



**ROYAL AUSTRALASIAN COLLEGE OF SURGEONS  
AUSTRALIAN AND NEW ZEALAND AUDIT OF  
SURGICAL MORTALITY**

# **NATIONAL REPORT 2016**



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



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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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## CHAIRMAN'S REPORT

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The 2016 National Report of the Australian and New Zealand Audits Surgical Mortality (ANZASM) builds on the impressive body of data already collected. We now have almost 100% of death audited, with national coverage. Media reports sometimes misunderstand what they are reading, but generally are becoming more mature, thoughtful and supportive of the Audit and its value to the Australian community. Participation is essential for obtaining Continuing Professional Development (CPD) recognition, and feedback from second-line assessment is provided to surgeons for education and comment. Those reports are protected by QP (Qualified Privilege) which means it is illegal to provide them to individuals (other than the surgeon), hospitals, and State and Commonwealth Governments. The Audit does also provide hospital reports, with detailed comparison between similar hospitals also shown.

With over a decade of experience and in excess of \$25 million of expense from state and territory jurisdictions, is it now time to allow reporting of individual surgeon performance to their hospital? QP should still be maintained over the reports on individual cases, but outlier performance could be made available to individual centres and state and territory jurisdictions. The Royal Australasian College of Surgeons (RACS) was not involved in the Bacchus Marsh tragedy, however a similar poor outlier performance could exist within RACS and it would currently be impossible to report this even if identified. Relying on insight and personal reflection of individual results is not always enough, indeed when it is present such situations rarely occur.

As surgeons, we must start the discussion and debate on how or if QP should be altered to maintain the robust input we currently have but also protect the public from poorly performing surgeons. Our first obligation is still to our patients, but we must be careful not to damage the support the Audit currently enjoys.

Constructive feedback on the data enclosed or the future of the Audit would be welcomed.



**Professor Guy Maddern**

Chairman

Australian and New Zealand Audit of Surgical Mortality

## SHORTENED FORMS

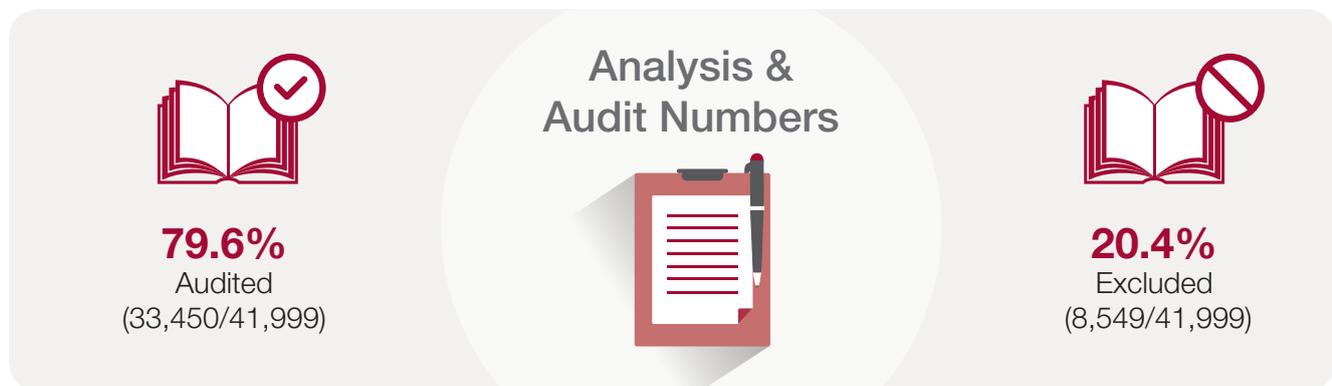
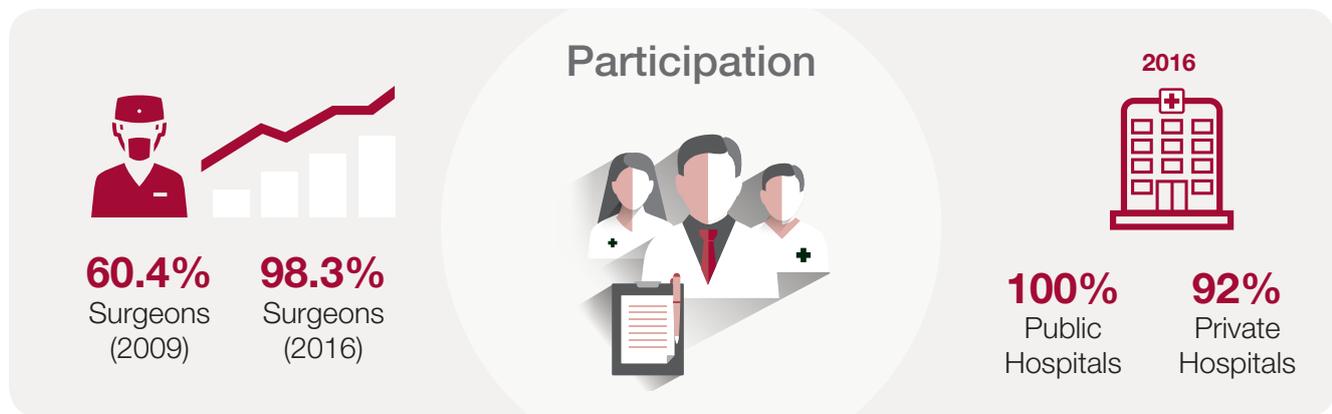
ACT	Australian Capital Territory
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anesthesiologists
CHASM	Collaborating Hospitals Audit of Surgical Mortality
CRP	C-reactive protein
CT	computed tomography
DVT	deep vein thrombosis
ED	emergency department
FLA	first-line assessment
GP	general practitioner
ICU	intensive care unit
MET	medical emergency team
NSW	New South Wales
NT	Northern Territory
NTASM	Northern Territory Audit of Surgical Mortality
QASM	Queensland Audit of Surgical Mortality
QLD	Queensland
RACS	Royal Australasian College of Surgeons
RANZCOG	The Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SA	South Australia
SCF	surgical case form
SLA	second-line assessment
TAS	Tasmania
TED	thromboembolic deterrent
VIC	Victoria
WA	Western Australia
WAASM	Western Australian Audit of Surgical Mortality
WBC	white blood cell count

## EXECUTIVE SUMMARY

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.

Each audit of surgical mortality is funded by its state or territory department of health (Western Australia, Victoria, South Australia, Queensland, Tasmania, Australian Capital Territory and Northern Territory).

The Collaborating Hospitals Audit of Surgical Mortality (CHASM) in New South Wales provides comparable data to ANZASM but is independently managed by the Clinical Excellence Commission of New South Wales.



### Operations



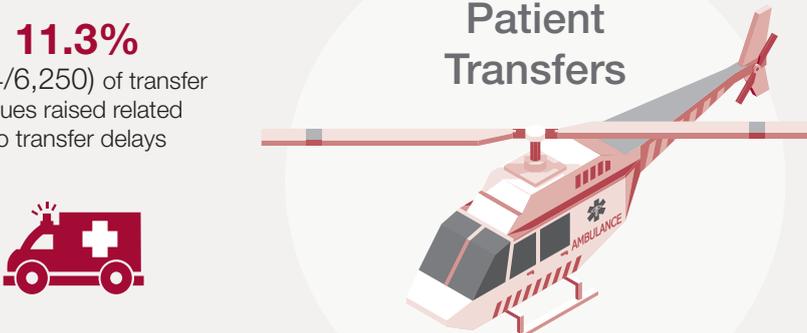
**79%**  
(26,078/33,034) of patients underwent a surgical procedure

**16%**  
(4,026/25,196) of the surgery patients had an unplanned return to the operating theatre because of complications

**87.9%**  
(32,369/36,842) of operations, the consultant surgeon made the decision to operate

**62.6%**  
(23,070/36,842) of cases the consultant surgeon performed the surgery

### Patient Transfers



**11.3%**  
(704/6,250) of transfer issues raised related to transfer delays

**4.1%**  
(257/6,258) for inappropriateness of transfer

**4.7%**  
(285/6,121) for insufficient clinical documentation

### Infection



**Infections were**

- 44%** Pneumonia
- 15.3%** Intra-abdominal sepsis
- 25.7%** Septicaemia

**34.2%**  
(5,267/15,404) of patients died with a clinically significant infection

### Outcomes



The most common criticism made by assessors was delay in delivering definitive treatment.

**50.8%**  
(3,927/7,728) of delays were attributed to the surgical team

**13%**  
(4,321/33,349) of audited cases were referred for second-line assessment (SLA)

**73.3%**  
(3,167/4,321) inadequate information was the reason for referral to SLA in audited cases

**11.0%**  
(3,655/33,356) cases with clinical management issues

**3.9%**  
(1,298/33,356) of cases had an adverse event in patient care

# COMPARISON OF DATA BETWEEN THE 2014 TO 2016 AUDIT PERIODS

**Table 1: National comparison, 2014-2016 audit periods**

Areas for national comparison	2014	2015	2016
Surgeon participation	97%	97%	98%
Hospital participation:			
Public	100%	100%	100%
Private	92%	92%	92%
Closed cases at year end (cumulative)	23,292	28,434	33,450
Admissions:			
Emergency	85%	85%	86%
Elective	15%	15%	14%
Gender:			
Male	55%	55%	55%
Female	45%	45%	45%
Median age for males and females	76 and 81	76 and 81	75 and 82
ASA status $\geq$ 4	54%	54%	58%
Admitted with one or more comorbidities	89%	89%	90%
Cases with perceived risk of death considerable or expected (as perceived by the surgeon)	62%	62%	62%
DVT prophylaxis use assessed as inappropriate by assessor	2%	2%	2%
Issues with fluid balance	6%	6%	7%
Patients who had one procedure <sup>∞</sup>	75%	79%	79%
Consultant deciding to operate	87%	88%	88%
Patients with unplanned return to theatre	15%	15%	16%
Patients with postoperative complications	32%	32%	34%
Patients with anaesthetic-related issues	7%	7%	7%
Procedures abandoned	5%	5%	5%
Patients transferred	26%	25%	26%
Total number of clinically significant infections*	24.5% (833/3,396)	26.6% (930/3,494)	25.5% (863/3,382)
Request for second-line assessment	13%	13%	13%
Areas of concern and adverse events (total)	6% and 3% (9%)	6% and 3% (9%)	7% and 4% (11%)

ASA: American Society of Anesthesiologists; DVT: deep vein thrombosis.

<sup>∞</sup> Patient underwent an episode of surgery during their last admission or within 30 days prior to death.

\* Excludes New South Wales data; Western Australia started collecting data from 2013.

Each column shows the closed cases' data as it stood when it was censored in that year.

## RECOMMENDATIONS AND KEY POINTS

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The recommendations and key points are lessons learned from the audited surgical mortality cases.

- Improve the completeness of data collected on the SCFs to reduce the number of SLAs required due to insufficient information. The majority of fields were made mandatory in the latter half of 2016 in the online Fellows Interface forms. Lack of information is the most frequent cause of referral for SLA and surgeons should try to reduce the number of SLAs required for that reason.
- Improved postoperative management is important, particularly in the detection of postoperative bleeding. The patient should be discharged to the ward with comprehensive orders, including preventative measures for reducing complications. Instructions must be given regarding further management when a patient is discharged from a clinical or surgical team.
- The patient should be transferred to a medical unit if very frail, elderly, high risk, and if medical issues are assessed as being the prominent clinical factor during the admission episode, providing that the surgical postoperative care can be performed appropriately in that setting. Time delays are to be minimised, particularly for elderly frail patients transferred between hospitals due to their limited physiological reserves. Time delays for these patients can significantly affect surgical outcomes.
- In response to the higher proportion of postoperative complications and serious clinical incidents among elective admissions, the audits of surgical mortality and departments of health should continue to promote the importance of recognising the signs of the deteriorating patient. Communication is one of the key elements to good patient care. This includes communication between surgeons and their junior staff, between disciplines, and between nursing and medical staff.
- Delay in the decision to operate remains an ongoing issue. In complex cases there needs to be clear demonstrable leadership in patient management. There should be regular multidisciplinary team meetings to ensure that the treatment plan is understood by all. Consultants should continue to be actively involved in the care of their patients, especially in the decision-making process.
- Surgical patients, particularly those with certain comorbidities, are more susceptible to developing infection and stringent infection control care should be considered. Improvements can be achieved by focusing on strengthening current guidelines for infection control procedures, especially hand washing, revision of existing infection control training and adherence to patient care protocols.
- The audit revealed that patients admitted as surgical emergencies have a greater risk of falling while in hospital. All health professionals should increase their awareness of this risk to improve the quality and safety of patient care.
- Surgeons are encouraged to report back to the audit any evidence of changes of practice or changes in hospital processes which have emanated from the audit.
- Senior surgical opinion is essential when dealing with surgical complications and should not be delayed by team hierarchy structure.
- The audit revealed that patients admitted for surgical care are at an increased risk of developing infection. The risk is high, especially in such a comorbid group of patients, and stringent infection control care should be considered for this patient pool. The Australian Guidelines for the Prevention and Control of Infection in Healthcare are designed to prevent and manage healthcare associated infection. These should be utilised at hospitals, and the ANZASM endorses the use of current hospital protocols and guidelines to reduce the incidence of infection.
- Delivery of themed national case note review booklets on current topical issues, such as the impact of obesity on surgery, issues around anticoagulation, delay in patient care and transfer issues.

- The audit should continue to review falling surgical mortality rates to ascertain how the audit process has contributed to the reduction of surgical mortality across the country. This could identify trends in which further perioperative improvements can be made in collaboration with the departments of health. In particular this should be able to assist hospitals in their own internal review of existing clinical activities and hospital processes, be able to influence public policy and identify areas where clinical improvement could be made.
- The ANZASM regional audit staff should continue to encourage active participation of surgeons and hospitals, with participation now close to 100%.
- The ANZASM regional audit staff should continue to identify emerging trends in mortality and address them where possible through educational seminars.

# 1 INTRODUCTION

## KEY POINTS

- ▶ The Australian and New Zealand Audit of Surgical Mortality (ANZASM) is an external peer-review audit of deaths that occur while a patient is under the care of a surgeon, whether or not the patient underwent an operative procedure.
- ▶ This report is a review of all deaths notified during the period 1 January 2009 to 31 December 2016.

## 1.1 Background

The Royal Australasian College of Surgeons (RACS) became responsible for the management of the Western Australian Audit of Surgical Mortality (WAASM) in 2005. WAASM was modeled on the Scottish Audit of Surgical Mortality, which began in 1988. The RACS has expanded the program to all other states and territories under the umbrella of ANZASM.

Completed data for the period 1 January 2009 to 31 December 2016 are included in this report from Western Australia, South Australia, Tasmania, Victoria, New South Wales and Queensland. The Australian Capital Territory and Northern Territory joined the program during 2010.

## 1.2 Objectives

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

## 1.3 Structure and governance

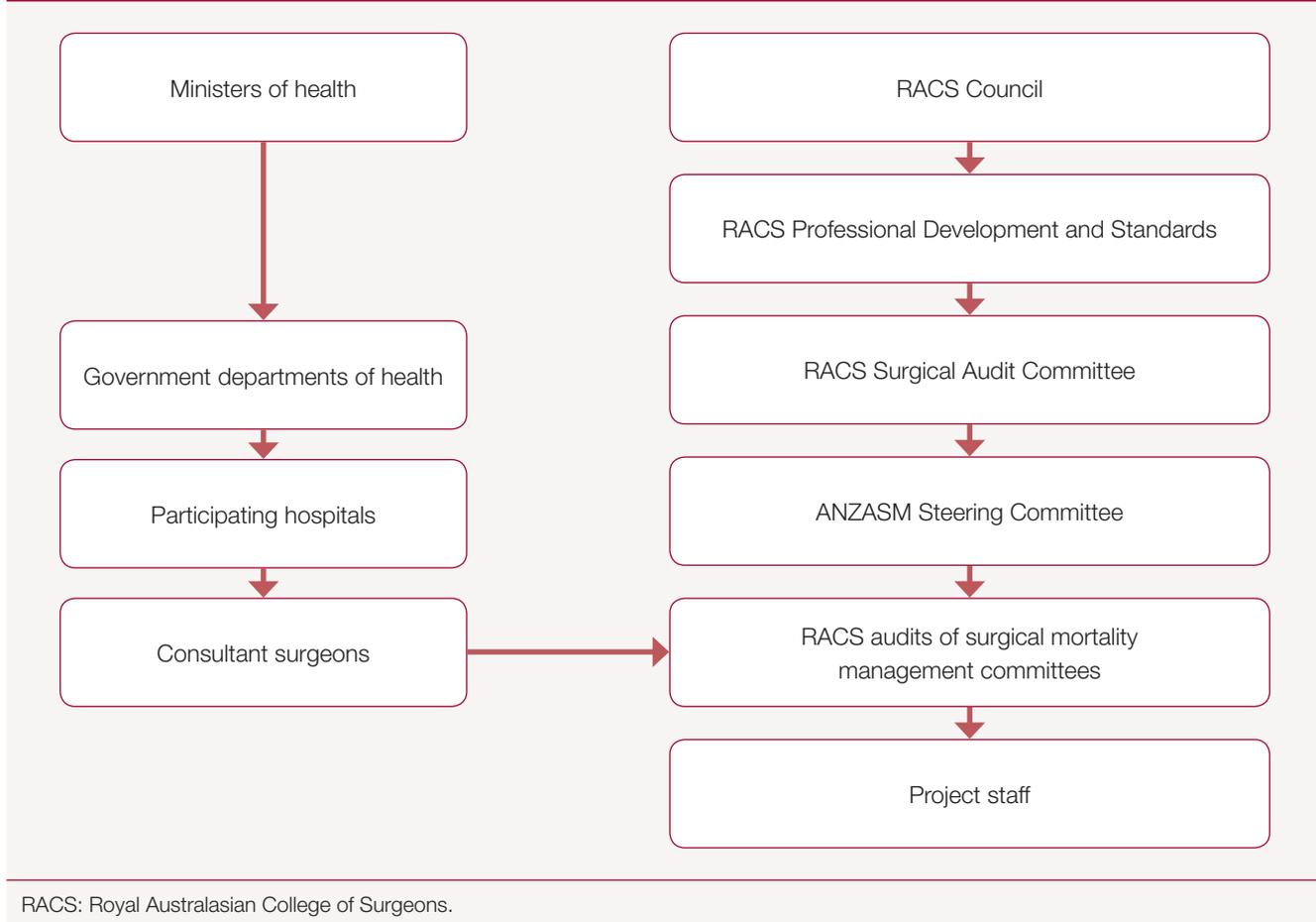
ANZASM is managed by the Research, Audit and Academic Surgery Division of RACS. ANZASM oversees the implementation and standardisation of each regional audit to ensure consistency in audit processes and governance structure across all jurisdictions (see Figure 1).

The individual regional 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 Program since January 2010.

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

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



## 1.4 Methodology

Individual regional audits of surgical mortality are notified of in-hospital deaths associated with surgical care. The method of notification varies by region. These notifications come from the hospitals or another source that is independent of the surgeon. 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.

The clinical details pertaining to the management of each case are recorded on a standard, structured surgical case form (SCF) completed by the consultant or treating surgeon associated with the case. The completed SCF is returned to the appropriate audit of surgical mortality office, where it is de-identified and sent for first-line assessment (FLA) by a surgeon of the same surgical speciality 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.

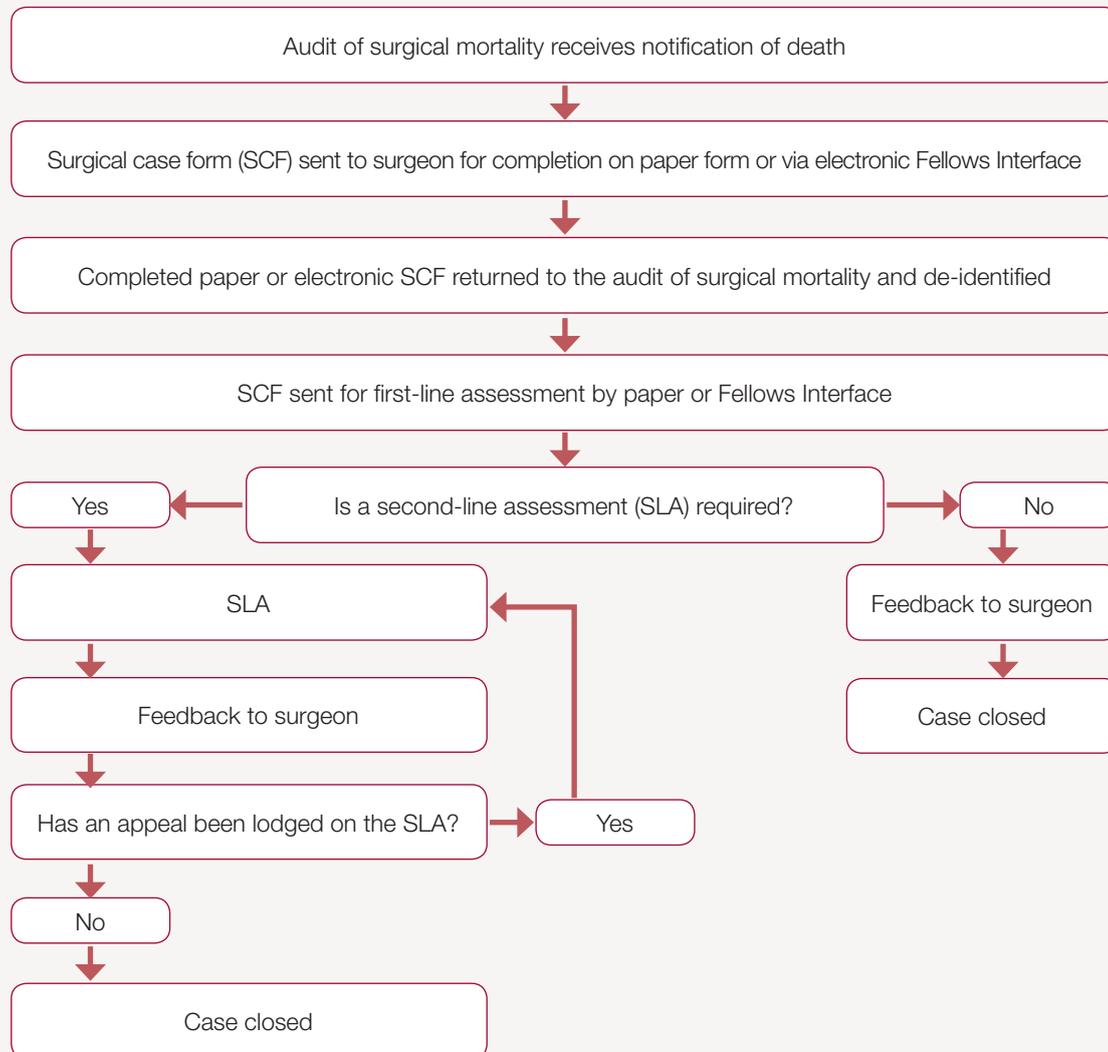
The clinical information from these deaths provides the patient profiles described in this report and is the denominator in all analyses pertaining to outcomes from the audit.

There are two possible outcomes of an FLA:

- The information provided by the treating surgeon is adequate to reach a conclusion about the case and to identify any issues of management, if present.
- A second-line assessment (SLA) is necessary either:
  - for clarification of issues of patient management identified or suspected by the first-line assessor, or
  - because the information provided by the treating surgeon was inadequate to reach a conclusion.

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

**Figure 2: The audit process**



## 1.5 Providing feedback

One of the primary aims of ANZASM is education, and participation in the audit is a mandatory component of a surgeon's continuing professional development. This is achieved by providing commentary obtained during the audit process directly to the treating surgeon, as well as highlighting lessons learned from de-identified cases in the National Case Note Review Booklet. The individual regional audits also produce their own yearly reports and case note review booklet series, which highlight important issues in patient management.

The case reviews, with examples provided within this report, form part of the feedback process. This is essential to the quality improvement of the ANZASM. The cases in this report are from a variety of specialties and a variety of authors, and have been chosen to highlight aspects of patient care that have been identified in this report as needing improvement. Some case reviews have been edited to focus on a few points in a complex story or to reduce their length.

## 1.6 Reporting conventions

### 1.6.1 Reporting clinical incidents

In the structured SCF the surgeon is asked to document whether there were any clinical incidents 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. The surgeon is asked to provide information based on the following assessment matrix.

- Report on the perceived impact of the incident on the outcome 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.
- Provide their perception as to preventability, using the following categories:
  - definitely preventable
  - probably preventable
  - probably not preventable
  - definitely not preventable.
- Indicate which clinical area was most responsible for the incident or event:
  - audited surgical team
  - another clinical team
  - hospital
  - other.

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

### 1.6.2 Analysis of clinical incidents

A primary objective of the ANZASM peer-review process is ascertaining whether death was a direct result of the disease process alone, or if aspects of management of the patient might have contributed to that outcome. When there is a perception that the clinical management may have contributed to death, ANZASM specifies that assessors use the spectrum of criticism outlined below.

- **Area for consideration.** The assessor believes an area of care could have been improved or different, but recognises that the issue is perhaps debatable.
- **Area of concern.** The assessor believes that an area of care should have been better.
- **Adverse event.** An unintended injury or event that was caused by the medical management of the patient rather than by the disease process, and which was sufficiently serious to lead to prolonged hospitalisation or which contributed to or caused death. Specific complications (e.g. pulmonary embolus, anastomotic leak) are by definition always adverse events but may not be preventable.

### 1.6.3 Data analysis and security

The 2016 report covers deaths reported to ANZASM from 1 January 2009 to 31 December 2016, censored on 31 March 2017. The full audit process can take up to 3 months from notification of death to completion. Some cases were still under review as at the census date, and the case outcomes were not available for this report. These cases will be featured in the next report. Patients admitted for terminal care are excluded from the full audit process.

For the purposes of collating data for the national report, data are encrypted, sent to 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 engine supports the creation of letters, reminders and management reports.

The 2016 report data were analysed using the Statistical Package for Social Sciences, version 24.0, statistical package STATA version 10.1, and Microsoft Office Excel (2010).

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

Data for the years 2009 to 2012 have been grouped in some tables and figures for the purpose of clarity. It should be noted that where no comparative data are given there was no significant difference for the 2009 to 2016 audit periods.

## 2 AUDIT PARTICIPATION

### KEY POINTS

- ▶ Nationally in 2016, 98.3% (4,926/5,013) of surgeons participated in the audit.
- ▶ 100% of all public hospitals and 92% of all private hospitals are currently participating in the audit program.

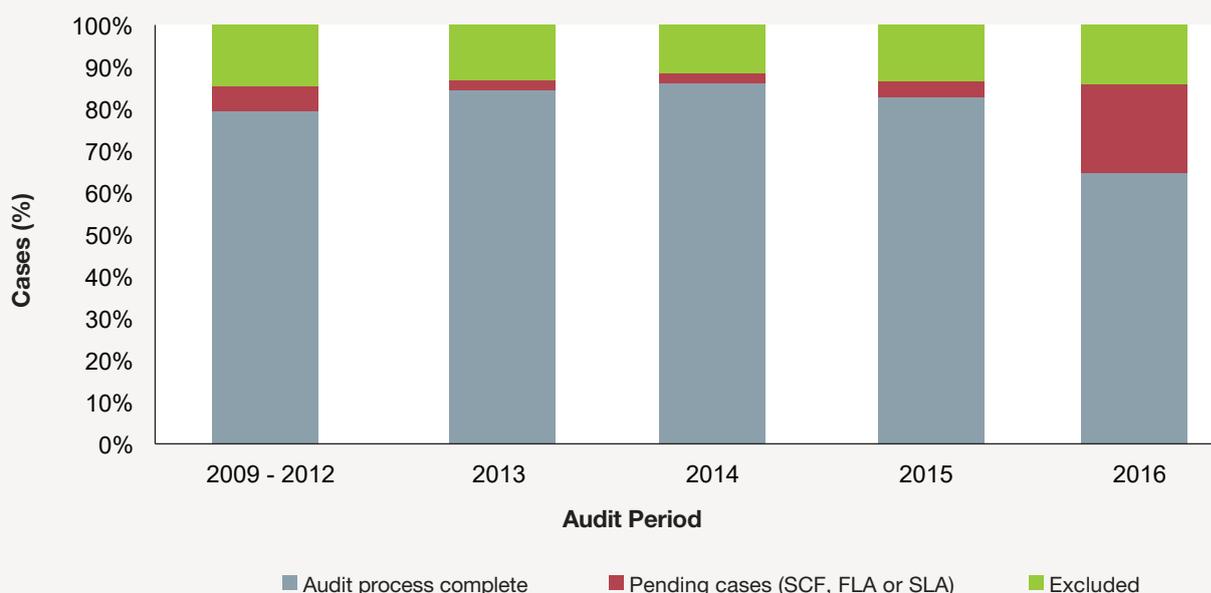
### 2.1 Audit numbers

During the period January 2009 to December 2016 ANZASM received 41,998 notifications of death associated with surgical care:

- The audit process was completed by the census date for 79.6% (33,450) of these cases. 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.
- The remaining 20.4% (8,548) of cases were not included in the audit for the following reasons:
  - The case was admitted for terminal care, inappropriately attributed to surgery, lost to follow-up or treated by surgeons not participating in the audit (5,757).
  - The case had not completed the full audit process at the census date (2,792).

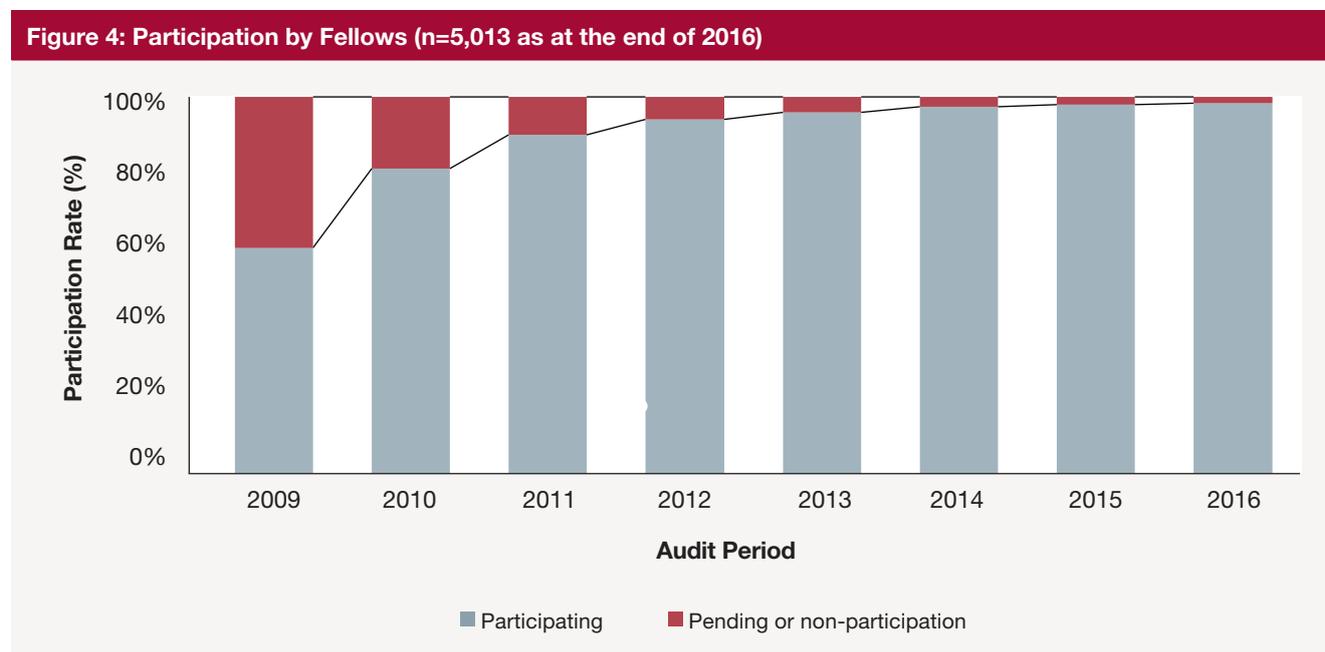
Figure 3 shows the proportion of cases with completed forms over the different audit periods. While the 2016 audit period has a higher number of pending cases, it is expected that this number will decrease to become more in line with the earlier years as additional cases are finalised. The audit process relies not only on surgeons agreeing to participate, but also on their timely completion of surgical case and assessment forms.

Figure 3: Audit status at census date (n=41,998)



\* Pending cases comprise non-surgical, non-participant, lost to follow-up or terminal care cases. SCF: surgical case form; FLA: first-line assessment; SLA: second-line assessment.

Figure 4 shows surgeon participation rates in Australia from 2009 to 2016. Pending participation indicates that a Fellow has not responded to the invitation to participate in the audit.



Nationally in 2016, 98.3% (4,926/5,013) of surgeons participated in the audit. This may also underestimate the true intent to participate, as not all hospitals are participating, some Fellows have retired from clinical practice and some Fellows have temporarily relocated overseas. Participation in ANZASM became a mandatory component of the RACS Continuing Professional Development Program in January 2010. The percentage of Fellows per region who participated in the audit (as at the end of 2016) is shown in Table 2, while the percentage of Fellows per region who acted as first- or second-line assessors (as at the end of 2016) is shown in Table 3.

**Table 2: Current regional participation by Fellows (n=5,013)**

Surgeon participation status	Region							
	SA	QLD	WA	TAS	VIC	ACT	NT	NSW
Participating	100%	100%	100%	100%	99%	100%	100%	96%
Not participating	0%	0%	0%	0%	1%	0%	0%	4%

**Table 3: Current regional participation by Fellows as assessors (n=5,013)**

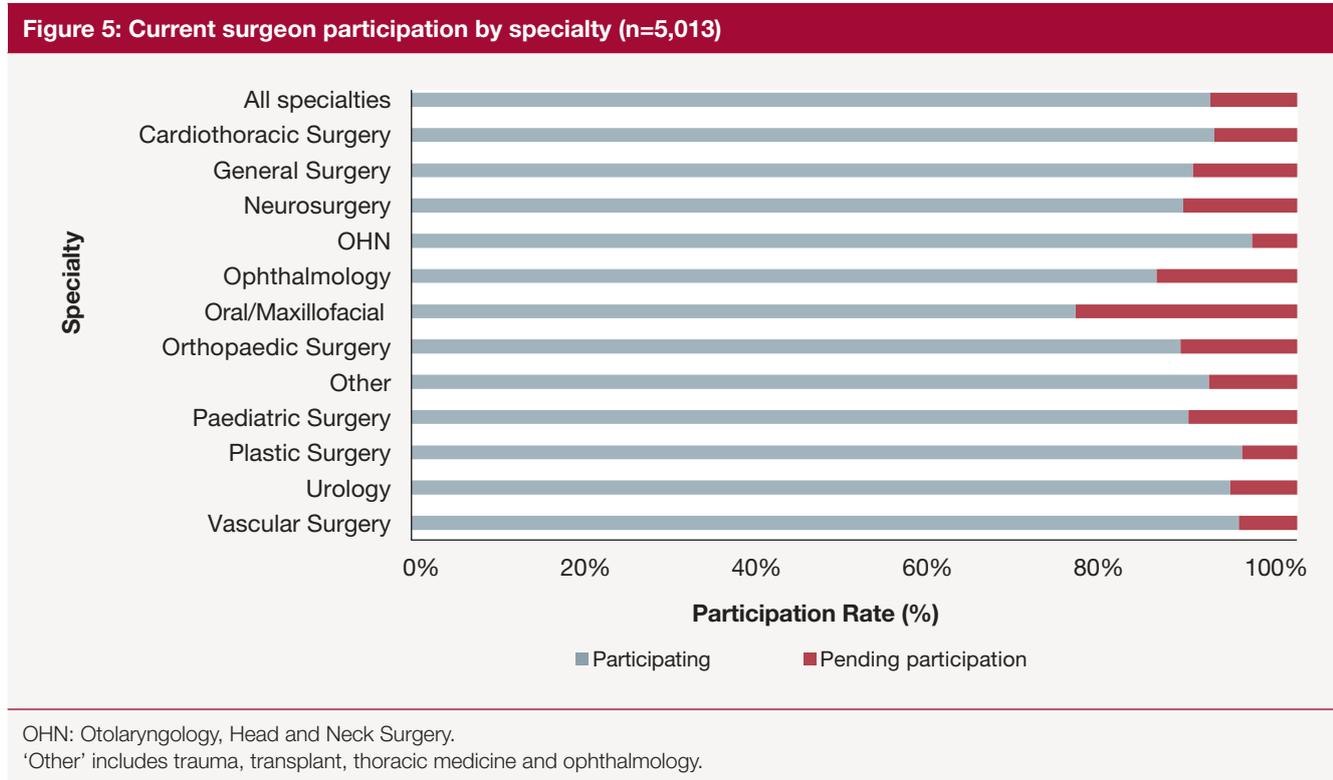
Assessor type	Region							
	SA	QLD	WA	TAS	VIC	ACT	NT	NSW
First-line assessor	55%	54%	92%	58%	56%	70%	48%	37%
Second-line assessor	55%	52%	93%	58%	57%	56%*	41%	28%

Note: \* In the ACT, all second-line assessments are conducted inter-state.

**Comment:**

- Reasons given for both surgeon and assessor non-participation included potentially participating in other CPD programs, refusing to participate in the audit, and surgeons working in a private hospital that was not yet participating in the audit.
- There is increasing use of the Fellows Interface in which surgeons enter the data online. Of current participating surgeons, 60.2% (3,017/5,013) are now using the Fellows Interface, compared with 57.4% (2,794/4,870) in the previous report.<sup>1</sup> Use of the Fellows Interface is encouraged as it is easy to use and provides both time and process efficiencies. It should be noted that it is not currently available in New South Wales.

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

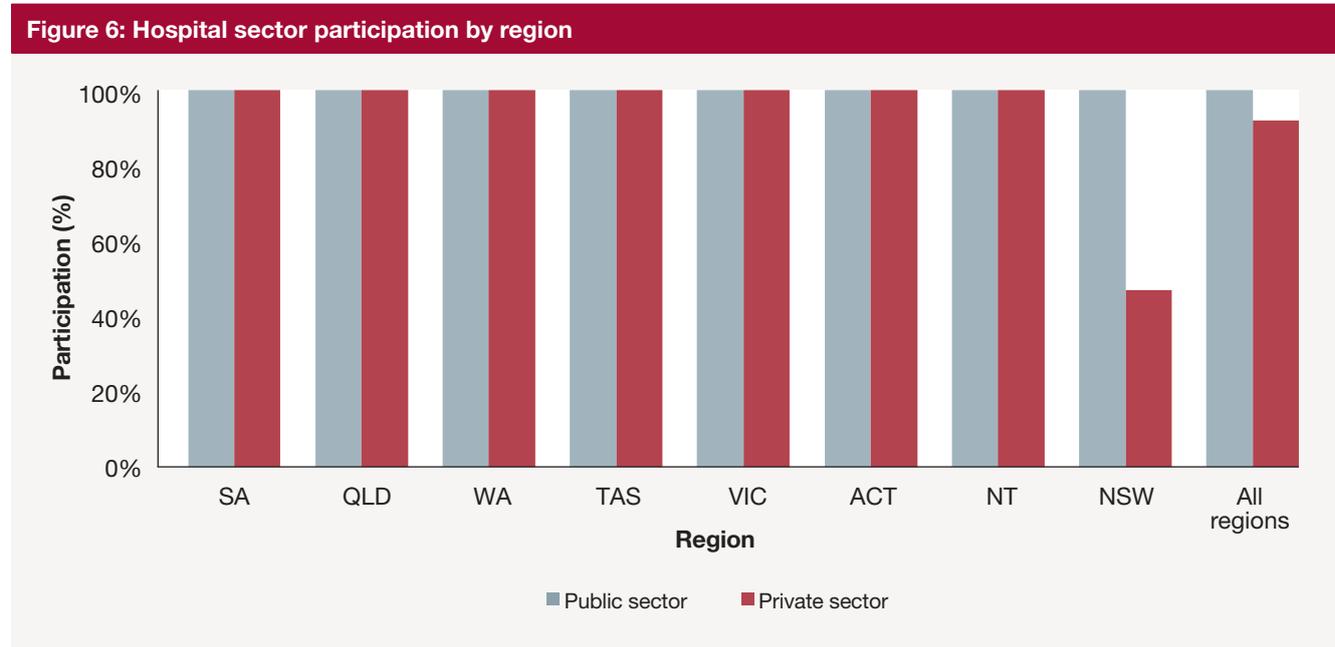


**Comment:**

- Participation rates vary slightly amongst the different specialties. Pending participation means that the surgeon has not yet responded to the invitation to participate.
- 58% (587) gynaecologists have agreed to participate in the ANZASM audit process (data not shown). Participation for the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) surgeons is voluntary under their Continuing Professional Development program. Gynaecologists formally started participating in the audit process in December 2011. The RACS approached the RANZCOG in September 2017 to consider making participation in the audits of surgical mortality compulsory for RANZCOG CPD.

## 2.2 Hospital participation

All public hospitals in which surgery is performed had agreed to participate in the audit by the end of 2016 (Figure 6).



### Comment:

- Recruitment drives targeting the private sector continued during the course of 2016. In general, the private sector's response to the opportunity to participate in the audit has been positive. There has been an encouraging expansion in private hospital participation in New South Wales, from 8% in 2013 to 47% in 2016. Overall, private hospital participation remained the same from the previous year at 92%.

### 3 DEMOGRAPHIC PROFILE OF AUDITED CASES

#### KEY POINTS

- ▶ 85.6% (28,245/33,003) of patients were admitted as emergencies with acute conditions.
- ▶ The median age and spectrum of comorbidity indicates that surgical mortality predominantly occurs in the sick and elderly with major pre-existing comorbidities.
- ▶ One or more pre-existing medical conditions or comorbidities were reported for 90.0% (28,701/31,862) of patients.
- ▶ 90.3% (28,165/31,205) of patients had an American Society of Anesthesiologists (ASA) grade greater than or equal to 3.

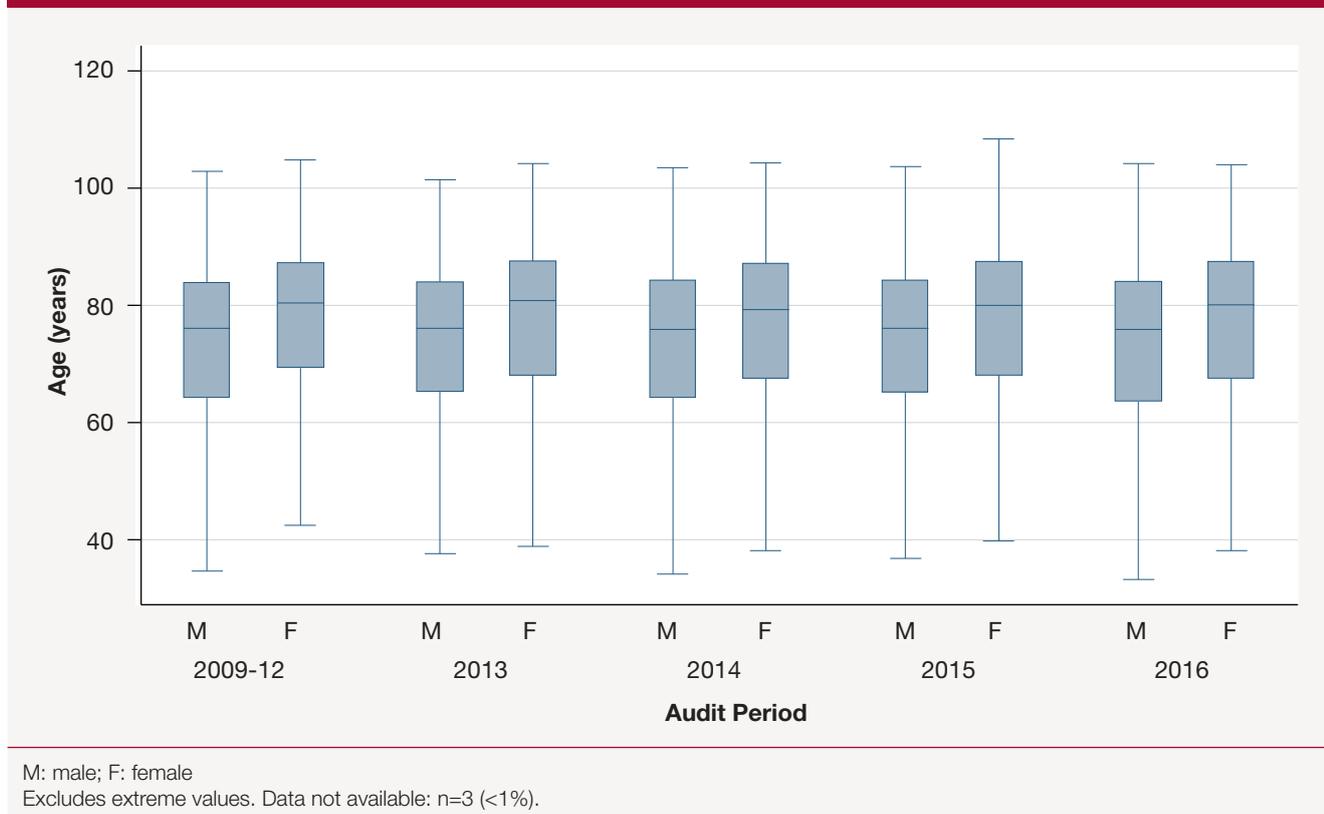
Figures 7, 8, 9, and 11 are box-and-whisker plots in which:

- the central box represents the values from the lower to upper quartile (25th to 75th percentiles)
- the middle line represents the median value
- the vertical line extends from the minimum value to the maximum value, excluding extreme values.

#### 3.1 Age and gender

The age distribution of deaths by gender and year, gender and region, and surgical specialty are shown in Figures 7, 8 and 9 respectively.

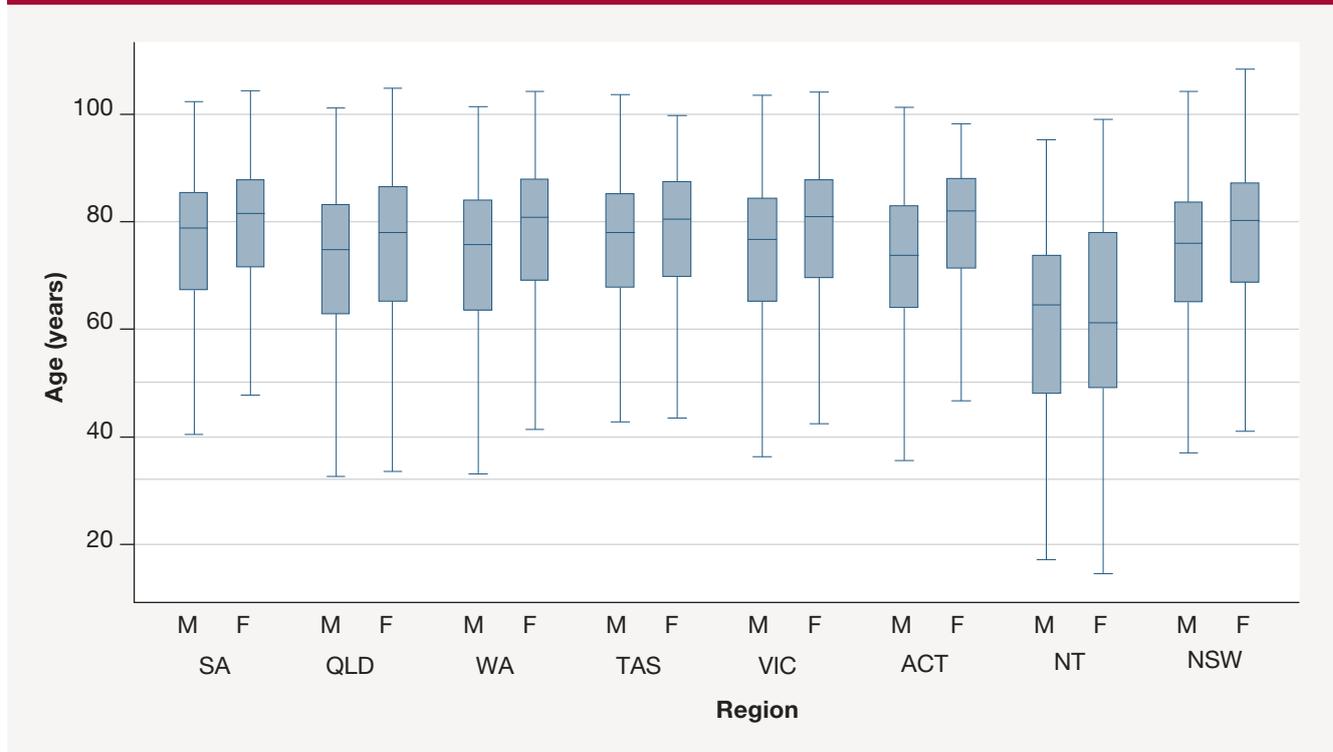
Figure 7: Age distribution of deaths by gender and year (n=33,447)



**Comment:**

- The age and gender distribution was similar over the audit reporting periods.
- The stable distribution of age and gender across the reporting period means that any trends identified are not due to a change in the demographics of the population.

**Figure 8: Age distribution of deaths by gender and region (n=33,447)**



M: male; F: female

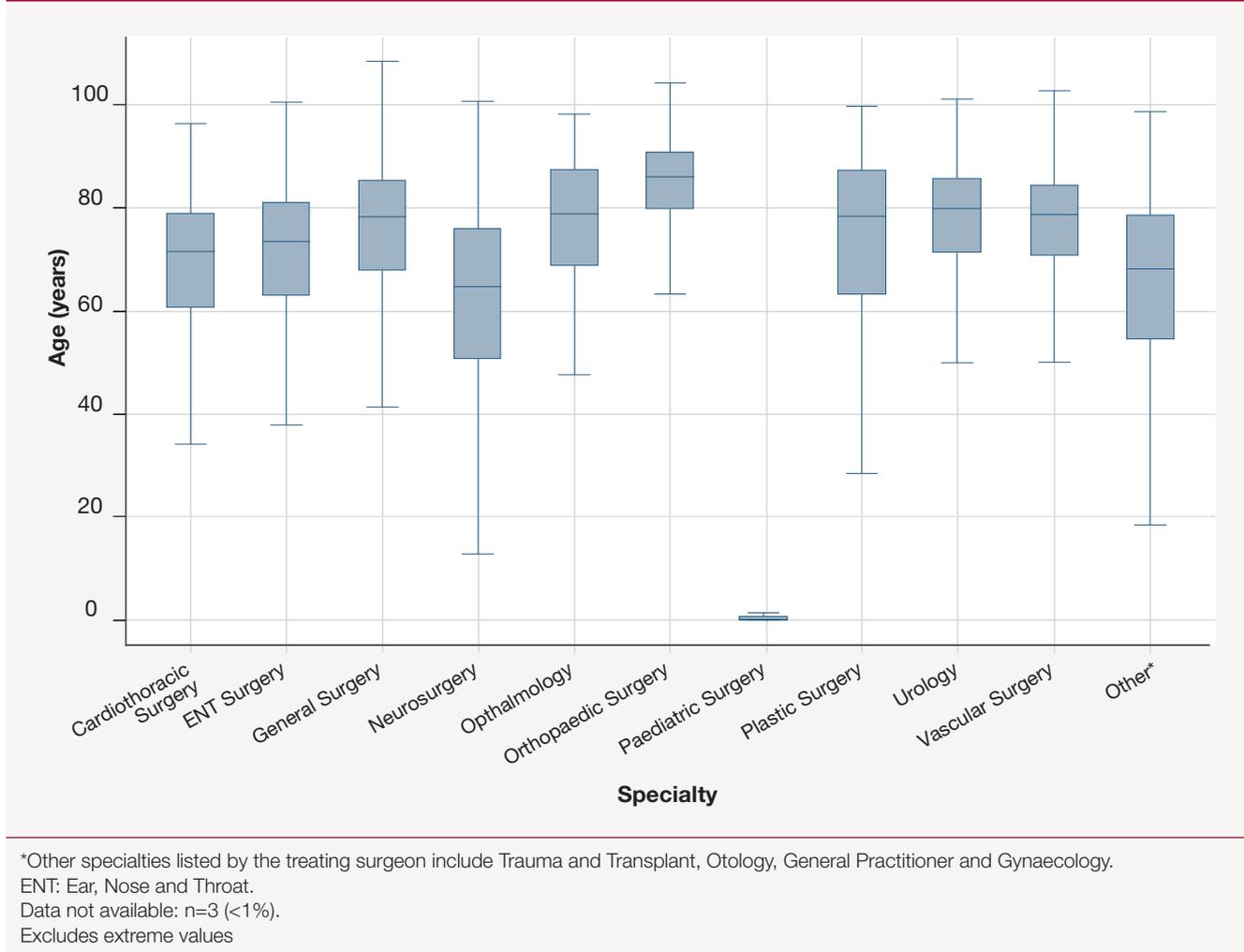
Excludes extreme values. Data not available: n=3 (<1%).

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

**Comment:**

- The gender distribution of audited deaths was similar across all regions with the exception of the Northern Territory. The Northern Territory has the lowest median age of death for males and females compared with all the other regions. The Australian Bureau of Statistics June 2010 data had the median age in NT at 31.3 years old and 36.9 for Australia. Thus the low median age of death may be due to a higher proportion of deaths of young males from head injury, primarily following motor vehicle accidents.

Figure 9: Age distribution of deaths by surgical specialty (n=33,447)



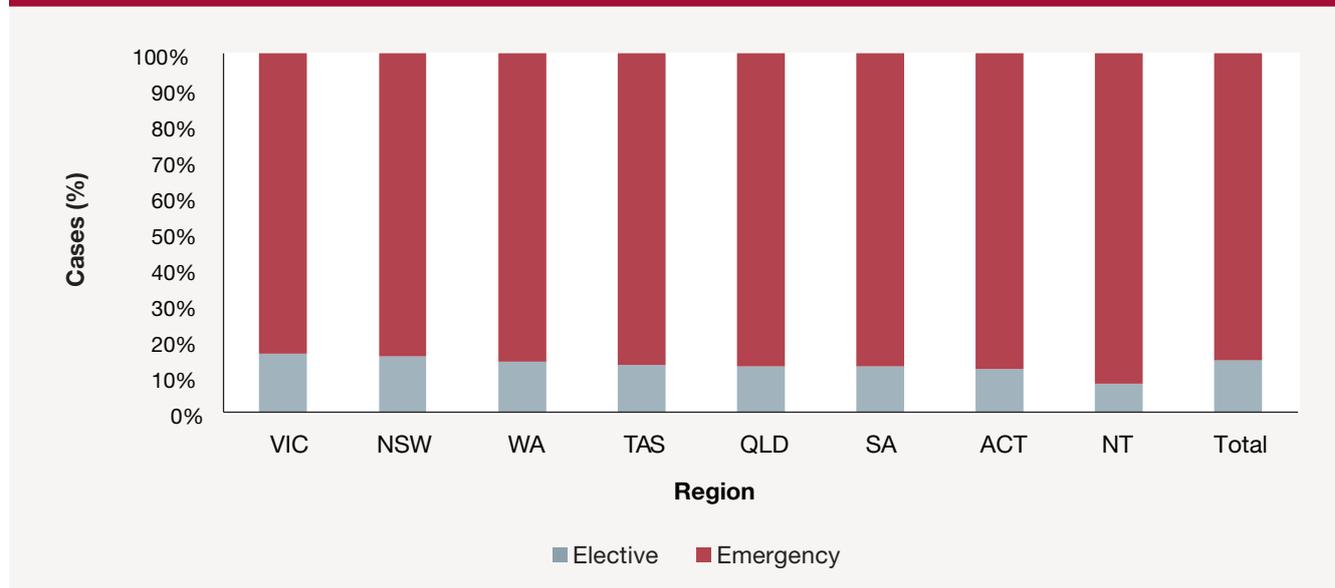
**Comment:**

- The mean age at death may relate to the underlying disease process in the individual specialties (such as young head injury patients in Neurosurgery).
- This plot excludes extreme values to avoid skewing the majority of the data, with the exception of those relating to Paediatric Surgery.

### 3.2 Admission status of audited cases

The admission status of audited cases indicates whether patients were admitted electively or as emergencies (see Figure 10 and Figure 11). The age range distribution by year and admission status can be seen in Figure 12.

**Figure 10: Admission status of cases by region (n=33,003)**



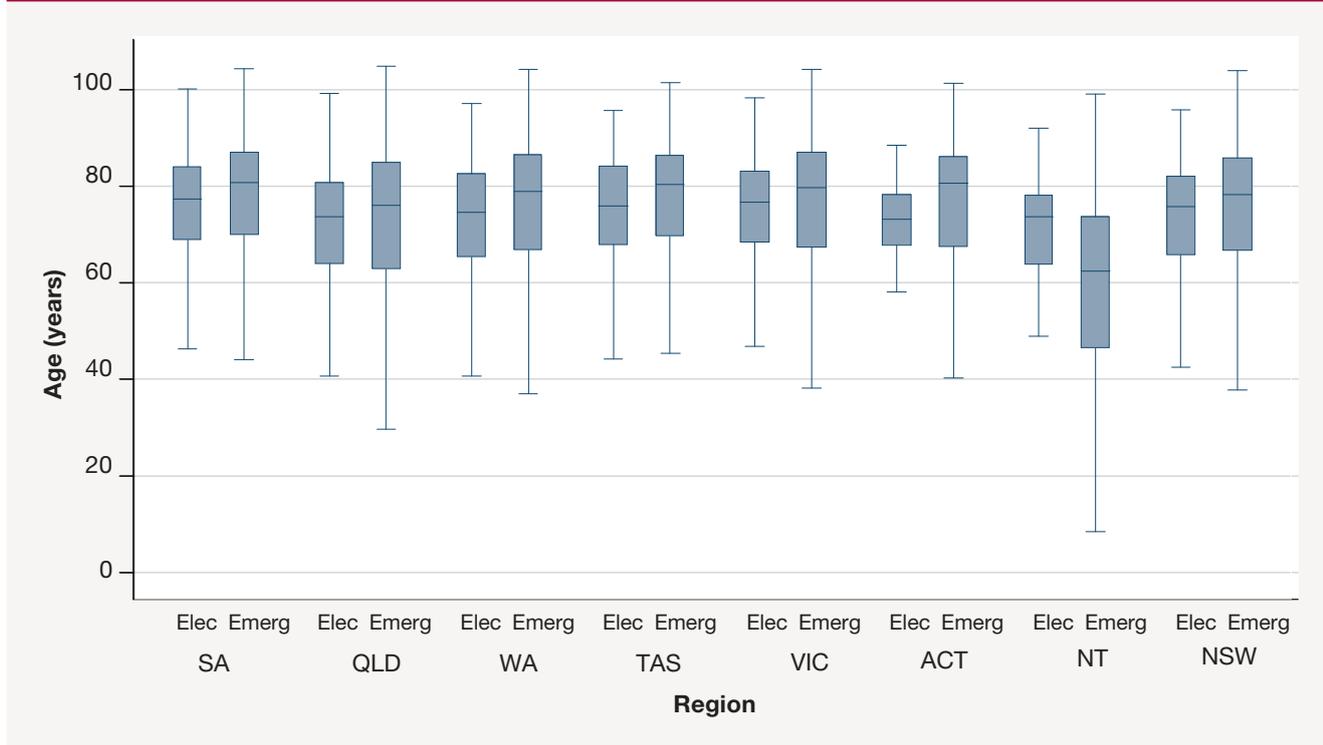
Data not available: n=447 (1%).

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

#### Comment:

- Patients admitted as emergencies for acute life-threatening conditions comprised 85.6% (28,245/33,003) of audited deaths.

**Figure 11: Age distribution of deaths by admission status and region (n=33,003)**



Data not available: n=447 (1%).

Note: excludes extreme values.

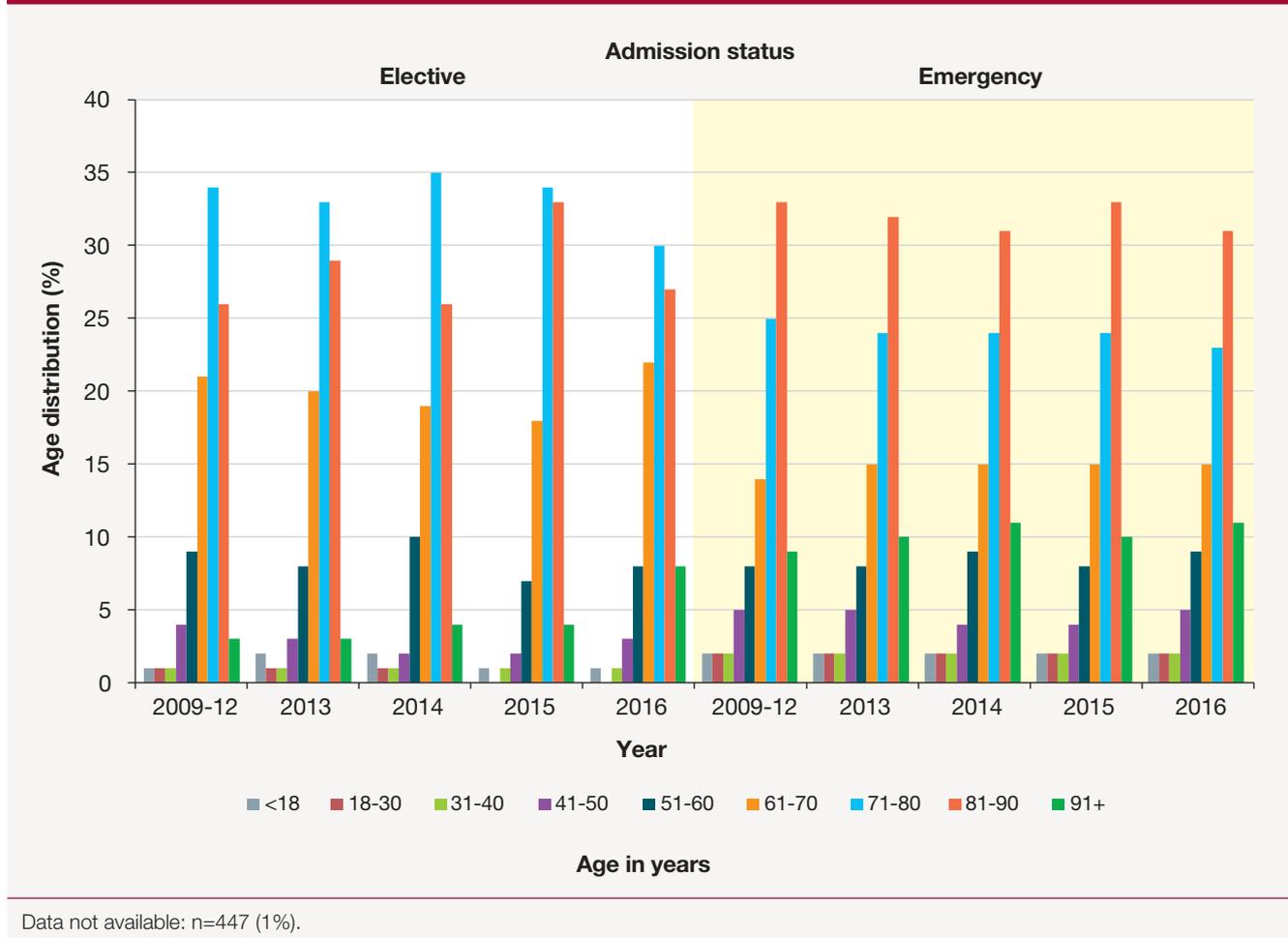
Elec: elective; Emerg: emergency.

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

### Comment:

- Between 2009 and 2016, patients who died following an emergency admission were generally (with the exception of patients within the Northern Territory) older than those who died following an elective admission ( $p < 0.001$ ; data not shown). In the reporting period, the median age of death was 76 years for elective admissions and 79 years for emergency admissions.
- The admission status distribution of audited deaths was similar across all regions, with the exception of the Northern Territory. Within the Northern Territory elective cases were older than emergency cases.

Figure 12: Age range distribution by year and admission status (n=33,003)



**Comment:**

- The age distribution of emergency and elective deaths has remained similar over time.
- Across the reporting period, the 71-80 year age group contributed to more elective surgery deaths than any other group, while the 81-90 year age group contributed the most emergency deaths.

### 3.3 Risk profile of audited cases

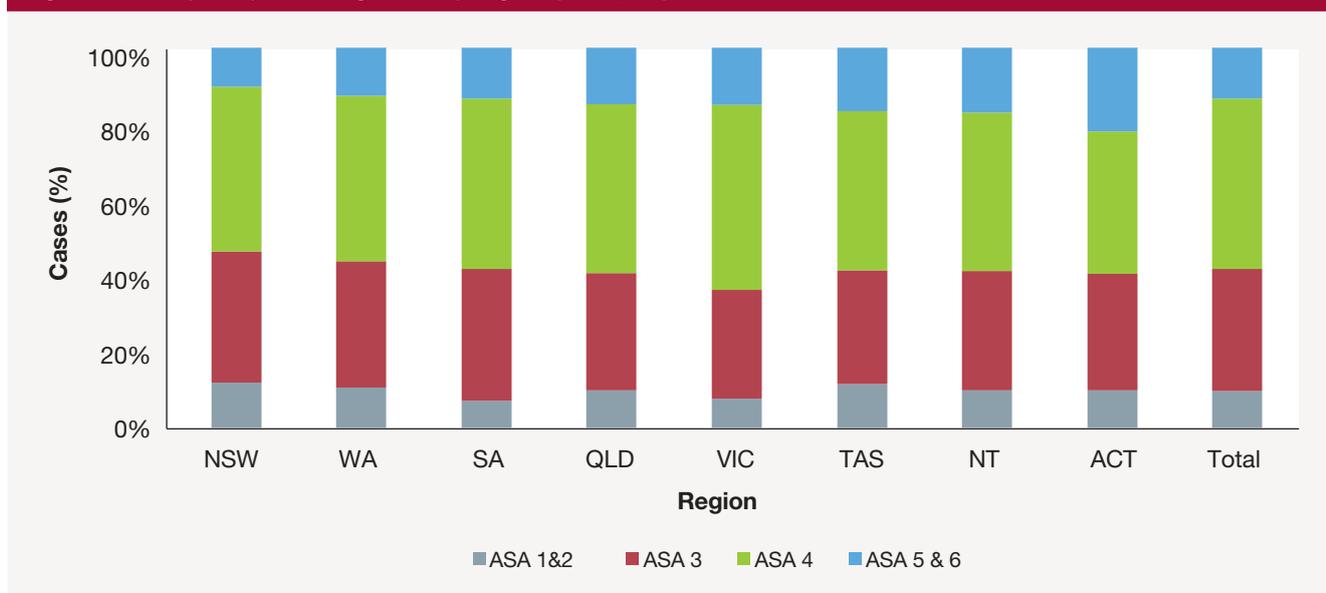
#### 3.3.1 American Society of Anesthesiologists grade

The American Society of Anesthesiologists (ASA) grade is an international measure of patient risk used by anaesthetists.<sup>(2)</sup> The ASA grades and their characteristics are:

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

The frequency of ASA grades according to region, year, specialty and admission status are provided in Figures 13, 14, 15 and 16 respectively.

**Figure 13: Frequency of ASA grades by region (n=31,205)**



Data not available: n=2,245 (7%).

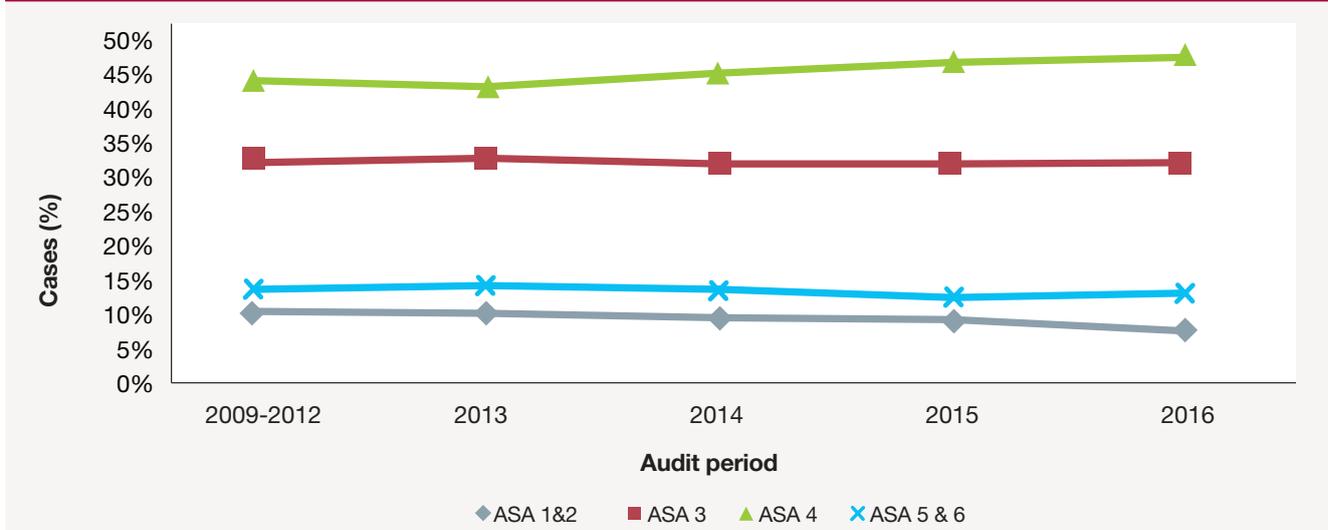
ASA: American Society of Anesthesiologists.

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

#### Comment:

- 90.3% (28,165/31,205) of patients had an ASA grade greater than or equal to 3. This indicates that a moderate to severe degree of systemic disease was present in the majority of patients at the time of treatment.
- The risk and physical status as indicated by the ASA grade was similar in all regions.

Figure 14: Distribution of ASA grades by year (n=31,205)

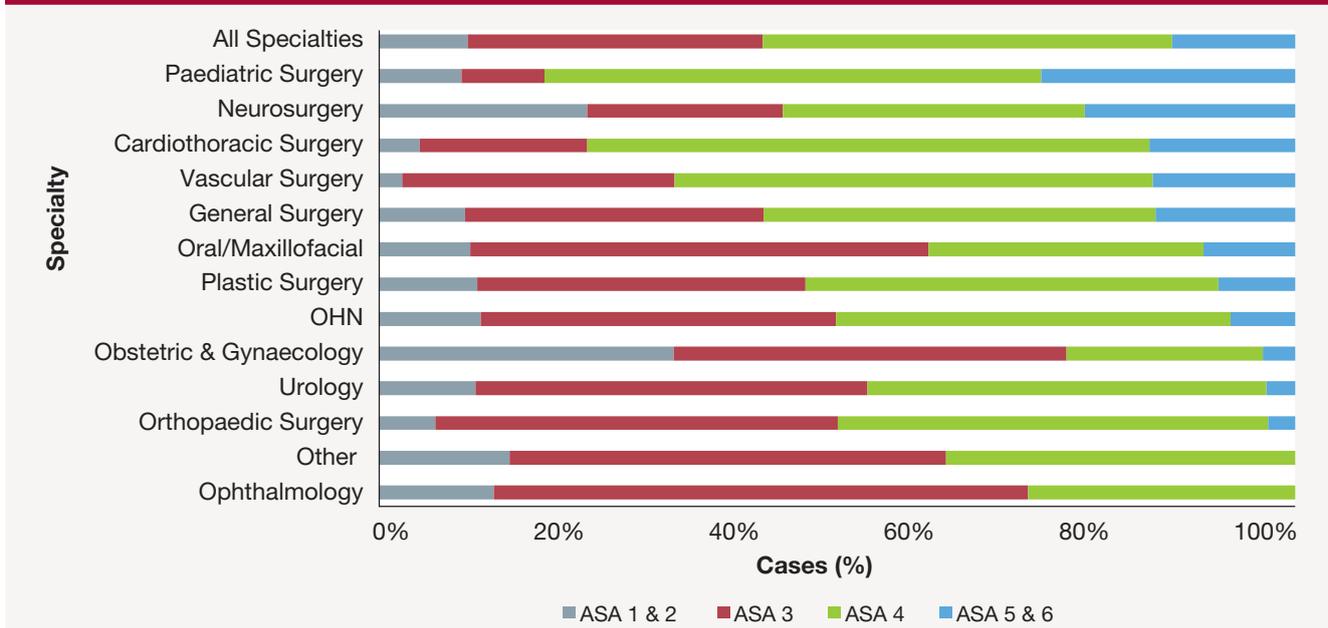


Data not available: n=2,245 (7%).  
ASA: American Society of Anesthesiologists.

**Comment:**

- There were no major differences across the five audit periods. The percentage of patients with an ASA grade greater than or equal to 3 was similar across the years.

Figure 15: Frequency of ASA grades by surgical specialty (n=31,205)

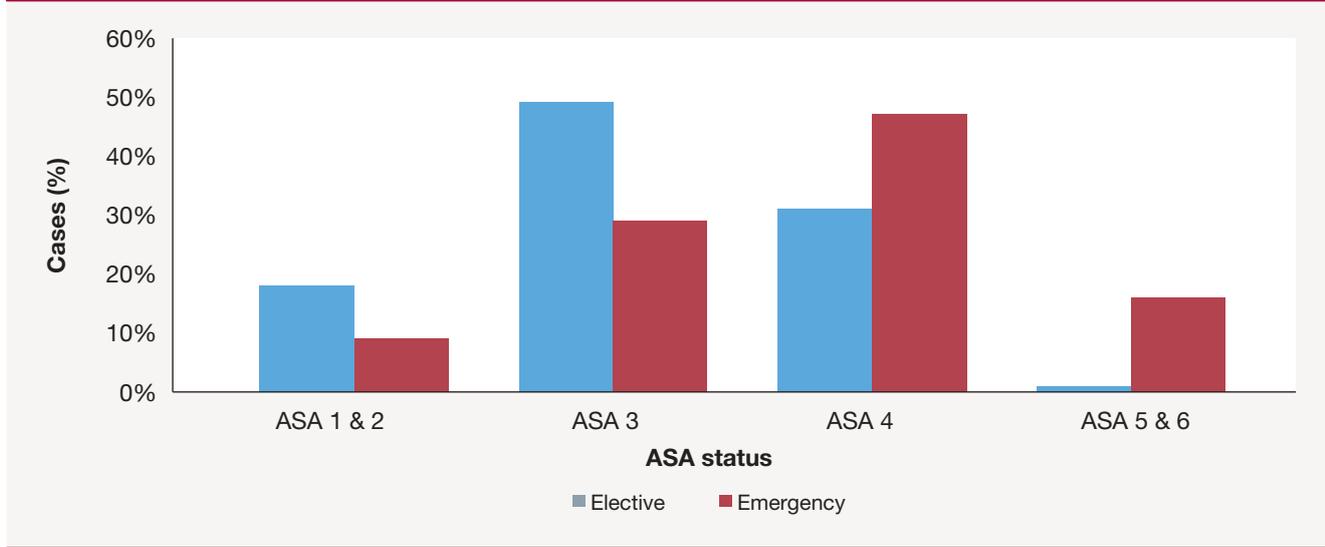


Data not available: n=2,245 (7%).  
Other specialties listed by the treating surgeon include Anaesthesia, Intensive Care Unit, Oncology, Thoracic medicine and Trauma. Includes cases in which multiple specialties were involved in a single case.  
ASA: American Society of Anesthesiologists; OHN: Otolaryngology, Head and Neck Surgery.

**Comment:**

- There was some variation in ASA grades, reflecting the casemix of the different specialties. The larger number of ASA 1 and 2 cases seen in Neurosurgery is a reflection of the population of young patients with head injuries, while in Gynaecology the patients generally tend to be the younger age group.

**Figure 16: Frequency of ASA grades by admission status (n=30,836)**



Data not available: n=2,614 (8%).  
 ASA: American Society of Anesthesiologists.

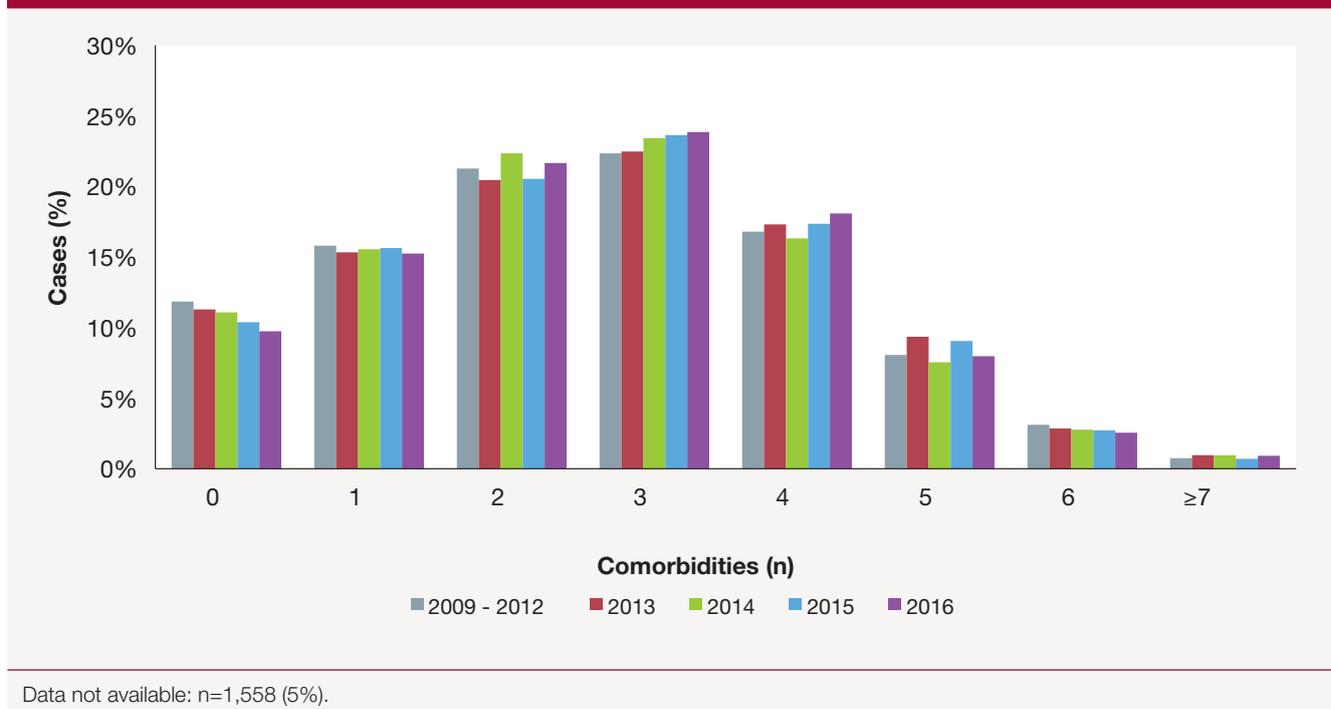
**Comment:**

- The majority of emergency (91.6%; 24,081/26,284) and elective (82.3%; 3,745/4,552) patients were described as having an ASA grade greater than or equal to 3. For elective patients this is a decrease from the previous report, in which 85% had an ASA score greater than or equal to 3 (data not shown).<sup>1</sup>

### 3.3.2 Comorbidity

Surgeons were asked to record all known comorbidities (coexisting medical conditions) in addition to the primary medical (presenting) problem. The number of comorbidities reported for individual patients by audit period is provided in Figure 17. According to the literature, comorbidities are a stronger predictor of mortality than the type of surgery.<sup>(3)</sup>

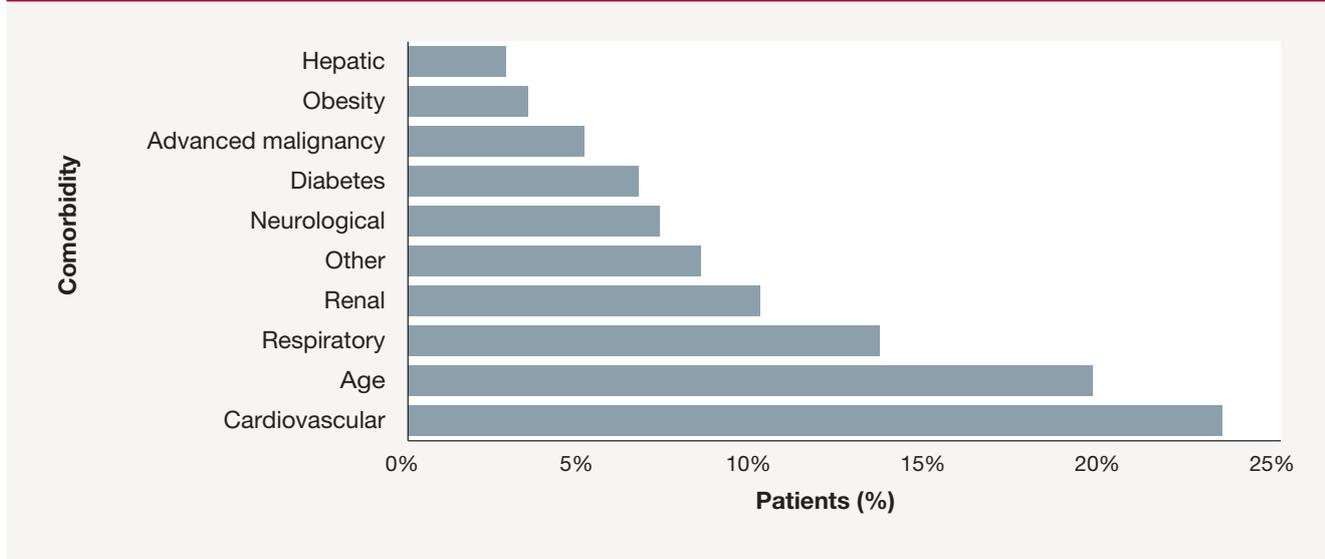
**Figure 17: Number of comorbidities in individual patients across audit years (n=31,862)**



#### Comment:

- One or more comorbidities were reported in 90% (28,701/31,862) of audited cases between 2009 and 2016.
- 74.3% (23,677/31,862) of patients had at least two comorbidities, emphasising the high-risk profile of this group.
- Information on the specific types of comorbidities present in audit patients is provided in Figure 18.
- The pattern of comorbidities was reasonably consistent across the audit periods.

Figure 18: Frequency of specific comorbidities (n=84,052 comorbidities in 31,862 patients)



Data not available: n=1,558 (5%).

\*Other covered a wide range of comorbidities, including: 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.

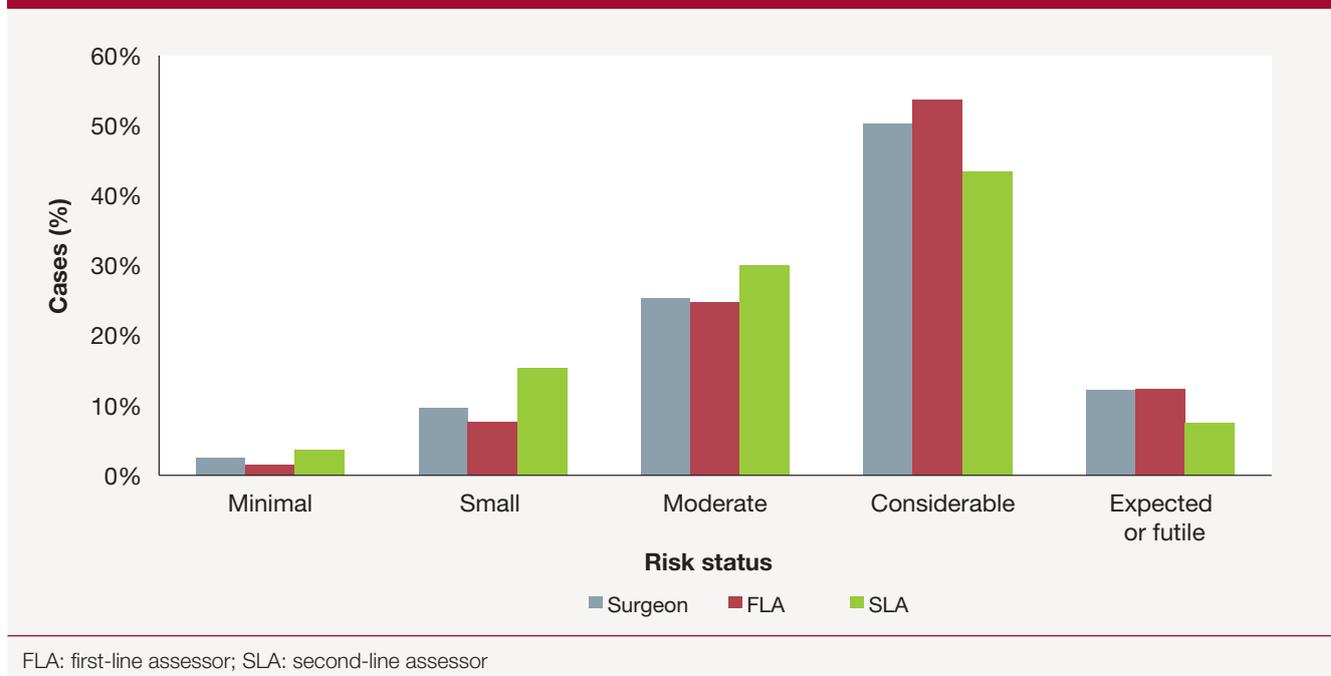
**Comment:**

- The most common comorbidities (cardiovascular, advanced age and respiratory failure) had a similar incidence in both male and female patients (data not shown).
- The number of cases involving obesity has increased. Advanced malignancy and obesity has overtaken hepatic in terms of frequency since the last report. <sup>(1)</sup>
- There were no major differences in the distribution of comorbidities between the five audit periods (data not shown).

### 3.3.3 Surgeon perception of risk status

The treating surgeon and assessors were asked to record the patient's perceived risk of death at the time of treatment (see Figure 19).

**Figure 19: Risk of death as perceived by the treating surgeon and assessors**



#### Comment:

- The perceived risk of death, as reported by surgeons, was considerable or expected in 62.5% (15,987/25,581) of cases, and small or minimal in 12.2% of cases (3,116/25,581). This is further evidence of the high-risk profile of this patient group suggested by the mean age, ASA score and associated comorbidity.
- There was a reasonable correlation between the treating surgeon, the first-line assessor and the second-line assessor regarding the risk of death.
- The patient's risk of death was perceived to be considerable or expected by the surgeon in 62.5% (15,987/25,581) of cases; by the first-line assessor in 66% of cases (16,507/25,023); and by the second-line assessor in 50.8% of cases (1,915/3,770).

## 4 RISK MANAGEMENT STRATEGIES

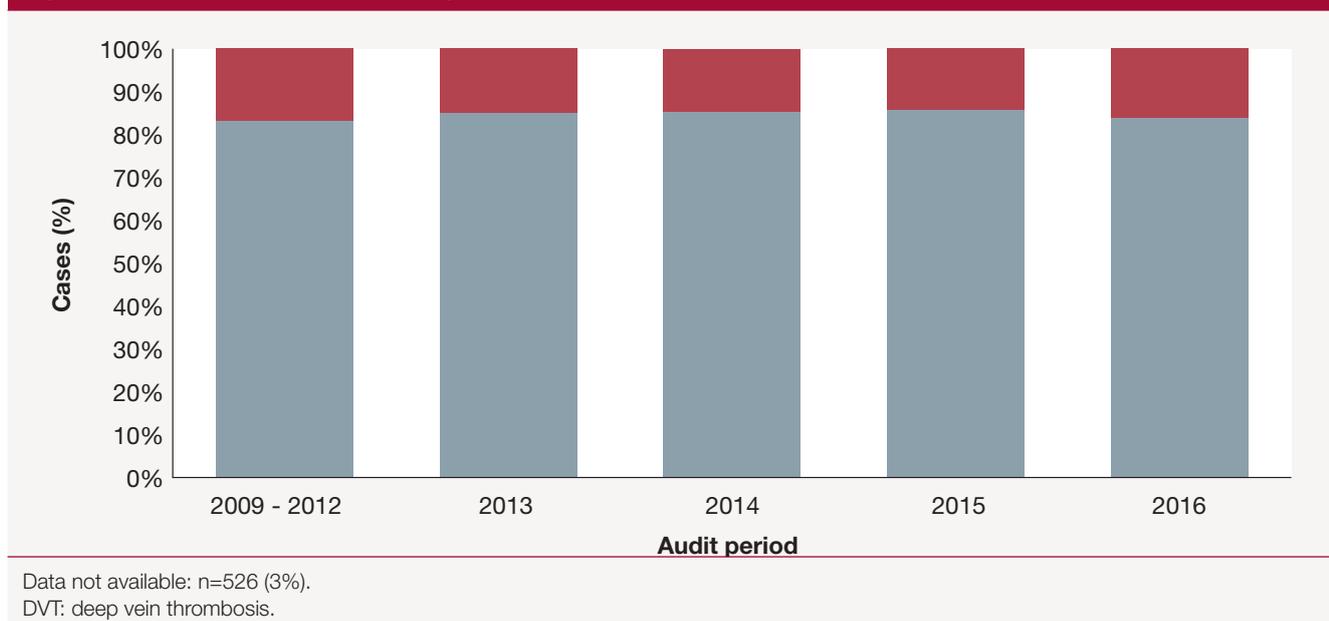
### KEY POINTS

- ▶ The use of deep vein thrombosis (DVT) prophylaxis was recorded for 84.3% (21,223/25,183) of cases in which patients underwent a surgical procedure.
- ▶ In only 2.3% (654/27,982) of cases did the assessor conclude that the DVT prophylaxis management was not appropriate.
- ▶ In the majority of instances, patients who required critical care support did receive it. The review process suggested that 5.3% (429/8,115) of patients who did not receive treatment in a critical care unit might have benefited from it.
- ▶ Fluid balance in the surgical patient is an ongoing challenge and 8.1% of patients were perceived to have had poor management of their fluid balance.

### 4.1 Prophylaxis for DVT

The treating surgeon was asked to record whether DVT prophylaxis was given and if it was, the type of prophylaxis used (see Figures 20 and 21). If DVT prophylaxis was not given, the treating surgeon was asked to record why it was withheld. Assessors were asked to review the appropriateness of the use, or non-use, of DVT prophylaxis.

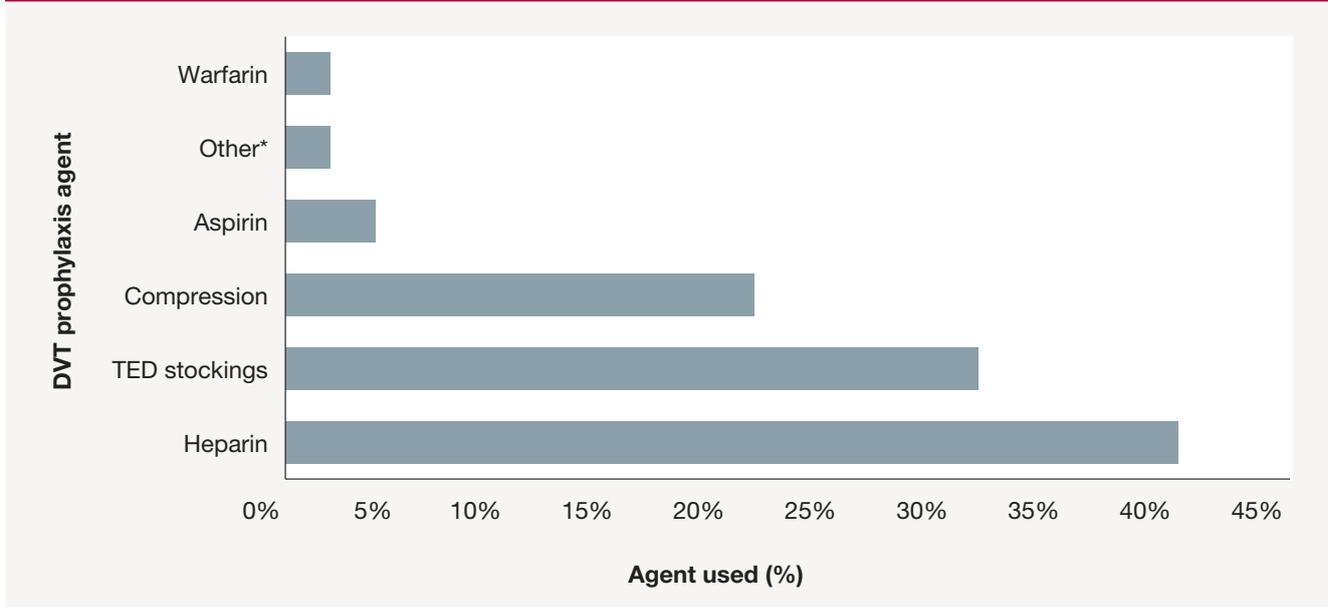
Figure 20: DVT prophylaxis use during the audit period (n=25,183)



### Comment:

- Over the entire audit period, DVT prophylaxis was used in 84.3% (21,223/25,183) of cases that underwent an operation. Usage has remained steady across the audit periods.

**Figure 21: Type of DVT prophylaxis**



Data not available: n=915 (4%).

\*Includes Clexane, Clopidogrel, Danaparoid, early mobilisation, Fragmin, inferior vena cava filter and Lepirudin.

DVT: deep vein thrombosis; TED: thromboembolic deterrent

**Comment:**

- The most frequently used prophylaxis agents were heparin (40%) and thromboembolic deterrent (TED) stockings (31%).

The distribution of DVT prophylaxis use by region is shown in Table 4.

**Table 4: Distribution of DVT prophylaxis use by region (n=39,478 instances in 21,223 patients)**

DVT prophylaxis agent	SA	QLD	WA	TAS	VIC	ACT	NT	NSW
Heparin (any form)	46% (1,776/3,883)	36% (3,315/9,265)	43% (1,483/3,458)	39% (439/1,118)	45% (4,095/9,203)	43% (307/717)	40% (132/330)	38% (4,412/11,504)
Warfarin	2% (83/3,883)	2% (166/9,265)	1% (44/3,458)	1% (10/1,118)	1% (131/9,203)	2% (14/717)	2% (5/330)	2% (214/11,504)
Aspirin	4% (159/3,883)	5% (470/9,265)	4% (135/3,458)	5% (50/1,118)	4% (381/9,203)	3% (23/717)	5% (16/330)	3% (331/11,504)
Sequential compression device	18% (714/3,883)	23% (2,106/9,265)	18% (625/3,458)	25% (279/1,118)	18% (1,656/9,203)	23% (164/717)	19% (64/330)	24% (2,744/11,504)
TED stockings	27% (1,054/3,883)	32% (3,000/9,265)	32% (1,098/3,458)	28% (313/1,118)	29% (2,653/9,203)	26% (187/717)	32% (105/330)	32% (3,654/11,504)
Other*	3% (97/3,883)	2% (208/9,265)	2% (73/3,458)	2% (27/1,118)	3% (287/9,203)	3% (22/717)	2% (8/330)	1% (149/11,504)

Data not available: n=915 (4%).

\*Includes Clexane, Clopidogrel, Danaparoid, Enocaprin, Enoxaparin, early mobilisation, Fragmin, inferior vena cava filter, Lepirudin and Plavix.

DVT: deep vein thrombosis; TED: thromboembolic deterrent.

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

**Comment:**

- DVT prophylaxis use varied across the regions, ranging from 77% of cases to 89% of cases (data not shown).
- There were variations in the use of certain forms of prophylaxis across the regions. Sequential compression device and heparin had the greatest proportionate difference.

**Figure 22: Stated reasons for non-use of DVT prophylaxis (n=3,960)**



Data not available: n=550 (14%).

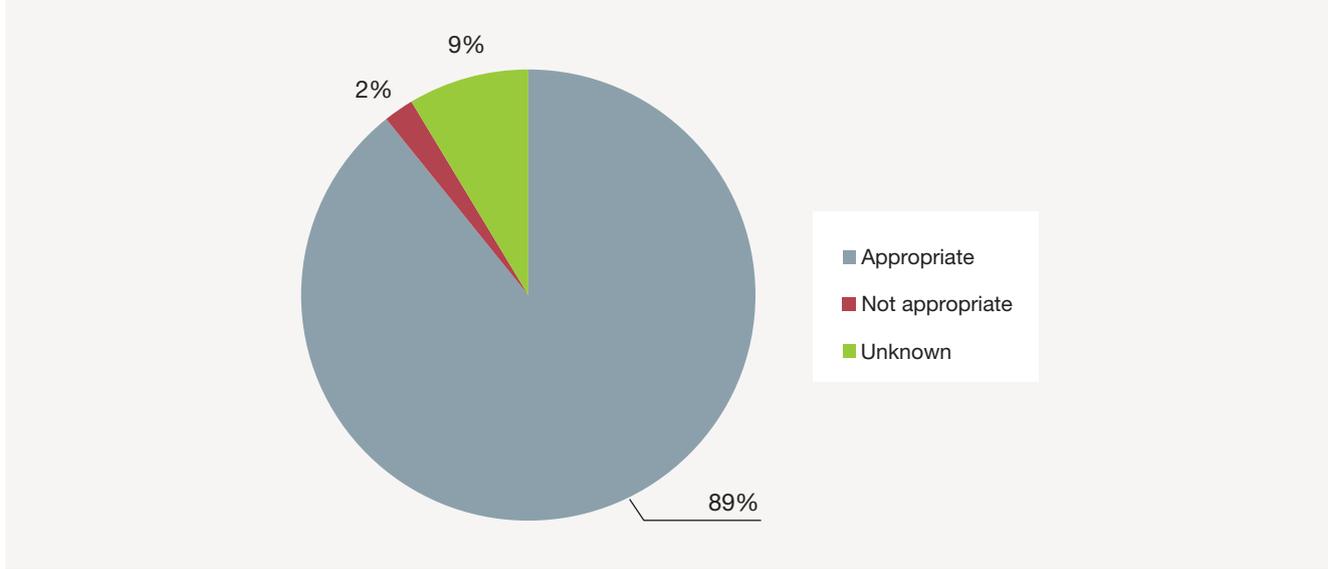
DVT: deep vein thrombosis.

**Comment:**

- Over the entire audit period, non-use of DVT prophylaxis was due to error or omission in only 2.5% (99/3,960) of cases. In the majority of instances prophylaxis was withheld for clinical reasons.

The assessors' perception of the appropriateness of DVT prophylaxis management is shown in Figure 23.

**Figure 23: Appropriateness of DVT prophylaxis management as perceived by first- and second-line assessors (n=27,982)**



Data not available: n=1,789 (6%).  
 DVT: deep vein thrombosis

**Comment:**

- Assessors concluded that DVT prophylaxis usage for cases in which the patient underwent a surgical procedure was not appropriate in 2.3% (654/27,982) of cases. The assessors also stated that appropriateness was unknown in 9% (2,528/27,982) of cases.

## **Case study #1: Difficult decision regarding DVT prophylaxis in a patient suffering from symptomatic rectal carcinoma**

### **Summary:**

An elderly man presented with blood loss per rectum, recurrent diarrhoea, faecal incontinence and general deterioration. These symptoms occurred over a 6-month period and were associated with a 40 kg weight loss. The referring general practitioner (GP) had requested a computed tomography (CT) scan that identified a circumferential tumour at the junction of the middle and lower third of the rectum extending to the internal sphincter. There did not appear to be any distant metastases. The diagnosis was confirmed at colonoscopy. The surgery was planned to take place 8 weeks after completing chemo-radiotherapy.

Concerns were expressed by the oncologist about the patient's comorbidities and the patient's cachectic appearance. The patient was not fit, being a heavy smoker with chronic obstructive airways disease and emphysema. Bilateral pleural effusions and ascites were noted on the initial CT scan. Respiratory function studies were, however, surprisingly satisfactory. The patient was known to have significant coronary artery disease with a history of a previous myocardial infarction, aortic regurgitation and a left ventricular ejection fraction of 55%. A preoperative cardiological assessment was undertaken and this did not indicate any requirement for interventional measures before the surgery.

Chemo-radiotherapy was completed and the patient was admitted for planned surgery. Immediately before admission the patient developed multiple pulmonary emboli. An intravenous catheter filter was inserted preoperatively and full prophylaxis for prevention of thromboembolic disease was commenced.

The operation to resect the rectum was performed the following day. Some bleeding from the prostate was noted during surgery. The anaesthetist was also concerned about electrocardiogram changes that suggested an intraoperative inferior ST-elevation myocardial infarction and this was associated with a rise in serum troponins. Because of these problems, the patient was transferred to the intensive care unit (ICU). In view of the surgeon's concern regarding bleeding from the pelvis, and a decision by the anaesthetist to position an epidural catheter, the anticoagulation was discontinued for 24 hours post-surgery.

The patient continued to experience chest pain and was transferred from the ICU to the Cardiology Unit where an angiogram was planned once fully re-anticoagulated. The patient became increasingly short of breath and a CT pulmonary angiography showed multiple pulmonary emboli despite the intravenous catheter filter. Clexane therapy was added. Nine days after his operation he had a cardiac arrest. Attempts at resuscitation were unsuccessful.

### **Clinical lessons:**

The overall management of this patient followed a predetermined management plan. The first-line assessor did not believe the decision to undertake radical surgery was a contentious issue. Untreated, or simply palliated, rectal cancer has a prolonged and miserable clinical course and, given the presenting symptoms, the planned treatment was entirely reasonable. One would, however, classify the risk of death from surgery as 'considerable'.

The only other issue concerns the lack of anticoagulation for the 24 hours after the operation, given the history of recurrent pulmonary emboli. From the case notes, it is apparent that this was a decision taken by senior clinicians concerned about bleeding following surgery and the advantages of being able to insert an epidural catheter. There was an intravenous catheter filter in position.

To conclude that although there was a considerable risk attached to radical treatment for this patient, all steps were taken in a planned and reasoned fashion. There were no significant adverse factors in the management of this very difficult clinical situation.

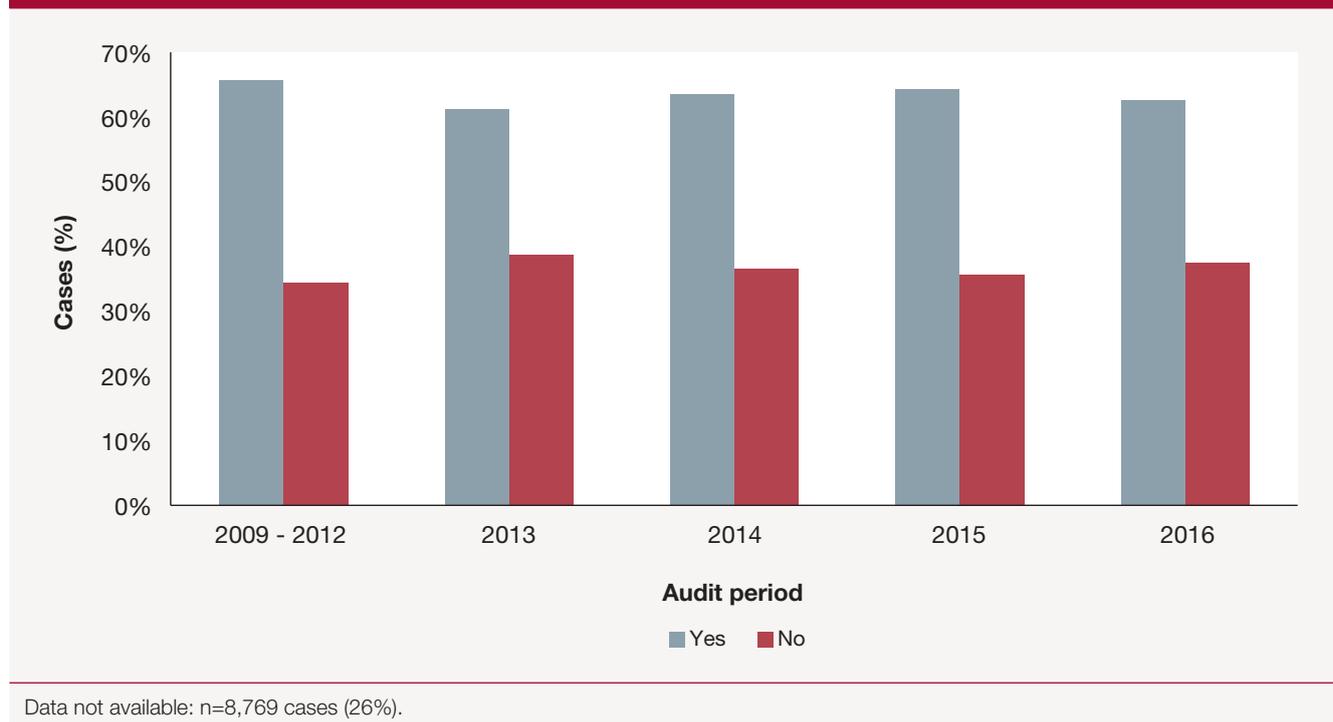
## 4.2 Provision of critical care support to patients

The treating surgeon was asked to record whether or not the patient received critical care support in an intensive care or high dependency unit before or after surgery (see Figure 24).

The first- and second-line assessors also review the appropriateness of the use, or non-use, of critical care support. It is recognised that this is a subjective assessment of needs and potential benefit.

The SCF was revised in early 2014 to collect data on the reasons why patients did not receive critical care support and to rectify the lack of data in this section.

**Figure 24: Provision of critical care support during audit period as reported by the treating surgeon (n=24,681)**



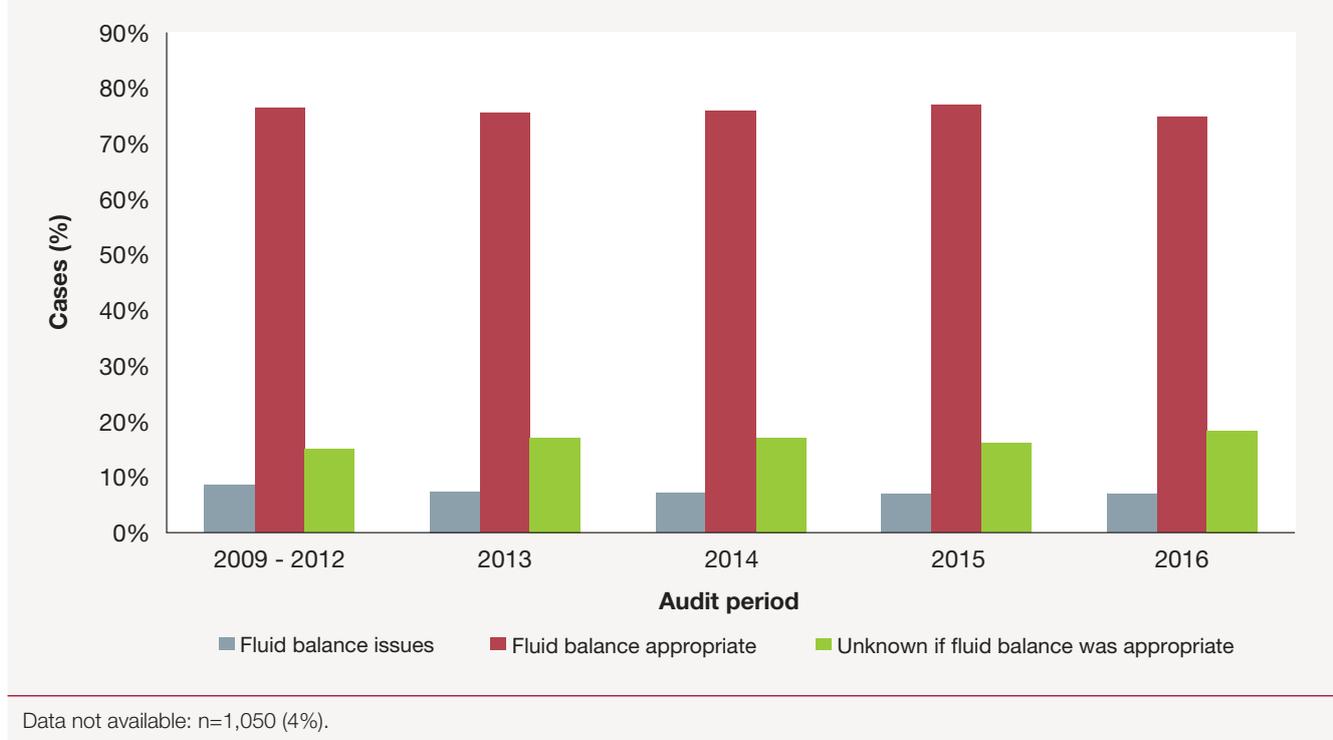
### Comment:

- Over the entire audit period, 64% (15,800/24,681) of patients received critical care support.
- It should be noted that a patient not receiving critical care support does not necessarily indicate a lack of critical care facilities.
- The assessors perceived that 5.3% (429/8,115) of patients who did not receive critical care support might have benefited from it (data not shown).
- Between 2009 and 2016 there has been a high proportion of unavailable data (26%) regarding the provision of critical care support.

### 4.3 Fluid management

This section looks at the appropriateness of fluid management in the audited cases.

**Figure 25: Appropriateness of fluid management as viewed by assessors (n=24,075)**



#### Comment:

- In 7.6% (1,838/24,075) of cases the assessors felt that there was an issue with fluid balance. In a further 18% (4,337/24,075) of cases the assessors indicated that the evidence provided was inadequate to support a conclusion regarding fluid balance.

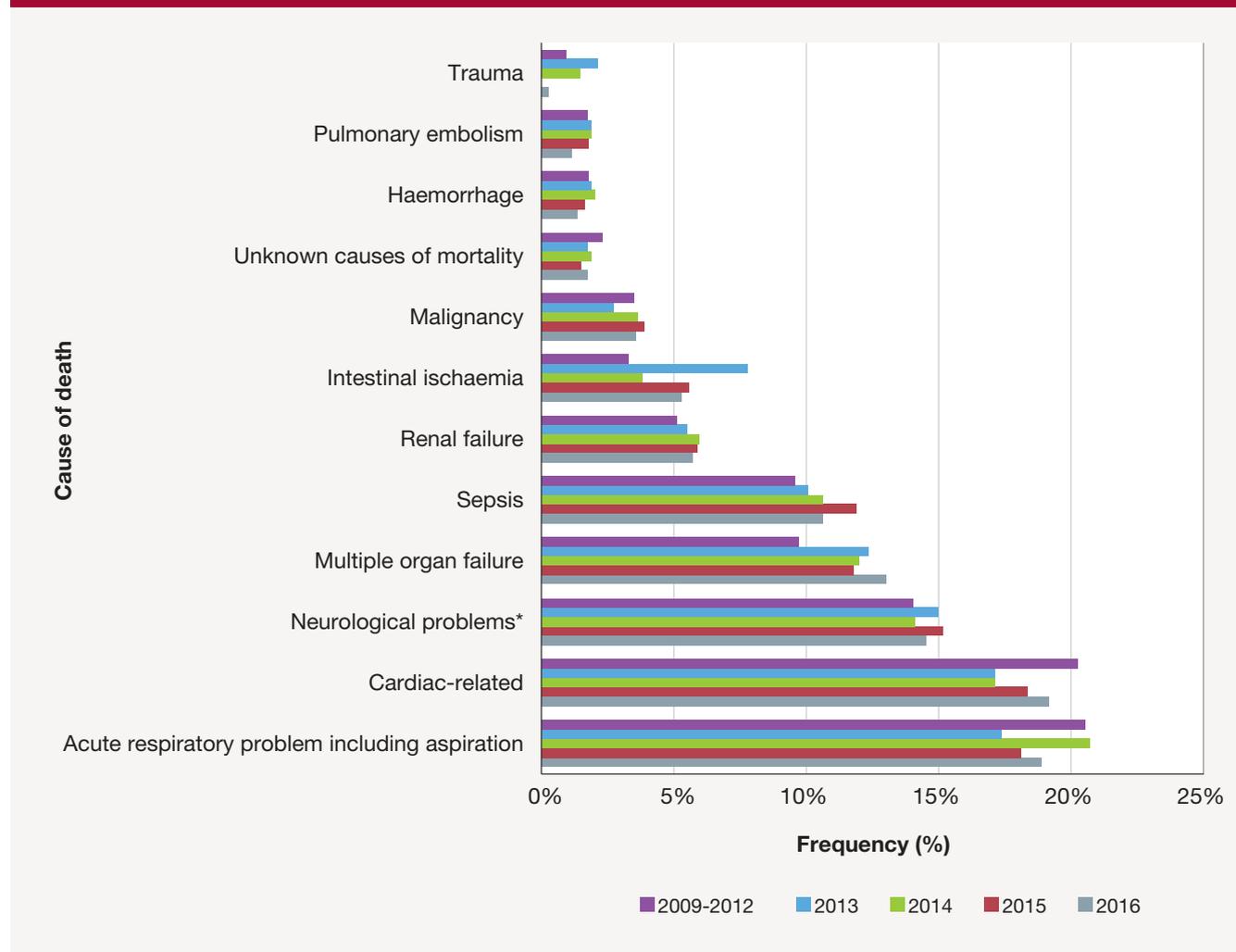
## 5 CAUSE OF DEATH

### 5.1 Most frequent causes of death

#### KEY POINTS

- ▶ The most frequent causes of death were acute respiratory problems, cardiac-related issues, neurological problems and multiple organ failure.
- ▶ Causes of death were consistent over the entire audit period.

Figure 26: Top 12 causes of death (n=38,629 causes of death recorded for 33,450 patients)



Data not available: n=347 patients (1%).

\*Neurological problems include diffuse brain injury, head injury, intracerebral haemorrhage, subarachnoid haemorrhage and subdural haematoma.

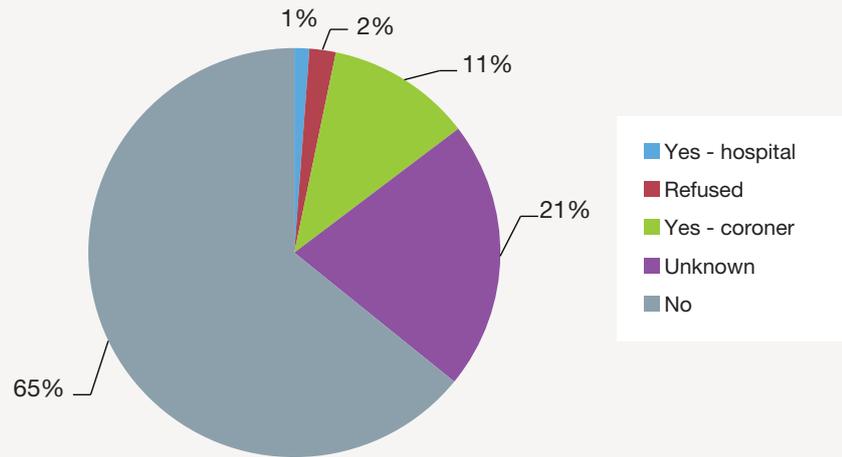
#### Comment:

- The frequency of cases relating to acute respiratory problems and cardiac-related issues has remained high across the reporting periods.<sup>(1)</sup>

## 5.2 Establishing cause of death

The cause of death recorded by the treating surgeon is based on the clinical course of the patient and any relevant supporting evidence from investigations. Where doubt exists around the circumstances leading to death, the case may be referred to the coroner. In other instances, where the cause of death is not clear, a postmortem examination may be requested. This latter method of confirming the cause of death is being requested with decreasing frequency (data not shown). An overview of postmortems performed is shown in Figure 27 and Table 5.

Figure 27: Overview of postmortems performed (n=32,607)



Data not available: n=843 cases (3%).

**Table 5: Overview of postmortems performed by region (n=32,607)**

Postmortem status	SA	QLD	WA	TAS	VIC	ACT	NT	NSW
Yes - hospital	<1% (13/3,885)	1% (103/7,180)	<1% (35/7,180)	2% (17/1,008)	1% (67/7,551)	2% (9/551)	2% (7/365)	1% (132/8,837)
Yes - coroner	13% (497/3,885)	8% (564/7,180)	5% (373/7,180)	10% (101/1,008)	17% (1,301/7,551)	28% (152/551)	14% (51/365)	8% (681/8,837)
Refused	1% (21/3,885)	2% (134/7,180)	1% (68/7,180)	2% (19/1,008)	3% (221/7,551)	2% (12/551)	1% (4/365)	2% (194/8,837)
Unknown	29% (1,115/3,885)	18% (1,257/7,180)	9% (637/7,180)	22% (217/1,008)	22% (1,640/7,551)	26% (146/551)	16% (60/365)	21% (1,844/8,837)
No	58% (2,239/3,885)	71% (5,122/7,180)	29% (2117/7,180)	65% (654/1,008)	57% (4,322/7,551)	42% (232/551)	67% (243/365)	68% (5,986/8,837)

Data not available: n=843 cases (3%).

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

**Comment:**

- The majority of postmortems were coronial. The need for coronial input varied amongst regions, with the highest percentage of cases recorded in the Australian Capital Territory.
- Across all regions, a coronial postmortem was reported to have been performed in only 12.6% (4,103/32,607) of cases. In some of the regions the numbers were low.
- In 87.4% (28,504/32,607) of cases a postmortem was not performed, it was refused, or it was unknown whether one was conducted.
- The low rate of postmortems limits confirmation of the cause of death.
- There were no significant changes in trends across the audit periods (data not shown).

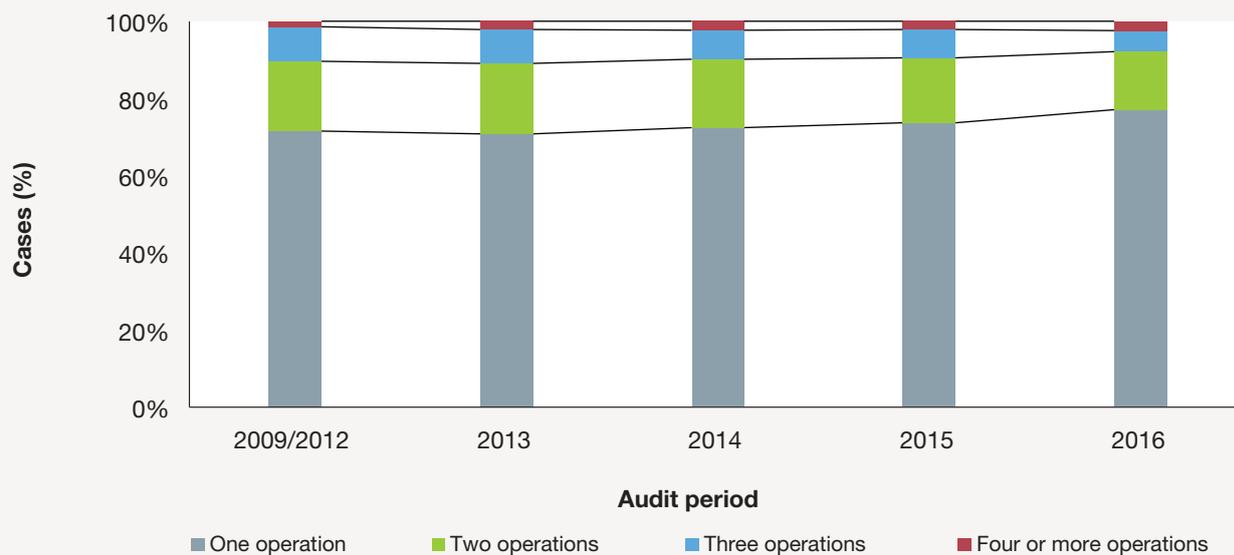
## 6 PROFILE OF OPERATIVE INTERVENTION

### KEY POINTS

- ▶ A surgical procedure was performed on 79.0% (26,098/33,034) of patients. More than one visit to the operating room was required for 27.5% (7,177/26,098) of patients during their hospital stay.
- ▶ A consultant surgeon made the decision to operate in 87.9% (32,369/36,842) of instances and performed 62.6% (23,070/36,842) of the operations.
- ▶ The rate of subsequent (unplanned) returns to theatre was 16.0% (4,026/25,196), with some patients requiring multiple episodes of surgery.
- ▶ The most common postoperative complications were postoperative bleeding, procedure-related sepsis and tissue ischaemia.

### 6.1 Operative rate

Figure 28: Frequency of patients undergoing one or more operations by audit period (n=33,034)



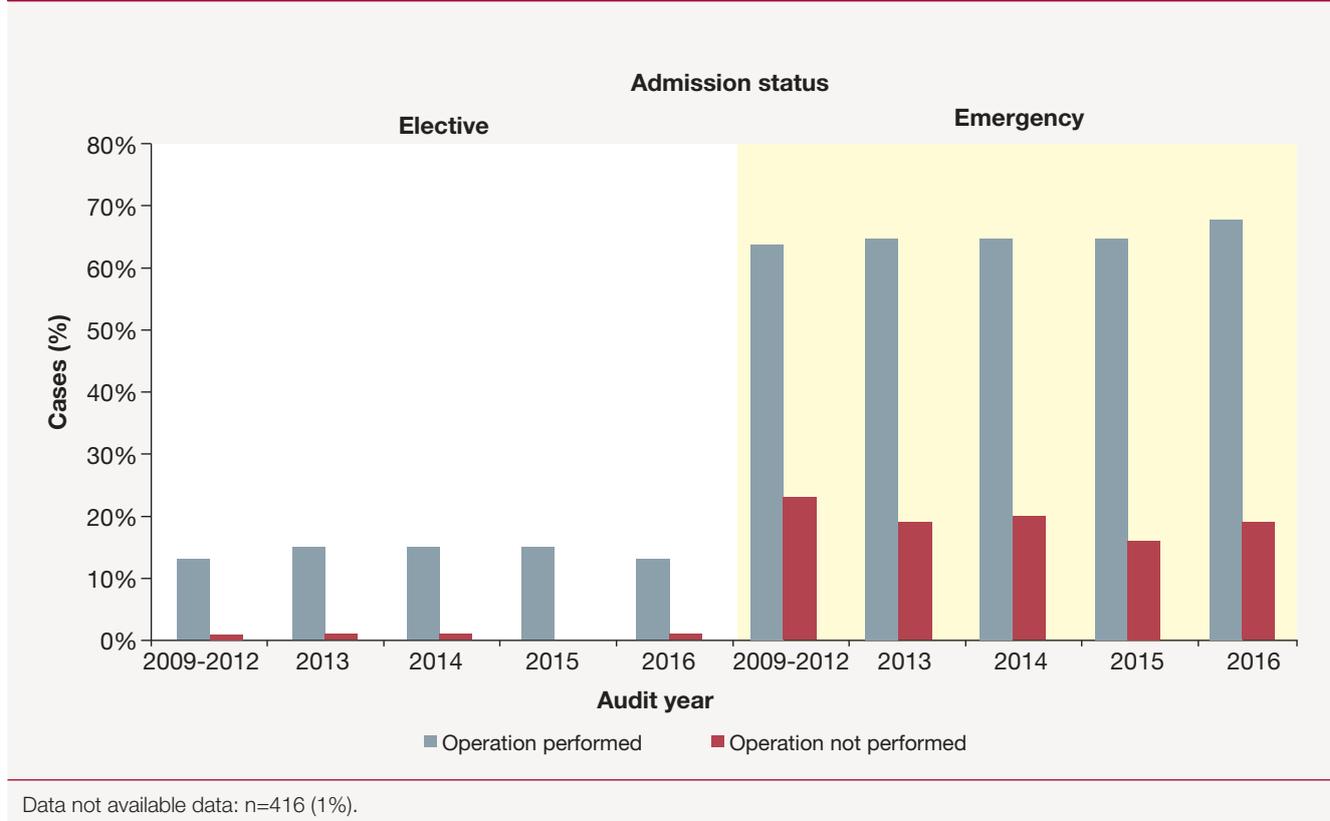
Data not available: n=416 cases (1%).

### Comment:

- 79.0% (26,098/33,034) of patients underwent an episode of surgery either during their last admission or within 30 days prior to death.
- 21.0% (6,936/33,034) of patients had no surgery during their final admission.
- A total of 36,842 operative episodes were undertaken on the 26,098 patients who had surgery, reflecting the fact that an individual patient can have more than one episode of surgery during their admission.
- 72.5% (18,921/26,098) of patients had just one operation.
- 27.5% (7,177/26,098) of patients had more than one operation.
- There has been relatively little change in the frequency of multiple operations between the 2009 and 2016 reporting periods.

Operative and non-operative cases by admission status and year are shown in Figure 29.

Figure 29: Operative and non-operative cases by admission status (n=32,605 patients)



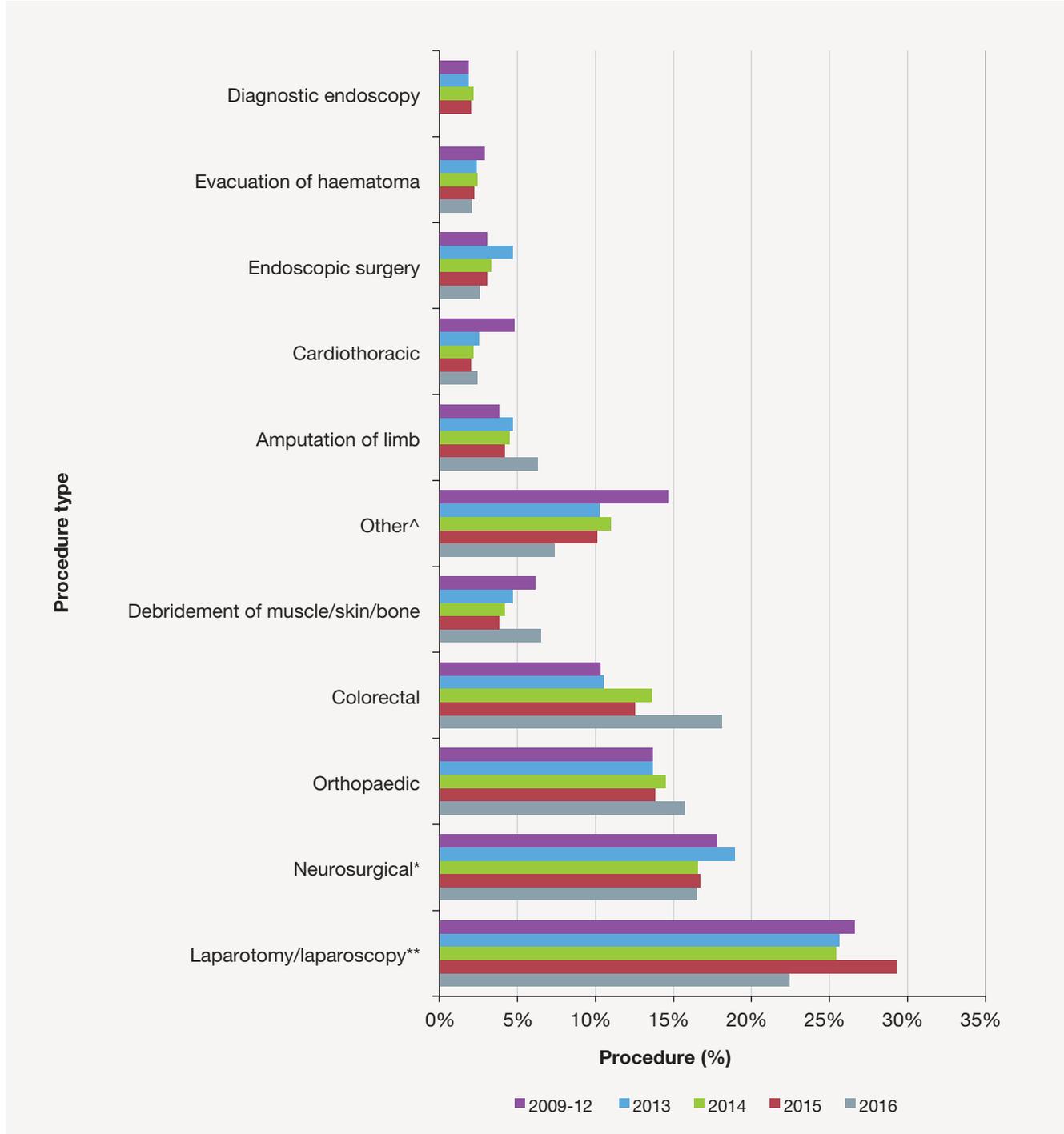
**Comment:**

- Across the reporting periods, 5.2% (246/4,690) of elective admission patients and 23.7% (6,612/27,915) of emergency admission patients did not undergo an operation prior to death. The decision not to operate was generally an active decision to palliate an irretrievable situation.

## 6.2 Frequency of operative procedures

The frequency of operative procedures is shown in Figure 30. A patient can undergo multiple procedures during the same admission and during the same surgical episode.

**Figure 30: Types of procedure, where the number of procedures >10 (n=36,842 procedures in 26,098 patients)**



^Includes dressing of wound, hernia repair, peripheral vascular procedure, haemorrhage control by packing, total cholecystectomy, tracheostomy, fasciotomy, splenectomy, open embolectomy of femoral artery, closure of perforated duodenal ulcer, operation abandoned, pancreaticoduodenectomy and nephrectomy.

\*Includes clipping of aneurysm of cerebral artery, craniotomy (evacuation of non-trauma injuries, tumour resection and excision or drainage of abscess) and posterior fossa craniotomy for infarct.

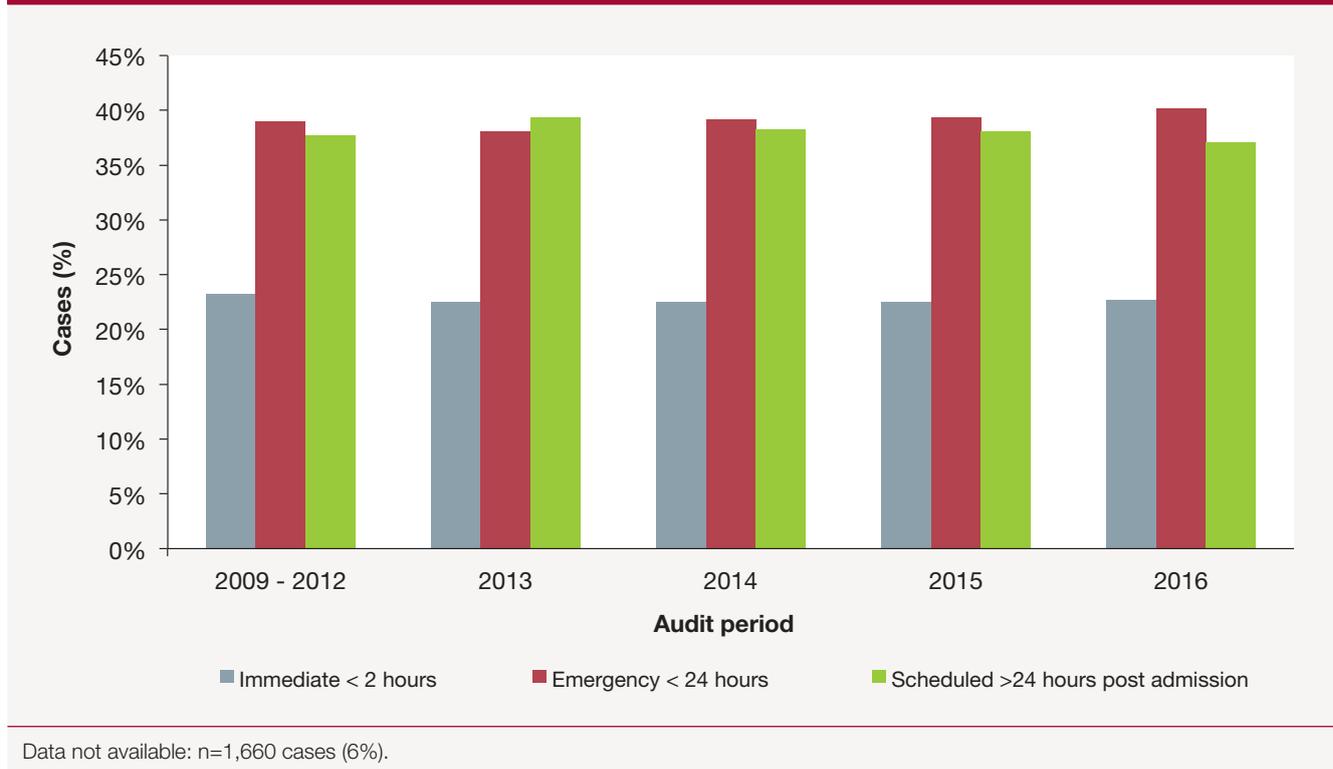
\*\*Includes all abdominal procedures not specified in other sections (e.g. colorectal procedures). Only the top 10 procedures are listed in the figure.

**Comment:**

- The laparotomy/laparoscopy operation group was likely to include multiple procedures. Neurosurgical procedures were the other operative category with a high number of recorded procedures.

**6.3 Timing of emergency episodes**

**Figure 31: Timing of emergency surgical episodes (n=25,687)**



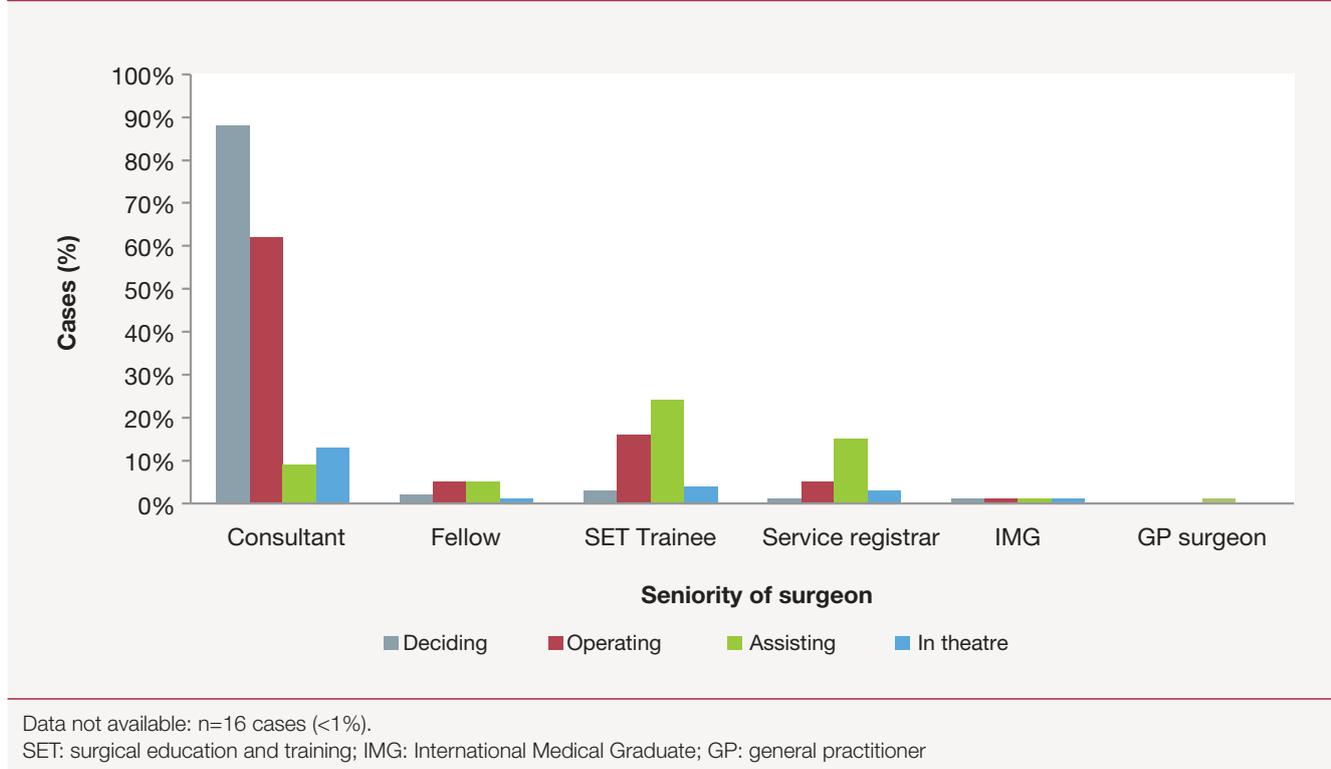
**Comment:**

- The timing and urgency of operations has been relatively consistent across the audit periods.
- The urgency (time criticality) of a patient's condition predicts the timing of any surgery.
- 61.9% (15,911/25,687) of patients were scheduled or deemed necessary for immediate or emergency surgery.
- 38.1% (9,776/25,687) of emergency admissions to a surgical unit deemed necessary within 24 hours of admission.
- Across the reporting periods, the majority of emergency surgery was performed in the public sector (data not shown).

### 6.3.1 Seniority of surgeon performing surgery

The surgeon completing the SCF was asked to record the seniority of the surgeon who made the clinical decision to operate as well as the seniority of the surgeon who performed the surgery (see Figure 32).

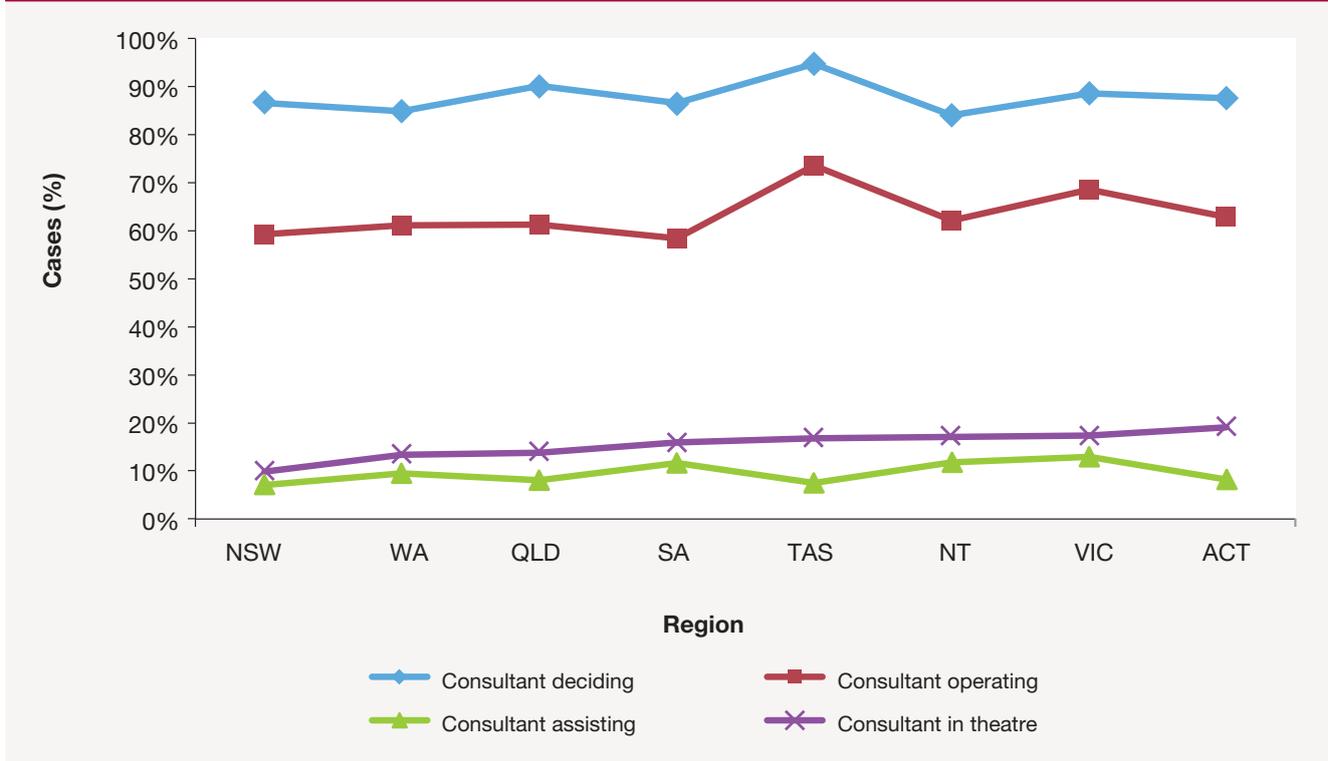
**Figure 32: Seniority of the surgeon making the decision to operate and performing the surgery (n=36,842 operations in 26,098 patients)**



#### Comment:

- The input from consultant surgeons was high. For 87.9% (32,369/36,842) of operations the consultant surgeon made the decision to operate.
- For each surgical episode there may have been more than one grade of surgeon deciding, operating, assisting, or in theatre.
- Between 2009 and 2016 there has been little change in the proportion of surgical episodes in which consultant surgeons made the decision to operate and performed the operation (data not shown).

**Figure 33: Consultant involvement in surgery by region (n=36,842 operations in 26,098 patients)**



Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

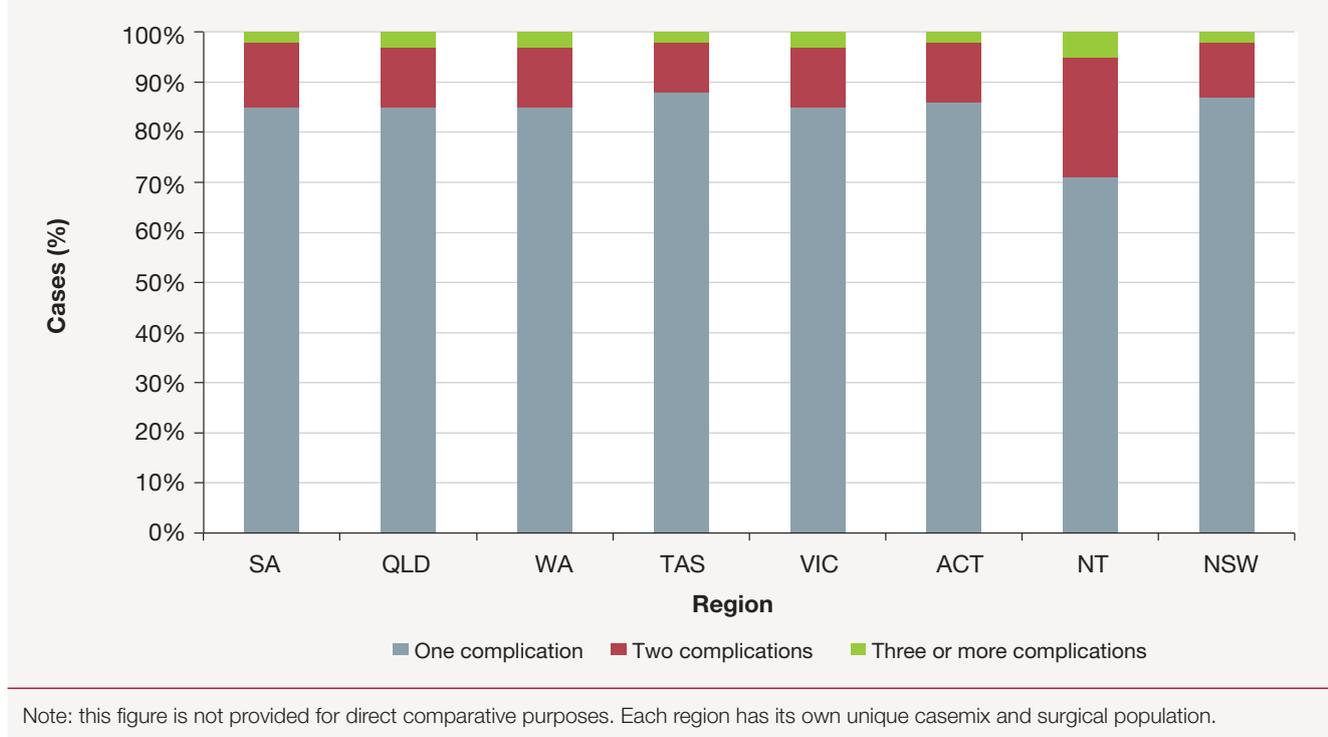
**Comment:**

- There was some variation across regions in terms of consultant involvement in surgery. These differences may reflect local approaches to surgical training and staffing levels.

## 6.4 Postoperative complications

The treating surgeon was asked to record any complications that occurred following a surgical procedure (Figure 34).

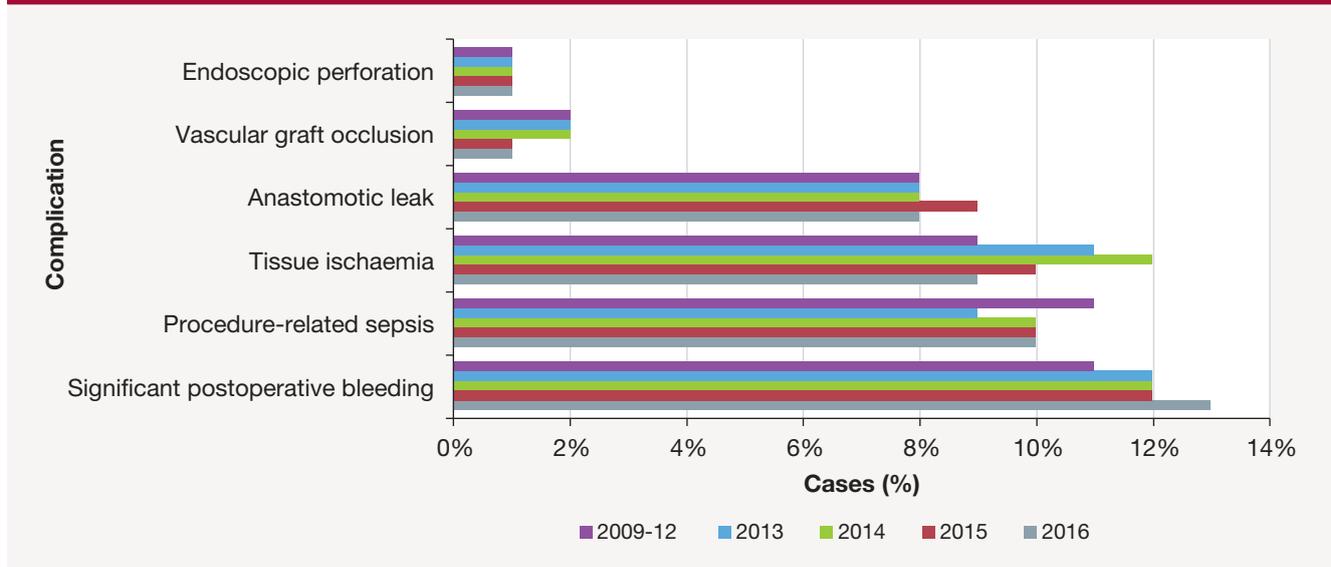
**Figure 34: Patients developing one or more postoperative complications (n=8,675 cases in 25,596 patients)**



### Comment:

- Postoperative complications were reported in 33.9% (8,675/25,596) of patients who underwent a surgical procedure.
- The significance of these complications in relation to the eventual outcome was unknown.
- Compared to other regions, there was some variation in the number of complications in the Northern Territory, where patients tend to present with a larger number of diabetic and hepatic diseases.

**Figure 35: Distribution of types of postoperative complications (n=6,603)**



**Comment:**

- Between 2009 and 2016 the most common postoperative complications were postoperative bleeding, procedure-related sepsis and tissue ischaemia.
- There has been a decrease in some of the more common postoperative complications between 2014 and 2016 (e.g. tissue ischaemia).

**6.5 Unplanned return to theatre**

The treating surgeon was asked to indicate whether there was an unplanned return to the operating theatre following the initial operative procedure (see Table 6).

Return to theatre status	2009-2012	2013	2014	2015	2016
No return to theatre	84% (9,409/11,252)	83% (2,870/3,453)	83% (3,159/3,792)	84% (3,386/4,034)	86% (2,291/2,665)
Return to theatre	16% (1,826/11,252)	17% (573/3,453)	16% (622/3,792)	16% (636/4,034)	14% (369/2,665)
Unknown	<1% (17/11,252)	<1% (10/3,453)	<1% (11/3,792)	<1% (12/4,034)	<1% (5/2,665)

Data not available: n=902 (3%).

**Comment:**

- 16.0% (4,026/25,196) of patients who underwent a surgical procedure had an unplanned return to theatre.
- The proportion of patients requiring a return to theatre was relatively unchanged across the audit periods.

## 6.6 Anaesthetic problems

A general anaesthetic in a critically ill elderly patient with comorbidities is a dangerous event, even more so in the emergency situation where there is not enough time to optimise the patient's state. Drug reactions, cardiac and respiratory complications may occur. According to the surgeons' assessments, only 7.5% (1,917/25,622) of cases were thought to have an anaesthetic component to the death.

- Anaesthesia was probably a significant factor in the death of 1.5% (373/25,622) of patients who had a surgical procedure. Anaesthesia was possibly involved in the outcome in 6% (1,544/25,622) of cases (data not shown).
- The proportion of deaths for which anaesthetic issues were identified was relatively unchanged between 2009 and 2016 (data not shown).
- Cases where anaesthesia appeared to play a major role are referred to the appropriate regional Anaesthetic Death 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 they abandoned any surgical procedure. If, during surgery, the surgeon finds that the patient is suffering from an incurable and untreatable disease they may decide to abandon the operative procedure. Such a decision was made in 5.4% (1,733/32,330) of operations. The proportion of abandoned operations was largely unchanged between 2009 and 2016.

## 7 PATIENT TRANSFER ISSUES

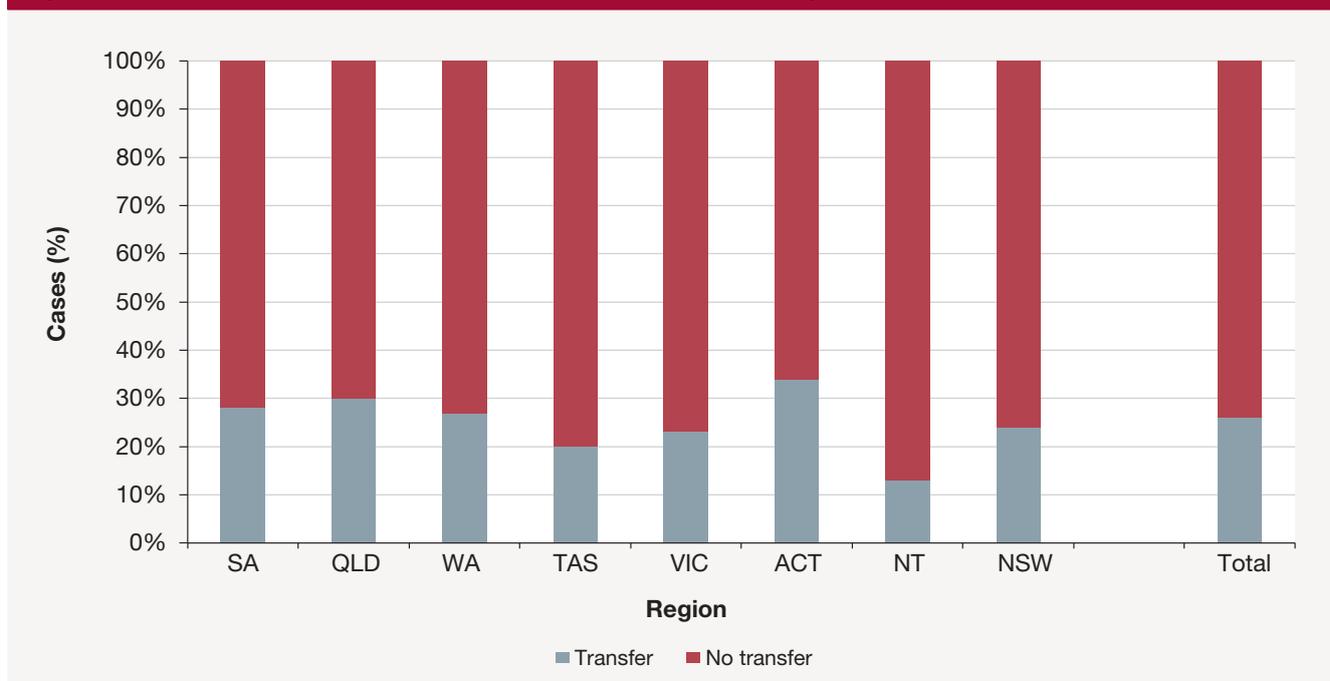
### KEY POINTS

- ▶ A transfer between hospitals was required in 25.9% (6,621/25,583) of cases.
- ▶ Between 2009 and 2016, in the transferred patients issues were raised in 11.3% due to transfer delays, in 4.1% due to inappropriateness of transfer, and in 4.7% due to insufficient clinical documentation.

### 7.1 Frequency of need for transfer

The audit process examines transfers into the audited hospitals. A transfer typically occurs because of the need for a higher level of care or specific expertise. Figure 36 provides a regional breakdown of the percentage of cases in which a transfer occurred.

Figure 36: Frequency of need for transfer into another hospital, by region



Data not available: n=515 cases (2%).

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

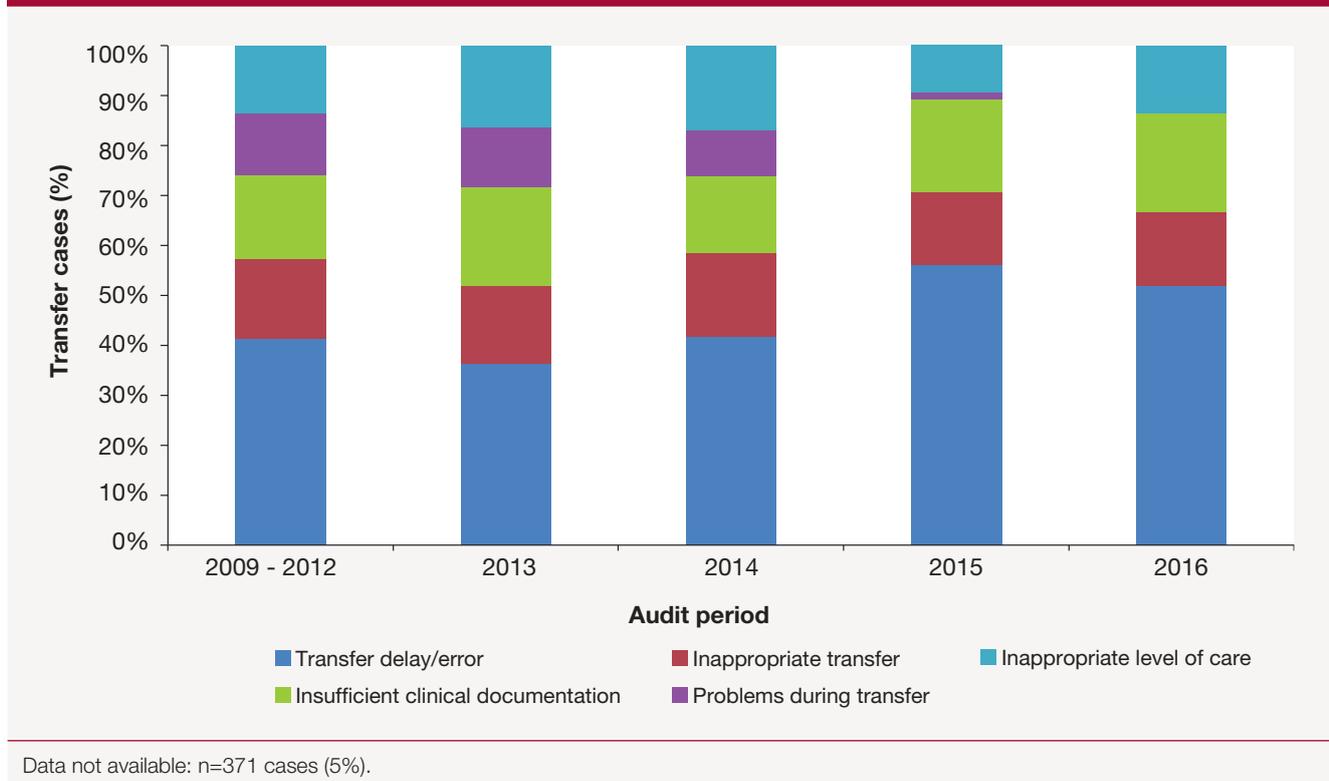
#### Comment:

- The need for transfer varied amongst the regions, probably reflecting the geographical distribution of available healthcare facilities, particularly in the Australian Capital Territory, Queensland and South Australia.
- 25.9% (6,621/25,583) of cases involved a transfer between hospitals.

## 7.2 Issues associated with patient transfer

The treating surgeon was asked to record any issues associated with the transfer of a patient into the audited hospitals (see Figure 37).

**Figure 37: Types of issues associated with patient transfer (n=6,250 issues in 1,631 patients)**



### Comment:

- 11.3% (704/6,250) of issues raised related to transfer delays into the audited hospitals, 4.1% (257/6,258) of cases related to inappropriateness of transfer, and 4.7% (285/6,121) to insufficient clinical documentation.
- Insufficient clinical documentation is a transfer issue that could be readily improved. Good communication ensures that all relevant clinicians have full knowledge of the patient's health status.

## Case study #2 Delay in transfer and lack of senior staff input for a case of cholangitis

### Case summary:

An elderly patient, who had a history of atrial fibrillation (on Warfarin), hypertension, renal impairment, stroke complicated by epilepsy and with jaundice was referred to the emergency department (ED) of a rural hospital by the GP. Liver function tests performed 6 months prior to this admission had been found to be abnormal. Repeat liver function tests were also abnormal and led to ultrasound and CT scan of the abdomen 4 days prior to referral. A dilated biliary tree was noted and the suggestion of a lesion in the head of the pancreas was made on ultrasound but not confirmed on CT.

On arrival the patient was described as being jaundiced and febrile with tachycardia and hypotension. Liver function tests were grossly abnormal. International normalised ratio was  $>10$ . A decision was made to transfer the patient to a tertiary institution for endoscopic retrograde cholangiopancreatography the following day. Antibiotics were commenced and the patient was transferred to a surgical ward. Overnight, tachycardia persisted and blood pressure gradually fell. There was no urine output recorded.

It was not until the following morning that the patient had an indwelling catheter inserted. There were no apparent attempts to correct the coagulopathy. Arrangements were then made for transfer to an ICU. Emergency medical assessment was carried out in the ICU and the patient was intubated after needing cardiopulmonary resuscitation for 6 minutes. The patient had a further cardiac arrest less than an hour after intubation. It was noted that the pupils were fixed and dilated. Further resuscitative efforts were not employed, with the family's consent.

### Clinical Lessons:

It appears that the record from the initial ED was incomplete and although decisions were clearly spelled out, there was no clear record of who made them, at what time or who was consulted. There was also no record of any other factors considered, such as the hospital accepting the patient but not having a bed available until the next day, or the retrieval service not being able to transfer the patient earlier. It is not clear what arrangements were actually made.

There appears to be no recognition that this febrile patient with jaundice, hypotension, tachycardia and anuria was at high risk of further deterioration. Very little seems to have been done overnight to correct any of these issues until the sudden and rapid deterioration of the patient in the morning. There seemed to have been no urgency to reverse the patient's coagulopathy, or monitor urine output, blood pressure or central venous pressure in any great detail. There was little in the way of medical notes apart from a review, I presume by an intern, at around midnight. By the morning the patient was deteriorating badly.

There was a lack of appreciation of the critical nature of this patient's condition on arrival at the initial hospital. An assessment by the admitting surgeon might have been desirable here. If the potential seriousness of the condition had been diagnosed at that time, perhaps anaesthetic and medical opinions could have been sought earlier and a more aggressive approach to treatment commenced.

Clear instructions should be given to junior staff at night to monitor such severely ill patients. Parameters should be given to them and if these are not adhered to then more senior advice should be sought.

The surgical team were dealt a difficult situation in that the patient deteriorated in a relatively short time. This patient's best chance of survival was in the months or at least days prior to admission to the ED and obviously the surgical team involved were not able to control this. We do not have any information on the management by the GP leading up to admission, but do wonder what he or she considered the reason for the abnormal liver function tests. It is hard to ignore the possibility of a more favourable outcome had referral occurred earlier.

## 8 INFECTION AND TRAUMA

### KEY POINTS

- ▶ ANZASM started collecting data on infection and trauma cases in 2012. All regions except New South Wales collect data on infection cases occurring in patients who require surgery. Data on trauma cases is currently collected in four regions: Queensland, Western Australia, Victoria and the Northern Territory.
- ▶ Of the 3,192 traumatic events, 80.5% (2,570) were caused by falls, 12.3% (392) were caused by traffic accidents and 4.5% (143) were associated with domestic, public or self-inflicted violence.

### 8.1 Infections

ANZASM started collecting data on infection in patients undergoing surgery in 2012. ANZASM is keen to monitor trends in infection, primarily to ensure that strategies are implemented to prevent and minimise infections contracted both prior to and during surgery. All regions except New South Wales collect this data (see Figure 38). Western Australia started collecting this data in July 2013.

**Figure 38: Proportion of infections acquired before or after the admission by region (n=15,404)**



Data not available: n=174 cases (3%).

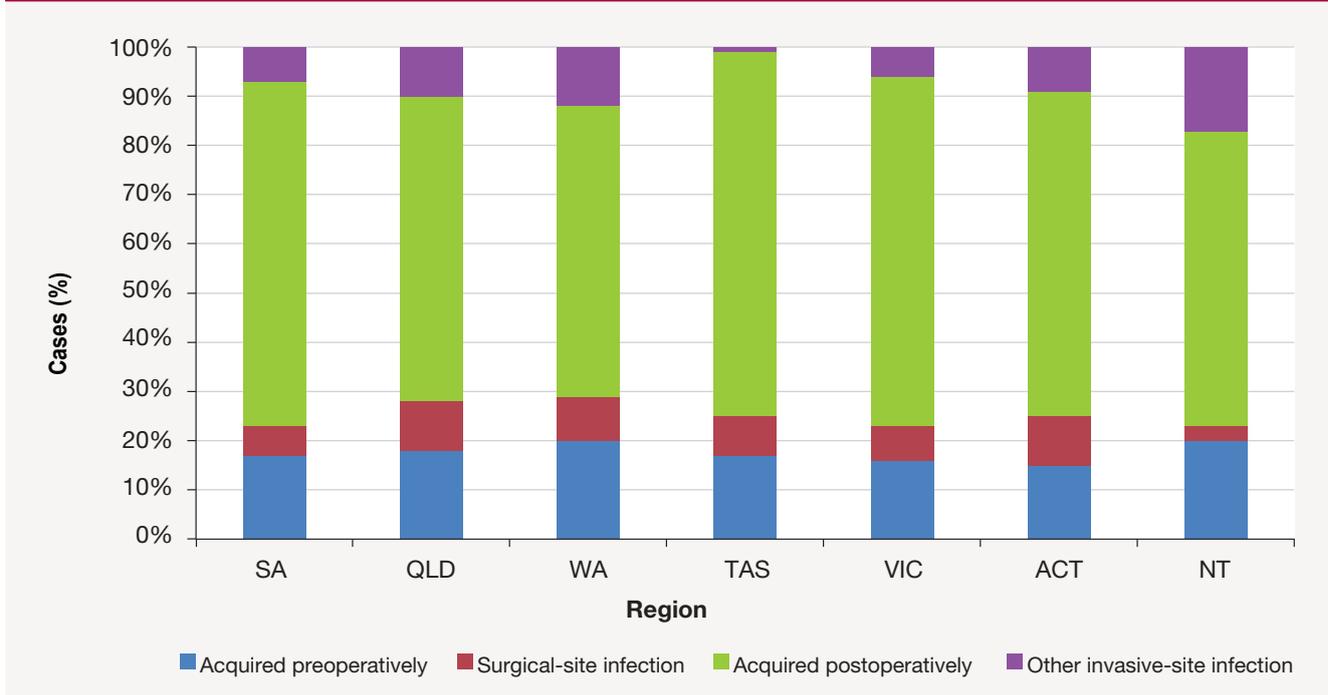
Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

### Comments:

- Of the 15,404 audited cases reported between 2012 and 2016 a clinically significant infection was present in 34.2% (5,267) of cases after admission but prior to surgery (data not shown).
- An infection occurred during the patient's admission in 58.2% of cases (2,965/5,093).
- The different distribution of infection within the Northern Territory may result from late presentations of patients living in remote communities.

Timing of infections acquired during admission is shown in Figure 39.

Figure 39: Timing of infections acquired during admission, by region (n=2,798)



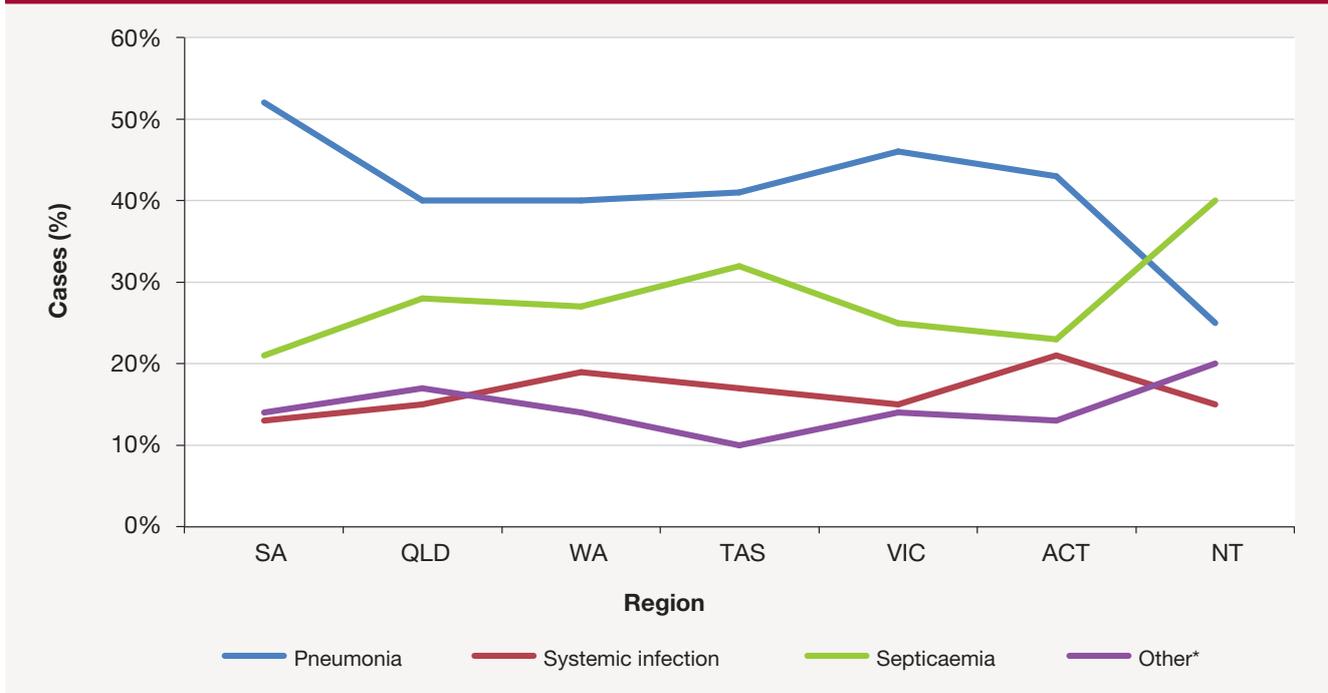
Data not available: n=167 cases (6%).

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

**Comments:**

- Of the patients who acquired an infection during admission, 66.8% (1,870/2,798) acquired the infection postoperatively, 17.4% (487) were acquired preoperatively, 7.4% (208) were as a result of other invasive-site infections and 8.3% (233) were surgical-site infections.

Figure 40: Type of infection acquired either before or during the admission by region (n=5,211)



Data not available n=56 cases (1%).

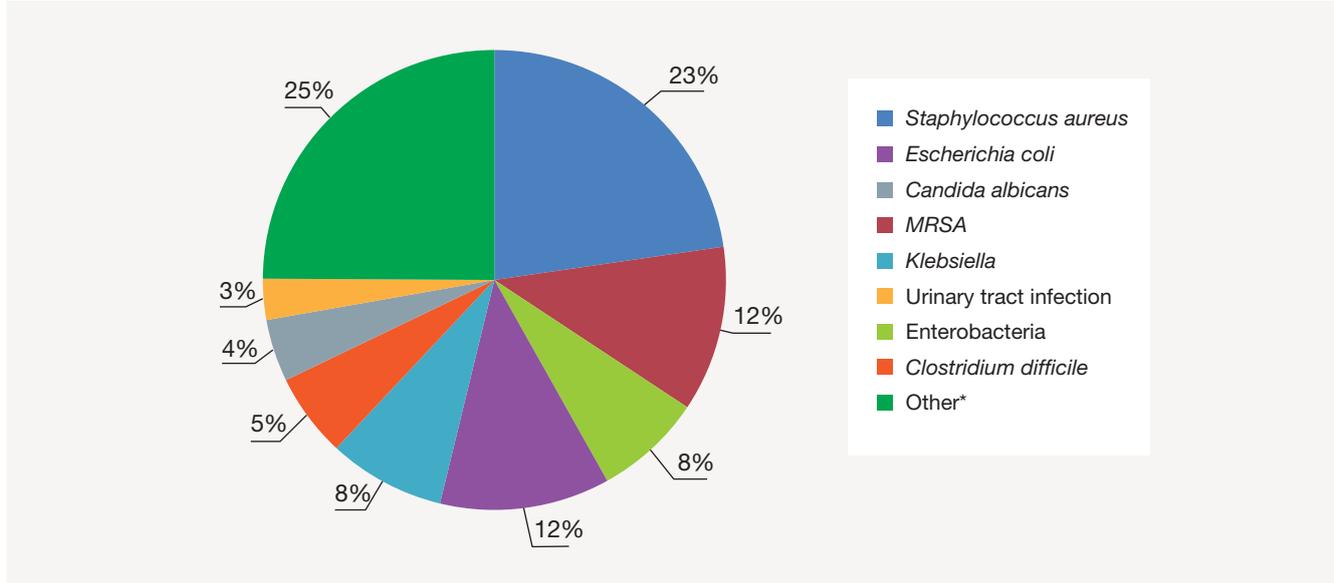
\*Other category includes *Klebsiella*, *Clostridium difficile*, *Escherichia coli* and Methicillin-resistant *Staphylococcus aureus*.

Note: this figure is not provided for direct comparative purposes. Each region has its own unique casemix and surgical population.

**Comments:**

- Of the 5,211 cases of infection acquired prior to or during admission, pneumonia was responsible for 44.0% of cases (2,293), septicaemia for 25.7% of cases (1,341), other infections were responsible for 14.9% of cases (775), and intra-abdominal sepsis for 15.3% of cases (798).

**Figure 41: Type of infection, where positively identified (n=2,097)**



Data not available: n=350 cases (6%).  
 \*Other infections include: Moraxella, multiple organisms, human immunodeficiency virus, pneumonia, Pseudomonas aeruginosa  
 MRSA: Methicillin-resistant Staphylococcus aureus.

**Comments:**

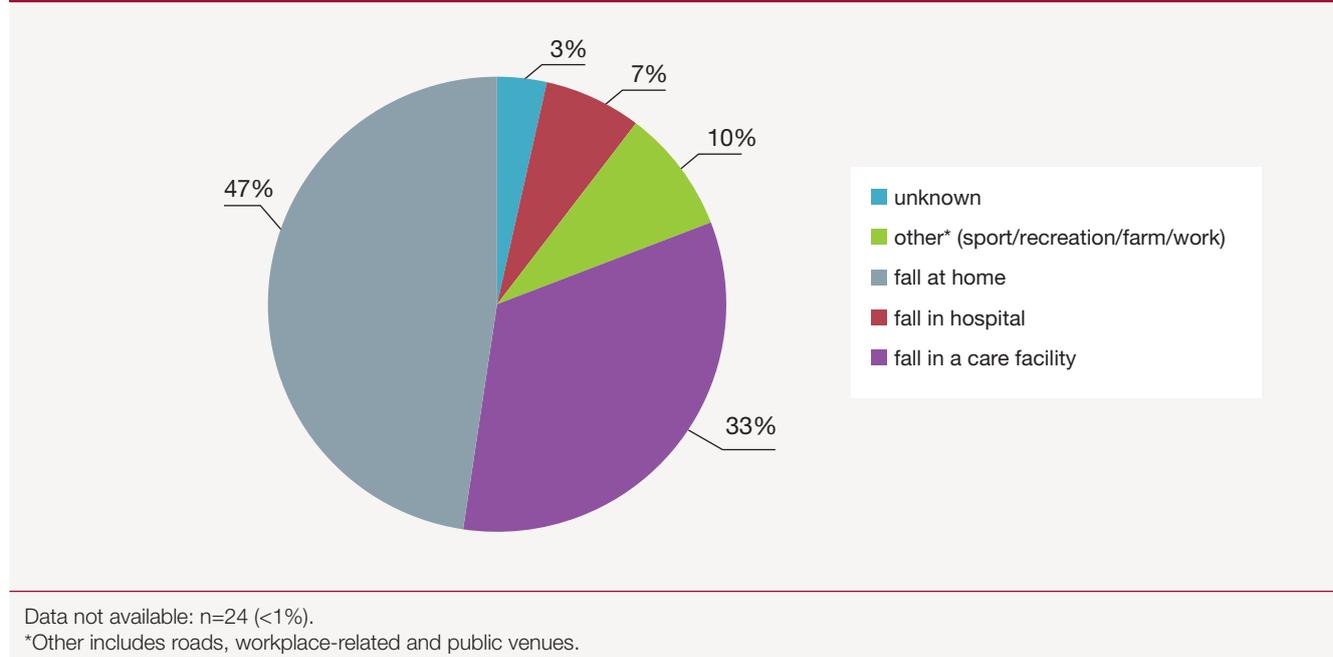
- Over the reporting period the infection was positively identified in 42.6% (2,097/4,917) of cases in which the infection was acquired prior to or during admission.
- Combined, Staphylococcus aureus, MRSA and Escherichia coli accounted for 47% (986/2,097) of all cases of infection.

## 8.2 Trauma

In 2012 ANZASM started collecting data on trauma cases in which severe bodily injury or shock occurred in patients requiring surgery. The types of traumatic events leading to injury or shock vary, but may include falls, accidents or violence. This data is currently collected by four regions: Queensland, Western Australia (from July 2013), Victoria and the Northern Territory.

During the period January 2012 to the end of December 2016, a traumatic event was attributed to 27.4% (3,192/11,659) of cases. Of the 3,192 traumatic events, 80.5% (2,570) were caused by falls. Figure 42 provides an overview of the locations associated with falls.

**Figure 42: Locations associated with falls (n=2,570)**



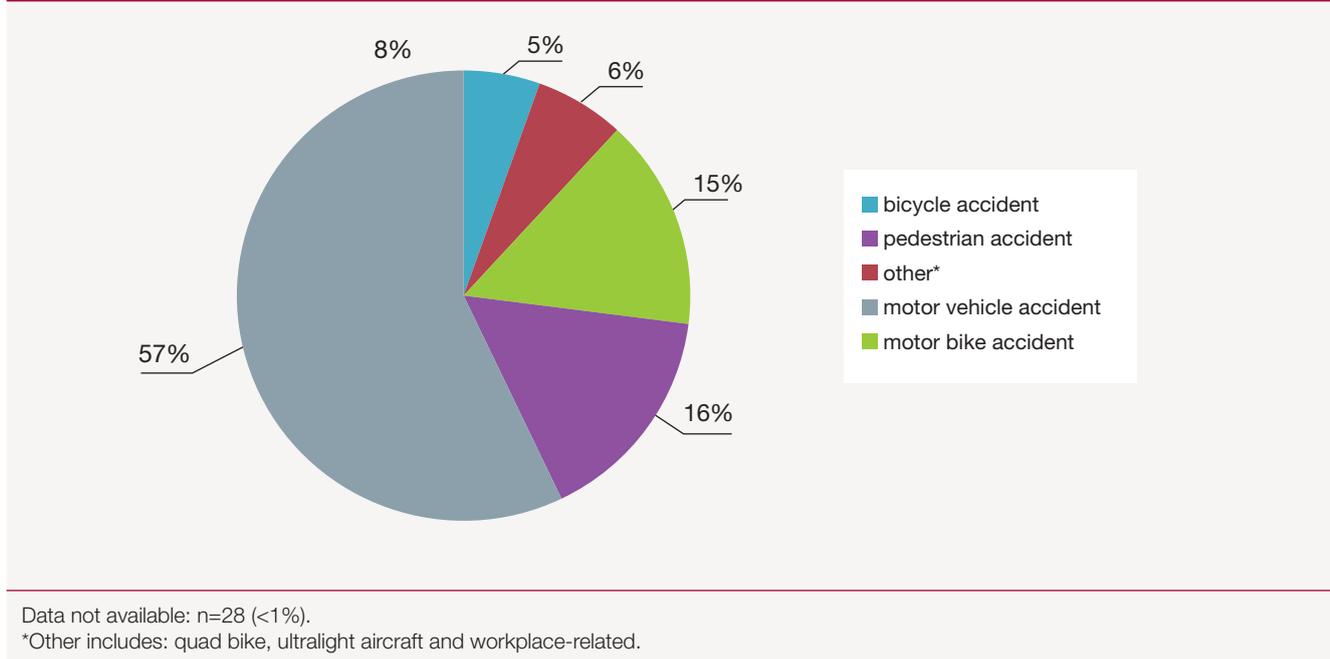
### Comments:

- Falls were associated with 80.5% (2,570/3,192) of recorded traumatic events.
- Of the 2,570 falls, 47.0% (1,208) were at home and 39.3% (1,010) occurred in a hospital or care facility. The location was listed as unknown or elsewhere in 12.3% (315) of falls.

Traffic accidents were associated with 12.3% (392/3,192) of cases, and an overview of the types of traffic accidents are shown in Figure 43. Domestic, public or self-inflicted violence was associated with 4.5% (143/ 3,192) of cases (data not shown).

Due to the small amount of current data in Figure 43, this should be interpreted with caution.

Figure 43: Types of accidents associated with trauma cases (n=3,192)



**Comments:**

- Motor vehicle accidents were associated with 7.1% (227/3,192) of cases.
- It should be noted that one-quarter of Northern Territory Audit of Surgical Mortality (NTASM) trauma cases were associated with motor vehicle accidents (data not shown). Published trauma data shows that fatalities in the Northern Territory due to motor vehicle accidents are nearly three times higher than for the rest of Australia.<sup>(9)</sup> This difference is most likely due to death occurring at the accident scene rather than in hospital, compared to other regions.

### Case study #3 Preoperative assessment of clotting state not done

#### Case summary:

An elderly man was admitted with a pertrochanteric fracture of the left femoral neck following a fall. Comorbidities included chronic renal failure, hypertension, gastroesophageal reflux, bipolar disease and osteoporosis. The patient was a heavy smoker with a high alcohol intake. The patient's medications included Alendronate, Asasantin, Astrix, Coversyl and numerous psychotropic drugs.

Initial laboratory investigations indicated that urea and creatinine were elevated, low-normal haemoglobin and low platelets. The International Normalised Ratio was reported as 1.1. The patient proceeded to open reduction and internal fixation with a short Gamma nail 10 hours after admission to the ED. Appropriate reduction and positioning were ascertained with guidance from an image intensifier and thromboprophylaxis was commenced.

Blood loss from the operative site necessitated dressing reinforcement 10 hours after surgery. Two hours later, hypotension and a decreasing level of consciousness with a very low oxygen saturation led to a medical emergency team (MET) call, intubation and a transfer to the ICU. Blood was noted in the nasogastric tube and the patient's haemoglobin was well below normal.

The patient's renal function and conscious state deteriorated. Treatment was withdrawn following discussions with the family and the patient died 4 days after admission.

#### Clinical lessons:

In this case it is evident that the orthopaedic and anaesthetic teams did not undertake adequate preoperative assessment.

- This patient was on platelet inhibitors, with liver and renal disease, but did not have their clotting or liver function investigated.
- There was no referral made to the medical or renal unit prior to surgery.
- Provision of postoperative care in an HDU might have led to earlier recognition of complications.

This case also calls into question the appropriateness of the trend towards early streaming of frail emergency admissions into subspecialties like orthopaedics. Medical staff in these units do not always possess the appropriate level of knowledge to optimally manage such patients.

Although it is recognised that surgery is best performed within 48 hours, careful preoperative assessment and management is essential. This medical care should be continued throughout the postoperative period. All health services involved in the management of the elderly with orthopaedic fractures must have in place a system that allows expert and timely medical care of these patients.

## 9 PEER REVIEW OUTCOMES

### KEY POINTS

- ▶ Between 2009 and 2016, an SLA was requested in 13.0% (4,321/33,349) of audited cases.
- ▶ Less than 3.5% (1,154/33,349) of audited cases were sent for SLA due to concerns over clinical issues.
- ▶ The most common criticism by both first- and second-line assessors was delay in the delivery of definitive treatment.
- ▶ In 3.9% (1,298/33,356) of patients, issues of clinical management were perceived to have contributed to the death of the patient.

### 9.1 Second-line assessments

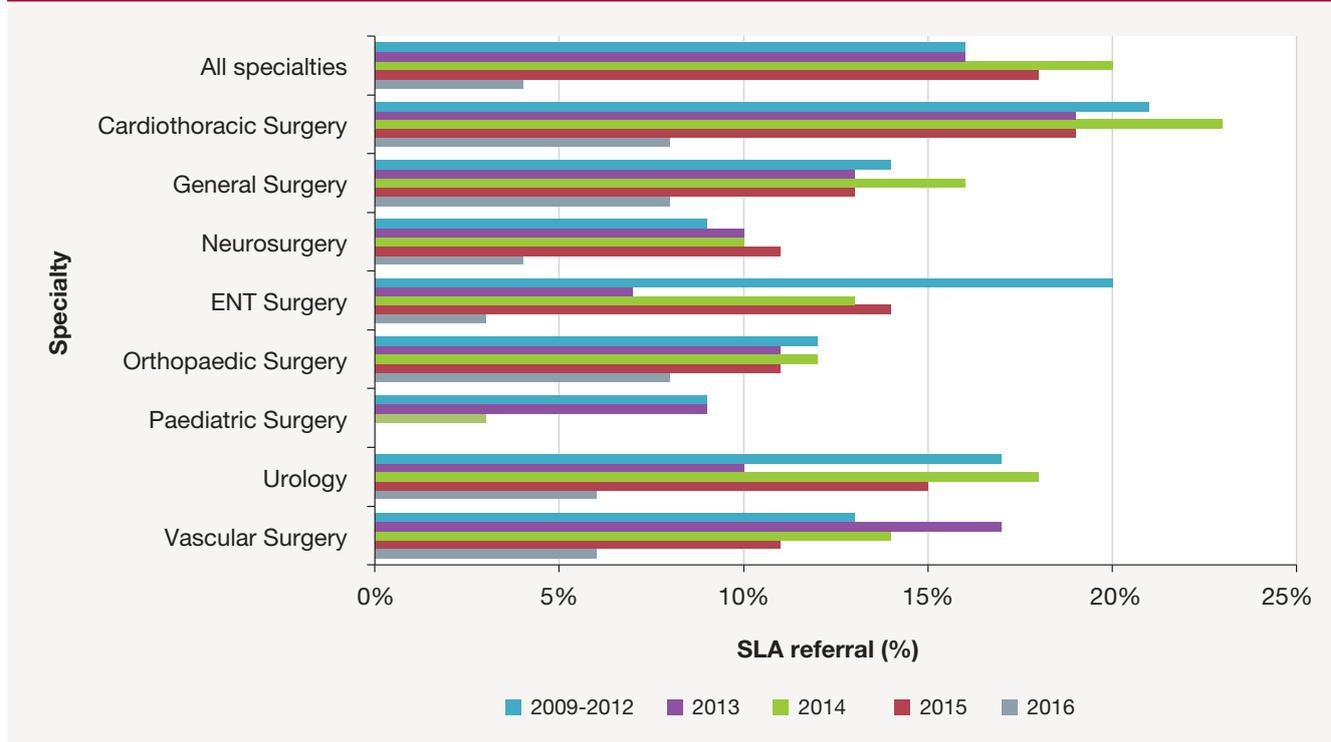
The peer review process comprises a retrospective examination of the clinical management of patients who died while under the care of a surgeon. All assessors (first- and second-line) must decide whether the death was a direct result of the disease process alone, or if aspects of the management of the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

A total of 33,182 cases underwent FLA. The first-line assessor decides whether the treating surgeon has provided enough information to allow them to reach an informed decision on the appropriateness of the management of the case. If inadequate information was provided then the first-line assessor requests an SLA. Other triggers for requesting an SLA are:

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

The frequency with which cases were referred for SLA, by surgical specialty, is provided in Figure 44.

Figure 44: Frequency of second-line assessment (SLA) referral amongst surgical specialties (n=4,321 SLAs)



Data not available: n=11 cases (1%).  
ENT: Ear, Nose and Throat.

**Comment:**

- There was some variation in the SLA rate among specialties, and across the audit periods. There was an overall drop in the need for SLA in most specialties in 2016, though this may be as a result of some cases still being under assessment.
- There have been no SLAs for Paediatric Surgery for the 2015 and 2016 reporting years.

## 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.

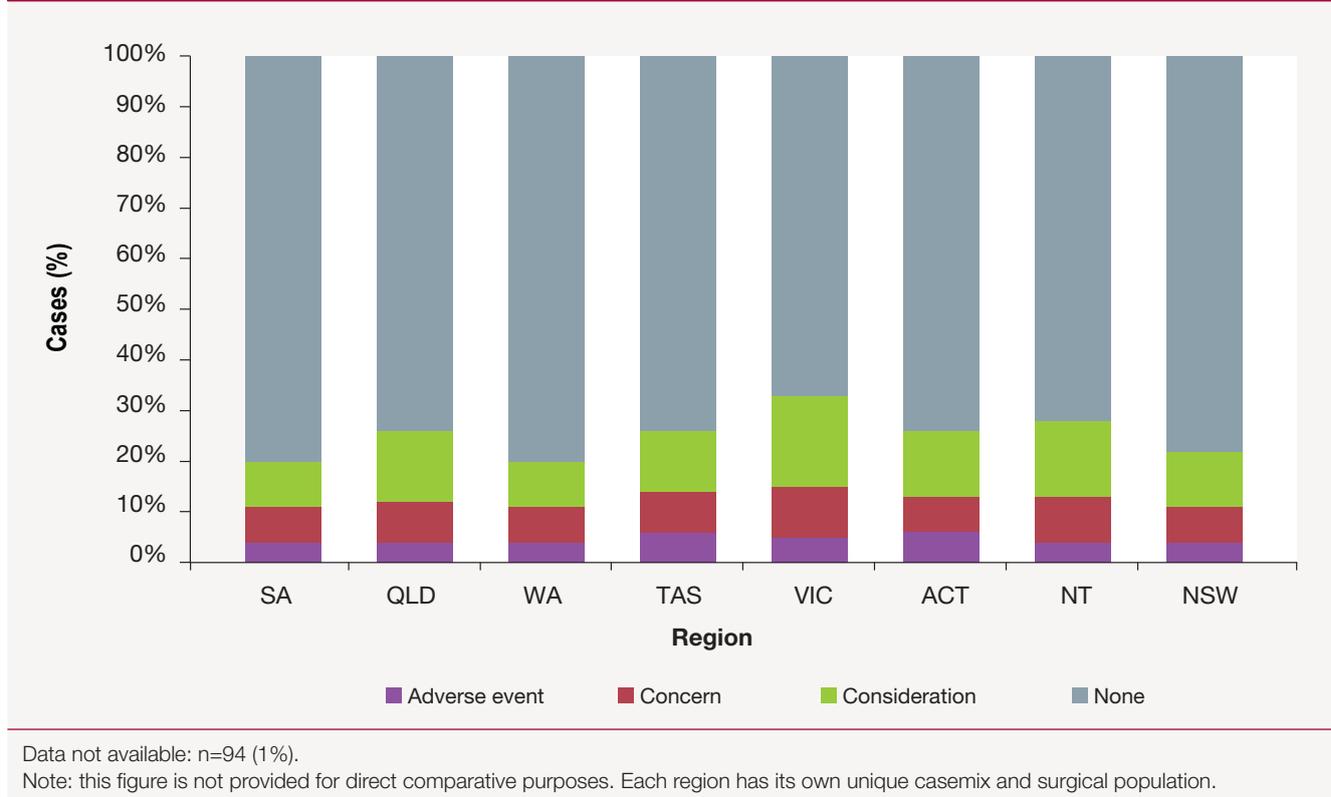
There are two possible outcomes for the peer-review process. The first is that the death of the patient was a direct outcome of the disease process, with clinical management having no impact on the outcome. The second is a perception that aspects of patient management may have contributed to the death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

In making an assessment of contributing factors the assessor can identify an:

- Area of consideration: the assessor believes an area of care could have been improved or different, but recognises the issue is perhaps debatable. It represents a suggestion regarding treatment options or a minor criticism.
- Area of concern: the assessor believes that an area of care should have been better.
- Adverse event: an unintended injury or event that was caused by the medical management of the patient rather than by the disease process. The injury or event was sufficiently serious that it led to prolonged hospitalisation; temporary or permanent impairment or disability; or contributed to or caused the death of the patient. In addition, there are predetermined outcomes classified as an adverse event (e.g. anastomotic leak or pulmonary embolus). It must be emphasised that an adverse event does not imply negligence. Some adverse events will occur even with the best of care, for example a fatal pulmonary embolism despite the use of the best DVT prophylaxis available. An adverse event is not necessarily preventable and may not contribute to the death of the patient (see 9.2.1).

Figure 45 demonstrates the degree of critique of clinical management recorded for each patient. Where a number of criticisms were made for any one case, the most severe degree of criticism has been attributed. The ANZASM primarily focuses on areas of concern and adverse events, although data is collected on areas of consideration.

**Figure 45: Frequency and spectrum of clinical management issues recorded per patient by assessors (n=33,349)**

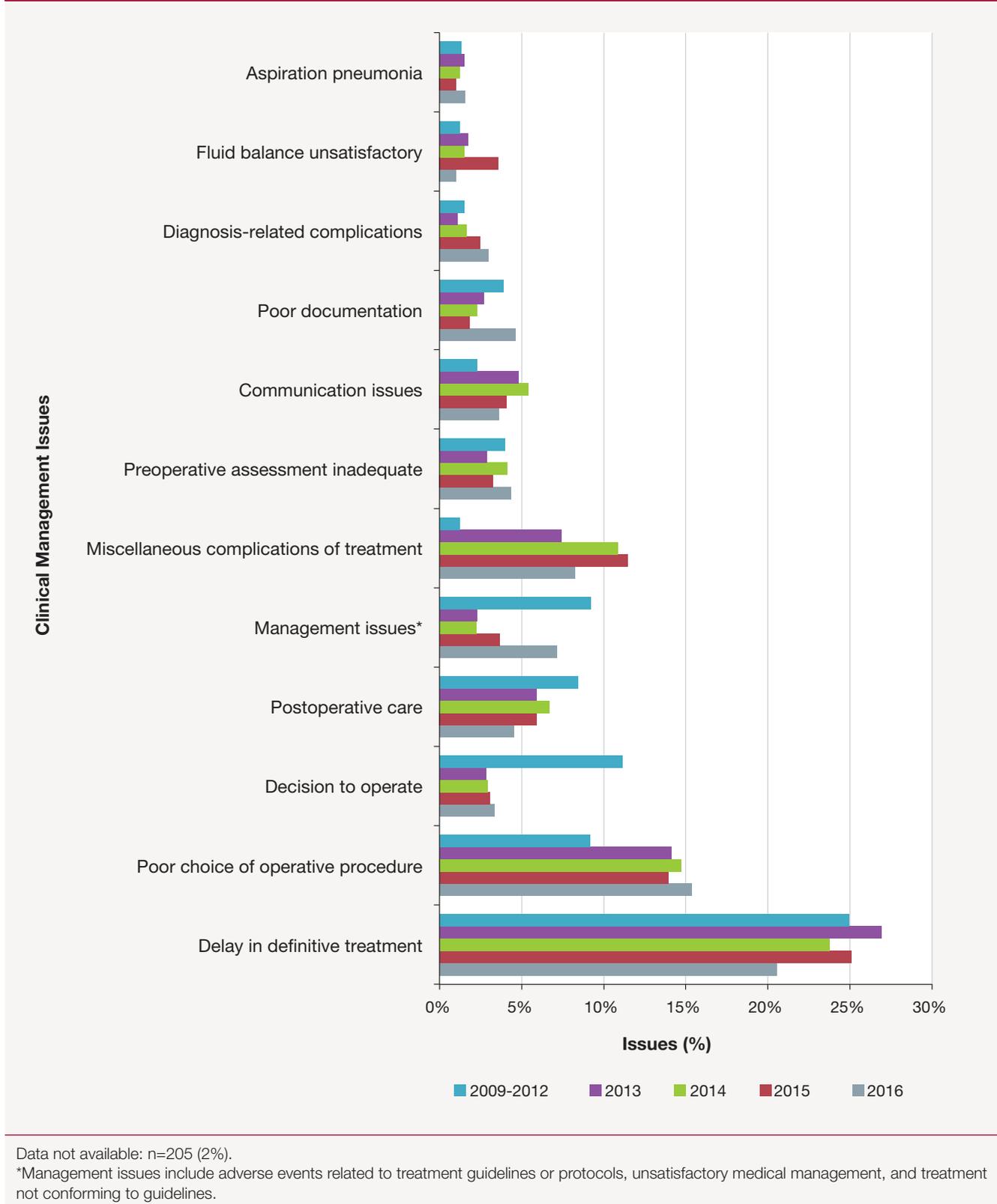


**Comment:**

- Assessors did not identify any clinical management issues in 74.7% (24,931/33,356) of cases. When combined with areas of consideration (14.3% of cases; 4,770), the total number of cases with no or minor criticism was 89.0% (29,701).
- The identification by an assessor of an area of concern or adverse event denotes a greater degree of criticism of clinical management. In this report, an area of concern or adverse event occurred in 11.0% (3,655/33,356) of cases.
- Cases in which patients experience an adverse event are a key focus of the audit if there is a perception by assessors that the treatment provided, may have led to the death of the patient. The proportion of cases with adverse events was 3.9% (1,298/33,356) over the entire audit period.

The frequency of specific clinical management issues is shown in Figure 46. This chart includes all clinical management issues (areas of consideration, concern and adverse events). In some patients more than one issue was identified.

**Figure 46: Top 12 frequencies of specific clinical management issues where there were more than 10 cases per procedure (n=11,254 instances)**

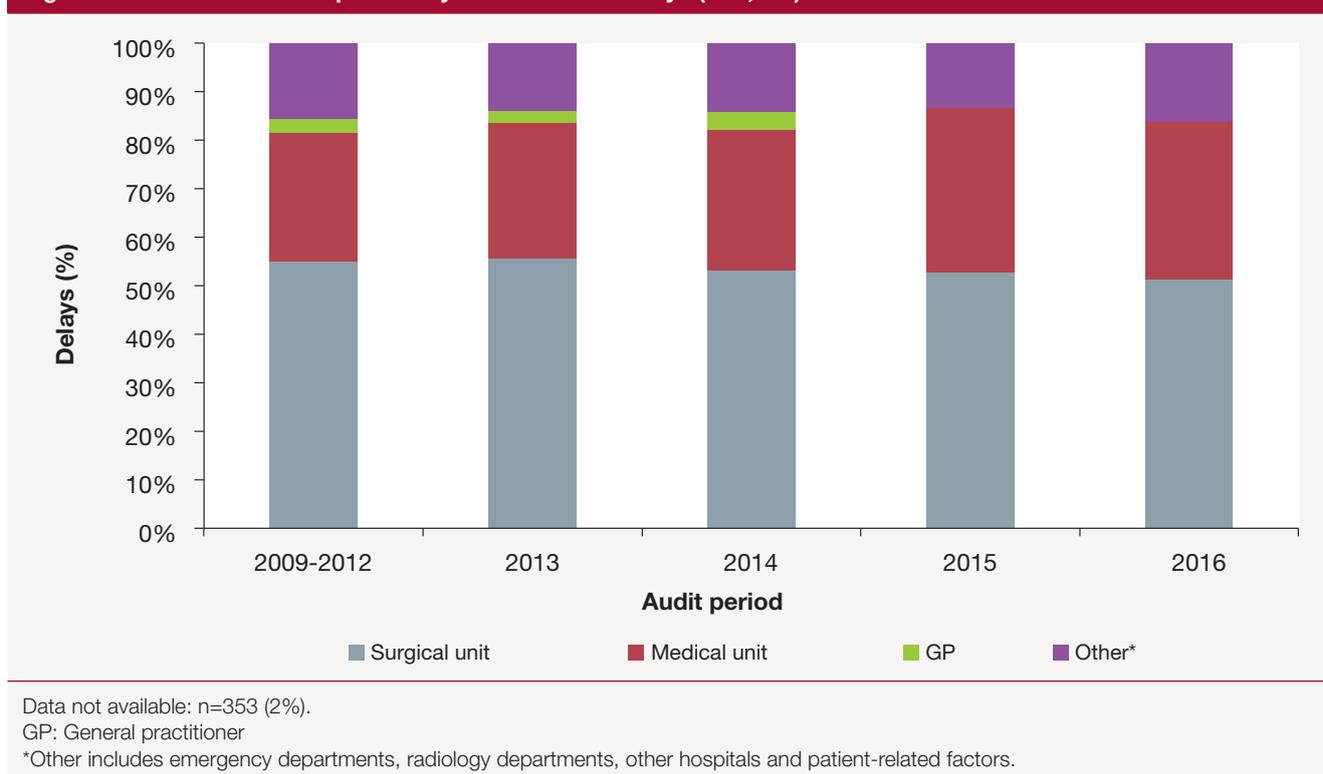


**Comment:**

- Delay in implementing definitive treatment is still the most frequent clinical management issue. These delays can be due to a number of factors and not all are the responsibility of the treating surgeon. Reasons for delay include geographical issues, diagnostic problems in the ED, inappropriate diagnosis, need for transfer, availability of theatre and communication issues.
- The decision to operate and the choice of operative procedure are also high on the list of clinical management issues.
- Good communication amongst those involved in patient care is essential to ensure the treatment plan is properly understood and coordinated. Poor communication accounted for 5.3% (597/11,254) of the specific issues identified.
- In a peer review article by the Queensland Audit of Surgical Mortality (QASM), surgeons indicated there was a need for improvement in a number of areas within the hospital service. Better preoperative assessment with precise radiology and preparation of patients is essential to achieve earlier diagnosis. Improvement in communication at the consultant level may reduce time to appropriate surgery without inappropriate delays.<sup>(4)</sup>
- The RACS has explored the topic of futile surgery and end of life matters and has prepared a policy statement.<sup>(5)</sup>

Between 2009 and 2016, a delay in the implementation of definitive treatment was perceived in 25.7% (2,896/11,254) of clinical management issues. The attribution of responsibility for treatment delays is shown in Figure 47. This data is derived from the SCF and reflects the view of the treating surgeon.

**Figure 47: Attribution of responsibility for treatment delays (n=2,896)**



**Comment:**

- The surgical unit was deemed responsible for 50.6% (2,106/4,159) of treatment delays in 2009-2012 and 56.5% (370/655) in 2016. Some 2016 cases are still under review and have not completed the audit process. The full extent of any variance will only become clear in the next report.
- Overall, other clinical areas, medical units or GPs were deemed responsible for 46.4% (1,345/2,896) of delays.
- More than one team may be responsible for any perceived delays in treatment.

## Case study #4 A series of systemic failures leads to death from abdominal sepsis

### Case summary:

An elderly patient with a 1-week history of abdominal pain presented to a regional hospital and was admitted overnight. A CT scan performed the following day showed acute diverticulitis. The patient's C-reactive protein (CRP) was 97 nmol/L and white blood cell count (WBC)  $13.7 \times 10^9/L$ . The patient self-discharged the next day. It is assumed that the patient was given antibiotics to take home although this was not clearly recorded.

The patient re-presented at the ED in the late evening 3 days later with an acute abdomen. The WBC was  $2.3 \times 10^9/L$  and CRP 282 nmol/L. The ED doctor recorded that the patient had 'worsening to generalised peritonitis' and the patient was admitted overnight. Blood tests performed in the morning showed a CRP of 334 nmol/L and WBC of  $2.3 \times 10^9/L$ . A repeat CT scan in the early afternoon showed perforated diverticular disease. The patient was transferred to a tertiary hospital by mid-afternoon and assessed by ED staff within 30 minutes, but was not seen by the surgical team until very late in the evening. The patient had faeculent peritonitis secondary to perforated sigmoid colonic diverticular disease. Surgery commenced shortly after the surgical team assessment, with a Hartmann's procedure performed by a non-consultant RACS Fellow.

The patient was hypotensive and acidotic (pH 7.25) shortly before dawn while in recovery. The patient was admitted to a general ward, however in the early afternoon was admitted to the ICU with severe acidosis. The patient responded well to supportive therapy and did not require ventilation. On the morning of the second day, approximately 30 hours after surgery, a MET call was placed from the ICU due to the patient showing reduced consciousness. The patient was reviewed 90 minutes later by the on-call consultant surgeon. A CT scan of the head was undertaken and the stoma was noted to be retracted and dusky. Later that day the patient was intubated. Over the next 8 days the patient was seen by a succession of surgical doctors, apparently from the on-call team. While the names of the on-call doctors who saw the patient were documented there was no record of a consultant being present.

The patient underwent a second laparotomy in the late evening, 8 days after the first laparotomy. This laparotomy was performed by a different surgeon to the first procedure, and the surgeon was neither a consultant nor a RACS Fellow. The retracted stoma was leaking faeces and there was extensive faecal contamination. The colostomy was refashioned and the abdomen washed out. The patient was returned to the ICU but died from sepsis 4 days later.

### Clinical lessons:

It is difficult to conclude anything other than that this patient's care was substandard. While it might be argued that an elderly patient presenting with faecal peritonitis would be lucky to survive, the fact that the patient lived so long suggests that with better care this patient may not have died.

A combination of events meant that there was a preventable delay of 24 hours in getting an elderly patient with a perforated colon into theatre. The mortality of patients with uncontrolled sepsis increases at seven per cent per hour of delay. The doctor at the peripheral hospital failed to recognise that the patient had worsening sepsis. This meant that the patient did not receive an urgent transfer to the tertiary hospital, and there was also a delay in obtaining a CT scan. On arrival at the tertiary hospital there was an additional 6-hour delay before the patient had a surgical review.

Within the teaching hospital the core failure was a lack of direct consultant responsibility. It appears that the patient was under the care of the emergency team, and was managed by the emergency surgeons, rather than the nominated consultant surgeon. This meant that an acutely sick patient in the ICU was not seen by a consultant for 8 days. It should be noted that the problems relating to patient care were associated with communication and team issues, rather than a lack of care by the consultant.

The lack of direct consultant responsibility was present from the outset. The consultant surgeon in charge of the case was not called into theatre during the first laparotomy, and this represents a serious communication breakdown. While it is expected that an on-call general surgeon can perform a Hartmann's resection, help from a more experienced colleague is sometimes useful.

Patients undergoing a laparotomy for 3-day-old faecal peritonitis very often require a second laparotomy after 48 hours. There was overwhelming evidence that the patient was still septic in the days after the Hartmann's resection. Despite this, the patient was not seen by a consultant for 8 days. The only recorded evidence of a consultant surgeon reviewing this patient was shortly after the patient's admission to the ICU. The responsible consultant recognised that there was a "delay of days in realising this patient needed a re-look laparotomy". On finally being returned to theatre the patient was found to have predictably extensive faecal contamination. The retracted colostomy appears to have been a major issue and testifies to the quality of the initial surgery.

Following the first procedure the patient's initial postoperative care was not in the ICU. The documentation indicates that this was due to a lack of resources. That the patient did not receive initial postoperative care in the ICU is of concern, as an elderly patient with faecal peritonitis is likely to have greater need of ICU support than most other patients.

The peripheral hospital needs to review the supervision of its ED staff, as the patient was clearly septic at re-presentation. Based on the summary of issues outlined above, it also is recommended that both the peripheral and teaching hospital review their organisational processes as a matter of urgency.

### 9.2.1 Perceived impact of clinical management issues

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

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

First- and second-line assessors may identify more than one issue of clinical management for each patient under review. Tables 7, 8, 9, 10 and 11 show data that is patient-focused rather than incident-focused.

**Table 7: Clinical management issues by specialty and severity, as identified by the highest level assessor (n=6,463 events in 32,835 patients)**

Specialty	Adverse Events	Concern	Consideration	No Issues
Cardiothoracic Surgery	7% (179/2,659)	10% (254/2,659)	20% (525/2,659)	64% (1,693/2,659)
General Surgery	4% (561/13,332)	8% (1,024/13,332)	14% (1,865/13,332)	74% (9,837/13,332)
Neurosurgery	2% (96/4,725)	4% (194/4,725)	9% (414/4,725)	85% (4,013/4,725)
Gynaecology	8% (5/66)	11% (7/66)	27% (18/66)	55% (36/66)
Orthopaedic Surgery	2% (135/6,450)	4% (254/6,450)	11% (709/6,450)	83% (5,338/6,450)
Other*	7% (2/28)	4% (1/28)	14% (4/28)	75% (21/28)
Paediatric Surgery	3% (6/189)	5% (9/189)	11% (21/189)	81% (153/189)
Plastic & Reconstructive Surgery	3% (17/529)	5% (28/529)	14% (73/529)	78% (411/529)
Urology	4% (50/1,167)	6% (70/1,167)	16% (181/1,167)	74% (864/1,167)
Vascular Surgery	4% (122/3,055)	7% (205/3,055)	14% (418/3,055)	75% (2,304/3,055)
All cases	4% (1,210/32,835)	6% (2,086/32,835)	13% (4,324/32,835)	77% (25,130/32,835)

Data not available: n=55 cases (1%).

\*Anaesthesia, Intensive Care Unit, Oncology, Oral and Maxillofacial, Thoracic Medicine, Trauma and Transplant.

### Comment:

- This analysis compares the incidence of significant criticisms of clinical care (areas of concern and adverse events) with lesser or no issues, by specialty.
- There is a difference in the percentage of adverse events between the specialties. The exact reason is not readily apparent; however, it 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, and this may explain the higher number of adverse events.<sup>(6)</sup>

**Table 8: Overall criticism of patient management over the total audit period (n=33,356)**

Degree of criticism of patient management	Number of patients	Per cent of patients
No issues of management identified	24,931	75
Consideration	4,770	14
Concern	2,357	7
Adverse event	1,298	4

In instances where a patient had more than one clinical management issue the most severe has been used in this data set.

### Comment:

- There was significant criticism of clinical management (area of concern or adverse event) in 11.0% (3,655/33,356) of cases.
- There was minimal variation across regions in terms of the incidence of significant clinical management issues (data not shown).

**Table 9: Perceived impact of clinical management issues on clinical outcomes over the total audit period (n=33,356)**

Impact of clinical management issues on clinical outcome	Number of patients	Per cent of patients
No issues of management identified	25,217	76
Made no difference	2,147	6
May have contributed to death	4,949	15
Caused the death of a patient who would otherwise be expected to live	1,153	3

Note: Data not available: n=94 cases (3%).

### Comment:

- Perceived issues of clinical management were felt to have probably caused death in 3.5% (1,153/33,356) of cases.

**Table 10: Perceived preventability of clinical management issues over the total audit period (n=33,356)**

Perceived preventability of clinical management issues	Number of patients	Per cent of patients
No issues of management identified	25,367	76
Definitely	1,608	5
Probably	3,301	10
Probably not	2,767	8
Definitely not	313	1

### Comment:

- The assessors felt that 1.0% (313/33,356) of patients had clinical incidents that were definitely preventable.

**Table 11: Perception of clinical team responsible for clinical management issues**

Clinical team perceived to be responsible	Number of patients	Per cent of patients
Surgical team	3,927	51
Other clinical team	2,416	31
Hospital issue	1,019	13
Other*	366	5

Note: Data not available: n=825 cases (10%). \*Other includes transferring hospital, blood bank or transfusion services, emergency department, the general practitioner or referring doctor, the ambulance service, remote areas or insufficient staff.

## Comment:

- Assessors indicated that the surgical team was responsible for the clinical issue in 50.8% (3,927/7,728) of patients with perceived clinical issues.

### Case study #5: Poor communication between surgical and renal teams

#### Case summary:

A 94-year-old patient was admitted for a left neck of femur fracture. The patient had multiple comorbidities including renal impairment, hypertension, gout, gastroesophageal reflux disease and atrial fibrillation. His initial bloods showed mild renal impairment (Creatinine 163, estimated Glomerular Filtration Rate (GFR) 31 and Urea 16.6) and he underwent an uncomplicated fracture fixation the next day. He was making a good recovery from this in the early postoperative period. Bloods on postoperative day four showed a slight deterioration in his renal function (Creatinine 196, estimated GFR 31, Urea 24.2) but no further bloods were noted. He was reviewed regularly by the surgical and medical team.

The patient was then started on Celebrex for his knee pain (as requested by the patient) and continued to make progress. Two weeks postoperatively he was reviewed for rib/chest pain which seemed mechanical in nature, but was noted to have pitting oedema up to the sacrum/buttocks. He was noted by the physiotherapists to have deteriorated in his mobility and was short of breath on exertion. Two days later he was seen by a medical team who repeated troponins and an electrocardiogram. He had several medical emergency team calls the next day and later that day was found unresponsive with acute kidney failure. He passed away despite attempts at correcting the metabolic disturbances.

#### Clinical lessons:

There appears to have been a lack of urgency regarding his deteriorating condition. He started deteriorating three days before his demise and this was noted by the ward call, but there are no notes to indicate that his increasing oedema was being investigated. By the time he was found unresponsive on the morning of his passing he had probably deteriorated too far.

In summary, this patient's deteriorating condition two weeks after surgery should have been investigated with greater urgency, and there appears to have been a lack of communication between the surgical and medical teams. It is also worth reflecting on whether the use of Celebrex in an elderly patient with impaired renal function may have contributed to his kidney failure.

# 10 ABORIGINAL AND TORRES STRAIT ISLANDER PERSONS

The findings presented here show that the Aboriginal and Torres Strait Islander surgical population were younger than the non-Indigenous surgical population. The report also shows that while the younger Aboriginal and Torres Strait Islanders had a much higher rate of serious comorbidities than the non-Indigenous population, access to surgical care was the same for the two groups.

An overview of Aboriginal and Torres Strait Islander persons in Australia and by region showed that at the end of 2016 it was estimated that there were 744,956 Aboriginal and Torres Strait Islander persons in Australia.<sup>(7)</sup>

- 30.9% (229,951) in New South Wales
- 27.8% (207,105) in Queensland
- 12.8% (95,653) in Western Australia
- 9.9% (73,696) in Northern Territory
- 7% (52,512) in Victoria
- 5.4% (40,596) in South Australia
- 3.5% (26,361) in Tasmania
- 0.9% (6,841) in the Australian Capital Territory.

## 10.1 Aboriginal and Torres Strait Islander persons and surgically-related deaths

Surgical deaths of Aboriginal and Torres Strait Islander persons occurred in all states and territories but reporting was not uniform.

In this analysis, the deaths occurred within Queensland (37%; 157/419), Northern Territory (33%; 138/419) and South Australia (14%; 60/419). The remaining (64 deaths relate to cases in the other regions).

Due to differences in collecting systems, there is no data from New South Wales, and limited data from Western Australia or Tasmania.

## 10.2 Aboriginal and Torres Strait Islander persons and age

Aboriginal and Torres Strait Islander persons who died in the perioperative period were younger than non-Indigenous persons (see Table 12 and Figure 48).

**Table 12: Age at death of Aboriginal and Torres Strait Islander persons and non-Indigenous persons (n=14,368)**

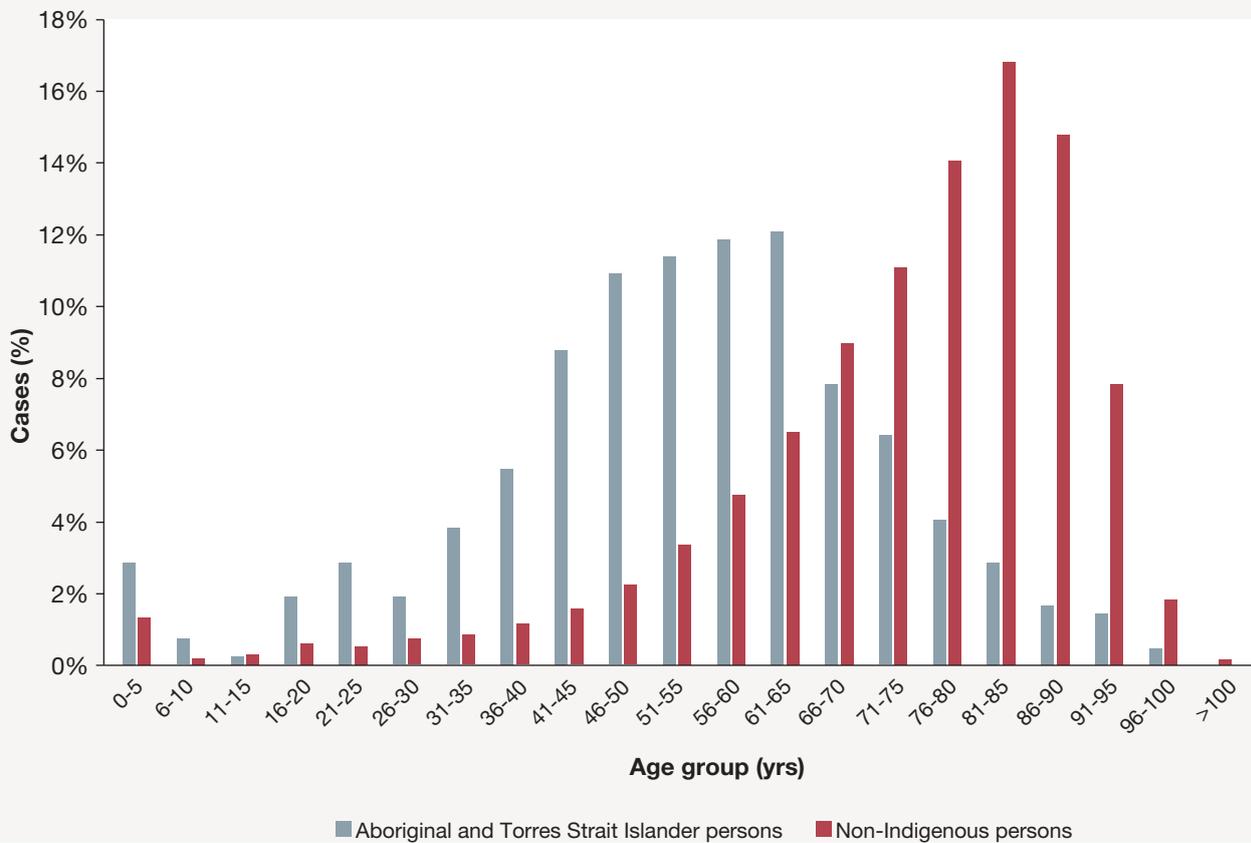
	Age at death of Aboriginal and Torres Strait Islander persons (n=419)	Age at death of non-Indigenous persons (n=14,368)
Median (Interquartile range)	55 years (44–65)	78 years (66–85)
Minimum	0 years	0 years
Maximum	99 years	105 years

Note: Data not available: n=17,467 cases (61%).

### Comment:

- There was a 23 year difference in the median age of death for Aboriginal and Torres Strait Islander persons compared with non-Indigenous persons.

**Figure 48: Age distribution of Aboriginal and Torres Strait Islander persons (n=419) and non-Indigenous persons (n=14,368) in 5-year groups**



Data not available: n=17,467 cases (61%).  
Yrs: years.

### 10.3 Aboriginal and Torres Strait Islander persons and comorbidities

The prevalence of comorbidities is a problem in the surgical care of Aboriginal and Torres Strait Islander persons, particularly younger people.

- When patient age was capped at 50 years or younger, a considerable difference emerged between Aboriginal and Torres Strait Islander persons and non-Indigenous persons (see Table 13).

**Table 13: Prevalence of comorbidities in Aboriginal and Torres Strait Islander persons (n=131) and non-Indigenous persons (n=896) aged 50 years or younger**

	Number of patients with comorbidities	Percentage of patients with comorbidities
Aboriginal and Torres Strait Islander persons	119/165	72%
Non-Indigenous persons	774/1,349	57%

As shown in Table 13, younger Aboriginal and Torres Strait Islander persons are at a higher risk of comorbidities than younger non-Indigenous persons (72% compared to 57%). There was a statistically significant risk ratio of 1.24 (95% confidence interval 1.11 to 1.38) for comorbidities in younger Aboriginal and Torres Strait Islander persons compared with younger non-Indigenous persons.

Similar findings were reported in a publication exploring health-related behaviours as predictors of mortality and morbidity in Australian Aboriginal persons.<sup>(7)</sup>

## 10.4 Aboriginal and Torres Strait Islander persons and operations

The operative rate was similar, with 74.9% (314/419) of Aboriginal and Torres Strait Islander patients undergoing an operation compared with 79.6% (11,442/14,368) of non-Indigenous patients.

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

Table 14 shows the risk of death of Aboriginal and Torres Strait Islander persons compared to Non-Indigenous persons, as perceived by the treating surgeon.

Death risk	Aboriginal and Torres Strait Islander persons (n=314)	Non-Indigenous persons (n=11,442)
Minimal	1.0% (3/314)	2.4% (278/11,442)
Small	5.4% (17/314)	9.5% (1,087/11,442)
Moderate	24.5% (77/314)	25.2% (2,888/11,442)
Considerable	50.6% (53/314)	49.3% (5,642/11,442)
Expected death	16.9% (53/314)	12.4% (1,420/11,442)

Note: Data not available: n=130 cases (1%).

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

In most areas of care, there was no strong difference in patients who had an operation in any of the clinical management indicators when Aboriginal and Torres Strait Islander persons were compared with non-Indigenous persons (see Tables 15 and 16).

A recent publication looking at patients in the Northern Territory showed that surgical care, as measured by accepted indicators, was generally equivalent in both groups.<sup>(9)</sup>

Improvement in management of surgical care	Aboriginal and Torres Strait Islander persons (n=419)	Non-Indigenous patients (n=14,368)	Risk Ratio (95% CI)
Preoperative management	9% (29/314)	7% (780/11,442)	1.35 (0.95-1.93)
Choice of operation	3% (9/314)	2% (245/11,442)	1.34 (0.69-2.58)
Timing of operation	8% (25/314)	5% (603/11,442)	1.51 (1.03-2.22)*
Improvement in decision to operate	8% (24/314)	7% (781/11,442)	1.12 (0.76-1.65)
Intraoperative	3% (8/314)	3% (334/11,442)	0.87 (0.44-1.74)
Postoperative care	4% (14/314)	5% (546/11,442)	0.93 (0.56-1.57)

Note: CI = Confidence interval \*Statistically significant difference between the two groups at the p<0.05 level

Timing of operation was the only area for which a statistically significant difference was found between the two groups.

**Table 16: Clinical management issues with postoperative care according to the treating surgeon**

Postoperative care	Aboriginal and Torres Strait Islander persons (n=314)	Non-Indigenous patients (n=11,442)	Risk Ratio (95%CI)
Postoperative complications detected	27% (85/314)	34% (3,849/11,442)	0.80 (0.67-0.97)*
Use of DVT prophylaxis	73% (229/314)	82% (9,438/11,442)	0.88 (0.83-0.95)*
Unplanned return to theatre	20% (62/314)	16% (1,800/11,442)	1.26 (1.00-1.57)*
Unplanned readmission	3% (8/314)	3% (378/11,442)	0.77 (0.39-1.54)
Fluid balance problems	8% (26/314)	9% (1,009/11,442)	0.94 (0.65-1.36)
Communication	7% (22/314)	4% (481/11,442)	1.67 (1.10-2.52)*
Treated in critical care unit	76% (238/314)	68% (7,787/11,442)	1.11 (1.04-1.19)*
Unplanned ICU admission	18% (58/314)	19% (2,228/11,442)	0.95 (0.75-1.20)
Different action should have been taken by surgeon	20% (64/314)	16% (1,832/11,442)	1.27 (1.02-1.59)*

Note: CI = Confidence interval; DVT: deep vein thrombosis; ICU: intensive care unit. \*Statistically significant difference between the two groups at the p<0.05 level

However, in Tables 16, there were statistically significant differences in the use of DVT prophylaxis, unplanned returns to theatre and being treated in critical care units. Aboriginal and Torres Strait Islander persons were less likely to receive DVT prophylaxis, but were more likely to have an unplanned return to theatre, or be treated in a critical care unit. Statistically significant differences were identified in a number of areas.

Postoperative complications and fluid balance issues were lower in Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients, as was the use of DVT prophylaxis. Aboriginal and Torres Strait Islander patients were more likely to be treated in a critical care unit, and assessors were more likely to identify communication issues and different action by the surgeon as issues in the care of Aboriginal and Torres Strait Islander patients compared with non-Indigenous patients.

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

**Table 17: Clinical incidents in Aboriginal and Torres Strait Islander patients and non-Indigenous patients**

Area of issue	Aboriginal and Torres Strait Islander patients (n=174)	Non-Indigenous patients (n=5,397)	Relative risk for Aboriginal and Torres Strait Islander persons
Consideration	94 (54.0%)	2,527 (46.8%)	1.15 (1.00-1.33)*
Concern	59 (33.9%)	1,249 (23.1%)	1.47 (1.18-1.81)*
Adverse event	19 (10.9%)	455 (8.4%)	1.30 (0.84-2.00)

Note: \*p=0.05 vs. non-Indigenous patient control

Table 17 presents data that makes two points: that there is a statistical difference in the proportion of Aboriginal and Torres Strait Islander patients who have areas of consideration and concern compared with non-Indigenous patients; also there is no significant difference between the two groups in the proportion that have adverse events.

# 11 CONCLUSIONS

The audits of surgical mortality are uniquely positioned to use the extensive information collected during the audit process to promote safer healthcare practices. Surgery in Australia is safe and well-regulated. Only a very small proportion of surgical patients die. However, when a death does occur, it is reviewed by peer surgeon assessors. This is the responsibility of the RACS through the ANZASM. There is significant value to the Australian health consumer in the audit continuing as a quality assurance activity, with its high level of participation by surgeons and the opportunity to enhance and expand the existing data on surgical mortality.

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

- The audit has achieved widespread acceptance, with a 98.3% (4,926/5,013) surgeon participation rate.
- The majority of patients in the audit were emergency admissions with at least one comorbidity.
- DVT prophylaxis use was recorded in 84.3% (21,223/25,183) of cases in which patients underwent a surgical procedure. Across the regions, DVT prophylaxis utilisation varied from 77% to 89% of cases. In only 2% of cases did assessors consider that the DVT prophylaxis management was not appropriate.
- In the majority of instances those patients expected to benefit from critical care support did receive it. The review process suggested that 5.3% (429/8,115) of patients who did not receive treatment in a critical care unit may have benefited from it.
- Fluid balance in the surgical patient is an ongoing challenge and 7.6% (1,838/24,075) of patients had issues with their fluid balance.
- Delay in implementing definitive treatment is still the most frequent clinical management issue. These delays can be due to a number of factors and not all are the responsibility of the treating surgeon. Reasons for delay include geographical issues, diagnostic problems in the ED, inappropriate diagnosis, need for transfer, availability of theatre and communication issues. The decision to proceed to surgery and the choice of operative procedure are also high on the list of clinical management issues.
- The average proportion of cases with adverse events between 2013 and 2015 has remained relatively static: 3.9% (188/4,815) and 2.6% (89/3,373) in 2016. A proportion of more recent cases are still undergoing assessment, so the figures for 2016 may change. Average 2010-2015 and compare 2016
- Peer review feedback has been provided directly to individual surgeons via assessor comments on individual cases. This is an essential component of the audit as it provides specific targeted information on a case-by-case basis.
- The ANZASM clinical governance reports are released annually to hospitals that have three or more operating surgeons (to ensure that the participants are not identifiable). These reports use audit data to inform hospitals and government health departments about trends in clinical management issues within their hospitals and in comparison to similar state and national hospitals.
- Seminars have been facilitated based on regional reports and in-depth investigation of the issues identified. These activities have increased the quantity and quality of information disseminated on issues supporting clinical governance and patient care across the country. Further workshops have been planned for the Australian Capital Territory, Tasmania, Victoria, Queensland and South Australia during the course of 2017 and 2018.
- The audit will continue to encourage use of the Fellows Interface, the web-based portal for entering SCFs and completing FLAs. The Fellows Interface is an important initiative that minimises data entry time and the risk of errors relating to data entry, while improving turnaround time. Nationally, usage is around 60%. It is expected that a phasing out of the paper-based forms will commence during the course of 2017, necessitating use of the Fellows Interface. The introduction of compulsory fields will improve the quality of the data.

- The audit will continue to produce the National Case Note Review Booklet twice a year for distribution to surgeons, trainees and other clinical staff involved in patient care. Each audit of surgical mortality contributes to the National Case Note Review Booklet, and the publication continues to be very well received by the surgical community. Some regions also produce their own regional case note review booklets.
- The ANZASM clinical governance and performance reports use audit data to provide departments of health, and public and private hospitals, with a trending analysis of clinical management events within their hospitals as well as comparisons with state and national data.
- The use of interstate assessors in some regions safeguards the independent peer-review process and ensures that second-line cases remain de-identified. This is of particular importance in instances where a case may be well known in a region or where there are very small numbers of surgeons in a particular specialty or subspecialty.
- Improvements have been made to the SCF that enable the collection of greater detail around patient mortality where infection was present.
- The quality and effectiveness of communication within the clinical team, and with other teams involved in the care of patients, was identified as an area for future improvement and education.
- The audit includes RANZCOG Fellows. It is encouraging that in the 12 months since the last report, many of the regions had over 58% participation by gynaecological Fellows.

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

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