Royal Australasian College of Surgeons

ACTASM ANNUAL REPORT 2021

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

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

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

ANZCA
AUSTRALIAN AND NEW ZEALAND COLLEGE OF ANAESTHETISTS

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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 2015-2020 (inclusive). This year we have changed the format of the report to include a 6-year period to provide a better understanding of long-term trends. This report reflects the important role the ACT hospitals have in the provision of health services to the region with a significant number of cases involving inter-hospital transferred patients. There continues to be a high percentage of emergency presentations during the reporting period.

ACTASM continues with excellent participation of the surgeons and health facilities. We hope to continue this engagement with surgeons and health facilities so as to have a robust audit process and to provide safe and good quality care to the patients of the ACT and the surrounding regions. This requires timely completion of the surgical case forms (SCF). 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). We hope to work with hospitals to have early notification of deaths so that the audit process can commence without any delay, and to engage with surgeons to facilitate early completion of the SCF.

Assessors reported a higher number of clinical management issues (CMI) and a higher number of CMIs that were preventable than the treating surgeon. This is important feedback to surgeons to help reflect on the case and provides an opportunity to identify any areas for improvement that were not evident on initial reflection without the benefit of peer review.

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 for their commitment to the audit process and ultimately to the safe and quality surgical care to the residents of the ACT and the surrounding regions.

Sivakumar Gananadha FRACS
Clinical Director
ACT Audit of Surgical Mortality

RECOMMENDATIONS AND KEY POINTS

Inter-hospital transferred patients accounted for a third of mortalities during the reporting period. These patients were younger with a higher ASA score and higher surgeon-rated risk of death. Transfer delays, delayed intervention and inappropriate or incorrect therapy were some of the factors identified in this cohort.

- Improve communication between the referring hospital consultant and the receiving hospital consultant to facilitate early transfer and select appropriate therapy.
- Improve collaboration with peripheral referring hospitals in the early identification of deteriorating patients so that the decision for the need for transfer is made early.
- Decision for transfer is made at a senior level so that futile transfers are minimised.

Clinically significant infections were reported in over a third of cases with the majority acquired postoperatively and pneumonia being the most common infection. Antibiotic regime was deemed appropriate in only a third of the cases in 2020 and 69% over the reporting period.

- Attention should be paid to appropriate surgical antibiotic prophylaxis.
- Early involvement of the Infectious Disease specialist for selecting the most appropriate antibiotics.

There is still delay in the timely completion of the surgical case forms with some forms having incomplete data that delays the assessment and increases the need for second-line assessments.

- Work with surgeons to improve the timely completion of surgical case forms.
- Improve communication to keep surgeons updated with ACTASM and RACS CPD requirements.

INTRODUCTION

The Australian Capital Territory Audit of Surgical Mortality (ACTASM) was created in 2010 to support surgeons through the establishment of an independent peer-review process for all in-hospital mortality associated with surgical care. As of the census date for this report, ACTASM has evaluated 978 cases since its inception (with feedback delivered to surgeons), while a further 108 are undergoing the audit process.

ACTASM is funded by the ACT Health Directorate and governed by the ACTASM Management Committee. Through this funding and under the protection of the Commonwealth Qualified Privilege Scheme, ACTASM has been able to foster the engagement of surgeons who provide critical yet constructive case evaluations—the data from which underpin this very report.

This report incorporates surgery-related deaths that occurred between 1 January 2015 and 31 December 2020. 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 goal 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

Cases

Following notification from public and private hospitals, ACTASM evaluates in-hospital surgical deaths meeting one 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 the Australian Orthopaedic Association (AOA) as part of its continuing professional development (CPD) program.

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 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, at this point, for a consultant surgeon to declare a case to have been a terminal 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 can be requested because of insufficient information from which to reasonably evaluate a case, or because of specific questions arising from the FLA. All assessors invited to evaluate submissions are independent of the institution from which the case arose and 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, sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent disability of the patient, or which contributes to or causes death.

The collection of SCF and FLA data is facilitated through the Fellows Interface, which is an online platform to which surgeons have access. Data from SLAs are entered by RACS staff using the Bi-National Audits of Surgical Mortality – ANZASM database. Data are stored securely and encrypted using Microsoft SQL Server 2016. Data subsets are scrutinised for consistency on a monthly basis.

Data analysis

The scope of this report is cases pertaining to the period 1 January 2015 through to 31 December 2020 with a census date of 1 July 2021. Data were analysed using SPSS Version 27[1]. 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 (with 25th and 75th percentile) 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.

RESULTS

Case context and patient demographics

In the period between 2015 and 2020 inclusive there were 784 relevant cases reported. Their distribution by year and case status is shown in Table 1. The majority of cases have completed the audit process (88.8%), although the most recent data demonstrate a high proportion of cases still awaiting submission (i.e. 'Surgical case pending', 25.3%). Those noted as 'terminal care' (n = 113, 14.4%) were excluded from the full audit process leaving 671 cases for analysis.

Table 1: Distribution of ACTASM cases according to audit status (n, %)

Case status	2015	2016	2017	2018	2019	2020	Overall
Surgical case pending	0 (0.0)	0 (0.0)	0 (0.0)	4 (3.4)	6 (5.9)	24 (25.3)	34 (5.1)
First-line pending	0 (0.0)	0 (0.0)	0 (0.0)	3 (2.5)	2 (2.0)	6 (6.3)	11 (1.6)
Second-line pending	0 (0.0)	0 (0.0)	1 (0.7)	5 (4.2)	9 (8.8)	6 (6.3)	21 (3.1)
Lost to follow-up	1 (0.9)	1 (0.9)	5 (3.6)	2 (1.7)	0 (0.0)	0 (0.0)	9 (1.3)
Closed	111 (99.1)	105 (99.1)	131 (95.6)	105 (88.2)	85 (83.3)	59 (62.1)	596 (88.8)
TOTAL FOR FULL AUDIT	**112**	**106**	**137**	**119**	**102**	**95**	**671**
Excluded – terminal care	23 (20.4)	21 (18.6)	18 (15.9)	14 (12.4)	20 (17.7)	17 (15.0)	113 (14.4)

Note: 'Surgical case pending' refers to cases awaiting submission from the treating surgeon; 'First-line pending' refers to those cases undergoing FLA; 'Second-line pending' refers to those cases undergoing SLA; 'Lost to follow-up' refers to cases that have not completed the audit process but where the treating surgeon has retired, moved overseas or passed away; 'Closed' cases have completed the audit process; 'Excluded – terminal care' refers to terminal care admissions where no therapeutic surgical intervention took place.

Table 2 displays the distribution of cases by surgical specialty. General surgery accounts for more than one-third of cases in 2020, consistent with what has been observed historically.

Table 2: Distribution of ACTASM cases by specialty (n, %)

Surgical specialty	2015	2016	2017	2018	2019	2020	Overall
Cardiothoracic Surgery	9 (8.0)	12 (11.3)	20 (14.6)	5 (4.2)	11 (10.8)	8 (8.4)	65 (9.7)
General Surgery	51 (45.5)	41 (38.7)	57 (41.6)	43 (36.1)	36 (35.3)	36 (37.9)	264 (39.3)
Neurosurgery	26 (23.2)	22 (20.8)	21 (15.3)	21 (17.6)	18 (17.6)	14 (14.7)	122 (18.2)
Obstetrics and Gynaecology	0 (0.0)	0 (0.0)	3 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.4)
Orthopaedic Surgery	11 (9.8)	14 (13.2)	15 (10.9)	20 (16.8)	13 (12.7)	15 (15.8)	88 (13.1)
Otolaryngology Head and Neck	1 (0.9)	0 (0.0)	2 (1.5)	0 (0.0)	1 (1.0)	1 (1.1)	5 (0.7)
Plastic Surgery	1 (0.9)	0 (0.0)	0 (0.0)	2 (1.7)	2 (2.0)	4 (4.2)	9 (1.3)
Urology	0 (0.0)	5 (4.7)	4 (2.9)	9 (7.6)	5 (4.9)	1 (1.1)	24 (3.6)
Vascular Surgery	13 (11.6)	12 (11.3)	15 (10.9)	19 (16.0)	16 (15.7)	16 (16.8)	91 (13.6)
TOTAL	**112**	**106**	**137**	**119**	**102**	**95**	**671**

Both the source of the case and the time from death to notification and notification to case submission, respectively (chronology) are shown in Table 3. Historically, cases have been predominantly sourced from hospitals and this trend continued in 2020. Both hospitals (death to notification) and Fellows (notification to submission) have been processing cases quicker in 2020 compared to previous years.

Table 3: Source and chronology of ACTASM notifications

Case source	2015	2016	2017	2018	2019	2020	Overall
Hospital (n, %)	112 (100.0)	104 (98.1)	136 (100.0)	118 (99.2)	99 (97.1)	93 (97.9)	662 (98.8)
Surgeon (n, %)	0 (0.0)	2 (1.9)	0 (0.0)	0 (0.0)	2 (2.0)	2 (2.1)	6 (0.9)
Health Department (n, %)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)	0 (0.0)	0 (0.0)	1 (0.1)
Coroner (n, %)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	0 0.0)	1 (0.1)
Chronology							
Death to notification†	4 (2, 7)	8 (4, 25)	28 (17, 41)	42 (27, 68)	43 (29, 73)	26 (15, 44)	25 (9, 44)
Notification to submission†	39 (43, 124)	69 (13, 194)	41 (9, 131)	76 (7, 222)	83 (5, 201)	45 (3, 145)	55 (10, 159)

Note: † Data expressed as median number of days (25th, 75th percentile).

The status and peer group (as defined by the AIHW[2]) of the hospitals at which cases occurred are presented in Table 4. The majority of cases came from principal referral public hospitals. There was no meaningful change to these data in 2020 from previous years. No hospital was classified as rural (data not shown).

Table 4: Admitting Hospital demographics for ACTASM cases (n, %)

Hospital status	2015	2016	2017	2018	2019	2020	Overall
Private	2 (1.8)	1 (0.9)	5 (3.6)	0 (0.0)	8 (7.8)	3 (3.2)	19 (2.8)
Public	110 (98.2)	105 (99.1)	132 (96.4)	119 (100.0)	94 (92.2)	92 (96.8)	652 (97.2)
Hospital peer group†							
Principal referral hospitals	103 (92.0)	104 (98.1)	126 (92.0)	119 (100.0)	94 (92.2)	92 (96.8)	638 (95.1)
Private acute group A	9 (8.0)	2 (1.9)	6 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	17 (2.5)
Private acute group B	0 (0.0)	0 (0.0)	5 (3.6)	0 (0.0)	8 (7.8)	3 (3.2)	16 (2.4)
TOTAL	**112**	**106**	**137**	**119**	**102**	**95**	**671**

Note: † Hospital peer group designations according to AIHW classification[2].

As detailed in Table 5, the cohort overall comprised 58.4% males (52.6% in 2020) with a median age of 76 years (and in 2020). They had spent a median of 5 days in hospital overall (4 in 2020). Patients were predominantly public (94.6%, 97.1% in 2020). Admissions were largely emergency (83.4%, 78.9% in 2020). The median ASA[3] (American Society of Anesthesiologists Physical Status Classification System) score was 4, with the modal risk of death being 'considerable'.

Table 5: Patient demographics for ACTASM cases

	2015	2016	2017	2018	2019	2020	Overall
Sex (% male)	58.9	54.7	57.7	68.1	56.9	52.6	58.4
Age (years)†	75 (64, 83)	76 (66, 84)	75 (64, 84)	76 (63, 84)	77 (70, 83)	76 (62, 83)	76 (64, 83)
Length of stay (days)†	6 (2, 15)	4 (1, 11)	5 (2, 14)	4 (2, 10)	4 (1, 11)	4 (2, 11)	5 (2, 12)
Patient status*							
Private	4.9	3.1	5.4	1.8	8.3	1.4	4.3
Public	94.1	94.9	93.0	97.3	91.7	97.1	94.6
Veteran	1.0	2.0	1.6	0.9	0.0	1.4	1.2
Admission status*							
Elective	13.6	12.4	16.7	17.7	19.8	21.1	16.6
Emergency	86.4	87.6	83.3	82.3	80.2	78.9	83.4
ASA score†, a	4 (3, 4)	4 (3, 5)	4 (3, 5)	4 (3, 4)	4 (3, 4)	4 (3, 4)	4 (3, 4)
Risk of death*							
Expected	9.6	17.5	13.4	13.2	6.8	6.9	11.6
Considerable	56.6	43.8	41.2	47.3	52.7	44.8	47.6
Moderate	25.3	25.0	21.6	26.4	28.4	34.5	26.3
Small	6.0	13.8	15.5	9.9	9.5	8.6	10.8
Minimal	2.4	0.0	8.2	3.3	2.7	5.2	3.7

Note: † Data expressed as median (25th, 75th percentile); * Data expressed as percentage of known cases; [a] Physical status classification system[3].

Patient transfers

Approximately one-third of admissions within this cohort resulted from patient transfers (31.0% in 2020). Details of transfers are shown in Table 6. Over 95% of transfers were reported as appropriate, with appropriate care, and sufficient information accompanying the patient. Delays were noted in 16.9% of cases, though no other problems were generally noted. Transferring hospitals were public in 80% of cases (data not presented).

Table 6: Patient transfer details for in-hospital surgical mortality

	2015	2016	2017	2018	2019	2020	Overall
Transferred patients*	35.2	43.1	27.6	31.5	37.2	31.0	34.1
Transfer appropriate	93.5	100.0	100.0	87.9	100.0	100.0	96.9
Care appropriate	90.3	97.6	100.0	97.0	97.0	100.0	96.8
Information sufficient	90.0	100.0	100.0	97.0	97.0	95.5	96.8
Transfer delays	10.0	14.6	10.0	18.2	21.2	31.8	16.9

Note: * Data represent percentage of affirmative responses (valid cases only).

Further analyses of transfer status sought to identify relevant demographic and contextual variables that may be associated with whether or not a patient was transferred. Chi-square analyses (χ^2) for categorical data and Mann-Whitney U tests (expressed as a z statistic) for continuous data were calculated. Males and females were equally represented among transferred patients ($\chi^2_{(1)} = 1.97$, ns). However, transferred patients (median = 73 years, 61–81) were statistically younger than non-transferred patients (median = 77 years, 68–84; $z = 3.16$, $p = 0.002$).

There was no difference in any of public vs private patients ($\chi^2_{(2)} = 0.92$, ns), whether or not an operation was performed ($\chi^2_{(1)} = 1.04$, ns) or whether deep vein thrombosis (DVT) prophylaxis was used ($\chi^2_{(1)} = 0.207$, ns). However, transferred patients were found to have a higher ASA score ($\chi^2_{(5)} = 26.71$, $p < 0.001$), a higher surgeon-rated risk of death ($\chi^2_{(4)} = 17.43$, $p = 0.002$), and were more likely to be emergency admissions ($\chi^2_{(1)} = 43.42$, $p < 0.001$). Transferred patients had a shorter admission (median = 3, 2–9) than non-transferred patients (median = 7, 2–14; $z = 3.53$, $p < 0.001$), while there was a trend towards transferred patients being treated in a critical care unit (CCU) ($\chi^2_{(1)} = 3.42$, $p = 0.064$).

Finally, the CMIs reported for transferred patients (by both treating surgeons and assessors) are described in Table 7. There were some discrepancies between the 2 sets of data, particularly for the 2 major categories: delayed intervention (17 reported by surgeons, 11 by assessors) and incorrect or inappropriate therapy (8 by surgeons, 13 by assessors).

Table 7: Clinical management issues identified by surgeons and assessors for transferred cases reported to ACTASM

	2015		2016		2017		2018		2019		2020		Overall	
Issue	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**
Adverse factors in management	0	0	0	0	0	0	0	1	0	1	1	1	1	3
Communication failures	1	0	0	0	0	0	0	1	0	0	0	0	1	1
Complications from endoscopic surgery	1	0	0	0	0	0	0	0	1	0	0	0	2	0
Complications from open surgery	1	2	1	0	0	0	0	0	0	0	1	0	3	2
Complications from radiological intervention	0	2	0	0	0	0	0	0	0	0	0	2	0	4
Delayed intervention	2	1	4	2	4	3	3	3	1	1	3	1	17	11
Difficulties in diagnosis	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Drug-related complication	0	1	1	0	0	1	0	0	1	1	0	0	2	3
Facilities not used	0	1	0	0	0	0	0	0	0	0	0	0	0	1
General complications of treatment	0	0	0	1	1	2	3	0	1	0	0	0	5	3
Incorrect or inappropriate therapy	2	2	1	3	3	4	1	1	0	2	1	1	8	13
Patient assessment issues	0	0	0	0	1	0	0	0	2	1	0	0	3	1
Patient issues	0	0	1	1	0	0	0	0	0	0	0	0	1	1
Patient transfer issues	0	0	1	0	0	0	0	0	0	0	0	0	1	0
TOTAL NO. ISSUES	7	9	9	7	9	10	8	6	6	6	6	5	45	43
TOTAL NO. CASES WITH ISSUES	7	9	8	5	9	8	5	6	5	5	6	5	40	38

Note: All data are the number of affirmative responses from treating surgeons (S) and assessors (A), respectively. Responses are not mutually exclusive; that is, multiple issues may have been identified for individual cases (max. = 3 for surgeons, 2 for assessors).

Patient surgical diagnosis

A delay in determining the surgical diagnosis was reported in 3.4% of cases (5.6% in 2020). Overall, the predominant source of delay was the institutional medical unit (53.0%), although in 2020 it was the institutional surgical unit (66.7%). (Note that these percentages are based on relatively small numbers.) At least one-third of delays were attributed to a combination of inexperienced staff, an incorrect test, and misinterpreted results (46.2%). In just over one-third of cases (36.4%) delays were considered unavoidable. Figure 1 and Table 8 summarise these data.

Figure 1: Proportion of ACTASM cases reporting a delay in main surgical diagnosis

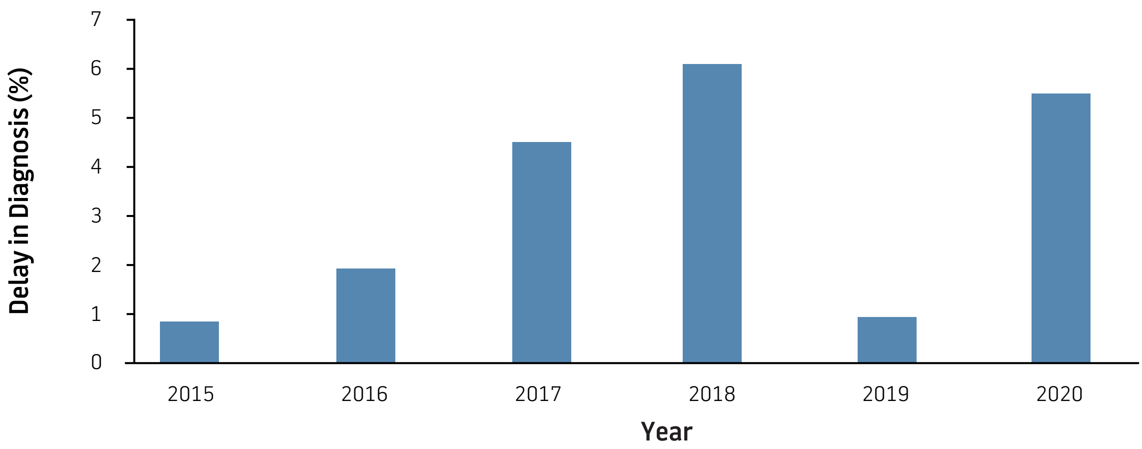

Table 8: Delayed surgical diagnoses and attribution for in-hospital patient mortality

	2015	2016	2017	2018	2019	2020	Overall
Delay in main diagnosis	0.9	2.0	4.6	6.2	1.0	5.6	3.4
Delay associated with:†							
General practitioner	0.0	0.0	25.0	25.0	0.0	0.0	20.0
Institutional medical unit	100.0	0.0	50.0	50.0	50.0	50.0	53.0
Institutional surgical unit	0.0	0.0	25.0	20.0	0.0	66.7	30.8
Other	0.0	100.0	100.0	100.0	0.0	100.0	100.0
Delay attributed to†							
Inexperienced staff	0.0	0.0	50.0	0.0	50.0	0.0	30.0
Incorrect test	0.0	0.0	25.0	25.0	50.0	50.0	33.3
Misinterpreted results	100.0	100.0	50.0	25.0	0.0	50.0	46.2
Results not seen	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unavoidable	0.0	0.0	33.3	40.0	0.0	50.0	36.4
Other	0.0	100.0	100.0	100.0	0.0	100.0	100.0

Note: All data represent percentage of affirmative responses (valid cases only); † Responses are not mutually exclusive.

Patient surgical intervention

Over three-quarters of patients (81.7% in 2020) underwent at least one surgical procedure during their admission (Table 9). An anaesthetic component to the death was indicated in 2.0% of cases, with a further 6.6% as 'possible anaesthetic component'.

Among the cases that did not undergo a surgical procedure, an active decision not to operate was made in 83.7% of cases. If surgery did not occur, the main reason was because the patient refused (52.0%). Rapid death was also noted as a key reason (Table 9). In nearly all cases (98.6%) the decision was made by a consultant.

Table 9: Rationale for decision not to operate

	2015	2016	2017	2018	2019	2020	Overall
Underwent Surgical procedure	78.4	78.1	75.0	82.3	77.1	81.7	78.5
Decision not to operate:†							
Not a surgical problem	0.0	0.0	25.0	50.0	0.0	0.0	10.0
Patient refused operation	71.4	55.6	25.0	0.0	50.0	0.0	52.0
Limits of treatment reached	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rapid death	40.0	18.2	42.9	0.0	50.0	0.0	32.1
Decision made by consultant	100.0	100.0	100.0	100.0	90.9	100.0	98.6

Note: All data represent percentage of affirmative responses (valid cases only); † Of those cases where no operation took place; responses are not mutually exclusive.

A CCU was used in 74.4% of cases (71.8% in 2020). Overall, this was considered appropriate in 95.7% of these cases. Table 10 summarises further issues concerned with resuscitative measures used. Of note are the 15.9% of cases with an unplanned return to theatre (17.1% in 2020) and the 26.1% of cases (31.0% in 2020) for which there was an unplanned admission to ICU.

Table 10: Resuscitative measures for patients experiencing in-hospital mortality

	2015	2016	2017	2018	2019	2020	Overall
CCU used	71.8	71.4	75.6	75.0	80.2	71.8	74.4
If no, HDU should have been used†	6.5	0.0	0.0	3.6	5.3	5.0	3.3
If no, ICU should have been used†	3.2	0.0	0.0	3.6	5.3	0.0	2.0
Surgeon considered fluid balance an issue	8.5	8.7	6.3	8.4	2.1	7.1	6.9
Unplanned return to theatre†	19.8	10.5	11.5	14.3	24.5	17.1	15.9
Unplanned admission to CCU†	3.7	2.9	0.0	1.8	3.1	5.6	2.6
Unplanned admission to ICU†	25.7	20.2	24.0	27.3	30.5	31.0	26.1

Note: All data represent percentage of affirmative responses (valid cases only); † Responses are not mutually exclusive.

Patient infection

A clinically significant infection was reported in just over one-third of cases (34.5%, 28.2% in 2020). Over half (58.0%) acquired this infection after they were admitted (70.0% in 2020)—two-thirds (69.0%) postoperatively (85.7% in 2020). Pneumonia was the most common infection overall (37.6%), although septicaemia was more common than pneumonia in 2020 (35.0% vs 30.0%). Infection data are summarised in Figure 2 and Table 11.

Figure 2: Clinically significant infections

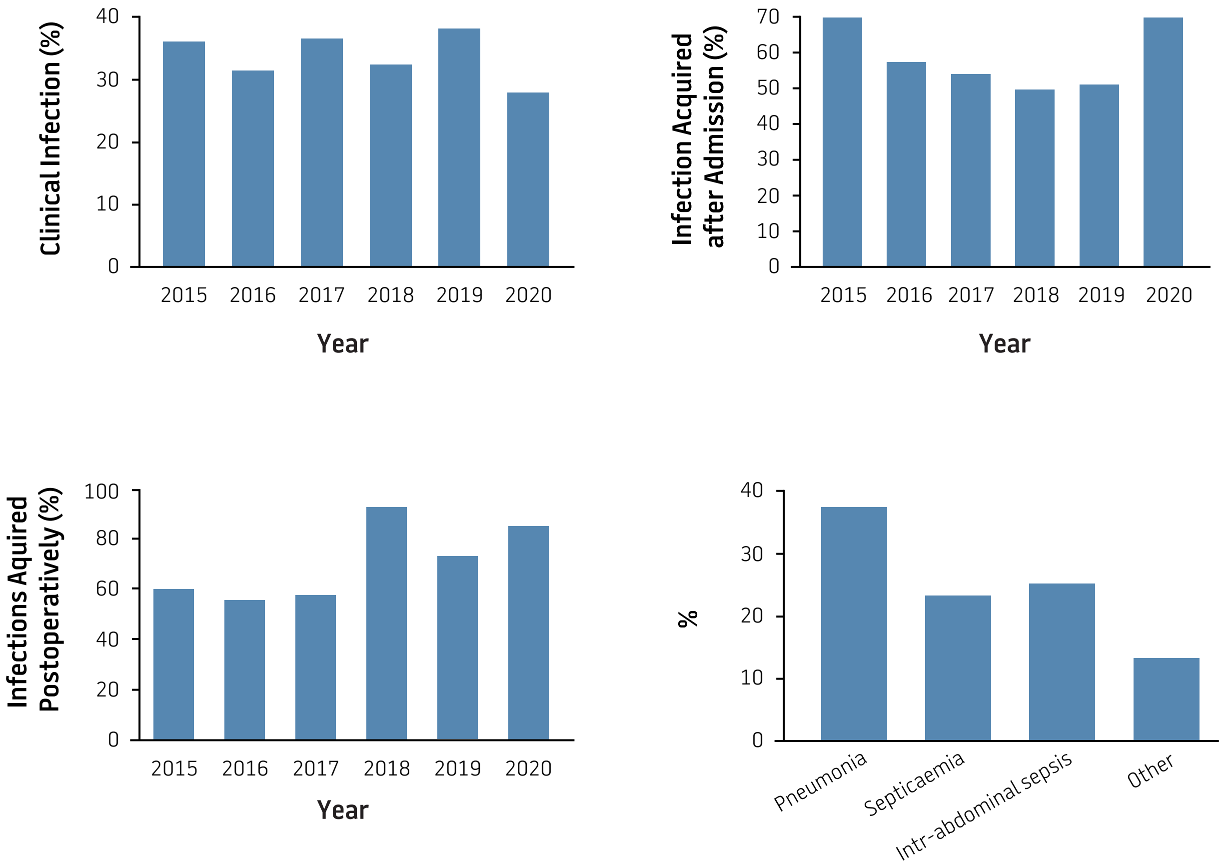

Table 11: Clinically significant infections among in-hospital mortality patients

	2015	2016	2017	2018	2019	2020	Overall
Infection	36.4	31.7	36.9	32.7	38.5	28.2	34.5
Acquired after admission†	70.0	57.6	54.3	50.0	51.4	70.0	58.0
If acquired after admission:							
Preoperative	17.9	12.5	33.3	6.7	10.5	0.0	15.5
Postoperative	60.7	56.3	58.3	93.3	73.7	85.7	69.0
Surgical site	10.7	12.5	4.2	0.0	5.3	7.1	6.9
Other invasive site	10.7	18.8	4.2	0.0	10.5	7.1	8.6
Infection type							
Pneumonia	51.3	30.3	46.8	27.0	32.4	30.0	37.6
Septicaemia	17.9	18.2	17.0	35.1	24.3	35.0	23.5
Intra-abdominal sepsis	28.2	33.3	23.4	10.8	32.4	25.0	25.4
Other	2.6	18.2	12.8	27.0	10.8	10.0	13.6
Antibiotic regime appropriate*	83.8	83.6	88.0	50.0	61.8	35.8	68.6

Note: All data are percentage of affirmative responses (valid cases only); † Proportion of infections acquired after admission;
* As considered by treating surgeon.

Patient management evaluation

An important component of the audit process is the availability of evaluative comments from a relevant assessor as well as the treating surgeon. For example, both treating surgeons and assessors are invited to evaluate the overall pathway of care for patients. Issues of preoperative, perioperative and postoperative care are reviewed (data are presented in Table 12 and Figure 3). For all questions an affirmative response suggests improvement could have occurred. The suggestion that care could have been improved was below 10% in all categories, although the assessor universally suggested improvement was possible more frequently than did treating surgeons. A kappa coefficient was calculated for each set of responses. Kappa is a commonly used test of agreement between two independent judges for categorical data, where values approaching 0.0 indicate poor agreement and values approaching 1.0 indicate excellent agreement. For all questions, although coefficients were relatively modest, statistically significant agreement was noted ($p < 0.001$).

Figure 3: Surgeon and assessor evaluation of patient management

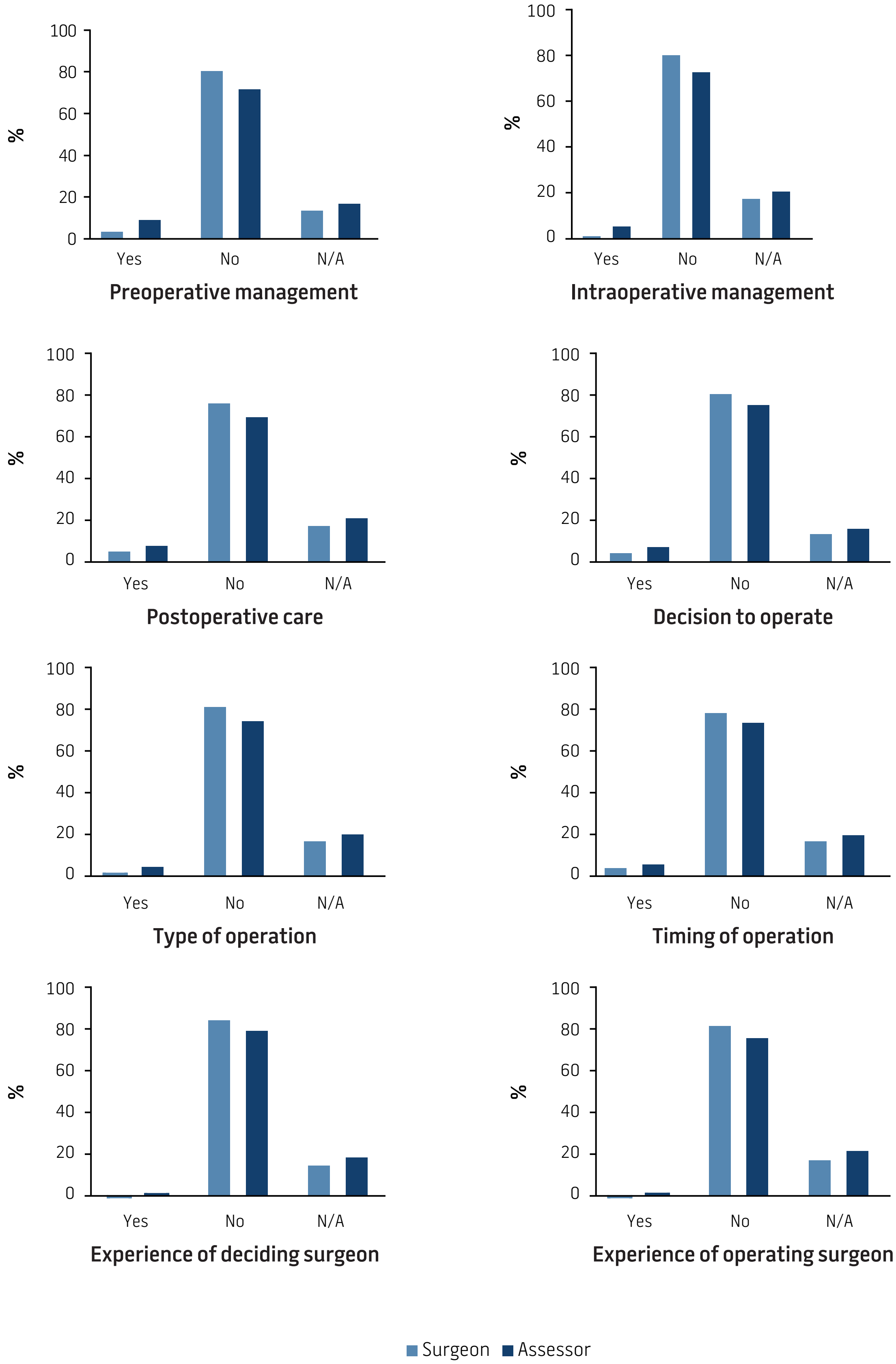

Table 12: Surgeon and assessor evaluation of patient care and possible improvement			
	Surgeon	Assessor	Kappa
Preoperative management			0.44
Yes	26 (4.2)	58 (9.8)	
No	500 (81.4)	428 (72.5)	
Not applicable	88 (14.3)	104 (17.6)	
Intraoperative management			0.58
Yes	9 (1.5)	33 (5.7)	
No	494 (80.7)	427 (73.2)	
Not applicable	109 (17.8)	123 (21.1)	
Postoperative care			0.58
Yes	34 (5.5)	48 (8.3)	
No	470 (76.7)	406 (70.1)	
Not applicable	109 (17.8)	125 (21.6)	
Decision to operate			0.51
Yes	30 (4.9)	45 (7.7)	
No	498 (81.2)	446 (75.9)	
Not applicable	85 (13.9)	97 (16.5)	
Type of operation			0.54
Yes	8 (1.3)	29 (4.9)	
No	501 (81.6)	439 (74.7)	
Not applicable	105 (17.1)	120 (20.4)	
Timing of operation			0.61
Yes	26 (4.2)	35 (5.9)	
No	483 (78.7)	436 (74.0)	
Not applicable	105 (17.1)	118 (20.0)	
Experience of deciding surgeon			0.61
Yes	1 (0.2)	7 (1.2)	
No	519 (84.8)	467 (79.8)	
Not applicable	92 (15.0)	111 (19.0)	
Experience of operating surgeon			0.63
Yes	1 (0.2)	8 (1.4)	
No	505 (82.2)	447 (76.4)	
Not applicable	108 (17.6)	130 (22.2)	

Patient anticoagulant use

As shown in Table 13, among the full cohort from 2015 to 2020 prophylaxis for DVT was used in 88.6% of cases (91.5% in 2020). Non-use was substantially due to it not being considered appropriate (72.1%, 93.3% in 2020), although the active decision to withhold such treatment was taken in 23.5% of cases (compared with 16.7% of cases in 2020). Following evaluation, 82.7% of assessors agreed with the DVT prophylaxis strategy. However, there appears to be a steady decrease over time in the proportion of assessors considering the DVT prophylaxis choice to be appropriate (and a commensurate increase in the proportion of 'unknown' responses). Note, in particular, the 2020 figures of 60.9% and 39.1%, respectively.

Table 13: DVT prophylaxis use among in-hospital mortality patients

	2015	2016	2017	2018	2019	2020	Overall
DVT prophylaxis used	87.0	86.0	91.3	89.3	86.5	91.5	88.6
Reason for non-use							
Active decision to withhold	15.4	28.6	30.0	25.0	23.1	16.7	23.5
Not appropriate	84.6	71.4	60.0	75.0	61.5	83.3	72.1
Not considered	0.0	0.0	10.0	0.0	15.4	0.0	4.4
DVT prophylaxis use appropriate†							
Yes	86.7	86.9	85.9	86.1	80.2	60.9	82.7
No	1.0	0.0	1.6	0.0	1.1	0.0	0.7
Unknown	12.4	13.1	12.5	13.9	18.7	39.1	16.6

Note: All data are percentage of affirmative responses (valid cases only); † Assessor evaluation.

Clinical management issues

The overall management of a case is further considered in terms of whether any CMIs are identified by way of the self-reflection of treating surgeons, and the evaluation of assessors, respectively. In the 2015 to 2020 period, treating surgeons nominated 128 CMIs while assessors identified 144. The number and nature of CMIs is detailed in Table 14. CMIs have been grouped according to Read Code designations[4].

Table 14: Clinical management issues identified by surgeons and assessors for cases reported to ACTASM

	2015		2016		2017		2018		2019		2020		Overall	
Issue	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**	**S**	**A**
Adverse factors in management	0	0	0	0	0	0	0	2	1	3	2	2	3	7
Anaesthetic issues	1	0	0	0	0	0	0	0	0	0	0	1	1	1
Communication failures	1	3	1	1	1	2	0	5	1	3	1	1	5	15
Complications from endoscopic surgery	1	0	0	0	0	0	0	0	1	0	0	0	2	0
Complications from laparoscopic surgery	1	0	1	0	0	3	0	1	1	0	1	0	4	4
Complications from open surgery	2	5	5	3	1	3	3	1	1	2	3	2	15	16
Complications from radiological intervention	0	2	1	0	0	0	0	0	1	0	0	2	2	4
Delayed intervention	6	9	5	5	14	9	9	10	3	2	7	3	44	38
Difficulties in diagnosis	0	0	0	1	1	0	1	0	0	0	1	0	3	1
Drug-related complication	0	1	1	0	1	3	1	0	1	1	0	0	4	5
Facilities not used	0	1	0	0	0	1	0	1	1	2	1	0	2	5
General complications of treatment	3	5	3	3	4	4	4	3	3	3	2	3	19	21
Incorrect or inappropriate therapy	6	6	6	6	8	17	5	13	4	6	5	10	34	58
Patient assessment issues	1	3	2	2	2	2	1	4	2	4	2	0	10	15
Patient issues	1	0	1	1	0	2	0	0	0	0	1	0	2	3
Patient transfer issues	0	0	1	1	0	0	0	0	0	0	0	0	2	1
Resuscitation issues	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Staffing problems	0	0	0	1	0	0	1	1	0	0	1	0	2	2
TOTAL NO. ISSUES	23	36	27	24	32	46	25	42	20	26	27	24	154	198
TOTAL NO. CASES	21	28	21	16	29	33	19	28	16	22	22	16	128	144

Note: All data are the number of affirmative responses from treating surgeons (S) and assessors (A), respectively. Responses are not mutually exclusive; that is, multiple issues may have been identified for individual cases (max. = 5 for surgeons, 4 for assessors).

The more frequently reported CMIs were 'incorrect or inappropriate therapy' and 'delayed intervention'. Assessors were more likely to consider CMIs to be preventable (59.9% 'definitely' or 'probably' preventable compared with 36.4% from treating surgeons [Table 15]). Evaluations of the severity of the CMIs reported, and their likely outcome to the patient, are also summarised in Table 15. Overall severity was at the 'consideration' level, while the likely outcome was predominantly 'may have contributed to death'. These data points are also depicted in Figure 4.

Figure 4: Surgeon and assessor perspectives on preventability, severity and likely outcome of CMIs

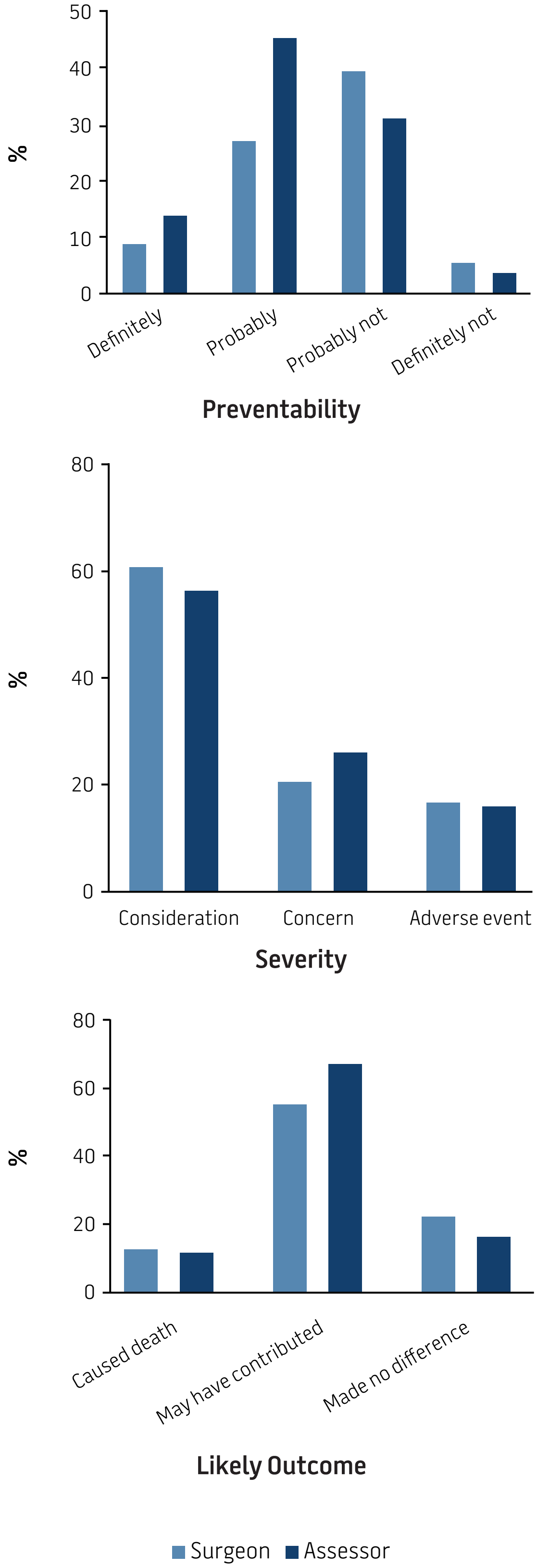

Table 15: Preventability, severity and likely outcome of CMIs identified by surgeons and assessors for cases reported to ACTASM

	2015		2016		2017		2018		2019		2020		Overall	
	S	A	S	A	S	A	S	A	S	A	S	A	S	A
Preventability														
Definitely	0.0	8.3	7.4	8.3	6.3	21.7	4.0	11.9	20.0	15.4	18.5	16.7	9.1	14.1
Probably	52.2	27.8	22.2	29.2	3.1	39.1	32.0	54.8	30.0	53.8	33.3	75.0	27.3	45.5
Probably not	43.5	38.9	51.9	41.7	6.3	30.4	56.0	31.0	45.0	30.8	44.4	12.5	39.6	31.3
Definitely not	0.0	13.9	7.4	8.3	15.6	0.0	4.0	0.0	0.0	3.8	3.7	0.0	5.8	4.0
Severity														
Consideration	65.2	41.7	51.9	66.7	53.1	56.5	80.0	69.0	60.0	53.8	59.3	50.0	61.0	56.6
Concern	17.4	30.6	25.9	8.3	25.0	32.6	12.0	23.8	10.0	23.1	29.6	33.3	20.8	26.3
Adverse event	13.0	22.2	18.5	25.0	21.9	8.7	8.0	7.1	30.0	26.9	11.1	16.7	16.9	16.2
Likely outcome														
Caused death	8.7	8.3	29.6	20.8	15.6	8.7	4.0	2.4	20.0	34.6	0.0	8.3	13.0	12.1
May have contributed to death	60.9	58.3	51.9	50.0	46.9	71.7	48.0	76.2	55.0	53.8	74.1	91.7	55.8	67.7
Made no difference	17.4	25.0	14.8	29.2	28.1	15.2	28.0	14.3	25.0	11.5	22.2	4.2	22.7	16.7
TOTAL NO. ISSUES	23	36	27	24	32	46	25	42	20	26	27	24	154	198

Note: Data from treating surgeons (S) and assessors (A), respectively, have been aggregated across all CMIs, with multiple responses possible for individual cases (max. = 5 for surgeons, 4 for assessors). Data are percentages (except for Total) calculated using the total number of issues as the denominator. Missing percentages are unspecified responses.

Determinants of clinical management issues

In this section the distribution of CMIs (according to treating surgeons and assessors, respectively) is presented according to a range of variables that might reasonably be hypothesised to have associations with the rate of CMIs reported.

Chi-square analyses (χ^2) have been conducted to test these hypotheses. The correction for continuity has been applied routinely when appropriate, while those tests that may be invalid (expected cell counts less than 5) are noted.

It was apparent that some surgeons are more (or less) likely to identify CMIs (data not shown). This was true regardless of whether surgeons themselves ($\chi^2_{(57)} = 121.47$, $p < 0.001$) or assessors ($\chi^2_{(56)} = 97.38$, $p < 0.001$) nominated the CMIs. (Note that both tests had cell frequencies less than 5.)

Table 16 shows the breakdown of CMIs as reported by both the treating surgeon and assessor, according to surgical specialty. CMIs were distributed across specialties. According to treating surgeons, the highest rate was found for Vascular Surgery (37.7%) while assessors considered Urology to have the highest rate (41.7%). It must be acknowledged that these percentages are based on relatively low numbers. The association between CMIs and speciality was marginally significant when using the data from treating surgeons ($\chi^2_{(7)} = 14.09$, $p = 0.05$) but strengthened when the data from assessors was analysed ($\chi^2_{(7)} = 29.61$, $p < 0.001$). Both tests had cell frequencies less than 5.

Table 16: Cases with CMIs identified by treating surgeon according to specialty

		Treating surgeon		Assessor	
Surgical specialty	**Deaths (n)**	**CMIs (n)**	**CMI %**	**CMIs (n)**	**CMI %**
Cardiothoracic Surgery	65	13	20.0	19	29.2
General Surgery	264	59	22.3	57	21.6
Neurosurgery	122	23	18.9	17	13.9
Obstetrics and Gynaecology	3	0	0.0	0	0.0
Orthopaedic Surgery	88	3	3.4	7	8.0
Otolaryngology Head and Neck	5	1	20.0	1	20.0
Plastic Surgery	9	2	22.2	1	11.1
Urology	24	4	16.7	10	41.7
Vascular Surgery	91	23	37.7	32	35.2
TOTAL	671	128	19.1	144	21.5

CMI rates for 3 relevant case characteristics are presented in Table 17, with both treating surgeon and assessor evaluations presented. While both treating surgeons and assessors recorded a higher rate of CMIs among elective cases, there was considerable disagreement between them. Both sets of data demonstrated a statistically significant association between admission status and CMIs; however, elective patients were more likely to experience CMIs than emergency patients (surgeons $\chi^2_{(1)} = 14.20$, $p = < 0.001$; assessors $\chi^2_{(1)} = 57.69$, $p < 0.001$). Data for patients who were transferred (compared with those who were not) show that treating surgeons and assessors were largely in agreement. Further, no significant association was identified between CMIs and patient transfer status (surgeons $\chi^2_{(1)} = 0.32$, ns; assessors $\chi^2_{(1)} = 3.36$, ns). Treating surgeons and assessors were also in agreement regarding the existence of CMIs and whether or not a patient was admitted to a CCU. In this instance; however, both surgeon-reported CMIs ($\chi^2_{(1)} = 10.13$, $p = 0.001$) and assessor-reported CMIs ($\chi^2_{(1)} = 7.96$, $p = < 0.005$) were significantly associated with a CCU admission (those admitted were more likely to experience CMIs).

Table 17: Cases with CMIs according to relevant case characteristics

		Treating surgeon		Assessor	
Admission status	**Deaths (n)**	**CMI cases (n)**	**CMI rate (%)**	**CMI cases (n)**	**CMI rate (%)**
Elective	104	36	34.6	55	52.9
Emergency	523	92	17.6	89	16.9
Patient transferred	**Deaths (n)**	**CMI cases (n)**	**CMI rate (%)**	**CMI cases (n)**	**CMI rate (%)**
Yes	208	40	19.2	39	18.8
No	402	86	21.4	102	25.4
Patient admitted to CCU	**Deaths (n)**	**CMI cases (n)**	**CMI rate (%)**	**CMI cases (n)**	**CMI rate (%)**
Yes	465	110	23.7	120	25.8
No	160	18	11.3	24	15.0

Table 18 documents CMIs according to ASA score. There was reasonable agreement between treating surgeons and assessors only in categories 4 and 5. The statistical analyses of these data demonstrated no association between ASA and CMIs as reported by surgeons ($\chi^2_{(5)}$ = 6.43, ns), while there was a statistical association using the assessors' CMI reports ($\chi^2_{(5)}$ = 18.95, p = 0.002). Patients with an ASA classification of 2 or 3 (and to a lesser extent 4) were more likely to experience CMIs.

Table 18: Cases with CMIs according to ASA status

	ASA Score					
CMI	**1**	**2**	**3**	**4**	**5**	**6**
Treating surgeon (% yes)	28.6	30.6	24.1	22.2	14.9	11.1
Assessor (% yes)	14.3	36.1	31.5	23.9	13.9	0.0

The relationship between surgeon-estimated death risk and CMIs is presented in Table 19. There was good agreement between treating surgeons and assessors for these data with statistically significant associations demonstrated (surgeons $\chi^2_{(4)}$ = 14.32, p = 0.006; assessors $\chi^2_{(4)}$ = 23.45, p < 0.001). The rate of CMIs decreased as surgeon-estimated death risk increased.

Table 19: Cases with CMIs according to surgeon-estimated risk of death

	Surgeon-estimated risk of death						
CMI	**Unknown**	**Minimal**	**Small**	**Moderate**	**Considerable**	**Expected**	**Futile**
Treating surgeon (% yes)	12.5	5.5	16.4	23.4	35.2	7.0	0.0
Assessor (% yes)	10.2	4.7	20.3	31.3	40.6	5.5	0.0
	Assessor-estimated risk of death						
CMI	**Unknown**	**Minimal**	**Small**	**Moderate**	**Considerable**	**Expected**	**Futile**
Treating surgeon (% yes)	11.1	4.9	14.6	20.8	31.3	6.3	0.0
Assessor (% yes)	4.9	0.7	11.8	27.1	37.5	6.9	0.0

Note: Proportions of cases where at least 1 CMI was identified by surgeons or assessors according to surgeon-estimated and assessor-estimated risk of death.

Finally, the data for assessor-estimated death risk is also shown in Table 19. There was less agreement between treating surgeons and assessors for these data, particularly in the 'minimal' and 'small' classifications. Nevertheless, both surgeon-reported CMIs ($\chi^2_{(4)}$ = 22.49, p < 0.001) and assessor-reported CMIs ($\chi^2_{(4)}$ = 72.50, p < 0.001) demonstrated statistically significant associations with assessor-estimated death risk. Again, the rate of CMIs decreased as surgeon-estimated death risk increased.

DISCUSSION

This report attempts to provide a meaningful snapshot of the cases reported to ACTASM in the period 2015–2020 inclusive, with the goal of providing a framework with which to empower surgeons by identifying those areas of surgical care in need of improvement.

The context and demography of those patients who died while under surgical care has been described, as has aspects of their management and care while in hospital. Additionally, how these cases were managed has been expressed using the perspectives of both surgeons and assessors.

Overall, the number and nature of cases appears to be stable over time, which is a pleasing aspect of the audit results. Key foci of the audit are those factors in the pathway of care that may either influence the final outcome of patients and/or which have the potential to drive practice changes for the betterment of patients. Highlighted in this discussion are transfers, infections, the use of DVT prophylaxis, clinical management issues (CMIs) and engagement with the audit process.

The transfer of patients to a more appropriate facility for their care is an inevitability of the system. In fact, the data show that approximately one-third of cases in this audit experienced a transfer. While transfers may be inevitable, understanding the risk factors for death among transferred patients is possible and desirable. Analyses in this report demonstrated that transfer cases are essentially younger and sicker patients (e.g. ASA score, CCU use, surgeon-rated risk of death) than are those in the full cohort. Although perhaps obvious, they have the potential to act as 'red flags' in the pathway of care of transferred patients.

Clinically significant infections remain a feature of ACTASM audit cases. Historically, one-third of deaths can be expected to develop a concomitant infection with the majority of these being acquired after admission and predominantly in the postoperative period. Rates of infection do not appear to be declining and are a cause of concern.

DVT prophylaxis use as a strategy to avoid venous thromboembolism (VTE) is high and stable over time. The appropriate use of DVT prophylaxis is compromised by the anticoagulant options available, the specific pathophysiological process to be alleviated and the extent to which such processes are evident. Nevertheless, it is of concern that assessors appear to be increasingly less likely to endorse DVT prophylaxis as appropriate. This trend is clear and warrants clarification.

Regarding the identification of CMIs, self-reporting by surgeons and reports by assessors have remained relatively consistent over time. However, assessors report a greater number of CMIs, with a higher proportion of them being rated as 'preventable', 'of concern', and with the conclusion that they 'may have contributed to death'. Of all the data reviewed in the audit, it is perhaps these data (Tables 13 and 14, and Figure 4) that best serve the feedback and self-reflection aim of the process, and which may result in an incremental improvement in overall surgical outcomes.

Of the 671 cases that qualified for full audit, Table 1 shows that 88.8% were 'closed' at the census date for this report. This suggests that overall engagement by surgeons with the process is quite satisfactory. Perhaps of some note; however, are the times taken for submission (Table 3). While the median is acceptable, the 75th percentile indicates that a substantial number of cases remain outstanding for some time. The value of the exercise as a feedback mechanism must surely be diminished the longer it takes for a case to be submitted.

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Notes

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