Royal Australasian
College of Surgeons

The Western Australian Audit of Surgical Mortality (WAASM)

2025 Report

5-year review
Jan 2020 - Dec 2024

RANZCOG™
Excellence in Women's Health

Contacts

T +61 8 6389 8650
F +61 8 6389 8655
E waasm@surgeons.org
www.surgeons.org/waasm

Royal Australasian College of Surgeons
Western Australian Audit of Surgical Mortality

Postal address:
M308, University of Western Australia, Crawley WA 6009

Street address:
Suite 1, Ground Floor, 216 Stirling Highway, Claremont WA 6010

Clinical Director	Dr James Aitken
Project Manager	Dr Franca Itotoh
Senior Project Officer	Ms Natalie Zorbas
Administrative Officer	Ms Katie Morgan

The information contained in this report has been prepared by the Royal Australasian College of Surgeons, Western Australian Audit of Surgical Mortality Management Committee, which, as part of the Australian and New Zealand Audit of Surgical Mortality is a declared quality assurance activity under the Health Insurance Act 1973 (Cwlth), Part VC (gazetted 24 April 2022).

Cover photo by Seashalia on Pixabay.

Contents

Clinical Director's report 5

Abbreviations 7

Snapshot 8

Review of 2024 recommendations 10

2025 recommendations for WAASM 13

1. Introduction 14

1.1 Background 14

1.2 Purpose and objectives 14

1.3 Methods 15

2. Audit overview 16

2.1 Number of reported deaths 16

2.2 Hospitals 20

2.3 Surgeon participation 21

3. Results 23

3.1 Patient demographics 23

3.2 Causes of death 25

3.3 Hospital transfers 26

3.4 Critical care units 28

3.5 Operative and nonoperative cases 29

3.6 Deep vein thrombosis prophylaxis 35

3.7 Infections 37

4. Outcomes of peer-review assessment 39

4.1 Levels of assessment 39

4.2 Care pathway 40

4.3 Clinical management issues 41

Contents (continued)

Acknowledgements 46

References 47

Appendix A: List of figures and tables 49

Appendix B: Data for review of 2024 recommendations 50

Figure B.1: Retrospective considerations by treating surgeons, 2020–2024 50

Figure B.2: Preoperative risk of death reported by treating surgeons and assessors, 2020–2024 50

Figure B.3: Deaths in elective patients aged ≤50 years, 2016–2023 51

Appendix C: WAASM governance structure 52

Appendix D: WAASM audit process 53

Appendix E: Definitions 55

Appendix E.1 Statistical process control charts 55

Appendix E.2 American Society of Anesthesiologists physical classification status 55

Clinical Director's report

Last year, the Western Australian Audit of Surgical Mortality (WAASM) 2024 Report anticipated that 2024 might be an inflection point in the scope, role and expectations of clinical quality registries (CQRs), including the Australian and New Zealand Audit of Surgical Mortality (ANZASM).[1] There is every reason to believe that was correct.

'The Australian Commission on Safety and Quality in Health Care (ACSQHC) Australian Framework for National Clinical Quality Registries 2024' contains a number of strategic and operating principles and these included the timeliness of data collection and data quality.[2] These requirements are consistent with the discussions ANZASM has had with the state/territory Departments of Health (jurisdictions) over the last 18 months.

This WAASM 2025 Report reflects the transition away from the traditional quality assurance format that presented summary and aggregated data only. In future, WAASM will use quality improvement (QI) methods and present individualised data using longitudinal statistical process control (SPC) charts. WAASM will be able to present quarterly analysis to surgeons, hospitals and the Department of Health. Subsequent annual reports are likely to provide a brief overall summary highlighting important issues, with embedded links to provide greater detail.

Many CQRs are already using SPC charts in dashboards that report informally near-real-time results, and report formally every quarter. These dashboards have extensive abilities to filter and present data in different formats suitable for diverse users (e.g. for surgical mortality and morbidity meetings).

The Safety and Quality Indicator Set (SQuIS) dashboard developed by the Healthcare Quality Intelligence Unit of the Western Australian (WA) Department of Health leads Australia, and arguably the world, in reporting clinical care via SPC charts. The SQuIS dashboard is available to all WA Health employees via the internal WA Health Intranet.

WAASM recommends that surgeons familiarise themselves with the content and layout of the statistical analysis provided by SQuIS, including SPC and funnel plot analysis. The WA Department of Health has shared this expertise with ANZASM, and it is anticipated that ANZASM will have a dashboard within the next 12 months.

The WAASM 2024 Report included a section that explored the use of SPC charts in the reporting of its data. That report —and subsequent ANZASM work—has shown this is entirely feasible. Thus, this WAASM 2025 Report has reported some data in the same style. This has undoubtedly added value.

The use of QI methods will also permit ANZASM to meet the requirements of the jurisdictions that want a more streamlined process that provides rapid reporting. A reasonable first aim is that cases that only require first-line assessment (initial stage of peer review) are closed within 90 days. Once revised processes are embedded, it is hoped this will be reduced to within 60 days. This will close almost 90% of all cases.

To achieve this, all parts of the ANZASM process must be reviewed for efficiency. States and territories now require hospitals to report surgical deaths to their mortality office within a week. Surgeons will need to return their Surgical Case Forms (SCFs) as soon as possible, within no more than 30 days. Clinical Directors will screen these SCFs with the intention of reducing the number of first- and second-line assessments required.

To improve the timeframe for completion of reviews, SCFs must contain all relevant details. While the majority of SCFs are completed appropriately, some are returned with brief—almost cursory— comments. Such SCFs will increasingly be returned to the surgeon and remain outstanding until resubmitted with adequate details. Obtaining complete SCFs will assist both the first- and second-line assessors and hopefully reduce the number of second-line assessments required.

ANZASM monitors the timeliness of each stage of the audit process using SPC charts. There has been great improvement, but the variation indicates that further gains are possible.

Clinical Director's report (continued)

Whilst there is not at present an agreed definition for timely reporting, it is likely to be no longer than quarterly and, where hospital numbers permit, in more granular detail. Subsequent work within ANZASM has shown that this is not only entirely feasible but provides much greater insight into the data.

Central to discussions with the jurisdictions has been the essential role of qualified privilege (QP). Since the changes to QP in 2022, it has been possible for WAASM to communicate limited high-level data to the WA Department of Health. This has been very valuable but needs to be explored further.

This data communication does not extend to the SCFs or first- and second-line assessments. These remain protected by QP in the same manner as always. It is appropriate, and important to record that the WA Department of Health acknowledges and understands that these confidential reports are central to the WAASM process.

Turning to this report, there are 3 points of note. The first, is that the upward trend in surgical deaths observed since 2020 has continued. WAASM has previously noted that, although there is no specific evidence, the reversal in the long downward trend in deaths coincided with the COVID-19 pandemic. It seems the rise is driven by General Surgery (accounting for some 40% of deaths) and by an increase in the number of patients who do not have an operation. SPC analysis of ANZASM data shows the number of deaths under the care of a surgeon where an operation has not occurred is far greater in WA than in all other states. The reason for this is unclear.

The second point of note is that in this and every previous WAASM report, many of the clinical management issues (CMIs) identified by assessors were unrelated to the technical aspects of surgery but related to non-technical actions and decisions (e.g. communication, leadership). The importance of non-technical skills (NTS) errors has been well established in many high-risk industries. Although many WAASM/ANZASM assessors comment on NTS errors, these have not been documented previously in any formal manner.

The third point, and one that reflects the very essence of WAASM, is the comments by surgeons as to what they would do differently with the benefit of hindsight. Some 80% of these relate to non-technical decisions.

These findings mirror 2 recent ANZASM papers published in the high impact British Journal of Surgery, which reported that 63.7% of surgical deaths were associated with NTS errors.[3,4] It would be unacceptable if this percentage of surgical deaths were associated with a technical error. These papers proposed a classification that would permit NTS errors to be retrospectively documented in a consistent manner. All surgeons are encouraged to familiarise themselves with these publications. Assessors should consider reporting any NTS errors, as described in these papers.

As in previous years, it is my genuine pleasure to again recognise the work of the WAASM staff —Franca Itotoh, Natalie Zorbas and Katie Morgan. It is quite impossible to overstate their enthusiasm, expertise and commitment. This report is testament to that. Their at least weekly emails to me with the subject line 'Action items' ensure I too remain timely. WA surgeons, myself in particular, are very fortunate and, on behalf of all, I again offer them sincere thanks for their excellent work throughout the year.

RJ Aitken

WAASM Clinical Director

Abbreviations

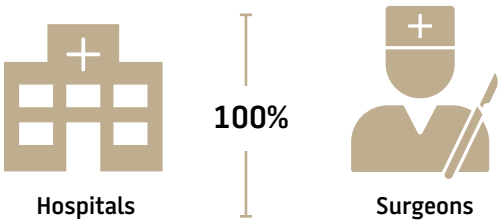
ACSQHC	Australian Commission for Safety and Quality in Health Care
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anesthesiologists
BAS	Bi-national audits of surgical mortality system
CCU	Critical care unit
CMI	Clinical management issue
CNR	Case note review
CPD	Continuing professional development
CQR	Clinical quality registry
DVT	Deep vein thrombosis
FLA	First-line assessment
NTS	Non-technical skills
QI	Quality improvement
QP	Qualified privilege
RAAS	Research, Audit and Academic Surgery
RACS	Royal Australasian College of Surgeons
SAC	Severity assessment code
SCF	Surgical case form
SLA	Second-line assessment
SPC	Statistical process control
SQuIS	Safety and quality indicator set
TED	Thromboembolic deterrent
WA	Western Australia/n
WAASM	Western Australian Audit of Surgical Mortality

Snapshot

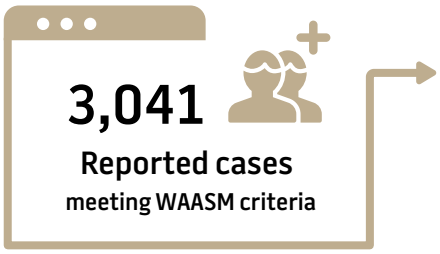
This snapshot covers cases reported to WAASM from **1 January 2020 to 31 December 2024**.

Note that differences in denominators are due to incomplete information provided in surgical case forms and assessment forms, resulting in missing data.

Participation



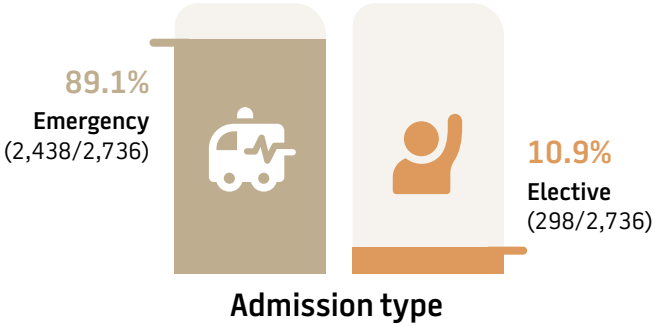
Analysis and audit numbers



88.0%
Completed cases
(2,677/3,041)

3.6%
Cases in progress
(109/3,041)

8.4%
Excluded terminal care cases
(255/3,041)

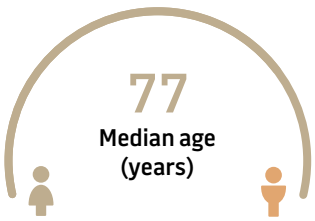


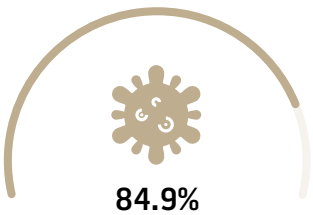
Public 83.6%
(2,288/2,737)

Private 9.8%
(268/2,737)

Co-location 6.6%
(181/2,737)

Risk profile

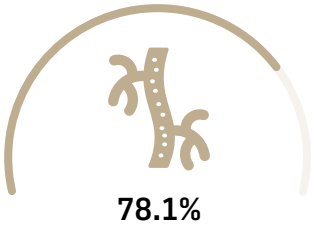




84.9%
Comorbidities
(2,323/2,737)

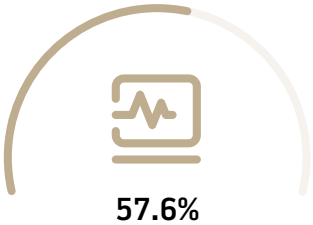
44.7%
ASA IV - most common ASA grade
(1,209/2,706)

ASA: American Society of Anesthesiologists.



78.1%
DVT prophylaxis use
(2,137/2,736)

DVT: deep vein thrombosis.



57.6%
CCU use
(1,574/2,735)

CCU: critical care unit.

Patient transfers

29.6% Patients transferred (811/2,736)

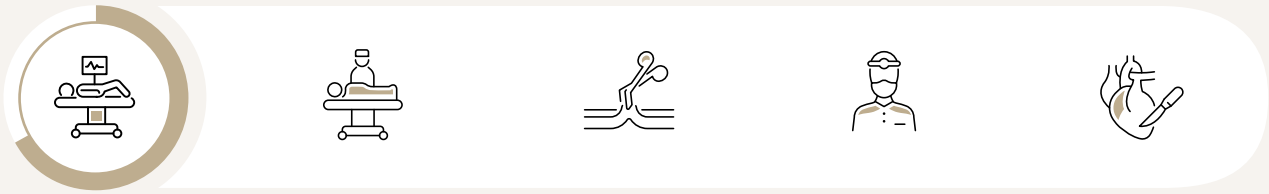
11.5% Delay in transfer (93/809)

4.2% Insufficient clinical information (34/808)

4.2% Inappropriate transfer (34/809)

2.4% Inappropriate level of care (19/807)

Operations



62.1% Patients with one or more operations (1,700/2,737)

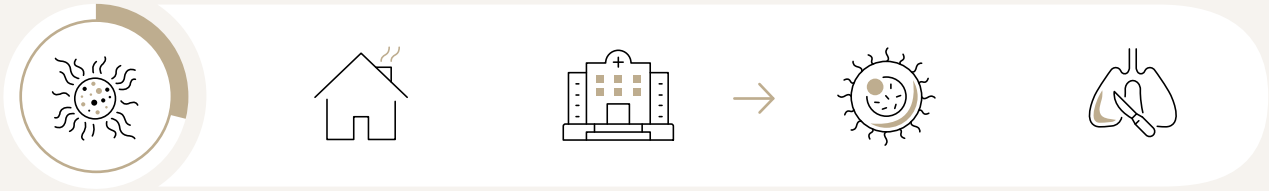
2,267 Number of operations

91.8% Consultant surgeons who made the decision to operate (2,081/2,267)

68.4% Consultant surgeons who performed the surgery (1,550/2,267)

14.5% Unplanned returns to theatre (246/1,700)

Infection



30.8% Patients with clinically significant infection (843/2,734)

53.4% Infection acquired prior to admission (450/843)

46.6% Infection acquired during admission (393/843)

28.0% Infection acquired preoperatively (110/393)

52.9% Infection acquired postoperatively (208/393)

Peer-review outcomes

13.6% Cases with one or more clinical management issues (365/2,677)

603 Number of clinical management issues

11.3% Adverse events (68/603)

44.1% Adverse events that caused death (30/68)

26.7% Definitely preventable adverse events that caused death (8/30)

Review of 2024 recommendations

2024 Recommendations	Progress
Education	
Ensure that surgeons are viewing WAASM feedback letters for each of their cases, so insights and suggestions made by assessors and subsequent lessons from the audit, are communicated to them.	WAASM now analyses feedback letter views and downloads for each case. This analysis also highlights those cases where CMIs have been noted during the assessment process (and outlined in the feedback letters). This enables WAASM to identify cases where feedback letters have not yet been read and provides an opportunity to draw surgeons' attention to this (particularly those with important insights and clinical lessons).
Clinical management	
For the 2025 and 2026 reports, examine surgeon responses to the SCF question: *'In retrospect, would you have done anything differently'*, and identify and report on any emerging themes.	For the reporting period 2020–2024, 9.1% of surgeons (250/2,737) responded 'yes' to the SCF question: 'In retrospect, would you have done anything differently.' Several themes emerged from the free-text component of the question, of which the 6 most frequently identified are represented in Appendix B, Figure B.1. Many individual surgeon responses contained more than one theme. Surgeons most frequently reflected on the type of operation performed or intraoperative technique used (22.0%; 55/250), followed by whether surgery should not have been undertaken (21.2%; 53/250). In 12.4% of responses (31/250), surgeons considered that more prompt action at a specified point in the patient's care pathway could have been beneficial.
For the 2025 and 2026 reports, examine the preoperative risk of death as recorded by surgeons in the SCF and by surgical assessors in the assessment form, and identify and report on any trends.	Both SCFs and assessment forms require respondents to choose the patient's preoperative risk of death from among 6 categories: minimal, small, moderate, considerable, expected, futile. Of the operative deaths that completed the audit process between 2020–2024, treating surgeons identified more patients as being at minimal (4.3%; 60/1,384) or small (11.6%; 161/1,384) preoperative risk of death than did assessors (1.6%; 22/1,362 and 7.3%; 99/1,362, respectively). Assessors identified more patients in each of the remaining 4 categories (see Appendix B, Figure B.2). The preoperative risk of death category most frequently reported by treating surgeons was considerable (53.0%; 734/1,384). This category was also the most identified by assessors, representing 55.6% of responses (757/1,362). The second most reported category for both treating surgeons and assessors was moderate, accounting for 23.8% (330/1,384) and 25.2% (343/1,362) of responses, respectively.

Review of 2024 recommendations (continued)

Research and reporting on audit data	
In conjunction with ensuring that WAASM feedback letters are viewed by audit participants (noted above), develop strategies to increase the number of peer-review feedback evaluation forms returned to WAASM following the receipt of feedback letters. This ongoing evaluation is important in closing the loop and indicating how care or processes have been improved.	WAASM is now able to identify cases where feedback letters have not yet been viewed by surgeons. Peer-review feedback evaluation forms are sent in conjunction with feedback letters, so if a surgeon is unaware of a peer-review outcome, there is no comment to offer about the results of a specific assessment. Improvement in the number of feedback letters viewed could potentially lead to an increase in the evaluation forms received by WAASM. To improve the viewing rate of feedback letters, a reminder process is being established for when feedback letters have not been viewed within one month of being sent by WAASM. Priority will be given to those cases where assessors identified a CMI.
The environment within which WAASM operates will be influenced by jurisdiction-initiated discussions with ANZASM regarding improvements it feels will enhance its value. The 3 major issues to be addressed are: • more timely reporting • complete participation and case ascertainment • nationally consistent approach to open and transparent reporting. This approach must be viewed alongside the publication of the ACSQHC revised Framework for Australian CQRs and the Commonwealth providing up to $40 million to fund national CQRs. A major focus for WAASM will be how best to respond to jurisdictions' requests.	ANZASM is engaged in ongoing discussions with the jurisdictions regarding enhancements that will increase its value. There has been some improvement in the timeliness of hospital reporting of surgical deaths, with the majority of hospitals now providing notifications within a week of the patient's death. Work is continuing regarding streamlining all aspects of the ANZASM process, ensuring cases are received from surgeons in sufficient detail, processed and peer-reviewed in a timely manner. With this achieved, ANZASM reports can be generated in near-real-time and made available more frequently. For further information, please see the Clinical Director's report, pages 5–6.

Review of 2024 recommendations (continued)

Research and reporting on audit data	
Continue analysis of unexpected deaths occurring in elective patients aged ≤50 years or in regional hospitals (where complex cases are predominantly transferred to metropolitan tertiary hospitals).	**2024 progress update** This analysis remains in progress. WAASM intends to examine the data over an extended period and present the results using SPC charts. **2025 progress update** In patients admitted for elective surgery, deaths in those aged ≤50 years or those treated in regional hospitals (where complex cases are likely transferred to metropolitan tertiary hospitals for surgery) can be considered potentially unexpected. WAASM has examined the data collected over an 8-year period (2016–2023) for the proportion of cases within these 2 categories. It was anticipated that SPC charts would be used to present these findings; however, data analysis indicated that the numbers were too small for this to be effective. **Deaths in elective patients aged ≤50 years** During 2016–2023, 12.9% (516/4,013) of patients were elective admissions, of which 5.4% (28/516) were those aged ≤50 years (see Appendix B, Figure B.3). Surgery was performed as planned in 100% of these cases (27/27; missing data n = 1). **Deaths in elective patients in regional hospitals** Of the 516 elective admissions from 2016–2023, 5.4% of surgical deaths (28/516) were spread among 4 regional hospitals.

2025 recommendations for WAASM

Education

- As part of ANZASM's commitment to providing a wide range of educational forums, it plans to present a series of bimonthly webinars 6 times per year. Responsibility for the webinars will rotate between individual audits of surgical mortality. WAASM's contribution to this program will consist of hosting one webinar each year, aimed at identifying timely and topical issues of relevance to WA surgeons.

Clinical management

- For the 2026 report, WAASM will continue to examine surgeon responses to the SCF question '*In retrospect, would you have done anything differently*', and identify and report on any emerging themes.
- For the 2026 report, WAASM will continue to examine the preoperative risk of death as recorded by surgeons in the SCF and by surgical assessors in the assessment form and identify and report on any trends.

Research and reporting on audit data

- To explore the relationship between CMIs as reported by the WAASM first- and second-line assessors, and the severity assessment code (SAC) 1 clinical incidents reported by the hospitals to the WA Department of Health.

1. Introduction

1.1 Background

The Western Australian Audit of Surgical Mortality (WAASM) is an external, independent peer-reviewed audit of the processes of care associated with surgery-related deaths in Western Australia (WA). WAASM is funded by the WA Department of Health and is protected by Federal legislation. The Australian and New Zealand Audit of Surgical Mortality (ANZASM) receives legislative protection under the Commonwealth Qualified Privilege Scheme, under part VC of the Health Insurance Act 1973 (gazetted 24 April 2022).

WAASM is governed by a management committee that monitors the structures and processes involved in the WAASM quality assurance activity (Appendix C). The WAASM Management Committee reports to the ANZASM Committee, which coordinates all regional audits of surgical mortality.

Participation in WAASM became compulsory in 2010 and has been part of the Royal Australasian College of Surgeons (RACS) continuing professional development (CPD) program since 2013. The Medical Board of Australia has now mandated that participation in ANZASM is a high-level specialist requirement for surgeons in Australia.

1.2 Purpose and objectives

The core purpose of WAASM is to improve patient outcomes. As a patient safety and quality improvement initiative, WAASM is designed as an educational tool and feedback mechanism for surgeons to encourage reflection on surgical care and practice following the death of a patient. Information submitted to WAASM by surgeons provides the opportunity to identify areas in which care can be improved. Surgical peers review the medical record and assess the surgical management of every patient, including hospital processes and systems, and provide feedback to the surgeon responsible for each case.

The objectives of WAASM are:

1. to audit all surgery-related deaths with the following criteria:

- the patient was under the care of a surgeon, regardless of whether an operation was performed
- the patient was under the care of a physician and subsequently underwent a surgical procedure.

(Cases outside of these criteria are excluded from the audit. Patients admitted under the care of a surgeon specifically for terminal care are excluded from the full audit process. These cases do not undergo peer review.)

2. to analyse clinical management issues (CMIs) identified by assessors (see the WAASM audit process in Appendix D for CMI definitions).

The improvement of patient outcomes is accomplished by the provision of detailed feedback to surgeons and hospitals to inform, educate, facilitate change and improve practice. This is achieved at different levels (individual, hospital or grouped) and is provided in several ways:

- **Individual feedback**

  Surgeons are provided with assessor feedback on individual cases. The identities of assessors remain anonymous at all times. WAASM encourages surgeons to complete the Peer-Review Feedback Evaluation Form providing comments in response to the feedback received.

1.2 Purpose and objectives (continued)

- **Hospital report**

  Individual hospital reports are sent annually to all hospitals participating in WAASM. These reports contain de-identified aggregated data that can be used for monitoring trends within the individual hospital and for comparisons with other participating peer-grouped hospitals across the country.

- **ANZASM publications**

  National Case Note Review Booklet – a selection of cases reviewed by assessors is summarised, collated and disseminated to all surgeons. All information within these reviews is de-identified, so events cannot be linked to an individual patient, surgeon or hospital.

  National Case of the Month – a case review emailed to surgeons at the end of each month.

- **RACS publications**

  Surgical News – released every 2 months, each issue contains an ANZASM case study.

  Fax Mentis – circulated fortnightly, contains ANZASM case studies and promotion of ANZASM events.

- **Annual report**

  The WAASM annual report is published in October and made available on the WAASM website. It is circulated to all WA surgeons and the WA Department of Health and is published on the RACS website.

1.3 Methods

WAASM audits all surgery-related deaths occurring in WA hospitals. WAASM's full audit process is outlined in Appendix D.

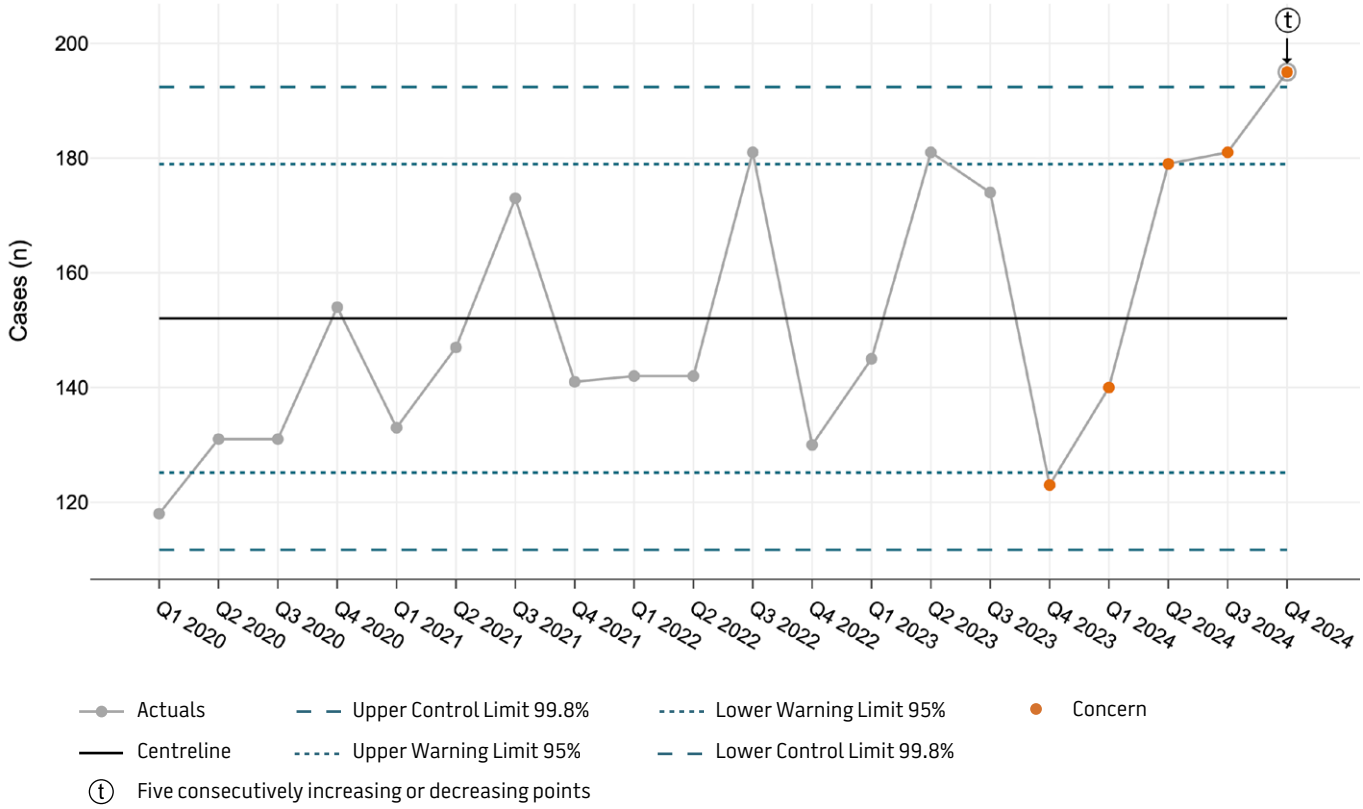
This 2025 report covers deaths reported to WAASM from **1 January 2020** to **31 December 2024** (census date 4 April 2025). The full audit process can take 3 months or longer from the initial notification of death, so some 2024 cases were still under review as of the census date and outcomes were unavailable for this report. Case numbers in previous reports, particularly in recent years, may differ from those in this report due to cases completed after the relevant census dates. Differences in denominators are due to incomplete information provided in surgical case forms and assessment forms, resulting in missing data.

2. Audit overview

2.1 Number of reported deaths

Figure 1 shows the number of reported deaths audited in the period 2020 to 2024, by quarter. There has been a progressive increase in the number of deaths, which can be seen from Q4, 2023.

Figure 1: WAASM deaths, by quarter

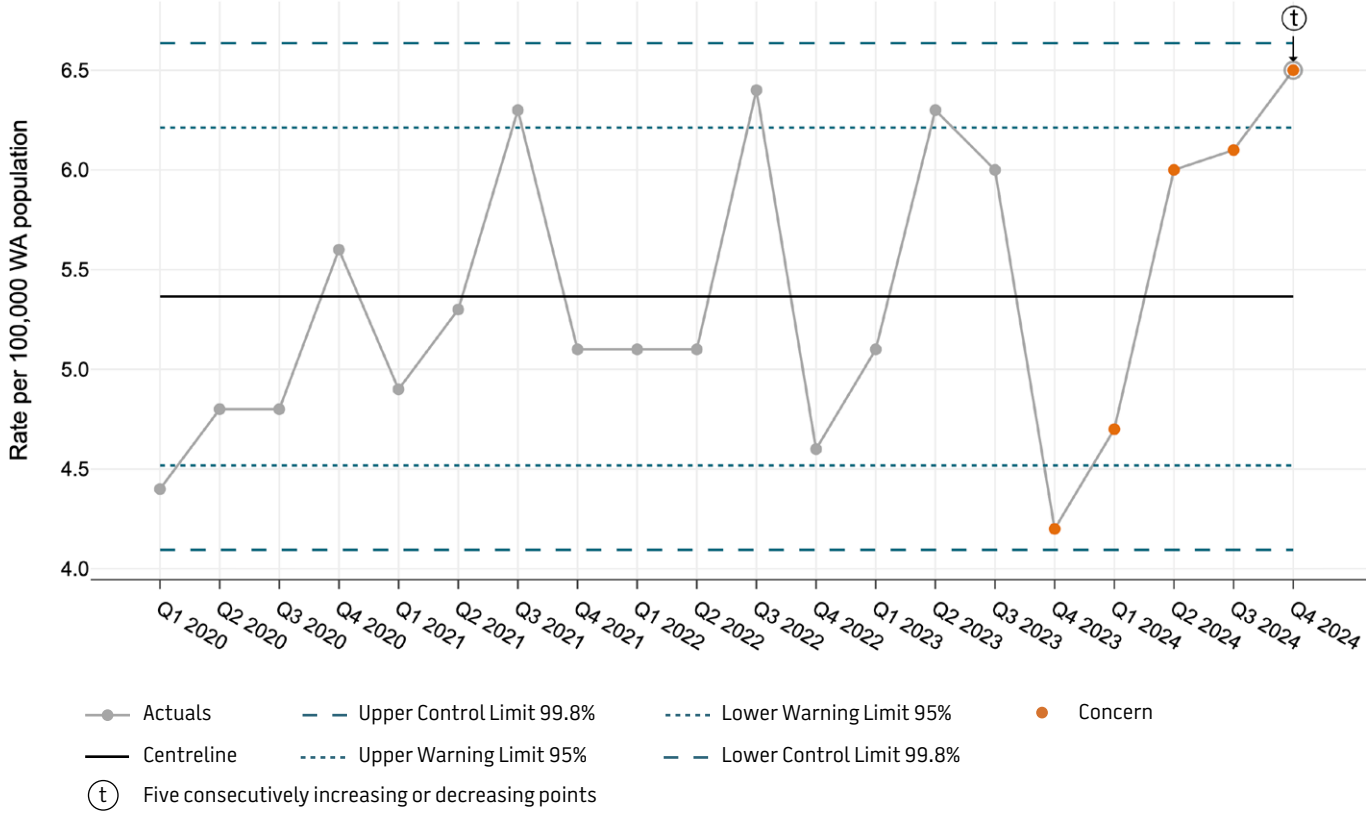


WAASM: Western Australian Audit of Surgical Mortality, Q: quarter.
Refer to Appendix E.1 for further SPC information.

2.1 Number of reported deaths (continued)

The rate of deaths under the care of a surgeon per 100,000 WA population is shown in Figure 2.[5] This also shows a progressive increase in the number of deaths under the care of a surgeon.

Figure 2: WAASM deaths and mortality rate per 100,000 WA population, by quarter



WAASM: Western Australian Audit of Surgical Mortality, WA: Western Australia, Q: quarter.
Note: No Australian Bureau of Statistics population data were available for Q4 2024 period, so an estimated value was used.
Refer to Appendix E.1 for further SPC information.

2.1 Number of reported deaths (continued)

During the audit period 1 January 2020 to 31 December 2024, 3,183 deaths were reported to WAASM. Of these, 142 deaths were excluded for not meeting WAASM inclusion criteria, resulting in a total of 3,041 deaths included for the current report (Table 1). The biggest increase was seen between 2023 and 2024 (11.6%; increase from 623 to 695).

Table 1: Deaths reported to WAASM, by year

Year	Number of deaths reported	Deaths not meeting criteria*	Deaths meeting criteria#
2020	556	22	534
2021	616	22	594
2022	632	37	595
2023	650	27	623
2024	729	34	695
Total	**3,183**	**142**	**3,041**

WAASM: Western Australian Audit of Surgical Mortality.
* Reported deaths subsequently found to have no surgeon involvement.
# All deaths meeting WAASM criteria, including terminal care cases.

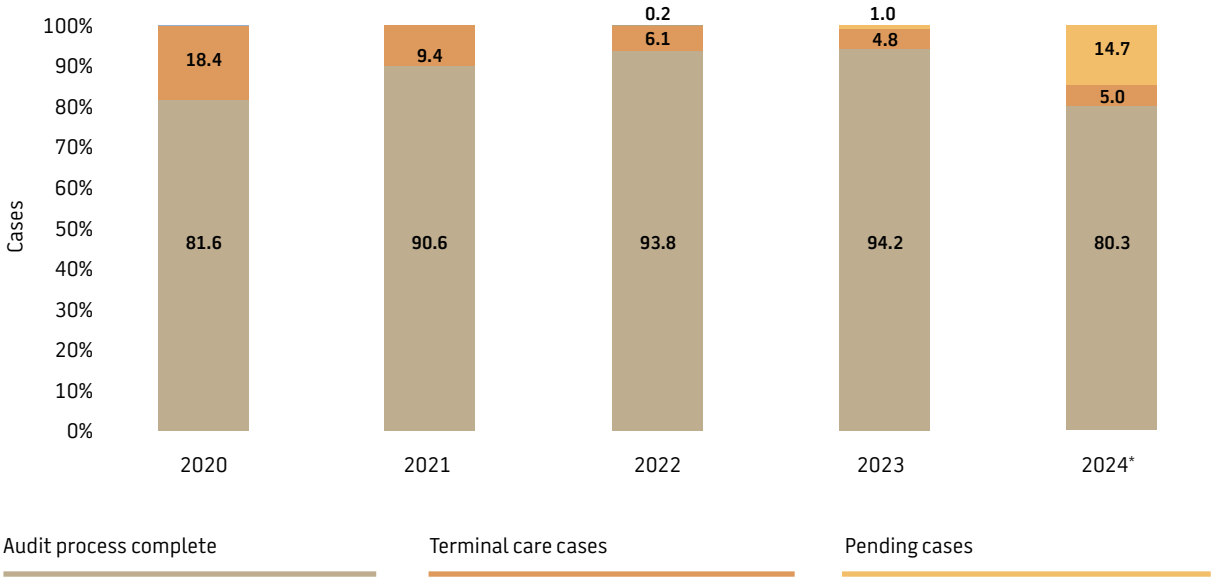
2.1 Number of reported deaths (continued)

In the period 2020 to 2024, 88.0% of cases (2,677/3,041) had completed the audit process. Cases in progress amounted to 3.6% (109/3,041), with cases from 2024 constituting the largest proportion of those incomplete (3.4%; 102/3,041).

Patients admitted specifically for terminal care are excluded from the full audit process and surgeons do not have to complete the SCF. Over the reporting period (2020–2024), terminal care accounted for 8.4% of cases (255/3,041).

Figure 3 shows that the proportion of terminal care cases has gradually decreased over the reporting period (18.4%, 2020; 9.4%, 2021; 6.1%, 2022; 4.8%, 2023; 5.0%, 2024). This can be attributed to the detailed review of terminal care cases that WAASM has undertaken since 2021 to ensure that incorrect terminal care classifications are identified and SCFs are returned to surgeons for completion.

Figure 3: Case status, by year



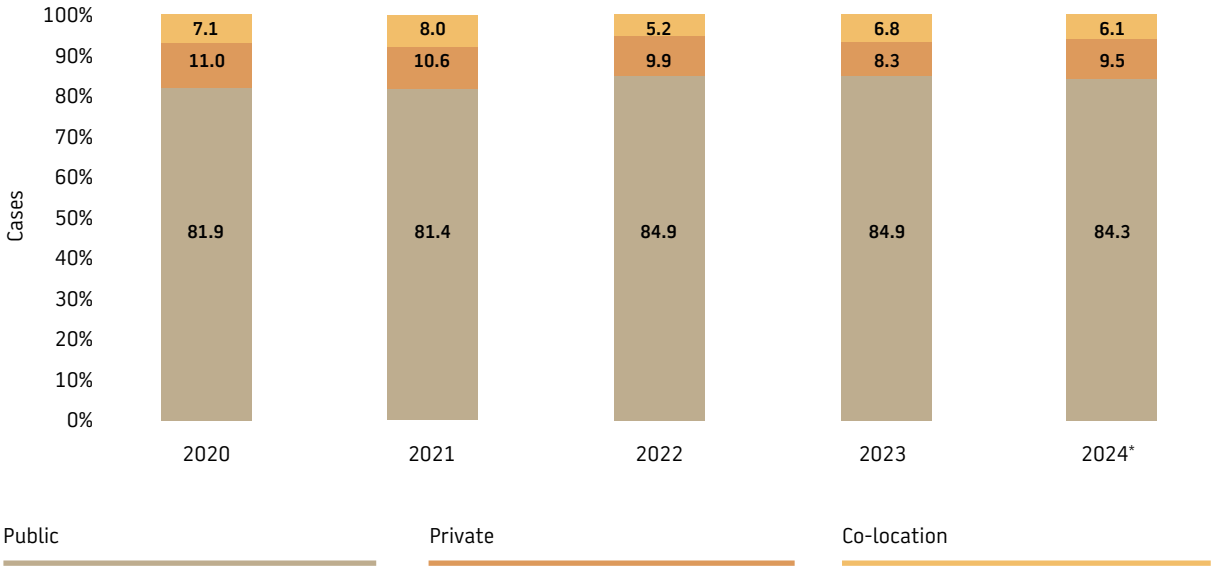
* Some 2024 cases still undergoing review, so case data unavailable for this report.

2.2 Hospitals

All hospitals providing surgical services in WA participate in the audit. Between 2020 and 2024, 26 hospitals (of 48) contributed to the 3,041 deaths meeting WAASM criteria.

Between 2020 and 2024, public hospitals accounted for 83.6% of admissions (2,288/2,737), with private and co-location hospitals accounting for 9.8% (268/2,737) and 6.6% (181/2,737) of admissions, respectively. Figure 4 shows the breakdown of hospital status by year. (Co-location hospitals are those that provide both privately and publicly funded surgical services. Data for co-location hospitals include public and private patients.)

Figure 4: Deaths by hospital status, by year



* Some 2024 cases still undergoing review, so case data unavailable for this report.
Data missing: n = 1.

2.3 Surgeon participation

Surgeons participate in WAASM both as treating surgeons responsible for cases being audited and as assessors undertaking peer reviews.

The return rate for SCFs, including terminal care cases, was 98.4% (2,993/3,041).

Table 2 shows WAASM deaths for each surgical specialty in the period 2020 to 2024. General Surgery reported the most deaths at 43.8% (1,331/3,041), followed by Orthopaedic Surgery at 17.9% (543/3,041) and Neurosurgery at 15.9% (483/3,041).

Table 2: WAASM deaths by surgical specialty, 2020–2024

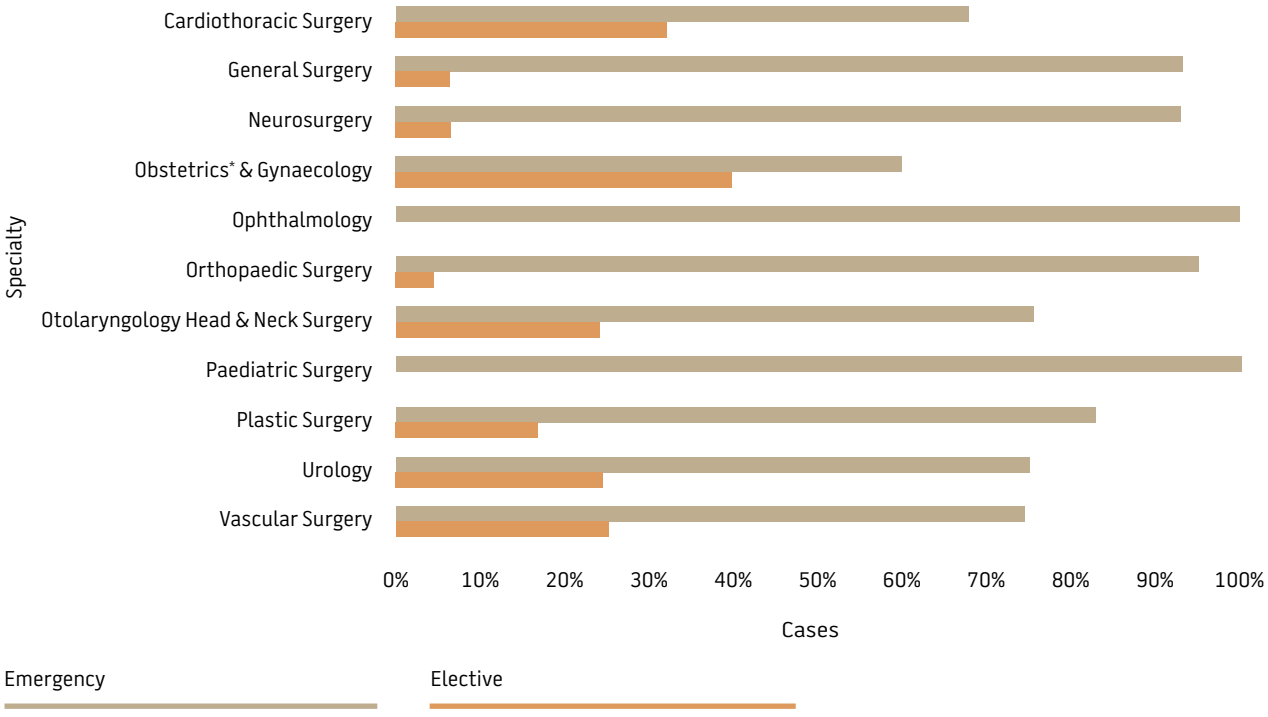
Surgical specialty	Number of deaths	Percentage (%)
General Surgery	1,331	43.8
Orthopaedic Surgery	543	17.9
Neurosurgery	483	15.9
Vascular Surgery	243	8.0
Cardiothoracic Surgery	187	6.1
Urology	128	4.2
Otolaryngology Head & Neck Surgery	49	1.6
Plastic Surgery	44	1.4
Paediatric Surgery	16	0.5
Obstetrics* & Gynaecology	14	0.5
Ophthalmology	3	0.1

WAASM: Western Australian Audit of Surgical Mortality.
* Obstetric cases are not included in the audit process; only gynaecological cases are audited.

2.3 Surgeon participation (continued)

Emergency admissions accounted for 89.1% (2,438/2,736) and elective admissions for 10.9% (298/2,736) of hospital admissions in the period 2020 to 2024. All specialties had more emergency admissions compared to elective admissions (Figure 5).

Figure 5: Deaths by surgical specialty and hospital admission, 2020–2024



* Obstetric cases are not included in the audit process; only gynaecological cases are audited.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Data missing: n = 2.

3. Results

3.1 Patient demographics

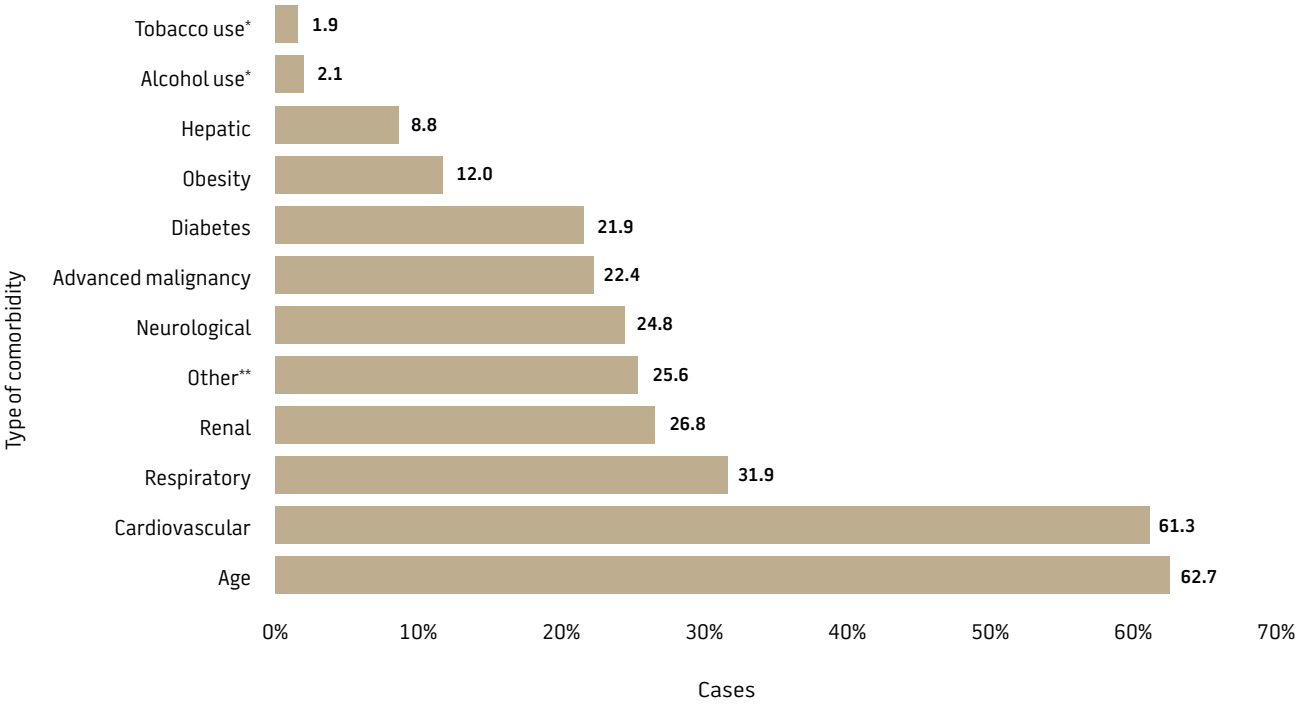
In the period 2020 to 2024, the median age at death for all patients and the age breakdown by sex are presented in Table 3. Males accounted for 56.8% (1,727/3,041) and females 43.2% (1,314/3,041) of all deaths.

Table 3: Median age by sex, 2020–2024

	Number of cases	Median age (years)	Interquartile range (years)
All patients	3,041	77	65–86
Sex			
Males	1,727	76	64–85
Females	1,314	78	66–87

Most patients (84.9%; 2,323/2,737) had at least one comorbidity, with 83.5% (1,939/2,323) of patients having more than one comorbidity. As shown in Figure 6, the 2 most reported comorbidities were age (62.7%; 1,457/2,323) and cardiovascular disease (61.3%; 1,424/2,323).

Figure 6: Cases with specific comorbidities, 2020–2024



* Data only collected since 2023.

** Other includes comorbidities other than those listed on the surgical case form, which may include the presence of other chronic illnesses, haematological or drug-related conditions, vasculopathy, hypertension, dementia, malnutrition, alcoholism and cachexia.

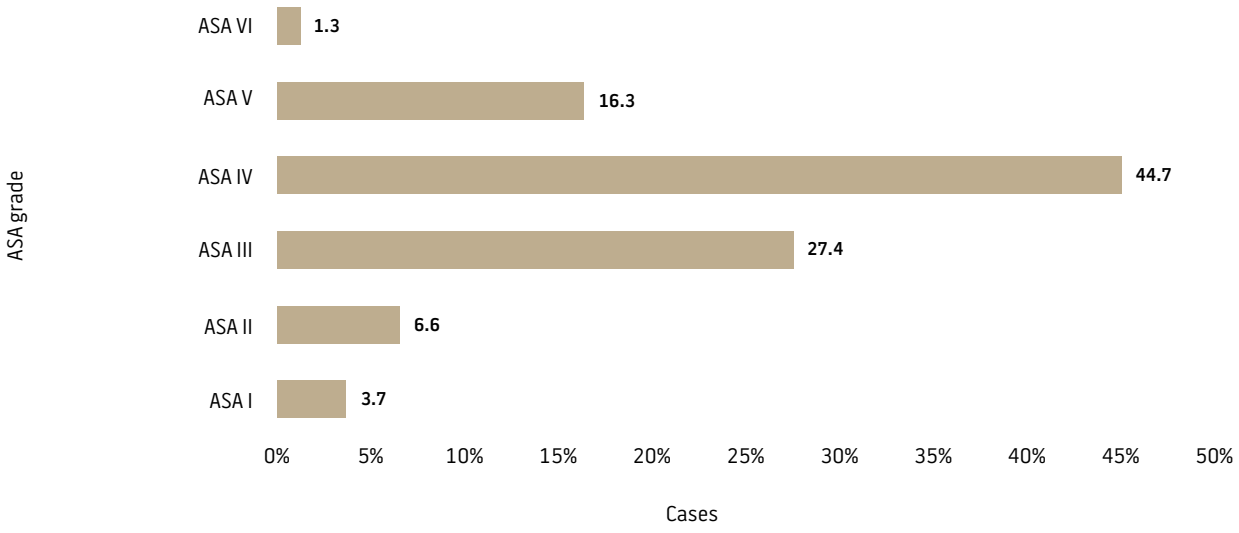
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.

3.1 Patient demographics (continued)

The American Society of Anesthesiologists (ASA) classification system is an internationally recognised measure of a patient's physical status (Appendix E.2).[6]

As Figure 7 demonstrates, most patients (44.7%; 1,209/2,706) were assigned ASA grade IV (patient with severe systemic disease that is a constant threat to life). ASA grade III, defined as a patient with severe systemic disease, was the second most frequently assigned (27.4%; 742/2,706).

Figure 7: Frequency of American Society of Anesthesiologists grades, 2020–2024

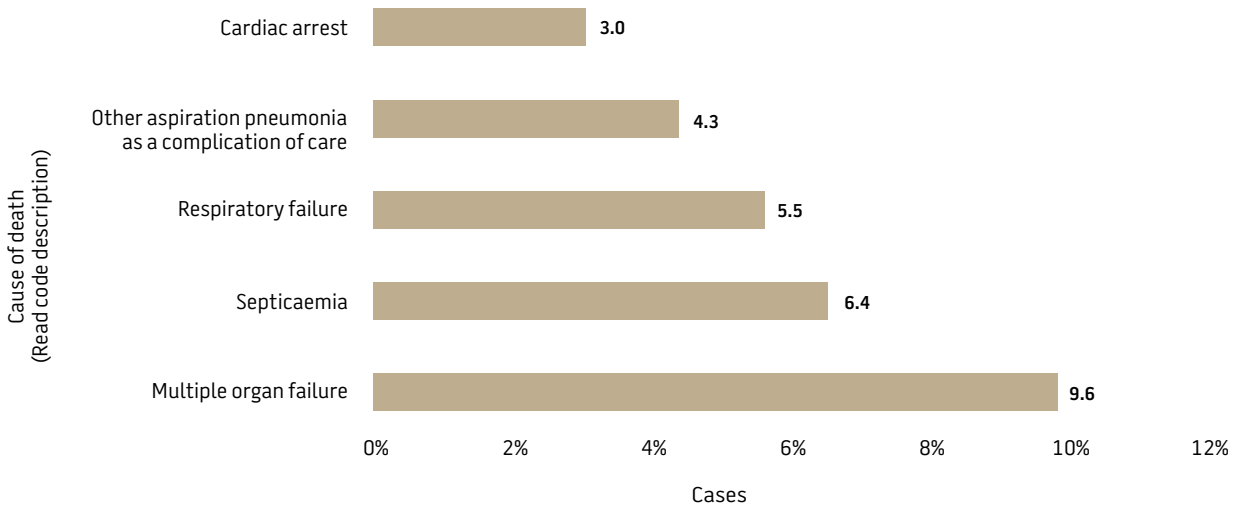


ASA: American Society of Anesthesiologists.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.2 for definitions of ASA grade.
Data missing: n = 32.

3.2 Causes of death

Overall, the most frequently reported causes of death were multiple organ failure (9.6%; 421/4,397) and septicaemia (6.4%; 281/4,397). Figure 8 shows the most common causes of death by Read code, which forms a clinical decision tree containing terms, synonyms and abbreviations covering all aspects of patient care. More than one cause of death can be listed for some cases.

Figure 8: Most common causes of death 2020–2024, by Read code*



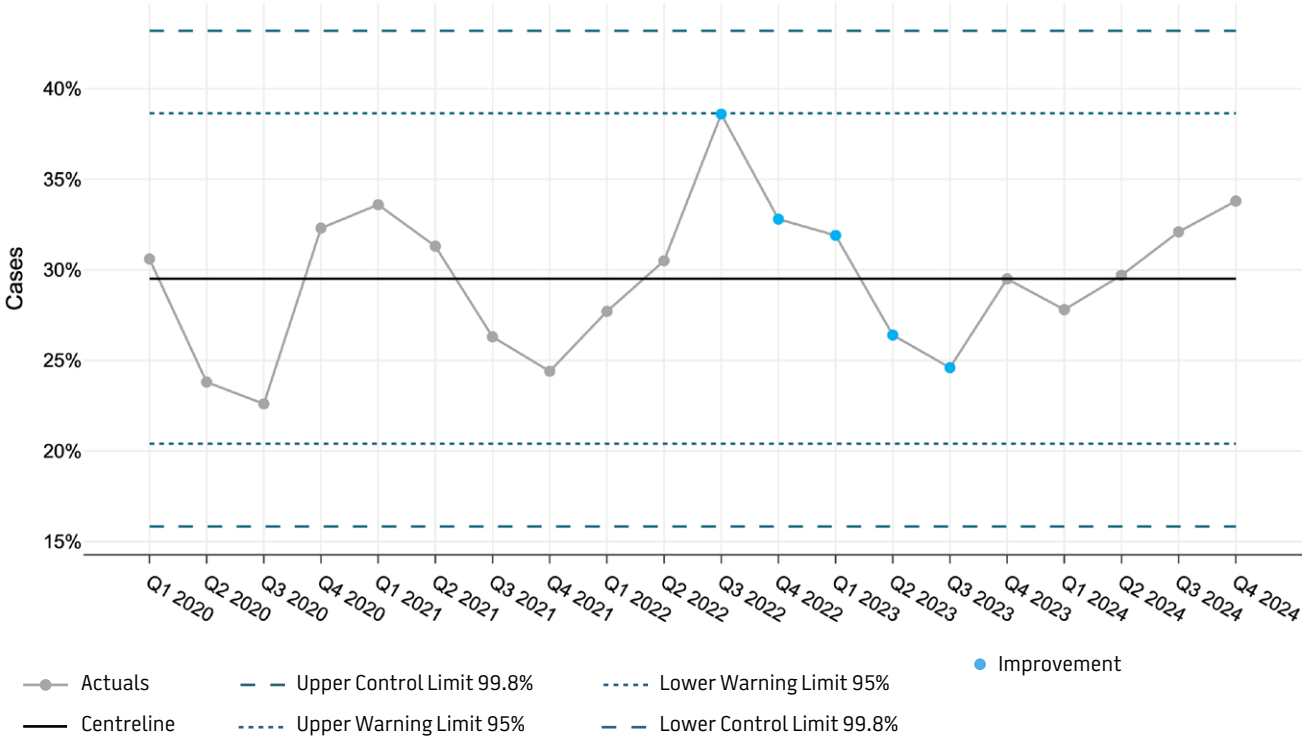
* Surgical diagnoses categorised using a coded thesaurus of clinical terms.

Note: More than one cause of death can be listed for some cases. Some 2024 cases still undergoing review, so case data unavailable for this report.

3.3 Hospital transfers

Between 2020 and 2024, preoperative hospital transfers occurred for 29.6% of patients (811/2,736) (Figure 9). Emergency admissions accounted for 96.8% (785/811) and elective admissions for 3.2% (26/811) of this group.

Figure 9: Preoperative hospital transfers, by quarter

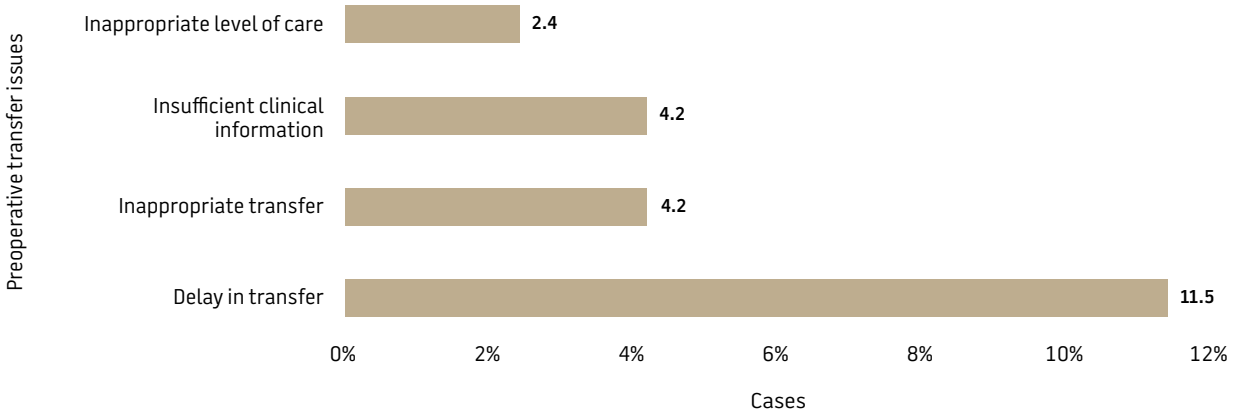


Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.
Data missing: n = 2.

3.3 Hospital transfers (continued)

In the period 2020 to 2024, there was a range of concerns related to preoperative transfers (Figure 10). The most frequently reported preoperative transfer issue was 'delay in transfer' (11.5%; 93/809).

Figure 10: Preoperative transfer issues, 2020–2024



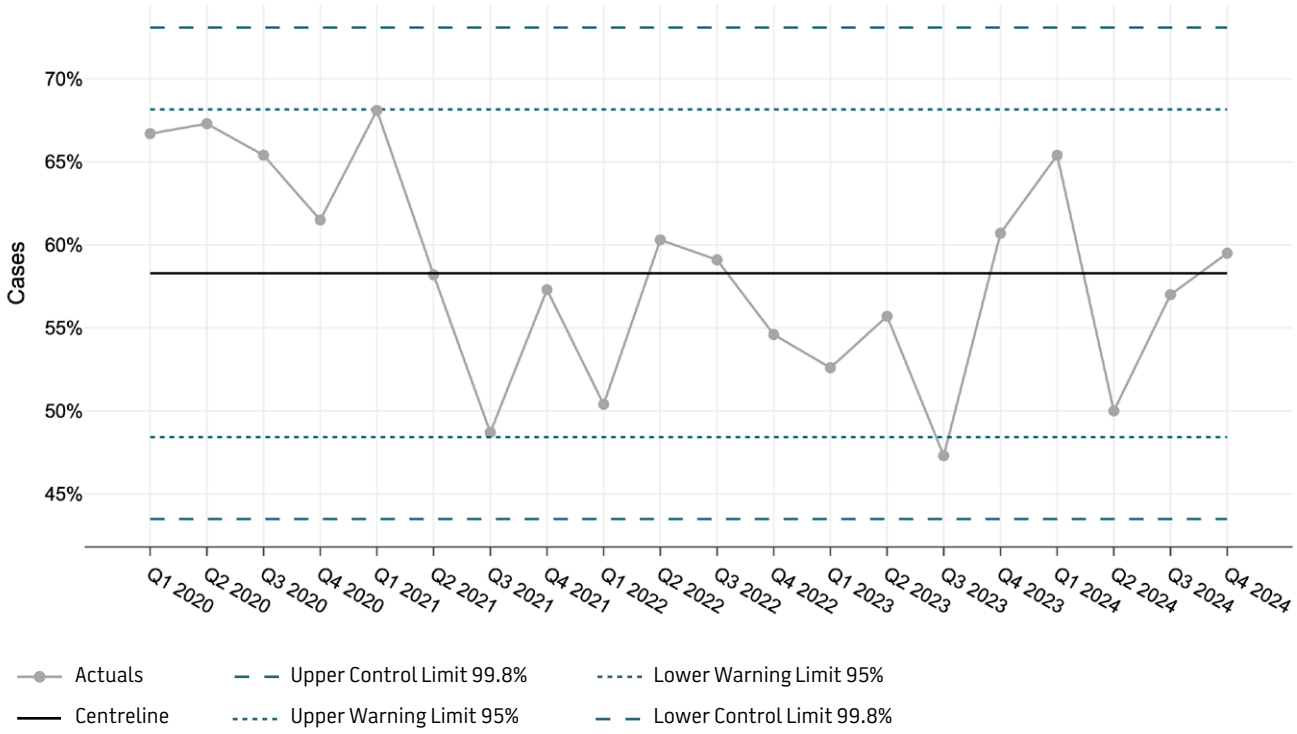
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Data missing: 'inappropriate level of care' n = 4; 'insufficient clinical information' n = 3; 'inappropriate transfer' n = 2; 'delay in transfer' n = 2.

3.4 Critical care units

Between 2020 and 2024, critical care units (CCUs) were utilised in 57.6% of cases (1,574/2,735) (Figure 11).

Emergency and elective admissions accounted for 87.0% (1,370/1,574) and 13.0% (204/1,574) of CCU use, respectively.

Figure 11: Critical care unit use, by quarter

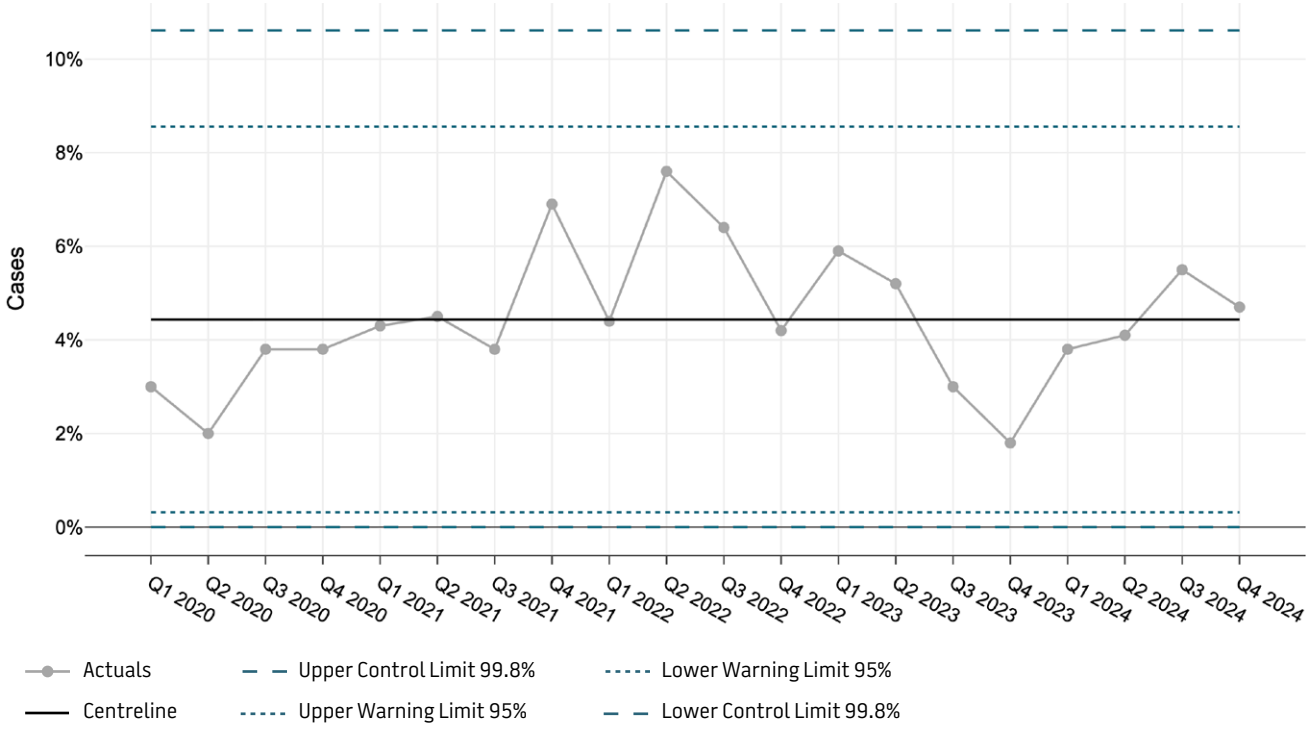


Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.
Data missing: n = 3.

3.5 Operative and nonoperative cases

In the period 2020 to 2024, a preoperative diagnostic delay was recorded by the surgeon in 4.5% of cases (124/2,737). The percentage of patients with preoperative diagnostic delays over the reporting period fluctuated across the quarters (Figure 12).

Figure 12: Cases with preoperative diagnostic delays, by quarter



Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.
Data missing: n = 1.

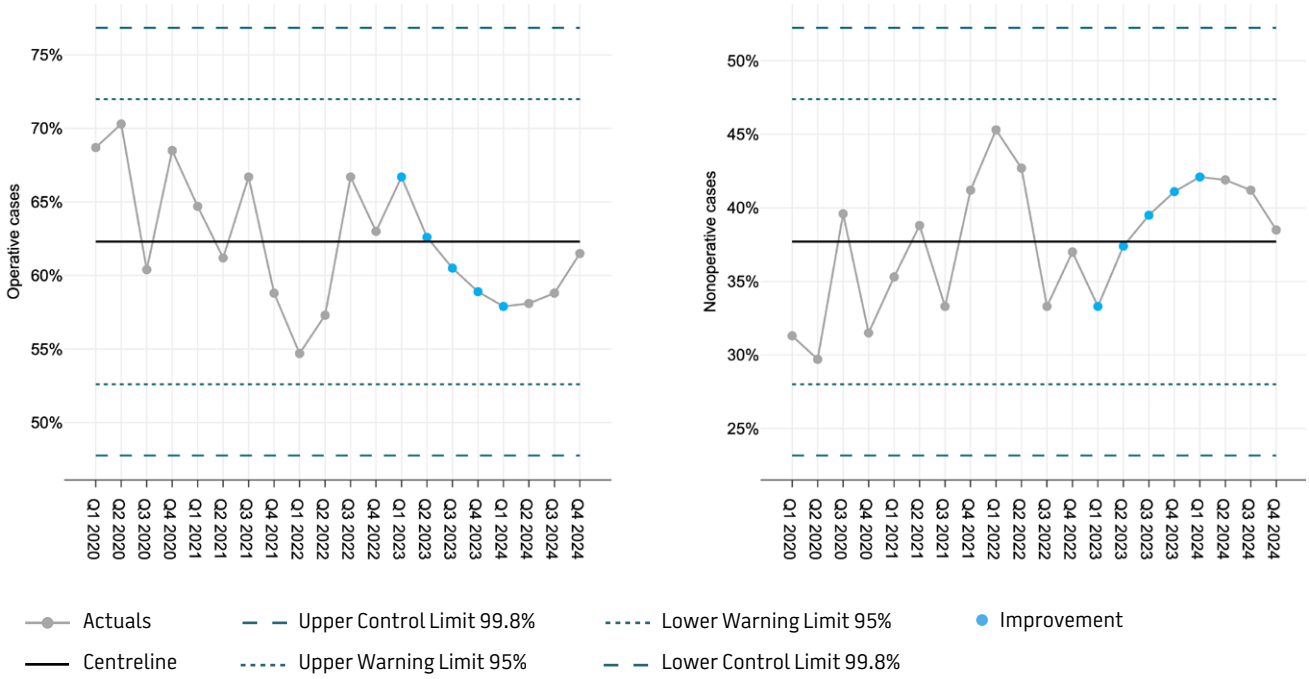
3.5 Operative and nonoperative cases (continued)

Over the reporting period, most surgeons who reported a preoperative diagnostic delay for a patient provided no details regarding the cause of the delay or with whom it was associated. The cause of a preoperative diagnostic delay can be related to more than one source. Most of the reported delays were associated with medical units (46.0%; 57/124), surgical units (23.4%; 29/124) and general practitioners (3.2%; 4/124).

Of the delays associated with a surgical unit, common reasons stated (potentially more than one for each patient) were 'misinterpretation of results' (11 cases), 'unavoidable factors' (11 cases), 'inexperience of staff' (6 cases), 'failure to do correct test' (3 cases) and 'results not seen' (2 cases).

In the period 2020 to 2024, 62.1% (1,700/2,737) of patients underwent one operation or more. Figure 13 shows that the proportion of operative cases reduced over the reporting period, and the reciprocal is true for nonoperative cases. A trend is observed in both operative and nonoperative cases since Q1 2023. It seems the rising trend in deaths under a WA surgeon over the audit period is unrelated to operative deaths, which have trended downwards. The number of patients who did not have an operation has continued to rise.

Figure 13: Operative and nonoperative cases, by quarter



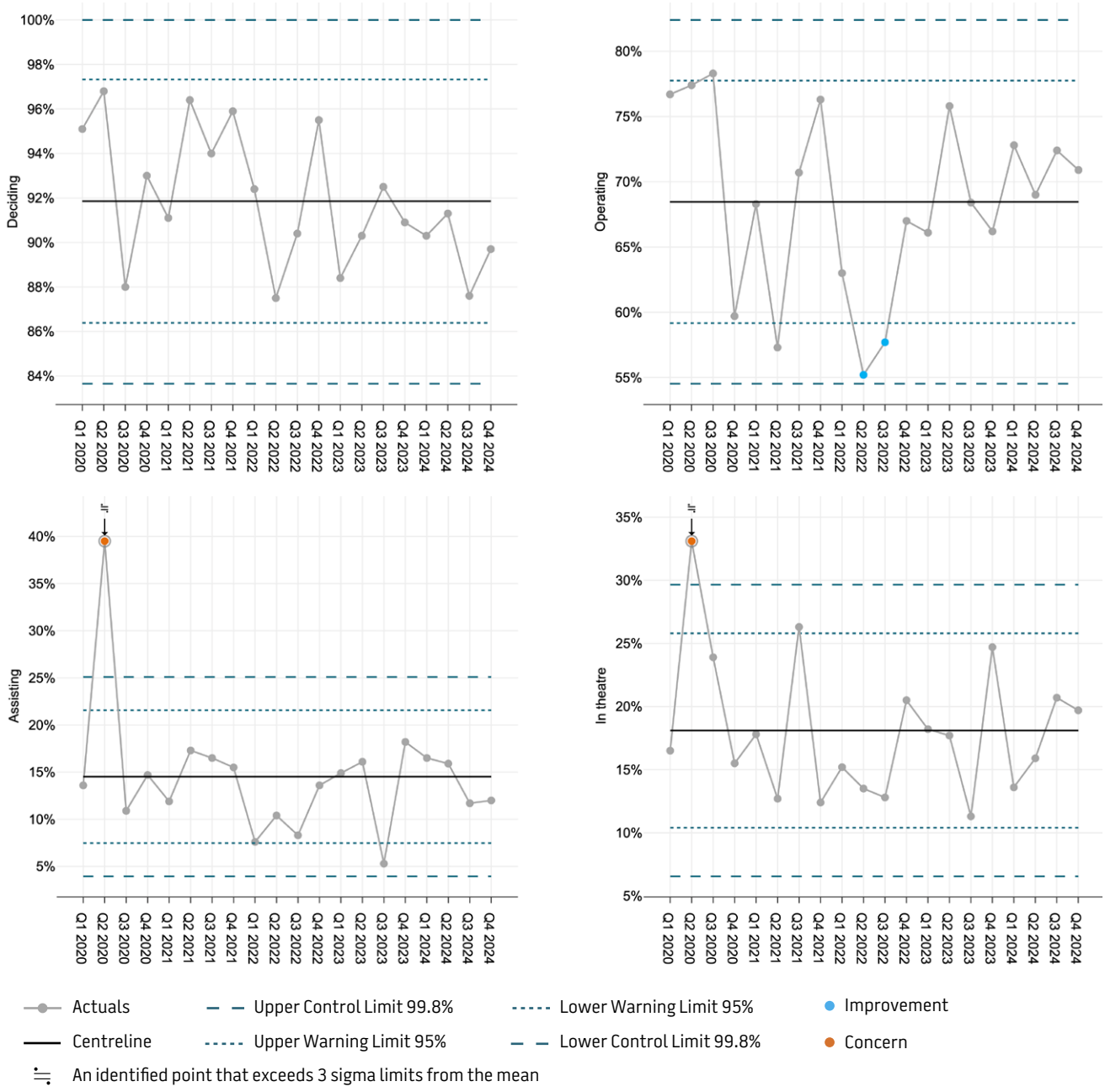
Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.
Data missing: n = 1.

3.5 Operative and nonoperative cases (continued)

The proportion of emergency and elective admissions involving an operation remained relatively steady over the period 2020 to 2024, with 83.8% of patients (1,424/1,700) admitted as an emergency.

Consultant surgeons may be in theatre to perform, assist with or supervise an operation. A total of 2,267 operations were performed on 1,700 patients between 2020 and 2024. For 91.8% of reported operations (2,081/2,267), a consultant surgeon made the decision to proceed to surgery and performed the surgery in 68.4% of operations (1,550/2,267) (Figure 14).

Figure 14: Consultant surgeon involvement in operations, by quarter



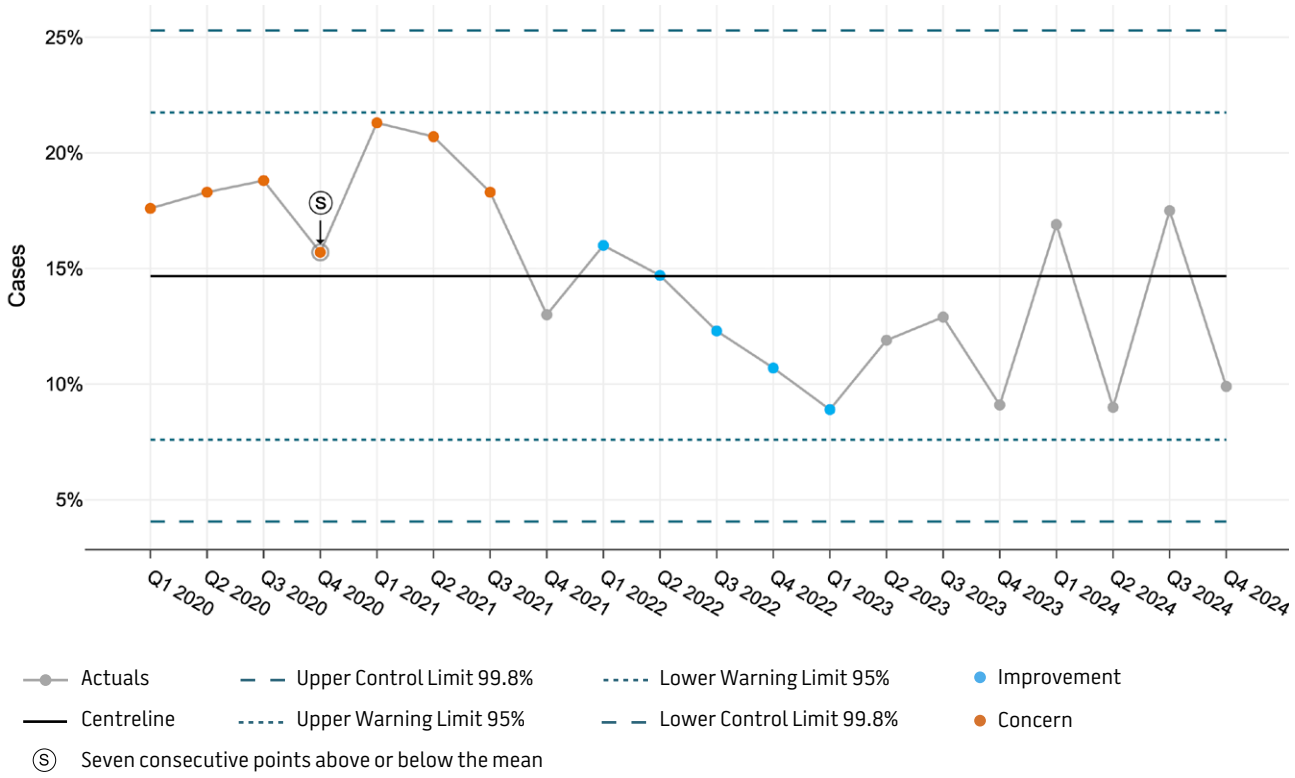
Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.

3.5 Operative and nonoperative cases (continued)

Overall, an operation was abandoned upon finding a terminal situation in 4.2% of operations (96/2,267).

In the period 2020 to 2024, 14.5% of operative cases (246/1,700) had an unplanned return to the operating theatre (Figure 15). The percentage of patients who had an unplanned return to theatre showed an improvement in the period January 2022 to January 2023.

Figure 15: Unplanned return to operating theatre, by quarter



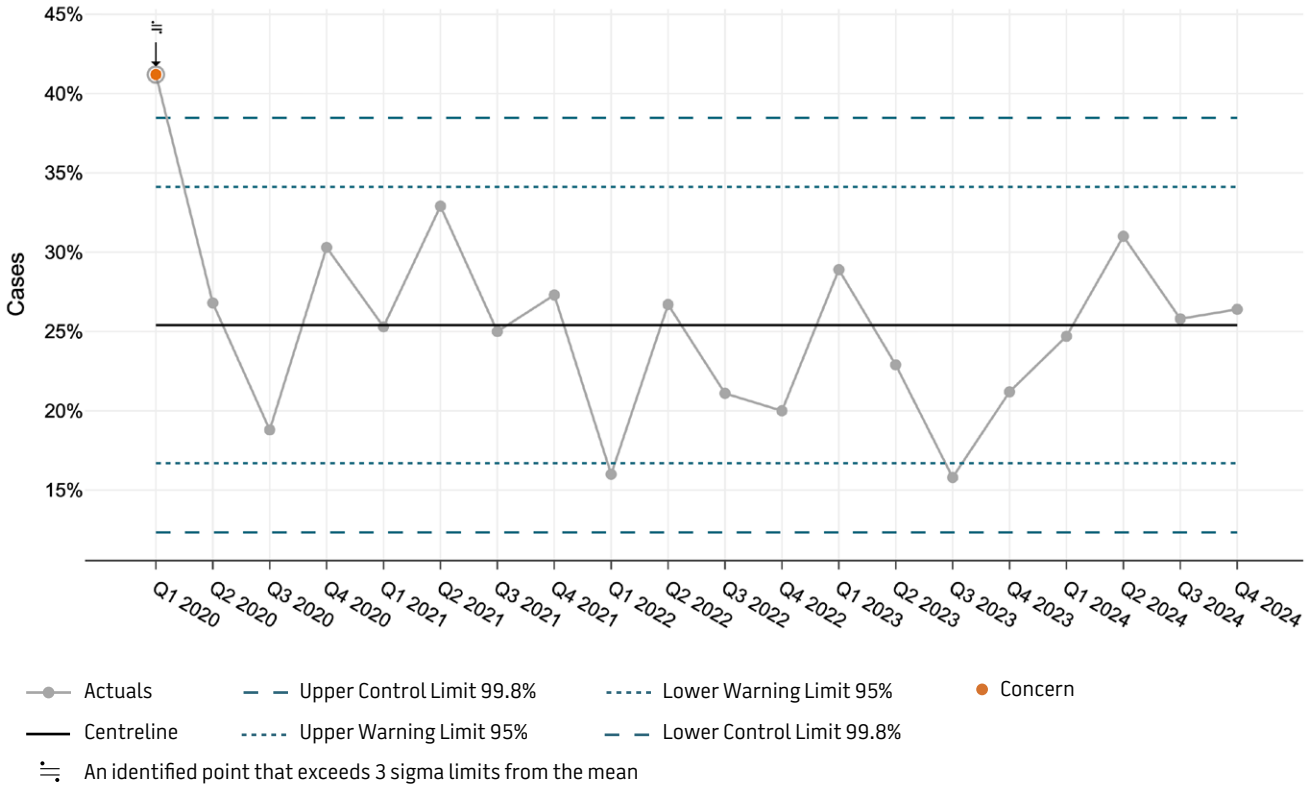
Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.

3.5 Operative and nonoperative cases (continued)

Postoperative complications occurred in 25.3% of operative patients (430/1,700) between 2020 and 2024.

There was a total of 602 postoperative complications among 430 operative patients. (Patients may have more than one postoperative complication listed.) The most frequently reported postoperative complications were postoperative bleeding (19.3%; 83/430), tissue ischaemia (11.4%; 49/430) and sepsis (8.1%; 35/430). These data make a strong case for a consultant surgeon to be present when a patient is returned to theatre. Figure 16 shows the distribution of postoperative complications by quarter.

Figure 16: Postoperative complications, by quarter



Q: quarter.

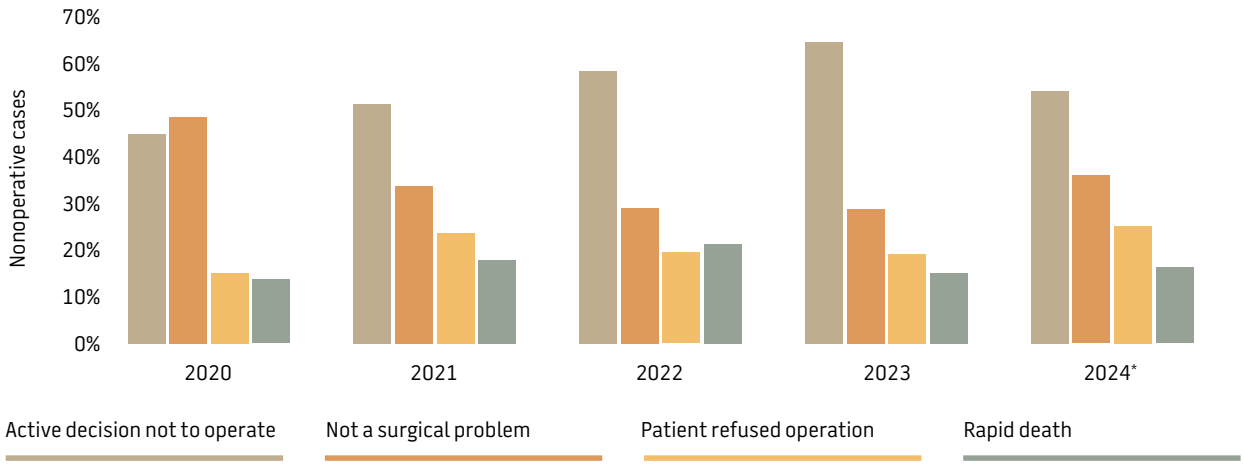
Note: Patients may have more than one postoperative complication listed. Some 2024 cases still undergoing review, so case data unavailable for this report.

Refer to Appendix E.1 for further SPC information.

3.5 Operative and nonoperative cases (continued)

More than one third of patients did not have surgery (37.9%; 1,037/2,737). Figure 17 shows that some patients did not undergo an operation for reasons such as an active decision by the consultant surgeon not to operate or there being no surgical problem. Some cases reported more than one reason for not operating. Most nonoperative cases were emergency admissions (97.9%; 1,014/1,036).

Figure 17: Reasons for not operating, by year

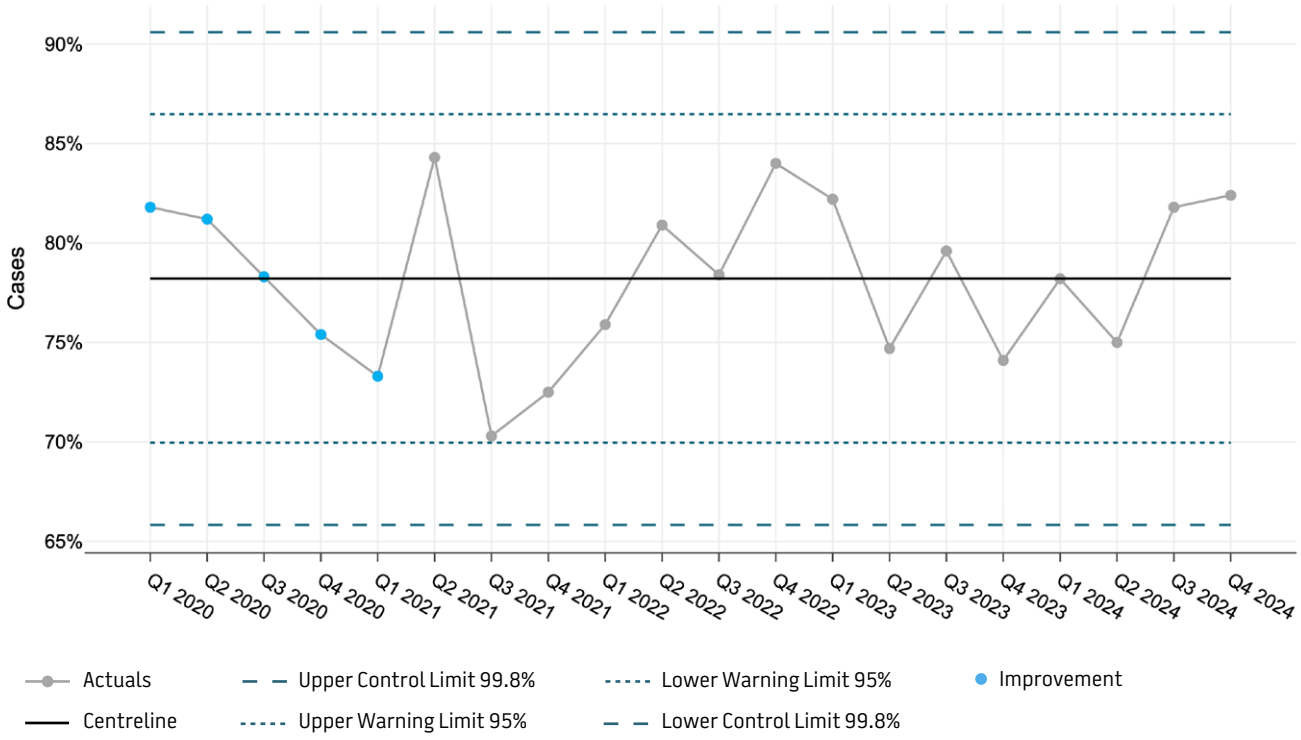


* Some 2024 cases still undergoing review, so case data unavailable for this report.
Data missing: n = 1.

3.6 Deep vein thrombosis prophylaxis

Surgeons reported the use of deep vein thrombosis (DVT) prophylaxis in 78.1% of cases (2,137/2,736) between 2020 and 2024. The use of DVT prophylaxis by quarter is presented in Figure 18.

Figure 18: Deep vein thrombosis prophylaxis use, by quarter



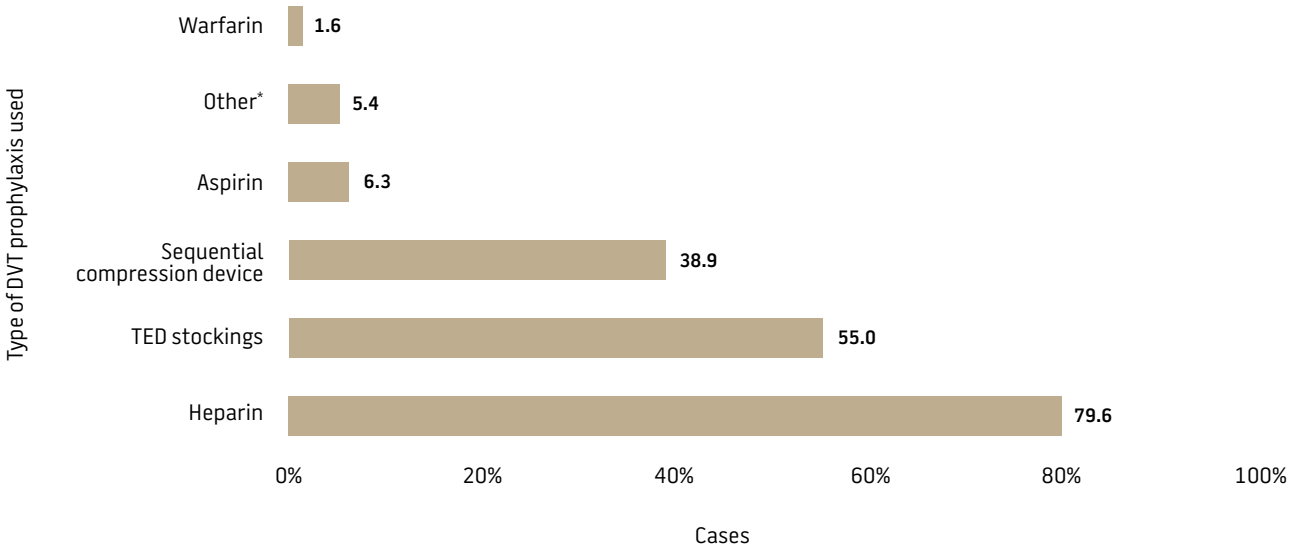
Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.
Data missing: n = 2.

3.6 Deep vein thrombosis prophylaxis (continued)

In 21.9% (599/2,736) of cases, DVT prophylaxis was not used because it was inappropriate (65.5%; 391/597), there was an active decision to withhold it (32.7%; 195/597), or it was not considered (1.8%; 11/597). (Data missing: n = 2)

In many cases, more than one type of DVT prophylaxis was used. Heparin (79.6%; 1,701/2,137) and TED (thromboembolic deterrent) stockings (55.0%; 1,176/2,137) were the most frequently used DVT prophylaxis agents (Figure 19).

Figure 19: Type of deep vein thrombosis prophylaxis used, 2020–2024



DVT: deep vein thrombosis, TED: thromboembolic deterrent.

* Other could include enoxaparin sodium, clopidogrel bisulfate, danaparoid sodium and enoxaparin sodium combined with early mobilisation.

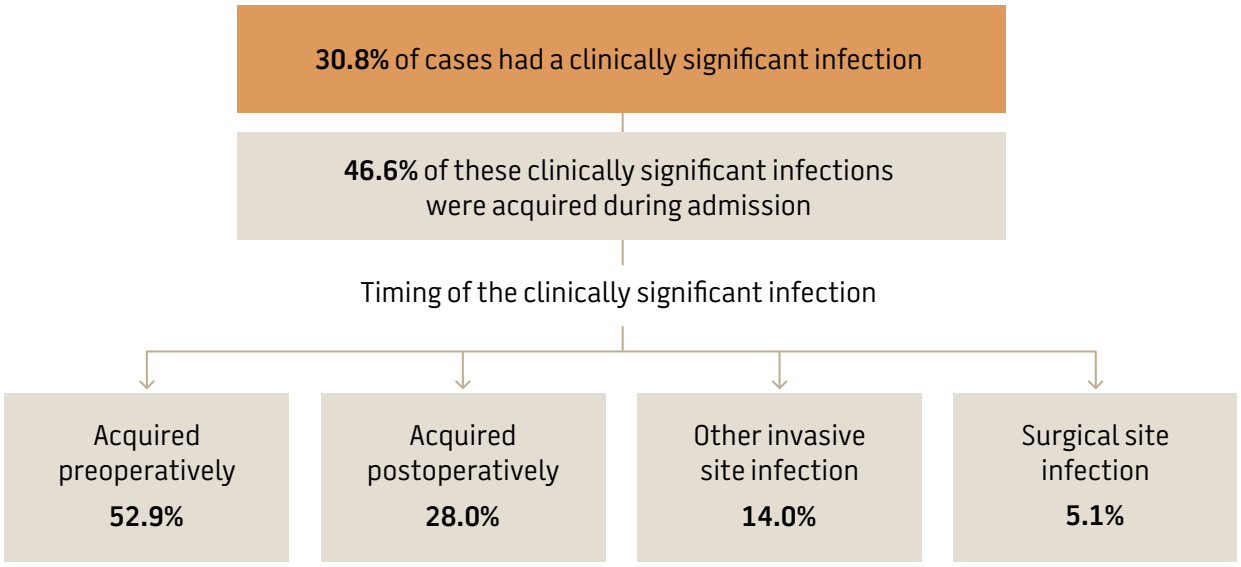
Some 2024 cases still undergoing review, so case data unavailable for this report.

3.7 Infections

Surgeons are asked to record whether patients died with a clinically significant infection and, if so, whether the infection was present before admission or if it developed during the hospital admission. Between 2020 and 2024, almost a third of patients (30.8%; 843/2,734. Data missing: n = 4) died with a clinically significant infection.

More patients acquired the clinically significant infection before their admission to hospital (53.4%; 450/843) than during their admission (46.6%; 393/843). Of the patients who acquired the infection during admission, 52.9% (208/393) acquired the infection postoperatively (Figure 20).

Figure 20: Clinically significant infections during admission, 2020–2024

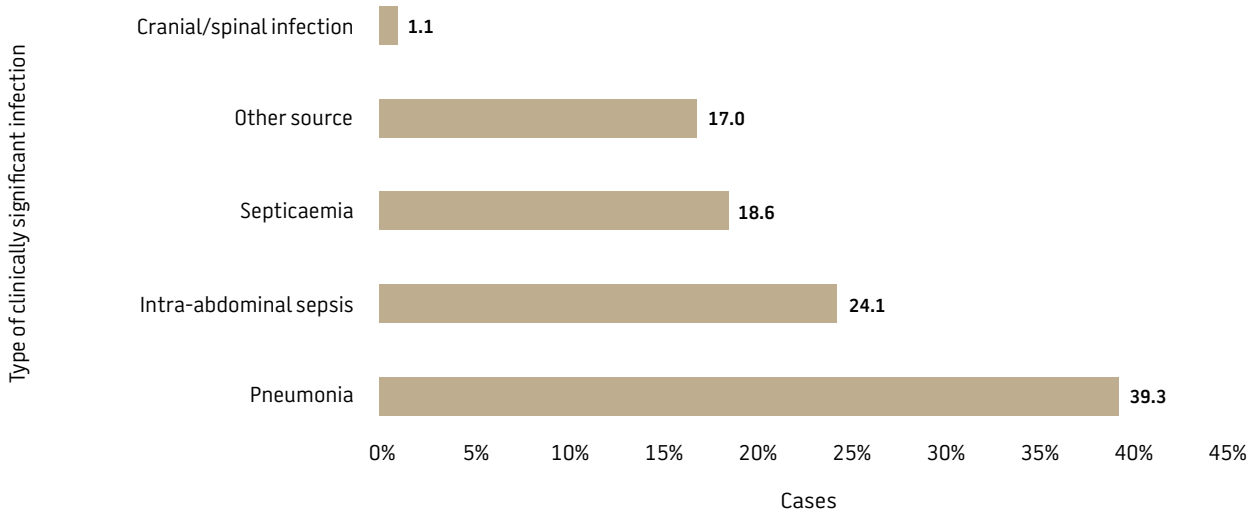


Note: Some 2024 cases still undergoing review, so case data unavailable for this report.

3.7 Infections (continued)

Figure 21 shows the types of clinically significant infections reported by surgeons before or during admission. Pneumonia was the most reported, accounting for 39.3% of cases (331/843). Intra-abdominal sepsis represented 24.1% of cases (203/843), followed by septicaemia (18.6%; 157/843). Other source and cranial/spinal infection accounted for 17.0% (143/843) and 1.1% (9/843) of cases, respectively.

Figure 21: Type of clinically significant infection reported, 2020–2024



Note: Some 2024 cases still undergoing review, so case data unavailable for this report.

Where information was provided, surgeons reported that the antibiotic regime was appropriate in 90.8% of cases of clinically significant infections (764/841). In 8.2% of cases (69/841) the appropriateness of the antibiotic regime was unknown, and in 1.0% (8/841) it was considered inappropriate (data missing: n = 2).

4. Outcomes of peer-review assessment

4.1 Levels of assessment

All cases undergo a peer-review assessment (except for those confirmed as terminal care). Following the initial first-line assessment (FLA), many cases are finalised. This process is assisted by SCFs that have been completed in full and provide detailed information about each case. A small proportion of cases are identified as requiring a more in-depth review and these are recommended for a second-line assessment (SLA).

Between 2020 and 2024, the rate of FLA returns was 98.9% (2,705/2,735). Of the 2,705 FLAs returned, 12.5% (337/2,705) were referred for SLA (Table 4).

Table 4: Peer-review assessments, by year

Year	FLAs returned	Cases referred for SLA	
		Number	Percentage (%)
2020	436	71	16.3
2021	538	64	11.9
2022	558	73	13.1
2023	588	70	11.9
2024*	585	59	10.1
Total	**2,705**	**337**	**12.5**

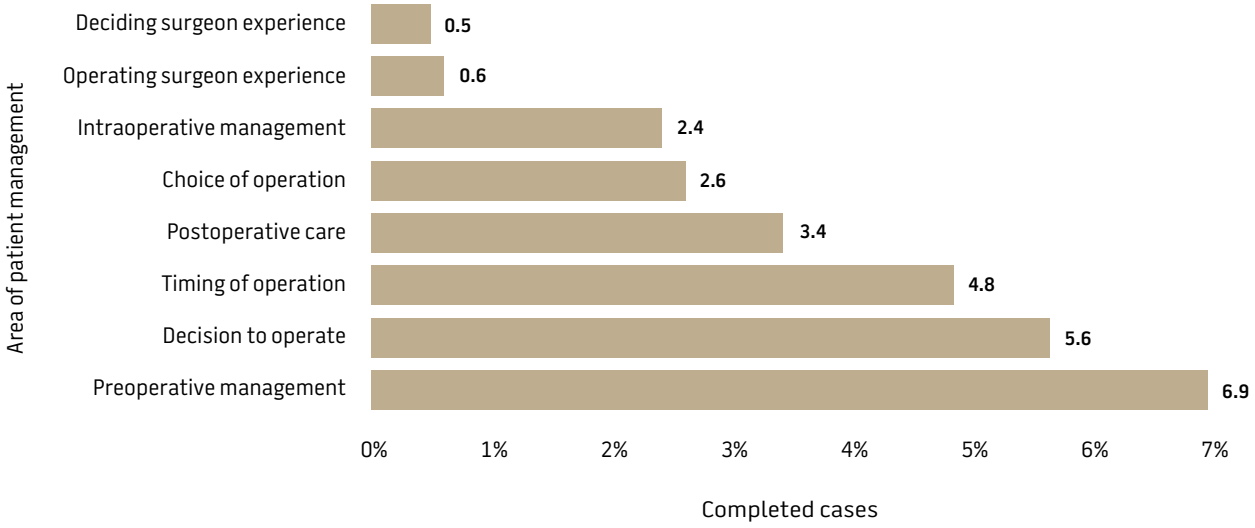
FLA: first-line assessment, SLA: second-line assessment.
* Some 2024 cases still undergoing review, so case data unavailable for this report.

4.2 Care pathway

When reviewing the surgical care that was provided, assessors are asked to consider whether any steps along the care pathway (from preoperative through to postoperative management) could have been improved. Figure 22 shows assessors' opinions on the care pathway during the 5-year audit period (where cases underwent both FLA and SLA, the analysis uses data from the SLA).

Between 2020 and 2024, assessors indicated that the preoperative management of patients (6.9%; 154/2,223) and the decision to operate (5.6%; 125/2,224) were the 2 most frequently reported areas of care requiring improvement (Figure 22).

Figure 22: Assessor perception of areas for patient management improvement, 2020–2024



Note: Some 2024 cases still undergoing review, so case data unavailable for this report.

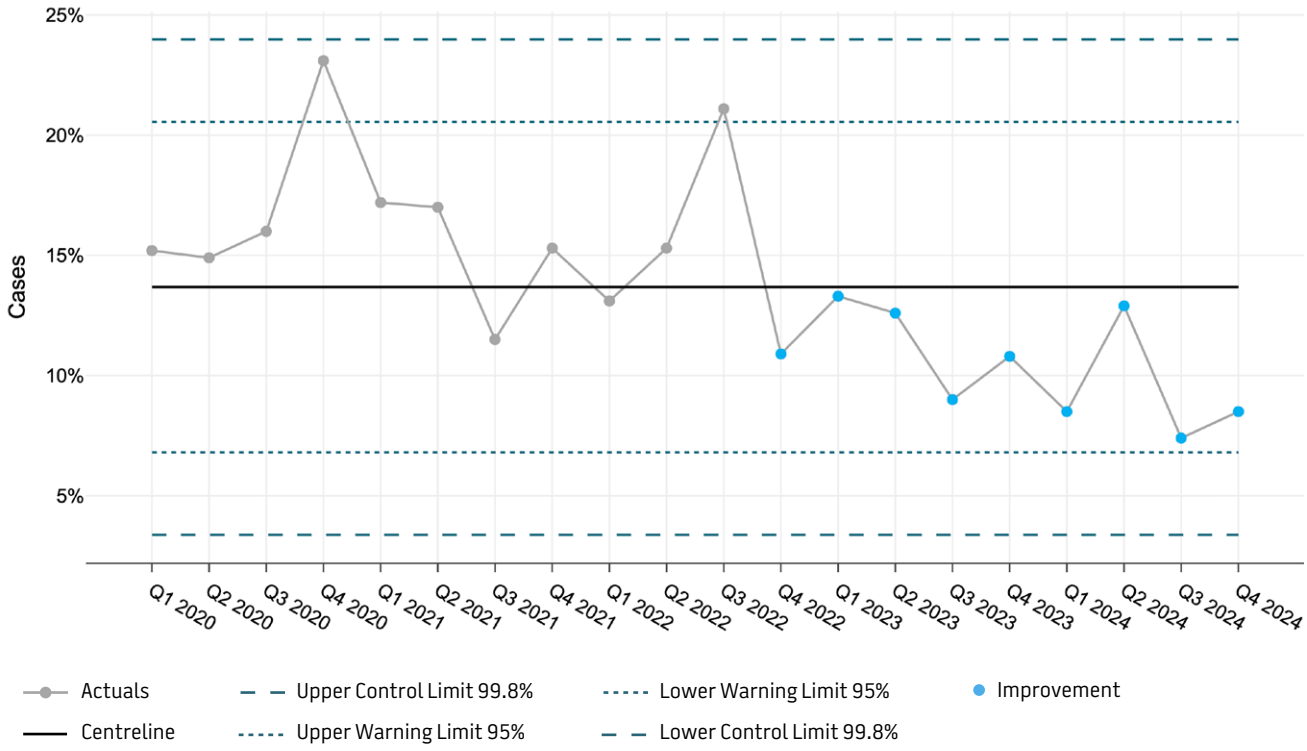
Data missing: 'preoperative management' n = 32; 'decision to operate' n =31; 'timing of operation' n = 32; 'postoperative care' n = 33; 'choice of operation' n = 32; 'intraoperative management' n = 33; 'operating surgeon experience' n = 41; 'deciding surgeon experience' n = 33.

4.3 Clinical management issues

One of the aims of the peer-review process is to determine whether a CMI occurred. CMIs are classified into an area for consideration, an area of concern, or an adverse event (Appendix D: WAASM audit process).

The proportion of cases in which CMIs were identified is shown in Figure 23, with the highest proportion noted in Q4, 2020. There has been an improvement from Q4, 2022 onwards. (Where cases underwent both FLA and SLA, the analysis in this section uses data from the SLA. Data from the FLA are used for cases not referred for SLA. Some 2024 cases are still undergoing the peer-review process, meaning these data are incomplete.)

Figure 23: Cases with any clinical management issues identified, by quarter



Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.

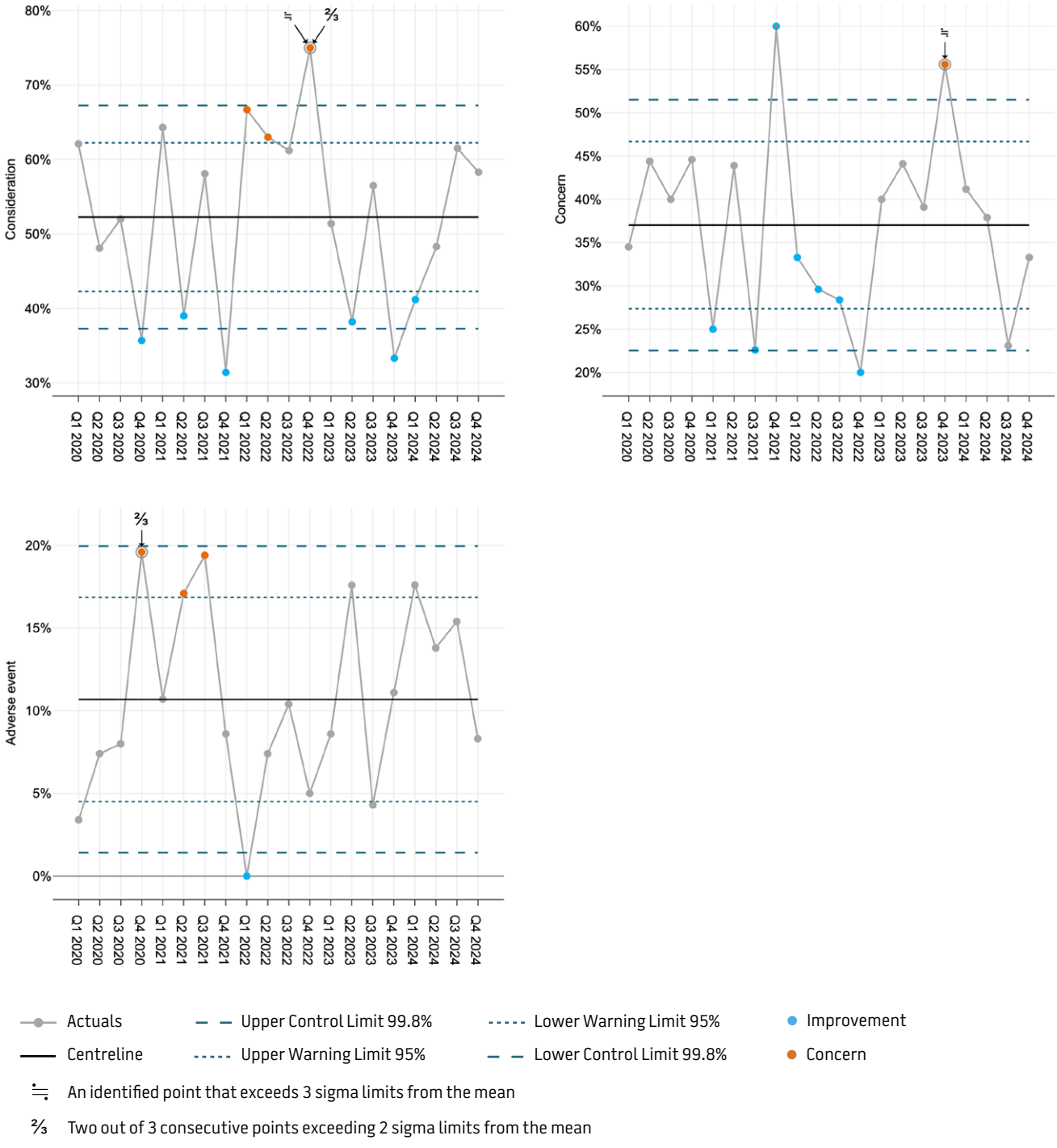
One or more CMIs were identified in 13.6% of cases (365/2,677) during the period 2020 to 2024. No CMI was identified in 86.4% of cases (2,312/2,677).

Assessors may identify several CMIs for each patient. (Figures 24 to 26 show data based on the number of CMI, not the number of patients.)

Assessors reported 603 CMIs in 365 cases (Figure 24). Between 2020 and 2024, about half (50.9%; 307/603) of the CMIs identified were regarded as areas for consideration. Areas of concern and adverse events comprised 37.8% (228/603) and 11.3% (68/603) of CMIs, respectively.

4.3 Clinical management issues (continued)

Figure 24: Categories of clinical management issues, by quarter



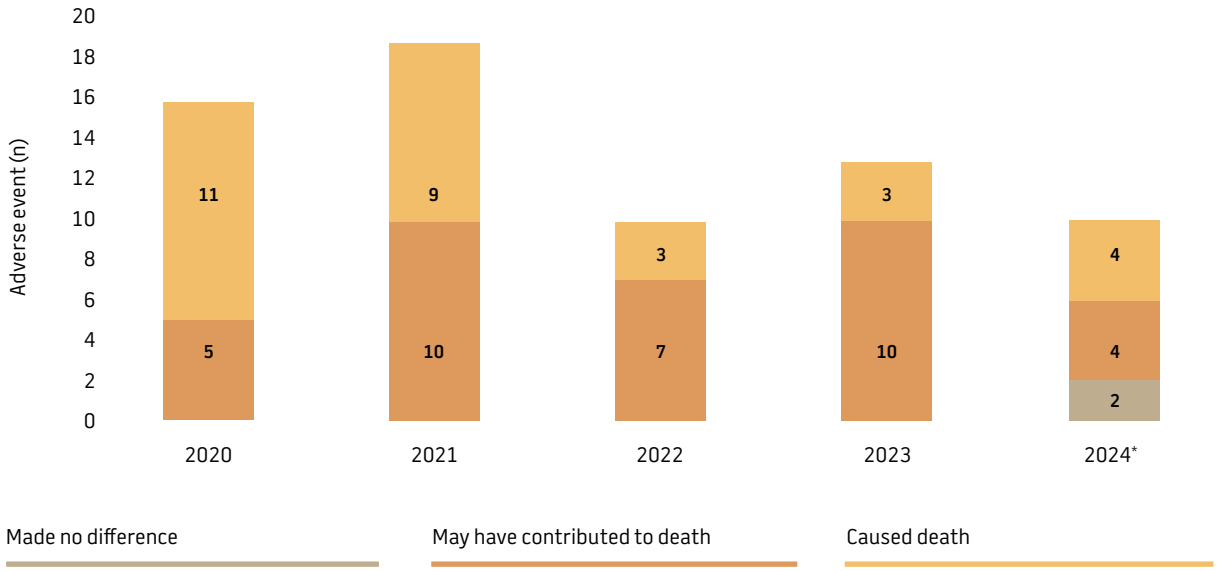
Q: quarter.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.
Refer to Appendix E.1 for further SPC information.

4.4 Clinical management issues (continued)

When an adverse event is identified, assessors indicate the degree of impact this may have had on the clinical outcome. Assessors' perceptions of the impact of adverse events on clinical outcomes, per year, are shown in Figure 25.

In the period 2020 to 2024, assessors perceived that 44.1% of the reported adverse events (30/68) caused the death of the patient. Assessors perceived that 52.9% of the reported adverse events (36/68) may have contributed to the death. For 2.9% of reported adverse events (2/68), assessors perceived that it made no difference to the outcome of the patient. There was considerable variability in assessors' perceptions of the impact of adverse events over the reporting period (2020–2024).

Figure 25: Assessor perception of impact of adverse event on clinical outcome, by year



* Some 2024 cases still undergoing review, so case data unavailable for this report.

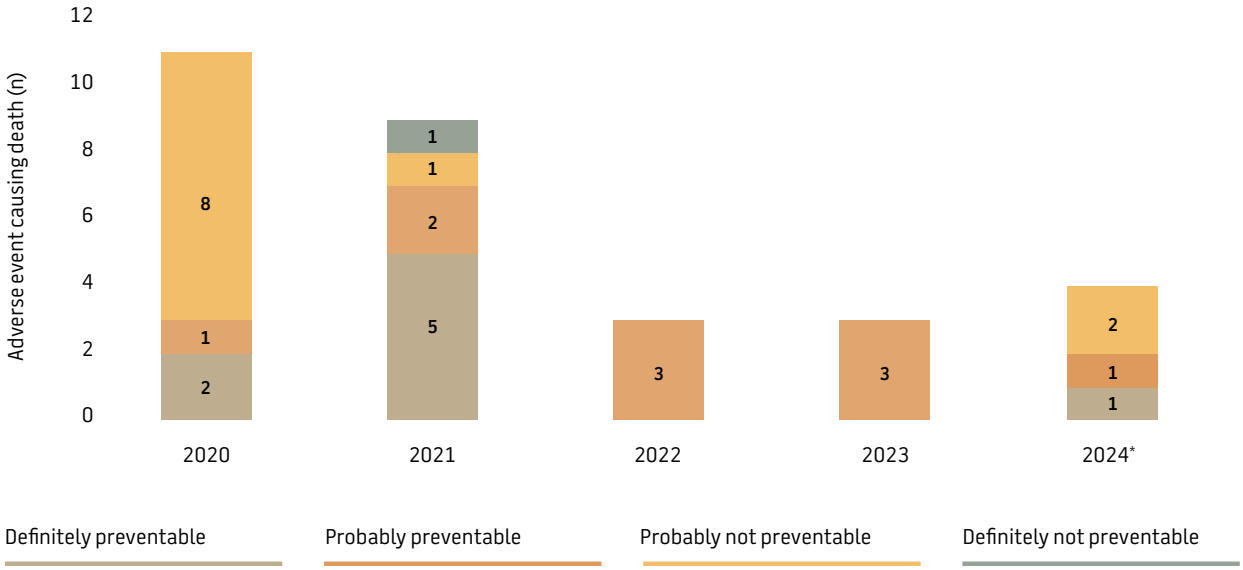
4.4 Clinical management issues (continued)

Assessors also report on the preventability of any adverse event that caused the death of a patient (Figure 26).

In the period 2020 to 2024, assessors indicated that 3.3% of adverse events (1/30) that caused the death of a patient were definitely not preventable. For 36.7% of adverse events (11/30) that caused the death of a patient, assessors stated that the deaths were probably not preventable. Assessors considered that 33.3% of adverse events (10/30) that resulted in the death of a patient were probably preventable. For 26.7% of adverse events (8/30) that caused the death of a patient, assessors indicated that the deaths were definitely preventable.

In 2023, there were no adverse events that were deemed to be definitely preventable. In 2024, assessors identified 1 patient where the adverse event that caused death was definitely preventable (noting all 2024 data is not yet available). [7]

Figure 26: Assessor perception of preventability of adverse event causing death, by year

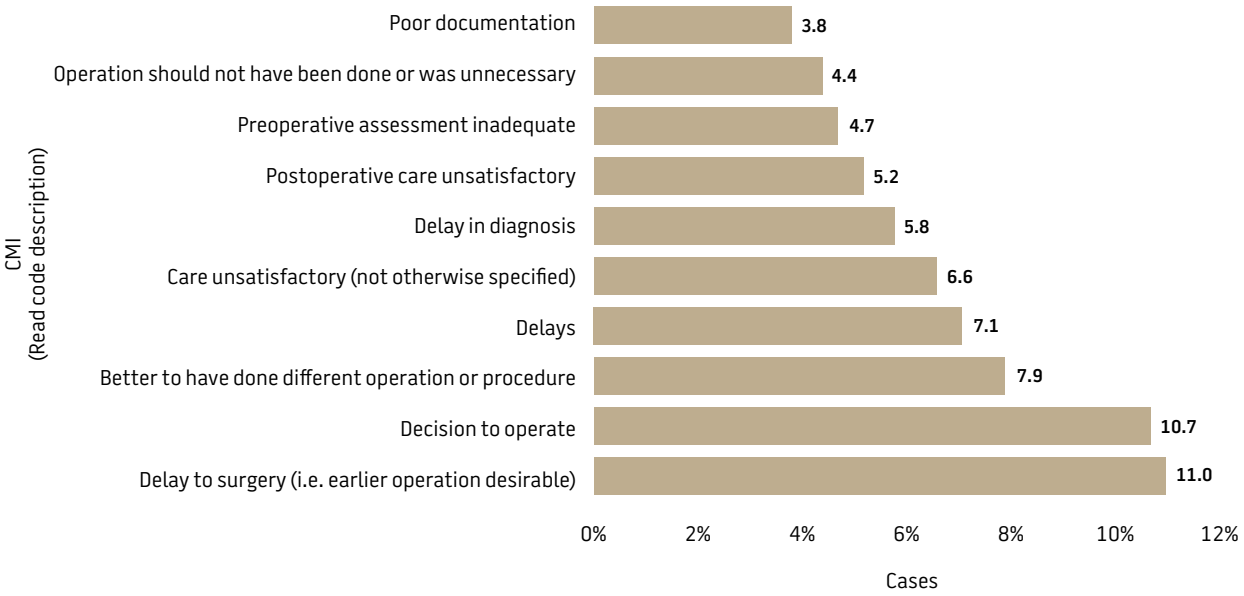


* Some 2024 cases still undergoing review, so case data unavailable for this report.

4.4 Clinical management issues (continued)

Assessors identified several CMIs in some patients. Delay to surgery (11.0%; 40/365) and decision to operate (10.7%; 39/365) were the 2 most frequently reported CMIs. The 10 most common CMIs are shown in Figure 27.

Figure 27: Most frequently reported clinical management issues 2020–2024, by Read code*



CMI: clinical management issue.
* Surgical diagnoses categorised using a coded thesaurus of clinical terms.
Note: Some 2024 cases still undergoing review, so case data unavailable for this report.

Among the top 10 CMIs listed in Figure 27, 23.0% of them relate to the assessor questioning whether an operation should have occurred at all (15.1%; 55/365) or believing there was a different, better option (7.9%; 29/365). Another 23.9% of CMIs relate to some sort of delay (delay to surgery 11.0%, 40/365; delays 7.1%, 26/365; delay in diagnosis 5.8%, 21/365). Therefore, 46.8% (171/365) of the listed CMIs relate to the decision to operate, the choice of operation or a delay of some kind.

Acknowledgements

WAASM would like to acknowledge the support and assistance of the following individuals and institutions that have helped in the development and continuation of this project:

- participating surgeons
- first-line assessors
- second-line assessors
- hospital medical records departments
- Western Australian Department of Health, for funding this project
- Patient Safety Surveillance Unit, Clinical Excellence Division, Western Australian Department of Health, for continual commitment to and support of WAASM
- RACS, for infrastructure and oversight of this project
- ANZASM Steering Committee.

- **WAASM Management Committee:**

Dr James Aitken	WAASM Clinical Director, general surgical representative
Dr Jonathan Spencer	Orthopaedic surgeon, orthopaedic surgical representative
Prof Francis Lannigan	Otolaryngology head and neck surgeon, otolaryngology head and neck surgical representative
Dr Senarath Werapitiya	General surgeon, rural surgical representative
Dr Mike Soares	Anaesthetist, anaesthetic representative
Dr Richard Murphy	Obstetrician and gynaecologist, obstetrics and gynaecology representative
Mr Rasa Subramaniam	Consumer representative

- **WAASM staff:**

Dr Franca Itotoh	Project Manager
Ms Natalie Zorbas	Senior Project Officer
Ms Katie Morgan	Administrative Officer

- **RACS, particularly Research, Audit and Academic Surgery (RAAS) staff:**

Prof Guy Maddern	ANZASM Committee Chair
Prof Wendy Babidge	RAAS General Manager
Dr Helena Kopunic	Manager, Surgical Audit
Dr Kristin Weidenbach	Academic Editorial Manager

References

1. Western Australian Audit of Surgical Mortality. 2024 Report. [Accessed 30 May 2025]. Available from: https://www.surgeons.org/-/media/WAASM-2024-Report.pdf

2. Australian Commission on Safety and Quality in Health Care. Australian Framework for National Clinical Quality Registries 2024. [Accessed 15 August 2025]. Available from: https://www.safetyandquality.gov.au/sites/default/files/2024-09/australian-framework-for-national-clinical-quality-registries-cqr-2024.pdf

3. Non-technical error leading to patient fatalities in the Australian surgical population. Ey JD, Kollias V, Lee O, Hou K, Herath MB, North JB, Treloar EC. Bruening MH, Wells AJ, Maddern GJ. Brit Journal Surg, 2025;112: https://doi.org/10.1093/bjs/znaf083

4. Development and validation of a novel tool for identification and categorization of non-technical errors associated with surgical mortality. Ey JD, Kollias, V, Herath MB, Lee O, Bruening MH, Wells AJ, Maddern GJ. Brit Journal Surg, 2024;111: https://doi.org/10.1093/bjs/znae253

5. Australian Bureau of Statistics. Australian Demographic Statistics, September 2024 [Accessed 10 April 2025]. Available from: https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release#data-downloads

6. American Society of Anesthesiologists (ASA) Physical Status Classification System [Accessed 20 May 2025]. Available from: https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system

7. Government of Western Australia, Department of Health. Review of Death Policy. [Accessed 15 August 2025]. Available from: https://www.health.wa.gov.au/About-us/Policy-frameworks/Clinical-Governance-Safety-and-Quality/Mandatory-requirements/Review-of-Death-Policy

Appendices

Appendix A: List of figures and tables

Figures

Figure 1: WAASM deaths, by quarter 16
Figure 2: WAASM deaths and mortality rate per 100,000 WA population, by quarter 17
Figure 3: Case status, by year 19
Figure 4: Deaths by hospital status, by year 20
Figure 5: Deaths by surgical specialty and hospital admission, 2020–2024 22
Figure 6: Cases with specific comorbidities, 2020–2024 23
Figure 7: Frequency of American Society of Anesthesiologists grades, 2020–2024 24
Figure 8: Most common causes of death 2020–2024, by Read code* 25
Figure 9: Preoperative hospital transfers, by quarter 26
Figure 10: Preoperative transfer issues, 2020–2024 27
Figure 11: Critical care unit use, by quarter 28
Figure 12: Cases with preoperative diagnostic delays, by quarter 29
Figure 13: Operative and nonoperative cases, by quarter 30
Figure 14: Consultant surgeon involvement in operations, by quarter 31
Figure 15: Unplanned return to operating theatre, by quarter 32
Figure 16: Postoperative complications, by quarter 33
Figure 17: Reasons for not operating, by year 34
Figure 18: Deep vein thrombosis prophylaxis use, by quarter 35
Figure 19: Type of deep vein thrombosis prophylaxis used, 2020–2024 36
Figure 20: Clinically significant infections during admission, 2020–2024 37
Figure 21: Type of clinically significant infection reported, 2020–2024 38
Figure 22: Assessor perception of areas for patient management improvement, 2020–2024 40
Figure 23: Cases with any clinical management issues identified, by quarter 41
Figure 24: Categories of clinical management issues, by quarter 42
Figure 25: Assessor perception of impact of adverse event on clinical outcome, by year 43
Figure 26: Assessor perception of preventability of adverse event causing death, by year 44
Figure 27: Most frequently reported clinical management issues 2020–2024, by Read code* 45

Tables

Table 1: Deaths reported to WAASM, by year 18
Table 2: WAASM deaths by surgical specialty, 2020–2024 21
Table 3: Median age by sex, 2020–2024 23
Table 4: Peer-review assessments, by year 39

Note that full data definitions for all figures and tables are available in a separate document accompanying this report.

Appendix B: Data for review of 2024 recommendations

Figure B.1: Retrospective considerations by treating surgeons, 2020–2024

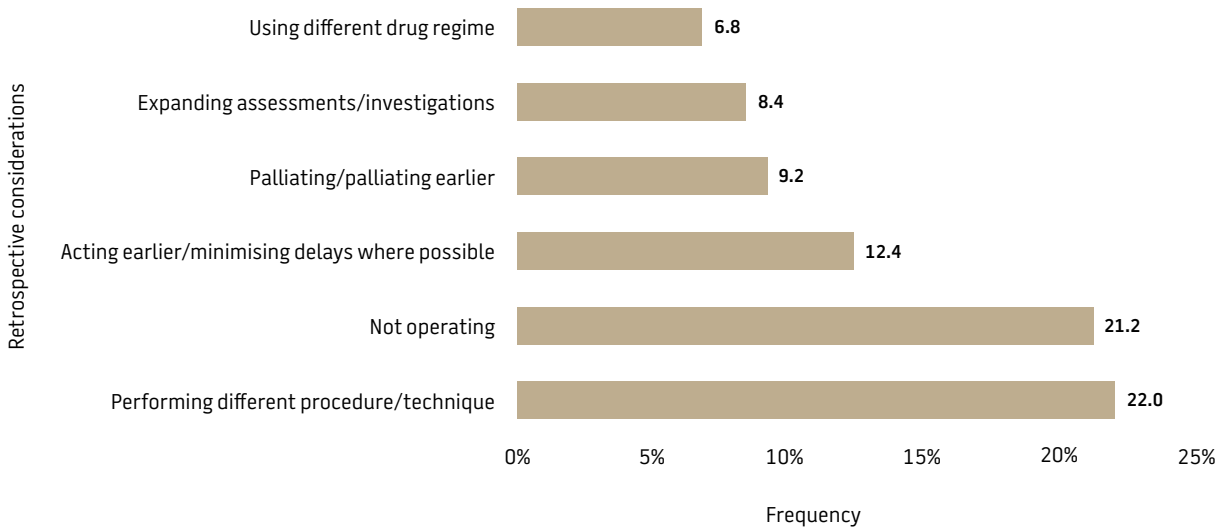
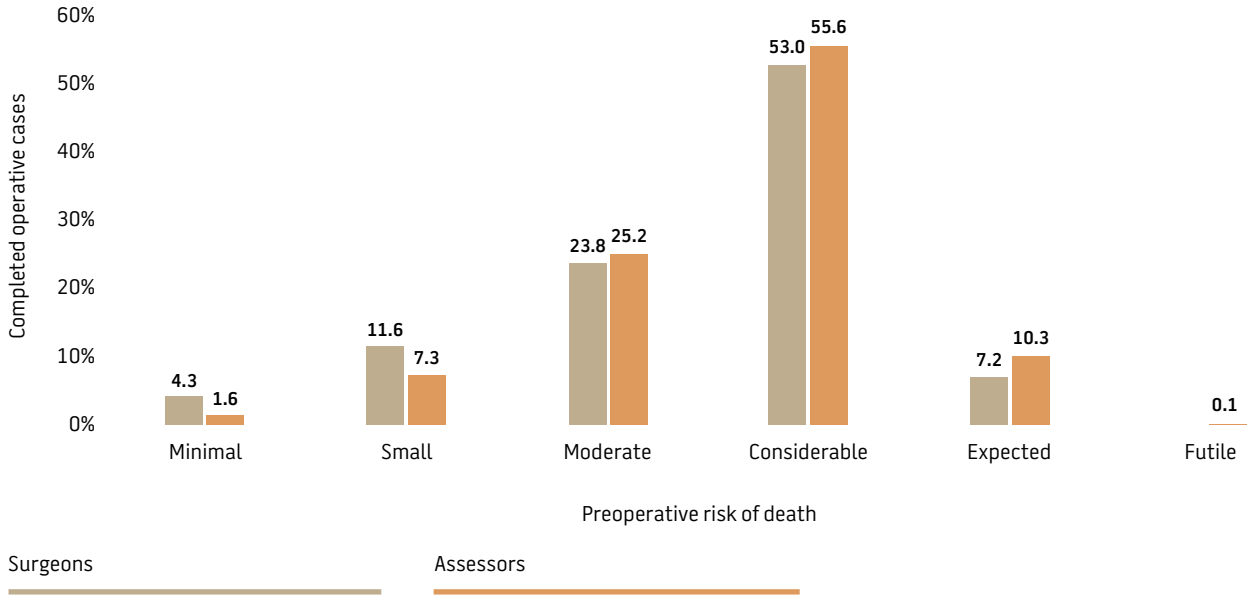
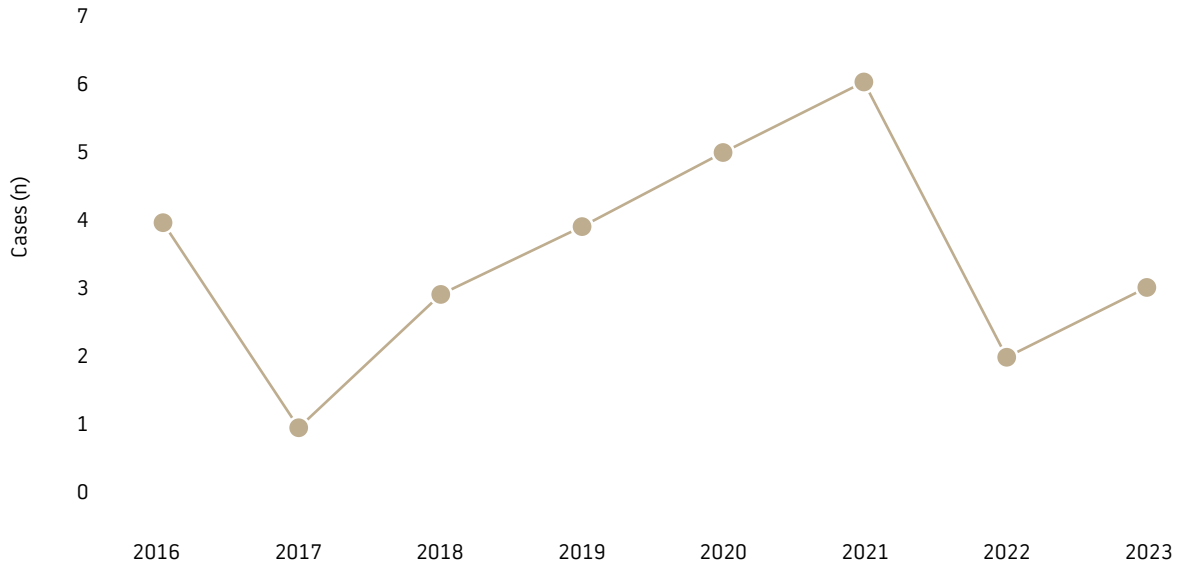


Figure B.2: Preoperative risk of death reported by treating surgeons and assessors, 2020–2024

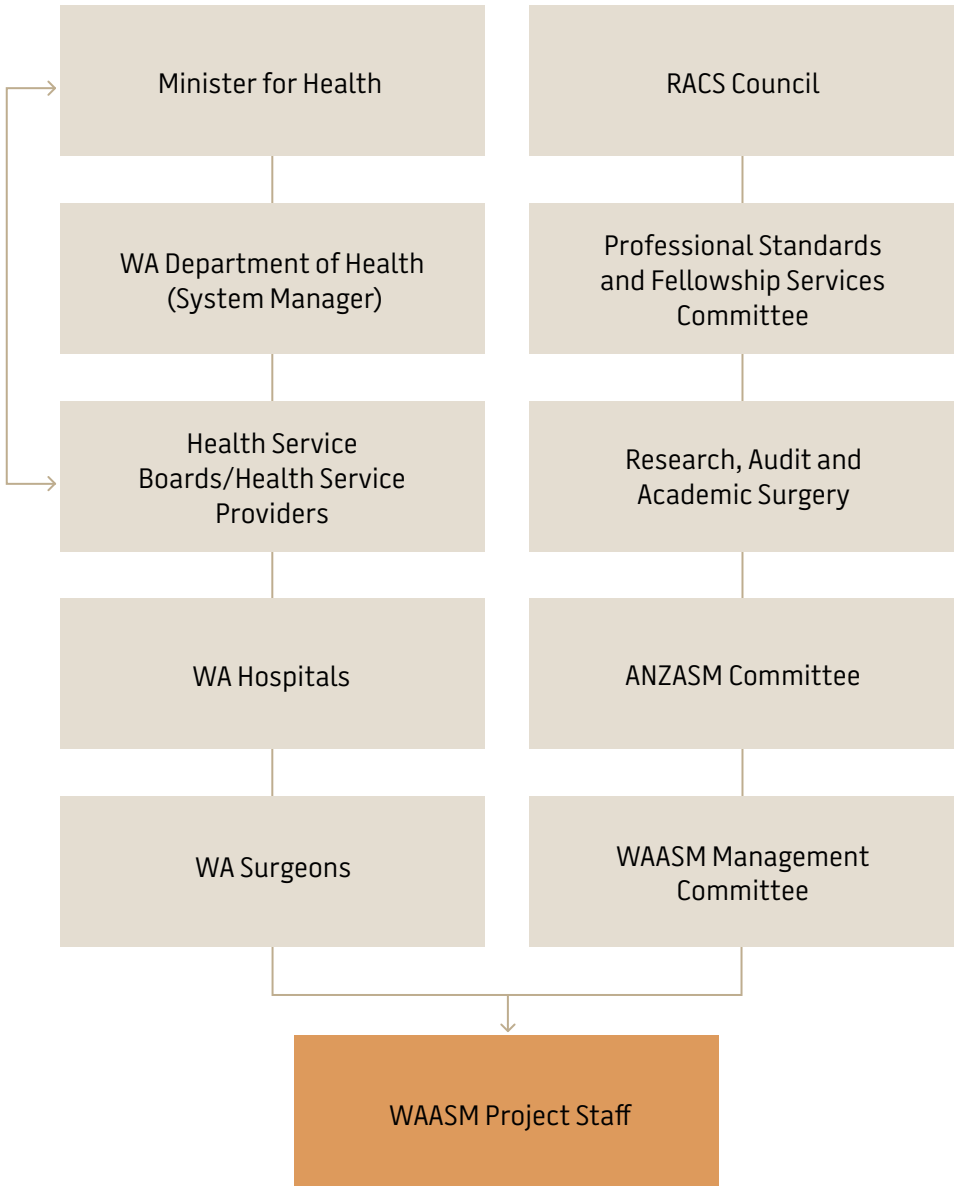


Appendix B: Data for review of 2024 recommendations (continued)

Figure B.3: Deaths in elective patients aged ≤50 years, 2016–2023

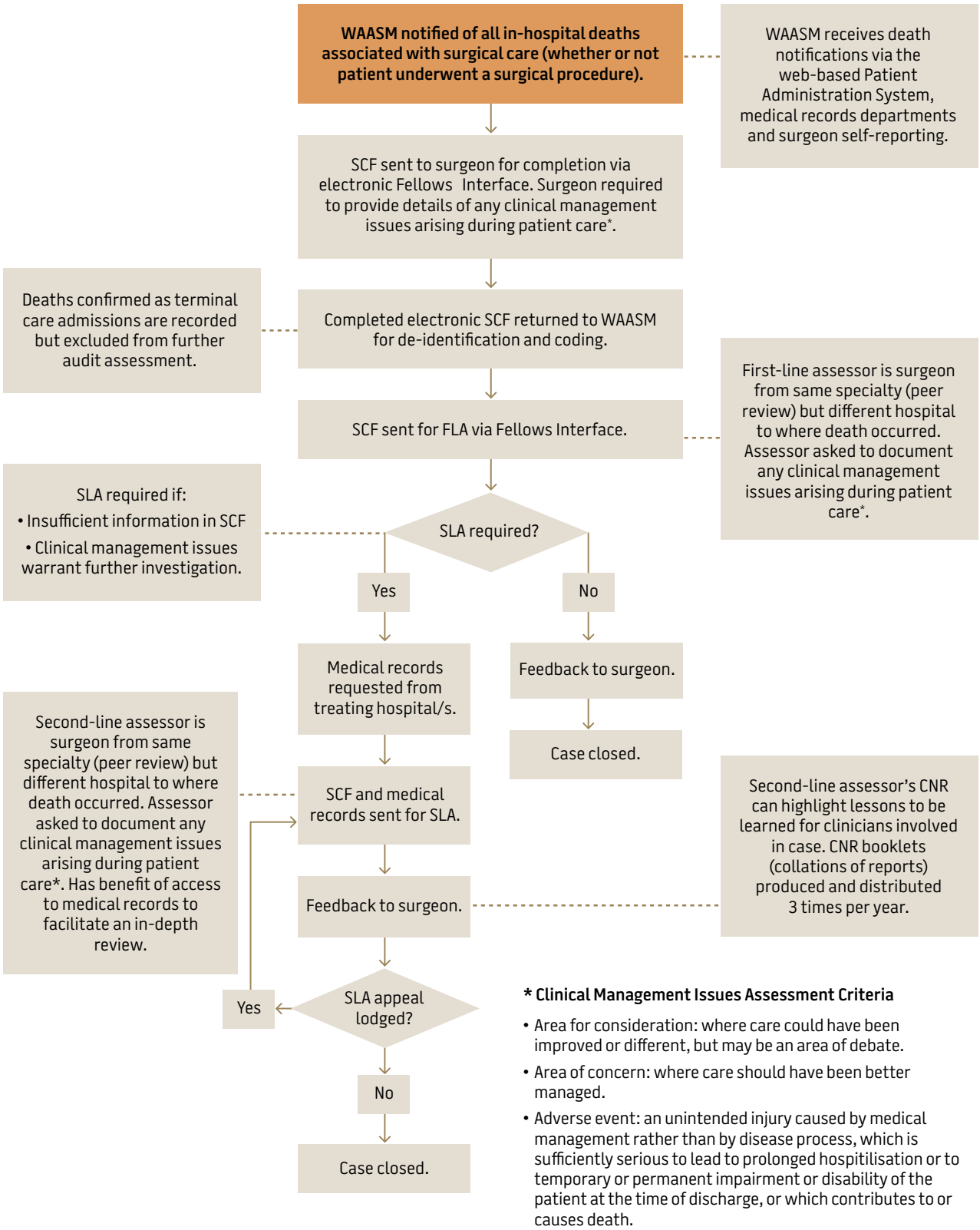


Appendix C: WAASM governance structure



RACS: Royal Australasian College of Surgeons, WA: Western Australian, ANZASM: Australian and New Zealand Audit of Surgical Mortality, WAASM: Western Australian Audit of Surgical Mortality.

Appendix D: WAASM audit process



*** Clinical Management Issues Assessment Criteria**

- Area for consideration: where care could have been improved or different, but may be an area of debate.
- Area of concern: where care should have been better managed.
- Adverse event: an unintended injury caused by medical management rather than by disease process, which is sufficiently serious to lead to prolonged hospitilisation or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributes to or causes death.

WAASM: Western Australian Audit of Surgical Mortality, SCF: surgical case form, FLA: first-line assessment, SLA: second-line assessment, CNR: case note review.

*See Clinical Management Issues Assessment Criteria.

Appendix D: WAASM audit process (continued)

The audit process combines surgeon self-reflection with the peer-reviews of all surgical deaths. The aim is to determine whether a death was the direct result of the disease process or injury, or whether aspects of patient management or hospital systems and protocols may have contributed.

Data are entered and stored in the bi-national audits of surgical mortality system (BAS) database. Since some data are incomplete for some cases (resulting from incomplete SCFs and assessment forms), the total number of cases used in each analysis may vary.

Statistical analysis was performed using the Statistical Package for Social Sciences (IBM SPSS version 28.0). Graphs were produced with Microsoft Office Excel (2010) and SPC. All data are de-identified to preserve the confidentiality of the patient, surgeon and hospital.

Appendix E: Definitions

Appendix E.1 Statistical process control charts

Pattern	Pattern symbol	Pattern summary
Astronomical point	⨪	An identified point that exceeds 3 sigma limits from the mean
Trend (5)	ⓣ	Five consecutively increasing or decreasing points
Two in 3	⅔	Two out of 3 consecutive points exceeding 2 sigma limits from the mean
Shift (7)	Ⓢ	Seven consecutive points above or below the mean

Elements of SPC charts
Three sigma (3σ) limits, displayed as dashed lines, represent the 99.8% control limits.
Two sigma (2σ) limits, displayed as dotted lines, represent the 95% warning limits.
The centreline, represented by the dark solid line, indicates the mean value of observed counts for a given calculation.
Improvement for a specific indicator is shown by a blue dot, while an orange dot represents a pattern of concern.
The grey dot represents the actual observed value.

Appendix E.2 American Society of Anesthesiologists physical classification status

ASA grade	Characteristics
I	A normal healthy patient
II	A patient with mild systemic disease
III	A patient with severe systemic disease
IV	A patient with severe systemic disease that is a constant threat to life
V	A moribund patient who is not expected to survive without the operation
VI	A declared brain-dead patient whose organs are being removed for donor purposes

Royal Australasian College of Surgeons
Western Australian
Audit of Surgical Mortality

Royal Australasian College of Surgeons
ACN 004 167 766 | NZCN 6235298
© RACS 2025