Victorian Audit of Surgical Mortality

ANNUAL REPORT 2011

Contents

Figures

Tables

Chairman's Report

The death of a patient can be a learning experience.

The Victorian Audit of Surgical Mortality (VASM) has now been actively collecting and reviewing deaths associated with surgery for four years. This is our fourth annual report and we have produced three case note review booklets. We have contributed to two national case note review booklets and two national reports, some of which are pending publication. In this report we present the outcomes of review of 2,013 deaths.

The steady progress of the audit might qualify as some measure of success, but there is nothing like getting a reality check on one's perceptions. To achieve some objectivity we need to stand back and let a team of independent external observers assess the various criteria others might feel important. An external review was conducted in the first half of 2011. The full report can be found on www.surgeons.org/VASM. In brief, VASM was felt to have achieved its goals efficiently and effectively and gained credibility with Victorian Fellows. Although such reports are important, the true value lies in recognising future opportunities. The input from a wide range of stakeholders has provided us with valuable suggestions to take us forward. I wish to thank all those who contributed to the review for their help. The learning from, and the outcomes of, this survey will benefit all regional audits of surgical mortality.

The review confirmed the importance of addressing prominent failings in clinical management. This is congruent with our goal of education. VASM and other states have identified delay in implementation of definitive care as an ongoing major issue. Recognising clinical deterioration is a major facet of this problem. VASM, in conjunction with the Victorian Surgical Consultative Council (VSCC) and the Victorian Managed Insurance Authority (VMIA), ran a seminar on this topic in late February.

In the latter half of 2011 we successfully commenced recruitment of the private hospital sector into the audit. We thank these 80% of private hospitals that have already come on board.

Although the information presented in this report is still a relative snapshot of surgical deaths in Victoria, some positive trend data is emerging. Most importantly, there is a downward trend in the frequency of significant criticism generated over clinical management of audited cases.

The success of VASM is really down to Claudia Retegan and the other members that make up the VASM team. Their attention to detail and adherence to protocol is the solid foundation on which the audit is built. With their help, and the support we receive from many others, I can only remain confident about the future of VASM. The support of the State Government, the Victorian Department of Health and VSCC have enabled and facilitated VASM's inception and progress. The Royal Australasian College of Surgeons provides much of the skeleton on which the audit has functioned.

The theme of this Chairman's report has been about 'taking stock'. This is influenced by the fact that this is my last, as I will stand down at the end of this May. I wish to thank all who have helped us to get where we are, it has been a challenge I needed and a pleasure I have enjoyed.

Colin Russell
VASM Chairman

Shortened Forms

AL	Anastomotic Leak
ANZASM	Australian and New Zealand Audit of Surgical Mortality
ASA	American Society of Anaesthesiologists
AMI	Acute Myocardial Infarction
CCU	Critical Care Unit
CEVD	Cerebrovascular Disease
CNRB	Case Note Review Booklet
CPD	Continuing Professional Development
CRF	Case Record Form
DH	Victorian Department of Health
DMA	Direct Marketing Association
DRG	Disease Related Group
ENT	Ear Nose and Throat
FLA	First-Line Assessment
GI	Gastro Intestinal
GIS	Geographic Information Systems
GP	General Practitioner
HDU	High Dependency Unit
IMG	International Medical Graduate
IQR	Interquartile Range
LGA	Local Government Area
OR	Operating Room
RAAS	Research Audit and Academic Surgery Division
SD	Standard Deviation
SLA	Second-Line Assessment
SQL	Structured Query Language
SSL	Secure Sockets Layer
TED	Thromboembolic Deterrent
VAED	Victorian Admitted Episodes Dataset
VASM	Victorian Audit of Surgical Mortality
VSCC	Victorian Surgical Consultative Council
VTE	Venous Thromboembolism
VMIA	Victorian Managed Insurance Authority

Executive Summary

Audit participation

There has been increasing participation in the Victorian Audit of Surgical Mortality (VASM) by Victorian Fellows. Intention to participate has risen from 60% in 2008 to 87% in 2011. This increase in intention to participate is supported by evidence of actual participation. The return of case record forms (CRFs), a pivotal step in the audit process, varies between 75% and 80%. This appears to have reached a steady state and is similar to other regions. Compliance in completing all necessary data fields (data quality) has improved but is still less than satisfactory. The treating consultant, rather than a junior member of the team, has provided the information as outlined in section two of the report. This indicates an ongoing high level of personal involvement by participating surgeons.

All public hospitals with relevant surgical activity continue to participate and provide notifications of death associated with surgery. Since our last report, funding has been increased to recruit the private sector to the audit. This is an important step to ensure that all surgical mortality undergoes peer review. Private hospital participation has reached 80% and continues to improve.

The majority of hospital deaths do occur in the public sector. This is not a reflection on the level of care provided in the public sector, but is a result of the less complex casemix generally receiving care in the private hospital sector.

In 2010–2011, 277,422 patients underwent surgical procedures in Victoria, while the number of deaths attributed to surgery over the entire three-and-a-half-year audit period was only 4,177. This is a very small percentage compared with the number of patients who actually underwent surgery over the audit period. Additionally, only 2% of the total deaths reported occurred in the private sector. When the number of deaths is compared with the Victorian Admitted Episode Dataset (VAED) figures, in 2010-2011 we are capturing an increasing percentage of recorded state deaths (83%).

Overall, 2,013 (48%) of the 4,177 deaths had proceeded to and completed the audit process by the census date.The clinical information from these 2,013 cases forms the basis of this report. The remaining 2,164 cases were not included in the audit for the following reasons: excluded due to admission for terminal care, inappropriately attributed to surgical care, treated by non-participating surgeons or had not completed the audit process by census date. This latter group (998) should of course be available by the next census date.

Demographic and risk profile

Review of the demographic and risk profiles of all cases that had completed the audit process (2,013) confirms the trends described in previous reports. The majority of surgical deaths have occurred in elderly patients with underlying health problems, who have been admitted as an emergency with an acute life-threatening condition that often requires surgery. The actual cause of death was often linked to their pre-existing health status, in that the cause of death frequently mirrored the pre-existing illness. Death was most often adjudged to be not preventable, and to be a direct result of the disease processes involved rather than of the treatment provided. The most common causes of death reported are cardiac and respiratory failure. This is congruent with the most common comorbidities in this series of patients.

Risk management

Risk management strategies for this generally elderly, sicker group of patients are especially important. The audit looks at three parameters: venous thromboembolism (VTE) prophylaxis to reduce the likelihood of pulmonary embolus, use of critical care facilities and fluid balance management.

- ***VTE prophylaxis:*** prophylaxis was provided in over two thirds of audited deaths. A conscious decision to withhold prophylaxis was the reason given for non-provision for most of the remaining cases. This was generally necessitated by some clinical contraindication to prophylaxis. Inadvertent omission of prophylaxis was rare, only occurring in 3% of cases.

  When the appropriateness of withholding prophylaxis was reviewed, there was generally agreement by assessors that the decision was correct. However, in 4% of cases where it was withheld, assessors felt the decision was questionable, although the decision did not affect the final outcome.

- ***Use of critical care facilities:*** more than half of the patients in this audited series received critical care support during the course of their hospital stay. This is significantly higher than previous years. In only a small percentage of cases not receiving critical care (7%) did assessors feel this may have been inappropriate.

- ***Fluid balance during treatment:*** there was a perception that this may have been an issue of management in only 5% of cases reviewed.

Operative profile

Twenty-one percent of the 2,013 patients had no operative interventions. This was most commonly an active decision not to proceed and usually occurred in patients admitted as an emergency for an irretrievable clinical problem. A total of 1,687 separate episodes of surgery occurred in 2,013 patients. In these surgical episodes, 2,641 operative procedures were recorded. The most frequent operative procedures described were for trauma or acute abdominal pathology. This reflects the high percentage of patients admitted as emergencies (86%) in this series. A consultant performed the surgery in 54% of instances and made the decision to proceed to surgery in 68%.

There was an unplanned return to the operating room (OR) in 231 (12%) of the1,590 patients who underwent a surgical procedure. Unexpectedly, the rate of unplanned return to the OR was significantly higher in patients admitted electively, and occurred despite a higher percentage of elective cases being operated on by a consultant surgeon. There is no obvious explanation for this trend. This will be monitored over time.

Unplanned return to the OR is often, but not always, necessitated by a complication of the initial procedure and is associated with increased risk of death. Consultant involvement in such cases is highly desirable. Direct consultant involvement in such cases has risen from around 30% in 2007–08 to 81% in 2010–11. This recognition of the need for direct consultant involvement is to be commended.

The demand for time in the OR to manage emergency cases remains a significant problem for hospitals. The issue is well recognised in this and other countries.

There continues to be a low rate of postoperative complications as reported by treating surgeons.

Inter-hospital transfers

Twenty-one per cent of cases in the audited series required inter-hospital transfer. Such transfers were usually necessitated by the need for higher levels of care. Issues of patient care related to transfer were raised in a third of these cases. The most common criticism was that transfer occurred at an inappropriately late point in the course of the patient's illness.

Peer-review outcomes

First and second-line assessors review and appraise the appropriateness of the clinical care provided to each case reported to VASM. All cases undergo first-line assessment (FLA)

- ***Second-line assessments (SLA):*** the frequency of need for SLA could be seen as an indirect measure of quality of care. SLAs are requested for cases in which the clinical care needs to be looked at more closely or the treating surgeon did not provide sufficient information to reach a conclusion. Importantly, the rate of second-line referral has decreased from 18% in 2007–08 to 10% in 2010–11 and this rate is similar to other states.

  It is disappointing that SLA was most commonly (65%) required because the clinical information provided by the treating surgeon was inadequate. The need for SLA was similar among surgical specialties, and between metropolitan and rural hospitals.

- ***Clinical management issues:*** assessors use a standard spectrum of criticism to convey their perceptions of appropriateness of care. These are described in detail in section 3.2.

  In 85% of audited deaths no, or only minor, issues of patient care were perceived. However, in 15% of cases more major issues of care were identified (areas of concern and adverse events). Over the audit period (2008–2011) there has been a significant decrease in the frequency with which assessors are identifying clinical management issues. The incidence of more major criticisms of clinical care is similar among the surgical specialties.

  There is no clear evidence that specific hospitals or surgical specialties have attracted higher rates of criticism than others. It is important to remember that criticism of clinical care is not always attributable to the surgical team. A third of the issues identified were attributed to other specialty areas.

- ***Perceived impact of identified issues on clinical outcome:*** there was a perception that the clinical management might have been better in 713 (35%) of the 2,013 audited deaths. In only 126 of these 2,013 patients (6% of audited series) the clinical management was deemed likely to have contributed to the adverse outcome. The perceived relationship of clinical management to outcome was less clear in the remaining cases.

- ***Frequency of specific issues of clinical management:*** the most common clinical issue among the 1,212 specific issues identified was delay in delivery of definitive care. This occurred at multiple levels in the care pathway. The underlying problem was usually delay in establishing the true diagnosis leading to late referral and delay in implementing definitive treatment. A similar pattern has been reported in the recent national report.

- ***Data quality:*** this is an essential component of this and other audits. We have looked at the frequency of missing data in this audit.There has been a slight improvement in some sections of the data collection forms. The volume of missing data is most prevalent in a few sections. We have recently reformatted two of these sections to make the audit forms more user-friendly.

  We take this opportunity to emphasise the importance of accuracy and completeness of all clinical information provided to VASM.

Recommendations

Many of our previous years' recommendations have been implemented. Collaboration between the Department of Health, Victorian Surgical Consultative Council (VSCC), Coroner's Office, hospitals and health services continues to facilitate our progress.

Objectives for the coming year are:

- Improve the return rate of CRFs and increase surgeon participation.
- Continue to collaborate with VSCC and other agencies like the Coroner's Office.
- Continue to disseminate important messages emanating from the audit.
- Enhance the electronic interface to allow Fellows to complete assessments online.
- Facilitate communication and information sharing with other state mortality audits.
- Contribute to the development of a national mortality audit report.
- Implement recommendations that resulted from the external evaluation of the audit program.

1. Introduction

1.1. Background

The Victorian Audit of Surgical Mortality (VASM) is part of the Australian and New Zealand Audit of Surgical Mortality (ANZASM), a bi-national network of regionally based audits of surgical mortality that aim to ensure the highest standard of safe and comprehensive surgical care.

1.2. Objectives

The objective of the audit is 'peer-review of all deaths associated with surgical care'. This includes:

- deaths that occur in hospital following a surgical procedure.
- deaths that occur in hospital whilst under the care of a surgeon, even though no procedure was performed.

If VASM receives notifications of deaths that have occurred following discharge from hospital but within 30 days of a procedure or inpatient stay under a surgical unit, these cases will also be reviewed.

The audit process is designed to highlight system and process errors, and trends in deficiencies of care. It is intended as an educational rather than a punitive exercise.

1.3. Performance review

Recommendations were included in the 2010 annual report. An important measure of the success of VASM is whether these recommendations have been subsequently addressed or achieved. Most key performance indicators, recommendations and progress against the indicators have been achieved.

1.4. Structure and governance

ANZASM is managed by the Research, Audit and Academic Surgery Division (RAAS) of the Royal Australasian College of Surgeons and is supported and funded by state and territory governments. ANZASM oversees the implementation and standardisation of each regional audit to ensure consistency in audit processes and governance structure across all of the jurisdictions involved.

Participation is now a mandatory component of attaining Continuing Professional Development (CPD) recertification. Surgeons and assessors gain points in Category 1: 'Clinical Governance and Evaluation of Patient Care' of the CPD program for their participation.

VASM is funded by Quality, Safety and Patient Experience Branch of the Victorian Department of Health (DH). The College provides infrastructure support and conducts the oversight of the project. VASM works closely with the Victorian Surgical Consultative Council (VSCC) and provides regular reports to ANZASM, VSCC, hospitals, surgeons and the DH (see Figure 1).

The VSCC was established by the state government in 2001 to review causes of avoidable mortality and morbidity associated with surgery, and to provide feedback to the medical profession on any systemic issues identified. VASM staff informs the VSCC of trends in surgical mortality and assists with the development of processes to enable the surgical community and healthcare providers to address system issues.

The VSCC receives de-identified second-line assessment (SLA) and aggregated reports from VASM that summarise all cases reviewed. The VSCC informs the surgical community about important issues arising from the collection and analysis of mortality and morbidity data. Along with the VSCC, VASM aims to support further improvements in patient care in Victoria.

1.5. Data management and statistical analysis

All deaths occurring in Victorian hospitals while the patient is under the care of a surgeon that are notified to VASM are audited. Cases admitted for terminal care and deaths incorrectly attributed to surgery are excluded from the full audit process. This 2010–2011 annual report includes deaths reported to VASM since data collection commenced on 1 January 2008 to 30 June 2011. As the multiple rate-limiting steps in the audit process result in a mean time to completion of three months, information on some deaths that occurred during the reporting period are still under review and not available for inclusion.

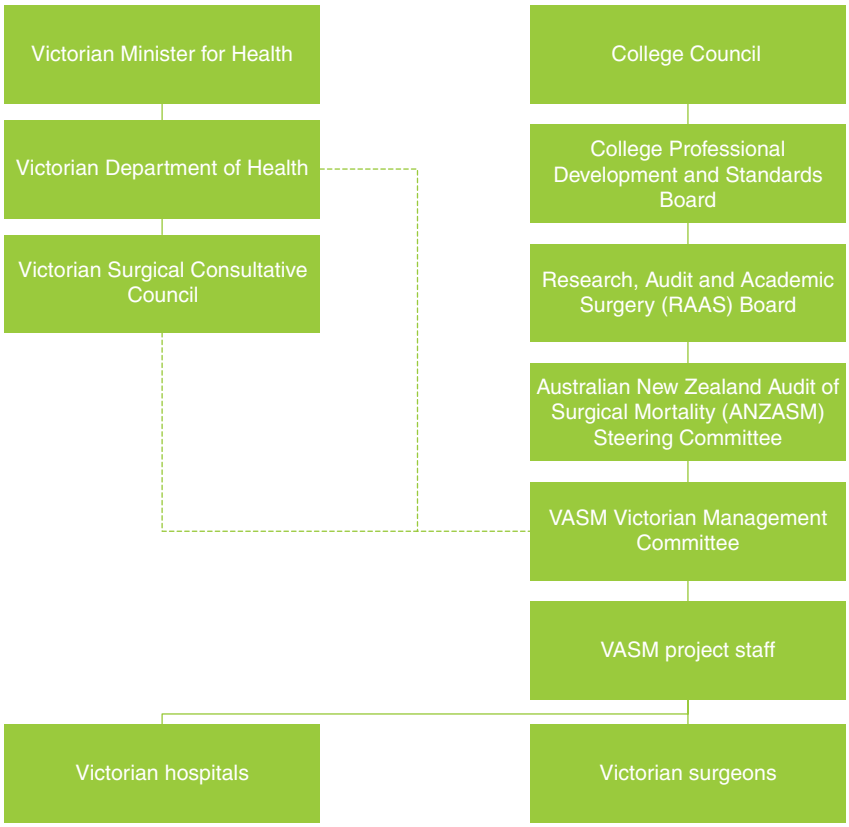
Data is encrypted in the web database. This data is sent to, and stored in, a central Structured Query Language (SQL) server database that includes a reporting engine. All transactions are time-stamped. All changes to audit data are written to an archive table, enabling a complete audit trail to be created for each case.

An integrated workflow rules engine supports the creation of letters, reminders and management reports. This system is designed and supported by Alcidion Corporation. All communications are encrypted with Secure Sockets Layer (SSL) certificates.

Data is downloaded from the secure database and then analysed using the statistical package Stata version 10.1, Microsoft Office Excel (2007) and mapping special analysis ArcGIS version 9. Demographic data and summary statistics have been presented. Continuous variables have been compared using Student's t-test or the non-parametric Ranksum test as appropriate. Categorical variables have been compared using Pearson's chi-square test. Kappa scores have been used as a measure of agreement. Funnel plots have been used to explore heterogeneity and have been presented with upper and lower two and three standard deviation (SD) limits.

Numbers in the parentheses in the text (n) represent the number of cases actually analysed. As not all data fields have been completed by surgeons these numbers vary.

Figure 1: Victorian Audit of Surgical Mortality (VASM) project governance structure



1.5.1 Interpretation of kappa scores

The kappa score is used to understand the difference between agreement levels beyond chance where:

<0 = no agreement

0.0–0.19 = poor agreement

0.20–0.39 = fair agreement

0.40–0.59 = moderate agreement

0.60–0.79 = substantial agreement

0.80–1.00 = almost perfect agreement

1.5.2 Interpretation of p-values

A *p*-value <0.05 is considered statistically significant.

1.5.3 Interpretation of funnel plots

Funnel plots are a visual tool to investigate bias in meta-analysis. They are scatter plots of the analysis effects estimated from individual studies (horizontal axis) against a measure of study size (vertical axis). The name funnel plot is based on the precision in the estimation of the underlying treatment effect increasing as the sample size of component studies increases.

1.5.4 Interpretation of geographic mapping

Geographic Information System (GIS) provides a common analytical framework in which data can be geographically displayed.

1.5.5 Exclusion of identifiable data

Labels and data that might identify surgical groups, patients, hospitals and extreme values have been excluded from this report.

2. Audit Results

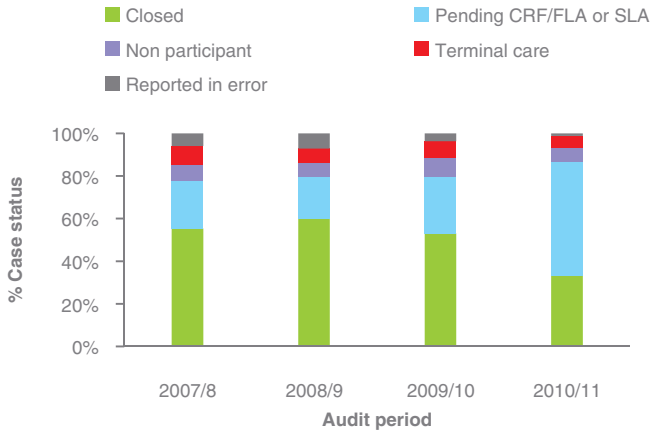
2.1. Audit numbers

From its commencement on 1 January 2008 to the end of the current audit period on 30 June 2011 the VASM received 4,177 notifications of death that have been associated with surgical care (see Figure 2).

It is beneficial to put these deaths in some perspective by reviewing the number of surgical procedures actually performed in Victoria over this period.

We interrogated the Victorian Admitted Episode Dataset (VAED) to establish that in the financial year 2010–11 a total of 277,422 patients underwent surgical procedures in Victoria. Over the same period VASM have been notified of 1,471 deaths associated with surgical care. This is a very small percentage (0.5%) of the patients who underwent surgery.

Figure 2: Synopsis of audit numbers over sequential audit periods



Note: Total n=4,177.

CRF: case record form; FLA: first-line assessment; SLA:second-line assessment.

Regarding the audit status of the 4,177 deaths reported to VASM:

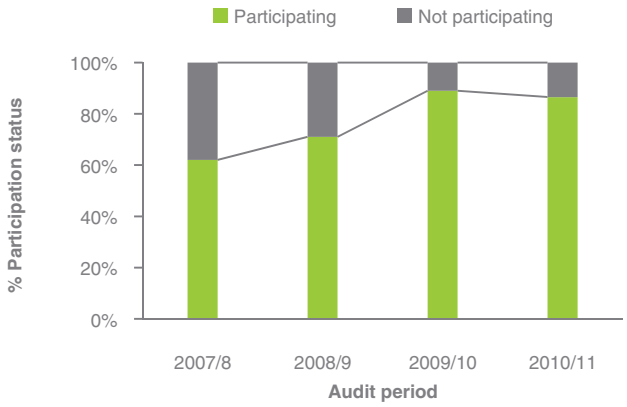
- By the census date 3,803 (91%) of the 4,177 case record forms (CRFs) sent to the treating surgeon had been completed and returned.This means that clinical data was available for review in 3,803 cases.
- A total of 277 of these cases (7%) were recorded as admissions for terminal care and therefore excluded from the review process.
- Additionally, 165 of these cases (4%) had been wrongly attributed to a surgical unit and were therefore excluded.
- A total of 314 (8%) cases could not proceed in the audit process as the treating surgeon had elected not to participate.
- In 36 (1%) cases, the treating surgeon could not access the hospital case notes to complete the CRF as the notes were at that time at the Coroner's Court.
- Clinical information was therefore available on the remaining 3,011 (79%) of the 3,803 cases.
- By the census date, only 2,013 (67%) of these 3,011 deaths had been fully audited. The outcomes from the actual peer review process are restricted to these 2,013 deaths and are the focus of this report. The outcomes of the remaining 998 (33%) cases still pending response from the treating surgeon or the assessor will be available in the next audit report.
- It should be noted that a small percentage of reported deaths emanate from the private sector (80, 2%). This is predictable from the known casemix of the two sectors. This is compounded by recent and ongoing recruitment of the private sector decreasing numbers further. In subsequent sections, private and public deaths have not been reviewed separately but as one group.

2.2. Audit participation rates

To comply with the audit process, surgeons must not only agree to participate but also return completed CRFs and assessment forms in a timely manner. The hospitals in which they work must provide notifications of deaths on a regular basis, as this is the main trigger for the audit process to begin.

2.3. Participation by Fellows

Figure 3: Surgeon agreement to participate as percentage of eligible College Fellows in Victoria

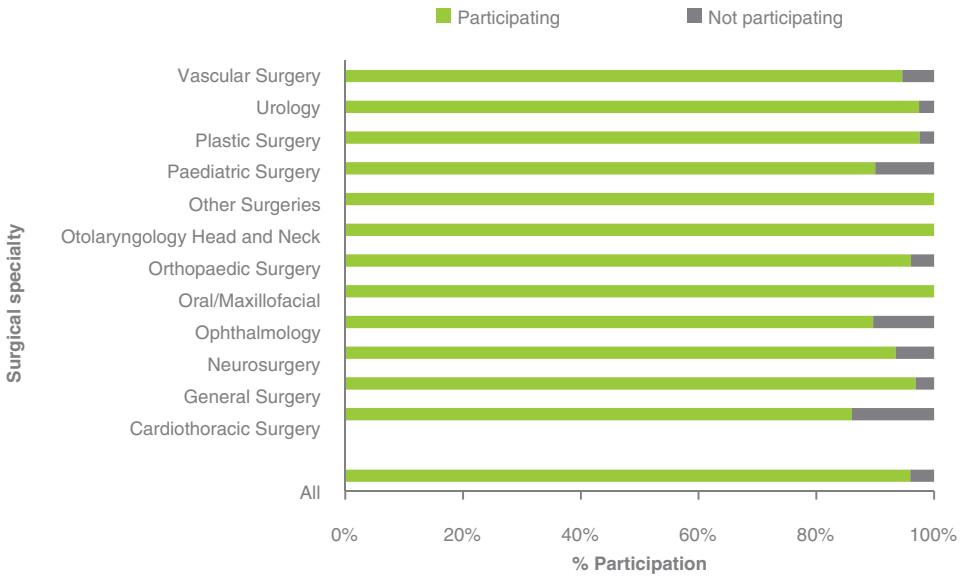


Note: Total n=1,050.

Comments:

- The majority 900 (86%)of the eligible 1,050 Victorian Fellows registered in the College database are currently participating.
- The increase in participation rate from 60% in 2008 to the current level of 86% is encouraging.
- Fourteen per cent of Fellows have refused to participate.
- Some 48% of Fellows have also agreed to be first and/or second-line assessors.
- Thirty-two per cent of Fellows registered in the audit database are submitting data electronically.
- The College Council has delivered strong support to ANZASM by requiring surgeons to participate in their state's mortality audit as a compulsory component of the CPD program since January 2010.
- In 2011, surgeons who refused to participate have been reinvited into the program.
- The College CPD programme conducts annual verification audits on compliance of surgeons for their CPD requirements. This requires confirmation of participation in VASM. The confirmation of participation has been provided to 22 (2%) surgeons for the verification purposes.

Figure 4: Surgeon agreement to participate by surgical specialty

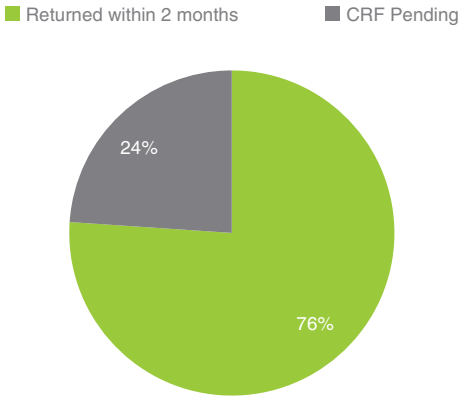


Note: Total n=1,050.
'Other surgeries' includes trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- Participation rates are similar among specialties.

Figure 5: Case record form return rate

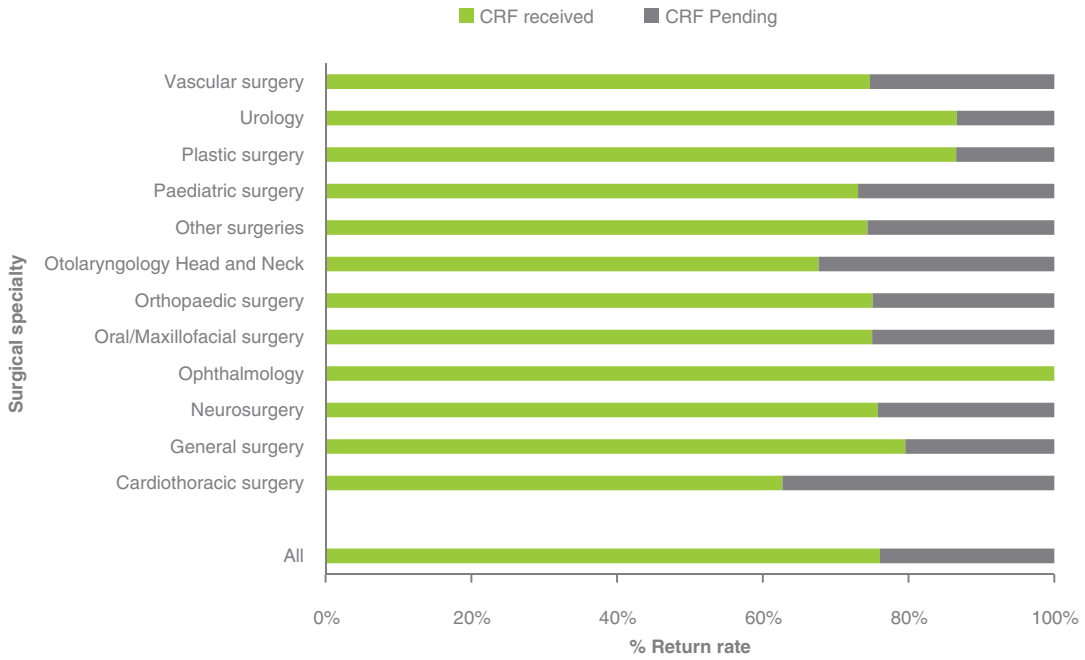


Note: Total n=4177.

Comments:

- A CRF was sent to each surgeon nominated as the treating surgeon in all 4,177 instances of death reported to VASM.
- Allowing two months from notification of death to receipt of the CRF, the return rate is 76%.
- The return rate across other states and territories varies between 70% and 95%.[1]
- The return rate in the Scottish Audit of Surgical Mortality Annual Report 2010 is 78%.[2]

Figure 6: Case record form return rate by surgical specialty

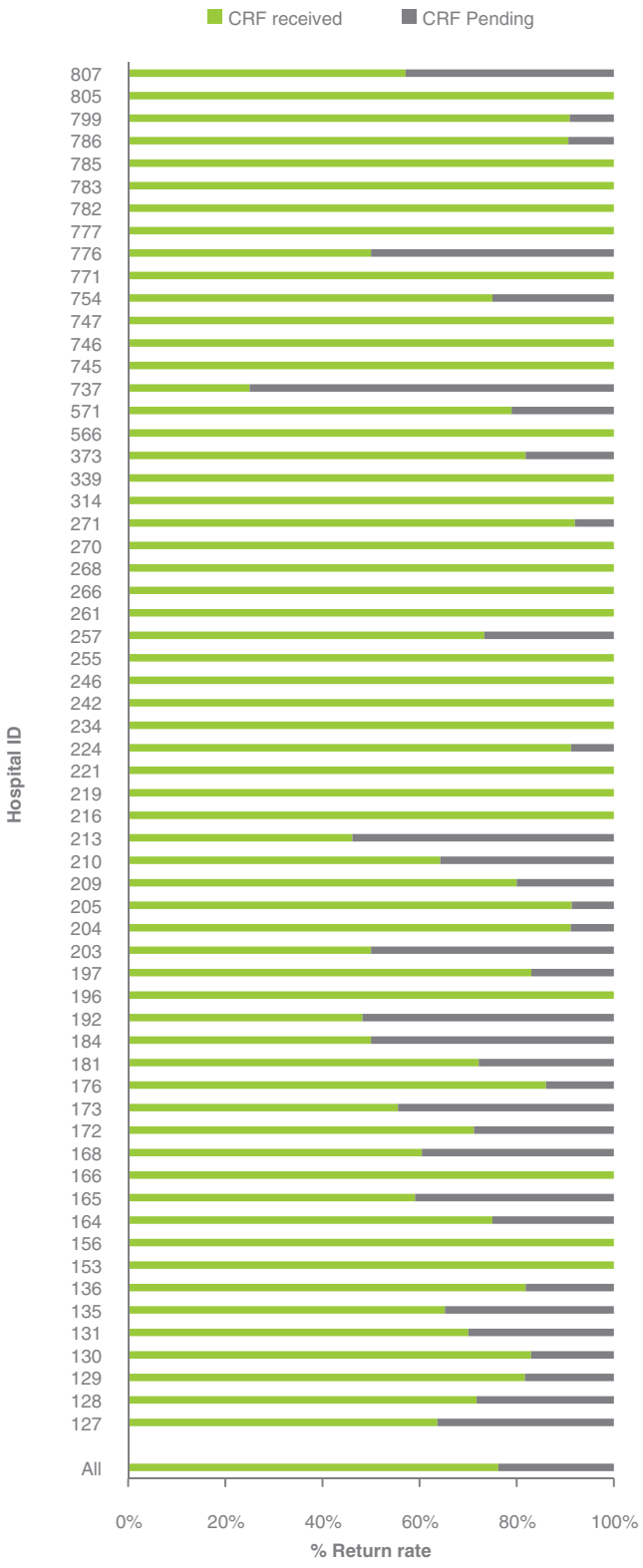


Note: Total n=3,803.
'Other surgeries' includes trauma, transplant, oncology, obstetrics and gynaecology.
CRF: case record form.

Comments:

- There is some variation in return rates among specialties.

Figure 7: Case record form return rate by hospital



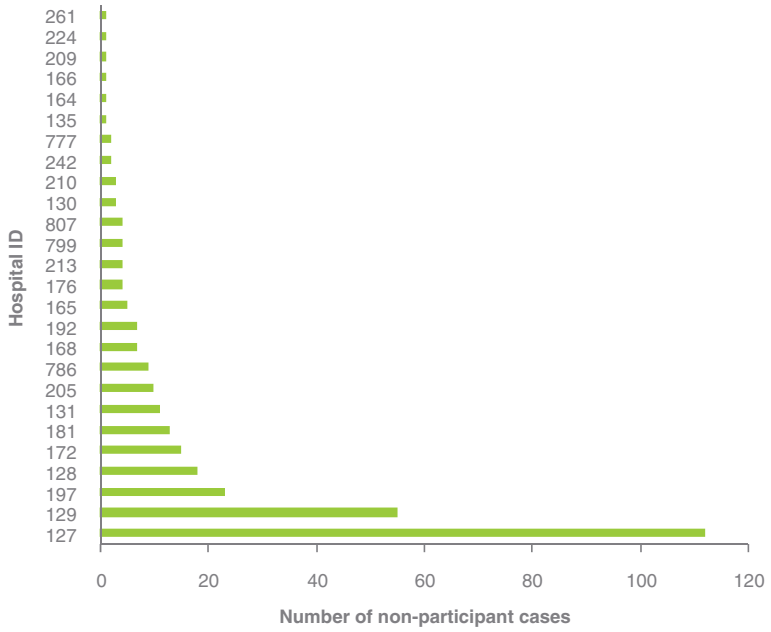
Note: Total n=3,803.

CRF: case record form; ID: identifier.

Comments:

- Compliance with the audit process, as assessed by CRF return rates,varies among hospitals.
- It should be noted that return rates are expressed as a percentage and could seem inappropriately low in recently recruited hospitals with small case numbers and only one death.

Figure 8: Hospital origin of cases that could not be reviewed due to non-participation by treating surgeon

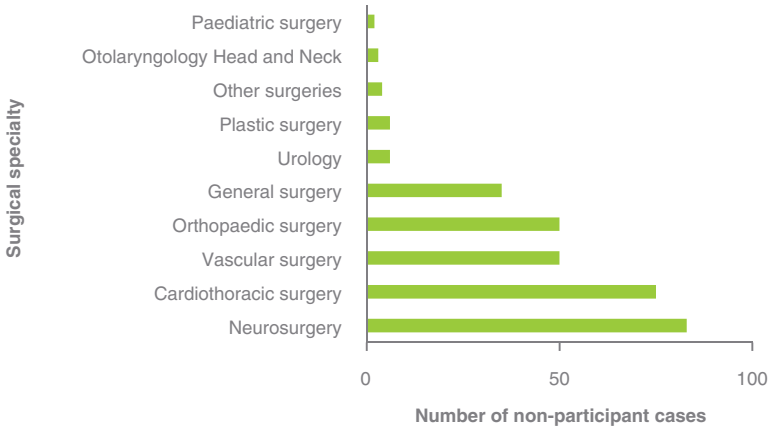


Note: Total n=314.
ID: identifier.

Comments:

- Surgeons electing not to participate seem to be focused in a few hospitals. This distribution has been relatively constant with time.
- In each instance, the hospital has agreed to participate and has notified deaths to VASM, but the surgeons responsible have not returned the CRFs. The audit process can not proceed if the surgeon does not actively participate.
- Since January 2010, participation in ANZASM has been made a mandatory component of CPD. It is hoped that this will encourage more surgeons to participate.
- VASM would like to encourage those hospitals with non-participating surgeons to review the approach to external audit adopted by their surgical staff.

Figure 9: Specialty origin of cases that could not be reviewed due to non-participation by treating surgeon



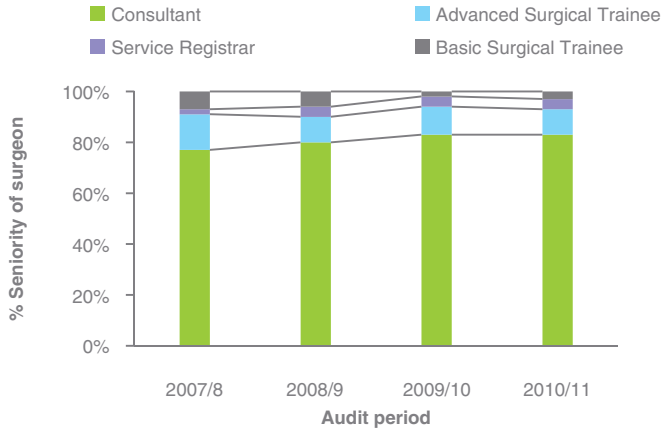
Note: Total n=314.

'Other surgeries' includes trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The specialties with the greatest degree of non-compliance are neurosurgery, cardiothoracic surgery and vascular surgery.
- These account for two thirds of deaths that could not be audited due to surgeon non-participation.

Figure 10: Seniority of surgeons completing the case record form

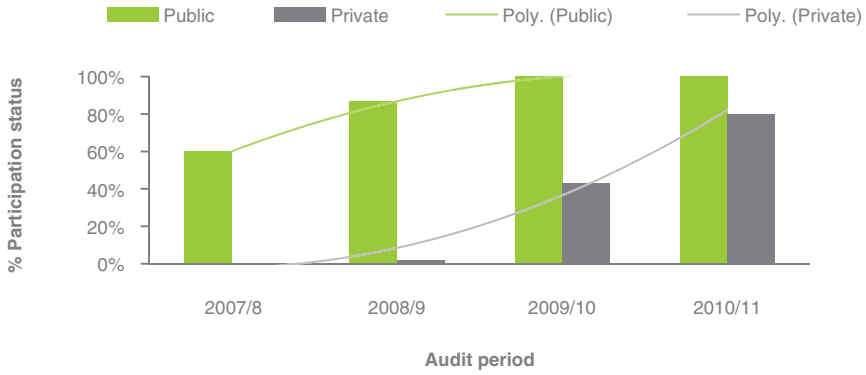


Note: Total n=2,013.

Comments:

- The completion rate of the CRF by consultants increased from 77% in 2008 to 83% in 2011, this is commendable.
- The 'Other' group of surgeons completing the CRF includes International Medical Graduates (IMG).

Figure 11: Hospitals participating in the audit



Note: The polynomial trend shows the rise and relationship between the two hospital groups private and public enrolments and the number of years of their participation in the audit.

Comments:

- All Victorian public hospitals and 80% of the private hospitals providing relevant surgical services are now participating and providing notifications of death.
- Hospitals that joined the audit after 30 June 2011 and where no mortalities occurred or where deaths have not been reported have been excluded from analysis.

2.4 Verification of audit numbers

The audit process is dependent on receiving notifications of death from participating hospitals. This requires each hospital to prepare and submit a list of deaths that have occurred while under the care of a surgeon. This generally means the discharge unit has been recorded as surgical. In some instances, patients who have received surgical care may not be under the care of a surgeon at the time of discharge. It can therefore be seen that the attribution of care to surgery or another specialty is not exact.

In parallel with our process, hospitals must submit data to the VAED which is maintained by the Victorian Department of Health (DH). This is a robust database providing casemix information required for hospital funding. The information allocates individual patient episodes to Disease Related Groups (DRGs). These DRGs are specialty-specific and can therefore provide an alternative source of mortality data. The DH has provided us with a list of deaths that occurred in patients with surgical DRGs over the period 1 July 2010 to 30 June 2011.

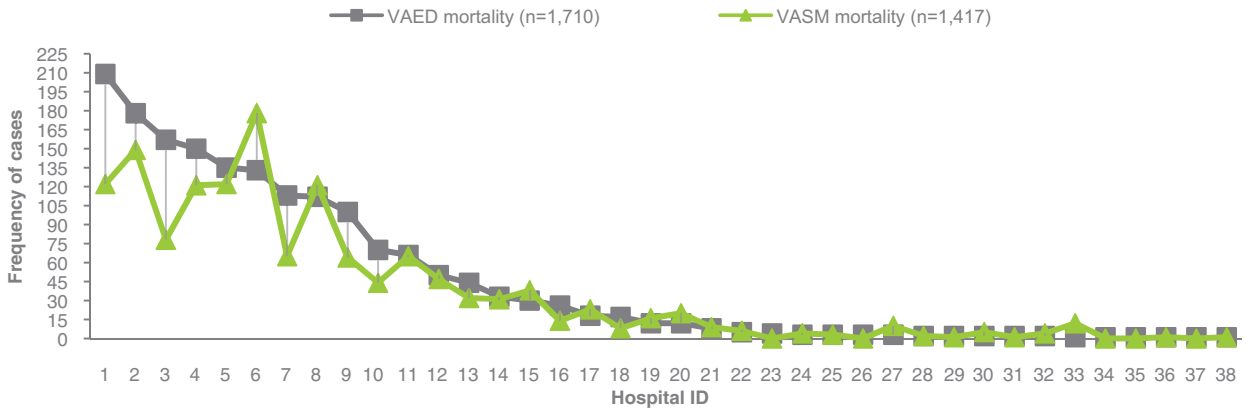
Figure 12: Comparison of mortalities reported by VAED and by VASM

VAED: Victorian Admitted Episode Dataset; VASM: Victorian Audit of Surgical Mortality.

Comments:

- The gap between the two sources has narrowed over the last few years from 66% in 2008–09 to 83% in 2010–2011. This is attributed to further recruitment of hospitals and increased participation and familiarity with the audit process among hospitals.
- Some hospitals experienced difficulties in reporting mortalities in a timely manner due to upgrades in their electronic health information systems.

Figure 13: Comparison of mortalities reported by VAED and by hospitals



ID: identifier; VAED: Victorian Admitted Episodes Dataset; VASM: Victorian Audit of Surgical Mortality.

Comments:

- This is a comparison of data collected between 1 July 2010 and 30 June 2011.
- Hospital identifier numbers have been de-identified in this analysis group, as they might identify hospitals.
- Over this time period, VAED data indicates there were 1,710 public hospital deaths that might be attributable to surgery, compared with the 1,417 (83%) deaths suggested by hospital notifications to VASM. VASM had an additional 159 mortalities reported from the private sector that were not included in this analysis as the collection time did not meet the full audit period analysis requirements.
- VAED also indicates that in a single year (2010–11) 277,422 patients received surgical care in the Victorian public hospital sector.
- It should be noted that the two methods of assessing mortality (hospital and VAED) have different sources and might therefore be considered as complementary rather than parallel.
- Hospitals where no mortalities occurred or where deaths have not been reported have been excluded from further analysis.

Key points

- There has been an increase in the percentage of eligible Victorian Fellows agreeing to participate in the audit between 2008 and 2011 (60% to 86%). Of these, 295 (32%) have adopted the new electronic interface to transfer data to VASM.
- 48% of participants have also agreed to be first or second-line assessors.
- The CRF return rate in 2011 remains constant at 76%.
- All Victorian public hospitals providing relevant surgical services are now participating and providing notifications of death.
- Recruitment of the private sector commenced in August 2010 and currently 80% of Victorian private hospitals have enrolled in the audit program.
- The gap between deaths reported to VASM and those recorded by VAED has narrowed.

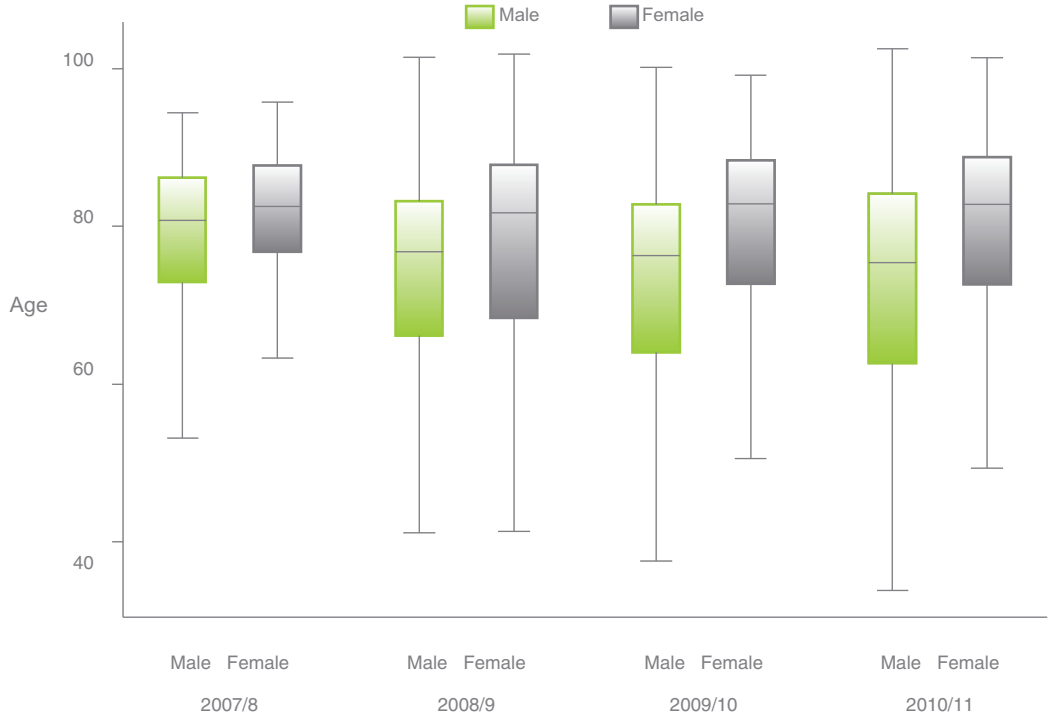
2.5. Demographic profile of audited cases

2.5.1 Age profile

Figures 14, 15, 16 and 17 are box and whisker plots in which:

- the central box represents the values from the lower to upper quartile (25–75 percentiles)
- the middle line represents the median value
- the vertical line extends from the minimum value to the maximum value, excluding outliers and extreme values - i.e. values larger than the upper quartile and plus 1.5 or 3 times the interquartile range (IQR).

Figure 14: Gender and age distribution of deceased as notified

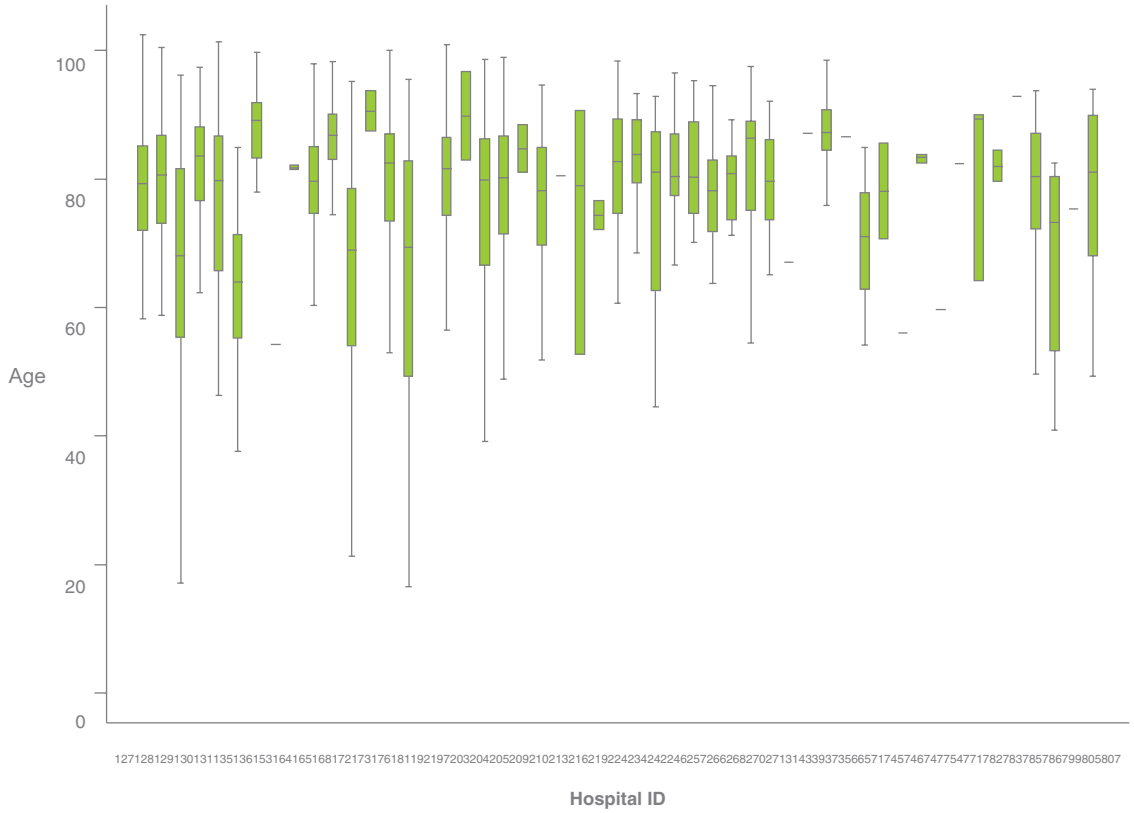


Notes: Total n=2,013.
Excludes outliers.

Comments:

- There were 2,013 audited cases with a mean (SD) age of 76 (18) years and a median (IQR) age of 80 (68–90) years. The age range varied from one day old to 102 years old.
- The median age for 954 (47%) females was 82 years compared to 76 for the 1,059 (53%) males, (p<0.01). Extreme values have not been displayed in Figure 14.
- This age and discharge summary profile is consistent with the aging general population.
- The high mean age of these patients indicates that surgical mortality predominantly occurs in the elderly.

Figure 15: Age distribution of deceased by hospital

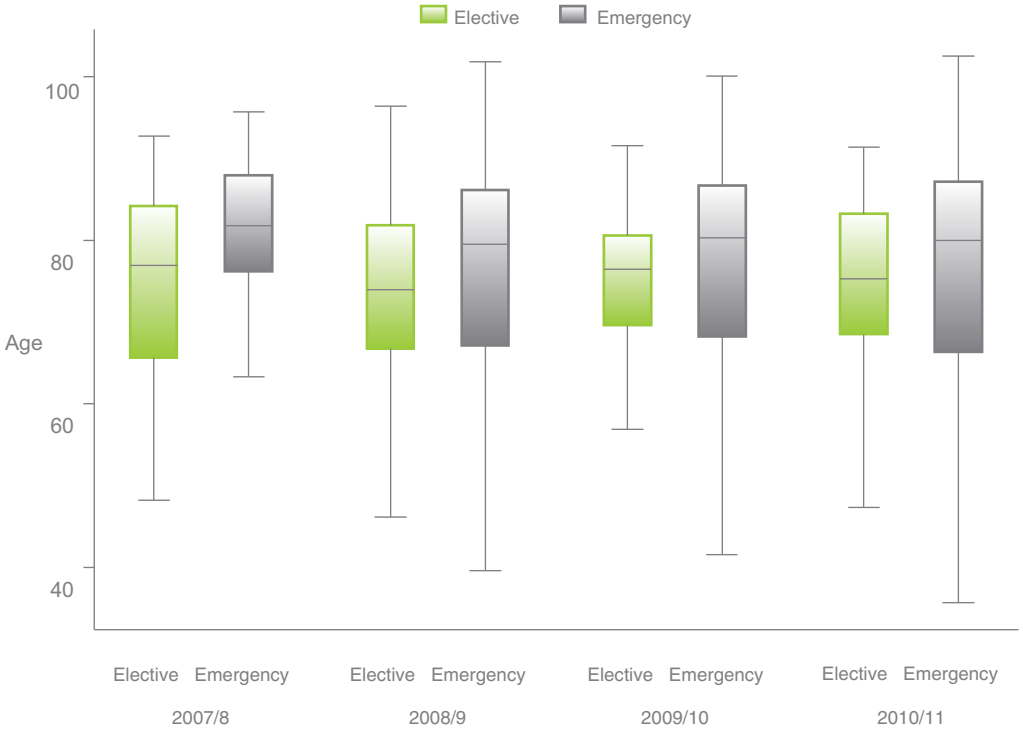


Note: Total n=2,013.
ID: identifier.

Comments:

- Extreme values have not been displayed in Figure 15.
- A thin horizontal bar indicates small patient numbers with a narrow age range.

Figure 16: Age distribution of deceased by admission status

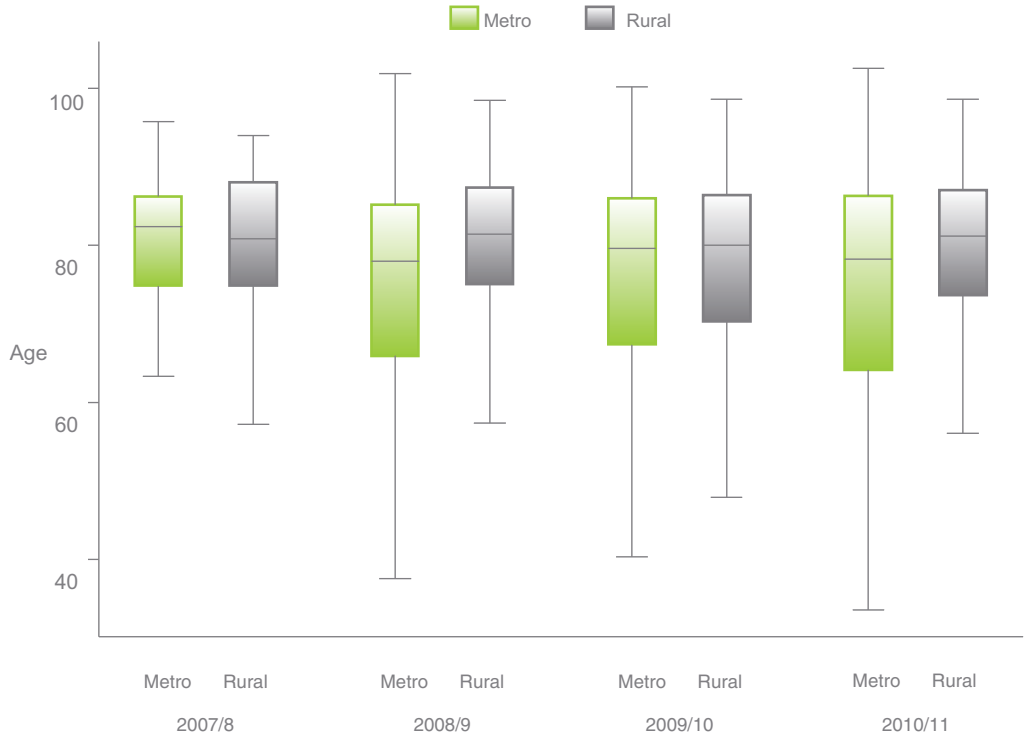


Note: Total n=2,013.
Missing data n=24(1%)

Comments:

- Extreme values have not been displayed in Figure 16.
- The age profile by admission status was similar across the audit period.
- The patients admitted as emergency cases (n=1,730, 86%) were significantly older than those admitted electively (n=259, 12%; $p<0.01$).
- A recent report on Australian hospitals emergency department care and elective surgery waiting times highlighted delays at the patients initial presentation for acute conditions, "potentially avoidable GP-type presentations accounted for almost 39% of all presentations to emergency department in hospitals within major cities".[3]

Figure 17: Age distribution of deceased by region

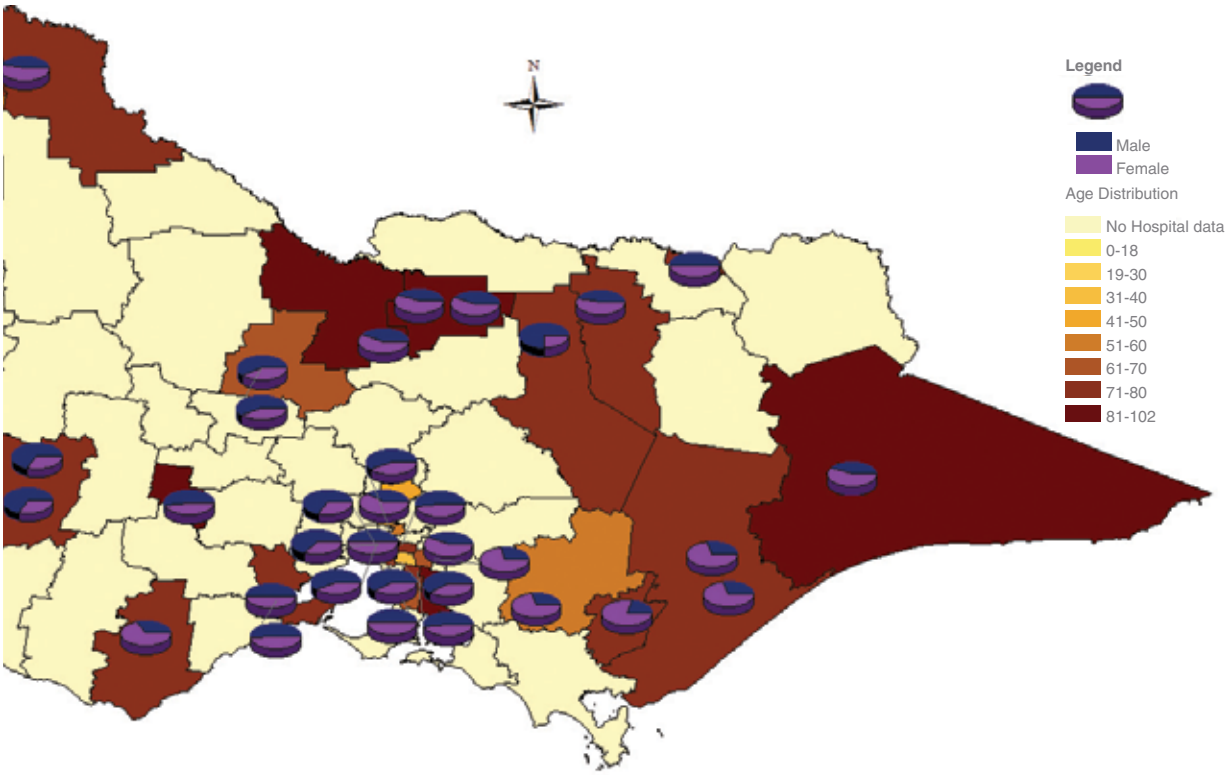


Note: Total n=2,013.
Metro: Metropolitan

Comments:

- Extreme values have not been displayed in Figure 17.
- The median age for rural and metropolitan areas was similar - 81 and 79 years respectively.

Figure 18: Age and gender of deceased by Local Government Area



Note: Total n=2,013.
Metro: Metropolitan

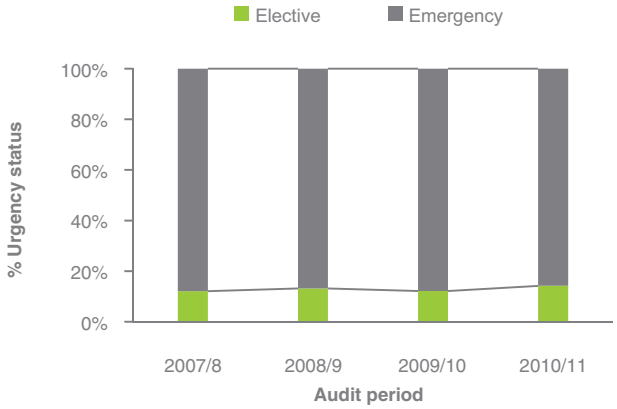
Comments:

- Figure 18 is a pictorial view of the gender and mean age distribution of reported deaths by Local Government Area (LGA). The points displayed represent the male female ratio per hospital and have been placed in their relevant LGA. Individual points do not indicate where a death occurred, only the LGA in which death occurred.
- Only LGAs where a surgical death has occurred have data points or shading.

2.5.2 Urgency status of patients

The urgency status of a patient records whether that patient was admitted electively or as an emergency for an acute condition (see Figure 19).

Figure 19: Urgency status of deceased over sequential audit periods

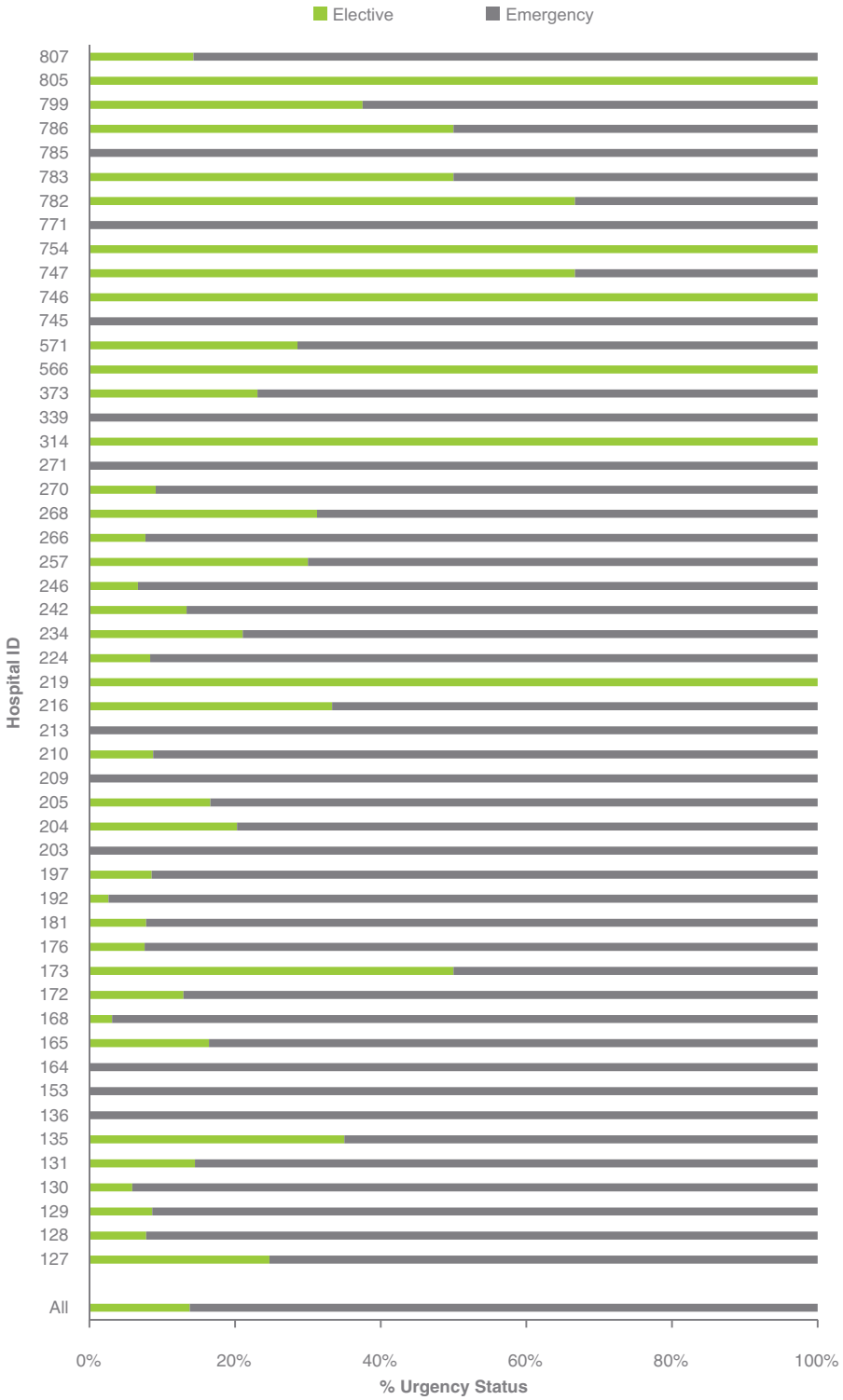


Note: Total n=2,013.
Missing data n=24 (1%).

Comments:

- The high percentage (86%) of patients admitted as emergencies with acute conditions has been constant over time.
- The larger distribution of emergency cases versus elective makes it difficult to compare clinical data among the two groups.
- The majority of audited deaths occurred in patients admitted as an emergency for an acute condition.
- A recent Western Australian study on hospital and emergency department use in the last year of life, found that "seventy per cent of the 1,071 decedents had at least one emergency presentation".[4]

Figure 20: Urgency status of deceased by hospital



Note: Total n=2,013.

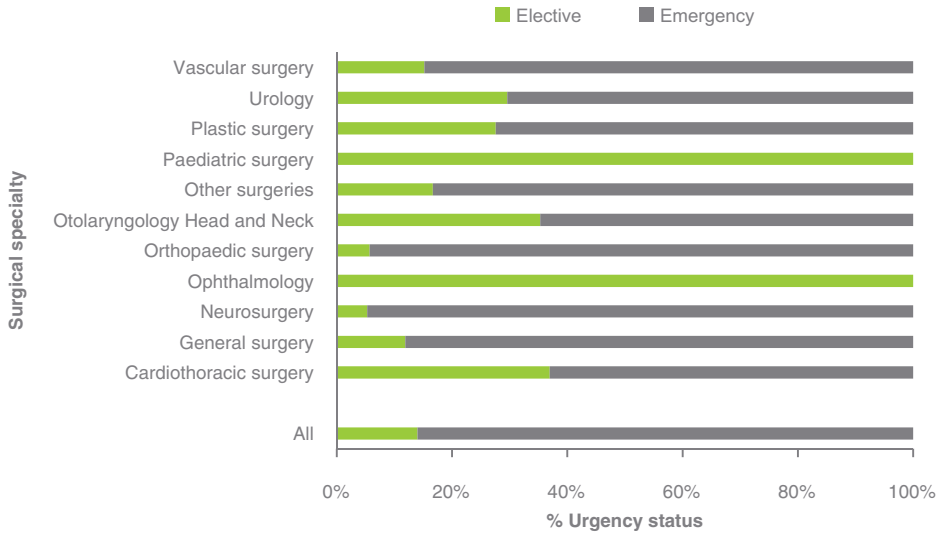
ID: identifier.

Missing data n=24 (1%).

Comments:

- The proportion of audited cases admitted as emergencies varied among hospitals. Some hospitals do not have emergency departments and provide very limited access for emergency services.
- This high rate of emergency admissions is similar among states and territories.(1)
- In a report by the Australian Institute of Health and Welfare, there were “almost 6.2 million emergency department presentations to major public hospitals. Between 2009-10 and 2010-2011, emergency department presentations increased in all states and territories”.(3)

Figure 21: Urgency status of deceased by surgical specialty

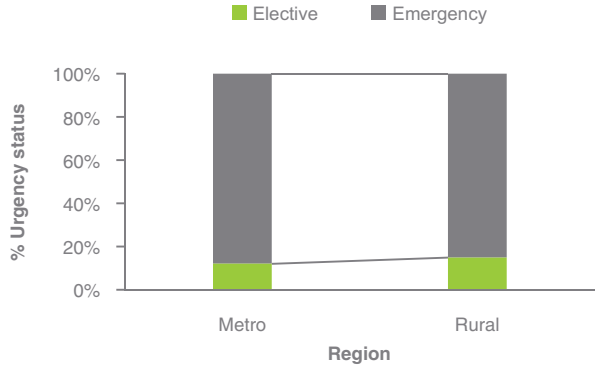


Note: Total n=2,013.
Missing data n=24 (1%).
'Other surgeries' includes trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The proportion of audited cases admitted as emergencies varied among specialties.
- In some instances this is a reflection of the expected casemix of the individual specialties.

Figure 22: Urgency status of deceased by region



Note: Total n=2,013.
Missing data n=24 (1%).
Metro: Metropolitan

Comments:

- The urgency profile was similar across rural and metropolitan hospitals.

Key points

- Eighty-six per cent of deaths in this audited series occurred in patients who were admitted as emergencies with acute conditions.
- The high mean age of these patients indicates that surgical mortality occurs predominantly in the elderly.

2.6. Risk profile and cause of death in audited cases

The following section reviews the risk profile of audited cases. This includes the American Society of Anesthesiologists (ASA) status, reported comorbidities and a surgeon's perception of risk of death.

2.6.1 ASA status of patients

The ASA physical status is an international measure of patient risk used by anaesthetists.[5]

ASA grade characteristics:

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

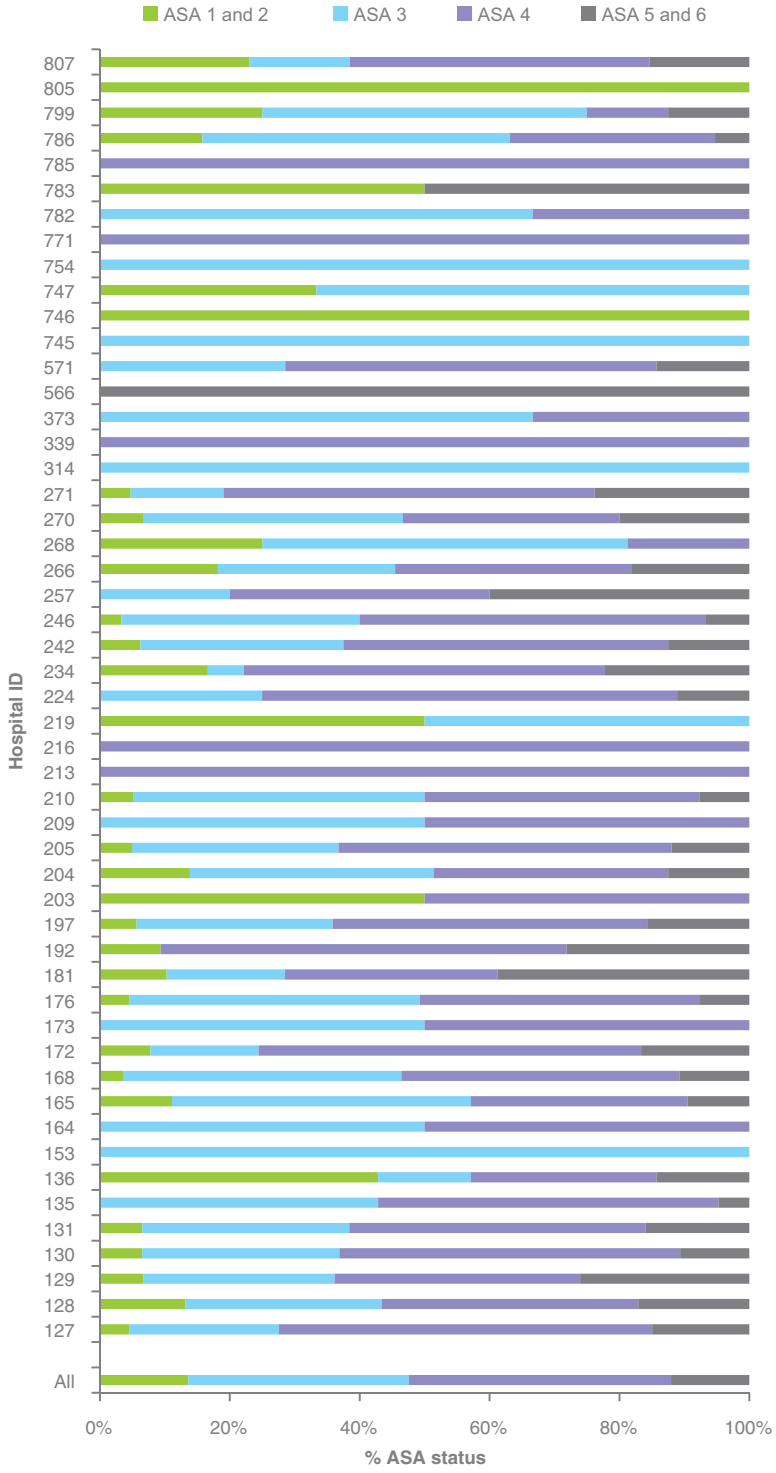
Figure 23: ASA grades of deceased over sequential audit periods

ASA: American Society of Anesthesiologists.
Note: Total n=2,013.
Missing data n=81 (4%).

Comments:

- The preponderance of moderate and high ASA grades has been consistent over time.
- The frequency of high ASA grades suggests most deaths have occurred in patients assessed as high risk by the anaesthetic team. The distribution of ASA grades has remained relatively constant over time.
- It is perceived the casemix managed in the private sector is different, with a greater preponderance of younger, fitter patients. Any impact due to this will not be seen for a few years when more data from the private sector has been collected.

Figure 24: ASA grades of deceased by hospital

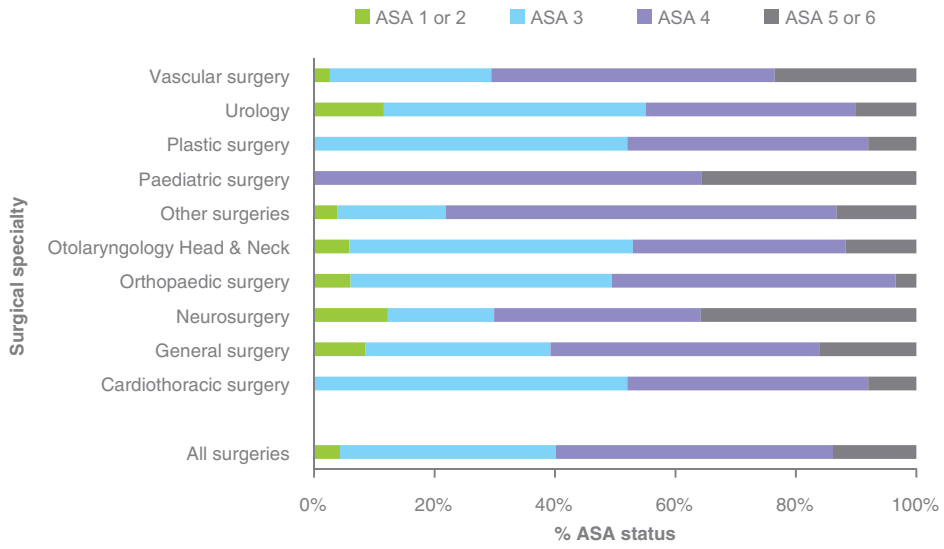


Note: Total n=2,013.
Missing data n=81 (4%).
ASA: American Society of Anaesthesiologists; ID: identifier.

Comments:

- ASA status varies among hospitals and may be a reflection of their individual casemix.

Figure 25: ASA grades of deceased by surgical specialty



Note: Total n=2,013.
Missing data n=81 (4%).
ASA: American Society of Anaesthesiologists.
'Other surgeries' include trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The variation in severity of ASA grades among specialties is a reflection of the risk profile inherent in their casemix.

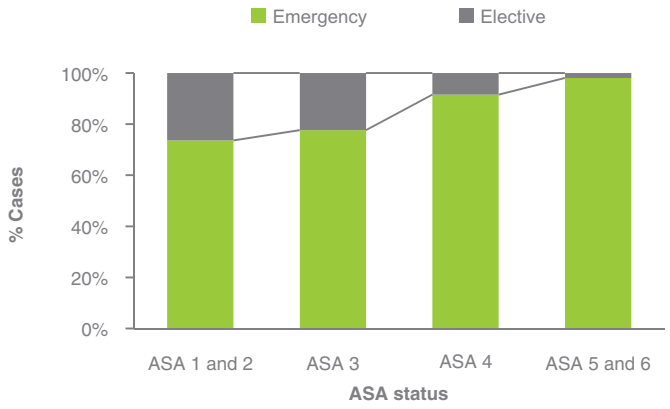
Figure 26: ASA grades of deceased by region

Note: Total n=2,013.
ASA: American Society of Anaesthesiologists; metro: metropolitan.
Missing data n=81 (4%).

Comments:

- This figure demonstrates a high mean ASA grade in both rural and metropolitan regions. It again suggests that the majority of deaths occurred in patients with significant comorbidity.

Figure 27: ASA grades of deceased by urgency status



Note:Total n=2,013.
Missing data n=44 (2%).
ASA: American Society of Anaesthesiologists.

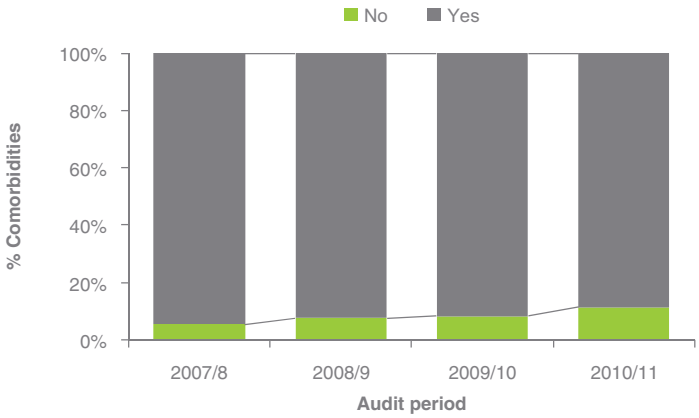
Comments:

- A high proportion of emergency admissions had ASA grades 4, 5 or 6. This could be expected, as elective cases with ASA 4, 5 or 6 often do not proceed to surgery when risk versus benefit is considered.[6]
- Cases with an ASA≥4 were significantly (p<0.01) more likely to be referred for SLA (full case note review). The reason for this is not obvious (data not shown in Figure 27).

2.6.2 Comorbidities

Comorbidity describes coexisting medical conditions or disease processes that are additional to the primary diagnosis.

Figure 28: Prevalence of comorbidities over sequential audit periods

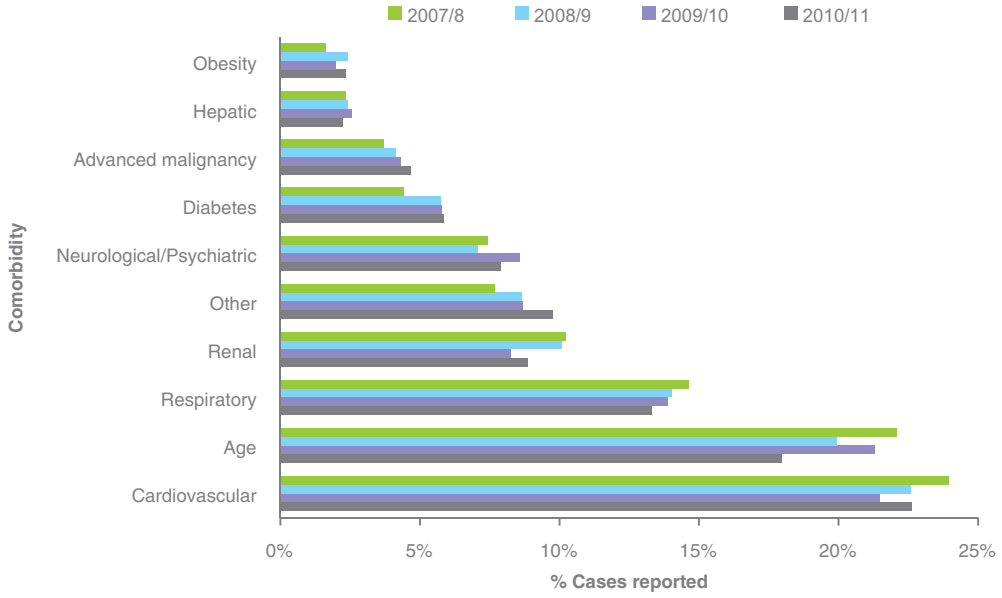


Note: Total n=2,013.
Missing data n=16 (<1%).

Comments:

- The majority of the audited cases (2,013) were reported to have had comorbidities (1,828; 91%). This high rate was consistent across the audit periods.
- There were 5,614 comorbidities reported in the 2,013 cases that had completed review.
- The apparent small increase in deaths without associated morbidity in 2010–11 was not statistically significant (p=0.1) compared with other audit periods.

Figure 29: Prevalence of individual comorbidities over sequential audit periods

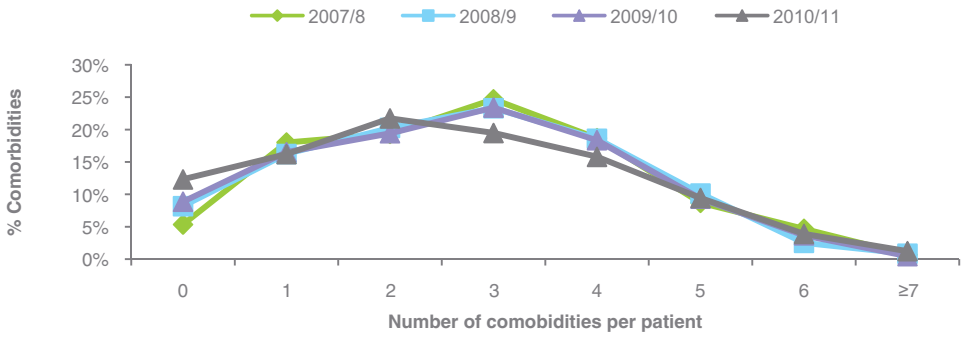


Note: Total number of comorbidities was 5,614 in 2,013 patients.
Missing data n=185 (4%) from the pool of total comorbidities.

Comments:

- The comorbidity profile associated with audited deaths appeared to have been similar across metropolitan and rural regions (data not shown in figure 29) and has remained constant over time.
- The most common risk factors notified were cardiovascular (1,254; 22%), age (1,127; 20%), respiratory problems (778; 14%) and renal (517; 9%) and these have remained similar overtime.
- This profile is similar to that reported in the 2010 ANZASM National Report.[1]
- The 'other' comorbidity category includes factors such as alcohol abuse, dementia, anorexia, malnutrition, chronic lymphatic leukaemia, chronic mesenteric ischaemia, coagulopathy, haemophilia, Crohn's disease, drug abuse, rheumatoid arthritis, epilepsy, extreme prematurity, Jehovah's Witness refusing transfusion, leukaemia, myelofibrosis, osteoporosis, scleroderma, thyrotoxicosis and spina bifida.

Figure 30: Frequency of multiple comorbidities in individual patients over sequential audit periods

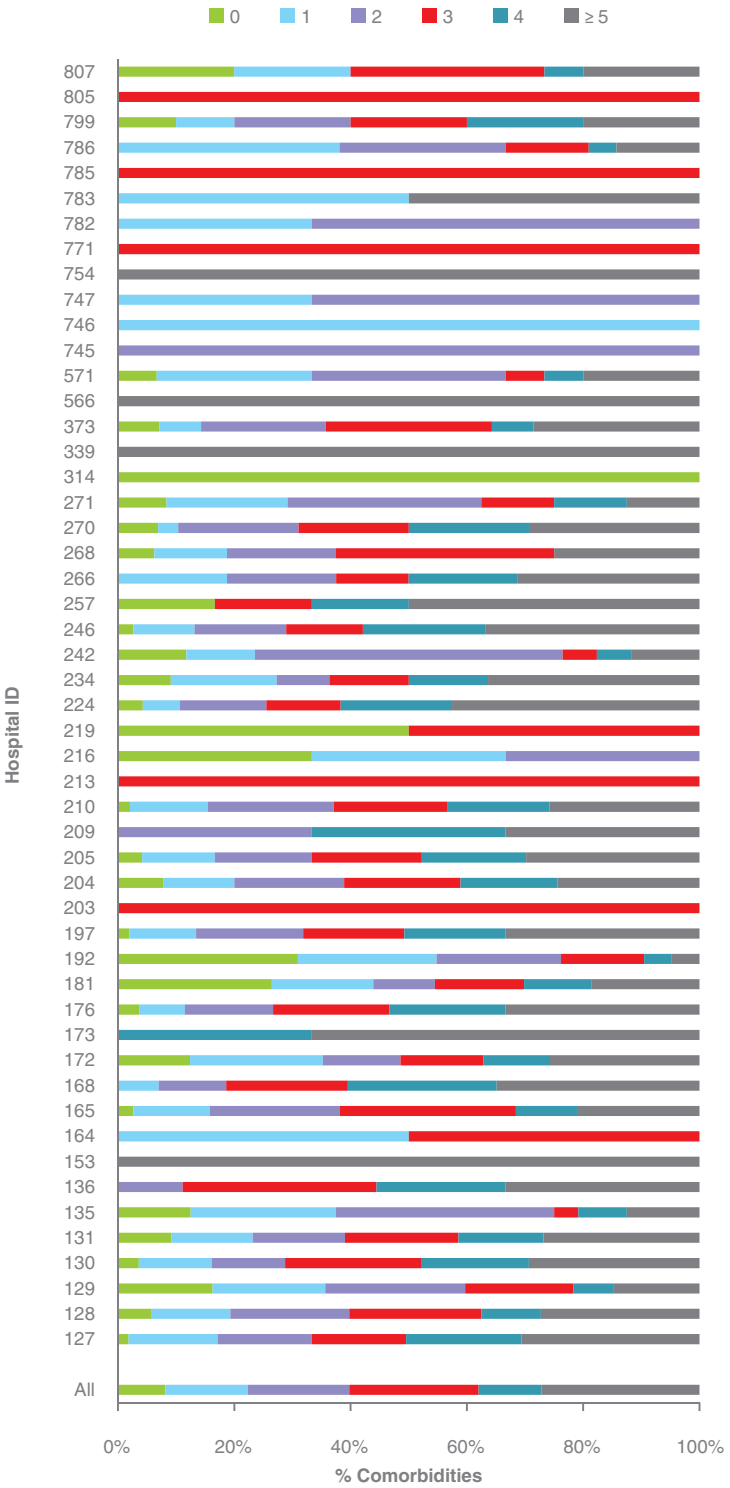


Note: Total number of comorbidities was 5,614 in 2,013 patients.
Missing data n=16 (<1%).

Comments:

- In this audited series, 1,828 (91%) cases were reported to have some comorbidity, with a mean of three comorbidities reported per patient.
- This reflects the presence of significant pre-existing illness in this cohort of deaths.

Figure 31: Frequency of comorbidities reported by hospitals



Note: Total n=2,013.
Missing data n=16 (<1%).
ID: identifier.

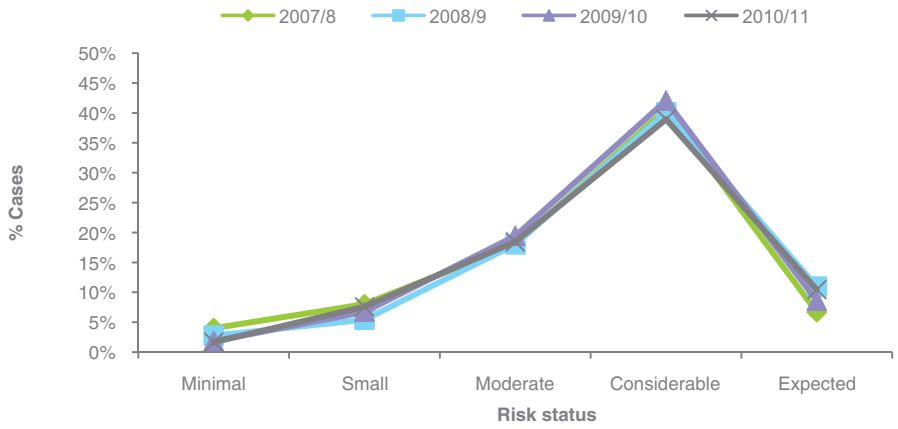
Comments:

- Figure 31 shows the comorbidity profile in surgical deaths across hospitals.
- The incidence of reported comorbidity varied among hospitals.

2.6.3 Surgeon's perception of risk status

Treating surgeons are asked to record their perception of risk of death of their patient at the time of treatment.

Figure 32: Surgeon's perception of risk of death over sequential audit periods

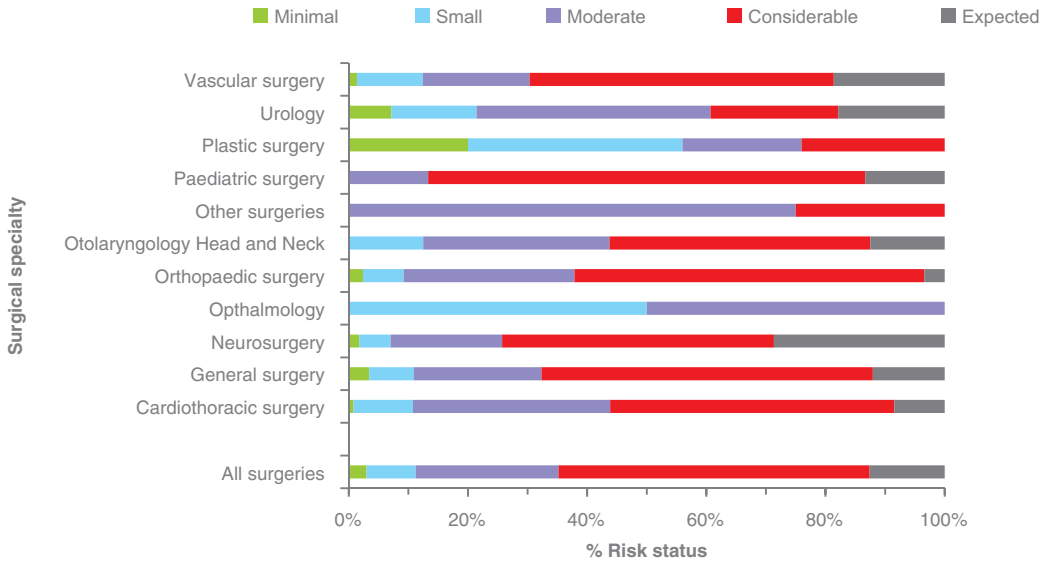


Note: Total n=2,013.
Missing data n=450 (22%).

Comments:

- The treating surgeon assessed the risk of death as considerably high in the majority of cases. This remained constant over time.
- The overall perception of risk of death by hospital as identified by surgeons was similar to the aggregate findings and reflective of the risk profile associated with the casemix of the individual hospital (data not shown in Figure 32).
- This supports the high risk profile suggested by the mean age, ASA score and associated comorbidity.

Figure 33: Surgeon's perception of risk of death by surgical specialty

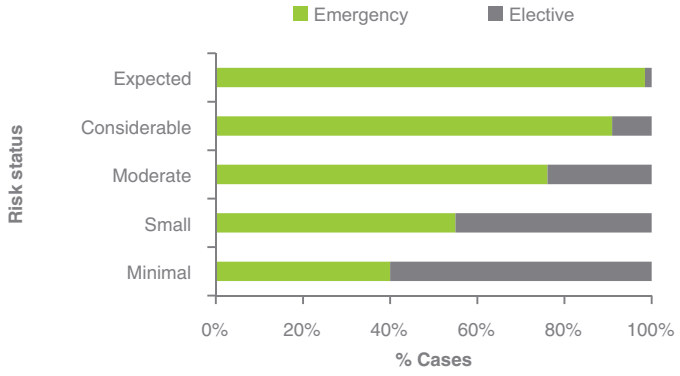


Note: Total n=2,013.
Missing data n=450 (22%).
'Other surgeries' include: trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The surgeon's perception of risk of death among surgical specialties was similar to the aggregate findings.
- In cardiothoracic surgery, general surgery, orthopaedic surgery, neurosurgery, urology and areas of paediatric surgery, surgeons perceived a higher risk of death than in other specialties. For example, cardiothoracic surgery patients would have serious heart conditions, with generally poor health and at greater risk of complications following surgery.[7]

Figure 34: Surgeon's perception of risk of death by admission status

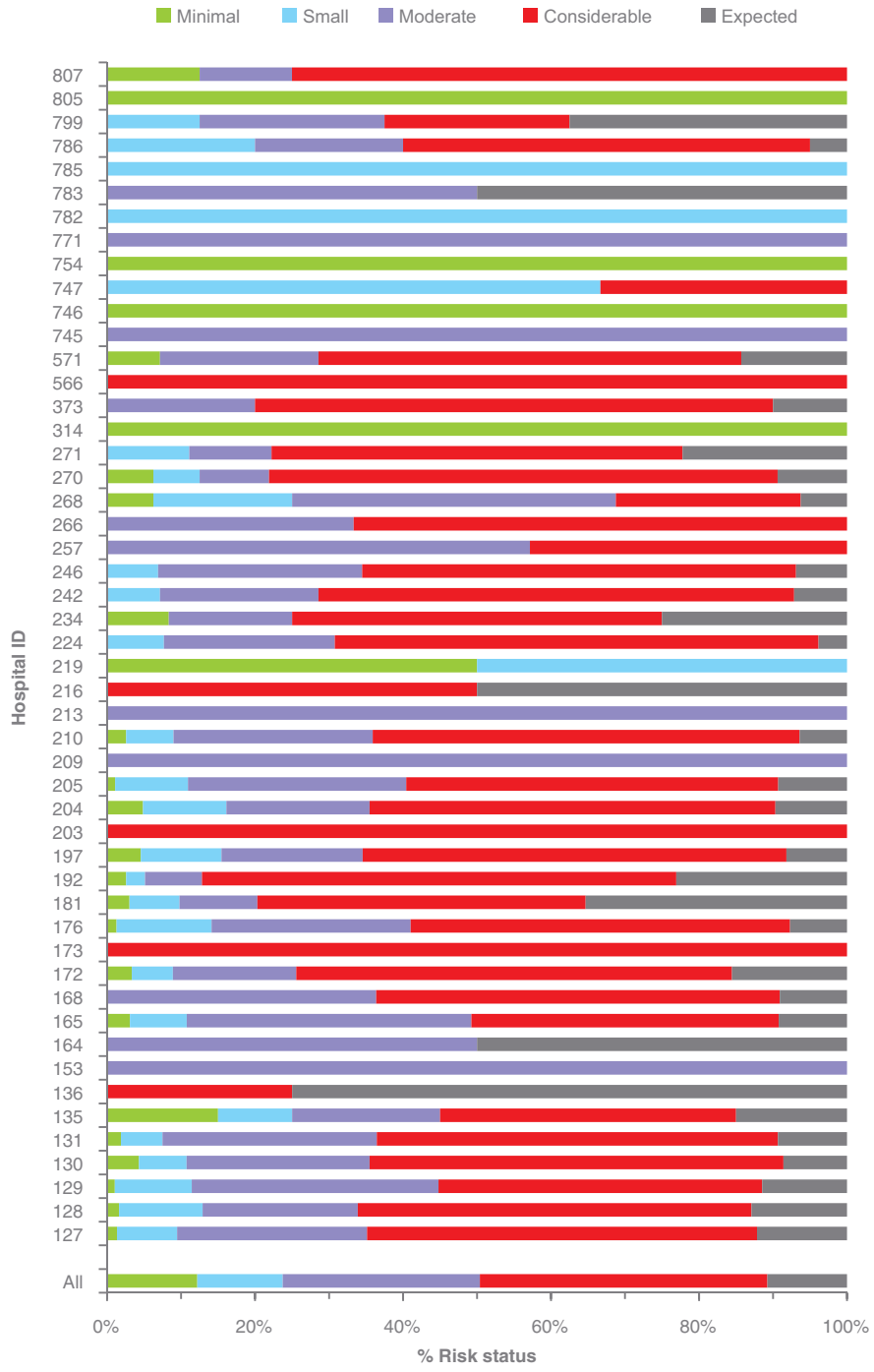


Note: Total n=2,013.
Missing data n=450 (22%).

Comments:

- Patients admitted as an emergency were perceived to be at a significantly greater risk of death than elective admissions ($p<0.001$).
- In a Victorian study, Acute Myocardial Infarction (AMI) and cerebrovascular disease (CEVD) were identified as potentially increasing the risk of suffering an adverse event in patients with comorbidities admitted as emergency patients in comparison to patients without any comorbidities.[6]
- It is to be expected that elective patients will have a lower perceived risk of death.

Figure 35: Surgeon's perception of risk of death by hospital

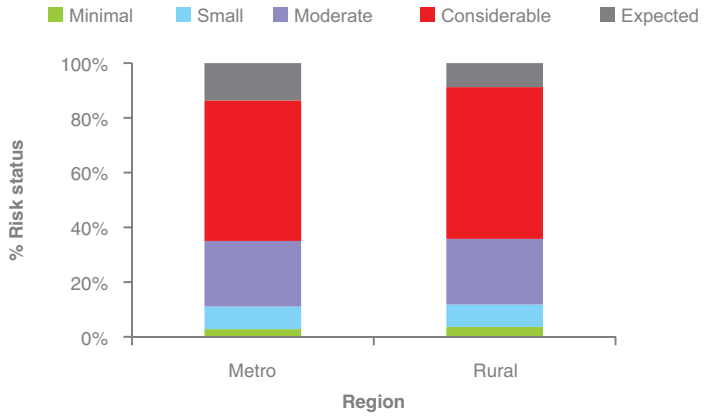


Note: Total n=2,013.
Missing data n=450 (22%).
ID: identifier.

Comments:

- The overall perceived risk of death in this series was high, with variances as expected between hospitals with differing casemix.
- The surgeon's perception of risk of death by hospital was similar to the aggregate findings and reflective of the risk profile associated with the casemix of the individual hospital.

Figure 36: Surgeon's perception of risk of death by region



Note: Total n=2,013.
Missing data n=450 (22%).
Metro: Metropolitan

Comments:

- The treating surgeon's perception of risk was similar among metropolitan and rural hospitals.

Key points

- The clinical risk profile of this audited series confirms that the majority of deaths have occurred in patients perceived to have a low possibility of surviving their current illness.
- Ninety-one per cent of patients had at least one pre-existing illness affecting their chance of recovery. The most frequent conditions cited were cardiovascular and respiratory.
- These findings are not surprising when considering the high mean age of patients in the series.

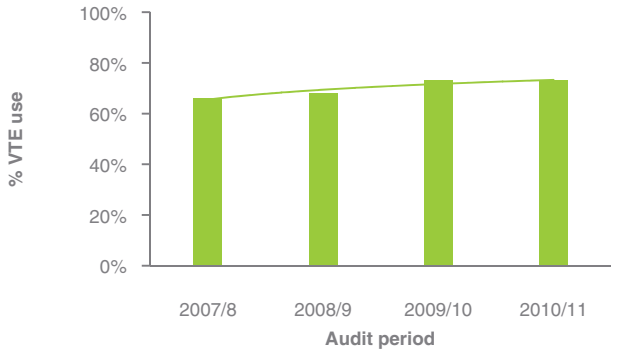
2.7. Risk management strategies

The following sections document application of clinical risk minimisation strategies.

2.7.1 Prophylaxis for venous thromboembolism

The treating surgeon has to record if venous thromboembolism (VTE) prophylaxis was given and what type of prophylaxis was actually used.

Figure 37: VTE prophylaxis use during the audit period

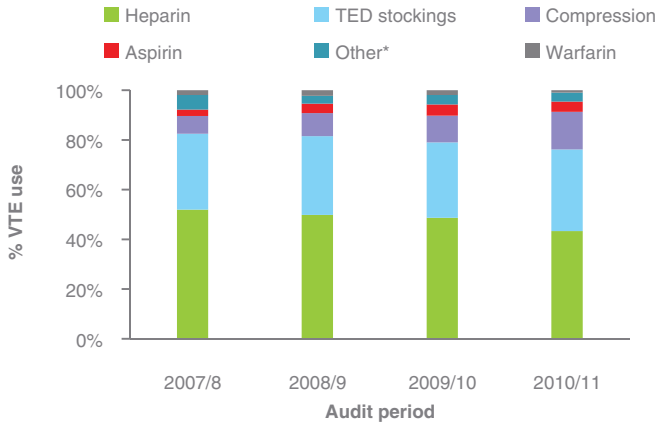


Note: Total n=2,013.
Missing data n=64 (3%).
VTE: venous thromboembolism.

Comments:

- The use of VTE prophylaxis has risen slightly from 68% in 2008 to 73% in 2010–11 (p=0.08).
- The use of VTE prophylaxis is similar among metropolitan and rural sectors and in elective and emergency cases (data not shown in Figure 37).

Figure 38: Type of VTE prophylaxis used

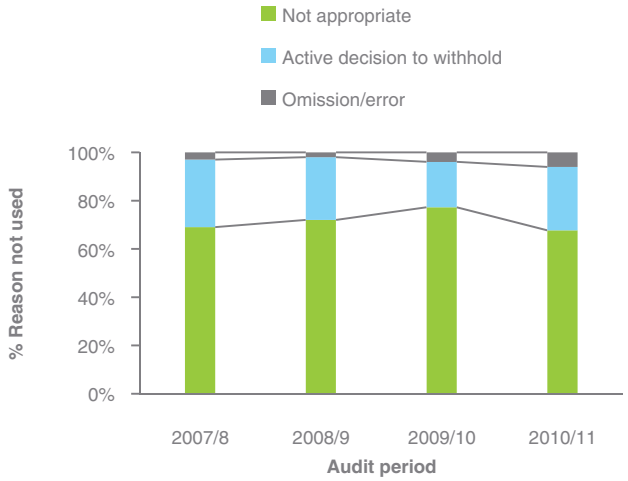


TED: Thrombo Embolic Deterrent stockings; VTE: venous thromboembolism.
Note: Total n=2,013.
Missing data n=64 (3%).
'Other' prophylaxis included calf stimulators, Clexane, Fragmin, clopidogrel, enoxaparin, epidural, full anticoagulation for non-ST segment elevation myocardial infarction, and inferior vena cava filter and infusion.

Comments:

- The spectrum of VTE prophylaxis used has been consistent over time.
- There was no difference between metropolitan and rural sectors (data not shown in Figure 38).

Figure 39: Reasons given by treating surgeon for not providing VTE prophylaxis

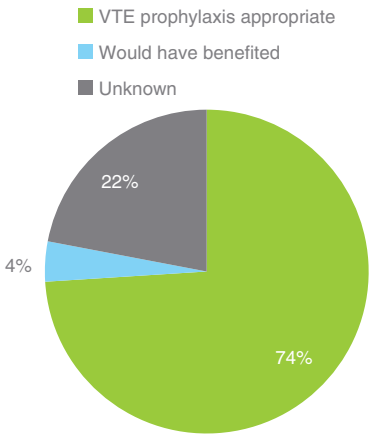


Note: Number of patients not receiving prophylaxis was 527 in a total of 2,013 patients.
Missing data n=64(3%).
VTE: Venous thromboembolism.

Comments:

- Overall, 527 (26%) of the 2,013 audited patients received no prophylaxis.
- In the majority of these cases this was a conscious decision by the treating team. The inadvertent omission rate has remained low at 3% during the audit period.

Figure 40: Assessor perception of appropriateness of decision to withhold VTE prophylaxis



Note: Number of patients not receiving prophylaxis was 527 in a total of 2,013 patients.
Missing data n=182 (9%).
VTE: Venous thromboembolism.

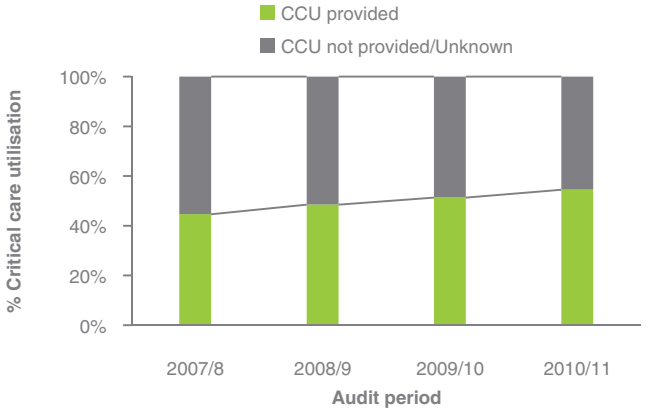
Comments:

- Assessors are asked to comment on the appropriateness of withholding prophylaxis.
- Assessors felt the decision to withhold on clinical grounds was appropriate in the majority (74%) of cases.
- In only 4% of cases assessors felt that patients who did not receive VTE prophylaxis would have benefited from it.
- In 379 cases where VTE data was available and where a first-line assessment (FLA) and second-line (SLA) had been performed, the findings were compared. Agreement between first and second-line assessors on appropriateness was fair 68% (kappa score 0.22).

2.7.2 Adequacy of provision of critical care support to patients

The treating surgeon is asked to record if their patient received critical care support before or after surgery. The first and second-line assessors review the appropriateness of the use of critical care facilities for patients.

Figure 41: Provision of critical care support during the audit period

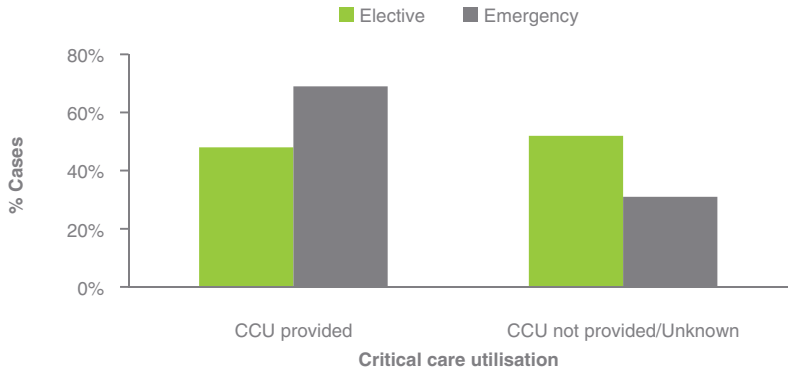


Note: Total n=2,013.
CCU: Critical care unit.
Missing data n=645(32%).

Comments:

- This question was reframed in 2010 to make it more informative and reduce the amount of missing data.
- Fifty-one per cent of the cases (1,019 of 2,013) received critical care support during their inpatient stay.
- The utilisation of critical care support has significantly increased from 45% in 2008 to 54% in 2010–11 (p<0.001).

Figure 42: Provision of critical care support by admission type

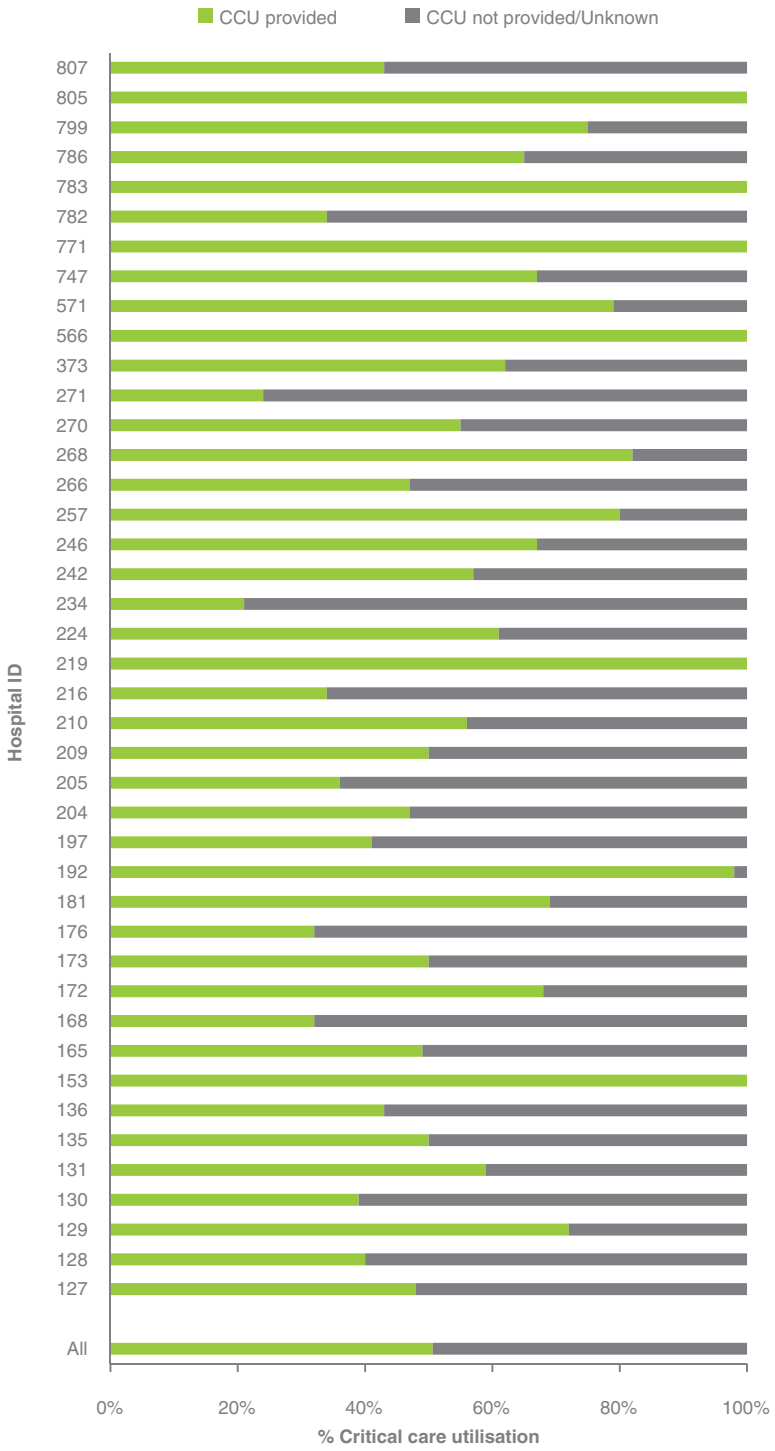


CCU: critical care unit.
Note: Total n=2,013.

Comments:

- Use of, and need for, critical care is higher in emergency cases.

Figure 43: Provision of critical care support by hospital

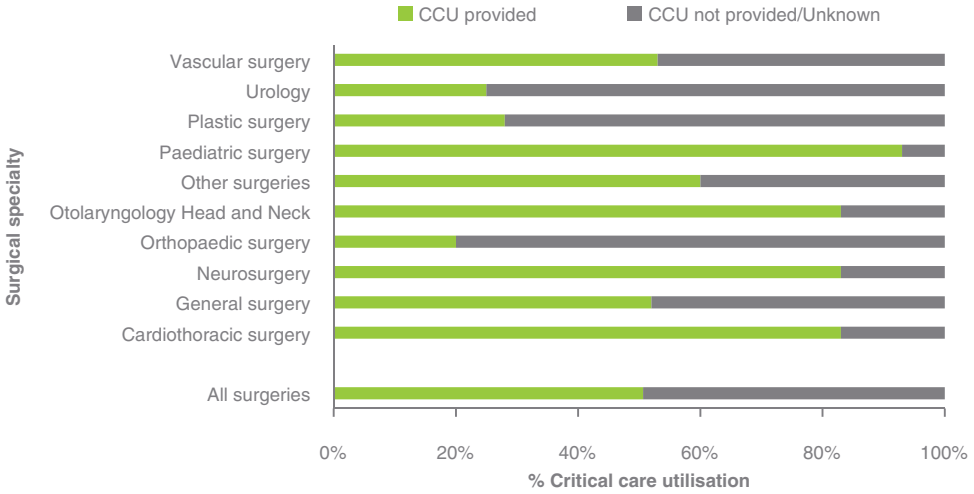


Note: Total n=2,013.
CCU: critical care unit; ID: identifier.

Comments:

- It should be acknowledged that not all hospitals have critical care services and therefore triage patients accordingly.
- There is no difference in the provision of critical care support between metropolitan and rural regions (data not shown in Figure 43).

Figure 44: Provision of critical care support to patients by specialty



Note: Total n=2,013.

Other surgeries include trauma, transplant, oncology, obstetrics and gynaecology.

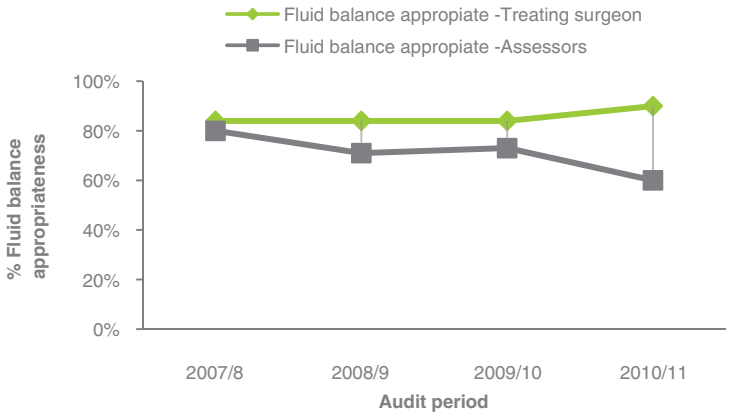
CCU: Critical care unit.

Comments:

- Similar to previous years, orthopaedic patients have low referral rates for critical care support. This is again postulated to be due to the high number of elderly patients with fractured necks of femur admitted from high-level care institutions.
- The treating surgeon perceived that lack of provision of critical care support to their patients was potentially an issue in only a very small percentage (1%) of their cases.
- The peer-review process (FLA and SLA) suggested that only 7% of patients who did not receive critical care support would likely have benefited from critical care support (data not shown in Figure 44).

2.7.3 Issues with fluid balance

Figure 45: Perception of fluid balance appropriateness



Note: Total n=2,013.
Missing data n=95 (5%).

Comments:

- The treating surgeon and all assessors are asked to comment on the appropriateness of fluid balance during the episode of care.
- Across the audit period from 2008 to 2011 in 86% of 2,013 audited cases the treating surgeon felt that fluid balance had been managed appropriately by their clinical team.
- The assessors made no adverse comment on fluid balance management in 71% of the audited cases. This gap between appropriateness of perception of fluid balance between treating surgeon and assessor appears to be widening.
- Fluid balance was assessed as inappropriate by first and second-line assessors in a very small number of cases (20 (5%) of the 379 combined assessment pool cases).
- From a recent study on the interaction between fluid balance and disease severity of critically ill patients, it was found that “early adequate fluid resuscitation together with conservative late fluid management may provide better patient outcomes”.[9]

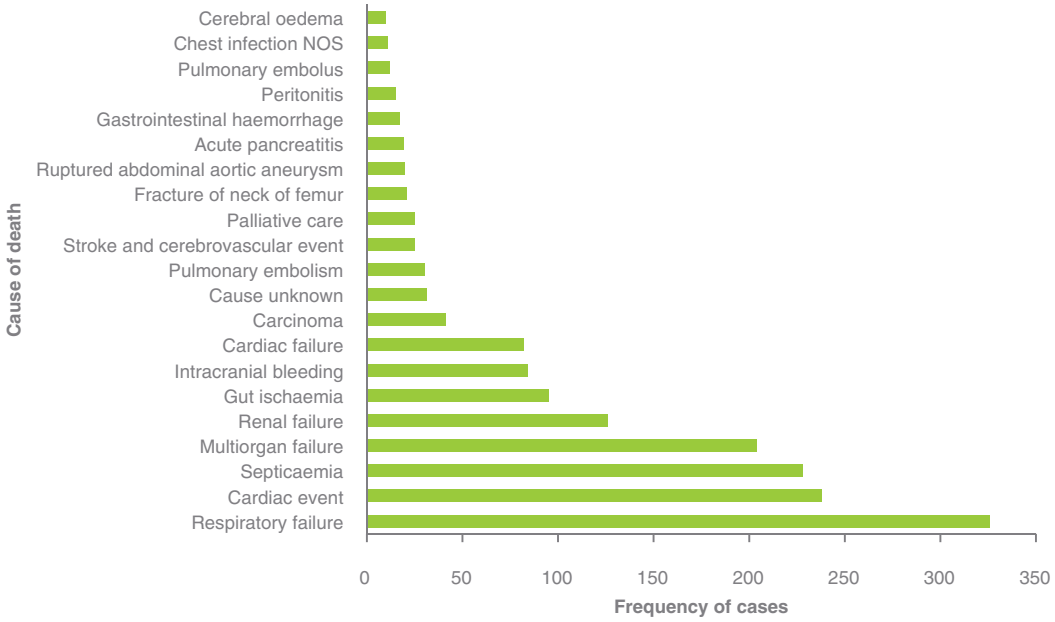
Key points

- It is important that surgical patients receive VTE prophylaxis where appropriate. The provision of VTE prophylaxis has improved, with some form of VTE prophylaxis being provided in 86% of cases. Inadvertent omission of prophylaxis was rare, only occurring in 3% of cases.
- In the majority of cases where VTE prophylaxis was withheld, the assessor agreed with the decision.
- In total 1,019 (51%) of patients in this audited series received critical care support during the clinical course of their illness. In the majority of instances, those who were perceived to have been likely to benefit from critical care support received it.
- There was a perception by assessors that only 7% of the cases who did not receive critical care support might have benefited from such support. The first-line assessors perceived this to be the case in a smaller percentage.
- Assessors have provided some criticism of fluid balance management.

2.8. Causes of death reported in audited cases

The treating surgeon records the probable cause of death as evidenced by the clinical features leading up to death.

Figure 46: Frequency of reported causes of death



Note: Total n=2,013.

Cause of death have been included in this graph if the total count was ≥10

Comments:

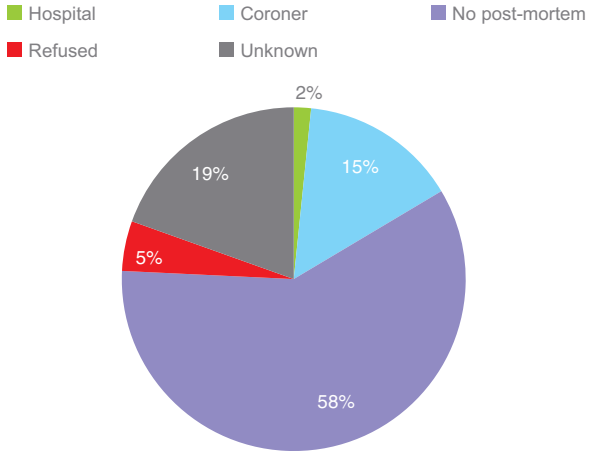
- A total of 2,307 conditions were perceived to be responsible for death in 2,013 cases.
- The most frequently cited causes of death were respiratory failure (326, 16%), cardiac factors including heart failure, cerebrovascular incident, ischaemic heart disease, cardiorespiratory failure and cardiogenic shock (238, 12%), septicaemia (228, 11%) and multiorgan failure (204, 10%). Death was attributed to these conditions in approximately half (996) of the 2,013 cases.
- Other causes for death were reported, however as the individual frequencies of each in the remainder were less than ten these have not been listed.

2.9. Establishing the cause of death

The cause of death recorded by the treating surgeon is based on the clinical course of the patient and any relevant supporting evidence from investigations. Where doubt exists around the circumstances leading to death, the case will be referred to the coroner. In other instances, where the cause of death is not clear, a post-mortem examination may be requested. This latter method of confirming cause of death is requested with decreasing frequency.

2.9.1 Post-mortem rate

Figure 47: Post-mortem utilisation



Note: Total n=2,013.
Missing data n=37 (2%).

Comments:

- The number of post-mortems performed, including coronial ones, was very low at 325 (17%) instances in 2,013 cases. This may be of concern to some as post-mortems are deemed to provide educational information and valuable insights.
- The pattern of referral to the coroner or request for post-mortem was similar for elective and emergency admissions (23% in elective and 15% in emergency cases - data not shown in Figure 47).
- There was no difference in referral pattern by hospital, region or admission type (data not shown in this graph).
- The majority of post-mortems were coronial and occurred in deaths associated with emergency admissions.

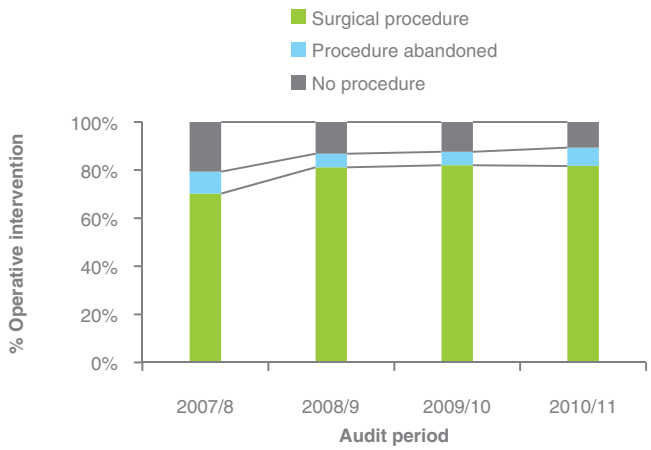
Key points

- Cardiac failure and respiratory failure have been cited as the most frequent causes of death. This is congruent with the risk profile described for this series of patients.
- These reasons for death are based on the clinical course to death.
- The low rate of post-mortems does not allow confirmation of these diagnoses.

2.10. Profile of operative procedures

The following section examines the frequency and timing of surgical procedures, the seniority of the surgeon performing them and the need for reoperation.

Figure 48: Operative procedures performed

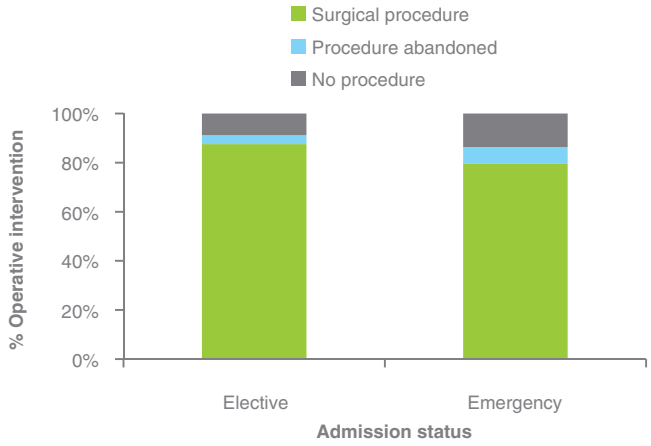


Note: Total n=1,687.
Missing data n=273 (16%).

Comments:

- A total of 1,687 (84%) audited cases underwent a surgical procedure.
- There was no significant change since 2008 in the rate of operative intervention over the audit period.

Figure 49: Operative intervention by urgency type

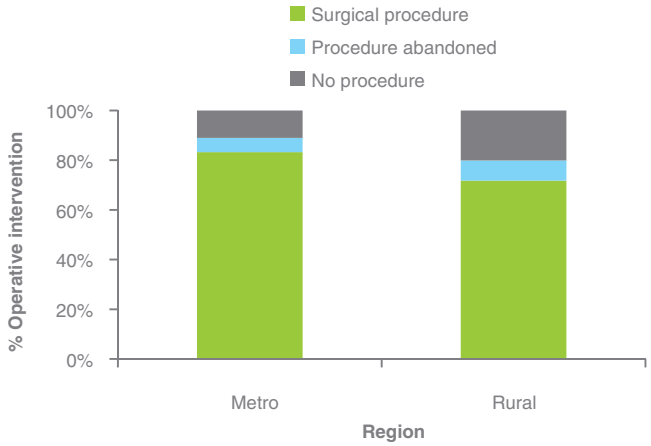


Note: Total n=1,687.
Missing data n=273 (16%).

Comments:

- Patients admitted as elective admissions and who subsequently died had a higher rate of operative intervention than those admitted as emergencies ($p<0.001$). This is not unexpected as most elective admissions to a surgical unit are for an operative procedure.
- Sometimes during surgery it is deemed inappropriate to continue with the procedure as there is no prospect of even short-term survival of the patient due to the extent of the disease process. This was necessary in a very low percentage of the audited cases (117, 7%).
- Deaths where no operative intervention occurred were more frequently associated with emergency admissions. In such cases there was usually an active decision not to operate.

Figure 50: Operative intervention by region

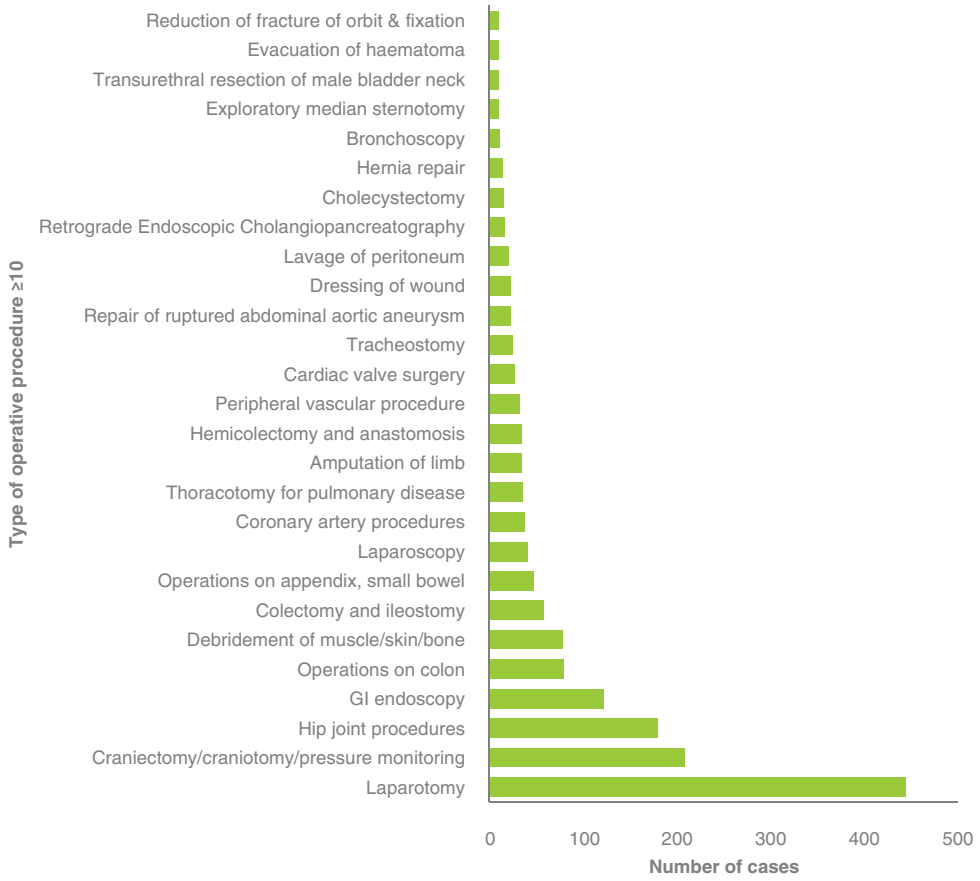


Note: Total n=1,687.
Missing data n=273 (16%).
Metro: Metropolitan

Comments:

- Death was more often associated with operative intervention in metropolitan areas compared to rural (p<0.01).
- The reason for this is not obvious, but could be due to sicker patients requiring complex surgery being referred to and managed in metropolitan hospitals.

Figure 51: Frequency of individual surgical procedures reported

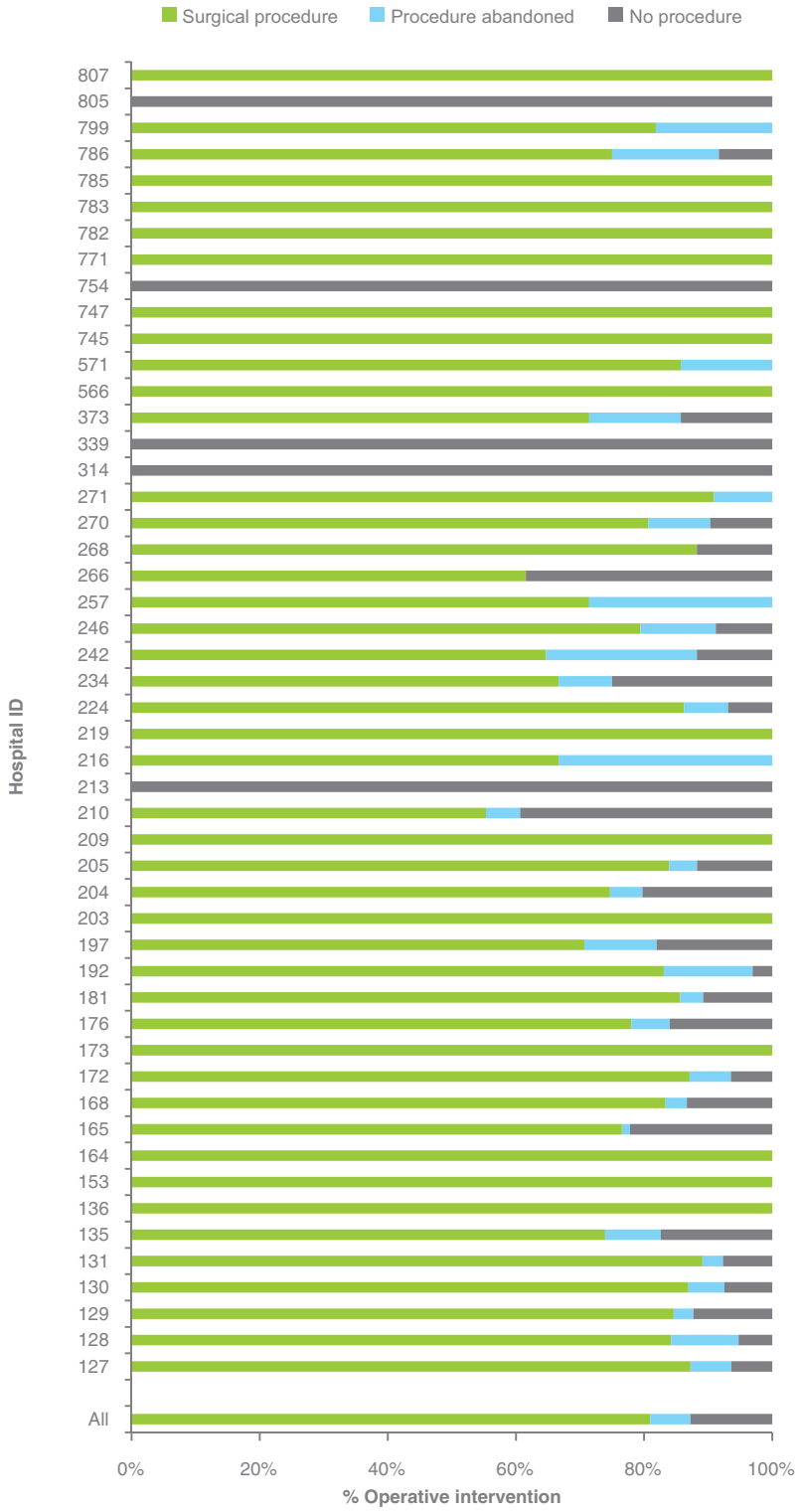


Note: total n=1,650.
GI: gastrointestinal.

Comments:

- Only procedures with a frequency ≥10 interventions have been recorded in Figure 51.
- During separate1,687 episodes of surgery in 2,013 patients, there were 2,641 operative procedures described, as a patient can undergo multiple procedures during the same admission and at the same surgical session.
- The most frequent procedures reported have usually been associated with emergency admission for trauma or acute abdominal pathology.
- The term 'Hip joint procedures' includes fractured neck of femur.
- Other procedures were reported, however as the individual frequencies of each in the remainder were less than ten these have not been listed.

Figure 52: Frequency of operative intervention by hospital

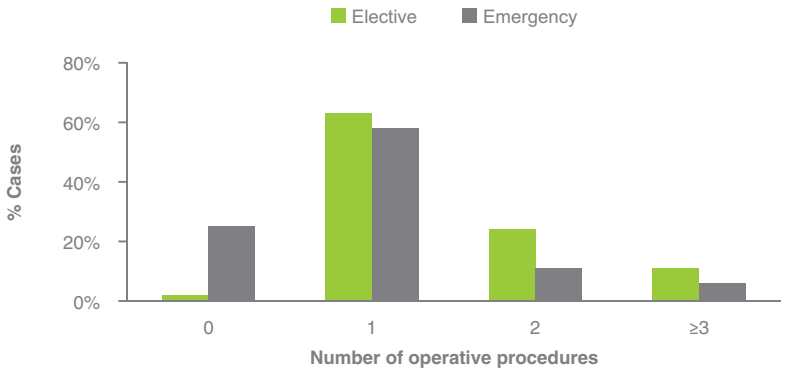


Note: Total n=1,687.
ID: identifier.

Comments:

- These figures reflect the general distribution of operative interventions by hospital in the aggregate data. A number of the hospitals represented here do not perform emergency surgery.
- Not all patients underwent surgery.

Figure 53: Operative procedures by urgency type

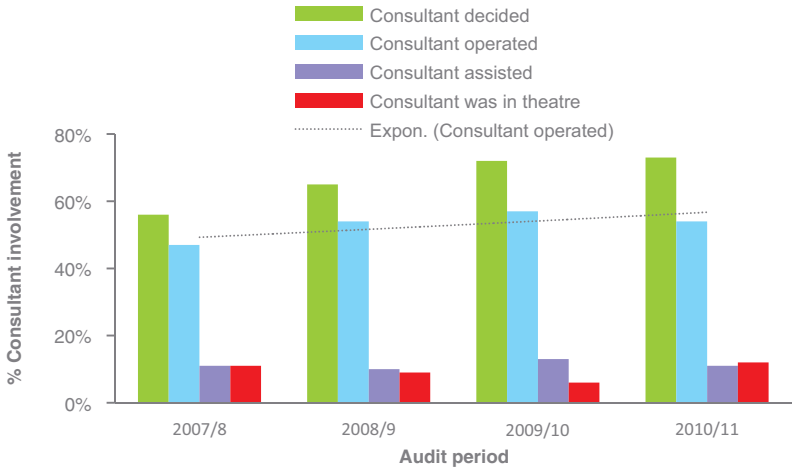


Note: Total n=1,687.
Missing data n=24 (1%)

Comments:

- The apparent higher frequency of multiple interventions in patients admitted electively is probably due to the higher percentage of emergency cases (86%) versus elective (14%) cases skewing the data.
- The frequency of multiple interventions was similar in metropolitan and rural regions (data not shown in Figure 53).[3]

Figure 54: Seniority of surgeons deciding on and performing surgery

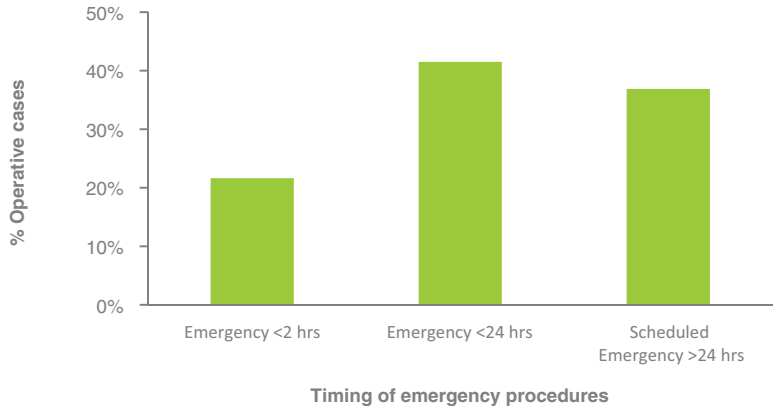


Note: Total n=1,687.
The consultant operated exponential trendline is steep which highlights considerable rise in consultant involvement.

Comments:

- A consultant surgeon performed the surgery in 54% of cases and took the decision to proceed to surgery in more than 68% of instances. This bias towards consultants is appropriate when the risk profile of the audited cases is considered. The increase in active participation by consultants over time does not reach statistical significance (p=0.8).
- A consultant anaesthetist was present in 1,500 (89%) of the 1,687 operative proceduresin the 2,013 audited series (data not shown in Figure 54).

Figure 55: Timing of operative procedures in emergency admissions



Note: Total n=1,535.
Hrs: Hours

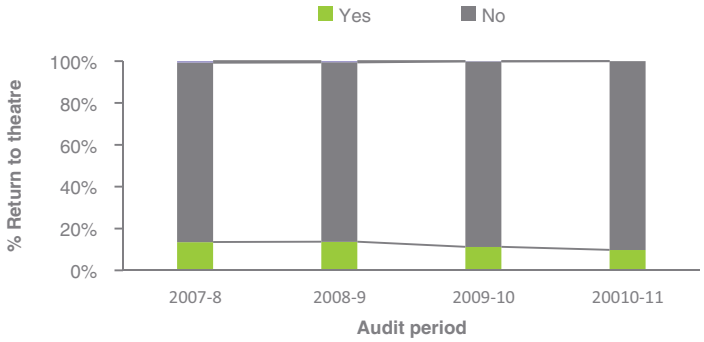
Comments:

- The time criticality of a patient's condition predicts the timing of emergency surgery. Of 1,535 emergency admissions who underwent surgery, 332 (22%) had surgery within two hours of admission, 637 (41%) had surgery within 24 hours and 566 (37%) after 24 hours.
- Therefore, 969 (63%) of the 1,535 emergency admissions to a surgical unit required surgery within 24 hours of admission. Strategies to address the associated scheduling problems are being implemented by government, surgeons and hospitals.[10, 11, 17]
- For example, cardiothoracic surgery initiated measurement and monitoring of safety and quality in cardiac interventional procedures by establishing the Australian Cardiac Procedures Registry.[13]
- Similarly, the College established the National Breast Cancer Audit.[14]

2.10.1 Unplanned return to the operating room

An unplanned return to the operating room (OR) is usually necessitated by the development of a complication requiring further operative intervention.

Figure 56: Unplanned return to the operating room

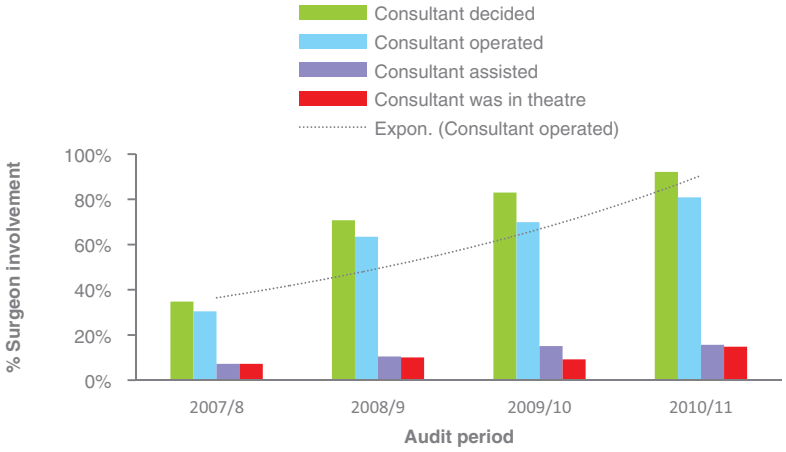


Note: Total n=2,013.
Missing data n=68 (3%).

Comments:

- An unplanned return to the OR was reported in 231 (14%) of the 1,687 cases where a surgical procedure was performed.
- There has been a downward trend in frequency of unplanned returns to the OR with a decrease from 13% in 2007–2008 to 9% in 2010–2011. This has not yet reached statistical significance.

Figure 57: Seniority of surgeons performing surgery at unplanned return to the operating room



Note: Total n=231.

The consultant operated exponential trendline is curved which highlights considerable rise in consultant involvement.

Comments:

- Active consultant participation was higher in cases requiring unplanned return to the OR as the exponential trend line shows the rise and continues to increase significantly with time ($p<0.001$).
- This is appropriate as such cases are more challenging and the risks are greater.

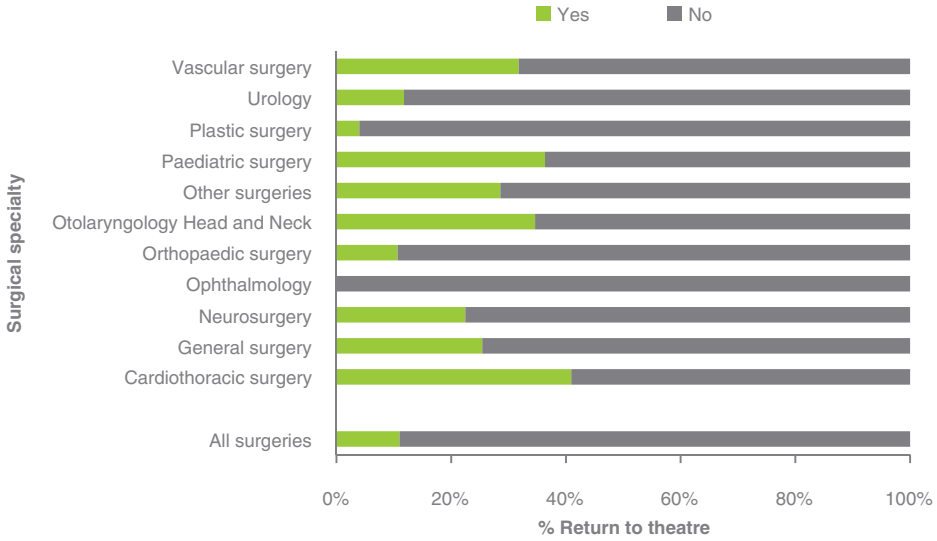
Figure 58: Unplanned return to the operating room by hospital

Note: Total n=2,013.
Missing data n=68 (3%).
ID: identifier.

Comments:

- An unplanned return to the OR was reported in 231(11%) of the audited cases undergoing a procedure.
- The incidence varied among hospitals. The variance may be explained by the casemix of individual hospitals.

Figure 59: Unplanned return to the operating room by surgical specialty

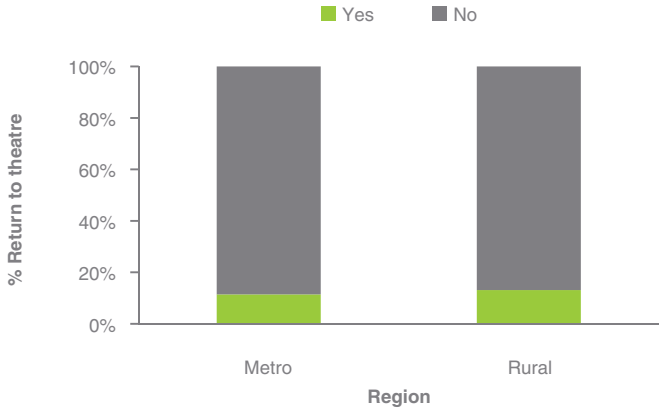


Note: Total n=2,013.
Missing data n=68 (3%).
'Other surgeries' includes trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The frequency of unplanned return to the OR is a reflection of the risk profile inherent in their casemix.

Figure 60: Unplanned return to the operating room by region



Note: Total n=2,013.
Missing data n=68 (3%).
Metro: Metropolitan

Comments:

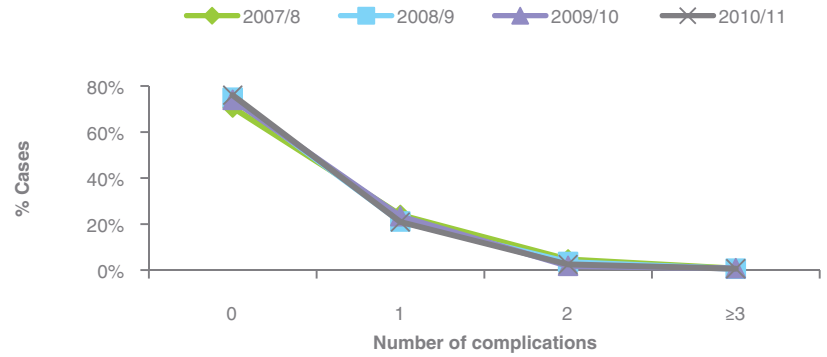
- There were no major differences in unplanned return to the OR between rural and metropolitan regions.
- The seniority of surgeons operating in rural and metropolitan regions was similar (data not shown in Figure 60).

Key points

- During separate 1,687 episodes of surgery in 2,013 patients, there were 2,641 operative procedures described, as a patient can undergo multiple procedures during the same admission and at the same surgical session.
- The most frequently-reported procedures were associated with emergency admission for trauma or acute abdominal pathology.
- A consultant surgeon performed the initial surgery in 55% of cases and took the decision to proceed to surgery in more than 68% of instances.
- Similar to previous reports, 969 (63%) of the 1,535 emergency admissions to a surgical unit required surgery within 24 hours of admission. The scheduling problems associated with managing these urgent cases and the elective workload remains an issue for hospitals.
- An unplanned return to the OR, usually necessitated by the development of a complication, was reported in 231 (11%) of 2,013 patients in the audited series. This percentage has decreased slightly over time yet, has not reached clinical significance (p=0.2).
- Active consultant participation was higher in cases that involved an unplanned return to the OR and has increased significantly over the audit period (p<0.001).

2.11. Postoperative complications

Figure 61: Postoperative complications recorded by treating surgeon

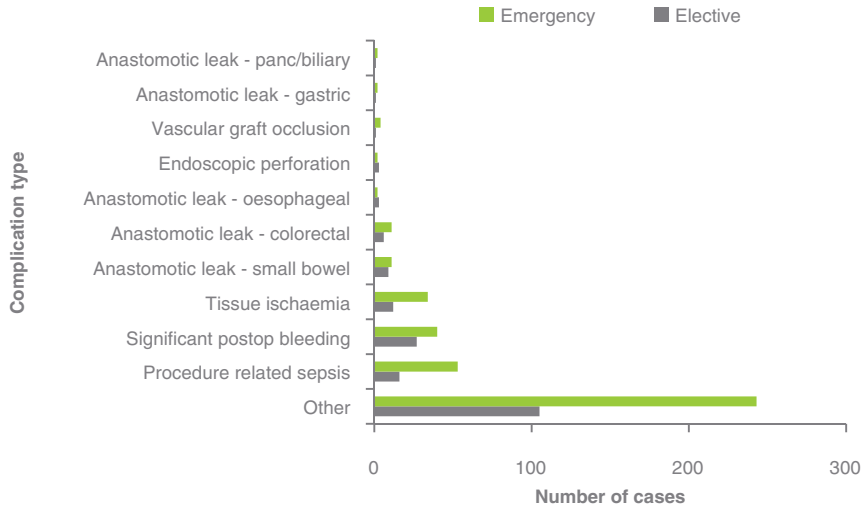


Note: Total n=2,013.
Missing data=8 (<1%)

Comments:

- The treating surgeon is asked to record any postoperative complications.
- The low rate of postoperative complications reported by treating surgeons has remained constant throughout the audit period. Of the 2,013 cases audited, 1,501 (75%) had no complications, and only a single complication was recorded in 443 (22%) patients.

Figure 62: Frequency of specific postoperative complications by urgency status

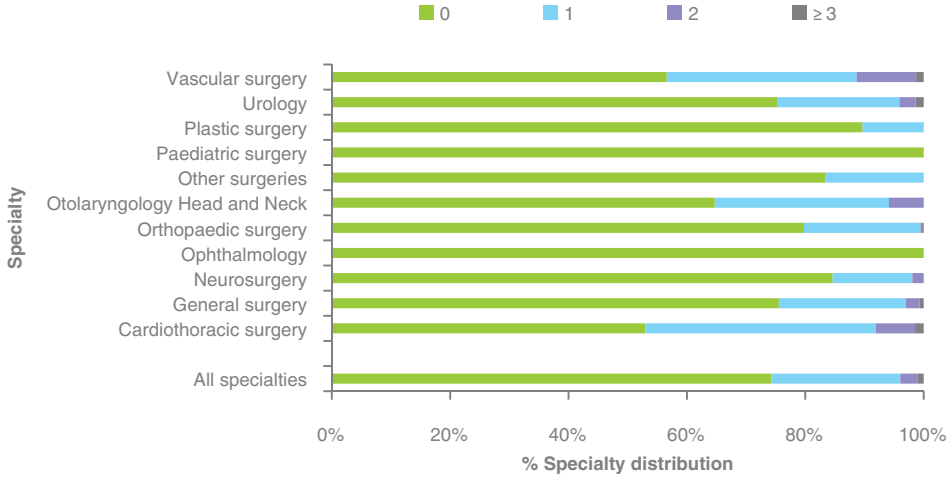


Note: Total n=596.
Panc: pancreatic; postop: postoperative.
Missing data: n=8 (1%).
A total of 348 'other' complications were identified, including cardiac failure, intrapulmonary haemorrhage, intra-cerebral bleed, postoperative hypoxia, acute or chronic renal failure, paraplegia, liver failure, pneumonia, perforated viscus, pulmonary embolism, pyelonephritis, renal failure, respiratory failure, seizures, sepsis, stroke and wound haematoma.

Comments:

- No obvious trend was seen for complication type in elective and emergency cases.

Figure 63: Postoperative complications by specialty

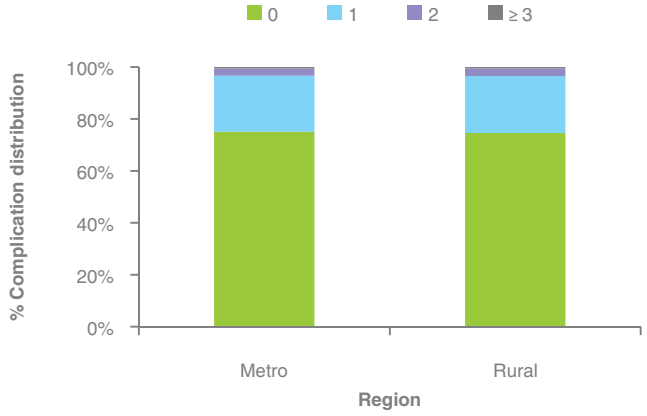


Note: Total n=2,013
Missing data=23 (1%)
'Other surgeries' include trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- There were differences in the rate of postoperative complications among specialties; however, these were not statistically significant.

Figure 64: Postoperative complications by region

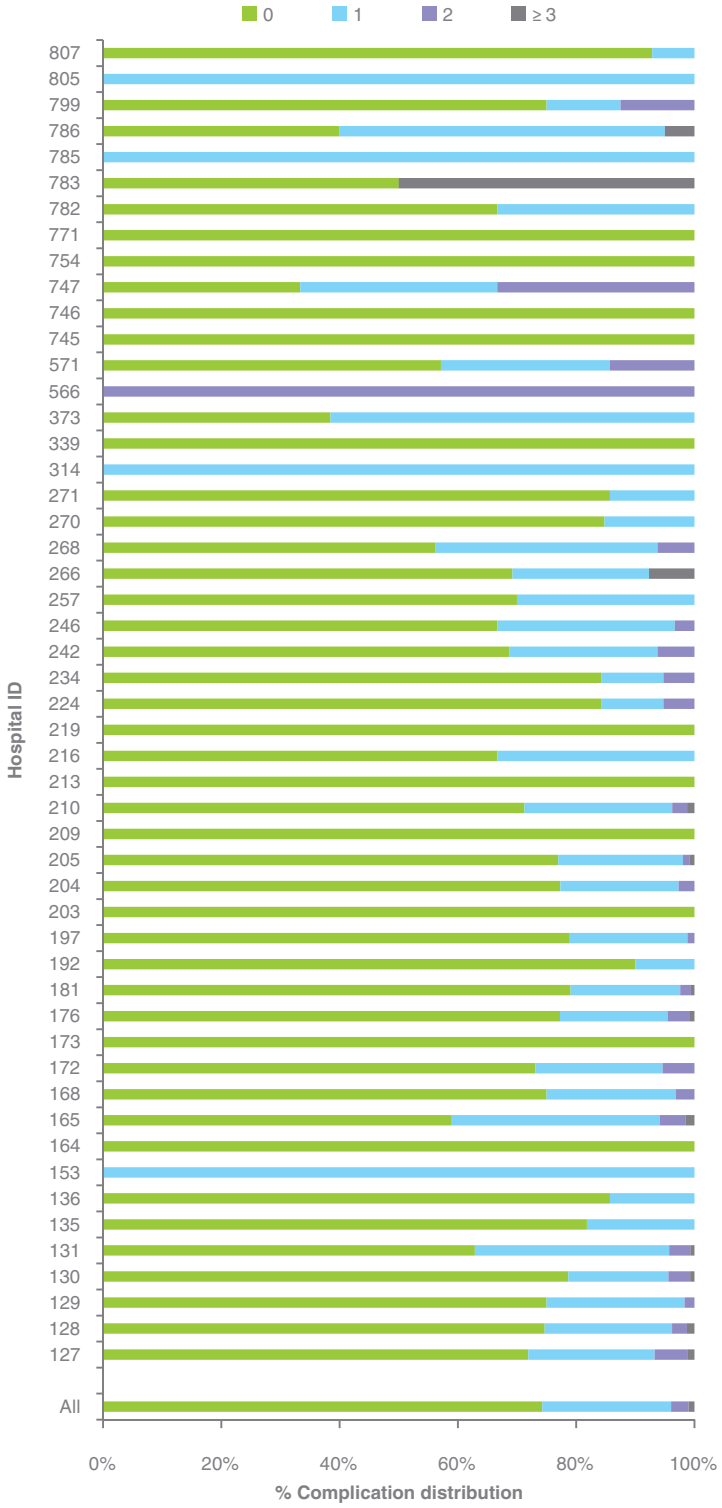


Metro: metropolitan.
Note: Total n=2,013.
Missing data: n=23 (1%).

Comments:

- There were no major differences between the rate of postoperative complications in rural and metropolitan regions.

Figure 65: Postoperative complications by hospital



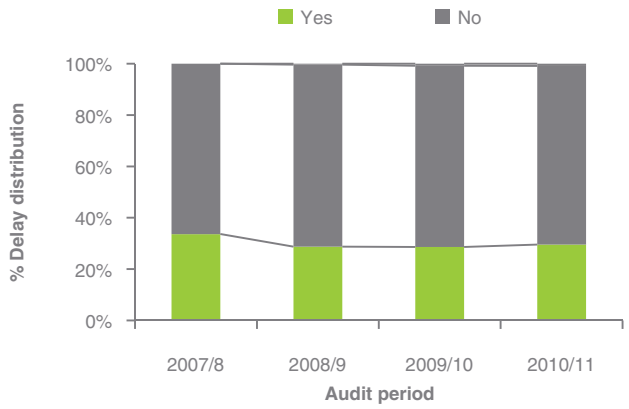
Note: Total n=2,013.
Missing data: n=23 (1%).
ID: identifier.

Comments:

- The reported rate of postoperative complications varied slightly between specialties, hospitals and regions.

2.12. Anaesthetic problems

Figure 66: Anaesthetic delays



Note: Total n=2,013.
Missing data n=452 (22%).

Comments:

- The frequency of delays related to anaesthesia was 22% (443 of the 2,013 cases audited). The reasons for these delays were not stated.

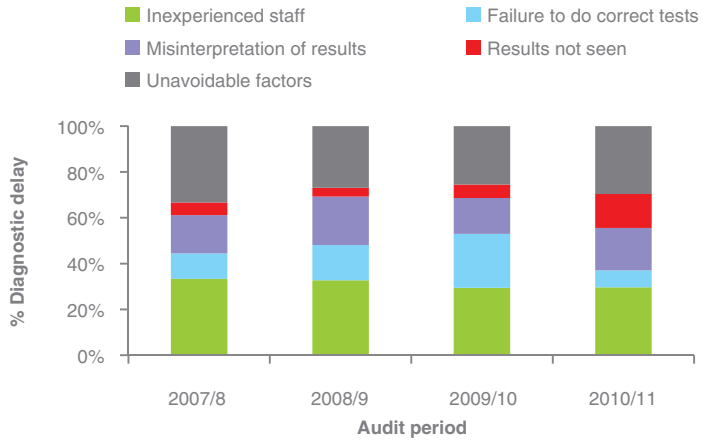
Key points

- The low rate of postoperative complications reported by treating surgeons has remained constant throughout the audit period.
- Of the 2,013 cases audited, no complications were recorded in 1,501 (75%) and only one complication was recorded in 443 (22%) patients.

2.13. Delay in diagnosis

Treating surgeons are asked to record any perceived delays in establishing a diagnosis and proceeding to definitive treatment.

Figure 67: Perceived delays in establishing a diagnosis



Note: Total n=173 issues identified in 2,013 audited cases.

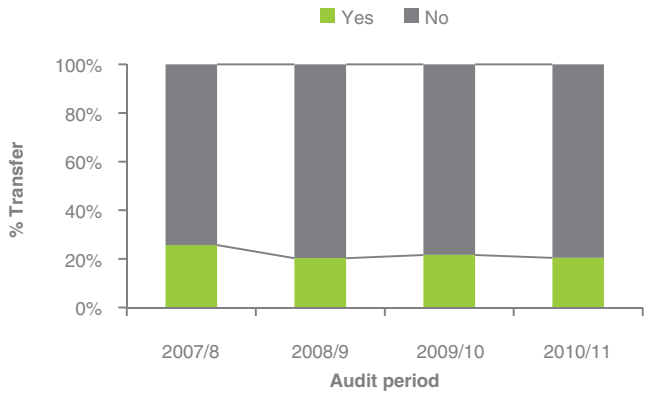
Comments:

- The treating surgeons identified delays in establishing the diagnosis in 173 (9%) of the 2,013 audited cases. This rate has remained relatively constant over time.
- When cases were submitted to first or second-line peer-review, the incidence of perceived delay in establishing a diagnosis rose to 18%.
- Delay in establishing a diagnosis is one facet of the concerning rate of delay in implementing definitive treatment shown in Figure 83.
- It is important to note that such delays are not always attributable to the surgical team.
- For example, in a recent UK review on care received by elderly patients undergoing surgery, delay between admission and operation was related to risk assessment which: “should include input from senior surgeons [or] anaesthetists” [in addition to] “extremely poor documentation, nutritional assessment and evidence of appropriate management”.[15]

2.14. Patient transfer issues

The treating surgeon is asked to provide information on patients who required inter-hospital transfer as part of their care. This includes timeliness and appropriateness of transfer.

Figure 68: Patients requiring transfer to another hospital



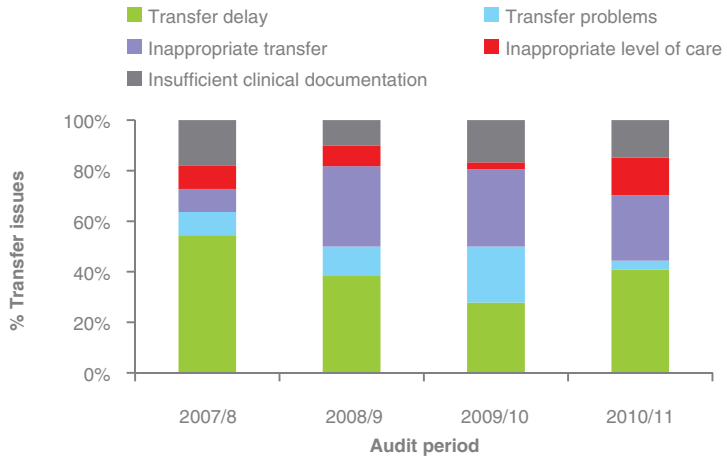
Note: Total n=2,013.
Missing data n=31 (1%).

Comments:

- There were 420 (21%) instances in the audited series of 2,013 cases where patients underwent transfer to another hospital.
- The frequency of patients requiring transfer for definitive care has remained constant throughout the audit period.

Treating surgeons are asked to record any perceived clinical issues associated with individual patient transfers.

Figure 69: Care of patient during transfer to another hospital



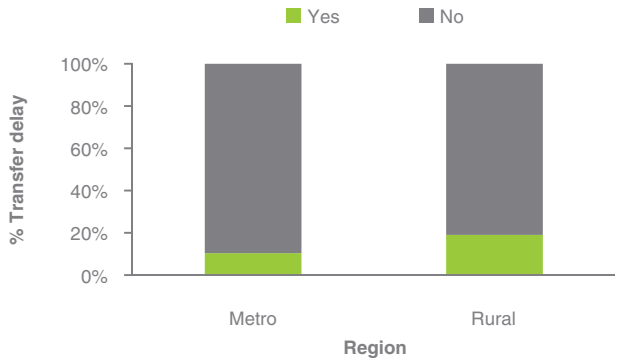
Note: Total n=420 in 2,013 audited cases.
Missing data: 31 (7%).

Comments:

- Various issues of care related to patient transfers were identified in 38 (9%) of the 420 patients requiring transfer. This rate has been constant over time. Figure 69 demonstrates the spectrum of all issues identified by surgeons.
- The level of care provided during transfer was deemed appropriate in 372 (89%) of the 420 cases and inappropriate transfer was identified in 48 (11%) cases.
- It was felt that adequate clinical information and documentation had been provided to the receiving hospital in 364 (87%) of the 420 cases.
- In a further 50 (12%) it was felt that the transfer had occurred inappropriately late in the course of the illness.

2.15. Transfer delays by region

Figure 70: Perceived delays in transfer of patients to another hospital by region



Note: Total n=420.
Metro: metropolitan.
Missing data n=27 (6%).

Comments:

- Transfer delays were more frequently seen in rural regions compared to metropolitan areas. This result was statistically significant ($p<0.001$). A major reason for transfer is to attain a higher level of care and access to critical care. As such it is to be expected that rural hospitals with their lower levels of care would predominate.
- The Rural Doctors Association of Victoria suggested: "ensuring that appropriate medical care is provided before transfer means a commitment on the part of the state to maintain the rural medical workforce and to ensure that rural hospitals take appropriate steps to guarantee round the clock availability of well trained and experienced rural doctors".[16]

Key points

- The peer-review process suggests the incidence of delay in establishing a diagnosis necessary for confirming definitive treatment is 9%. Such delays are a concern. It is important to note these delays are not always attributable to the surgical team.

3. Peer-review outcomes

The VASM peer-review process is a retrospective examination of the clinical management of patients who died while under the care of a surgeon. All assessors (first and second-line) must decide if the death was a direct result of the disease process alone, or if aspects of the management of the patient may have contributed to the outcome. FLAs were completed in 2,013 cases. Each first-line assessor had to decide if the treating surgeon had provided adequate information to allow a conclusion to be reached. If the information is deemed inadequate then a SLA or case note review is requested.

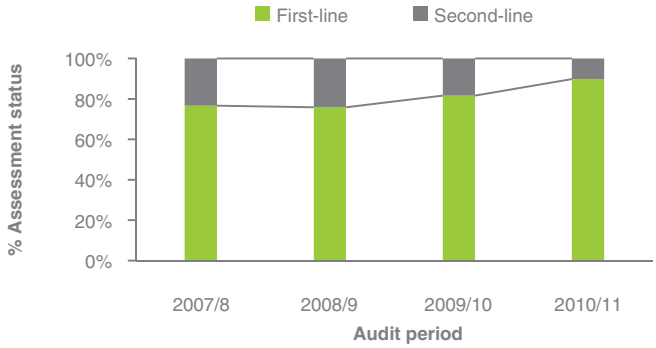
Other triggers for requesting SLA are:

- where a more detailed review of the case is required, which could better clarify events leading up to death and any lessons emanating from the case under review.
- where death was unexpected, for example in a young, fit patient with benign disease or a day surgery case.

The number of SLAs required because of a lack of information provided in the case record form (CRF) is an indirect measure of surgeon compliance in the audit process. SLAs required for the other triggers are more likely to represent suspected issues of clinical management.

3.1 Second-line assessments

Figure 71: Referral for second-line assessment

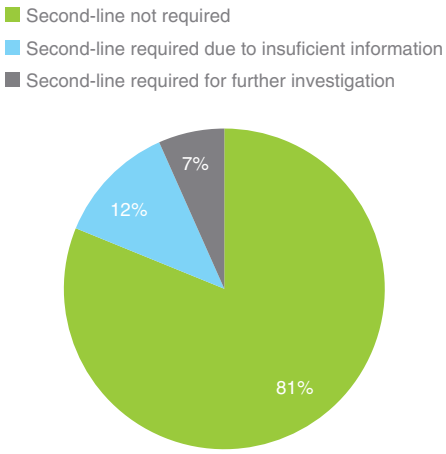


Note: Total n=2,013.

Comments:

- The perception of need for SLA has decreased over time, in part because the quality of CRFs returned by treating surgeons has improved. The percentage of cases referred for SLA dropped significantly from 18% in 2007–2008 to 10% in 2010–2011.
- Cases with an ASA>4 were significantly more likely to be referred for SLA ($p<0.001$), data not shown in this graph.

Figure 72: Reason for referral for second-line assessment

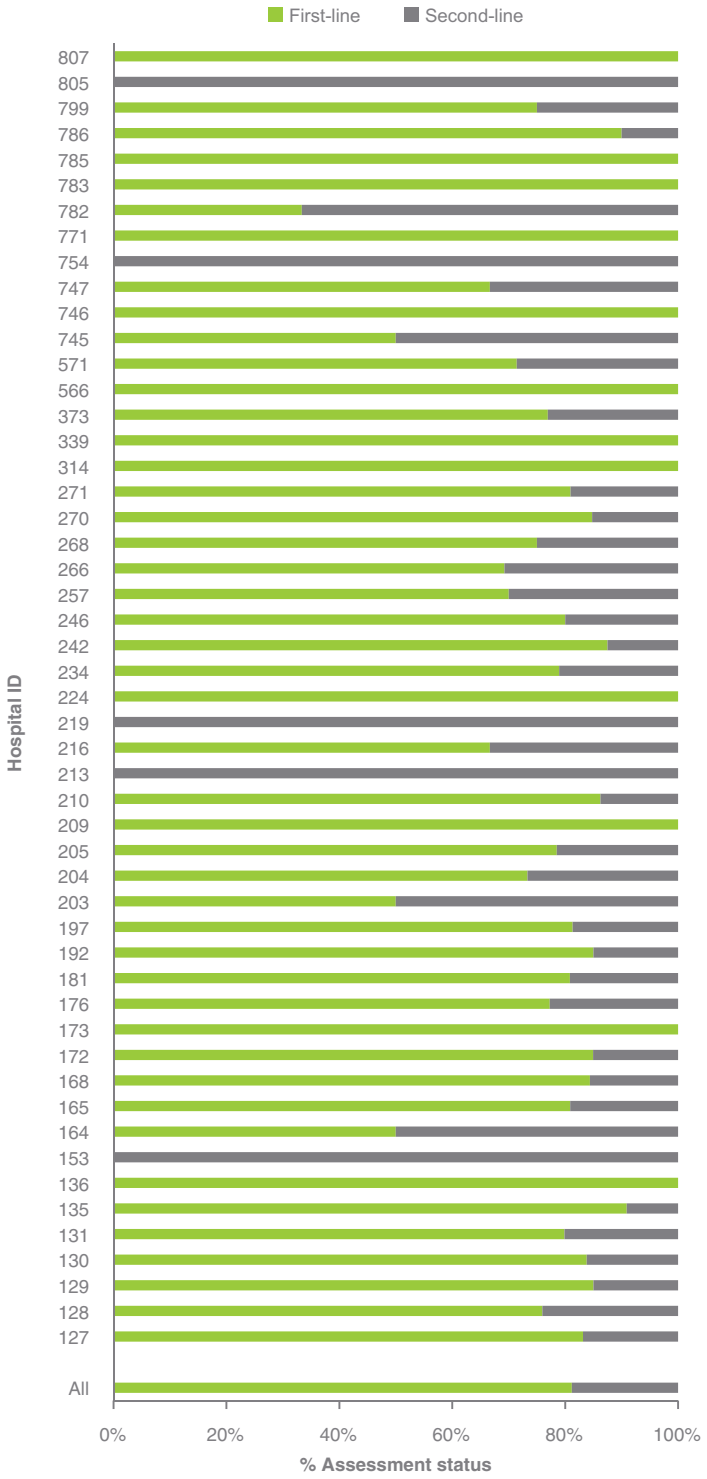


Note: Total n=2,013.

Comments:

- Despite some improvement, insufficient clinical information provided by the treating surgeon remains the most common trigger for SLA (245 (65%) of the 379 cases). The remaining 134 cases (35%) required more detailed review for perceived issues of management.
- This issue with the quality of the data provided by some treating surgeons is unfortunately ongoing. Greater attention to detail in completing the CRF can help reduce the workload of colleagues who have agreed to act as first and second-line assessors.

Figure 73: Frequency of need for second-line assessment in individual hospitals

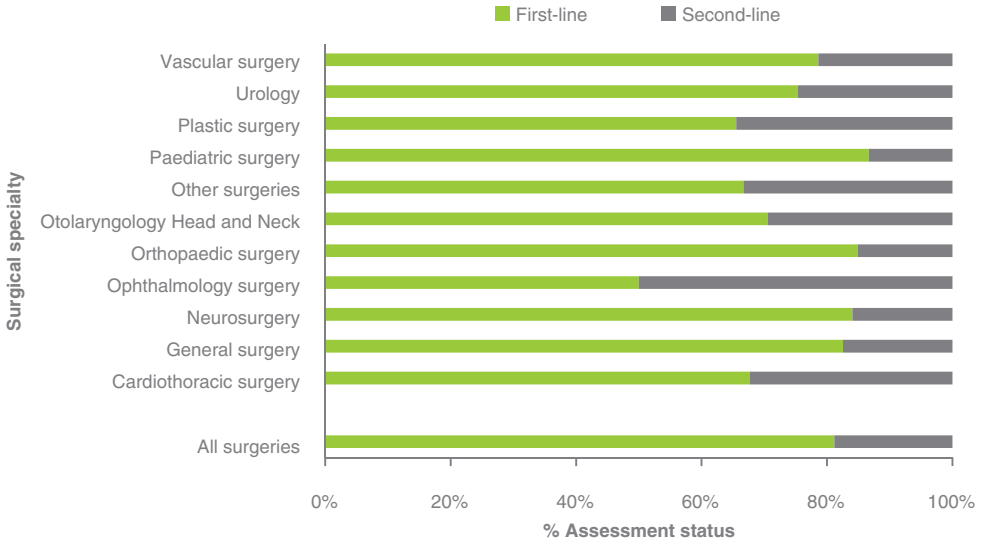


Note: Total n=2,013.
ID: identifier.

Comments:

- The frequency of referral for SLA varied slightly among hospitals.
- No inferences can be drawn as risk stratification is not possible.

Figure 74: Frequency of need for second-line assessment in surgical specialties



Note: Total n=2,013

'Other surgeries' include trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- All cases require first-line assessment.
- The need for SLA referral was similar between specialties. No inferences have been made.
- The need for referral for SLA was similar in metropolitan and rural regions (data not shown in Figure 74).

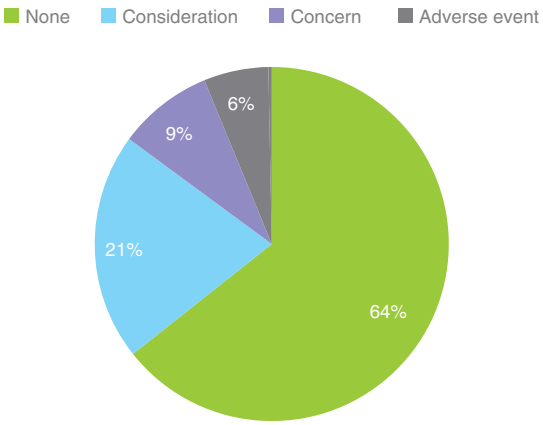
3.2 Clinical management issues

A primary objective of the VASM peer-review process is ascertaining if death was a direct result of the disease process alone, or if aspects of management of the patient might have contributed to that outcome. There are two possible outcomes; either death was a direct outcome of the disease process and the clinical management had no impact on the outcome, or there was a perception that aspects of patient management may have contributed to the death of the patient.

In cases in which there is a perception that the clinical management may have contributed to death, VASM has specified a spectrum of criticism from which the assessor can choose:

- An area for consideration exists: the assessor believes an area of care **could** have been improved or different, but recognises that the issue is perhaps debatable. It represents very minor criticism.
- An area of concern exists: the assessor believes that an area of care **should** have been better.
- An adverse event occurred: defined as an unintended injury or event that was **caused** by the medical management of the patient rather than by the disease process, and which was sufficiently serious to lead to prolonged hospitalisation, or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributed to or caused death.

Figure 75: Clinical management issues as perceived by assessors

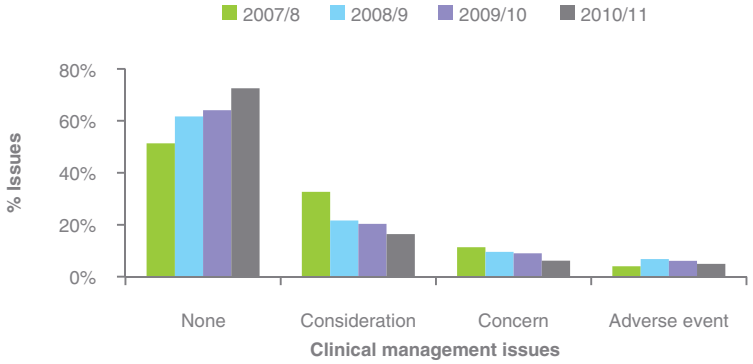


Notes: Total n=2,013.
Missing data n=29 (1%)

Comments:

- In 1,713 (85%) of the 2,013 cases that completed the audit process, no or only minor issues of patient management were perceived to have occurred.
- In 175 (9%) of cases, areas of concern were identified.
- In 119 (6%) of 2,013 patients, assessors felt the clinical issues were serious enough to be called adverse events.
- The prevalence of areas of concern and adverse event perceived by assessors was similar across rural and metropolitan regions (data not shown in this graph).

Figure 76: Spectrum of clinical management issues across the audit period

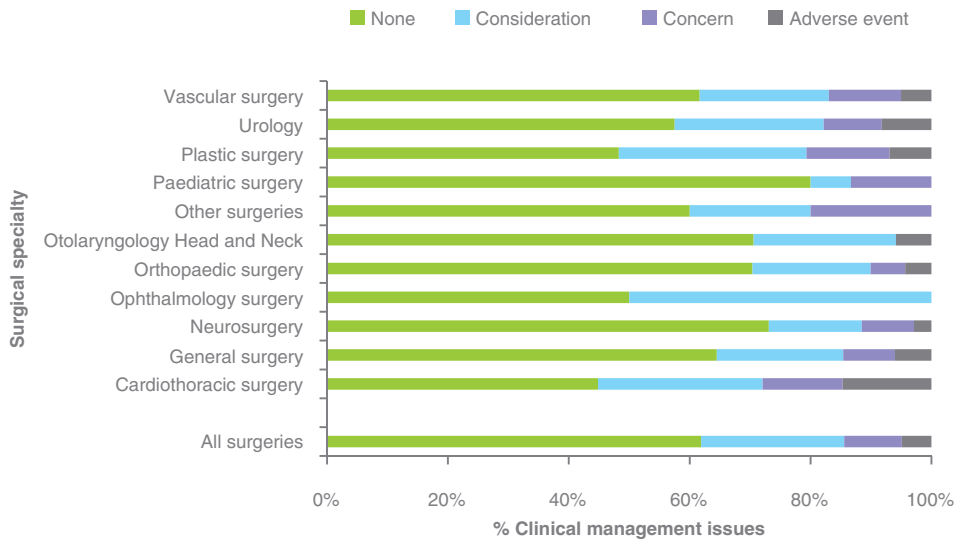


Note: Total n=2,013.
Missing data n=29 (1%)

Comments:

- There has been an apparent reduction in the overall rate of perceived clinical issues.
- In 2007–2008, no clinical management issues were identified in 51% of patients. This figure rose to 62% in 2008–2009, 64% in 2009–2010 and 73% in 2010–2011 (p<0.001).

Figure 77: Spectrum of clinical management issues by specialty

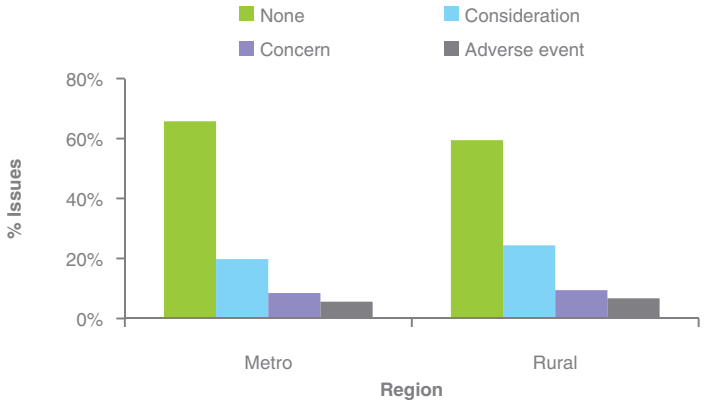


Note: Total n=2,013.
Missing data n=29 (1%)
'Other surgeries' include trauma, transplant, oncology, obstetrics and gynaecology.

Comments:

- The prevalence of areas of concern and adverse events identified by assessors was similar among the specialties.

Figure 78: Spectrum of clinical management issues by region

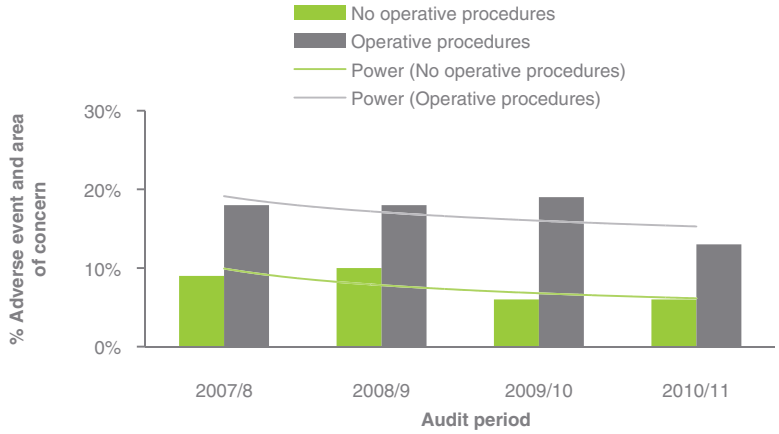


Note: Total n=2,013.
Missing data n=29 (1%)
Metro: Metropolitan.

Comments:

- The prevalence of areas of concern and adverse events perceived by assessors was similar between metropolitan and rural regions.

Figure 79: Frequency of adverse events and areas of concern by operative status



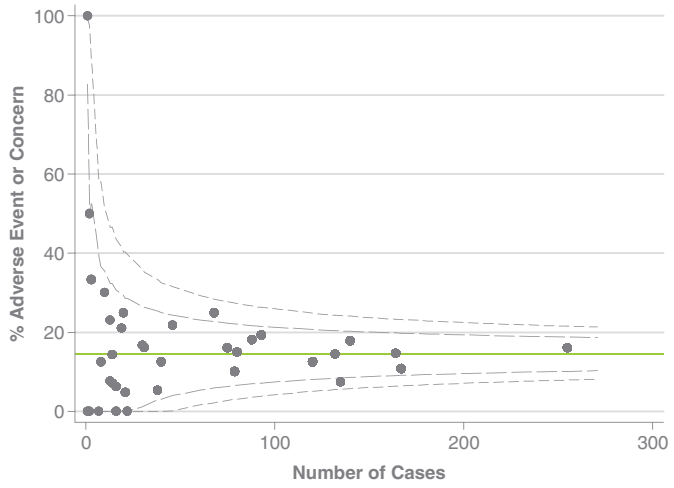
Note: Total n=309.
Missing data n=29 (1%)
The operative and non-operative power trend line compares the decreased adverse event and areas of concern rates in both groups.

Comments:

- Cases where no operative procedure occurred had a significantly lower rate of areas of concern and adverse events identified (7%) than cases where an operative procedure occurred (18%; $p<0.01$).
- There was a reduction in the frequency of areas of concern and adverse events from 18% in 2007–2008 to 13% in 2010–2011.
- Cases where the consultant surgeon had no involvement in the surgery, for example, not operating, deciding, assisting or being present in theatre, had similar rates of areas of concern and adverse events (16%) as those where a consultant was involved in the operative procedure (18%). This suggests that in these cases the physical absence of the consultant had no impact on the outcome.

Where cases have undergone both FLA and SLA, only the SLA was included in the analyses provided in figures 80 and 81. If an assessor flags an area of concern or adverse event, this implies significant criticism. In the funnel plots detailed below, we have combined these to look at the prevalence of this degree of criticism among hospitals and surgical specialties.

Figure 80: Adverse events and areas of concern by hospital during the audit period

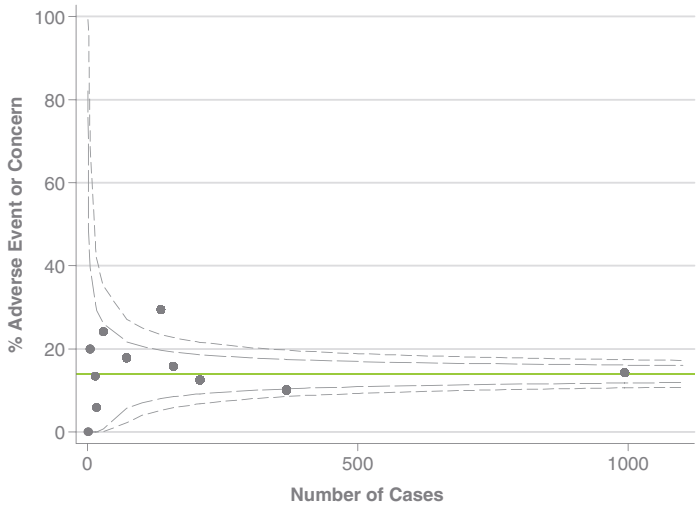


Note: Total n=2,013.
Missing data n=29 (1%)

Comments:

- No hospital was outside the 3 SD limit during the audit period.

Figure 81: Adverse events and areas of concern by surgical speciality

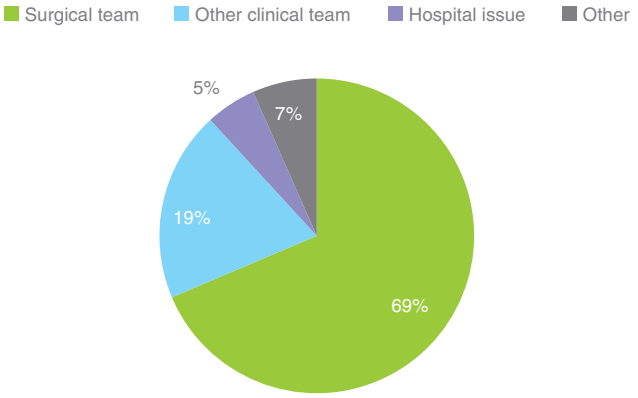


Note: Total n=2,013.
Missing data n=29 (1%)

Comments:

- One specialty was outside the 3 SD limit; however, as it is not possible to stratify risk among the specialties, no inference can be made.

Figure 82: Attribution of responsibility for clinical management issues



Note: Total n=718.

Missing data: n=84 (12%)

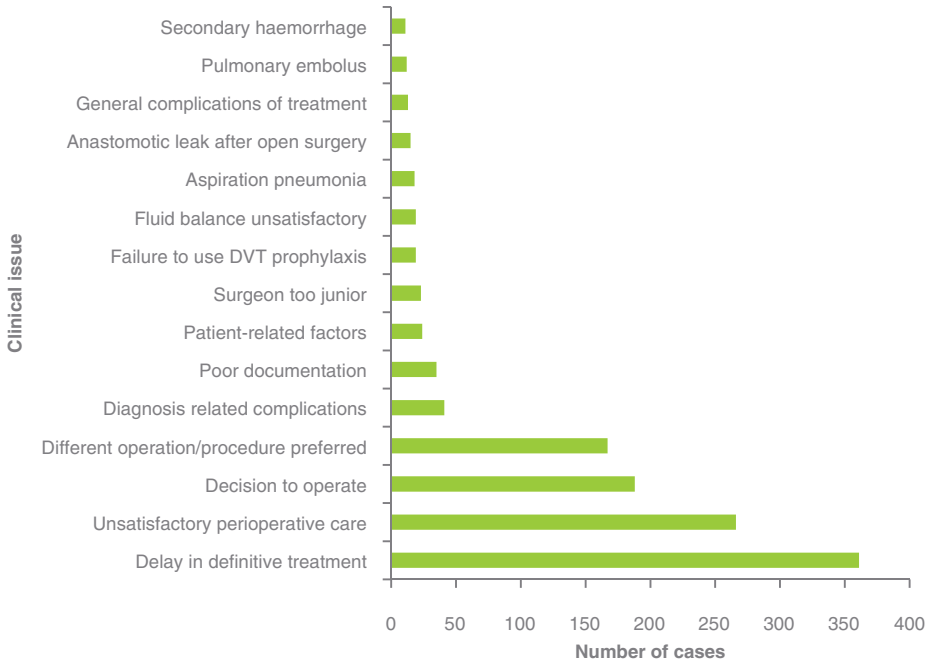
Other factors can include issues such as staffing levels, patient transfer, patient refusal, ambulance care, anaesthetic care and availability or quality of critical care support.

Comments:

- Patients often require input from other clinical teams during their course of treatment. Management issues raised may therefore be attributable to any of these teams.
- In 69% of the 718 cases, the issues identified were attributed to the surgical team. Another 19% were attributed to other clinical teams (for example, medical and emergency department), hospital issues or patient-related factors.

In addition to simply identifying if a management issue occurred, assessors have to indicate and categorise the actual clinical issue.

Figure 83: Frequency of specific clinical issues of management



Note: Total n=1,212.

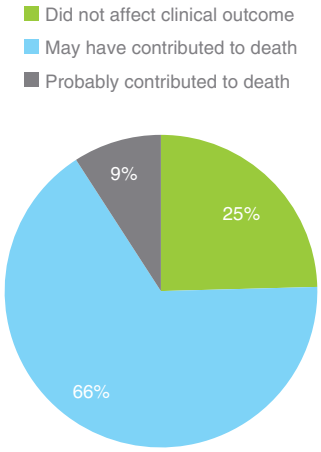
DVT: deep vein thrombosis.

Comments:

- Delay in implementing definitive treatment was the most common clinical issue, listed in 361 (30%) of the 1,212 specific issues described.This category includes delays in transfer, establishing diagnosis and starting treatment. A number of studies on hip fracture patients found that delay to surgery is attributable to patient factors such age[8] and comorbidities,[6] in addition to waiting times.[10, 17, 18]
- Criticism of management of the patient in the perioperative period, 266 (22%) of the 1,212 specific issues described, is another major issue. This group includes delay in recognising and responding to clinical deterioration. Examples of cases emphasising individual problems have been featured in the case note review booklets.
- There was also criticism of choice of operative procedure and decision to consider an operative approach. For example, “patients with significant co-morbidities maybe better suited to a less complex and invasive procedures”.[6]
- Another example was related to the type of operation where “open surgery had greater risk of anastomotic leak (AL) than laparoscopic operations. Surgical site infection and intraoperative blood transfusions were also associated with significantly higher rates of anastomotic leak (AL).”[19]

Assessors have to gauge the likely impact of these clinical incidents on the clinical outcome as part of the peer-review process.

Figure 84: Clinical incidents outcomes



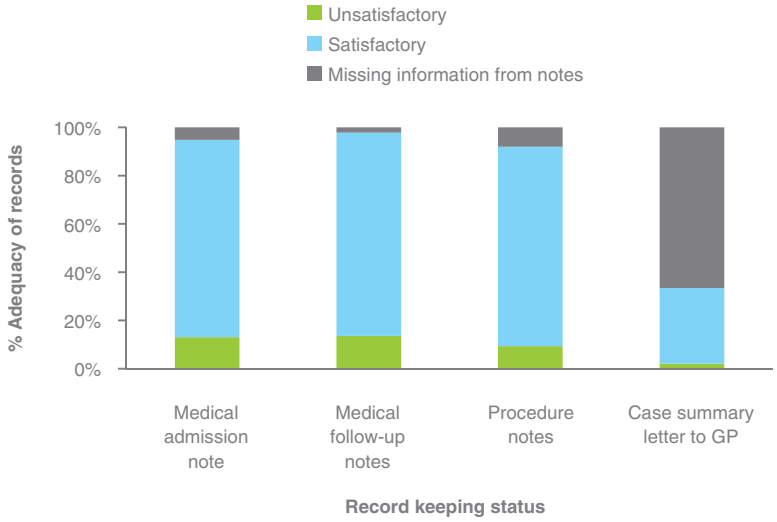
Note: Total n=713.
Missing data: 29 (4%)

Comments:

- Assessors perceived that clinical management issues occurred in 713 (35%) of the 2,013 cases in this audited series.
- Assessors felt these clinical management issues had probably contributed to death in 9% of the 2,013 cases. In the remaining cases where management issues were perceived, the impact of these issues on outcome was uncertain.

Second-line assessors are asked to comment on the adequacy of the information contained in the hospital case record.

Figure 85: Adequacy of information provided by hospital case record



Note: Total n=379.
GP: general practitioner.

Comments:

- In 121 (32%) of 379 SLAs, at least one aspect of the medical record was deemed unsatisfactory. Criticism included poor medical admission notes (11%) and follow-up records (11%) and unsatisfactory description of the surgical procedure (7%).
- The hospital case notes are an important record of what occurred during a patient's treatment. The difficulty in managing patients in a complex environment where there is an increasing lack of continuity in the care provided during a patient's stay in hospital is exacerbated by poor and inaccurate clinical notes. This is a similar finding to a review of care received by the elderly patients undergoing surgery in the UK.[15]

Key points

- A case note review (SLA) was deemed necessary to clarify events leading to the clinical outcome in 379 (19%) of 2,013 audited cases. In 245 (12%) of the audited cases, the inadequacy of information provided by the treating surgeon was the trigger for further review.
- The need for SLA was similar across hospitals, surgical specialties and metropolitan and rural regions.
- In 1,295 (64%) of audited cases, no issues pertaining to the clinical management of patients were identified.
- The review process perceived that faults in the clinical management, serious enough to be deemed adverse events, had occurred in 126 (6%) of the audited cases.
- An adverse event and an area of concern are at the higher end of the spectrum of criticism applied by the peer-review process. Assessors felt these clinical management issues had probably contributed to death in 9% of the 2,013 cases. In the remaining cases where management issues were perceived, the impact of these issues on outcome was uncertain.

4. Concordant validity considerations

Completion of all fields in the CRF by the treating surgeon requires some self-reflection. An example is where the treating surgeon is asked to nominate any areas of consideration, concern or adverse event emanating from their care of the patient. Such responses by the treating surgeon were compared to assessors' responses to the same question and the degree of concordance was estimated. These results are shown in Tables 1 - 3.

Full concordance between the treating surgeon and assessor is not anticipated. There are various factors behind this. Among these, the information available to first-line assessors relies heavily on the treating surgeons' account of the clinical events. However, second-line assessors have a de-identified copy of the patients' medical records and thus a relatively unbiased chronology of care as it happened.

The highest level of concordance expected would therefore be between the treating surgeon and first-line assessor as they are generally accessing the same clinical information. The lowest expected is between treating surgeon and second-line assessor who has access to an independent description of the episode of care. For this reason, agreement between first and second-line assessors is also predicted to be weak.

Analysis of concordance is a method of studying inter-relater reliability in reporting clinical management issues. Performing a full case note review on all reported deaths is not feasible for logistic reasons.

The outcomes of concordance analysis shown below are reassuring as they mirror the predicted outcomes.

Table 1: Concordant validity between the treating surgeon and the first-line assessor

Concord areas	Surgeon and first-line assessor			
	n (%)	% Concord	Kappa score	(95% CI)
Risk of death	1,530 (76%)	**64%**	**0.44**	(0.42–0.47)
ICU care benefit if not received	242 (24%)	**98%**	**0.53**	(0.17–0.89)
HDU care benefit if not received	201 (20%)	**88%**	**0.19**	(0.00–0.34)
Fluid balance	1,849 (92%)	**67%**	**0.22**	(0.19–0.24)
Preoperative management/preparation	1,456 (72%)	**87%**	**0.37**	(0.30–0.44)
Intraoperative/technical management	1,432 (71%)	**93%**	**0.27**	(0.17–0.37)
Decision to operate at all	1,456 (72%)	**88%**	**0.28**	(0.21–0.36)
Choice of operation	1,418 (70%)	**94%**	**0.27**	(0.17–0.38)
Grade/experience of surgeon deciding	1,433 (71%)	**99%**	**0.31**	(0.10–0.52)
Grade/experience of surgeon operating	1,436 (71%)	**98%**	**0.30**	(0.12–0.46)
Timing of operation	1,453 (72%)	**92%**	**0.46**	(0.37–0.54)
Postoperative care	1,396 (69%)	**91%**	**0.31**	(0.23–0.40)
Clinical management issues	1,964 (98%)	**77%**	**0.46**	(0.41–0.50)

Note: A total of 2,013 surgical case record forms and first-line assessments were available for analysis.
CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.
'Critical care not received' data was available in 994 audited cases (49%).
There were 1,687 surgical interventions.

Comments:

- As indicated by the kappa scores, there was fair to moderate agreement between the treating surgeon and the first-line assessor.
- Variance between the treating surgeon and the first-line assessor was prominent in the critical care (ICU and HDU) section, where the first-line assessor perceived more issues in clinical management than the treating surgeon as indicated by the kappa scores.

Table 2: Concordant validity between the treating surgeon and the second-line assessor

Concord areas	Surgeon and second-line assessor			
	n (%)	% Concord	Kappa score	(95% CI)
Risk of death	275 (73%)	**50%**	**0.27**	(0.24–0.36)
ICU care benefit if not received	20 (5%)	**75%**	**0.00**	(0.00–0.00)
HDU care benefit if not received	19 (5%)	**69%**	**0.00**	(0.00–0.09)
Fluid balance benefit	304 (80%)	**69%**	**0.27**	(0.26–0.34)
Preoperative management/preparation	265 (70%)	**68%**	**0.21**	(0.10–0.33)
Intraoperative/technical	264 (70%)	**85%**	**0.35**	(0.19–0.50)
Decision to operate at all	270 (71%)	**82%**	**0.26**	(0.11–0.40)
Choice of operation	268 (71%)	**81%**	**0.09**	(0.00–0.23)
Grade/experience of surgeon deciding	261 (69%)	**94%**	**0.28**	(0.01–0.54)
Grade/experience of surgeon operating	255 (67%)	**95%**	**0.28**	(0.13–0.54)
Timing of operation	264 (70%)	**75%**	**0.19**	(0.06–0.32)
Postoperative care	261 (69%)	**75%**	**0.19**	(0.06–0.32)
Clinical management issues	320 (84%)	**57%**	**0.15**	(0.06–0.24)

Note: A total of 379 surgical case record forms and second-line assessments were available for analysis.
CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

Comments:

- As indicated by the kappa scores, only poor to moderate agreement was noted between the treating surgeon and the second-line assessor.
- Disagreement between the treating surgeon and second-line assessor was most marked in the clinical management section and critical care (ICU and HDU) sections, where second-line assessors perceived more issues with the clinical management of the patient than the treating surgeon. Perhaps the treating surgeon is less objective in their assessment of the clinical management of patients. This is not an unexpected finding and supports the value of independent peer review.

Table 3: Concordant validity between the first-line assessor and the second-line assessor

Concord areas	First-line assessor and second-line assessor			
	n (%)	% Concord	Kappa score	(95% CI)
Risk of death	298 (79%)	**53%**	**0.31**	(0.28–0.36)
ICU care benefit if not received	71 (19%)	**54%**	**0.26**	(0.23–0.34)
HDU care benefit if not received	102 (27%)	**54%**	**0.30**	(0.24–0.30)
Fluid balance	295 (78%)	**41%**	**0.11**	(0.09–0.16)
Preoperative management/preparation	245 (65%)	**61%**	**0.32**	(0.23–0.33)
Intraoperative/technical management	243 (64%)	**74%**	**0.44**	(0.37–0.44)
Decision to operate at all	263 (69%)	**75%**	**0.41**	(0.36–0.44)
Choice of operation	249 (66%)	**72%**	**0.35**	(0.26–0.41)
Grade/experience of surgeon deciding	245 (65%)	**83%**	**0.30**	(0.22–0.44)
Grade/experience of surgeon operating	248 (65%)	**86%**	**0.49**	(0.44–0.60)
Timing of operation	247 (65%)	**70%**	**0.40**	(0.35–0.44)
Postoperative care	244 (64%)	**60%**	**0.30**	(0.27–0.38)
Clinical management issues	327 (86%)	**74%**	**0.05**	(0.00–0.14)

Note: A total of 379 first and second-line assessments were available for analysis.
CI: confidence interval; HDU: high dependency unit; ICU: intensive care unit.

Comments:

- As indicated by the kappa scores, agreement was fair to moderate between first and second-line assessors.
- Disagreement between first and second-line assessors was most marked in the clinical management section, with second-line assessors perceiving more issues than the first-line assessors, particularly in relation to appropriateness of fluid balance and postoperative critical care support.

Key points

- In general, concordance between the treating surgeons versus the first and second-line assessors was as expected.
- The key areas of variance between the treating surgeon and assessors were in the clinical management issues section. The assessors perceived there were more issues in clinical management than the treating surgeon.

Table 4: Severity of criticism of perceived clinical management issues

	Less severe ←			→ Most severe
Areas of clinical incidents	None detected	Consideration	Concern	Adverse event
Outcome of incidents	N/A	Did not affect clinical outcome	May have contributed to death	Probably contributed to death
Preventable incidents	N/A	Probably not	Probably	Definitely
Association of incidents	N/A	Hospital	Clinical team	Surgical team

Note: Other factors can include issues such as staffing levels, patient transfer, patient refusal, ambulance care, anaesthetic care and availability or quality of critical care support.
N/A: not applicable.

Table 5: Frequency of clinical management issues

Degree of criticism of patient management	Total occurrences	Patients affected by clinical issues (n=2,013)
No issues identified	1,295	1,295 (64%)
Area of consideration	902	404 (20%)
Area of concern	397	183 (9%)
Area of adverse event	162	126 (6%)
Missing data	29	5 (<1%)
Total	**2,785**	2,013 (100%)
Perceived impact on patient outcome	**Total occurrences**	**Patients affected by clinical issues (n=2,013)**
No issues of management identified	1,295	1,295 (64%)
Did not affect clinical outcome	347	175 (9%)
May have contributed to death	936	418 (21%)
Probably contributed to death	129	102 (5%)
Missing data	77	23 (1%)
Total	**2,784**	2,013 (100%)
Perceived preventability of clinical issues	**Total occurrences**	**Patients affected by clinical issues (n=2,013)**
No issues identified	1,295	1,295 (64%)
Definitely preventable	163	120 (6%)
Probably preventable	581	259 (13%)
Probably not preventable	525	266 (13%)
Definitely not preventable	59	35 (2%)
Missing data	161	38 (2%)
Total	**2,784**	**2,013 (100%)**
Clinical team responsible for management issue	**Total occurrences**	**Patients affected by clinical issues (n=2,013)**
No issues identified	1,295	1,295 (64%)
Surgical team	795	435 (22%)
Other clinical team	384	124 (6%)
Hospital issue	121	33 (2%)
Other	151	42 (2%)
Missing data	220	84 (4%)
Total	**2,966**	**2,013 (100%)**

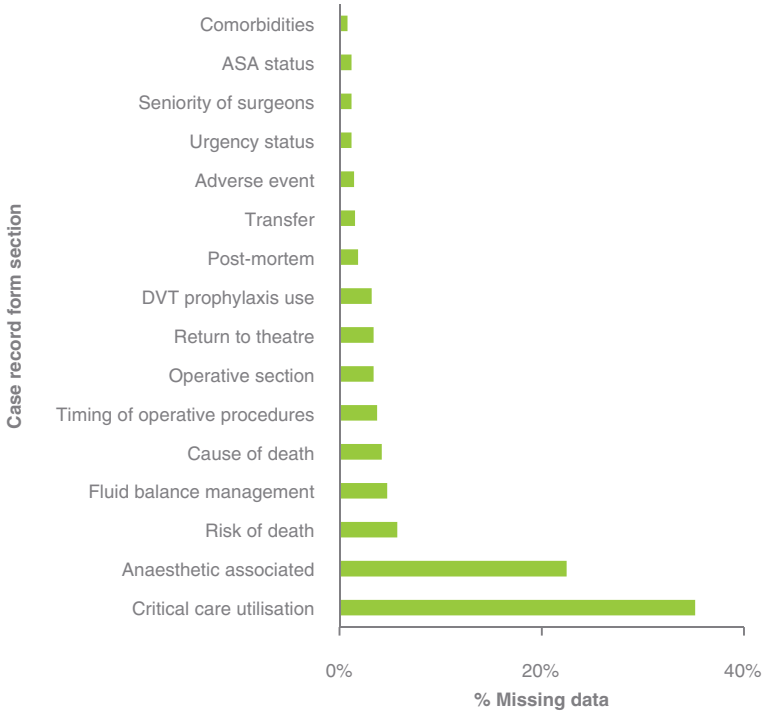
Comments:

- Audited cases can have more than one clinical management issue identified for each patient. The percentage of patients affected is the important measure.

5. Data management and data quality

Data quality is an essential component of all audits. Inaccurate and incomplete clinical information will impair the audit process and prevent identification of trends.[11,12]

Figure 86: Limitations of the audit due to missing data



ASA: American Society of Anesthesiologists; DVT: deep vein thrombosis.
Note: Total n=2,013.

Comments:

- Figure 86 demonstrates the frequency (in decreasing order) of missing data for individual questions in the CRF.
- The volume of missing data is most prevalent in the 'utilisation of critical care facilities', 'risk of death', 'anaesthetic association' and 'fluid balance' sections. These questions are important if we are to identify and address adverse trends.
- Where data integrity issues are identified, it is important to review the format of the questions that will generate the data. ANZASM felt it appropriate to revise the critical care and VTE questions in 2010 and the trauma, infection and outcome sections in 2011. It is hoped this will lead to improved data integrity in the future.
- It is important to note that there has been a slight improvement in these sections since 2010.
- VASM wishes to emphasise the importance of accuracy and completeness of data.

6. First and second-line assessment validation studies

First and second-line assessment validation studies have been conducted among a random sample of cases that have completed the audit process. The findings are consistent with a process that has some degree of subjectivity and lacks a 'gold standard'. The primary objective of the audit program (education of surgeons) is still being achieved by the current process. The reports can be downloaded from http://www.surgeons.org/vasm.

7. Establishment of external evaluation

In 2011, VASM contracted Aspex Consulting to conduct an external evaluation of the entire audit process. This process aimed to ascertain the extent to which VASM is achieving its objectives.

The scope of the evaluation included:

- effectiveness of processes used to collect, analyse, maintain and report the VASM data.
- a qualitative analysis of the effectiveness of communication between VASM and health services/ clinicians, with recommendations arising from the audit process.
- a qualitative analysis of the effectiveness of the relationship and governance arrangements.

The major outcomes of the evaluation were focused upon: identifying strengths and areas for improvement in relation to the scope of activities undertaken by VASM; the efficiency and effectiveness of current program operations; and future development to improve the impact of VASM activities.

Overall, findings from the evaluation indicated that VASM has operated effectively and efficiently within its contracted terms of reference to deliver a peer-review audit process that is acceptable to surgical Fellows. High rates of hospital participation and surgeon commitment to the audit process have been achieved. Audit coverage across the private hospital sector is now increasing. Methods of case reporting, case assessment and feedback to a range of stakeholders have been subject to continuous quality improvement to maximise relevance and minimise burden (within the operational constraints imposed upon audit operations). The audit has now achieved a level of maturity in data capture and processing.

VASM is now in a position to build upon current achievements by:

- maintaining surgical trust and commitment.
- streamlining a range of processes.
- extending analysis of data.
- promoting integration of information across the health system, and targeting messages identified through the audit to a range of different audiences.

By focusing upon these activities, VASM will demonstrate its relevance and strengthen its capacity to positively impact upon changes in the quality and safety of patient management. The full report of the independent Aspex Consulting Evaluation can be found on http://www.surgeons.org/vasm.

8. VASM evaluation surveys on 2010 audit activities

With the release of the 2010 VASM Annual Report an evaluation survey was sent to surgeons and hospitals. The survey sought feedback on the perceived value of the annual report, the case note review booklet (CNRB) previously published, the value of the personal feedback sent to treating surgeons as part of the peer-review process and the value of the new electronic interface. In addition there were also free text sections soliciting suggestions for improvement and requesting topics that might be addressed with future educational seminars. Surgeons were also asked if the outcomes from any part of the audit process had led to any change in their practice.

The questions directed to hospitals were similarly structured, but limited to the perceived value of the CNRB and annual report, and general educational value of process.

Fifteen per cent of surgeons canvassed (130 out of 896) returned the survey, as did 21% of participating hospitals (18 out of 87). These survey return rates can be classified as 'excellent' according to the Direct Marketing Association's (DMA) 2010 Response Rate Trend Report.[20]

The evaluation surveys have presented positive results on the entire VASM audit.

A number of hospital representatives have requested for feedback to be provided back to the hospitals in aggregate hospital reports in addition to the surgeon reports. In regards to the CNRB, the hospital representatives have expressed interest in receiving shorter case summaries. Conversely, the surgeons have requested that more detailed case note reviews are included in the CNRB and annual report.

There was a significant amount of interest from the surgeons on seminars being presented by the VSCC and VASM. 'Delay in Diagnosis' received the most interest from the surgeons, which was followed by 'Deteriorating Patients' and 'Guidelines for Assessors' respectively.

From all the surveys which have been received, the majority agreed with the appropriateness of the VASM program.

A summary of the findings was published in the Surgical News. The full report of the evaluation survey can be found on http://www.surgeons.org/vasm.

9. VASM performance review

Table 6: Project schedule and delivery status

Schedule of key deliverables	Status
Establishment of governance model	✓ Completed 27 November 2007
Establishment of mortality audit at four pilot sites	✓ Completed 27 November 2007
Establishment of mortality audit at a further four sites	✓ Completed 23 May 2008
Establishment of mortality audit at all Victorian public hospitals	✓ Completed 23 November 2008
Provision of confidential, specific reports to the department, the Minister for Health and VSCC, and: 1. A report on the four pilot hospitals after their commencement, including data analysis and qualitative issues and lessons. 2. Reports to involved surgeons after their commencement in the audit. 3. Reports to involved hospitals.	✓ Completed 30 June 2009
Individual case report forms provided to the VSCC in instances where areas of consideration, concern or adverse event were identified by the second-line assessor	✓ Completed 30 June 2009
Provision of annual public report in lay format	✓ Completed 30 October 2009
Agreement reached regarding the process to address individual surgeons and surgical outcomes that have been identified as outside of acceptable parameters, in line with the following principles: - The definition of normal parameters to be agreed by RACS, VSCC and DHS. - Recommendations are to be made by VSCC to address deficiencies in surgical outcomes. - Identified surgeons to be informed of audit findings and VSCC recommendations by the chair of the VSCC. - Continued monitoring of surgeon performance to be ongoing following implementation of VSCC recommendations. - Surgeons identified as having surgical outcomes outside of normal parameters following the implementation of VSCC recommendations to undergo further remediation.	✓ Completed 30 October 2009
Provision of an outlier report to the DHS and the VSCC	The audit provides limited opportunities for identifying Fellows who might be considered to be 'outliers'. The aim of the program has been improving clinical standards through education. However, if outlier criteria can be developed through consensus these might be applied to identify surgeons who would benefit from support from colleagues.
VASM contract renewal	✓ Completed 30 July 2010
Establishment of the Fellows electronic interface	✓ Completed 1 August 2010
Establishment of mortality audit at all Victorian private hospitals	Commenced 1 August 2010 80% Private sector recruited
Establishment of external evaluation of the VASM audit processes	✓ Completed 30 July 2011

DHS: Department of Human Services; RACS: Royal Australasian College of Surgeons; VASM: Victorian Audit of Surgical Mortality; VSCC: Victorian Surgical Consultative Council.

References

1. Australian and New Zealand Audit of Surgical Mortality. National report 2010. North Adelaide: *Royal Australasian College Of Surgeons*. 2011.

2. Scottish Audit of Surgical Mortality. Annual Report 2011: reporting on 2009 data. Edinburgh: *NHS National Services Scotland.* 2011.

3. Australian Institute of Health and Welfare. Australian hospital statistics 2010-11: Emergency department care and elective surgery waiting times. Canberra: *Australian Institute of Health and Welfare.* 2011.

4. Rosenwax LK, McNamara BA, Murray K, McCabe RJ, Aoun SM, Currow DC. Hospital and emergency department use in the last year of life: a baseline for future modifications to end-of-life care. *Medical Journal Australia.* 2011;194(11):570-3.

5. American Society of Anesthesiologists (ASA). ASA Physical Status Classification System. Park Ridge, Illinois.1995-2012 [cited 2012 Feb 29]; Available from: http://www.asahq.org/For-Members/Clinical-Information/ASA-Physical-Status-Classification-System.aspx.

6. Hauck K, Zhao X, Jackson T. Adverse event rates as measures of hospital performance. *Health Policy.* 2011.

7. Dinh DT, Di Giambattista K, Vijayasingham L, Billah B, Shardey G, Reid CM. Victorian Cardiac Surgery Database Project Annual Public Report 2008-2009: *ASCTS Database Project Steering Committee.* 2009.

8. Shiga T, Wajima Z, Ohe Y. Is operative delay associated with increased mortality of hip fracture patients? Systematic review, meta-analysis, and meta-regression. *Canadian Journal of Anesthesia.* 2008;55(3):146-54.

9. Shum HP, Lee FMH, Chan KC, Yan WW. Interaction between fluid balance and disease severity on patient outcome in the critically ill. *Journal of Critical Care.* [ABSTRACT]. 2011;26(6):613-9.

10. Curtis AJ, Wolfe R, Russell CO, Elliott B, Hart JAL, McNeil J. Determining priority for joint replacement: comparing the views of orthopaedic surgeons and other professionals. *Medical Journal Australia.* 2011;195(11/12):699-702.

11. Evans SM, Scott IA, Johnson NP, Cameron PA, McNeil JJ. Development of clinical-quality registries in Australia: the way forward. *Medical Journal Australia.* 2011;194(7):360-3.

12. NHMRC Centre for Research Excellence in Patient Safety (CRE PS), National E-Health Transition Authority (NEHTA), Monash University. Operating Principles and Technical Standards for Australian Clinical Quality Registries. Melbourne: *Australian Commission on Safety and Quality in Health Care.* 2008.

13. Reid CM, Brennan AL, Dinh DT, Billah B, Costolloe CB, Shardey GC, et al. Measuring safety and quality to improve clinical outcomes: current activities and future directions for the Australian Cardiac Procedures Registry. *Medical Journal Australia.* 2010;193(8):S107-S10.

14. Crowe P. Improving Surgical Outcomes for Patients With Cancer: An Australian Perspective. *Journal of Surgical Oncology.* 2009;99:478-80.

15. Wilkinson K, Martin IC, Gough MJ, Stewart JAD, Lucas SB, Freeth H, et al. An Age Old Problem: A review of the care received by elderly patients undergoing surgery. *National Confidential Enquiry into Patient Outcome and Death* [serial on the Internet]. 2010: Available from: www.ncepod.org.uk.

16. Rural Doctors Association of Victoria [Internet]. Retrieval: Victorian rural emergency retrieval. Victoria: *Rural Doctors Association of Victoria;* 2011 [updated 20 May 2008]; Available from: http://www.rdav.com.au/retrieval.html.

17. Curtis AJ, Russell COH, Stoelwinder JU, McNeil JJ. Waiting lists and elective surgery: ordering the queue. *Medical Journal Australia.* 2010;192:217-20.

18. Carr T, Teucher U, Mann J, Casson AG. Waiting for surgery from the patient perspective. *Psychology Research and Behavior Management.* 2009;2:107-19.

19. Luján JJ, Németh ZH, Barratt-Stopper PA, Bustami R, Koshenkov VP, Rolandelli RH. Factors influencing the outcome of intestinal anastomosis. *The American Surgeon.* 2011;77(9):1169-75.

20. The Direct Marketing Association [Internet]. DMA Releases 2010 Response Rate Trend Report. New York: *The Direct Marketing Association;* 2002 [cited 2012 Feb 29]; Available from: http://www.the-dma.org/cgi/disppressrelease?article=1416.

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