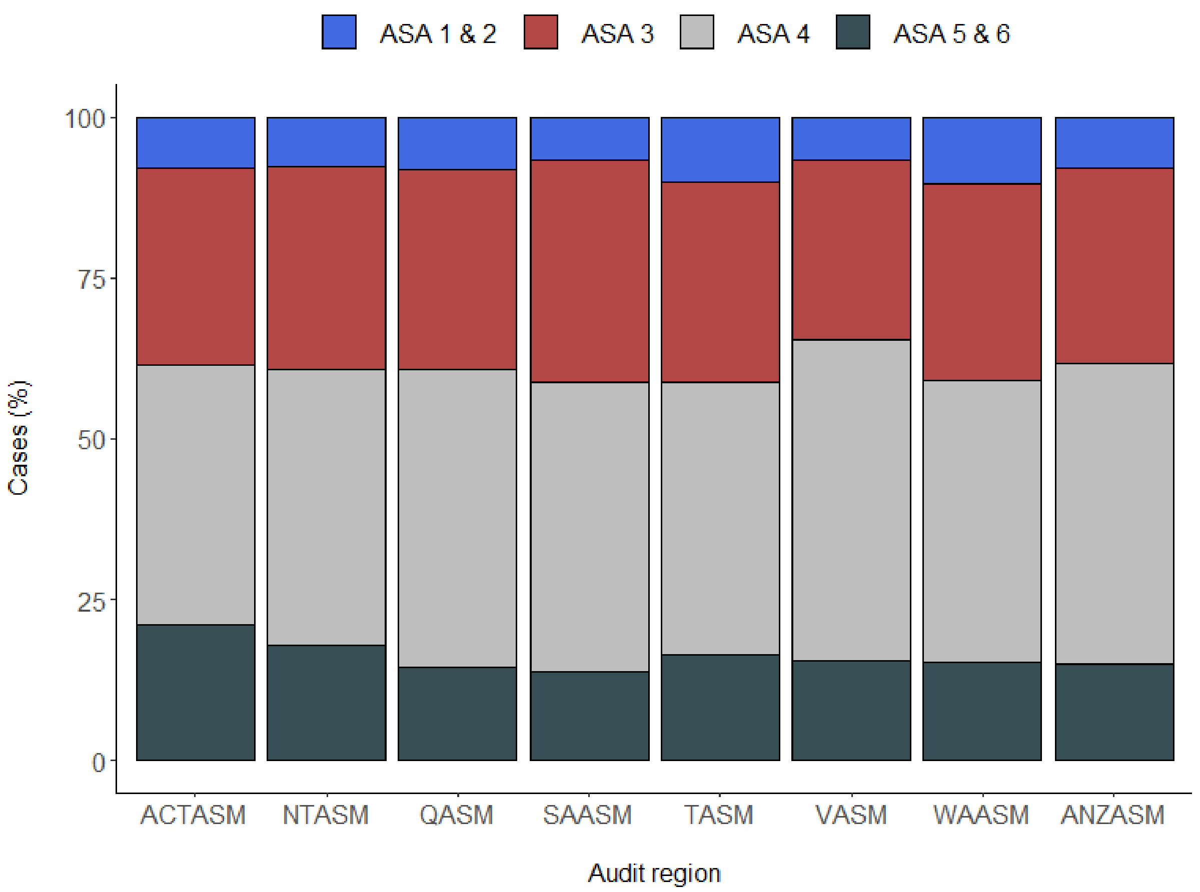
Table 1: ASA grade and characteristics

ASA Grade	Definition
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 purposes

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.

ASA grade 3 or higher was observed in 92.2% 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 across audit regions.

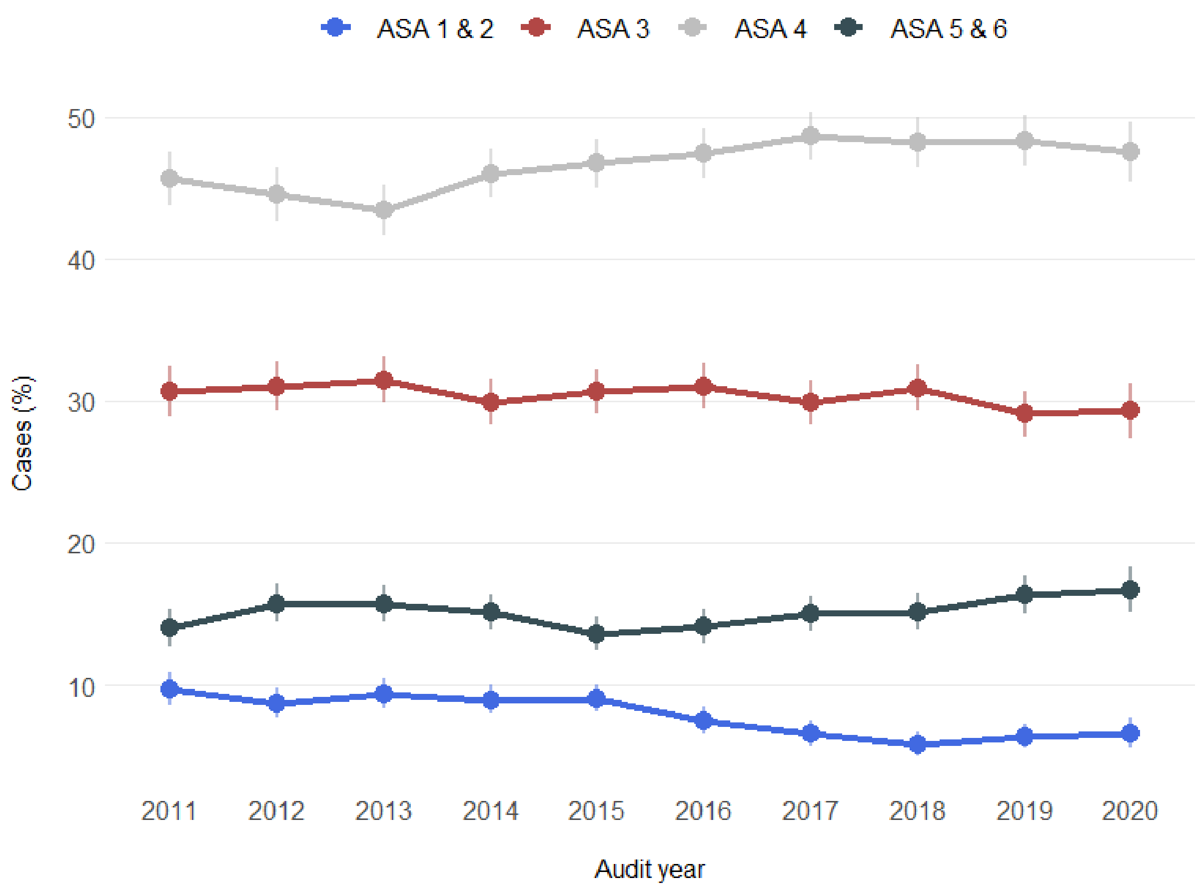
Figure 11: Patient ASA grade according to treating surgeon, by audit region



ASA: American Society of Anesthesiologists.
Note: each audit region has its own unique case mix and surgical population.
Data not available: n = 2,967 (9%); (N = 31,344); audit period 2011–2020.

ASA grade 4 comprised the highest number of patients—about 46% of patients in 2011. The percentage decreased slightly between 2012 and 2013; however, it increased again from 2014, reaching almost 50% by the end of 2020 (Figure 12). The number of patients with ASA 1–2 decreased slightly from 2016 to 2018. There was minimal variation across the audit years for those with ASA grade 3.

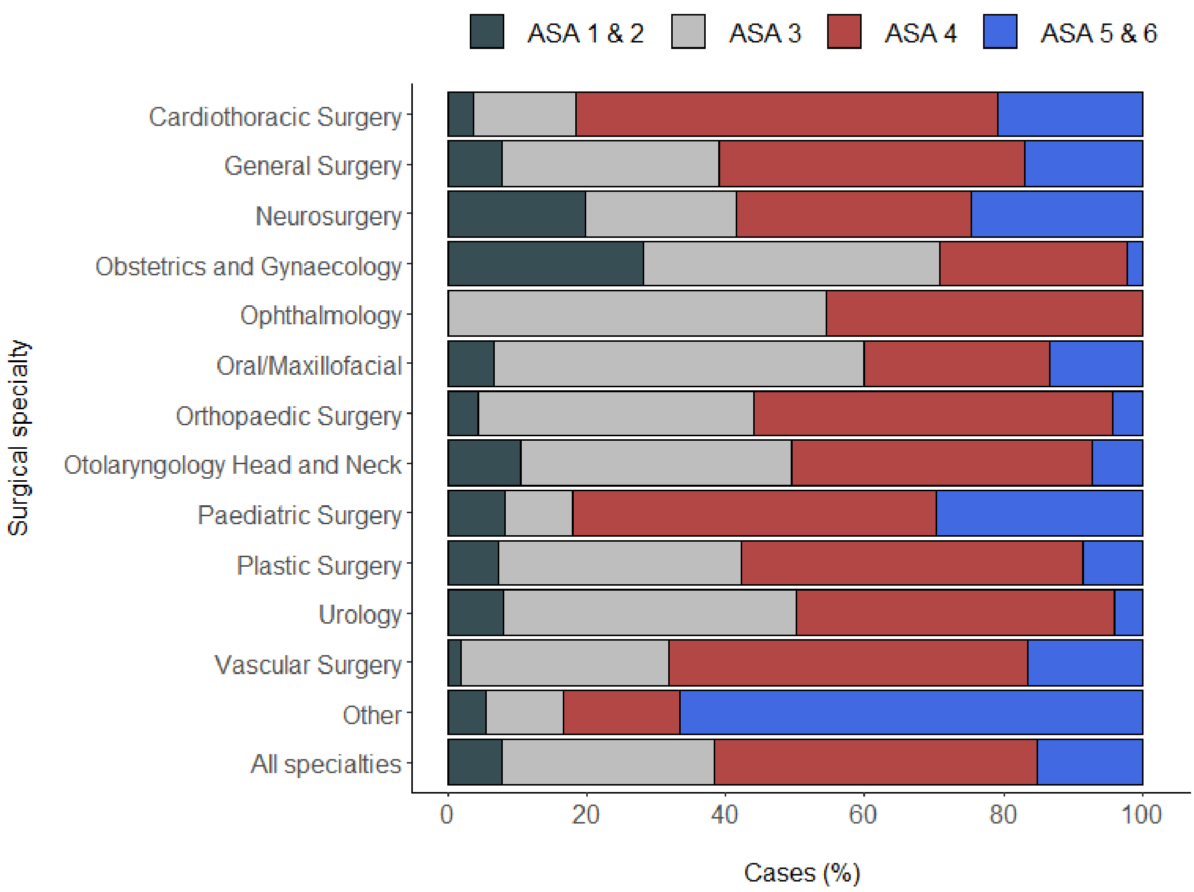
Figure 12: Patient ASA grade according to treating surgeon, by audit year



ASA: American Society of Anesthesiologists.
Note: each audit region has its own unique case mix and surgical population.
Error bars show 95% confidence intervals.
Data not available: n = 2,967 (9%); (N = 31,344); audit period 2011–2020.

Variation in ASA grade may reflect the case mix of different surgical specialties (Figure 13). The larger number of Neurosurgery cases rated ASA 1–2 may reflect the greater number of paediatric patients encountered in this specialty. Obstetrics and gynaecology patients rated ASA 1–2 also generally tend to be younger.

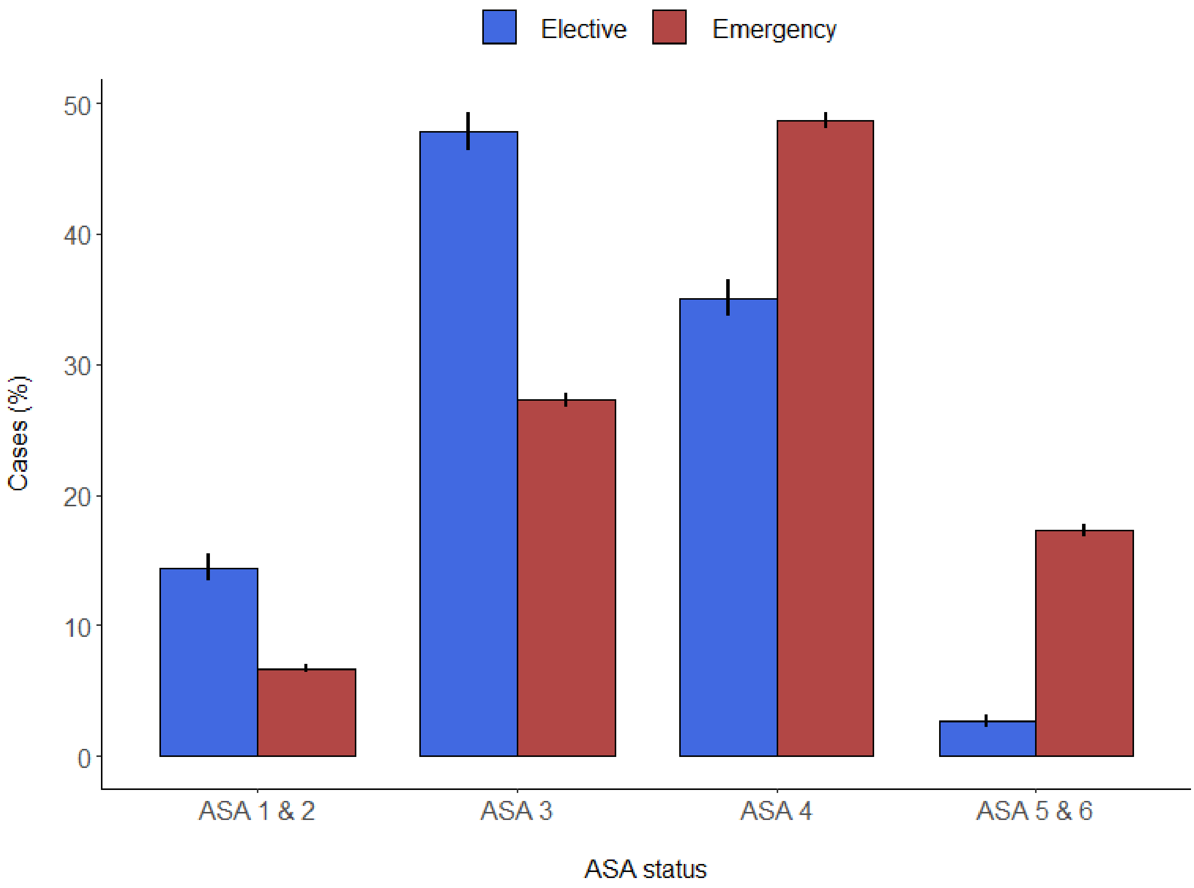
Figure 13: Patient ASA grade, by surgical specialty



ASA: American Society of Anesthesiologists.
Note: colorectal surgery is included within the General Surgery group. 'Other' specialties listed by the treating surgeon include anaesthesia, intensive care, oncology, thoracic medicine and trauma. This includes cases where multiple specialties were involved in a single case.
Data not available: n = 2,967 (9%); (N = 31,344); audit period 2011–2020.

The majority of emergency (94.0%) and elective (86.2%) patients were rated ASA grade 3 or higher (Figure 14). This is a slight increase over the proportion of ASA ≥3 emergency (92.9%) and elective (84.8%) surgery cases reported in 2017–2018.[1]

Figure 14: Patient ASA grade, by admission status



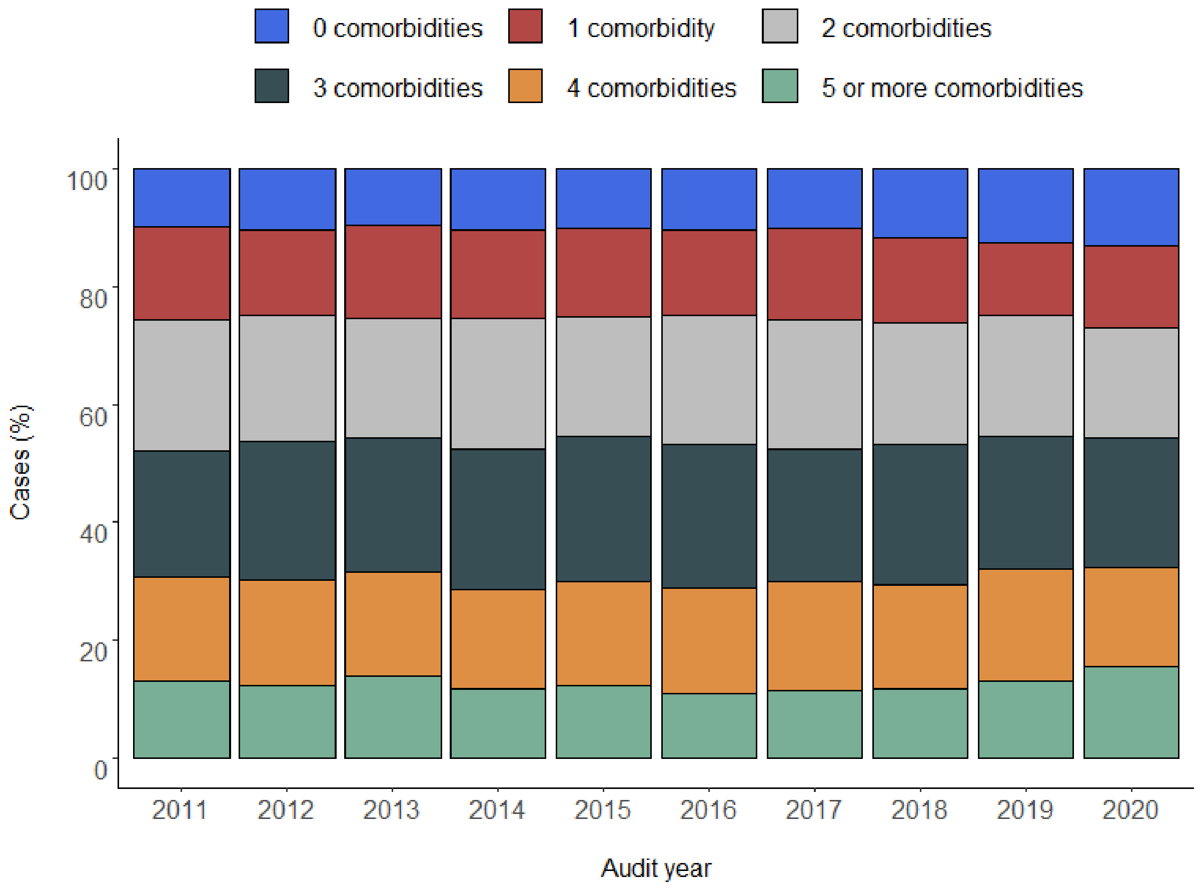
ASA: American Society of Anesthesiologists.
Note: error bars show 95% confidence intervals.
Data not available: n = 3,170 (9%); (N = 31,141); audit period 2011–2020.

3.3.2 Comorbidity

Surgeons were asked to record all known comorbidities in addition to the primary medical (presenting) problem. The frequency of multiple comorbidities per patient in each audit period is provided in Figure 15. Previous research indicates that comorbidity is a stronger predictor of mortality than is the type of surgery.[5]

One or more comorbidities were reported in 89.1% of audited cases between 2011 and 2020 (Figure 15). A total of 74.3% 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.

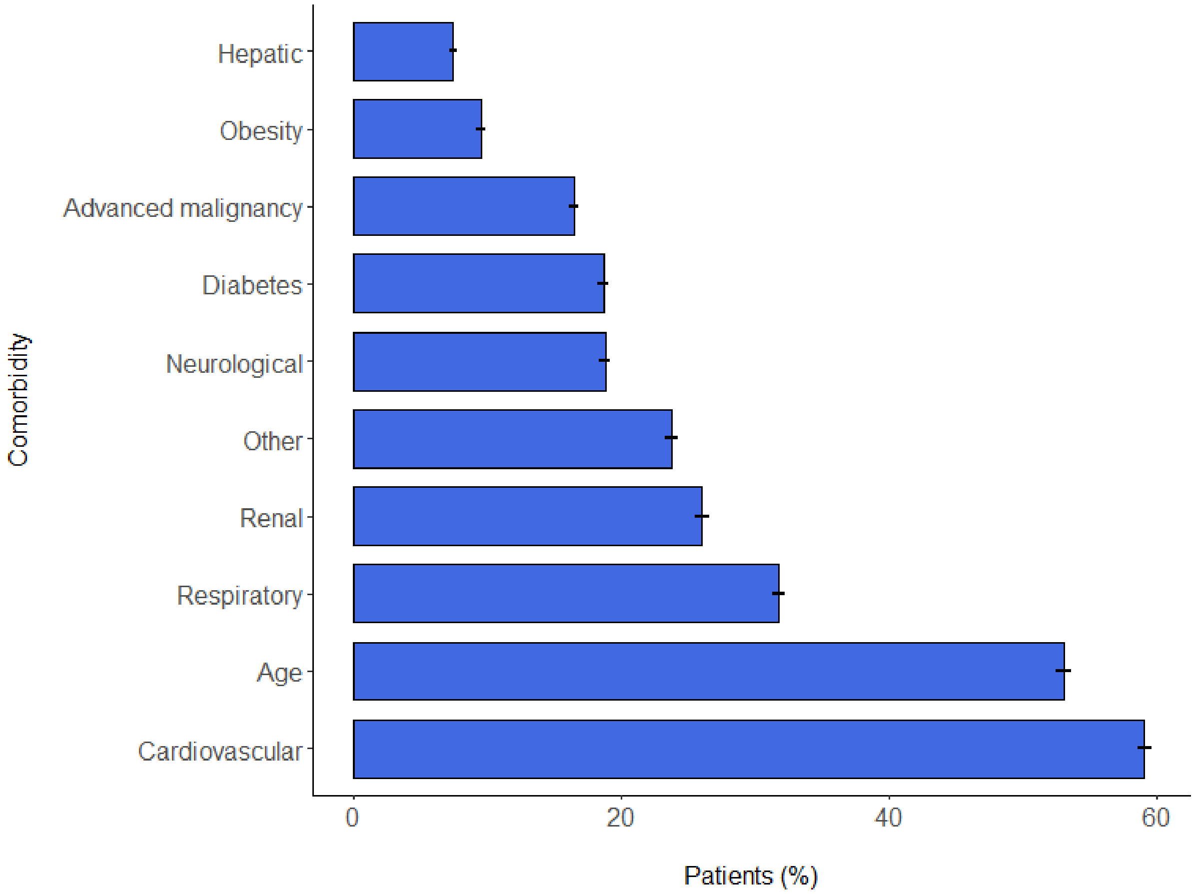
Figure 15: Number of comorbidities in individual patients, by audit year



Data not available: n = 417 (1%); (N = 33,894).

Information on the specific types of comorbidities present in audit patients is provided in Figure 16. The 3 most common comorbidities were cardiovascular disease, age and respiratory problems. These occurred at similar incidences in both male and female patients (data not shown). The distribution pattern of the most common comorbidities has remained consistent over the 10 audit years (data not shown).

Figure 16: Percentage of specific comorbidities



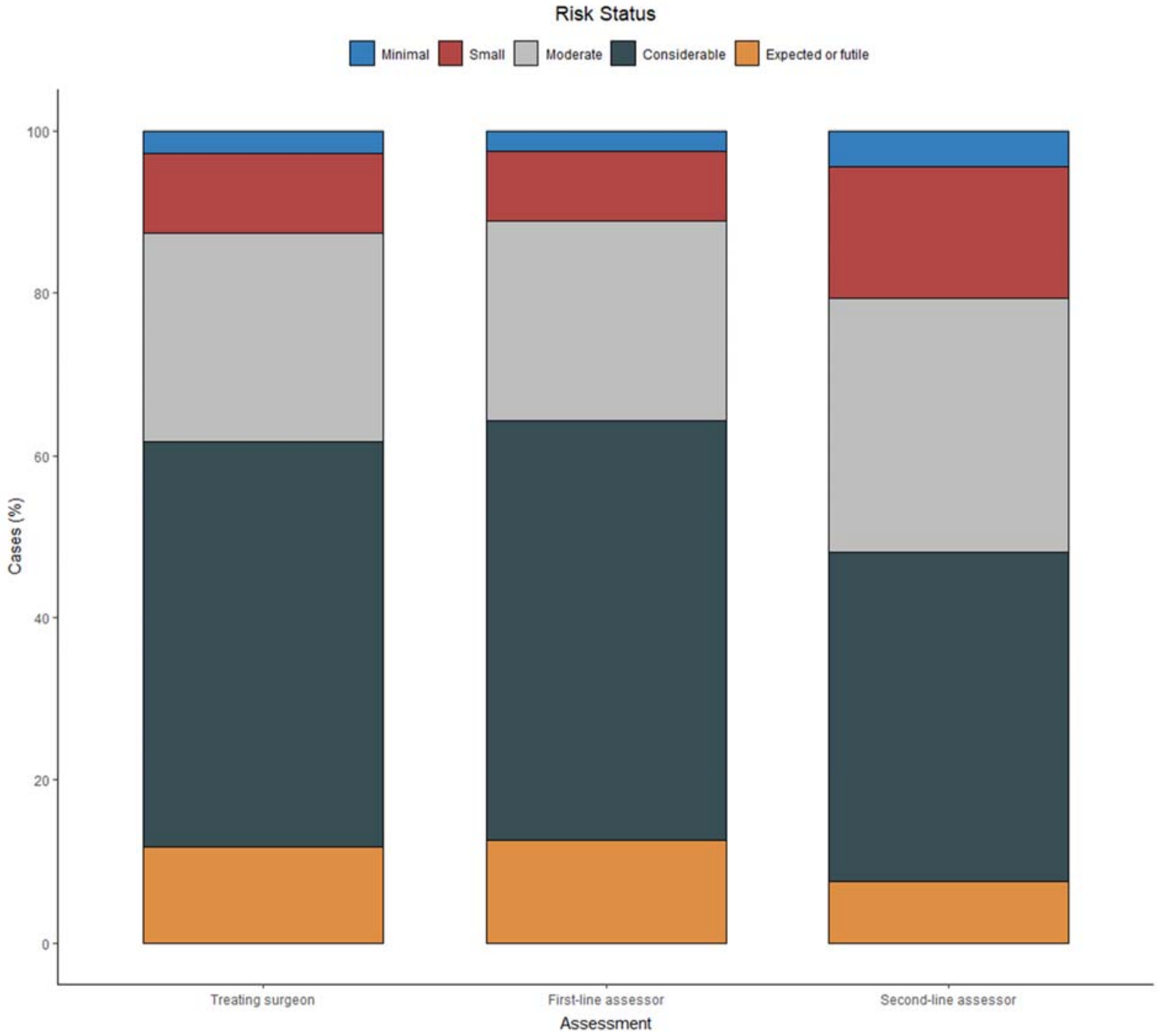
Note: Error bars show 95% confidence intervals.
Data not available: n = 417 (1%); n = 89,749 comorbidities; (N = 33,894); audit period 2011–2020. Categories are not mutually exclusive (i.e. a single patient can have multiple comorbidities).
'Other' category includes a wide range of comorbidities such 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.

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).

The perceived risk of death, as reported by surgeons, was considerable or expected in 61.7% of cases and small or minimal in 12.7% of cases. By comparison, the risk of death was perceived to be considerable or expected in 64.4% of cases by first-line assessors and 48.0% of cases by second-line assessors. This is further evidence of the high-risk profile of patients in the audit, as suggested by mean age, ASA score and associated comorbidity.

Figure 17: Perceived risk of death



N = 27,248; first-line assessor (n = 22,738); second-line assessor (n= 4,510).

4 RISK MANAGEMENT STRATEGIES

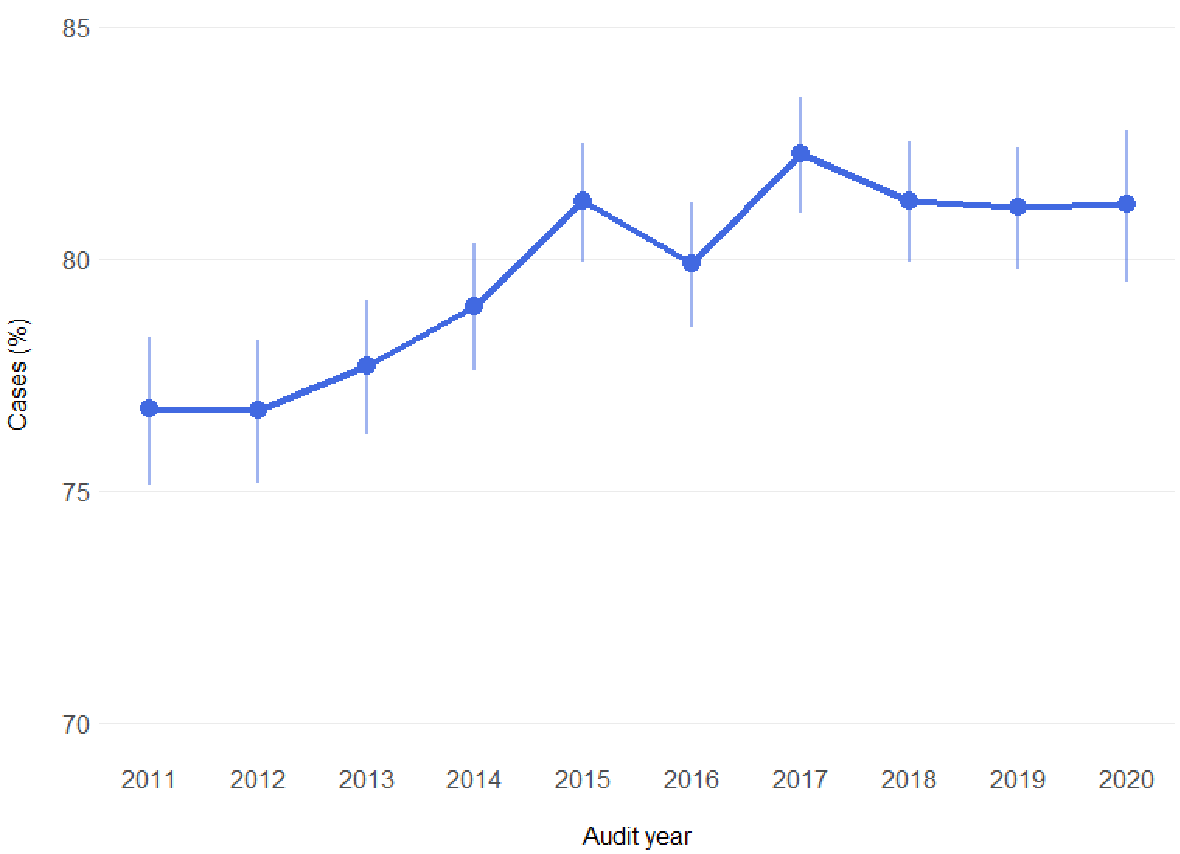
KEY POINTS
• Use of deep vein thrombosis (DVT) prophylaxis was recorded in 79.9% of cases in which patients underwent a surgical procedure. • In only 1.8% of cases did the first- and second-line assessors state that the DVT prophylaxis management was inappropriate. • In most instances, patients who required critical care support received it. The review process suggested that 7.3% of patients who received no treatment in a critical care unit would most likely have benefited from it. • Assessors perceived that 7.1% of patients 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. 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.

Between 2011 and 2020, DVT prophylaxis was used in 79.9% of cases in which patients underwent an operation. Across the audit years DVT prophylaxis use varied from 77% to 82% of cases (Figure 18).

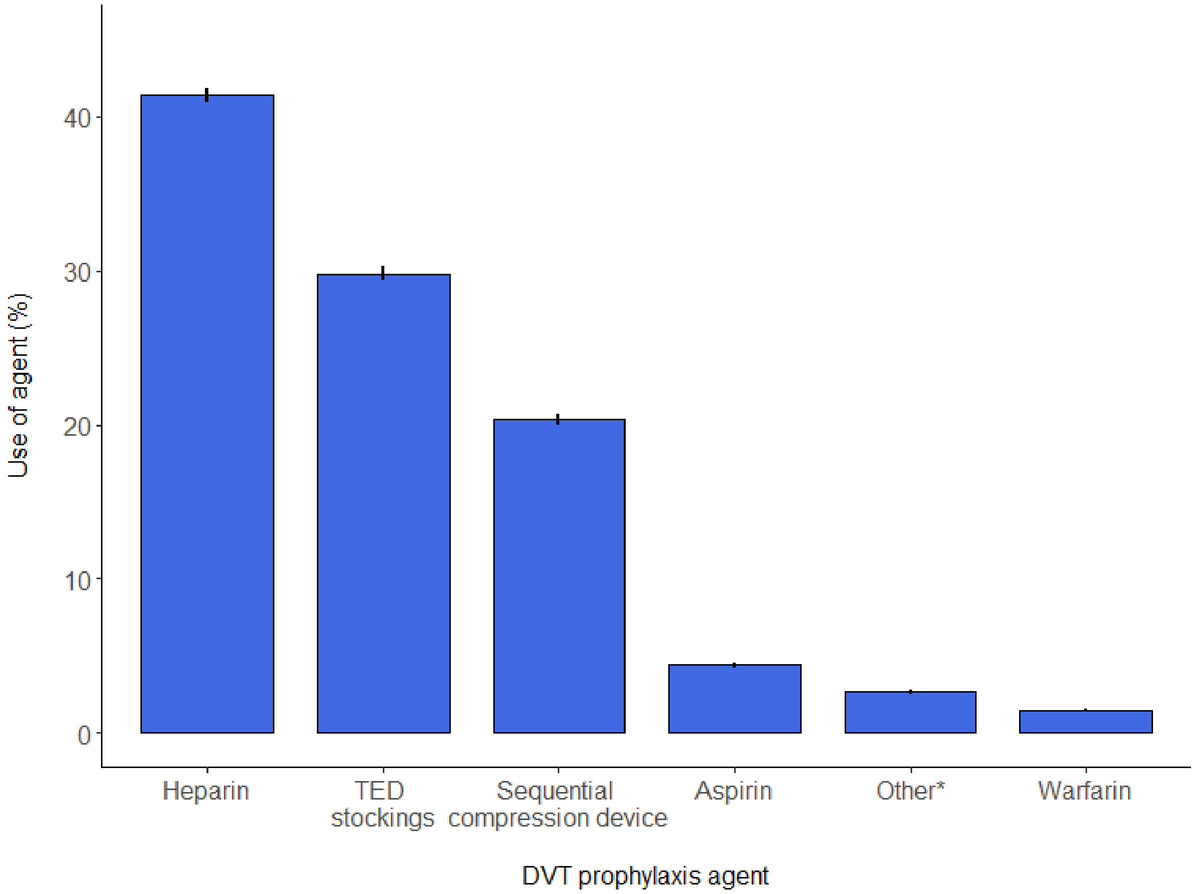
Figure 18: DVT prophylaxis use according to treating surgeon, by audit year



DVT = deep vein thrombosis.
Note: error bars show 95% confidence intervals.
Data not available: n = 785 (2%); (N = 33,526).

The most frequently used prophylaxis agents were heparin 41.4% and thromboembolic deterrent (TED) stockings 29.7% (Figure 19).

Figure 19: Type of DVT prophylaxis agent used



DVT: deep vein thrombosis; TED: thromboembolic deterrent.
Note: a single patient may have multiple agents administered. *Other includes Clexane, clopidogrel, danaparoid, early mobilisation, Fragmin, inferior vena cava filter and lepirudin.
Error bars show 95% confidence intervals.
Data not available: n = 785 (2%); n = 49,255 instances of DVT use; (N = 33,526); audit period 2011–2020.

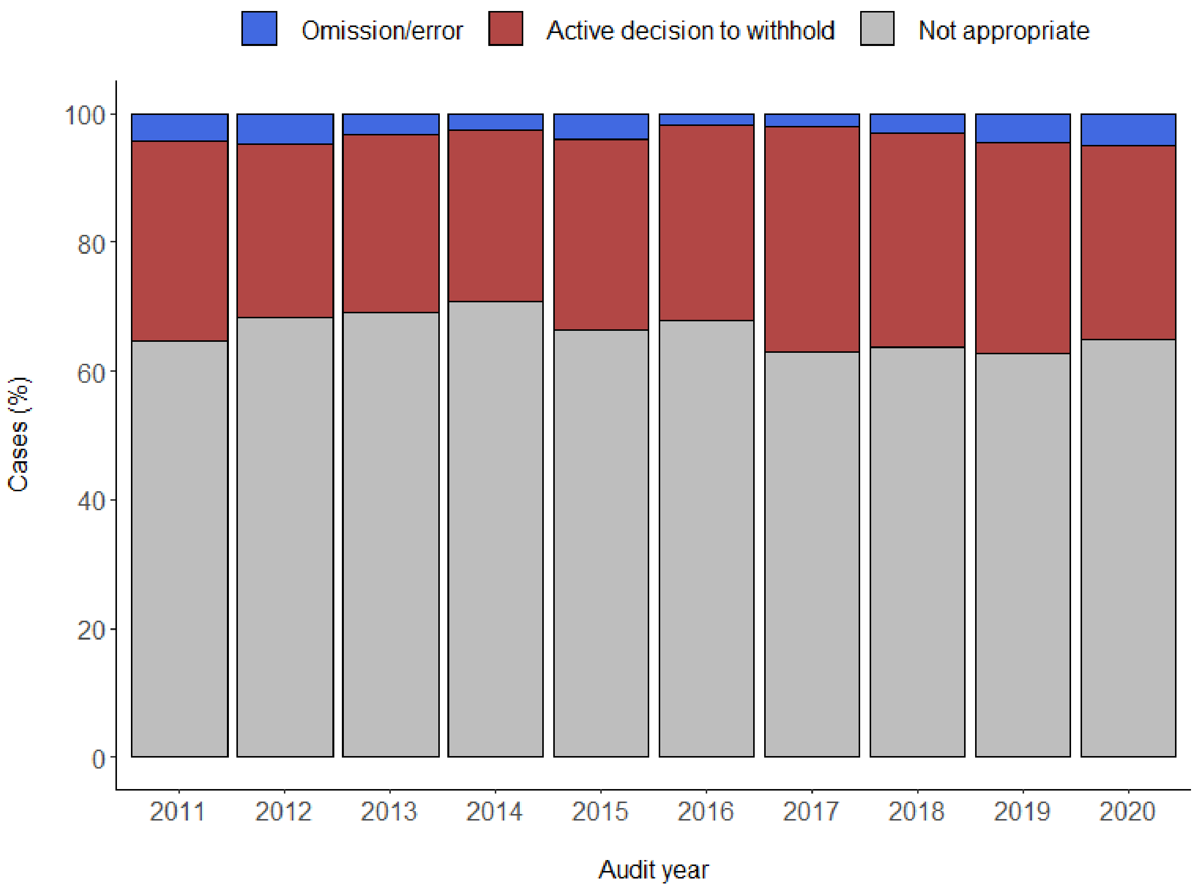
Choice of DVT prophylaxis agent varied across the audit regions, with sequential compression devices and heparin showing the greatest variation in usage across states and territories (Table 2). Between 2011 and 2020, DVT prophylaxis use varied across the audit regions, ranging from 75.6% of cases in SA to 86.6% of cases in ACT (data not shown).

Table 2: DVT prophylaxis use by audit region DVT prophylaxis agent	SA	QLD	WA	TAS	VIC	ACT	NT
Heparin (any form)	45%	37%	42%	37%	45%	43%	44%
Warfarin	2%	2%	1%	1%	1%	2%	1%
Aspirin	4%	5%	4%	6%	4%	4%	5%
Sequential compression device	19%	22%	19%	25%	20%	23%	18%
TED stockings	27%	32%	32%	29%	27%	27%	30%
Other*	2%	3%	2%	3%	3%	2%	2%

TED: thromboembolic deterrent; DVT: deep vein thrombosis.
Data not available: n = 785 (2%); n = 49,255 instances; (N = 33,526); audit period 2011–2020.
*Other includes Clexane, clopidogrel, danaparoid, early mobilisation, Fragmin, inferior vena cava filter and lepirudin.

Between 2011 and 2020, non-use of DVT prophylaxis was due to error or omission in only 3.5% of cases (Figure 20). In most instances the treating surgeon actively withheld prophylaxis for 30.3% of patients.

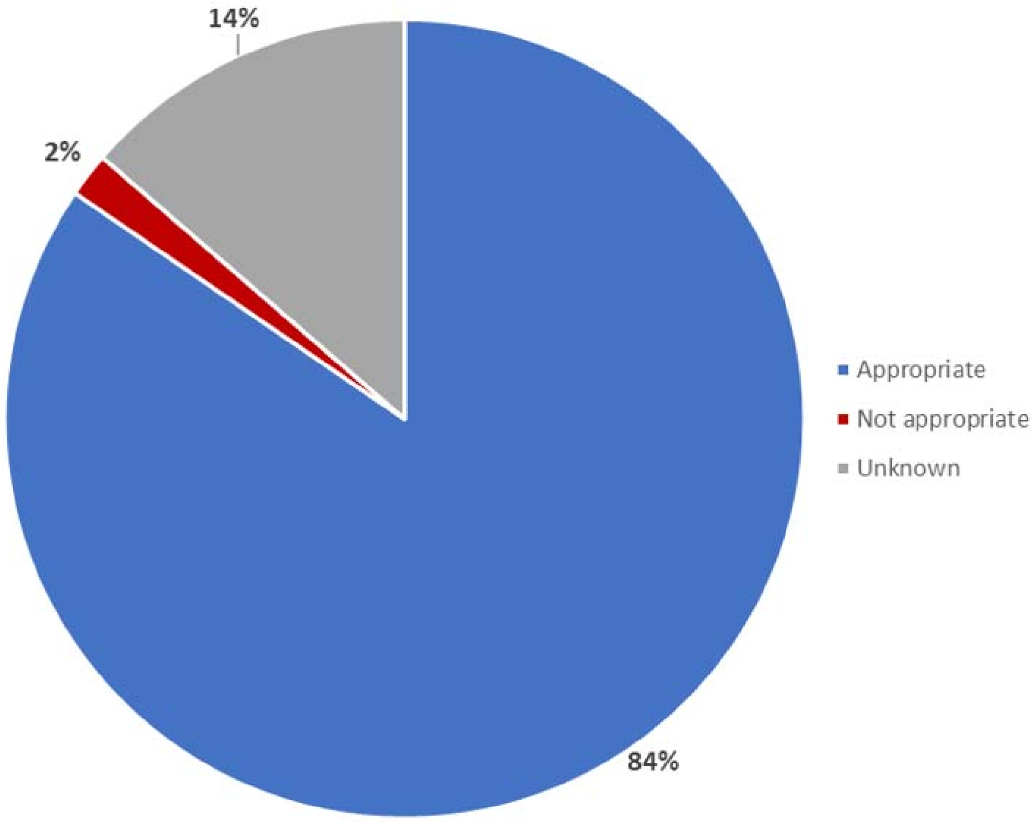
Figure 20: Reasons for non-use of DVT prophylaxis according to treating surgeon, by audit year



DVT: deep vein thrombosis.
Data not available: n = 598 (9%); (N = 6,137).

Assessors concluded that DVT prophylaxis management was appropriate in most instances (84.6%) where the patient underwent a surgical procedure (Figure 21). Only in 1.8% of cases was DVT prophylaxis management considered inappropriate. In 13.6% of cases the perception of appropriateness was unknown.

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



DVT: deep vein thrombosis.
Data not available: n = 1,363 (4%); (N = 34,311); audit period 2011–2020.

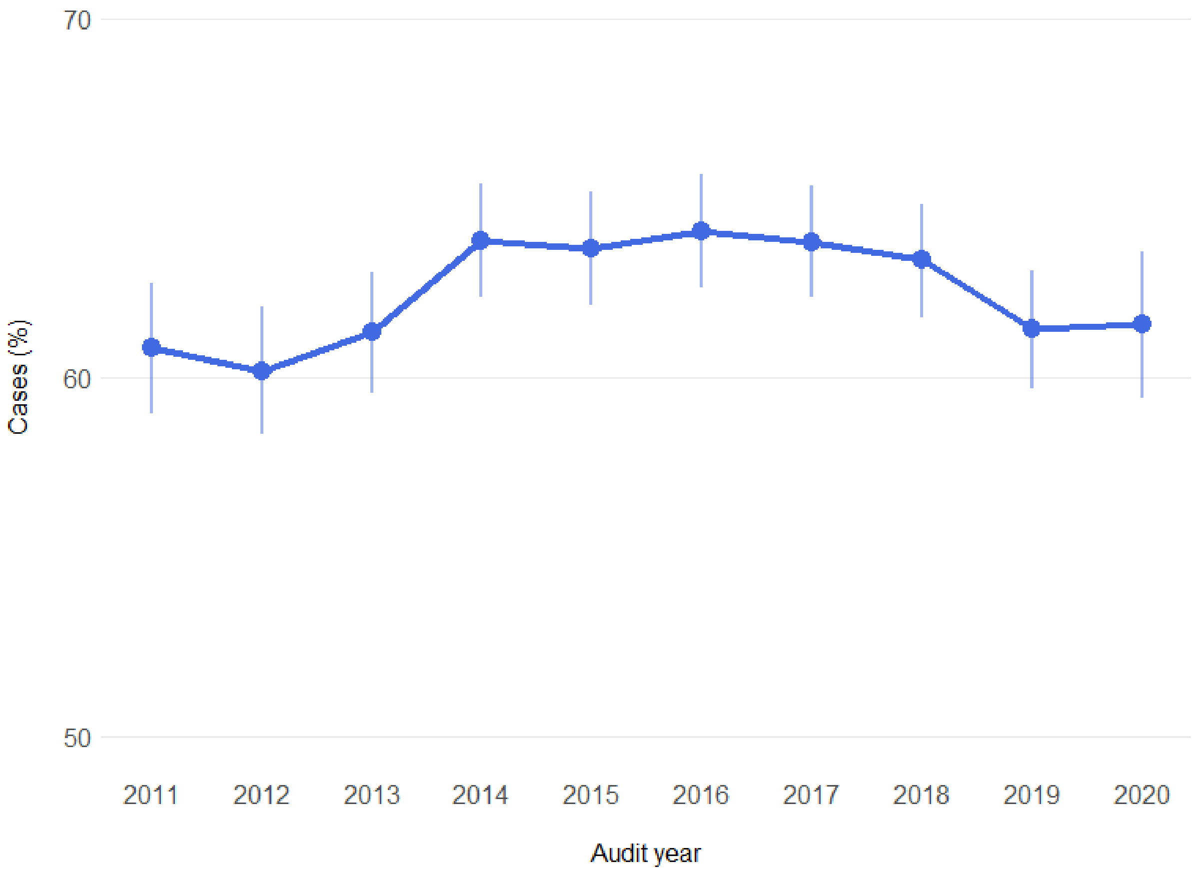
4.2 Provision of critical care support to patients

The treating surgeon was asked to record whether a patient received critical care support in an intensive care or high dependency unit during admission. 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.) A patient not receiving critical care does not necessarily indicate a lack of critical care facilities.

Between 2011 and 2020, 62.6% of audit patients received critical care support (Figure 22). Assessors perceived that 7.3% of patients who did not receive critical care support might have benefited from it (data not shown).

Over the 10 years of the audit, there has been a drop in the proportion of unavailable data regarding the provision of critical care support, from 6.0% in the 2017–2018[1] report to 1.0% in this report. This reduction is a result of revising the SCF in 2014 to improve reporting for this question to enable analysis of the reasons why patients do not receive critical care support. The increase in available data allows for more meaningful analysis of this area of care.

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



Note: Error bars show 95% confidence intervals.
Data not available: n = 418 cases (1%); (N = 33,893).

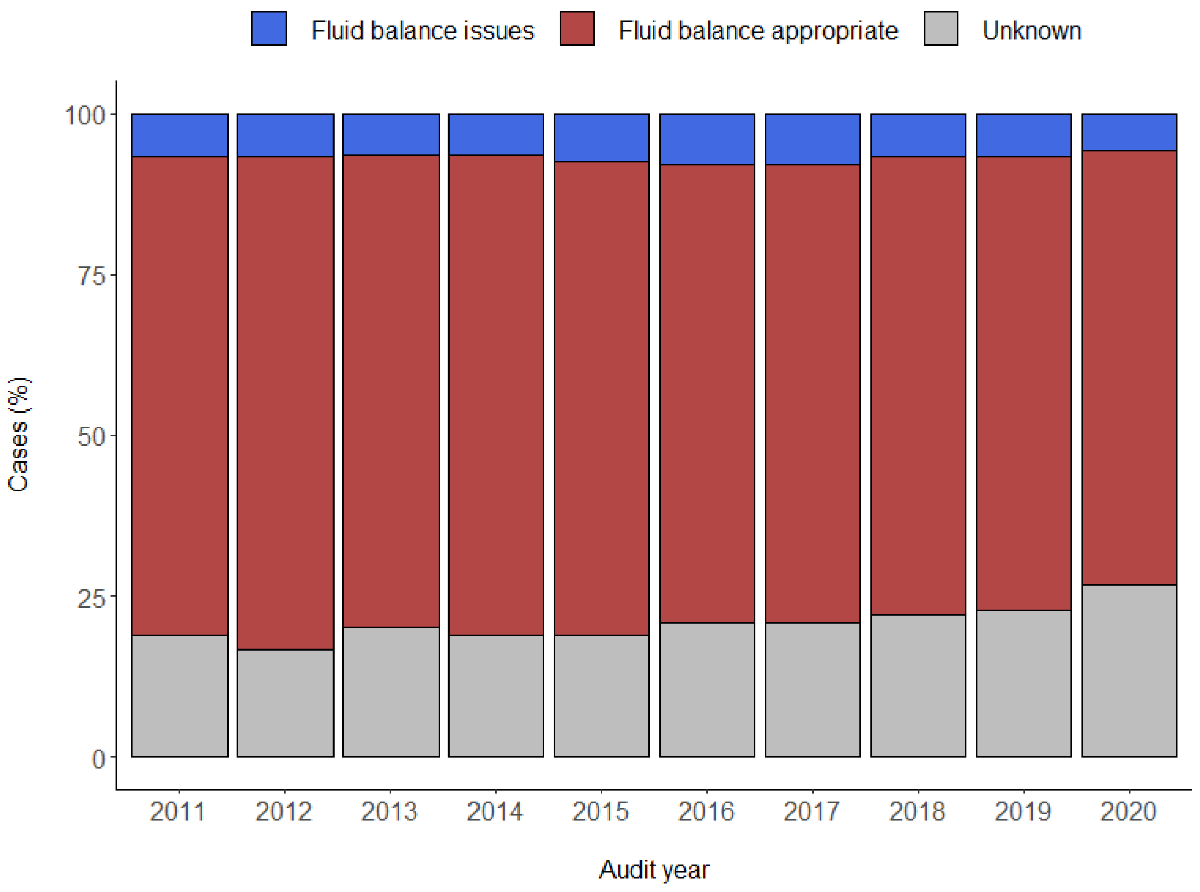
4.3 Fluid management

Fluid balance in the surgical patient is an ongoing challenge.

Assessors concluded that management of fluid balance was appropriate in most instances (72.3%) where the patient underwent a surgical procedure (Figure 23). Only in 7.1% of cases did the assessors feel that there was an issue with fluid balance.

In 20.6% of cases the assessors indicated that the evidence provided was inadequate to support a conclusion regarding fluid balance.

Figure 23: Appropriateness of fluid balance management as viewed by assessors, by audit year



Data not available: n = 1,263 (4%); (N = 33,048).

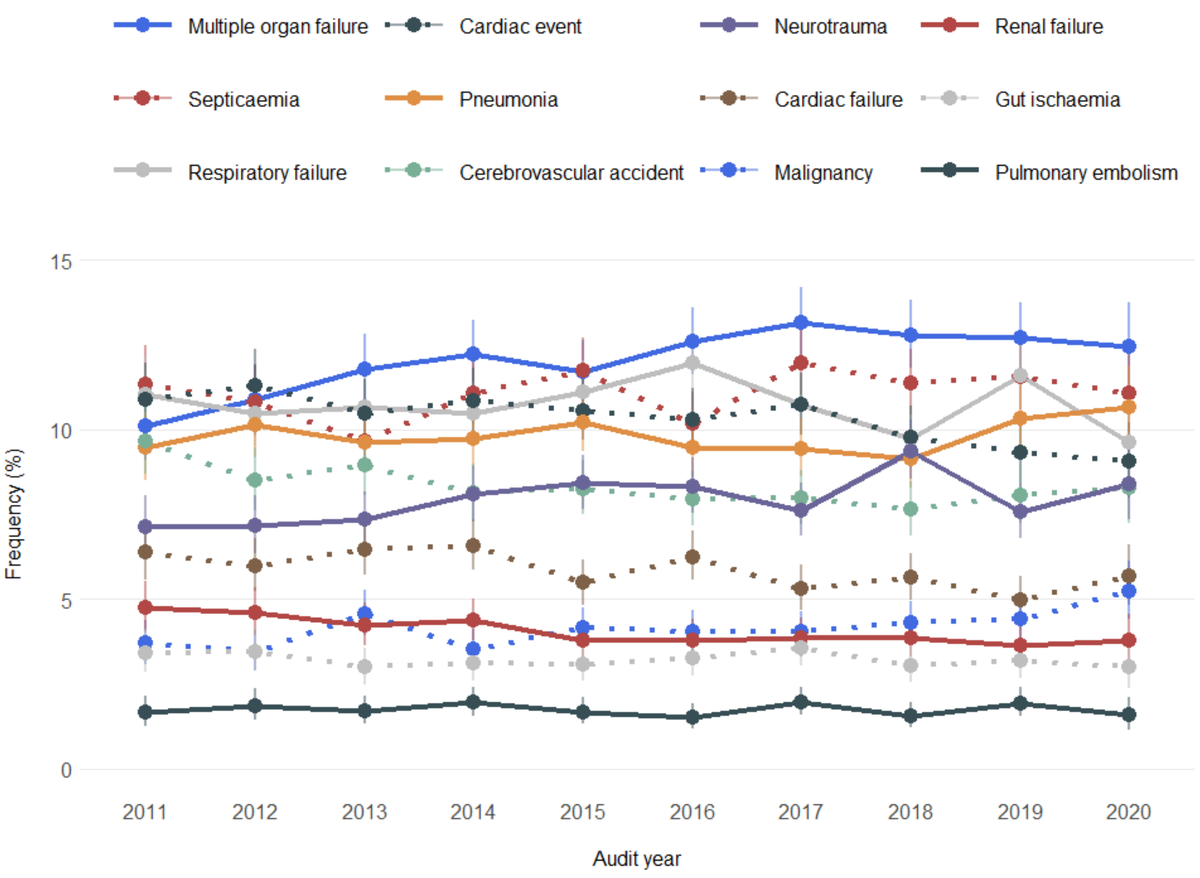
5 CAUSE OF DEATH

KEY POINTS
• The 4 most frequent causes of death were multiple organ failure, septicaemia, respiratory failure and cardiac events. • Causes of death were consistent over the 10-year audit period.

5.1 Frequency of causes of death reported in audited cases

The most frequent causes of deaths reported during the audit period 2011–2020 are shown in Figure 24. The distribution of the most common causes of deaths showed little or no change from that reported in 2017–2018.[1]

Figure 24: Twelve most frequent causes of death



Note: percentages show the proportions of each specific cause of death from the total number of deaths. Neurotrauma includes diffuse brain injury, head injury, intracerebral haemorrhage, subarachnoid haemorrhage and subdural haematoma.
Data not available: n = 40,221 causes of death recorded; (N = 33,351).

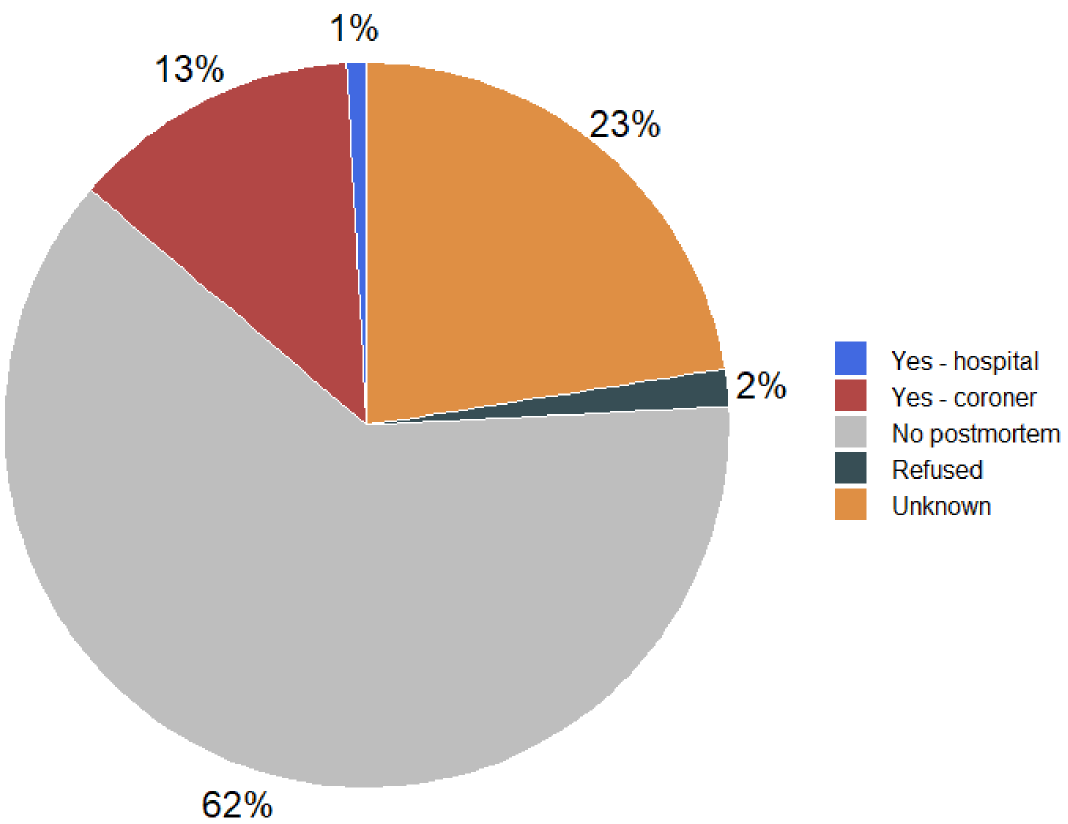
5.2 Establishing cause of death

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. If the cause of death is unclear, a postmortem examination may be requested, conducted either at the hospital or by the coroner. Where doubt exists around the circumstances leading to death, the case may be referred to the coroner. A coronial postmortem was performed in only 13.9% of audited cases between 2011 and 2020 (Figure 25). In 86.1% of cases a postmortem was not performed, or permission was refused, or it is unknown whether a postmortem was conducted.

The need for coronial input varied among audit regions, with the highest percentage of cases recorded in the Australian Capital Territory (Table 3). In some audit regions the numbers were low, which could impact interpretation of the data.

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

Figure 25: Overview of postmortems performed over the audit period



Data not available: n = 879 cases (3%); (N = 33,432); audit period 2011–2020.

Table 3: Overview of postmortems performed by audit region

Postmortem status	SA	QLD	WA	TAS	VIC	ACT	NT
Yes – hospital	<1%	1%	1%	1%	1%	1%	1%
Refused	1%	2%	2%	2%	2%	2%	2%
Yes – coroner	13%	7%	14%	12%	18%	22%	13%
Unknown	31%	16%	23%	23%	25%	24%	18%
No	56%	74%	61%	62%	55%	51%	66%

Note: each audit region has its own unique case mix and surgical population.
Data not available: n = 879 cases (3%); (N = 33,432); audit period 2011–2020.

6 PROFILE OF OPERATIVE INTERVENTION

KEY POINTS
• A surgical procedure was performed on 80.0% of patients. More than one visit to the operating theatre was required for a quarter (24.0%) of patients during their hospital stay. • A consultant surgeon made the decision to operate in 94.4% of instances and performed 70.4% of the operations. • The rate of subsequent (unplanned) returns to theatre was 15.8%, with some patients requiring multiple operations. • The most common postoperative complications were postoperative bleeding, procedure-related sepsis and tissue ischaemia.

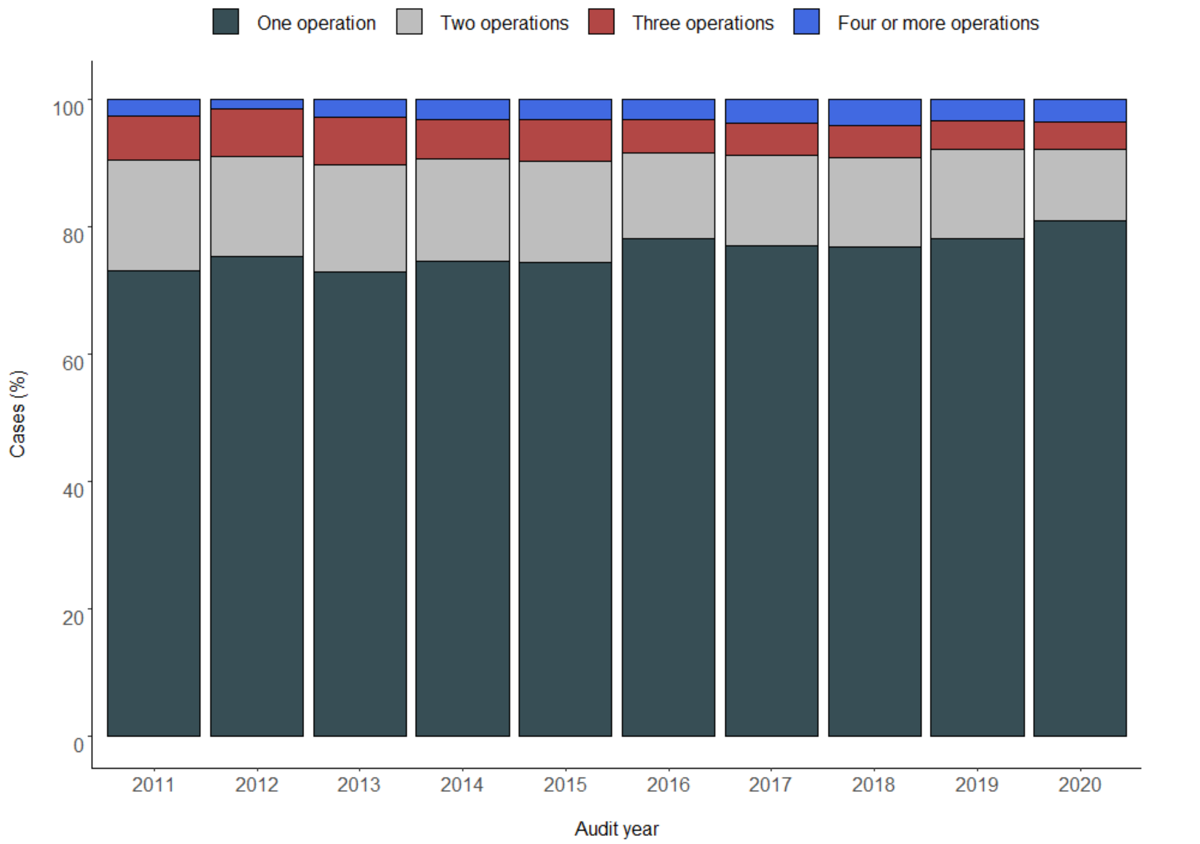
6.1 Operative rate

The frequency of patients undergoing operations and the total number of operations performed during the audit period are shown in Figure 26. There has been relatively little change in the frequency of multiple operations over the 10-year audit period.

Between 2011–2020:

- 80.0% of audit patients underwent an episode of surgery either during their last admission or within 30 days prior to death.
- 20.0% of patients had no surgery during their final admission.
- A total of 38,537 operative episodes were undertaken on the 27,422 patients who had surgery, indicating that an individual patient can have more than one episode of surgery during admission.
- of the patients who had an operation during their last admission or within 30 days prior to death, 76.0% had just one operation (Figure 26).
- of the patients who had an operation during their last admission or within 30 days prior to death, 24.0% had more than one operation (Figure 26).

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

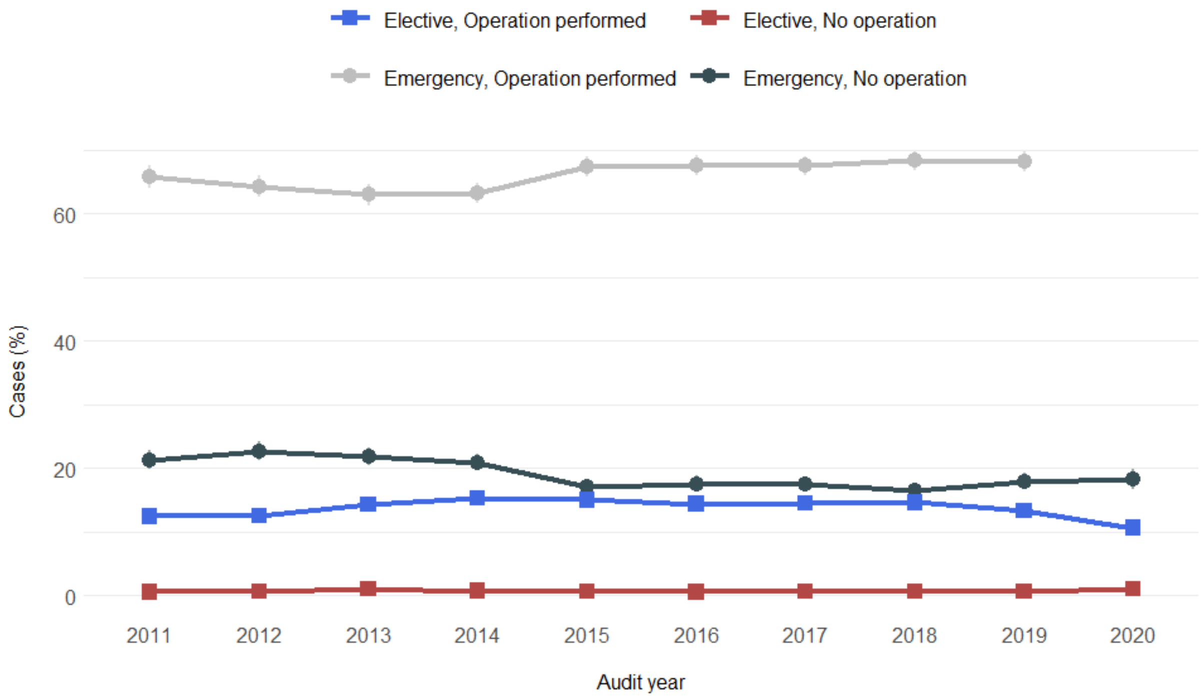


Data not available: n = 35 (<1%); (N = 27,422).

Operative and nonoperative cases by admission status and audit year are shown in Figure 27.

Between 2011 and 2020, 4.7% of elective admission patients and 22.6% 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.

Figure 27: Percentage of operative and nonoperative patients, by audit year



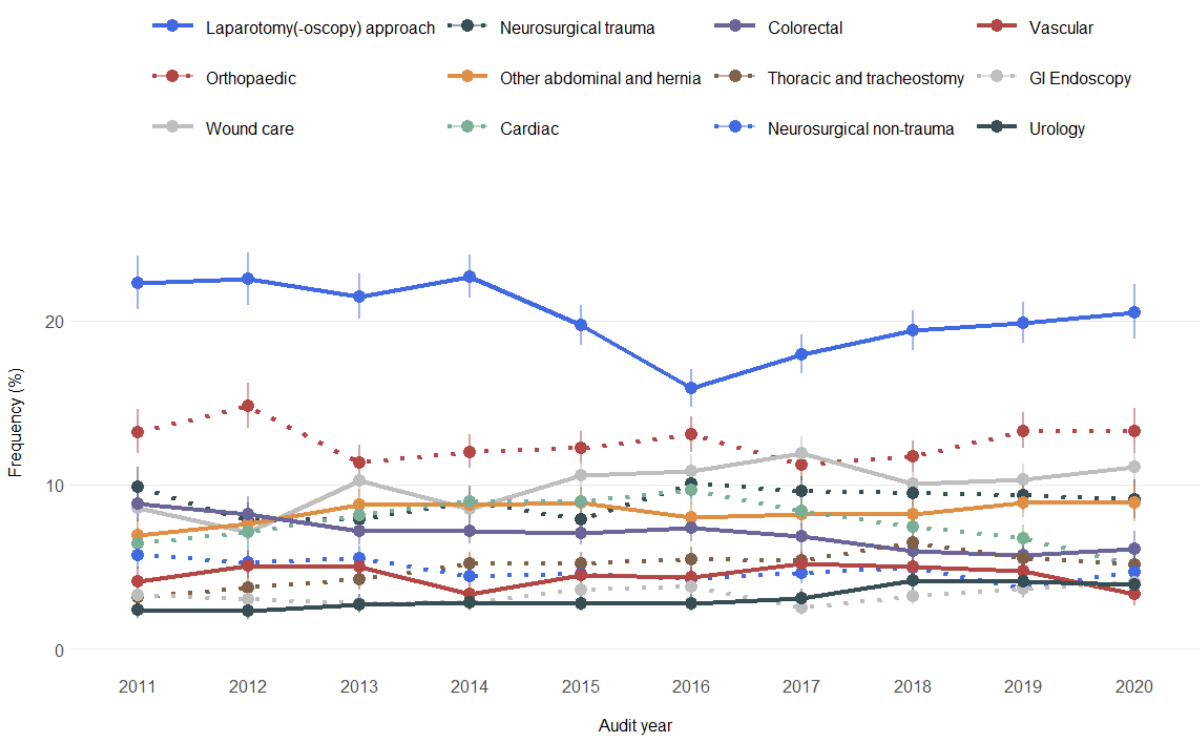
Note: Error bars show 95% confidence intervals.
Data not available: n = 247 (1%); (N = 34,031).

6.2 Frequency of operative procedures

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

The total number of procedures for each type of operation remained similar across the audit period and frequency remained below 10.0% for most of the procedure types. Laparotomy/laparoscopy and orthopaedic procedures comprise the most frequent operations (Figure 28). The distribution of types of procedures has remained consistent over the audit years.

Figure 28: Most frequent types of operative procedures



Note: 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).
n = 38,537 procedures; (N = 27,422).

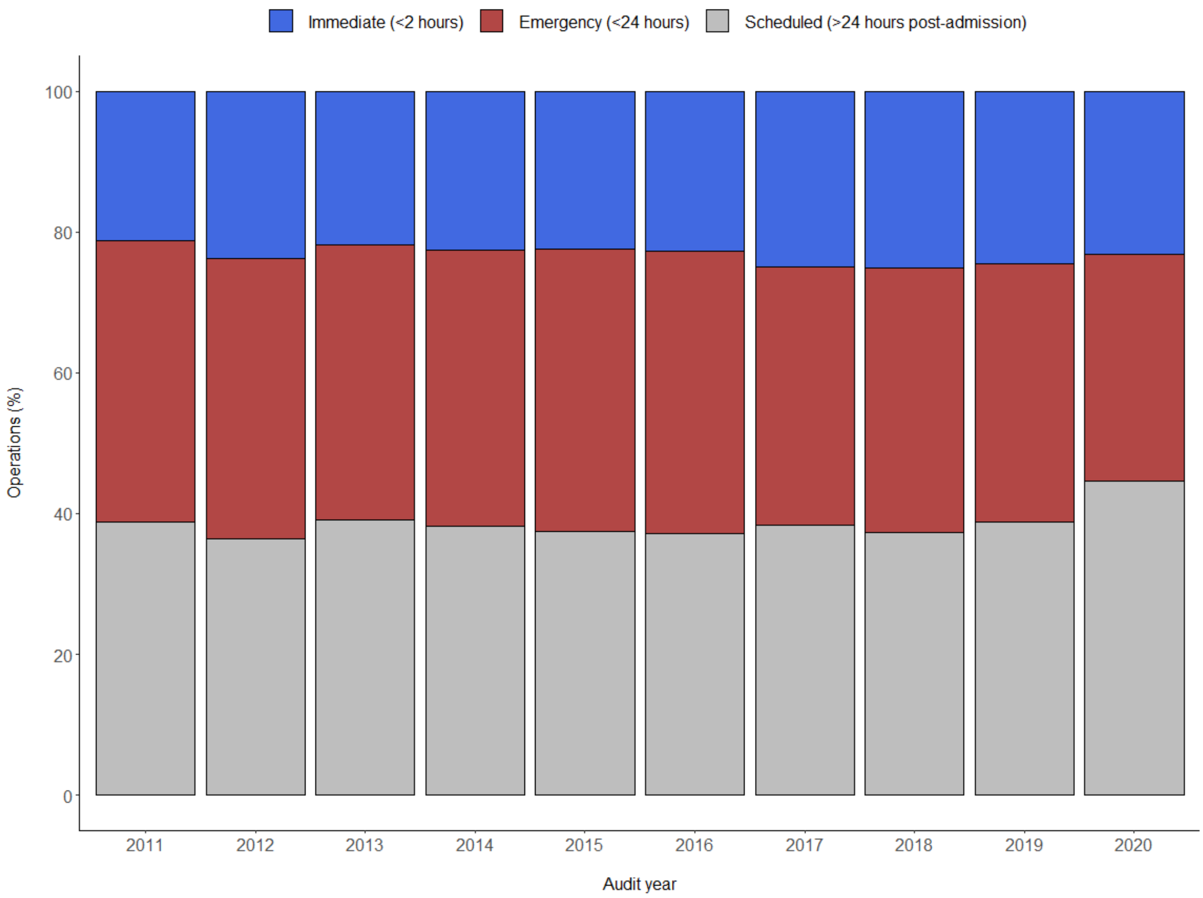
6.3 Timing of operations for emergency admissions

The urgency (time-critical nature) of a patient's condition predicts the timing of any surgery. The timing of operations performed for emergency admissions has remained relatively consistent across the audit period (Figure 29).

The data show that 23.8% of emergency admissions were scheduled for surgery as immediate (<2 hours) and 37.9% were scheduled as emergency (<24 hours). The remaining emergency admissions (38.3%) were not scheduled for surgery within 24 hours of admission (<24 hours) (Figure 29).

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

Figure 29: Timing of operations for emergency admissions



Data not available n = 247 cases (1%); n = 30,367 operations; (N = 34,031).

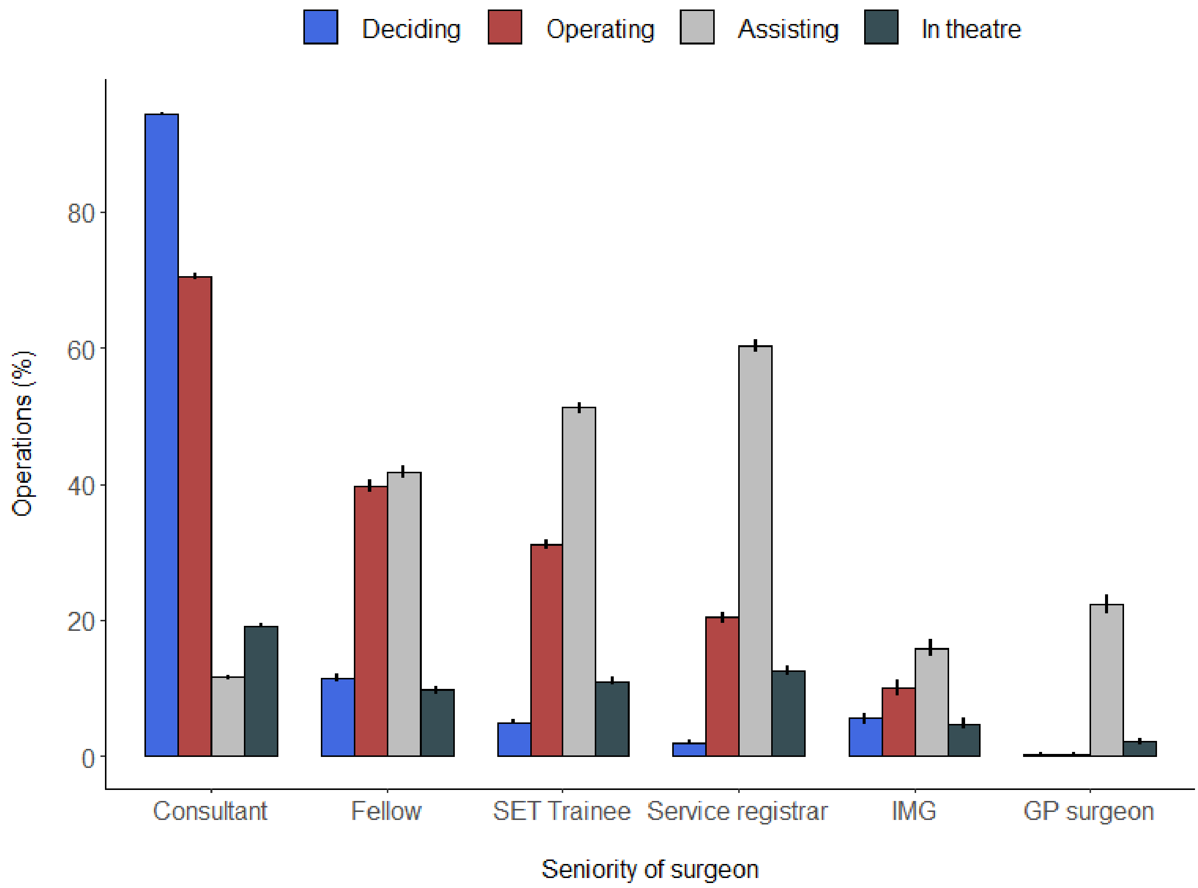
6.3.1 Seniority of surgeon performing surgery

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

Input from consultant surgeons was found to be high (Figure 30). In 94.4% of cases the consultant surgeon made the decision to operate and in 73.0% of cases the consultant surgeon performed the operation. The assisting surgeon was most likely to be the service registrar (60.2%).

The proportion of surgical episodes in which consultant surgeons made the decision to operate remained unchanged in the current audit period (2019–2020) compared to the 2017–2018 report.[1] There was a small increase in the proportion of surgical episodes where consultant surgeons performed the operation (from 71.0% in 2018 to 73.0% in 2020) (data not shown).

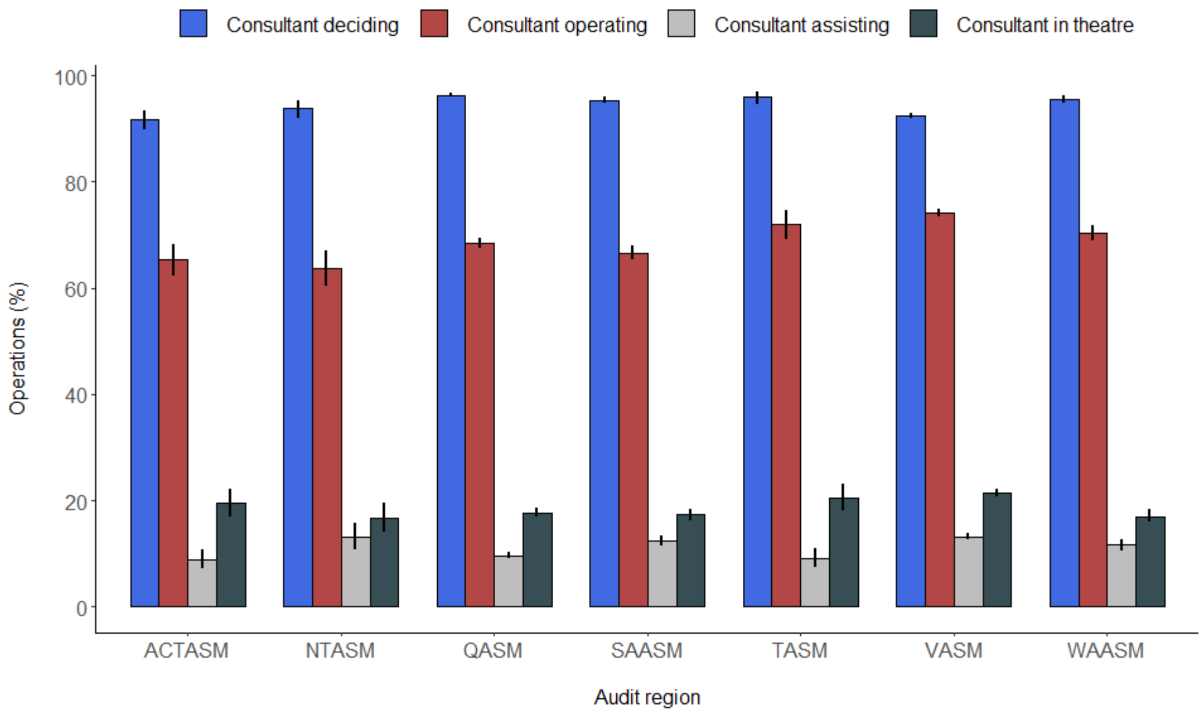
Figure 30: Seniority of surgeon making the decision to operate and performing the surgery



SET: surgical education and training; IMG: International Medical Graduate; GP: general practitioner.
Note: error bars show 95% confidence intervals.
Data not available: n = 35 cases (<1%); n = 38,537 operations; (N = 27,422); audit period 2011–2020.

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

Figure 31: Consultant involvement in surgery, by audit region



Note: Error bars show 95% confidence intervals.
Data not available: n = 35 (<1%); n = 38,537 operations; (N = 27,422); audit period 2011–2020.

6.4 Unplanned return to theatre

The treating surgeon was asked to indicate whether the patient had an unplanned return to the operating theatre following the initial operative procedure.

Between 2011 and 2020, 15.8% of patients who underwent a surgical procedure had an unplanned return to theatre (Table 4). The proportion of patients requiring a return to theatre changed little over the audit period.

Table 4: Percentage of patients with unplanned return to theatre

Return to theatre status	2011–2012	2013–2014	2015–2016	2017–2018	2019–2020
No return to theatre	84%	83%	84%	84%	85%
Return to theatre	16%	17%	16%	16%	14%
Unknown	<1%	<1%	<1%	<1%	<1%

Data not available: n = 331 (1%); N = 27,091.

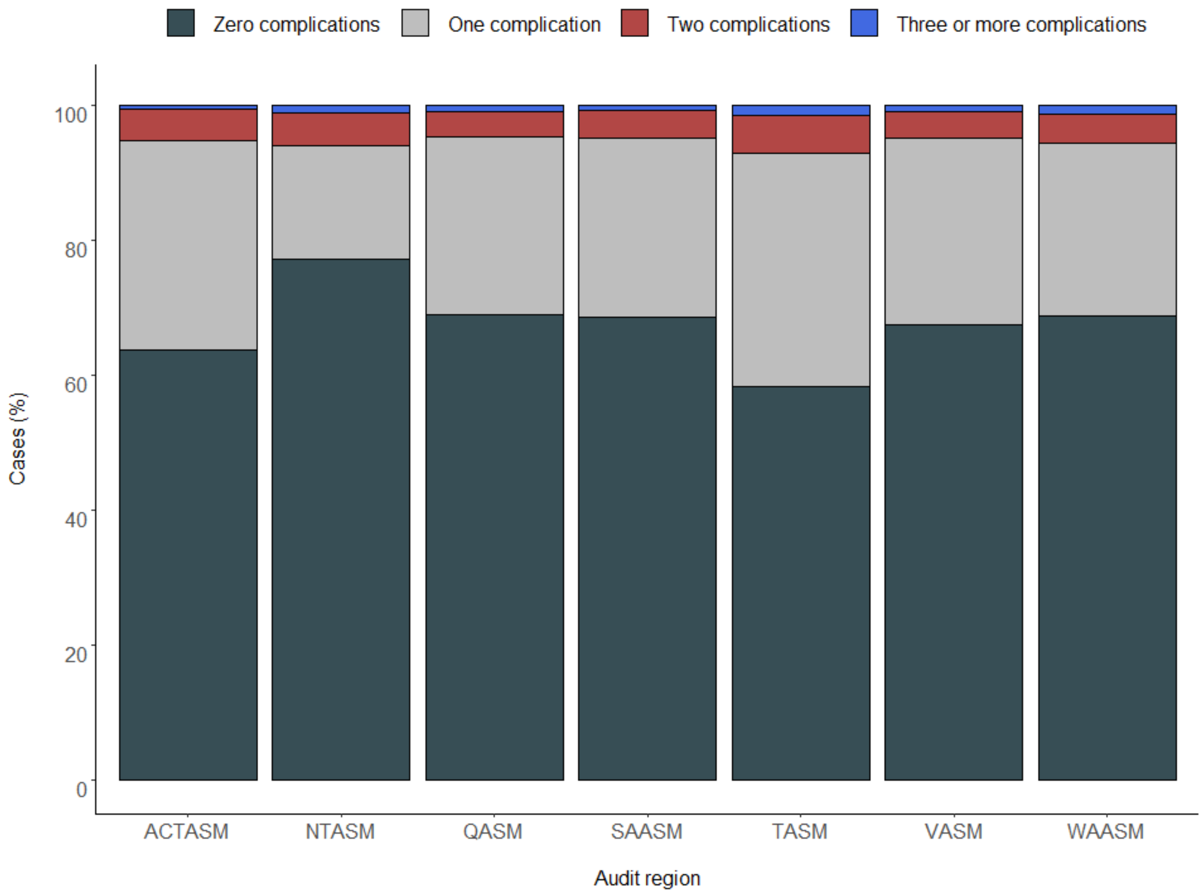
6.5 Postoperative complications

The treating surgeon was asked to record any complications that occurred following a surgical procedure. The significance of complications varies from minor (no effect on outcome) to major (led to death). The effect of complications on the eventual outcome is unknown.

Between 2011 and 2020, at least one postoperative complication was reported in 32.5% of audit patients who underwent a surgical procedure (Figure 32).

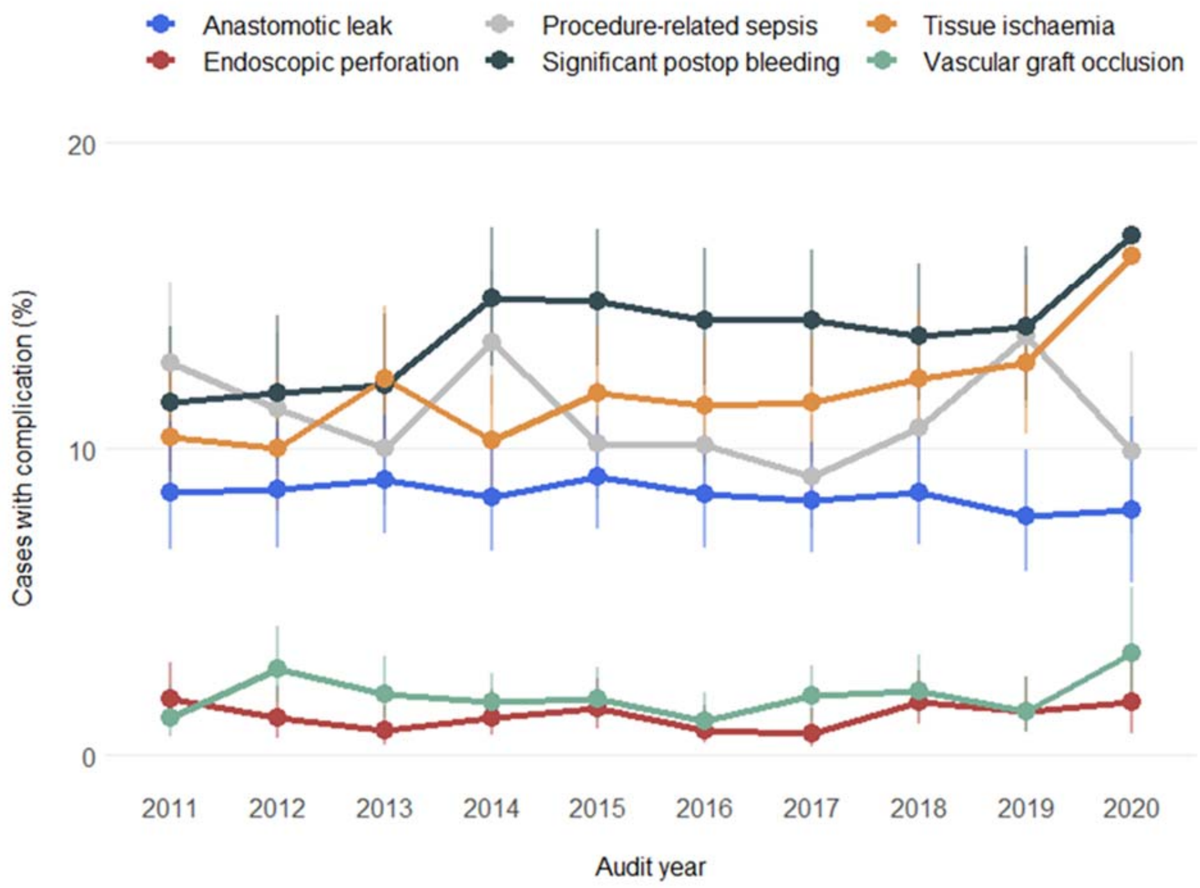
Some variation exists in the number of complications between audit regions, with more patients in Tasmania presenting with at least one complication. There was also a slightly larger proportion of patients presenting with 2 or more complications in Tasmania compared to other audit regions.

Figure 32: Patients developing one or more postoperative complications



Note: Each audit region has its own unique case mix and surgical population.
Data not available: n = 322 (1%); n = 10,363 complications; (N = 27,100); audit period 2011–2020.

Figure 33: Most common postoperative complications according to treating surgeon, by audit year



Note: error bars show 95% confidence intervals.
Other postoperative complications include 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.
Data not available: n = 322 (1%); n = 10,363 complications recorded; (N = 27,100).

6.6 Anaesthetic problems

General anaesthesia 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, and cardiac and respiratory complications may occur. According to the opinion of the treating surgeons, 92.3% of audit cases had no anaesthetic component to the death.

Anaesthesia was *probably* a significant factor in the death of 1.6% of patients who had a surgical procedure. Anaesthesia was *possibly* involved in the outcome in 6.1% of cases.

The proportion of deaths for which anaesthetic issues were raised was relatively unchanged between 2011 and 2020.

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 terminal condition. Such a decision was made in 5.3% of audited operations.

The proportion of abandoned operations was largely unchanged between 2011 and 2020.

7 PATIENT TRANSFER ISSUES

KEY POINTS
• Transfer between hospitals was required in 26.0% of audited cases. • Between 2011 and 2020, 10.6% of transfer issues related to delays, 4.8% to inappropriate transfer, 4.8% to insufficient clinical documentation and 2.8% to inappropriate level of care.

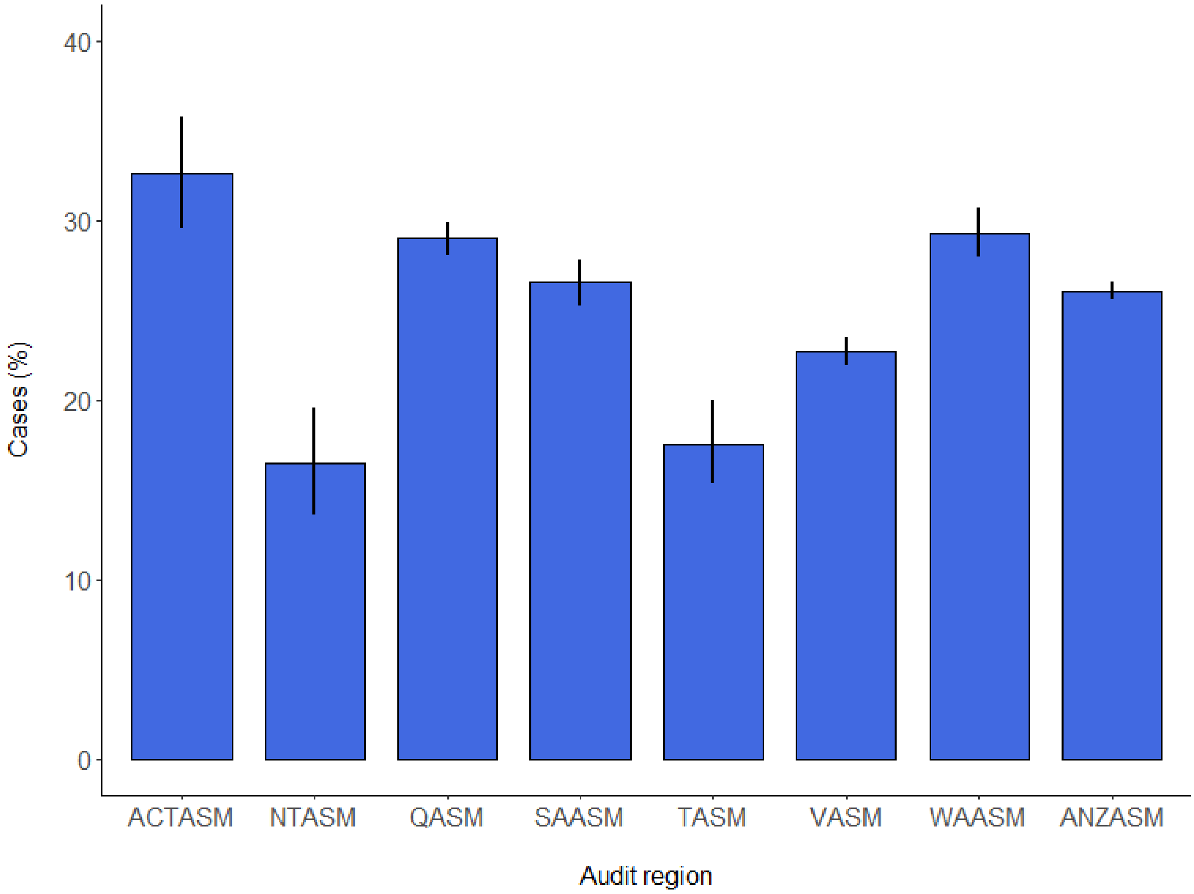
7.1 Frequency of need for transfer

The audit process examines transfers between hospitals. A transfer typically occurs because of the need for a higher level of care or specific expertise.

Between 2011 and 2020, 26.0% of audited cases involved a transfer between hospitals (Figure 34).

The need for transfer varied among audit regions, probably reflecting the geographical distribution of available healthcare facilities (Figure 34). More of the patients who required transfer were initially admitted to hospitals in the Australian Capital Territory, Western Australia and Queensland.

Figure 34: Patients needing transfer to another hospital, by audit region



Note: Each audit region has its own unique case mix and surgical population.
Error bars show 95% confidence intervals.
Data not available: n = 946 (3%); (N = 8,662); audit period 2011–2020.

7.2 Issues associated with patient transfer

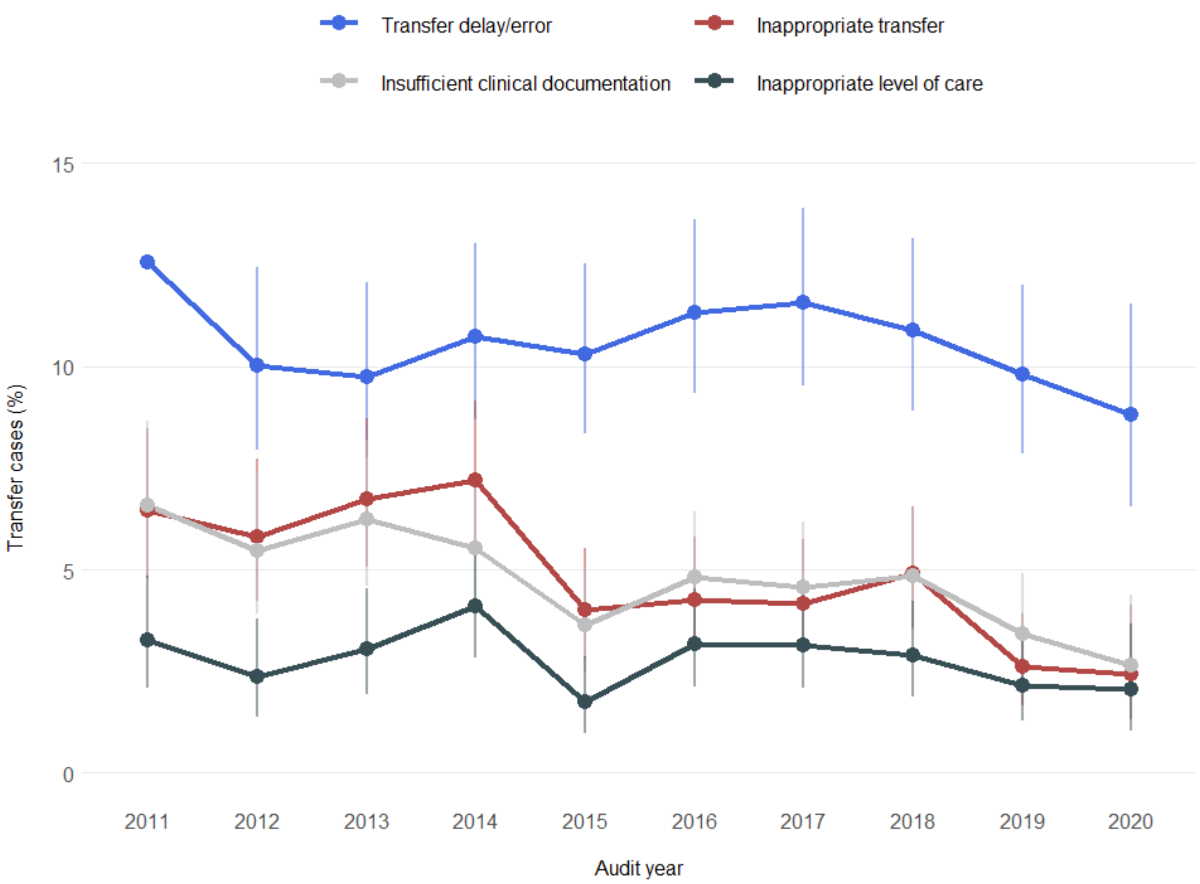
The treating surgeon was asked to record any issues associated with the transfer of a patient between hospitals.

Transfer issues were raised by the treating surgeon in almost a quarter of cases involving patient transfer (data not shown). Under the audit's current legal framework, specific case information cannot be provided to the ambulance service or referring hospital.

Between 2011 and 2020, 10.6% of audit issues related to transfer delay, 4.8% to appropriateness of transfer, 4.8% to insufficient clinical documentation and 2.8% to inappropriate level of care (Figure 35).

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.

Figure 35: Issues associated with patient transfer



Note: Issues are not mutually exclusive; multiple issues can occur for a single transferred patient.
Error bars show 95% confidence intervals.
Data not available: n = 946 cases (3%); n = 1,858 issues; (N = 8,662).

8 INFECTION AND TRAUMA

KEY POINTS

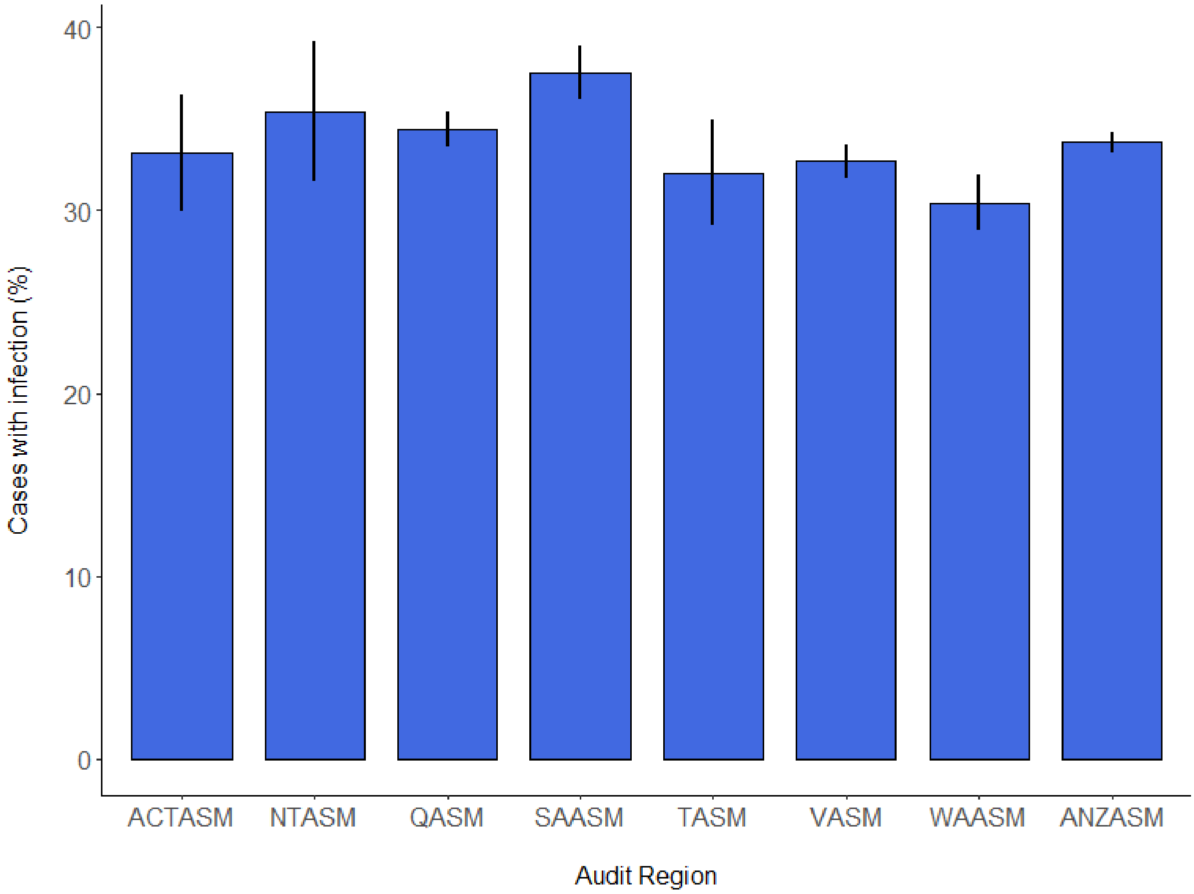
- ANZASM began collecting data on infection and trauma cases in 2012.
- Between 2012 and 2018, 33.6% of audited patients died with a clinically significant infection.
- Of the 6,777 documented trauma events, 79.5% were caused by falls, 13.1% were caused by accidents and 4.5% were associated with domestic, public or self-inflicted violence.

8.1 Infections

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). In 2012, ANZASM started collecting data on infection in patients undergoing surgery. These data were being collected in all states and territories by the end of 2018.

Between 2012 and 2020, 33.6% of patients died with a clinically significant infection (data not shown). Figure 36 shows the distribution across audit regions of patients who died with a clinically significant infection.

Figure 36: Patients who died with a clinically significant infection present, by audit region

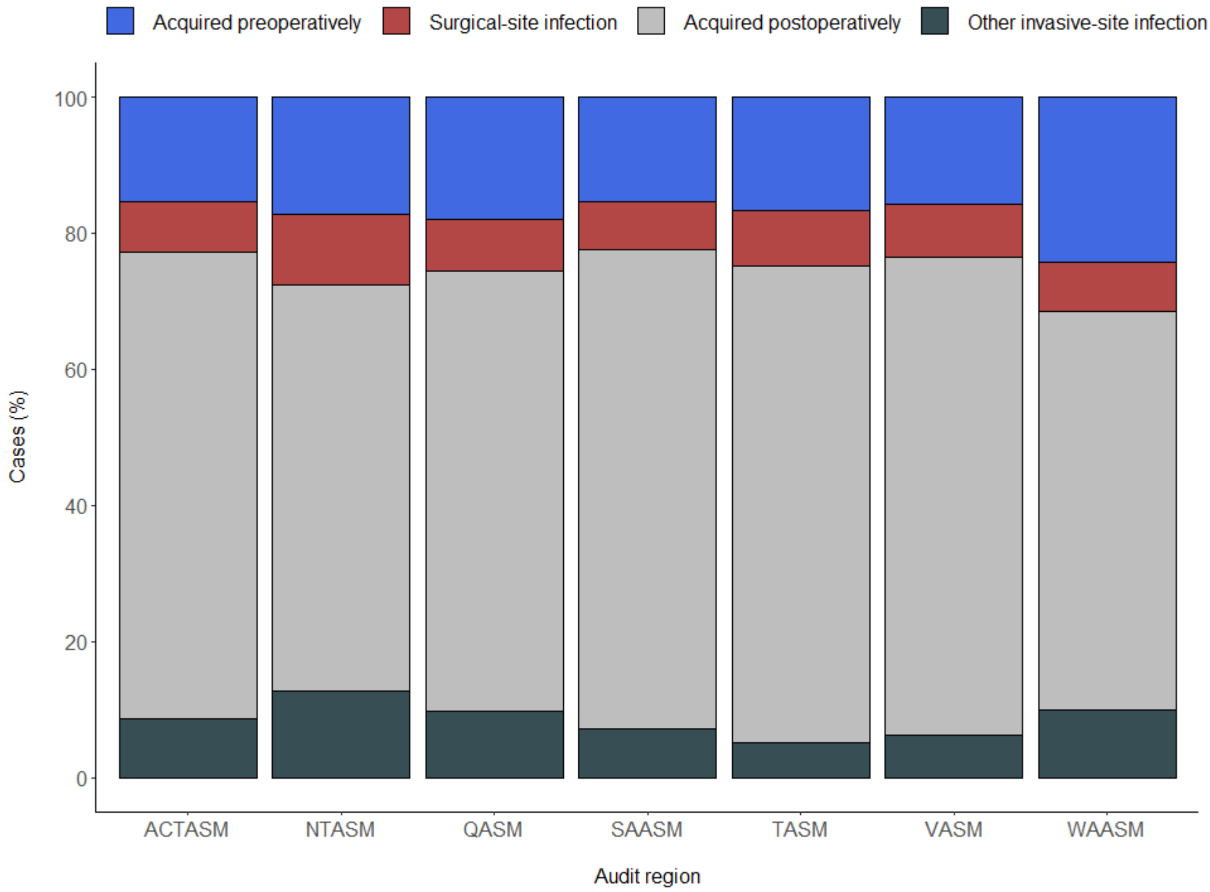


Note: Each audit region has its own unique case mix and surgical population.
Error bars show 95% confidence intervals.
n = 10,428 infections; (N = 31,020); audit period 2012–202.

Among the patients who died with a clinically significant infection, 57.3% of the infections occurred during admission.

Among the patients who acquired an infection during admission, 67.2% of the infections were acquired postoperatively, 17.2% were acquired preoperatively, 7.6% were surgical-site infections and 8.0% were an invasive infection at a different site (Figure 37).

Figure 37: Timing of infections acquired during admission, by audit region



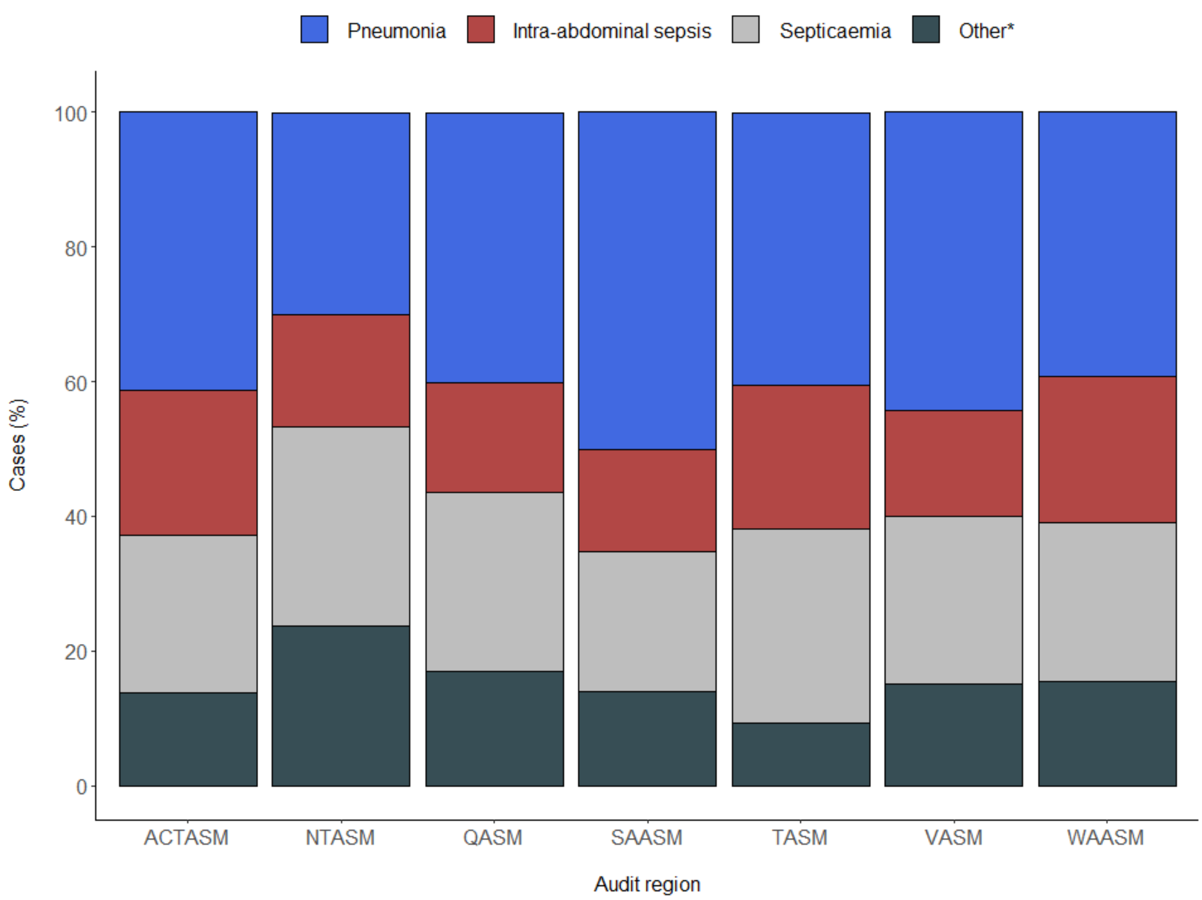
Note: each audit region has its own unique case mix and surgical population.
Data not available: n = 237 cases (4%); (N = 5,589); audit period 2012–2020.

Of the infections acquired before or during admission over the 9-year period 2012–2020, 42.8% were cases of pneumonia, 24.9% were cases of septicaemia, 16.8% were cases of intra-abdominal sepsis and 15.5% were other infections (Figure 38). The infective agent was positively identified in 40.4% of the cases.

Escherichia coli was the most frequently identified species, accounting for 10.9% of recorded infective organisms (Figure 39); however, *Staphylococcus aureus*, when combined with methicillin-resistant (MRSA) and methicillin-susceptible (MSSA) strains, represented the most frequently reported bacterial pathogen, at 16.4% of total instances (Figure 39).

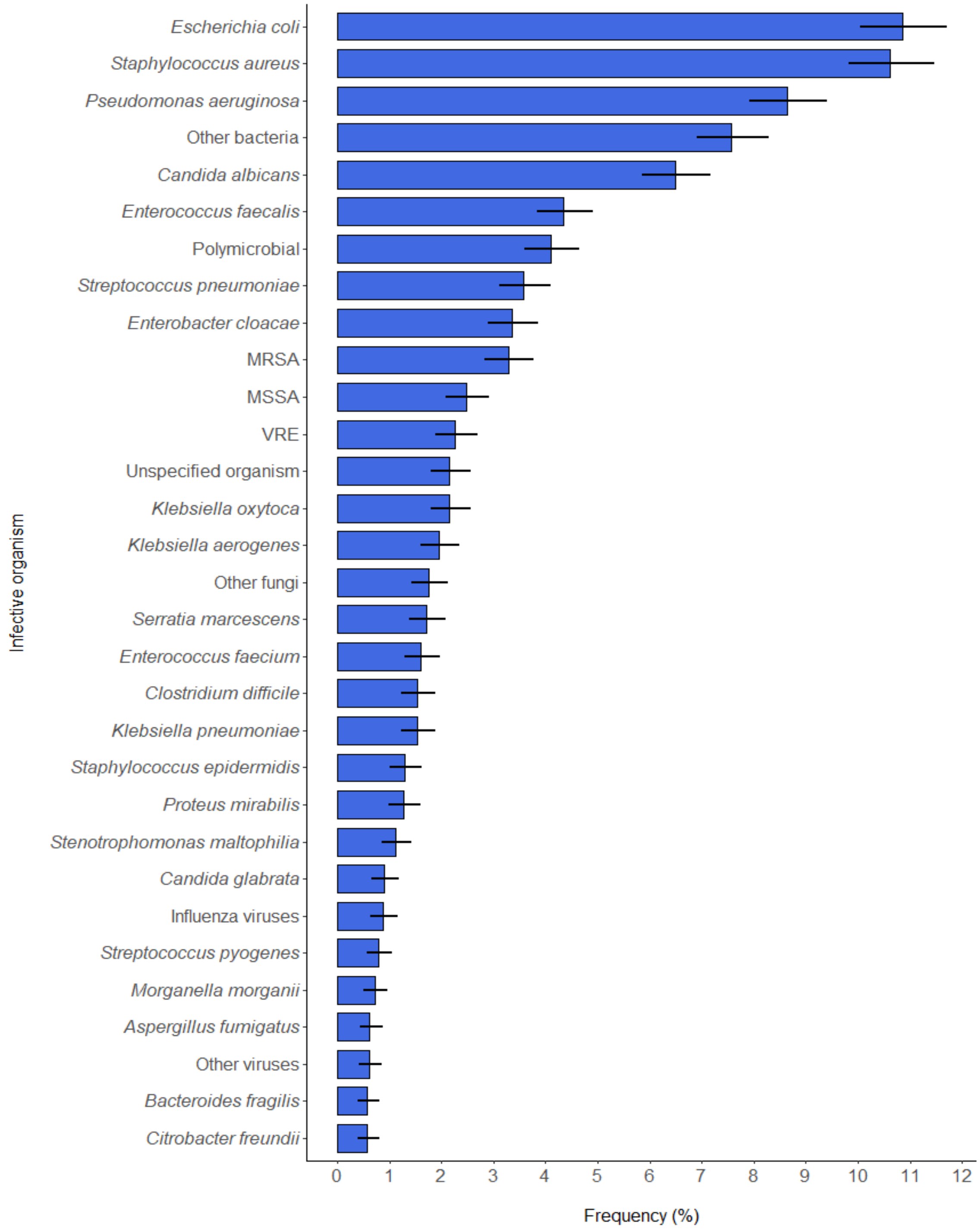
The most frequently reported fungal species was *Candida albicans* 6.5% followed by *Candida glabrata* 0.9% (Figure 39).

Figure 38: Type of infection acquired before or during admission, by audit region



Note: *other category includes *Klebsiella*, *Clostridium difficile*, *Escherichia coli* and methicillin-resistant *Staphylococcus aureus*. Each audit region has its own unique case mix and surgical population.
Data not available n = 86 cases (1%); (N = 10,342); audit period 2012–2020.

Figure 39: Most commonly reported infective organisms according to treating surgeon



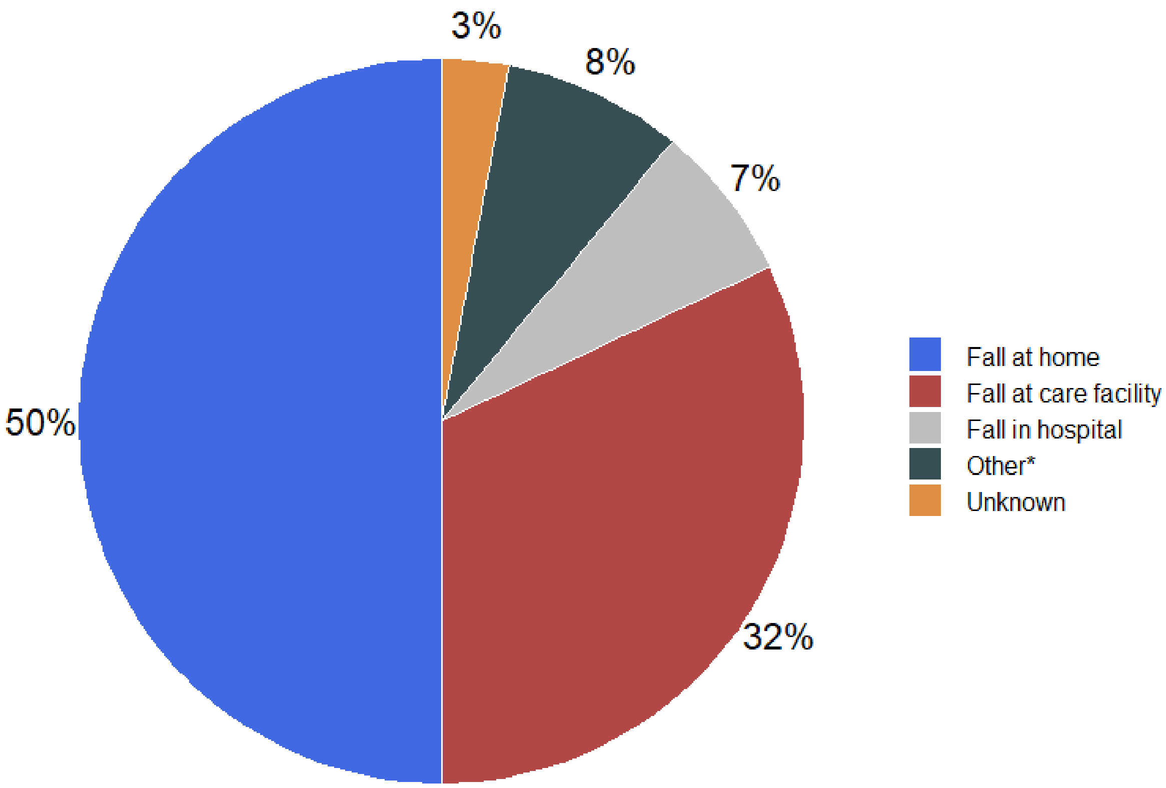
MRSA: methicillin-resistant *Staphylococcus aureus*; MSSA: methicillin-susceptible *Staphylococcus aureus*; VRE: vancomycin-resistant *Enterococcus*.
Note: only organisms reported with a frequency ≥0.5% are displayed. Categories are not mutually exclusive, meaning multiple organisms were often identified 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.
Error bars show 95% confidence intervals.
Data not available n = 115 cases (3.0%); n = 5,610 total recorded organisms; (N = 4,180); audit period 2012–2020.

8.2 Trauma

In 2012, ANZASM began 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 2020, 26.9% of cases were attributed to a traumatic event (data not shown).

Of the 6,777 traumatic events, 79.5% were caused by falls occurring at various locations. Between 2012 and 2020, 49.8% of falls occurred at home, 39.0% occurred in a hospital or care facility and 11.2% were unknown or occurred elsewhere (Figure 40).

Figure 40: Locations associated with falls

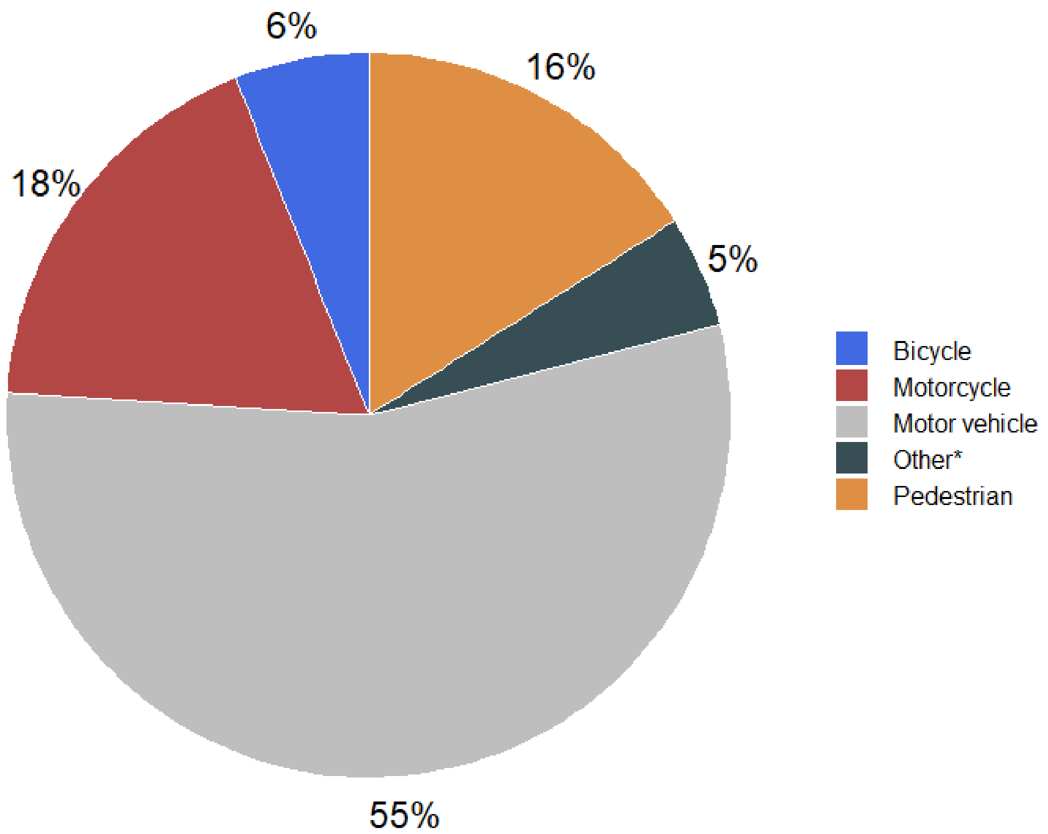


Note: *other includes falls associated with sport/recreation, roads, workplace, farms and public venues.
Data not available: n = 46 (1%); (N = 5,385); audit period 2012–2020.

Traffic accidents were associated with 13.1% of trauma cases, and domestic, public or self-inflicted violence was associated with 4.5% of trauma cases.

An overview of the types of traffic accidents causing trauma is provided in Figure 41. Due to the small amount of data currently, this should be interpreted with caution. Motor vehicle accidents were associated with 7.2% of cases where trauma occurred (Figure 41).

Figure 41: Type of traffic accidents associated with trauma



Note: *other includes accidents associated with quad bikes or ultralight aircraft or at the workplace.
Data not available: n = 1 (<1%); (N = 887); audit period 2012–2020.

9 PEER-REVIEW OUTCOMES

KEY POINTS
• Between 2011 and 2020, an SLA was requested in 14.5% of audited cases. • The 2 most common criticisms by both first- and second-line assessors were operative management issues and delays in implementing definitive treatment. • No CMIs were reported for 76.1% of patients; 23.9% of patients had at least one CMI. • Of the CMIs reported, 13.4% were classified as adverse events in patient care. • In 10.5% of audited cases, 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 patient management may have contributed to the outcome.

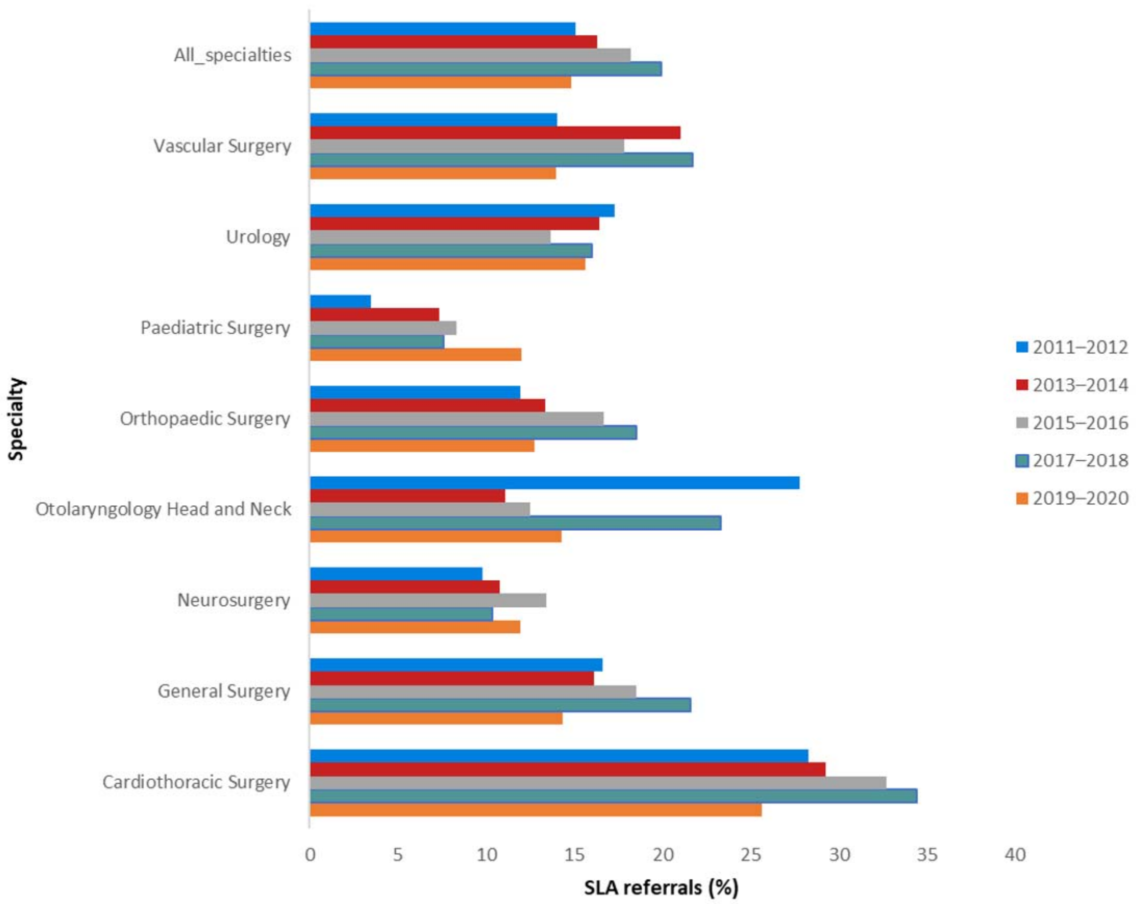
A total of 34,311 cases underwent an FLA. The first-line assessor decides whether the treating surgeon has provided enough information to allow an informed decision to be reached on the appropriateness of the case management. If inadequate information was provided, the first-line assessor requests an SLA. Other triggers for requesting an SLA are:

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

Between January 2011 and December 2020, an SLA was requested for 14.5% of audited cases. Of all cases referred for an SLA, lack of adequate information in the SCF was the trigger in 21.3% 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.

Figure 42 shows the frequency with which cases were referred for SLA, according to surgical specialty. 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 while Cardiothoracic Surgery consistently had the highest rate of SLAs (Figure 42).

Figure 42: Percentage of SLA referrals, by specialty and audit period



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

9.2 Clinical management issues

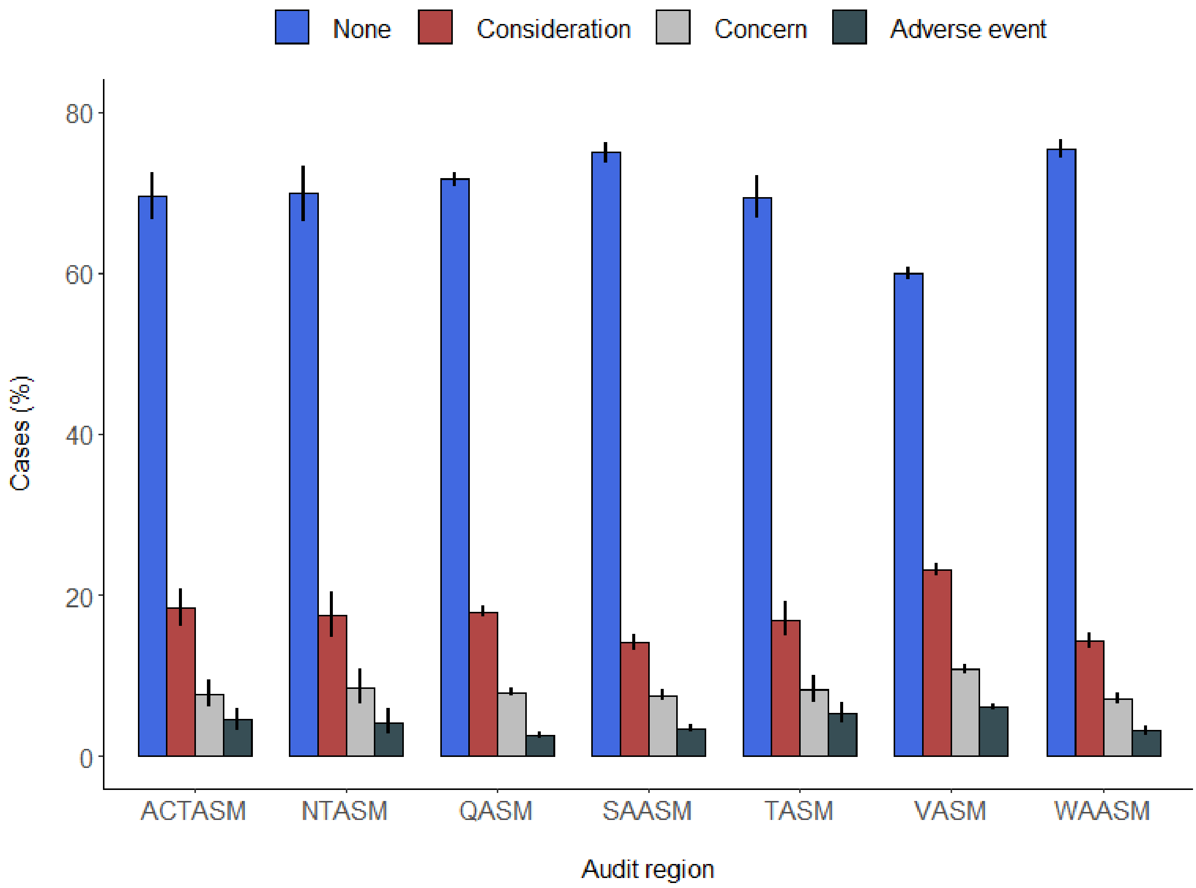
A primary objective of the peer-review process is to determine whether death was a direct result of the disease process alone, or if aspects of patient management might have contributed to that outcome.

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

In making an assessment of any contributing factors, the assessor can identify if CMIs were areas of consideration, areas of concern or an adverse event (Section 1.6.2). ANZASM primarily focuses on CMIs that are areas of concern and adverse events, although data are collected on areas of consideration. CMIs recorded by the highest-level assessor have been tabulated.

Figure 43 demonstrates CMIs recorded per patient. In 76.1% of audited cases, the assessors felt that there were no CMIs.

Figure 43: CMIs identified by assessors, by audit region



CMI: clinical management issue
Note: frequencies of different clinical management issues (consideration, concern, adverse event) are not mutually exclusive; multiple overlapping issues may be recorded for a single case.
Error bars show 95% confidence intervals.
Data not available: n = 1 case (<0.1%); n = 38,219 possible instances recorded; (N = 34,311), audit period 2011–2020.

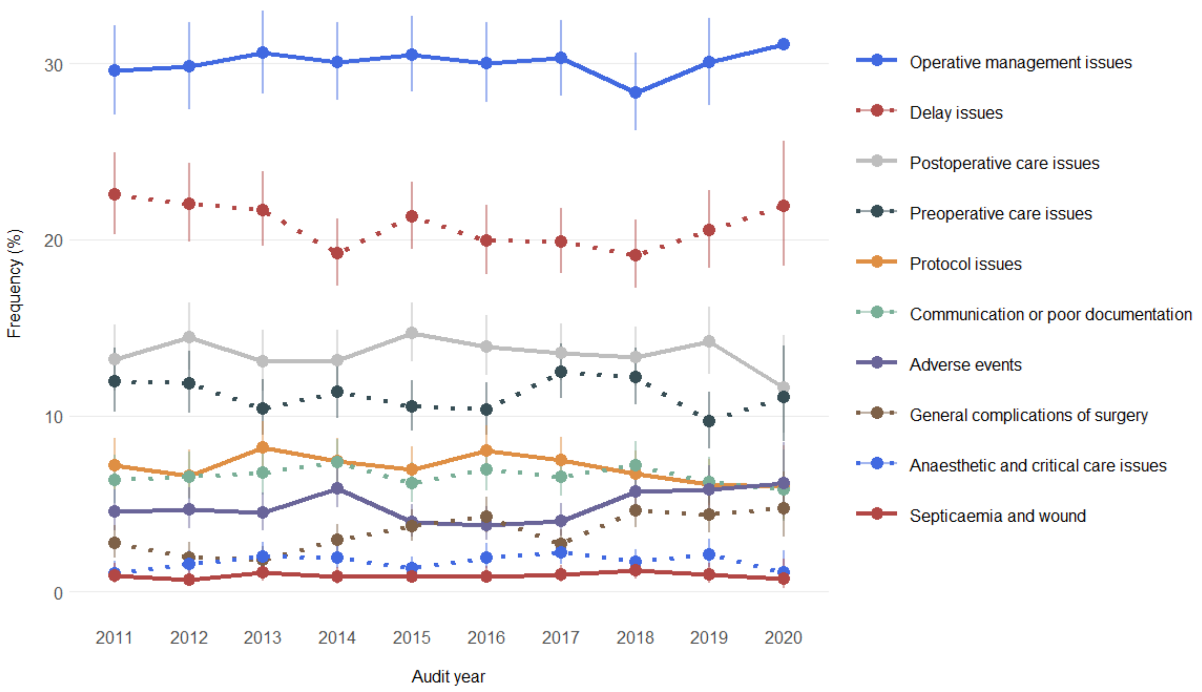
A total of 12,287 CMIs were recorded in 8,137 patients, indicating that a patient can have more than one CMI.

Of the total CMIs recorded, 13.4% were classified as adverse events, 58.7% were classified as areas of consideration and 27.9% as areas of concern. The identification of an area of concern or an adverse event by an assessor denotes a greater degree of criticism of clinical management. Cases in which a patient experiences an adverse event are a key focus of the audit, where there is a perception by assessors that the treatment provided may have led to the patient's death.

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

Operative management issues and delays in implementing definitive treatment remain the most frequent CMIs (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, disagreement on the need for transfer, availability of theatre and communication issues.

Figure 44: Most common CMIs according to assessor



CMI: clinical management issue
Note: CMIs include adverse events related to treatment guidelines or protocols, unsatisfactory medical management and treatment not conforming to guidelines.
CMIs that could not be categorised = 2,329; n = 12,287 instances; (N = 34,311) first- and second-line assessments; audit period 2011–2020.

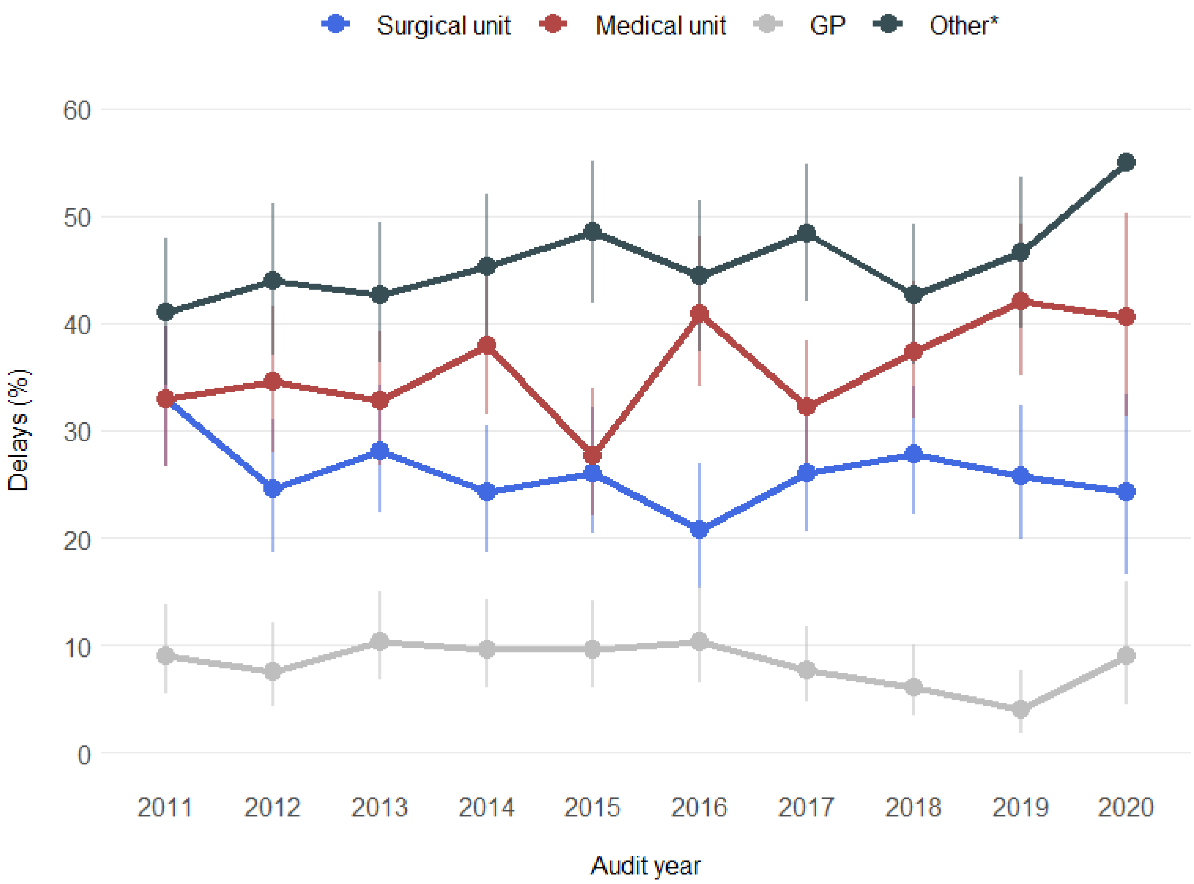
Postoperative and preoperative care issues are also high on the list of CMIs.

Good communication among those involved in patient care is essential to ensure the treatment plan is properly understood and coordinated. Poor communication accounted for 6.6% of the specific issues identified in the audit period.

Between 2011 and 2020, a delay in the implementation of definitive treatment was perceived in 20.7% of CMIs. The attribution of responsibility for treatment delays is shown in Figure 45. These data are derived from the SCF and reflect the view of the treating surgeon.

The surgical unit was deemed responsible for 32.9% of treatment delays in 2011 and 24.3% in 2020, showing an overall decrease in the proportion of CMIs attributable to the surgical unit compared to other units or areas (Figure 45). Other clinical areas (e.g. emergency departments, radiology departments, other hospitals or patient-related factors), medical units or general practitioners were deemed responsible for 89.2% of delays over the entire audit period. More than one team may be responsible for any perceived delays in treatment.

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



GP: general practitioner
Note: 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.
Error bars show 95% confidence intervals. Data not available: n = 816 (27.9%); N = 2,084 episodes of delay.

9.2.2 Perceived impact of CMIs

Using a 3- or 4-part Likert scale, 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 issue?

More than one CMI may be identified for each patient under review. (Tables 5–9 present data that are incident-focused rather than patient-focused.)

Table 5 shows that the frequency of adverse events differs between specialties. 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.[6]

Table 5: CMIs by specialty and severity, according to assessor				
Specialty	**Adverse event**	**Concern**	**Consideration**	**No issues**
Cardiothoracic Surgery	7.7%	14.8%	28.5%	49.0%
General Surgery	4.7%	10.4%	19.7%	65.2%
Neurosurgery	2.6%	5.6%	11.1%	80.6%
Obstetrics & Gynaecology	8.2%	14.6%	35.4%	41.8%
Ophthalmology	2.9%	11.8%	44.1%	41.2%
Oral/Maxillofacial	22.2%	5.6%	38.9%	33.3%
Orthopaedic Surgery	2.4%	5.7%	15.3%	76.6%
Other*	0.0%	4.3%	8.7%	87.0%
Otolaryngology Head and Neck Surgery	5.0%	7.0%	18.8%	69.2%
Paediatric Surgery	3.8%	2.3%	13.3%	80.7%
Plastic and Reconstructive Surgery	3.7%	5.6%	20.9%	65.5%
Urology	4.3%	7.3%	22.8%	63.5%
Vascular Surgery	4.7%	10.3%	19.5%	65.4%
All cases	4.3%	8.9%	18.8%	68.1%

CMI: clinical management issue
Note: *other includes anaesthesia, intensive care unit, oncology, thoracic medicine, trauma and transplant. Results for Oral/Maxillofacial group should be interpreted with caution due to low case numbers (n = 16).
Data not available: n = 114 case (<1%); n = 38,105 events; (N = 34,311); audit period 2011–2020.

Tables 6 and 7 show the impact of CMIs on clinical outcome and their preventability, according to assessors, based on the total number of cases with CMIs.

Of the total 11,835 CMIs identified, assessors concluded that 61.1% of these may have contributed to the death of a patient, 28.4% made no difference to the outcome and 10.5% were felt to have probably caused the death of the patient (Table 6). For 25,932 cases no CMIs were identified by assessors.

Table 6: Impact of CMI on clinical outcome, according to assessor		
Impact of CMI on clinical outcome	**Number of clinical issues**	**% of clinical issues**
Made no difference	3,366	28.4
May have contributed to death	7,232	61.1
Caused the death of a patient otherwise expected to survive	1,237	10.5
Total	11,835	100

CMI: clinical management issue
Data not available: n = 452 (1%) in 12,287 CMIs; (N = 34,311); audit period 2011–2020.

In patients where CMIs were identified, assessors felt that 20.1% of these clinical incidents were definitely preventable and 4.7% were definitely not preventable (Table 7).

Table 7: Perceived preventability of CMI, according to assessor

Perceived preventability of CMI	Number of clinical issues	% of clinical issues
Definitely preventable	2,318	20.1
Probably preventable	4,798	41.5
Probably not preventable	3,890	33.7
Definitely not preventable	542	4.7
Total	11,548	100

CMI: clinical management issue
Data not available: n = 452 (1%) in 12,287 CMIs; (N = 34,311); audit period 2011–2020.

Assessors indicated that the surgical team was responsible for more than half of CMIs identified (57.4%; 7,286/12,693) (Table 8).

Table 8: Assessor perception of clinical team responsible for CMI

Clinical team deemed responsible	Number of clinical issues	% of clinical issues
Surgical team	7,286	57.4
Other clinical team	3,614	28.5
Hospital issue	902	7.1
Other*	891	7.0
Total	12,693	100

CMI: clinical management issue
Note: *other includes transferring hospital, blood bank or transfusion service, emergency department, general practitioner or referring doctor, ambulance service, remote geographic area or insufficient staff.
N = 12,424; audit period 2011–2020.

10 ABORIGINAL AND TORRES STRAIT ISLANDER PATIENTS

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

In the 2021 Australian census it was estimated that there were 983,762 Aboriginal or Torres Strait Islander people living in Australia,[7] distributed as follows:

- 34.5% (339,546) New South Wales
- 27.8% (273,224) Queensland
- 12.2% (120,037) Western Australia
- 7.8% (76,736) Northern Territory
- 8.0% (78,698) Victoria
- 5.3% (52,083) South Australia
- 3.4% (33,894) Tasmania
- 1.0% (9,544) Australian Capital Territory

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

Between 2011 and 2020, at least 2.8% of the audited deaths were patients of Aboriginal or Torres Strait Islander descent.

Surgical deaths of Aboriginal and Torres Strait Islander patients occurred in all states and territories; however, reporting was inconsistent, explaining the large proportion of missing data for this variable. Of those who identified as Aboriginal and/or Torres Strait Islander, most deaths occurred in Queensland (36.5%), the Northern Territory (29.4%) or Western Australia (13.2%). This could be due to differences in reporting and data collection between audit regions. The remainder (173 deaths) related to cases in other audit regions.

10.2 Aboriginal and Torres Strait Islander patients and age

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

There was a 21-year difference in median age of death for Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients (Table 9). This median age gap has decreased over the audit years from 25 years at the end of 2015, to 23 years at the end of 2016, 22 years at the end of 2017–2018 and 21 years at the end of the 2019–2020 audit period.

Table 9: Age at death for Aboriginal or Torres Strait Islander patients and non-Indigenous patients		
	Age at death, Aboriginal and Torres Strait Islander patients (n = 830)	**Age at death, non-Indigenous patients (n = 28,884)**
Median (IQR)	56 years (44–66)	77 years (66–86)
Minimum Maximum	0 100	0 106

IQR: interquartile range.
Data not available: n = 4,597 cases (13%); (N = 29,714).

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 comorbidities emerged between Aboriginal or Torres Strait Islander patients and non-Indigenous patients (Table 10). In this age group, Aboriginal and Torres Strait Islander patients were at higher risk of comorbidities than non-Indigenous patients, corresponding to a statistically significant risk ratio of 1.22 (95% confidence interval 1.12 to 1.33). 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.[8]

Table 10: Prevalence of comorbidities in Aboriginal or Torres Strait Islander patients and non-Indigenous patients age 50 years or younger		
	Cases (n)	**Comorbidities present (%)**
Aboriginal and Torres Strait Islander patients	219	72.3
non-Indigenous patients	1,523	56.7

N = 303 Aboriginal and Torres Strait Islander patients, N = 2,685 non-Indigenous patients.

When the overall population was examined (i.e. not just those age 50 or younger), the audit data showed that serious comorbidities were present at similar rates between Aboriginal or Torres Strait Islander patients (86.7%) and non-Indigenous patients (89.1%) (Table 11).

Table 11: Prevalence of comorbidities in Aboriginal or Torres Strait Islander patients and non-Indigenous patients		
	Cases (n)	**Comorbidities present (%)**
Aboriginal and Torres Strait Islander patients	718	86.7
non-Indigenous patients	25,689	89.1

N = 828 Aboriginal and Torres Strait Islander patients, N = 28,825 non-Indigenous patients.

10.4 Aboriginal and Torres Strait Islander patients and operations

The rate of operations in the audit was similar between the 2 groups, with 79.5% (660/830) of Aboriginal and Torres Strait Islander patients undergoing an operation compared with 81.2% (23,450/28,875) of non-Indigenous audit patients.

10.5 Aboriginal and Torres Strait Islander patients and risk of death

The risk of death for Aboriginal and Torres Strait Islander patients compared to non-Indigenous patients, as perceived by the treating surgeon, is shown in Table 12. A higher proportion of Aboriginal and Torres Strait Islander surgical patients had a death risk in the category of 'expected' compared to non-Indigenous patients.

Table 12: Risk of death for Aboriginal or Torres Strait Islander patients and non-Indigenous patients, as perceived by treating surgeon

Death risk	Aboriginal and Torres Strait Islander patients (n = 653)	non-Indigenous patients (n = 23,235)
Minimal	1.7%	2.9%
Small	6.7%	10.0%
Moderate	24.5%	26.0%
Considerable	51.5%	49.6%
Expected	15.6%	11.6%

N = 830 Aboriginal and Torres Strait Islander patients, N = 28,875 non-Indigenous patients.

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 most areas of clinical management were not statistically significant. This is consistent with a recent study of patients in the Northern Territory, showing that surgical care as measured by accepted indicators was generally equivalent in both groups.[8]

There were statistically significant differences in communication issues between Aboriginal and Torres Strait Islander patients and non-Indigenous patients (risk ratio = 0.56; 95% CI 0.34 to 0.92) (Table 13).

Table 13: Percentage of specific CMIs in Aboriginal or Torres Strait Islander patients and non-Indigenous patients, according to treating surgeon

CMI	Aboriginal and Torres Strait Islander patients (n = 869)	non-Indigenous patients (n = 30,453)	Risk ratio (95% CI)
Delay issues	6.6%	5.0%	0.77 (0.59–1.00)
Operative management issues	5.8%	4.9%	0.85 (0.64–1.12)
Postoperative care issues	3.0%	2.3%	0.75 (0.51–1.11)
Treatment protocol issues	2.0%	1.8%	0.94 (0.58–1.51)
Preoperative management issues	1.2%	1.7%	1.45 (0.78–2.70)
Adverse events	0.9%	1.2%	1.26 (0.63–2.53)
Communication issues	1.8%	1.0%	0.56 (0.34–0.92)*
General complications	0.6%	0.9%	1.50 (0.62–3.62)
Anaesthetic and critical care issues	0.4%	0.3%	0.95 (0.30–2.99)
Septicaemia and wound	0.1%	0.2%	1.48 (0.21–10.72)

CMI: clinical management issue; CI: confidence interval (statistically significant difference between 2 groups at $p < 0.05$); *statistically significant.

Table 14 shows that there were statistically significant differences in postoperative care between Aboriginal or Torres Strait Islander and non-Indigenous patients in the categories of: postoperative complications detected, use of DVT prophylaxis, unplanned return to theatre, communication, treatment in a critical care unit and different action taken by surgeon.

Aboriginal and Torres Strait Islander patients were less likely to receive DVT prophylaxis or have postoperative complications detected. These patients were more likely to have an unplanned return to theatre or treatment in a critical care unit.

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.

Table 14: Postoperative care issues in Aboriginal or Torres Strait Islander patients and non-Indigenous patients, according to assessors

Postoperative care issue	Aboriginal and Torres Strait Islander patients (n = 795)	non-Indigenous patients (n = 29,664)	Risk ratio (95% CI)
Postoperative complications detected	26.4%	32.4%	0.82 (0.71–0.93)*
Use of DVT prophylaxis	74.5%	80.5%	0.92 (0.89–0.96)*
Unplanned return to theatre	15.8%	12.7%	1.24 (1.06–1.47)*
Unplanned readmission	2.6%	3.2%	0.79 (0.51–1.22)
Fluid balance problems	8.5%	8.4%	1.00 (0.79–1.27)
Communication	7.2%	4.0%	1.81 (1.40–2.34)*
Treated in critical care unit	75.1%	62.5%	1.20 (1.15–1.25)*
Unplanned ICU admission	18.7%	18.0%	1.03 (0.89–1.20)
Different action by surgeon	18.4%	14.0%	1.32 (1.13–1.53)*

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

10.7 Aboriginal and Torres Strait Islander patients and clinical incidents

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

Table 15: Severity of CMIs in Aboriginal or Torres Strait Islander patients and non-Indigenous patients, according to assessor

Clinical incident	Aboriginal and Torres Strait Islander patients (n = 177)	non-Indigenous patients (n = 6,896)	Risk ratio (95% CI)
Area of consideration	57.8%	58.9%	1.04 (0.94–1.15)
Area of concern	31.0%	27.7%	1.02 (0.76–1.37)
Adverse event	11.2%	13.4%	0.78 (0.51–1.20)

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. Continued participation by surgeons and the opportunity to enhance and expand the existing data on surgical mortality provide significant value to the Australian health consumer as a quality assurance activity.

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

Achievements:

- The audit has achieved widespread acceptance, with a 98.8% surgeon participation rate (NSW data not included).
- The audit process is becoming more standardised, with ANZASM now producing a national series of Case of the Month and the National Case Note Review Booklet, which both contribute to the improvement of patient care and outcomes.
- ANZASM Clinical Governance Reports are released annually to hospitals that have 3 or more operating surgeons (this ensures 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 is provided directly to individual surgeons via assessors' comments on individual cases. Feedback is an essential component of the audit process, providing specific, targeted information on a case-by-case basis.
- Audit regions hold seminars and webinars and produce clinical governance reports to share knowledge learned from the audits with surgical communities and the general public.

Future directions for the attention of surgeons:

- Review DVT prophylaxis strategies in accordance with accepted guidelines for all patients scheduled for surgery.
- Address fluid balance in the surgical patient, which is an ongoing challenge, with 7.1% of patients perceived to have had poor fluid balance management.
- Encourage increased usage of critical care support when appropriate, with audit data suggesting that 7.3% of patients who did not receive treatment in a critical care unit were likely to have benefited from it.
- Reduce operative management issues and delays in provision of definitive treatment.
- Improve communication within and between clinical teams.
- Spread awareness of the audit within the surgical community.

RACS, together with the state and territory departments of health, can be proud of ANZASM, an important initiative to promote best surgical practice across the nation.

A greater national awareness of the audit and acknowledgment of its value among health professionals should see increased surgical participation and greater detail provided on audit forms. This, in turn, will enable further in-depth trend analysis and informative reporting to continually improve surgical care in Australia and Aotearoa New Zealand.

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