Royal Australasian College of Surgeons

AUSTRALIAN CAPITAL TERRITORY AUDIT OF SURGICAL MORTALITY (ACTASM)

ANNUAL REPORT

5-YEAR UPDATE, 2017–2021

Royal Australasian College of Surgeons
Australian Capital Territory Audit of Surgical Mortality

Acknowledgements

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

The Australian Capital Territory Audit of Surgical Mortality is a declared quality assurance committee under the Australian Capital Territory *Health Act 1993*, and is funded by the ACT Health Directorate.

The Australian and New Zealand Audit of Surgical Mortality, including the Australian Capital Territory Audit of Surgical Mortality, has protection under the Commonwealth Qualified Privilege scheme under Part VC of the *Health Insurance Act 1973* (gazetted 24 April 2022).

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CHAIR'S REPORT

I am pleased to present the report for the Australian Capital Territory Audit of Surgical Mortality (ACTASM) that covers the period 2017–2021. The number of cases reported to ACTASM has remained relatively consistent over the reporting period with most patients being elderly male patients with emergency presentations to public hospitals.

ACTASM continues with excellent participation by surgeons. Time to completion of the surgical case form (SCF) has improved, with the median time in line with the recommended ANZASM standard of 60 days. However, orthopaedic surgeons took significantly longer to complete their SCFs, although this has improved more recently with improved communication with the craft group. Participation in the ANZASM process is now a mandatory component of the continuing professional development (CPD) program for Fellows of the Royal Australasian College of Surgeons (RACS) as well as the CPD program of the Australian Orthopaedic Association (AOA). We hope to work with hospitals to have early notifications of deaths so the audit process can commence without any delay, and to engage with surgeons to facilitate early completion of the SCF.

I would like to thank ACT Health for their continued funding of this important quality assurance activity. I would also like to thank the ACTASM team, the members of the ACTASM management committee, RACS and the surgeons themselves, for their commitment to the audit process and ultimately to the provision of safe and quality surgical care to the residents of the ACT and surrounding regions.

Sivakumar Gananadha FRACS

Clinical Director
ACT Audit of Surgical Mortality

KEY POINTS

- General Surgery patients continue to account for most of the in-hospital mortality associated with surgical care in the ACT.
- Most ACTASM patients are elderly male patients who were emergency admissions to principal public hospitals.
- For the overall ACTASM patient cohort, both surgeons and assessors identified the risk of death at presentation as *considerable*.
- The number of patients undergoing operations has varied year to year, with non-operative admissions being a result of active decisions against surgery.
- Postoperative complications occurred in 13.3% of patients, with anastomotic leaks accounting for most of the complications in 2021.
- Cases with elective admissions, delayed diagnoses and postoperative complications were more likely to be associated with clinical management issues.
- Inter-hospital transfers from both intrastate and regional New South Wales hospitals continue to account for a significant number of ACTASM cases, with Neurosurgery and Vascular Surgery representing the largest patient groups.
- Unplanned returns to theatre occurred in 13.7% of cases, with Vascular Surgery and Urology representing the largest patient groups.

INTRODUCTION

The Australian Capital Territory Audit of Surgical Mortality (ACTASM) was launched in 2010 to support surgeons through the provision of an independent peer-review process for all in-hospital mortality associated with surgical care. As of 30 June 2022, ACTASM has evaluated 1086 cases since its inception, while 104 cases are still undergoing the audit process. A further 199 cases were excluded from the full audit process due to being terminal care (palliative) admissions.

ACTASM is funded by the Australian Capital Territory (ACT) Health Directorate and governed by the ACTASM Management Committee. Via its inclusion in the Australian and New Zealand Audits of Surgical Mortality (ANZASM), ACTASM enjoys Commonwealth Qualified Privilege as a declared quality assurance activity. This protection has helped foster the engagement of surgeons, whether by submission of cases in which they were involved in surgical care or by undertaking assessments and providing critical yet constructive feedback.

ACTASM would like to acknowledge the constructive relationships held with hospitals within the ACT and with those interstate health institutions which share close ties with the ACT health system.

This report incorporates in-hospital surgery-related deaths that occurred between 1 January 2017 and 31 December 2021. The clinical and demographic characteristics of these cases are presented, as are the perspectives on case management of both treating surgeons and independent assessors. The objective of this report is to identify potential areas of improvement for the ongoing professional development of surgeons, as well as the systems and processes within which care is conducted.

METHODS

Case criteria

Following notification from public and private hospitals, ACTASM evaluates all in-hospital surgical deaths that meet either of the following criteria:

- any patient admitted to hospital by a surgeon, regardless of whether a procedure took place
- any hospital admission where a procedure took place that was performed by a surgeon.

Terminal care admissions are excluded from the full audit process.

Collaborations

The Royal Australasian College of Surgeons (RACS) has collaborations with the Australian and New Zealand College of Anaesthetists (ANZCA) and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) for participation in ACTASM. For cases involving gynaecological surgery, the treating surgeon is invited to participate in the audit and to voluntarily submit the case to ACTASM. Similarly, Fellows from the Royal Australian and New Zealand College of Ophthalmologists (RANZCO) and the Royal Australasian College of Dental Surgeons (RACDS) are invited to participate in the audit on a voluntary basis. Participation in ACTASM has been mandated by RACS and the Australian Orthopaedic Association (AOA) as part of their continuing professional development (CPD) programs.

Data collection

Following notification of a patient death, ACTASM requests that the consultant surgeon responsible for the patient submit a surgical case form (SCF), which details the clinical, diagnostic and procedural data of the patient's final hospital admission. The SCF includes the opportunity to identify any clinical management issues (CMIs) perceived to have occurred during the course of patient care. It is also possible, for a consultant surgeon to declare a case to have been a terminal care admission (i.e. the patient was palliated almost immediately upon admission, with no surgical intervention taking place). Terminal admissions are excluded from the full audit process.

SCFs are reviewed for clarity, de-identified and assigned for first-line assessment (FLA) by ACTASM. Assessors provide initial feedback on the overall management of submitted cases and the level of care provided. They also indicate whether there is a need for further evaluation via second-line assessment (SLA), which includes medical note review. An SLA is generally requested because of specific questions arising from the FLA that require more considered evaluation. All assessors invited to evaluate submissions are surgeons from the same surgical specialty as the treating surgeon and are independent of the institution from which the case arose. All assessors are required to sign a declaration acknowledging the confidentiality of the process. SLAs allow for the provision of in-depth feedback to the consultant surgeon responsible for the case.

CMIs identified by surgeons or assessors as part of the audit process are classified as either:

- *Areas of consideration* – the clinician believes aspects of care could have been improved but recognises that this is debatable
- *Areas of concern* – the clinician believes that aspects of care should have been better
- *Adverse events* – an unintended injury caused by patient management rather than by the disease process that is sufficiently serious to lead to prolonged hospitalisation or temporary or permanent disability of the patient, or which contributes to or causes death.

The collection of SCF and FLA data is facilitated by the Fellows Interface, which is a secure online platform to which surgeons have access. SLA data are entered by RACS staff using a bespoke administrative interface.

Where relevant, data are coded using READ code deisgnations.[1] Data are stored securely and encrypted using Microsoft SQL Server 2017, with data subsets scrutinised for consistency on a monthly basis.

Data analysis

The scope of this report includes cases where the patient passed away as an in-patient during the period 1 January 2017 through 31 December 2021 (census date 30 June 2022). Data were analysed using R 4.2.1[2], RStudio 2022.02.0[3], GraphPad Prism 9.4.1 and Microsoft Excel 365. Statistical tests are introduced in the context within which they were applied. Categorical variables are expressed as counts and/or proportions. Continuous variables are expressed as means (± standard deviation) or medians (interquartile range, IQR) depending on the normality of the distribution. Statistical significance was assumed at $p \leq 0.05$ (ns = non-significant). Analyses have been conducted using all available valid data points. Auditable cases include all cases notified to ACTASM, except those excluded due to being terminal care admissions.

RESULTS

Case summary

During the period 2017–2021, there were 634 cases reported to ACTASM. Those noted as terminal care (n = 86; 13.6%) were excluded from the full audit process, leaving 548 cases for analysis. Most cases from this period have completed the audit process (86.9%). The distribution by year and surgical specialty is shown in Figure 1. General Surgery accounted for the majority of cases during this period (39.6%).

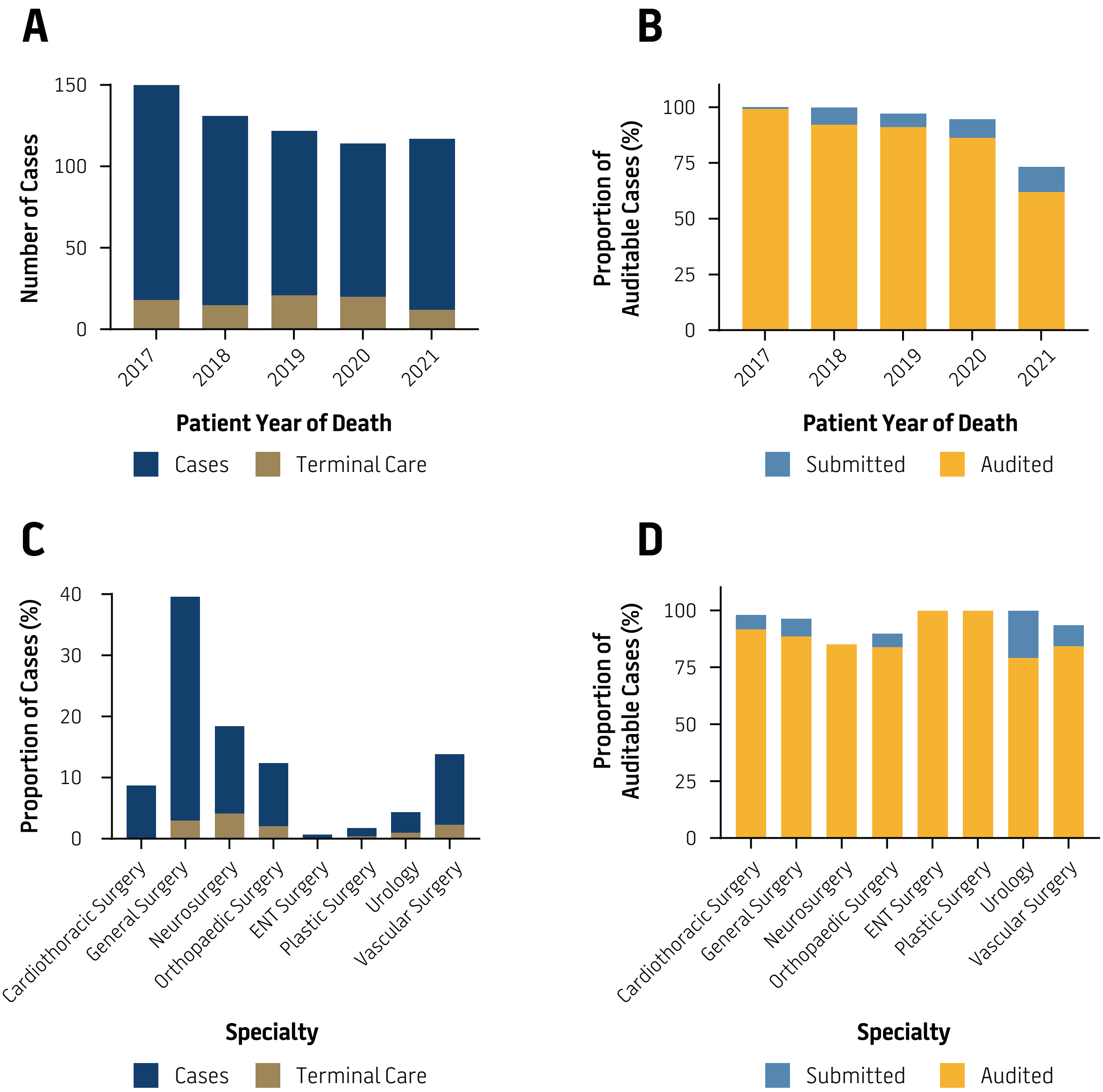


Figure 1: Distribution of ACTASM cases

A: Total number of cases notified to ACTASM per year and proportion that were terminal care admissions.

B: Proportion of cases submitted to ACTASM per year that have completed the audit process.

C: Proportion of cases submitted (2017–2021) based on surgical specialty and proportion that were terminal care admissions.

D: Proportion of cases submitted (2017–2021) based on surgical specialty that have completed the audit process.

Note: ENT Surgery = Otolaryngology Head & Neck Surgery.

In 2021 there was a slight decrease in duration between patient death and notification of cases to ACTASM (median 24 days, IQR 16–35) compared to 2020 (median 28 days, IQR 16-44). The amount of time taken for surgeons to complete their cases has continued to improve, with surgeons taking a median of 60 days (IQR 4–155) to submit cases to ACTASM (the recommended ANZASM standard is for submission of SCFs within 60 days of surgeon notification). Of all the surgical specialties, orthopaedic surgeons took notably longer to submit their cases to ACTASM (median 165 days, IQR 45–413). These data are summarised in Figure 2.

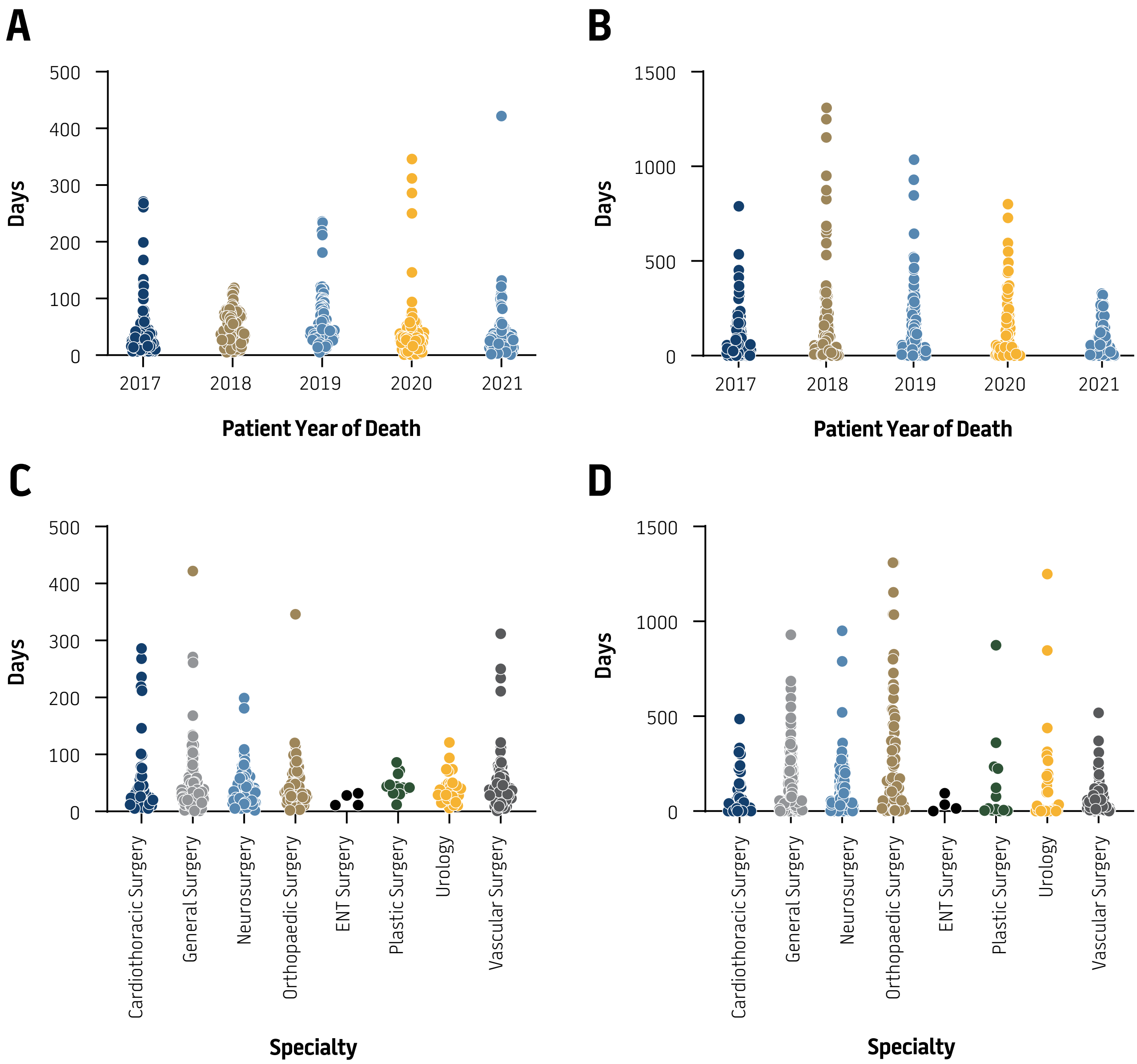


Figure 2: Time to notification and submission of ACTASM cases by year and surgical specialty

A: Time between patient death and notification of ACTASM by the treating institution.

B: Time between the treating surgeon being notified by ACTASM of a pending case and its eventual submission.

C: Time between patient death and notification of ACTASM by the treating institution, according to surgical specialty.

D: Time between the treating surgeon being notified by ACTASM of a pending case and its eventual submission, according to surgical specialty.

Note: ENT Surgery = Otolaryngology Head & Neck Surgery.

Abbreviation: IQR = interquartile range

Patient demographics for cases reported to ACTASM have been summarised in Table 1. Most patients tended to be elderly, male and with cardiovascular disease as the most commonly reported comorbidity. The majority of patients were emergency admissions to public principal referral hospitals. These trends have remained relatively consistent over time.

Table 1: Patient demographics for ACTASM cases by year

	2017 (n=132)	2018 (n=116)	2019 (n=101)	2020 (n=94)	2021 (n=105)
Age (median years; IQR)	75 (65–84)	76 (63–84)	76 (70–83)	76 (62–82)	74 (64–83)
Male:Female (%:%)	59.8:40.2	67.2:32.8	56.4:43.6	51.1:48.9	59.0:41.0
Indigenous (%)					
Yes	1.5	0.9	2.0	1.1	1.9
No	94.7	96.6	95.0	93.6	71.4
Unknown	3.8	2.6	3.0	5.3	26.7
Comorbidities[1] (%)					
Advanced malignancy	17.7	20.4	21.3	16.4	15.9
Age	58.4	73.1	66.3	62.7	61.9
Cardiovascular	61.1	68.8	60.0	67.2	66.7
Diabetes	12.4	25.8	25.0	29.9	23.8
Hepatic	6.2	4.3	5.0	7.5	0.0
Neurological	15.0	23.7	25.0	23.9	33.3
Obesity	12.4	10.8	10.0	14.9	11.1
Other	21.2	21.5	26.3	16.4	25.4
Renal	22.1	25.8	25.0	38.8	17.5
Respiratory	29.2	38.7	27.5	29.9	27.0
Patient status (%)					
Private	5.3	1.7	7.9	5.3	2.9
Public	90.9	97.4	89.1	86.2	70.5
Veteran	1.5	0.9	0.0	1.1	0.0
Unknown	2.3	0.0	3.0	7.4	26.7
Admission status (%)					
Elective	16.7	17.2	18.8	21.3	11.4
Emergency	83.3	82.8	78.2	73.4	61.9
Unknown	0.0	0.0	3.0	5.3	26.7
Hospital status (%)					
Private	5.3	0.0	6.9	6.4	6.7
Public	92.4	99.1	89.1	88.3	72.4
Colocation	0.0	0.0	1.0	0.0	0.0
Unknown	2.3	0.9	3.0	5.3	26.7
Hospital type[2] (%)					
Principal referral hospitals	91.7	100.0	92.1	94.7	95.2
Public acute group A hospitals	4.5	0.0	0.0	1.1	2.9
Private acute group B hospitals	3.8	0.0	7.9	4.3	1.0
Other acute specialised hospitals	0.0	0.0	0.0	0.0	1.0
Length of stay (median days; IQR)	5 (2–14)	5 (2–10)	5 (2–12)	5 (2–12)	5 (2–15)

Note: [1] Proportions are not mutually exclusive; [2] Hospital peer group designations according to AIHW classification[4]; 'Unknown' includes cases for which the information was not provided or for which the case is still pending submission; IQR = interquartile range.

The most frequent diagnoses for ACTASM cases have been summarised in Table 2. Admission diagnoses were those conditions prompting initial admission; surgical diagnoses were the issues requiring surgical care; causes of death were as declared by the submitting surgeon. Diagnoses have been aggregated into parent groups (according to READ code designation[1]) for ease of summary.

Table 2: The 5 most common diagnoses for ACTASM cases

	2017	2018	2019	2020	2021
Admission diagnoses					
1	Other diseases of the intestines and peritoneum	Other bacterial diseases	Other diseases of the intestines and peritoneum	Other diseases of the intestines and peritoneum	Other diseases of the intestines and peritoneum
2	Cerebrovascular disease	Arterial, arteriole and capillary disease	Arterial, arteriole and capillary disease	Fracture of lower limb	Cerebrovascular disease
3	Other respiratory system diseases	Fracture of lower limb	Carcinoma in situ	Carcinoma in situ	Noninfective enteritis and colitis
4	Fracture of lower limb	Cerebrovascular disease	Intracranial injury excluding those with skull fracture	Cerebrovascular disease	Fracture of lower limb
5	Liver, biliary, pancreas + gastrointestinal diseases not elsewhere classified	Intracranial injury excluding those with skull fracture	Fracture of lower limb	Other bacterial diseases	Other urinary system diseases
Surgical diagnoses					
1	Other diseases of the intestines and peritoneum	Arterial, arteriole and capillary disease	Other diseases of the intestines and peritoneum	Other diseases of the intestines and peritoneum	Other diseases of the intestines and peritoneum
2	Cerebrovascular disease	Fracture of lower limb	Arterial, arteriole and capillary disease	Fracture of lower limb	Cerebrovascular disease
3	Arterial, arteriole and capillary disease	Intracranial injury excluding those with skull fracture	Carcinoma in situ	Intracranial injury excluding those with skull fracture	Noninfective enteritis and colitis
4	Intracranial injury excluding those with skull fracture	Other bacterial diseases	Intracranial injury excluding those with skull fracture	Arterial, arteriole and capillary disease	Fracture of lower limb
5	Fracture of lower limb	Cerebrovascular disease	Fracture of lower limb	Cerebrovascular disease	Internal injury of chest, abdomen and pelvis
Cause of death					
1	Other endocrine gland diseases	Other endocrine gland diseases	Other endocrine gland diseases	Other bacterial diseases	Cerebrovascular disease
2	Other bacterial diseases	Other bacterial diseases	Other bacterial diseases	Other endocrine gland diseases	Other endocrine gland diseases
3	Other respiratory system diseases	Other forms of heart disease	Cerebrovascular disease	Cerebrovascular disease	Other bacterial diseases
4	Cerebrovascular disease	Intracranial injury excluding those with skull fracture	Intracranial injury excluding those with skull fracture	Intracranial injury excluding those with skull fracture	Other diseases of the intestines and peritoneum
5	Other forms of heart disease	Other respiratory system diseases	Other forms of heart disease	Other forms of heart disease	Other forms of heart disease

For the majority of cases in 2021, the reported ASA[5] score (American Society of Anesthesiologists physical status classification system) was 4 (a patient with severe systemic disease that is a constant threat to life), with both the treating surgeon and assessors mostly ranking risk of death as 'considerable', as depicted in Figure 3.

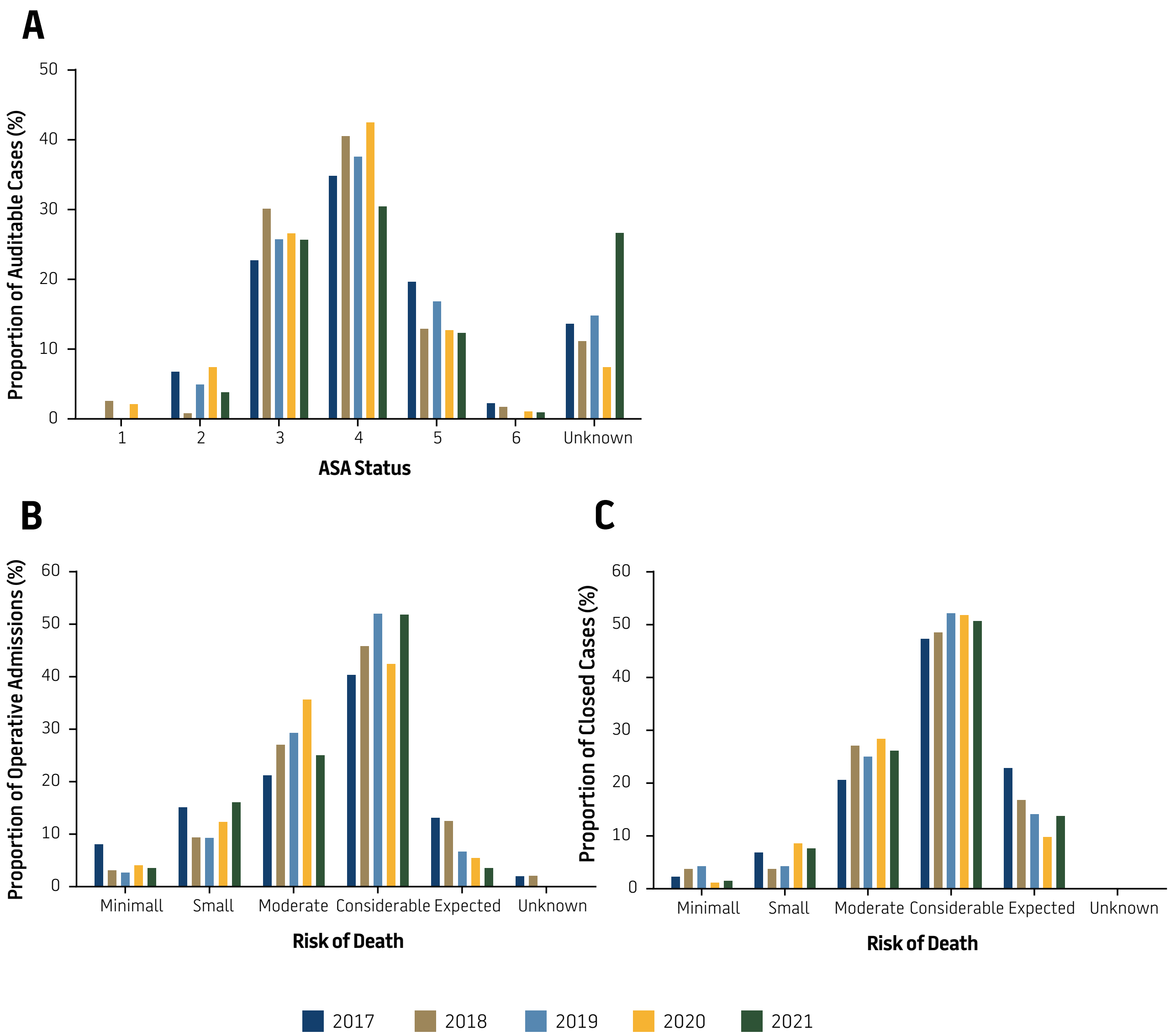


Figure 3: ASA and risk of death scores for ACTASM cases

A: ASA score identified by treating surgeon as proportion of audited cases.

B: Risk of death rating identified by the treating surgeon as proportion of operative admissions.

C: Risk of death rating identified by the assessor as proportion of closed cases.

Note:

ASA 1 = A normal healthy patient

ASA 2 = A patient with mild systemic disease

ASA 3 = A patient with severe systemic disease

ASA 4 = A patient with severe systemic disease that is a constant threat to life

ASA 5 = A moribund patient who is not expected to survive without the operation

ASA 6 = A declared brain-dead patient whose organs are being removed for donor purposes

Delayed patient surgical diagnosis

A delay in determining the surgical diagnosis was reported in 4.8% of cases in 2021. Of these, the source of delay was primarily associated with the institutional medical unit (40.0% of delayed cases). In 2021 most delayed surgical diagnoses were attributed to inexperienced staff and were considered unavoidable. By comparison during 2020 most delays were attributed to incorrect tests and/or misinterpreted results, but were still considered unavoidable. Significant variation in these proportions from year to year are due to relatively low numbers of cases where delays in determining the surgical diagnosis are reported. This information is depicted in Figure 4.

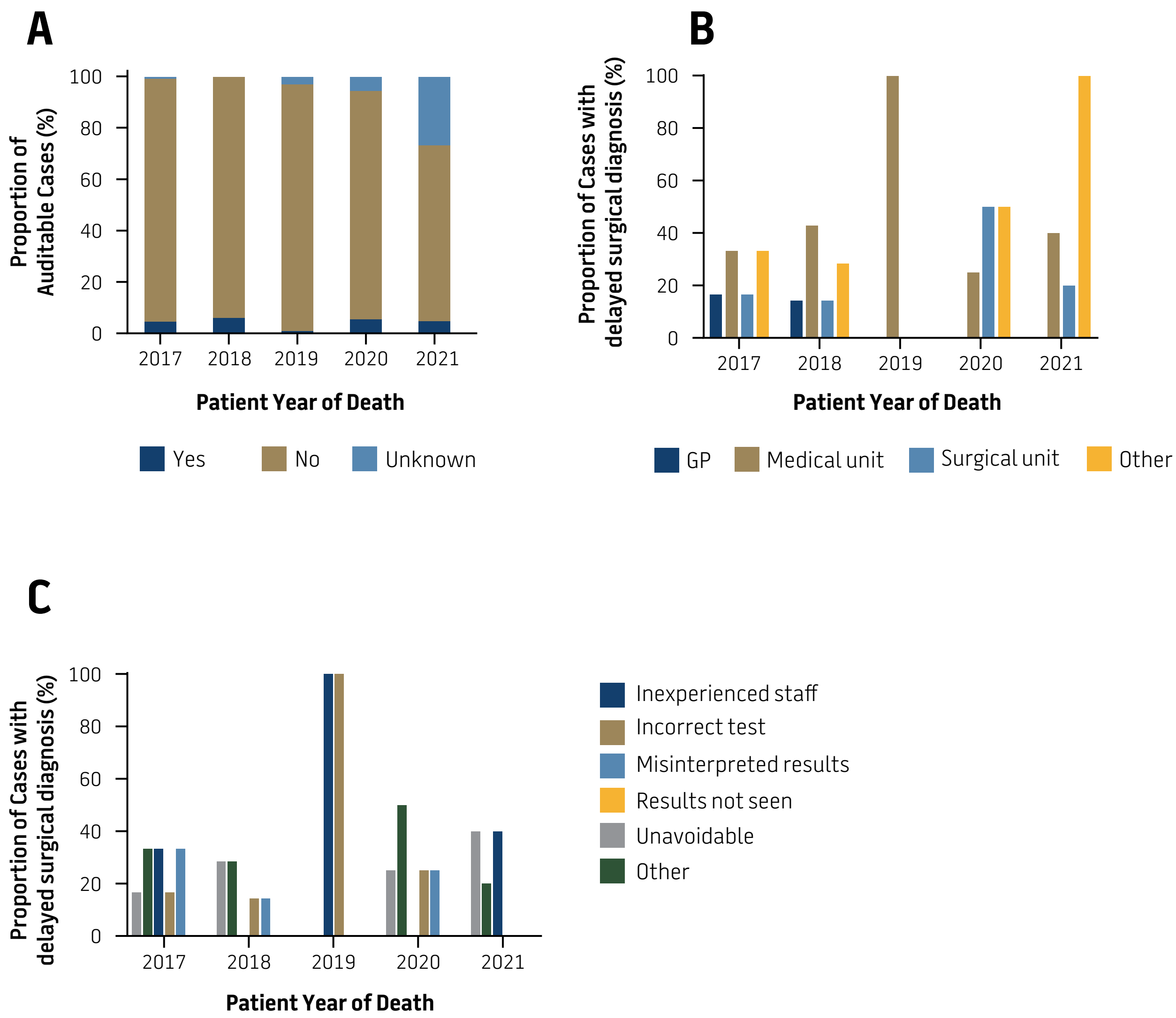


Figure 4: Reported delay in determining the main surgical diagnosis
A: Proportion of cases per year where delays determining the surgical diagnosis were reported.
B: Health units primarily responsible for the delay in diagnosis, according to treating surgeon (data not mutually exclusive).
C: Underlying causes of delay, according to treating surgeon (data not mutually exclusive).

Deep vein thrombosis prophylactic strategies

Deep vein thrombosis (DVT) prophylaxis was used in 65.7% of cases in 2021 (Figure 5) (The relatively high proportion of cases for which the DVT prophylaxis strategy is unknown is due to unsubmitted data at the census date). For those in whom DVT prophylaxis was employed, heparin was overwhelmingly the preferred form of prophylaxis (88.4%), followed by the use of thromboembolic deterrent (TED) stockings (58.0%) and sequential compression devices (44.9%) (data not mutually exclusive). Non-use of DVT prophylaxis was substantially due to its use being considered inappropriate (50.0% of cases) and an active decision to withhold such treatment (37.5% of cases). Following evaluation, assessors considered the DVT prophylactic strategy employed appropriate in most cases (80%), with active disapproval of the DVT prophylactic strategy being relatively rare (1.5%).

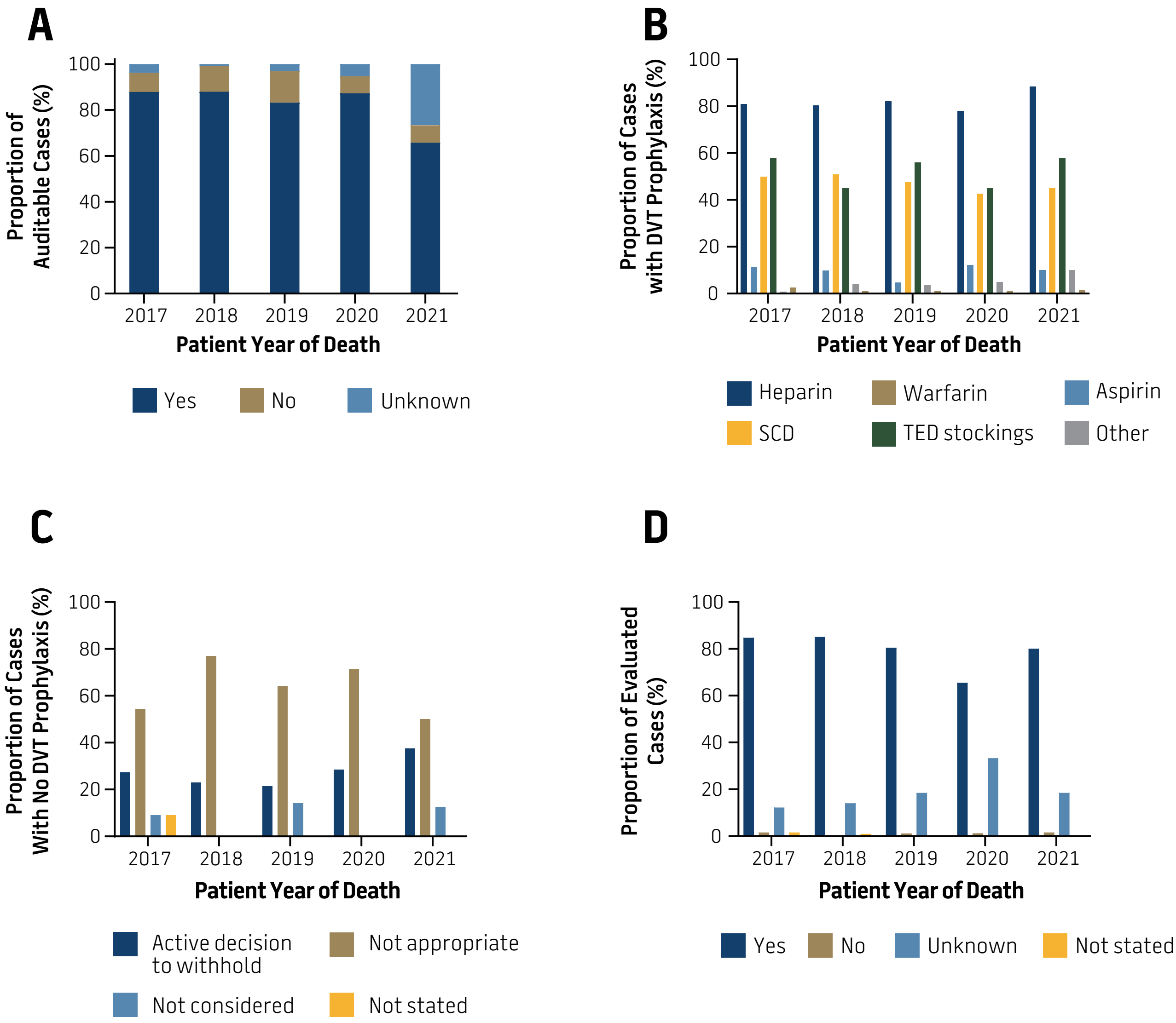


Figure 5: DVT prophylaxis use among ACTASM cases

A: Proportion of cases per year in which DVT prophylaxis was used.
B: Type of DVT prophylaxis used per year (data not mutually exclusive).
C: Reasons given by treating surgeons per year why DVT prophylaxis was not used (data not mutually exclusive).
D: Assessor conclusions of appropriateness of DVT prophylaxis strategy in cases where DVT prophylaxis was used.

Patient surgical intervention and ICU/HDU usage

Just over half of the reported cases in 2021 (53.3%) underwent at least one surgical procedure during their admission (Figure 6A). In 2021, the urgency of surgical intervention for most patients was considered an emergency operation (33.4%). The need for an immediate operation was the next most frequent category (26.9%) (Figure 6B). Among the cases that did not undergo a surgical procedure, an active decision not to operate was made in 52.4% of cases. If surgery did not occur, the main reason given was that the issue was not considered a surgical problem (28.6%) (Figure 6C).

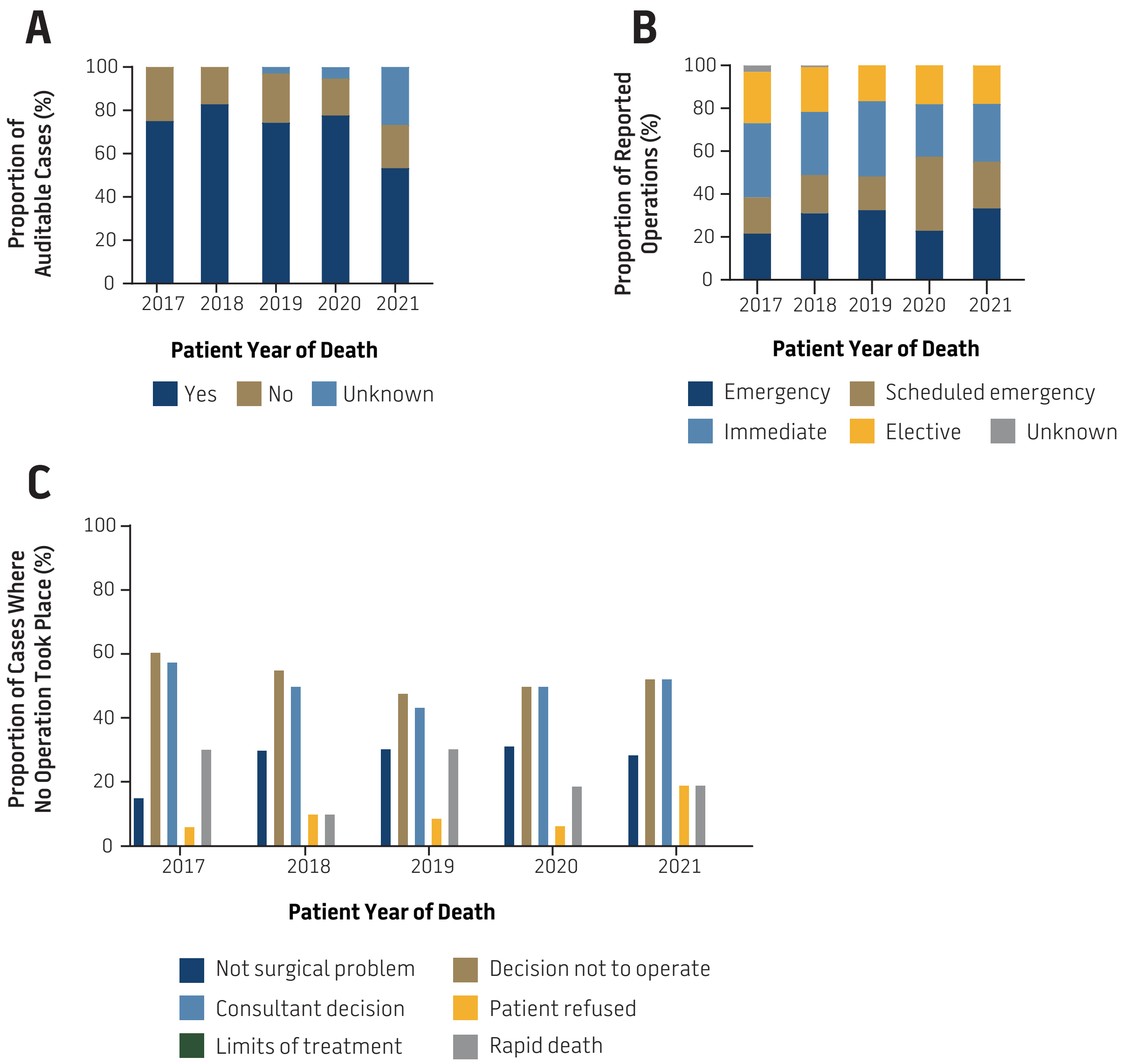


Figure 6: Patient surgical interventions

A: Proportion of patients who underwent one or more operations during their last admission.

B: Urgency of operation for patients who underwent one or more operations during their last admission. (Emergency = <24 hours post-admission, immediate = <2 hours post-admission, scheduled emergency = >24 hours post-admission, elective = agreed time prior to admission).

C: Reasons for no operation taking place in patients who did not undergo an operation during their last admission (data not mutually exclusive).

In 2021, postoperative complications were reported in 13.3% of cases (Figure 7A). Of these, a delay in recognising the complication was reported in 7.1% of cases (Figure 7B). The main postoperative complications that occurred in 2021 were anastomotic leaks (50%) and other factors (Figure 7C).

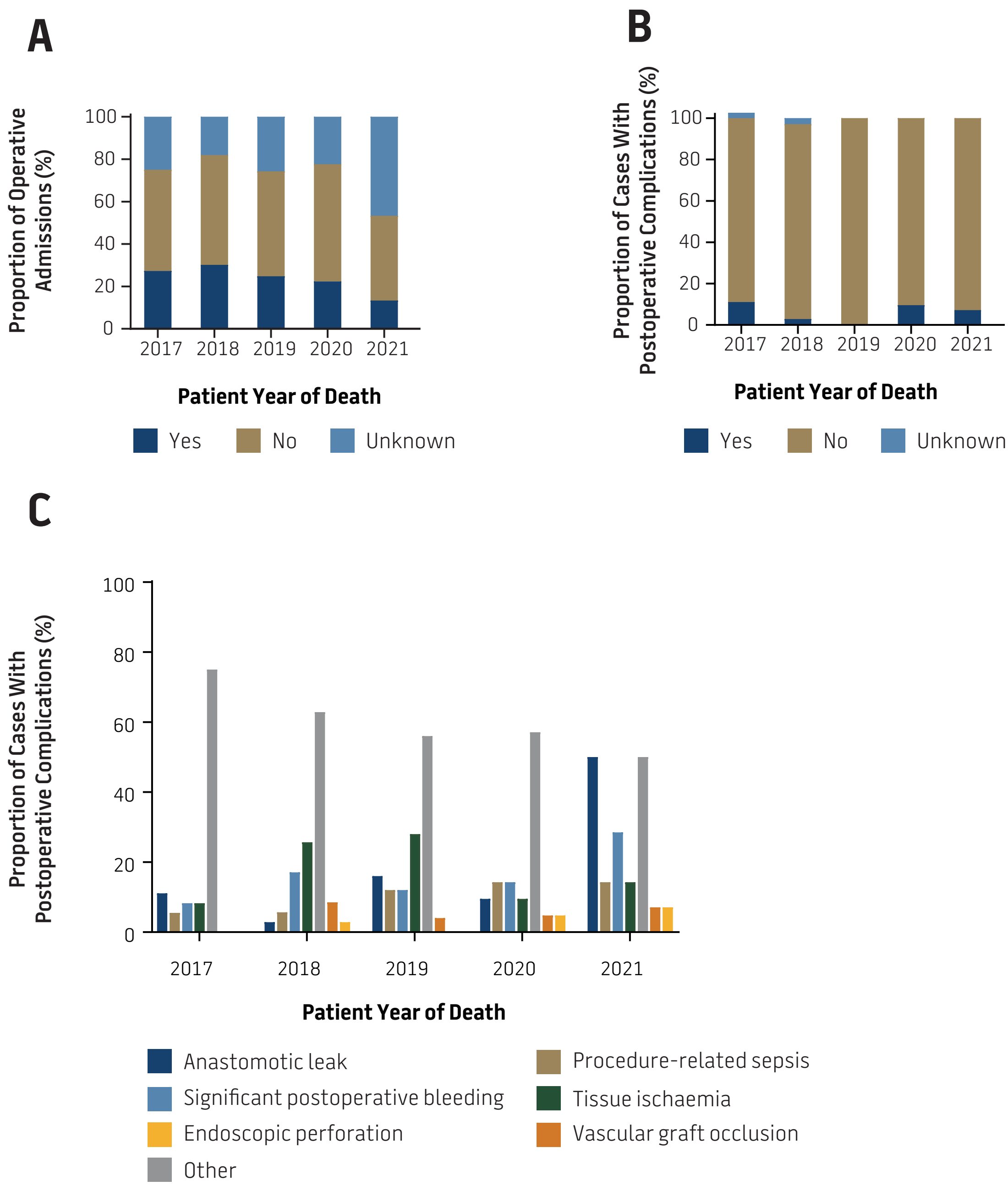


Figure 7: Postoperative complications
A: Proportion of postoperative complications per year resulting from operative admissions.
B: Proportion of operative admissions per year in which there was a delay in recognising postoperative complications.
C: Types of reported postoperative complications per year (data not mutually exclusive).

The most common types of operations for cases reported to ACTASM have been summarised in Table 3. Operations have been aggregated into parent groups (according to READ code designation[1]) for ease of summary.

Table 3: The 5 most common operation types for ACTASM cases

	2017	2018	2019	2020	2021
Operation types					
1	Soft tissue operations	Artery and vein operations	Soft tissue operations	Artery and vein operations	Soft tissue operations
2	Lower digestive tract operations	Other bone and joint operations	Lower digestive tract operations	Burrhole(s) for ventricular external drainage	Upper digestive tract operations
3	Upper digestive tract operations	Urinary operations	Artery and vein operations	Lower digestive tract operations	Lower digestive tract operations
4	Heart operations	Lower digestive tract operations	Other bone and joint operations	Soft tissue operations	Urinary operations
5	Artery and vein operations	Soft tissue operations	Upper digestive tract operations	Other bone and joint operations	Artery and vein operations

An intensive care unit (ICU) or high dependency unit (HDU) was used in just over half of the cases for which an operation was performed in 2021, which is lower than that observed in previous years (Figure 7). In 23.8% of cases, there was an unplanned admission to an ICU/HDU, which has been a consistent trend during the reporting period. Overall, ICU/HDU use was considered appropriate in 94.7% of these cases. The treating surgeon reported fluid balance as an issue in 7.6% of cases.

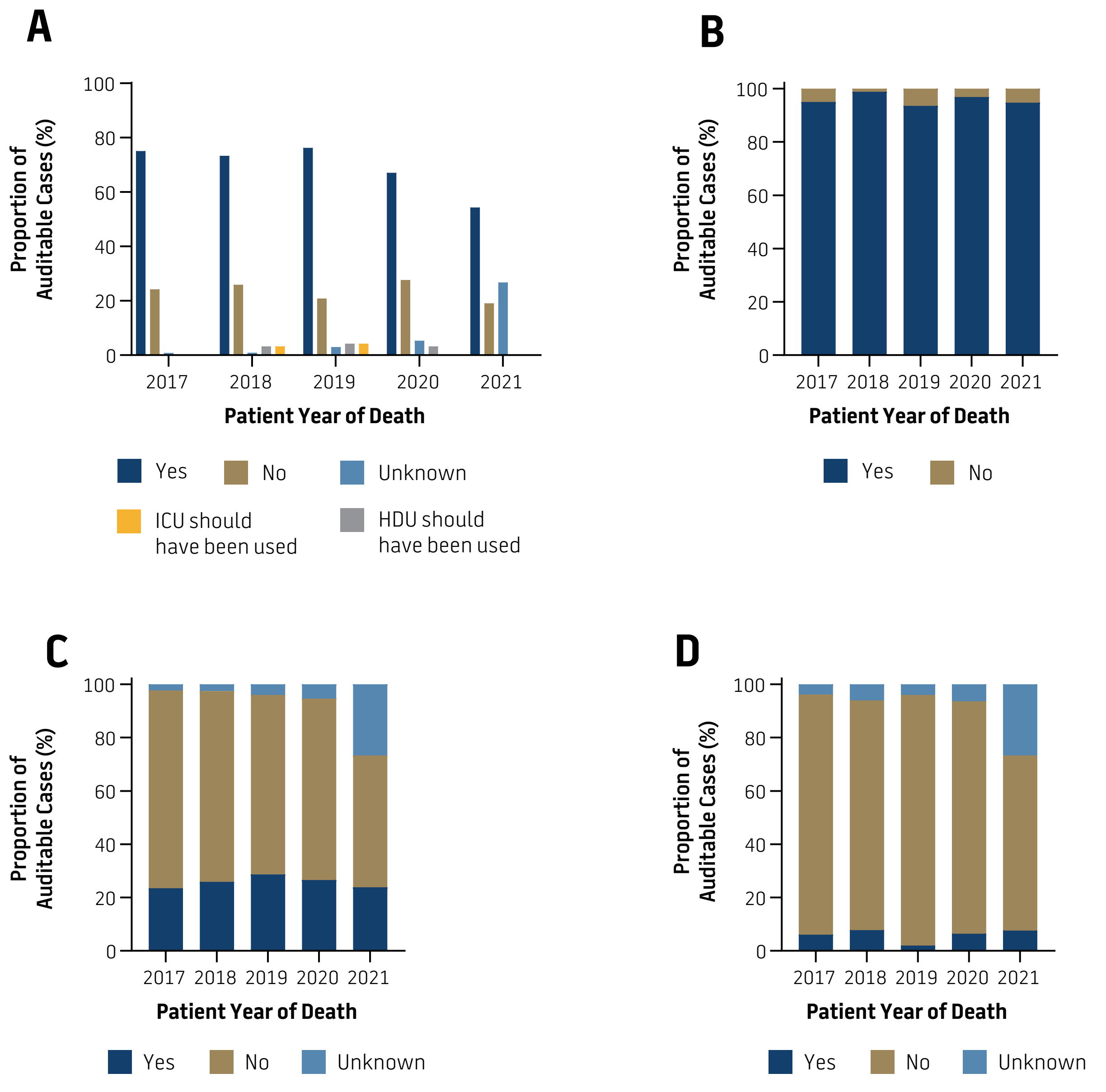


Figure 8: ICU/HDU usage and patient fluid management
A: Proportion of cases per year in which ICU/HDU use was necessary.
B: Proportion of cases per year in which ICU/HDU use was satisfactory.
C: Proportion of cases per year with an unplanned admission to ICU/HDU.
D: Proportion of cases per year in which fluid balance was an issue.

Patient infection

Data on patient infections are summarised in Figure 9. Clinically significant infections were reported in just over one quarter of cases (27.6%) in 2021. Of these, 58.6% were acquired prior to hospital admission. For those infections acquired during admission, most occurred postoperatively (50.0%) and were unrelated to the surgical site (25.0%). Pneumonia was the most common infection overall (34.5%) followed by intra-abdominal sepsis (31.0%), reflecting a relatively consistent trend in infection types. The antibiotic regime administered to patients was considered appropriate by the treating surgeon in most cases (96.6%) with 93.1% of patients receiving antibiotic treatment with no delay.

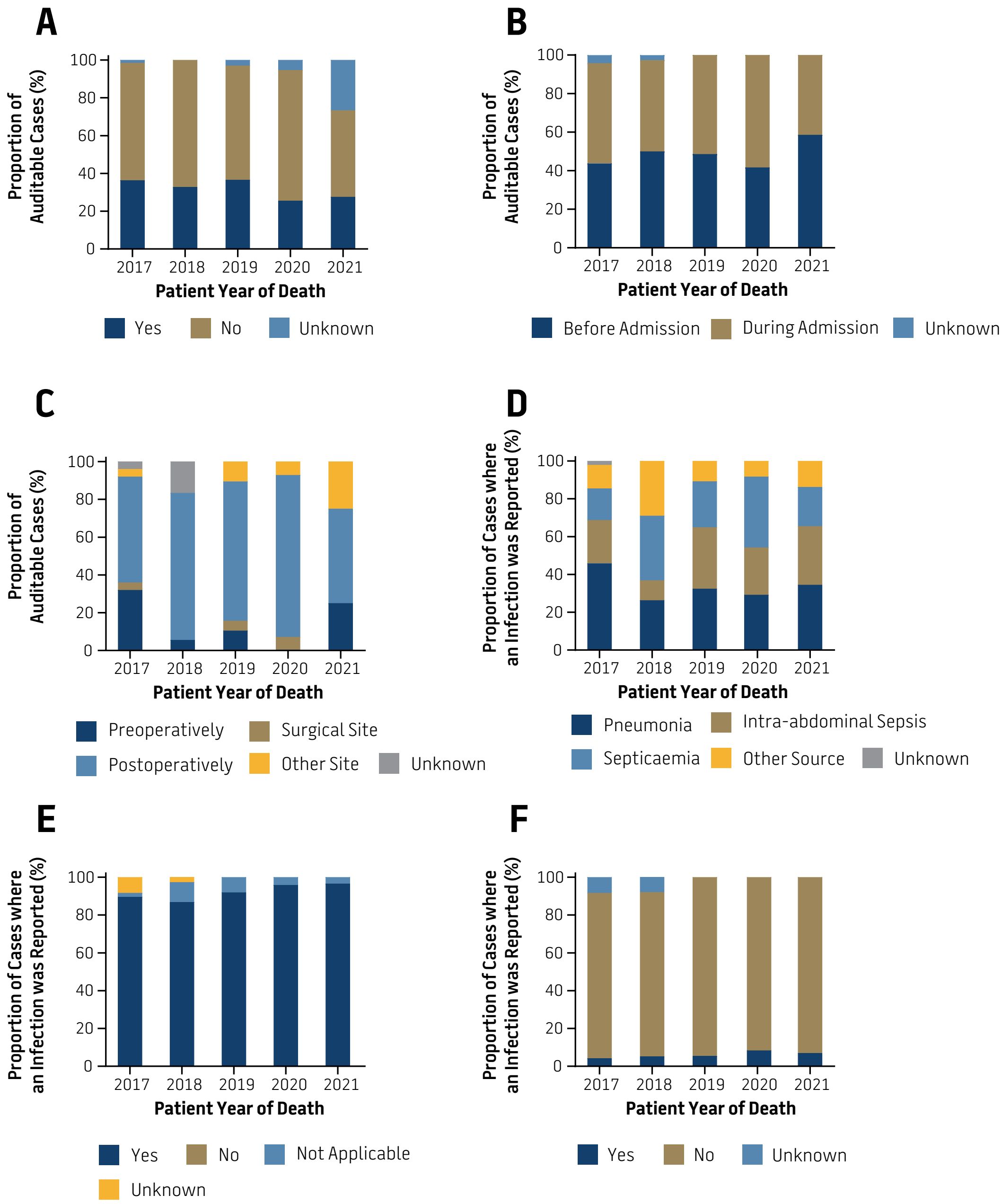


Figure 9: Clinically significant infections among ACTASM cases
A: Proportion of patients per year where a clinically significant infection was reported by the treating surgeon.
B: Admission period per year during which infection was acquired.
C: Site of infection per year.
D: Type of infection acquired per year.
E: Treating surgeon assessment of appropriateness of antibiotic regime per year.
F: Delay in initiation of antibiotic treatment per year.

Overall pathway of patient care

An important aspect to the audit process is the opportunity for surgeons (and assessors) to indicate whether various parts of the overall pathway of care for a patient could have been improved. This is distinct from the identification of potential CMIs. Factors influencing preoperative, intraoperative, and postoperative care are considered, as well as the decision to operate (or not). These data have been summarised in Figure 10 and Figure 11. Overall, assessors were more likely to identify room for improvement than treating surgeons, but by and large both surgeons and assessors thought the pathway of patient care was appropriate.

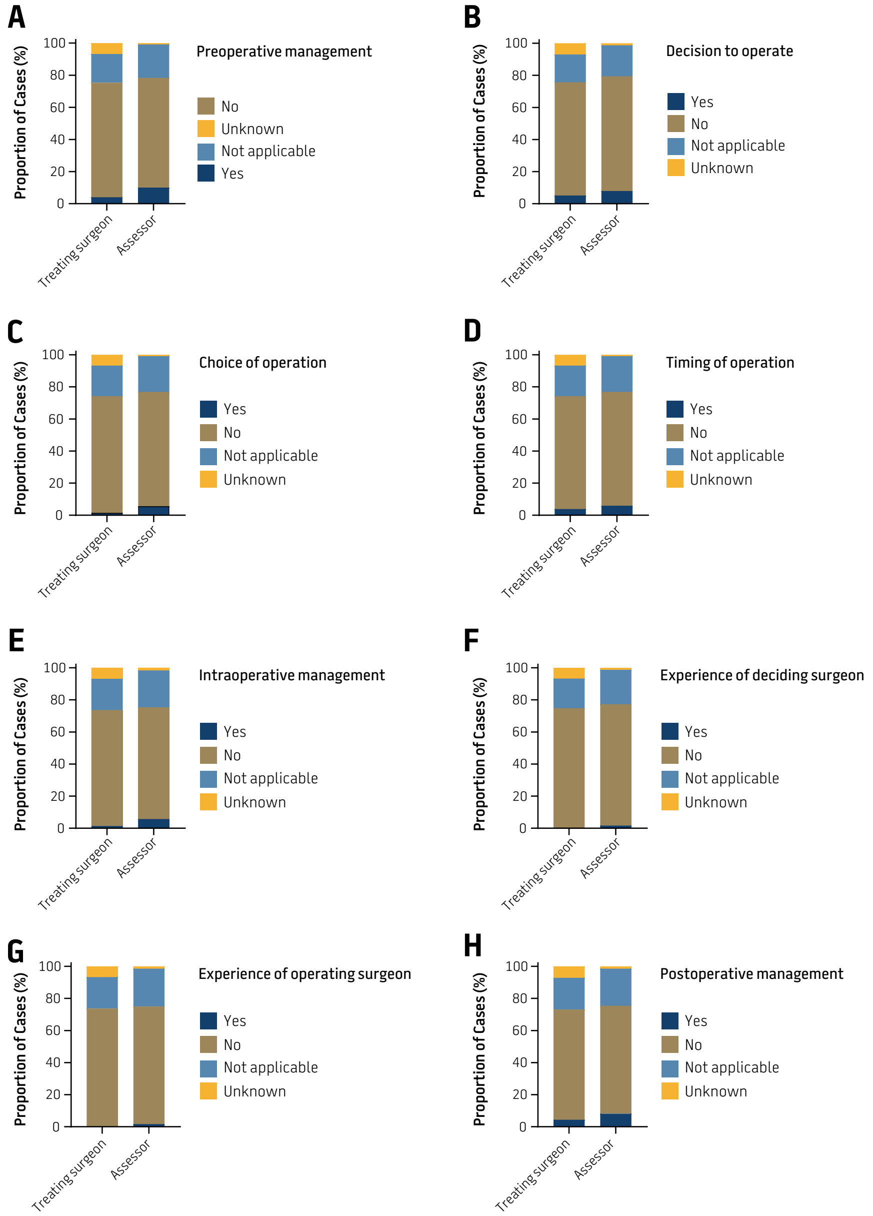


Figure 10: Improvements in patient management

A: Proportion of cases per year where preoperative management could be improved.
B: Proportion of cases per year where the decision to operate could be improved.
C: Proportion of cases per year where the choice of operation could be improved.
D: Proportion of cases per year where the timing of operation(s) could be improved.
E: Proportion of cases per year where intraoperative management could be improved.
F: Proportion of cases per year where the experience of the surgeon deciding to operate could be improved.
G: Proportion of cases per year where the experience of the operating surgeon could be improved.
H: Proportion of cases where postoperative management could be improved.

Clinical management issues

The overall surgical management of a case is also evaluated with respect to whether distinct CMIs were identified by surgeons and/or assessors. In the period 2017–2021, treating surgeons nominated 124 CMIs from 20.8% of cases, while assessors identified 146 CMIs from 19.2% of cases.

The more frequently reported CMIs have been summarised in Table 4. CMIs have been aggregated into parent groups (according to READ code designation[1]) for ease of summary. The most common CMIs for the overall cohort were delays and incorrect or inappropriate therapy.

Table 4: The 5 most common CMIs as identified by treating surgeons and assessors

	2017	2018	2019	2020	2021
CMIs (surgeon-identified)					
1	Delays	Delays	Incorrect/ inappropriate therapy	Delays	Delays
2	Incorrect/ inappropriate therapy	Incorrect/ inappropriate therapy	Delays	Incorrect/ inappropriate therapy	Incorrect/ inappropriate therapy
3	General complications of treatment	General complications of treatment	General complications of treatment	Open surgery, organ related technical	Communication failures
4	Assessment problems	Open surgery, organ related technical	Assessment problems	Adverse factors in management	Open surgery, organ related technical
5	Communication failures	Assessment problems	Adverse factors in management	Assessment problems	Patient-related factors
CMIs (assessor-identified)					
1	Incorrect/ inappropriate therapy	Delays	Incorrect/ inappropriate therapy	Incorrect/ inappropriate therapy	Incorrect/ inappropriate therapy
2	Delays	Incorrect/ inappropriate therapy	Assessment problems	Delays	Delays
3	General complications of treatment	Communication failures	Communication failures	General complications of treatment	Adverse factors in management
4	Drugs related complication	General complications of treatment	Delays	Communication failures	Assessment problems
5	Laparoscopic surgery, organ related technical	Adverse factors in management	General complications of treatment	Open surgery, organ related technical	Monitoring problems

The number and nature of CMIs and how they were classified by surgeons and assessors are detailed in Figure 11.

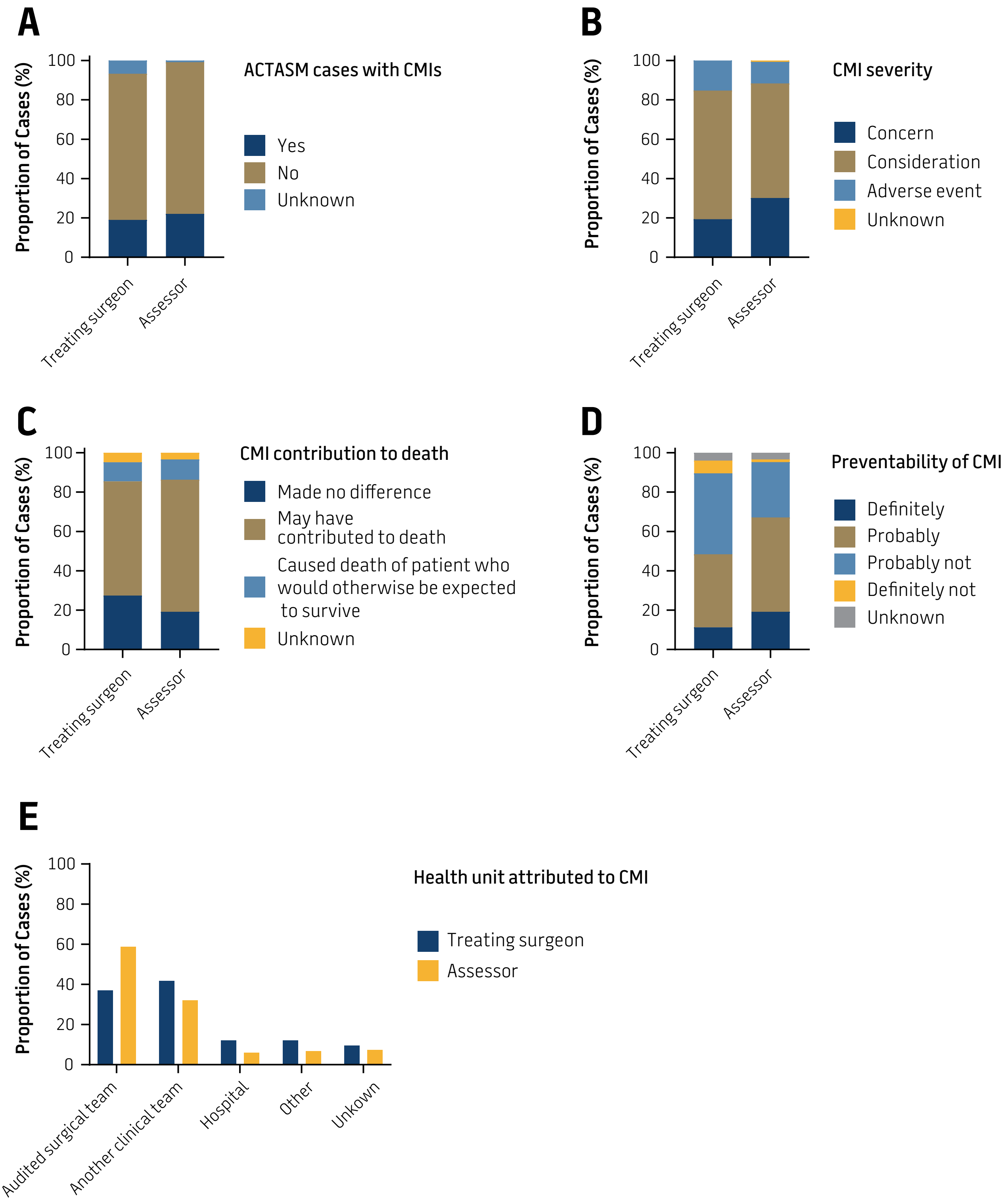


Figure 11: CMI classifications as identified by treating surgeons and assessors (2017–2021)

A: Proportion of cases per year where at least one CMI was reported by surgeons or assessors.

B: Severity of CMIs reported per year. (Areas of 'consideration' are considered minor, areas of 'concern' are of moderate severity and 'adverse events' are issues where the patient may have survived, had they not occurred.)

C: Extent to which the CMI was thought to have contributed to patient demise.

D: Extent to which the CMI was considered potentially preventable.

The dataset was interrogated to identify those clinical factors that seemed to be strongly associated with the presence of CMIs (as identified by assessors). Basic analysis identified the factors listed below (univariate correlates) in Table 5; the 'p' value indicates the probability of these factors being associated with the presence of CMIs occurring by random chance. The factors identified by basic analysis were compared with each other in a complex multivariate model, identifying those variables (multivariate correlates) most strongly associated with the presence of CMIs. These data have been summarised in Figure 12. CMIs were more likely to be identified in elective cases, those in which delays had occurred in determining the surgical diagnosis, and those where postoperative complications had arisen.

Table 5: Correlates of the presence of assessor-identified CMIs

Univariate correlates	p
Specialty	<0.05
Admission type	<0.001
ASA	<0.01
Delay in surgical diagnosis	<0.01
Operation	<0.001
Risk of death (surgeon)	<0.001
Postoperative complication	<0.001
Unplanned return to theatre	<0.001
Unplanned admission to ICU	<0.001
Fluid balance issues	<0.01
Treated in CCU	0.052
Clinically significant infection	<0.05
Age	<0.001
Length of stay	<0.001

Multivariate correlates	p
Admission type	<0.05
Delay in surgical diagnosis	<0.05
Postoperative complication	0.055

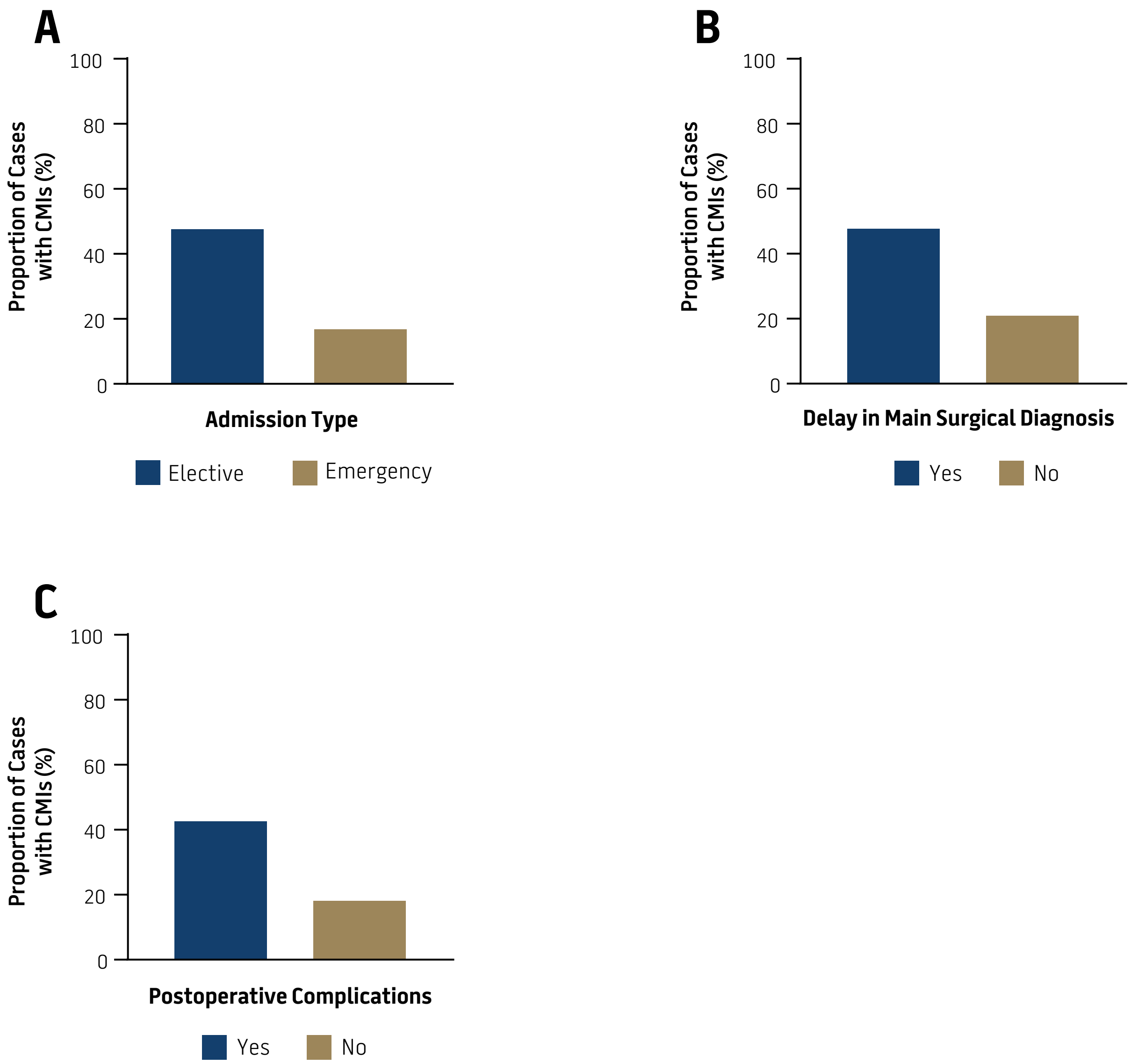


Figure 12: Multivariate correlates of the emergence of CMIs in ACTASM cases as identified by assessors (2017–2021)
A: Proportion of CMIs according to hospital admission type.
B: Proportion of CMIs according to recorded delay in surgical diagnosis.
C: Proportion of CMIs according to presence of postoperative complications.

Patient transfers

The ACT experiences high levels of patient transfers between hospitals, from both intrastate and interstate hospitals. From the ACTASM cohort, 61.0% of transferred patients were from interstate hospitals. For the majority of cases where transfer occurred the patients were public, emergency admissions to public hospitals (Figure 13). Patients that were transferred during the course of care were likely to be younger (median 74 years, [IQR 62–82] vs 77 years [IQR 66–84], $p < 0.05$) and experience shorter hospital admissions (median 4 days [IQR 2–10] vs 6 days [IQR 2–13], $p < 0.05$) than non-transferred patients.

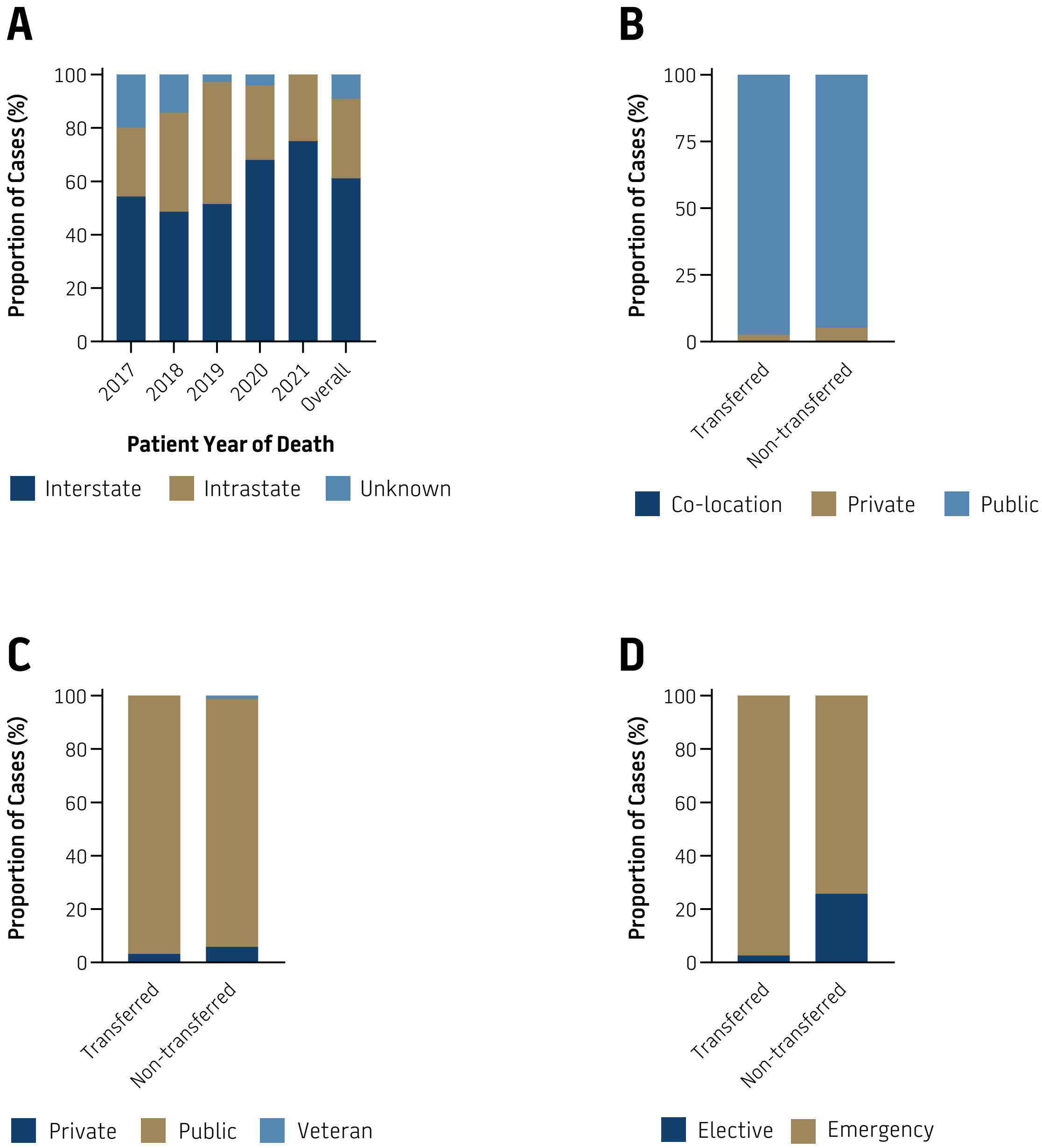
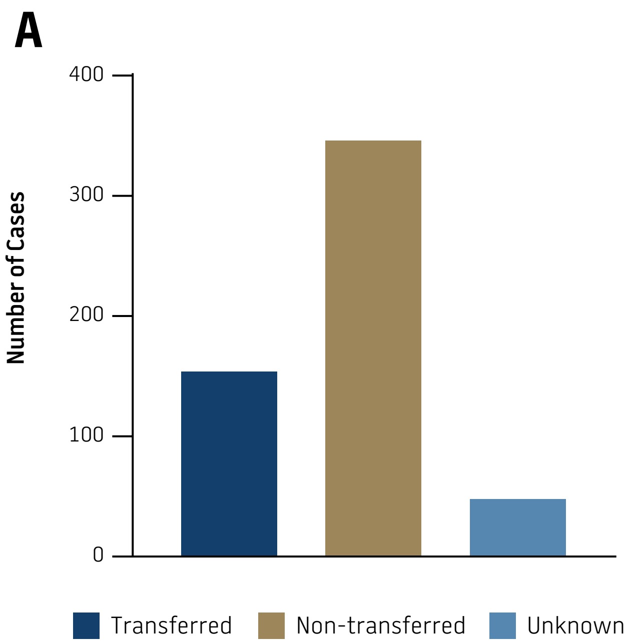


Figure 13: Demographics of transferred ACTASM cases
A: Proportion of cases per year transferred from interstate and intrastate hospitals.
B: Proportion of cases transferred to public and private hospitals.
C: Demographics of transferred patients.
D: Surgical urgency of transferred patients.

The proportion of cases requiring transfer for each surgical specialty are depicted in Figure 14, with Neurosurgery and Vascular Surgery reporting the highest rates of patient transfers.



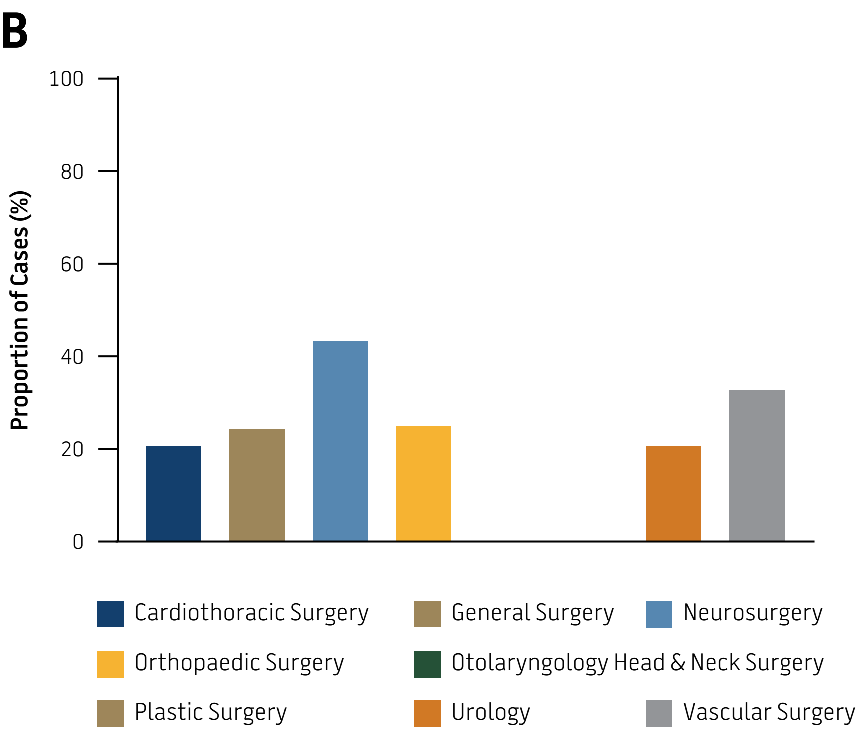


Figure 14: Surgical specialties and transferred patients 2017-2021
A: Proportion of transferred patients.
B: Proportion of transferred cases according to surgical specialty.

Table 6 lists the most common diagnoses on admission to hospital, diagnoses requiring surgical intervention and causes of death according to the treating surgeon for transferred and non-transferred patients. The most common admission and surgical diagnosis for transferred patients was cerebrovascular disease, compared to diagnosis of intestinal and peritoneal disease for non-transferred patients. The most common cause of death, as stated by the treating surgeon, was endocrine gland disease (e.g. diabetes mellitus) for both transferred and non-transferred patients.

Table 6: The 5 most common diagnoses for transferred and non-transferred ACTASM cases

	Transferred	Non-transferred
Admission diagnosis		
1	Cerebrovascular disease	Other diseases of the intestines and peritoneum
2	Other diseases of the intestines and peritoneum	Fracture of lower limb
3	Arterial, arteriole and capillary disease	Arterial, arteriole and capillary disease
4	Intracranial injury excluding those with skull fracture	Other bacterial diseases
5	Fracture of lower limb	Carcinoma in situ
Surgical diagnosis		
1	Cerebrovascular disease	Other diseases of the intestines and peritoneum
2	Arterial, arteriole and capillary disease	Fracture of lower limb
3	Other diseases of the intestines and peritoneum	Arterial, arteriole and capillary disease
4	Intracranial injury excluding those with skull fracture	Intracranial injury excluding those with skull fracture
5	Fracture of lower limb	Noninfective enteritis and colitis
Cause of death		
1	Other endocrine gland diseases	Other endocrine gland diseases
2	Cerebrovascular disease	Other bacterial diseases
3	Other bacterial diseases	Other respiratory system diseases
4	Other forms of heart disease	Other forms of heart disease
5	Intracranial injury excluding those with skull fracture	Cerebrovascular disease

The most common ASA status for transferred patients was 4 (a patient with severe systemic disease that is a constant threat to life), similar to non-transferred patients. According to both treating surgeons and assessors, the most common risk of death rating was ‘considerable’. These trends are similar for both transferred and non-transferred patients, as depicted in Figure 15.

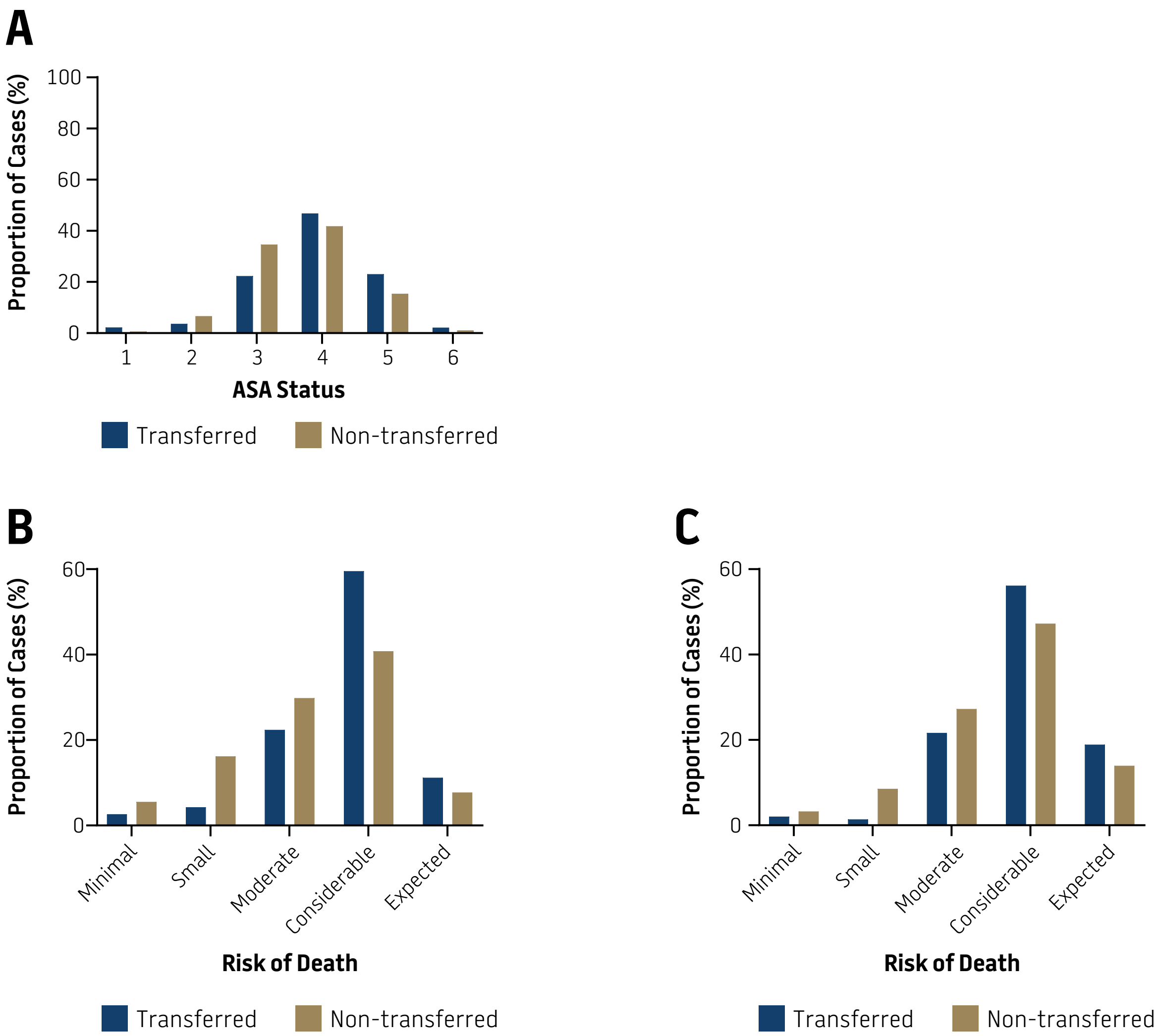


Figure 15: ASA and risk of death scores for ACTASM cases with transferred patients
A: Proportion of transferred and non-transferred cases according to ASA status.
B: Proportion of transferred and non-transferred cases according to risk of death as identified by treating surgeon.
C: Proportion of transferred and non-transferred cases according to risk of death as identified by assessor.
Note:
ASA 1 = A normal healthy patient
ASA 2 = A patient with mild systemic disease
ASA 3 = A patient with severe systemic disease
ASA 4 = A patient with severe systemic disease that is a constant threat to life
ASA 5 = A moribund patient who is not expected to survive without the operation
ASA 6 = A declared brain-dead patient whose organs are being removed for donor purposes

The proportion of cases with at least one comorbidity reported was slightly less among transferred patients compared with non-transferred patients (Figure 16). Among those patients where comorbidities were reported, age, cardiovascular disease and diabetes were more likely to be noted for transferred patients.

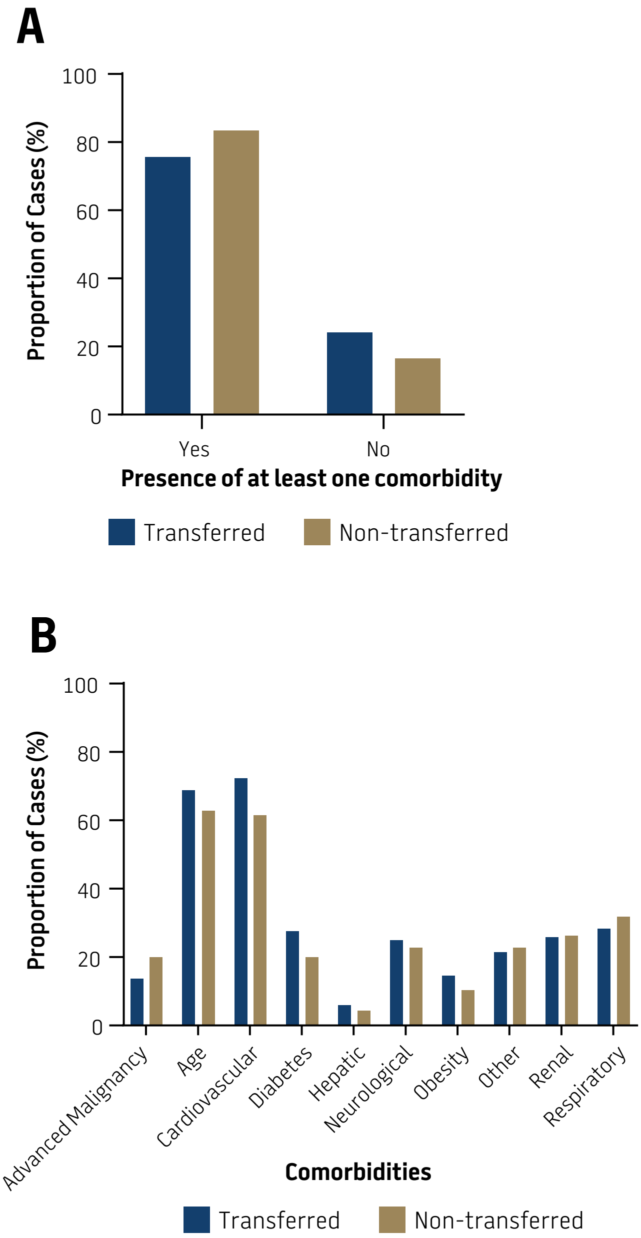


Figure 16: CMI classifications in transferred patients as identified by treating surgeons and assessors
A: Proportion of transferred cases with at least one comorbidity.
B: Comorbidities present among transferred and non-transferred patients.

CMIs were less prevalent in transferred cases according to both treating surgeons (34 CMIs identified in transferred cases vs 88 in non-transferred cases) and assessors (35 CMIs identified in transferred cases vs 108 in non-transferred cases). Most CMIs identified in transferred cases were areas of consideration that may have contributed to the patient's death. In transferred cases, most treating surgeons indicated that CMIs were *probably not* preventable, in contrast to assessors who believed that CMIs were *probably* preventable. Treating surgeons mostly indicated that CMIs were attributable to another clinical team, whereas assessors indicated that CMIs were attributable to the audited surgical team, as depicted in Figure 17. The most frequently reported CMIs are listed in Table 7.

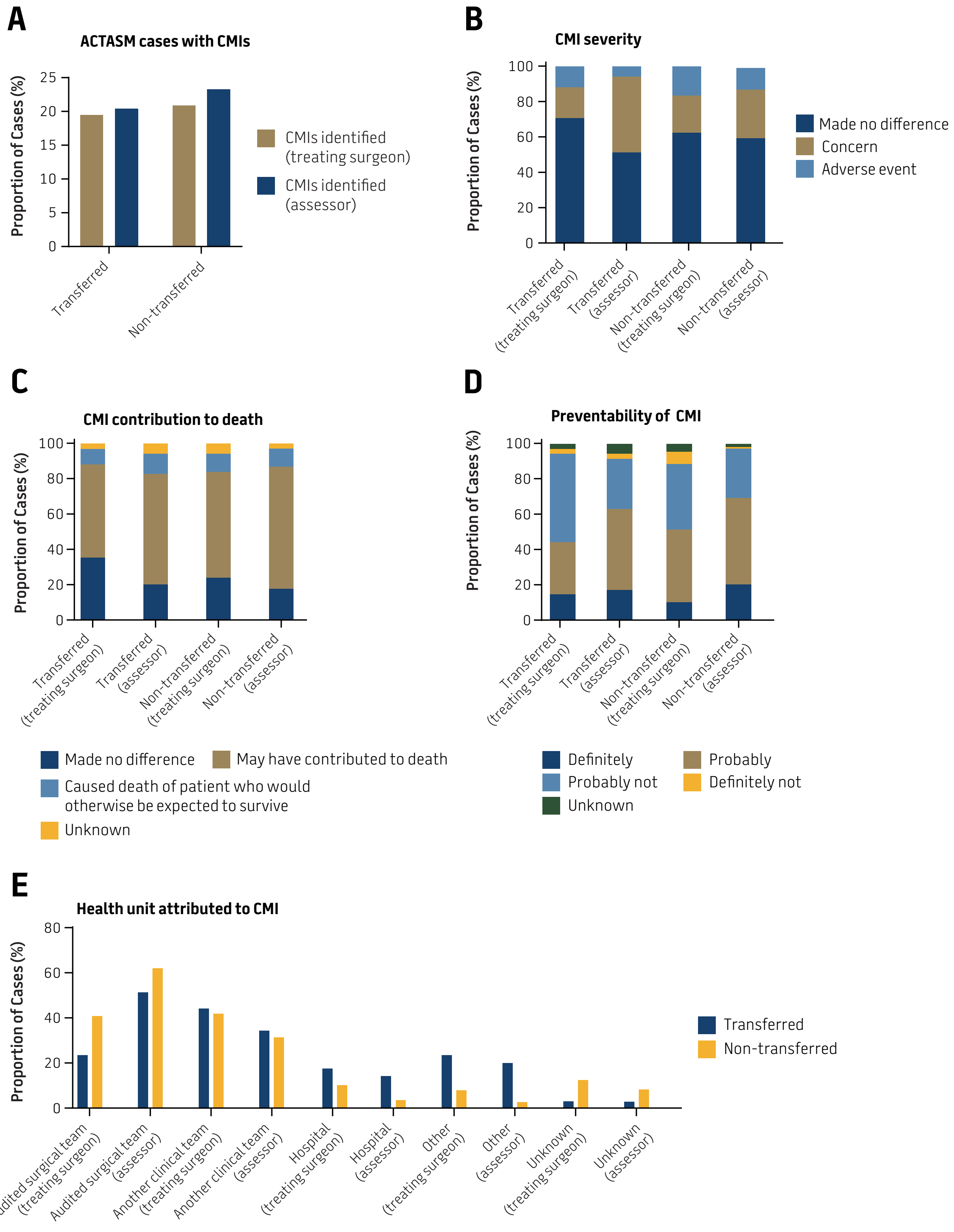


Figure 17: CMI classifications in transferred patients as identified by treating surgeons and assessors
A: Proportion of cases where CMIs were reported in transferred and non-transferred cases.
B: Severity of CMIs in transferred and non-transferred cases.
C: CMI contribution to the death of transferred vs non-transferred patients.
D: Preventability of CMIs in transferred vs non-transferred patients.
E: Source attributed to CMIs.

Table 7: The 5 most common CMIs for ACTASM cases (transferred vs non-transferred patients)

	Transferred	Non-transferred
Clinical management issues (surgeon-identified)		
1	Delays	Delays
2	Incorrect/inappropriate therapy	Incorrect/inappropriate therapy
3	General complications of treatment	General complications of treatment
4	Assessment problems	Open surgery, organ related technical
5	Adverse factors in management	Assessment problems
Clinical management issues (assessor-identified)		
1	Incorrect/inappropriate therapy	Incorrect/inappropriate therapy
2	Delays	Delays
3	Adverse factors in management	Communication failures
4	General complications of treatment	General complications of treatment
5	Assessment problems	Open surgery, organ related technical

The dataset was interrogated to identify those clinical factors that seemed to be strongly associated with the presence of CMIs (as identified by assessors). Basic analysis identified the factors listed below (univariate correlates) in Table 8, the 'p' value indicates the probability of these factors being associated with the presence of CMIs occurring by random chance. The factors identified by basic analysis were compared with each other in a complex multivariate model, identifying those variables (multivariate correlates) most strongly associated with the presence of CMIs. Consistent with observations in the overall cohort, delay in determining the surgical diagnosis was most strongly associated with the emergence of CMIs (as identified by assessors).

Table 8: Correlates of the presence of assessor-identified CMIs for transferred patients

Univariate correlates	p
Specialty	0.07
Delay in surgical diagnosis	<0.05
Unplanned readmission	<0.05
Fluid balance issues	<0.05
Age	<0.001
Length of stay	<0.001

Multivariate correlates	p
Delay in surgical diagnosis	<0.01

Unplanned return to theatre

An unplanned return to theatre during the course of patient care was reported in 13.6% of ACTASM cases. Unplanned returns to theatre pose a challenge for healthcare systems: they place the patient under additional physiological stress, they may interrupt patient flow through hospitals and may be indicative of inadequate planning for and management of surgical patients. Vascular Surgery experienced the highest rate of unplanned returns to theatre, followed by Urology (Figure 18). When comparing these patients with the rest of the cohort, unplanned returns to theatre were proportionately higher as male, elective admissions with increased length of stay (Table 9).

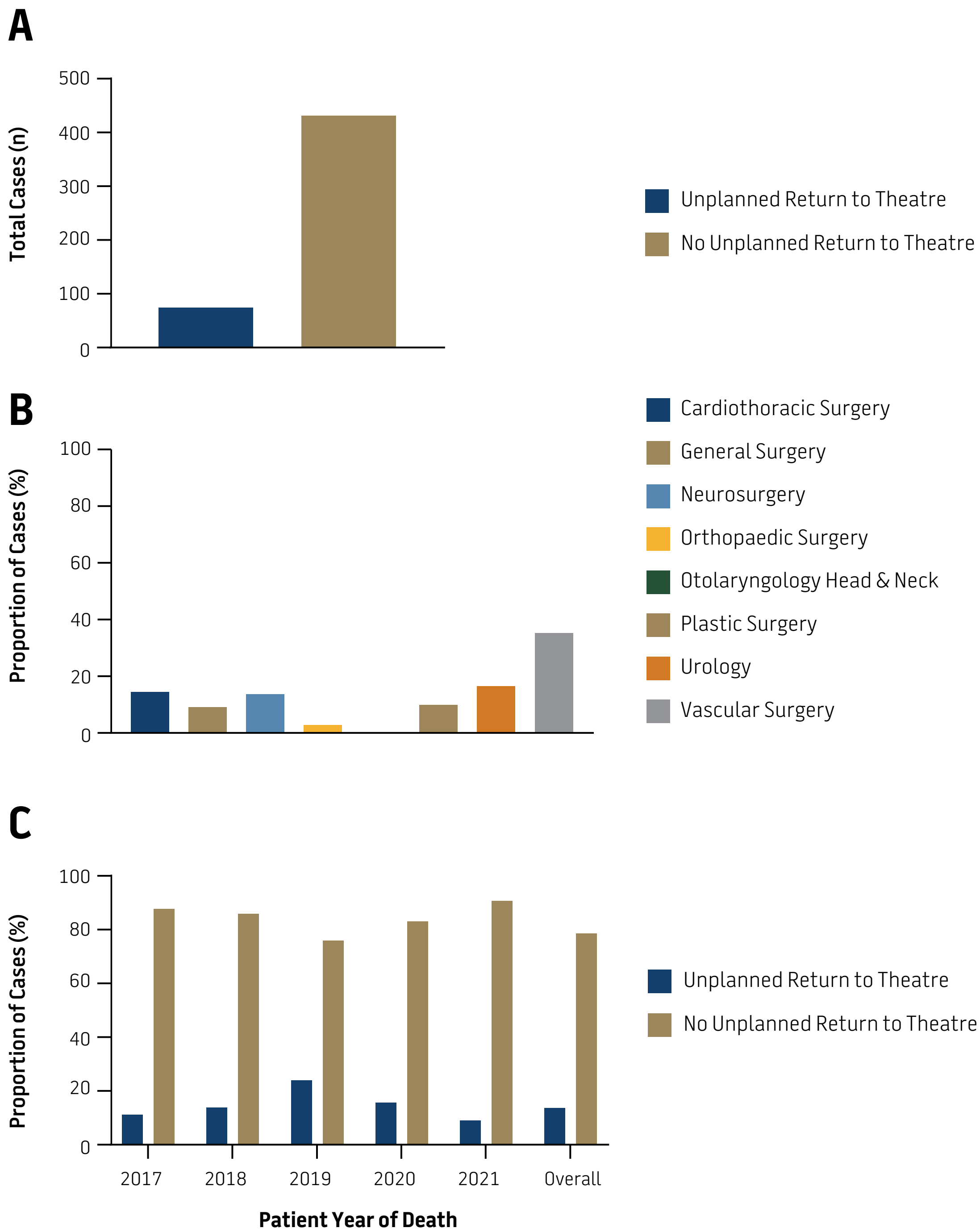


Figure 18: ACTASM cases with unplanned returns to theatre
A: Total number of cases with unplanned return to theatre.
B: Proportion of cases with unplanned return to theatre based on surgical specialty.
C: Proportion of cases per year that underwent unplanned return to theatre.

Table 9: Patient demographics for those with unplanned return to theatre

	Unplanned Return to Theatre (n = 75)	No Unplanned Return to Theatre (n = 432)	p
Age (median years; IQR)	75 (66–82)	76 (64–84)	<0.001
Male:Female (%:%)	65.3:34.7	58.3:41.7	0.12
Indigenous (%)	1.4	1.4	<0.001
Patient status (%)			0.89
Private	6.7	4.5	
Public	92	94.8	
Veteran	1.3	0.7	
Admission status (%)			<0.001
Elective	44	13.7	
Emergency	56	86.3	
Hospital status (%)			0.19
Private	5.3	4	
Public	93.3	96	
Colocation	1.4	0	
Hospital type (%)			0.91
Principal referral hospital	96	94.7	
Public acute group A hospital	0	2.1	
Private acute group B hospital	4	3	
Other acute specialised hospital	0	0.2	
Length of stay (median days; IQR)	9 (3–15)	5 (2–11)	<0.001

The most common ASA score for those returning to theatre was 3 (a patient with severe systemic disease), differing from those who did not return to theatre (ASA 4) (Figure 19). Patients who had unplanned returns to theatre were more likely to be graded with minimal, small or moderate risks of death (as determined by both the treating surgeon and assessor). The most commonly reported admission and surgical diagnoses for patients with an unplanned return to theatre were arterial, arteriole and capillary disease, and the most common cause of death, as reported by the treating surgeon, was other endocrine gland diseases (Table 10).

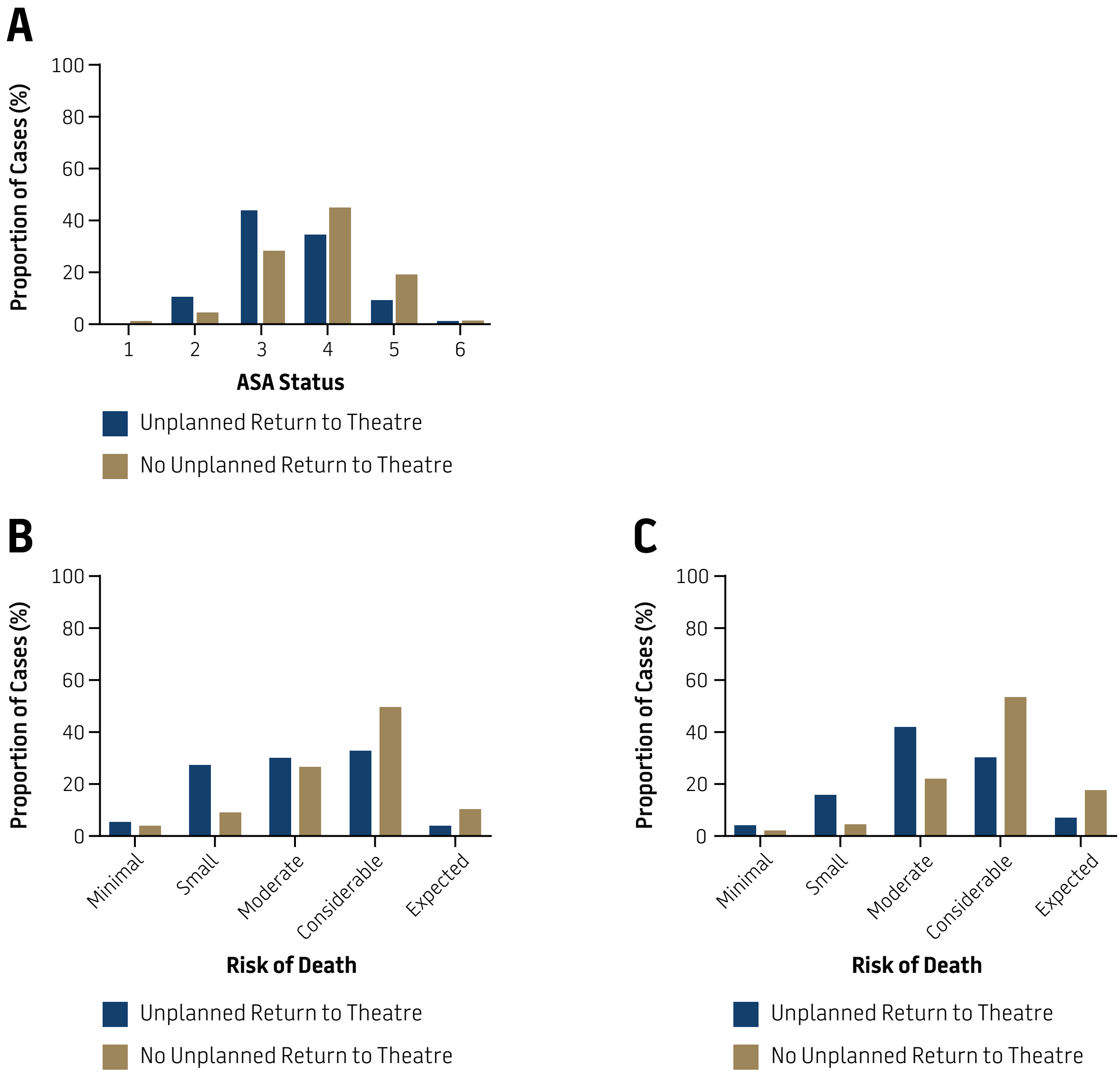


Figure 19: ASA and risk of death scores for patients with unplanned returns to theatre

A: ASA status of cases that underwent a return to theatre.

B: Risk of death scores for patients returned to theatre as identified by treating surgeon.

C: Risk of death scores for patients returned to theatre as identified by assessor.

Note:

ASA 1 = a normal health patient

ASA 2 = a patient with mild systemic disease

ASA 3 = A patient with severe systemic disease

ASA 4 = a patient with severe systemic disease that is a constant threat to life

ASA 5 = A moribund patient who is not expected to survive without the operation

ASA 6 = A declared brain-dead patient whose organs are being removed for donor purposes

Table 10: The 5 most common diagnoses for ACTASM cases that underwent an unplanned return to theatre

	Unplanned return to theatre	No unplanned return to theatre
Admission diagnoses		
1	Arterial, arteriole and capillary disease	Other diseases of the intestines and peritoneum
2	Carcinoma in situ	Cerebrovascular disease
3	Other diseases of the intestines and peritoneum	Fracture of lower limb
4	Cerebrovascular disease	Intracranial injury excluding those with skull fracture
5	Malignant neoplasm of digestive organs and peritoneum	Other bacterial diseases
Surgical diagnoses		
1	Arterial, arteriole and capillary disease	Other diseases of the intestines and peritoneum
2	Carcinoma in situ	Fracture of lower limb
3	Cerebrovascular disease	Cerebrovascular disease
4	Intracranial injury excluding those with skull fracture	Intracranial injury excluding those with skull fracture
5	Other diseases of the intestines and peritoneum	Arterial, arteriole and capillary disease
Cause of death		
1	Other endocrine gland diseases	Other endocrine gland diseases
2	Other bacterial diseases	Other bacterial diseases
3	Cerebrovascular disease	Cerebrovascular disease
4	Nephritis, nephrosis and nephrotic syndrome	Other respiratory system diseases
5	Other diseases of the intestines and peritoneum	Other forms of heart disease

Comorbidities were less likely to be reported among patients with an unplanned return to theatre (Figure 20A), but those that were reported were proportionately similar with the rest of the cohort.

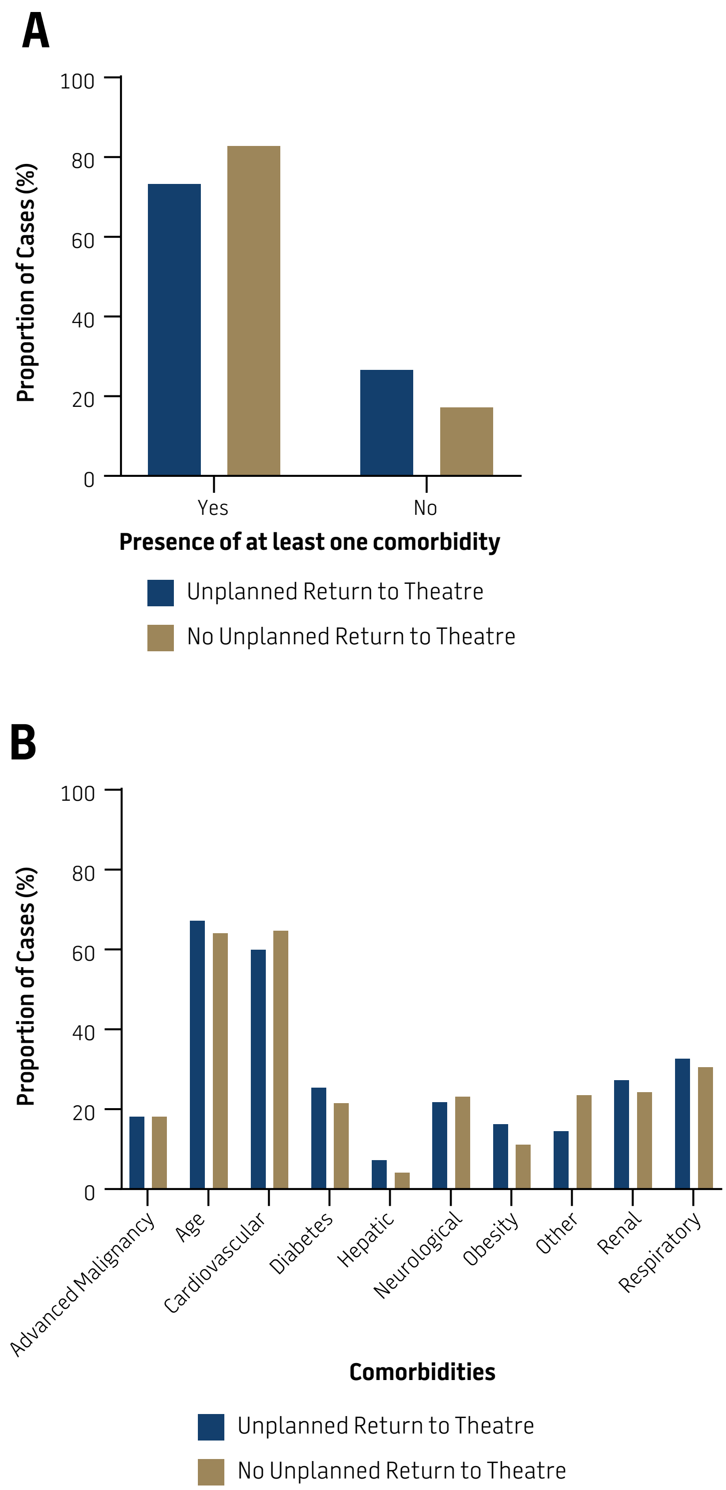


Figure 20: Comorbidities for patients with unplanned return to theatre
A: Proportion of cases with unplanned return to theatre with at least one comorbidity.
B: Types of comorbidities present in patients who had unplanned returns to theatre.

The dataset was interrogated to identify those clinical factors that seemed to be strongly associated with the presence of CMIs (as identified by assessors). Basic analysis identified the factors listed below (univariate correlates) in Table 11; the 'p' value indicates the probability of these factors being associated with the presence of CMIs occurring by random chance. The factors identified by basic analysis were compared with each other in a complex multivariate model, identifying those variables (multivariate correlates) most strongly associated with the presence of CMIs. The surgical specialties with the most unplanned returns to theatre were neurosurgery, urology and vascular surgery.

Table 11: Correlates of assessor-identified CMIs in patients who underwent an unplanned return to theatre

Univariate correlates	p
Specialty	<0.001
Indigenous	<0.001
Admission type	<0.001
ASA	0.06
Patient transfer	0.06
Operative admission	<0.001
Risk of death (identified by treating surgeon)	<0.001
Postoperative complications	<0.001
Unplanned ICU	<0.001
Treated in ICU	<0.001
Unplanned readmission	<0.001
Fluid balance issues	<0.001
Age	<0.001
Length of stay	<0.001

Multivariate correlates	p
Surgical specialty	<0.01
Neurosurgery	<0.05
Urology	<0.05
Vascular Surgery	<0.001
Risk of death (identified by treating surgeon)	
Small	<0.05
Postoperative complications	<0.001
Unplanned CCU	0.06

DISCUSSION

The current report summarises data on patient in-hospital mortality where surgical care was involved for the period 2017–2021. ACTASM cases were more likely to be elderly, emergency presentations to public hospitals. Patients were more likely to be male, with cardiovascular disease the most common comorbidity. The number of cases reported to ACTASM over time continues to remain relatively consistent (Figure 1).

Evaluation of the overall management of these patients reflects the acute nature of the presentations. Proportionately, emergency presentations were much less likely to be associated with CMIs than elective presentations. Delays in determining the surgical diagnosis were also significantly associated with the emergence of CMIs in these cases. Delays in surgical diagnosis were reported for less than 5% of cases. These delays were primarily attributed to inexperienced staff from institutional medical units and were considered largely unavoidable. Nonetheless these data highlight the importance of appropriate consultant involvement in these cases.

Given the high burden of transferred cases that the ACT manages, these data were also investigated for the potential effect of transferred status on the quality of patient care. The ACTASM data shows that transferred patients were much more likely to be emergency cases involving public hospital admissions. The presence of CMIs was proportionately lower among transferred than non-transferred cases. This is consistent with the overall cohort, where emergency cases were less likely to be associated with the presence of CMIs. Similar to the overall cohort, delays in determining the surgical diagnosis were significantly associated with the presence of CMIs among transferred patients.

Unplanned returns to theatre among this dataset were also explored, given the challenge it presents to health systems. Our data confirmed this, with patients who had unplanned returns to theatre experiencing much longer duration in hospital (median 9 days [IQR 3–15] vs 5 days [IQR 2–11]) for those with no unplanned return to theatre ($p < 0.05$). From the clinical data we sought to identify whether there were particular factors that increase the likelihood of an unplanned return to theatre. Further discussions to better understand this phenomenon may be warranted.

Notifications of patient deaths are received promptly from ACT hospitals, enabling timely submission of cases by surgeons. The median time taken for submission of cases – 60 days (IQR 4–155) – aligns with the ANZASM recommendation for submission of SCFs within 2 months of surgeon notification. That said, the time taken by orthopaedic surgeons to submit cases was exceedingly poor (median 165 days [IQR 45–413]). This requires improvement. It is also worth noting that there are still cases outstanding from 2021 and earlier. Surgeons are encouraged to address this backlog so the cases can be evaluated, and feedback disseminated.

It is pleasing to note the constructive engagement ACTASM enjoys with the ACT surgical community. Efforts in recent years to foster increased interstate interaction have been positively received. More cases from the ACT are being sent interstate to ensure independent assessment and more ACT surgeons are being invited to evaluate interstate cases. There is a clear benefit to participating in ACTASM, whether through submission of cases and being receptive to feedback, or by providing constructive yet critical evaluation of patient care undertaken by another surgeon. Participation in ACTASM remains a mandated activity of CPD programs for both RACS and the AOA.

It is hoped that the data summarised in this report benefit surgeons during the course of their practice and health systems seeking to achieve the best possible outcomes for patients.

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Audit of Surgical Mortality