Australian and New Zealand Emergency Laparotomy Audit – Quality Improvement (ANZELA-QI)

Third ANZELA–QI program summary report

1 January 2022 – 31 December 2024

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Chair's report

This third bi-annual report from the Australia and New Zealand Emergency Laparotomy Audit – Quality Improvement (ANZELA–QI) Working Party marks a time of rapid transition. It bridges our traditional retrospective annual Quality Assurance reporting with a new era of prospective Clinical Quality Registry (CQR) reporting supported by near real-time dashboards (see Appendix B).

Over the past year, ANZELA-QI has adapted to major national developments, including:

- The Framework for Australian Clinical Quality Registries (2024) published by Australian Commission for Safety and Quality in Heath Care (the Commission) [1]
- The forthcoming Emergency Laparotomy Clinical Care Standard (due mid-2026)[2]
- The pending edition of the National Safety and Quality Health Service Standards (NSQHS) [3]

ANZELA-QI has also secured funding through the Federal Department of Health, Disability and Ageing's National Clinical Quality Registry Program, strengthening its national role.[4]

Since its establishment in 2018, inspired by the transformative impact of UK's National Emergency Laparotomy Audit (NELA) program,[5] ANZELA–QI has demonstrated the value of a coordinated national emergency laparotomy Clinical Quality Registry (CQR).

This report highlights significant inter-hospital variation in risk-adjusted post-operative mortality (10-fold) and average length of stay (3-fold). Compliance with evidence-based standards remains inconsistent, though some outcomes—such as Failure to Rescue rates—have improved.

The most concerning finding is poor and variable timely access to theatre, especially overnight, when high-risk surgeries are most urgent. Consultant presence during these hours appears limited.

Following previous ANZELA-QI reports,[6-7] the Commission confirmed in 2023 its intention to develop an emergency laparotomy clinical care standard, due mid-2026. Once approved, the National Safety and Quality Health Service Standards will require hospitals to demonstrate compliance,[3] and ANZELA-QI offers a proven, nationally consistent platform to support this.

A highlight this period has been ANZELA-QI's collaboration with the Health Quality Intelligence Unit (HQIU) at the WA Department of Health.[8] Their expertise has enabled the use of funnel plots and statistical process control (SPC) charts—central to the CQR Framework and future dashboards—and has greatly strengthened ANZELA-QI's reporting. Their support has been invaluable.

However, data quality remains a critical challenge. Hospital participation, case ascertainment, and data completeness are often poor. [9-11] The CQR Framework mandates auditing data completeness and identifying non-participating hospitals as "alarm" level outliers.[1]

Despite international precedent for mandatory CQR participation,[12-13] Australia has not adopted this approach.[14-15] This undermines the reliability of CQRs and risks misleading conclusions. ANZELA-QI has set transparent benchmarks—80% key performance indicator (KPI) compliance and 85% data completeness—but no state has yet addressed major data quality issues.

Evidence shows that CQRs improve care and outcomes, including reduced mortality and length of stay and through that, reduced costs for emergency laparotomy patients.[16-20] Failure to support CQRs equates to endorsing suboptimal care—an indefensible position.

While political leadership is essential for surgical CQRs in Australia to reach their full potential, medical Colleges also bear responsibility.[21-23] The establishment of continuous professional development (CPD) Homes means it is now the Colleges rather than the individual clinicians who must report CPD compliance. Colleges have a unique opportunity to lead.[23]

ANZELA-QI has fulfilled its primary aim: to justify a national Emergency Laparotomy CQR. It meets the requirements of the CQR Framework, NSQHS Standards, and the forthcoming Clinical Care Standard—despite limited and unpredictable funding.

To date, ANZELA-QI has operated under an informal working party, allowing agility and responsiveness. Given the evolving landscape, a formal governance structure will be established in the coming months.

ANZELA-QI has necessarily relied on the goodwill of many individuals, without whom it would not exist. I extend my sincere thanks to all, especially the working party, hospital leads, and the staff in the Royal Australasian College of Surgeons Adelaide office. It would also be remiss not to acknowledge Lettie Pule, who has been at the centre of all ANZELA-QI activities. Her contribution cannot be overstated, and on behalf of all, and especially myself, I extend to her my sincere thanks.

James Aitken

Chair, ANZELA-QI Working Party

Abbreviations

ANZCA	Australian and New Zealand College of Anaesthetists
ANZELA-QI	Australian and New Zealand Emergency Laparotomy Audit – Quality Improvement
ASA	Australian Society of Anaesthetists
CCU	critical care unit
CPD	continuous professional development
CT	computed tomography
CTANZ	Clinical Trials Network Australia New Zealand
CQR	clinical quality registry
DTO	decision to operate
ED	emergency department
ELFUS	Emergency Laparotomy Follow-Up Study
ERAS	emergency laparotomy recovery after surgery
FFS	fee for service
GIRFT	Getting It Right First Time
GSA	General Surgeons Australia
HREC	Human Research Ethics Committee
KPI	key performance indicator
LOS	length of stay
NCEPOD	National Confidential Enquiry into Patient Outcome and Death
NELA	National Emergency Laparotomy Audit
NSQHS	National Safety and Quality Health Service Standards
NZAGS	New Zealand Association of General Surgeons
NZSA	New Zealand Society of Anaesthetists
PELA	Perth Emergency Laparotomy Audit
RACS	Royal Australasian College of Surgeons
REDCap	Research Electronic Data Capture tool
RCS	Royal College of Surgeons of England
SD	standard deviations
SPC	statistical process control

Executive summary

7,682 Emergency laparotomy patients admitted between 1 Jan 2022 and 31 Dec 2024, at 42 hospitals nationally

PARTICIPATION AND CASE NUMBERS

7,682 emergency laparotomy **patients at 42 participating hospitals** were included
94.8% of these were **admitted as emergency**

PREOPERATIVE RADIOLOGY — KPI 1

93.8% had a **CT scan before surgery**.
78.3% of these had a **consultant radiologist report available**

SEPSIS AND ANTIBIOTICS — KPI 2

71.3% had **lactate level available** at the time of surgical referral
29.3% of these patients had **sepsis on admission**, and
9.2% received **antibiotics within 1 hour** of sepsis assessment

PREOPERATIVE RISK ASSESSMENT — KPI 3

43.7% had a documented **preoperative risk assessment**
Median scores within each preoperative risk category were 1.5% **(lower risk)**, 7.0% **(high risk)** and 20.1% **(highest risk)**

PREOPERATIVE FRAILTY ASSESSMENT — KPI 4

25% of patients aged ≥65 years **had their frailty assessment done preoperatively**

OUTCOMES

Risk-adjusted in-hospital **mortality** (6.9% nationally) **ranged from** 1.5% **to** 14.5% across hospitals–a large spread representing a **9.7-fold variation**

Mean postoperative **length of stay** (12.6 days nationally) **ranged from** 5.5 **to** 16.1 days across different hospitals (for those in hospital <60 days)

TIMELY ARRIVAL IN THEATRE — KPI 5

73.7% had a surgical urgency of **<18 hours**
58.9% of these **arrived in theatre within the appropriate timeframe**

CONSULTANT PRESENCE — KPI 6-8

Consultant presence in theatre was recorded for **97.4%** of those **who had a** documented **preoperative risk of death of ≥5%**
82.4% had both consultant surgeon and consultant anaesthetist present **in theatre during surgery**

CRITICAL CARE ACCESS — KPI 9

63.9% **of patients** with a preoperative risk score of ≥10% were **admitted to critical care** following surgery

POSTOPERATIVE GERIATRIC ASSESSMENT — KPI 10

21.8% of patients aged ≥65 years received a **postoperative assessment by a geriatrician**
27.0% had **assessment within 72 hours** of admission

Key messages

- **Improvement but with persistent inter-hospital variation:** Patient outcomes have improved between 2022 and 2024, but wide inter-hospital variation remains across key standards of care.
- **Comparable mortality, variable performance:** The national risk-adjusted mortality of 6.9% compares favorably with overseas, but there is still a tenfold inter-hospital variation
- **Consultant presence in the most urgent cases:** Only 20% of the most urgent cases reached theatre within two hours, and consultant presence after hours was inconsistent
- **KPI compliance drives better outcomes:** Hospitals achieving higher adherence to ANZELA–QI care standards show lower mortality and shorter hospital stays.
- **Frailty assessment remains low:** Few older patients receive formal frailty assessment or geriatric review, highlighting an important care gap.
- **Postoperative outcomes have improved:** Return-to-theatre rates and hospital stay have both decreased, indicating progress in perioperative care.
- **Failure to rescue highlights critical risk points:** Mortality was four times higher in patients returning to theatre (22.6% vs 5.5%), underscoring the need for timely escalation and consultant presence.
- **Data quality underpins progress:** Sustained participation, complete data capture, and investment in infrastructure are essential to realising ANZELA–QI's full potential.

Recommendations

For hospitals and clinicians:

- A documented preoperative risk assessment should be a requirement for all patients booked for a potential emergency laparotomy.
- Strengthen theatre access pathways to ensure time-to-surgery targets are met, particularly for urgent and septic cases.
- Ensure critical care access for all patients with a predicted mortality risk ≥10%, and implement protocols for postoperative escalation of care.
- Increase consultant presence for high-risk and out-of-hours emergency cases.
- Integrate frailty screening and early geriatric involvement into standard perioperative pathways for older adults.

For ANZELA-QI and national partners:

- Prioritise near real-time reporting by further developing data infrastructure to automate case capture and facilitate timely feedback.
- Expand performance measures to include postoperative outcomes beyond discharge, such as 30-day mortality and readmission.
- Improve data completeness through clearer governance and mandatory data submission standards across jurisdictions.
- Develop training and education modules aligned with audit findings to target areas of poor KPI performance.
- Collaborate nationally with state health departments, the Commission, and specialist colleges to embed ANZELA–QI into a sustainable national clinical quality registry framework.

1 Introduction

The Australian and New Zealand Emergency Laparotomy Audit – Quality Improvement (ANZELA–QI) is a prospective clinical quality registry established to monitor and improve the care and outcomes of emergency laparotomy patients across Australia. Modelled on the UK's National Emergency Laparotomy Audit (NELA), the audit benchmarks performance, identifies variation in care and supports evidence-based quality improvement.

Since it commenced in 2018, ANZELA has aimed to:

- build a high-quality database aligned (but locally adapted) to NELA standards and international guidelines to enable international and jurisdictional comparison
- collect high-quality, standardised data on emergency laparotomy patients
- monitor compliance with KPIs linked to patient outcomes
- provide timely, hospital-level feedback through monthly reports
- benchmark hospitals nationally to drive improvement in outcomes and processes of care.

Ethical approval is provided by a central Human Research Ethics Committee (HREC) – the South Metropolitan Health Services (SMHS) HREC (with waiver of individual consent). Local governance requirements and approvals are managed at site level.

2 Data collection and management

Hospitals contribute data either by entering it directly into a secure Research Electronic Data Capture (REDCap) database or via automated uploads from hospital systems. Built-in validation rules support data quality at the point of entry, supplemented by ongoing checks for completeness, accuracy, consistency and reconciliation with sites.

Data included in this report are from patients who met the following criteria:

- aged 18 years or over
- hospital admission date between **1 January 2022 and 31 December 2024**
- had an emergency laparotomy or laparoscopy
- required the laparotomy/laparoscopy urgently (within 24 hours).

Detailed inclusion and exclusion criteria can be found on the ANZELA website.

Data are extracted, cleansed and analysed, with hospitals receiving feedback in the second week of each month. Reports include patient-level summaries and performance against 10 KPIs, presented using funnel plots and SPC charts. SPC charts replaced the red-amber-green (RAG) system in 2023, enabling clearer distinction between true performance changes and random variation and earlier identification of areas requiring action. Data completeness is displayed using run charts but will shortly be presented with SPC charts.

KPI definitions and sample monthly reports including interpretation guide for SPC charts are provided in **Appendices A and B**. Data validation processes are outlined in **Appendix C**.

In addition, the audit monitors key outcomes, including:

- mortality
- mean length of stay
- discharge destination
- return to theatre
- Clavien-Dindo complication grade.

Reports can be used to inform local morbidity and mortality reviews, strengthen clinical governance and support targeted quality improvement initiatives.

3 Findings

3.1 Who has emergency laparotomy surgery?

This report is based on 7,682 patients who had an emergency laparotomy at one of 42 Australian hospitals between 1 January 2022 and 31 December 2024 (see list of participating hospitals in Appendix D, Table D1).

- The number of patients recorded increased from 2,041 in 2022 to 3,294 in 2024.
- The number of hospitals included in the report increased from 25 to 42.
- Females represented 50.7% of cases; males 49.2%.
- The median age was 66 years (interquartile range [IQR] 52–77).
- Patients aged ≥65 years comprised 53.6% of the total population (4,117/7,682).
- Most patients (95.1%; 7,303/7,682) were admitted as an emergency (Table 1).

Table 1: Characteristics of patients included in this report, (2022–2024)

Patient characteristic	Patient characteristic group	Patients, n (%)
Sex	Male	3,785 (49.2)
	Female	3,892 (50.7)
	Intersex or indeterminate or not stated	5 (0.1)
Ethnicity	Aboriginal	172 (2.2)
	Torres Strait Islander	1 (<1)
	Māori	27 (0.4)
	Pacific peoples	17 (0.2)
	All other ethnicities	6,589 (85.8)
	Missing	876 (11.4)
Age (years)	18–24	136 (1.8)
	25–34	365 (4.8)
	35–44	648 (8.4)
	45–54	1,010 (13.2)
	55–64	1,406 (18.3)
	65–74	1,726 (22.5)
	75–84	1,659 (21.6)
	85–94	701 (9.3)
	≥95	31 (0.4)
Admission type	Emergency	7,303 (95.1)
	Elective	339 (4.4)
	Missing	40 (0.5)
Urgency of EL procedure	0–<2 hours	413 (5.4)
	2–<6 hours	2,929 (38.1)
	6–<18 hours	2,318 (30.2)
	18–24 hours	2,022 (26.3)
Hours from DTO to theatre	0–<2 hours	648 (8.4)
	2–<6 hours	116 (1.5)
	6–<18 hours	1203 (15.7)
	18–24 hours	443 (5.8)
	>24 hours	239 (3.1)
	Missing	5033 (65.5)
Discharge status	Alive	6,883 (89.6)
	Died	525 (6.8)
	Still in hospital at 60 days after admission	103 (1.3)
	Missing	171 (2.2)
Total		**7,682 (100.0)**

Abbreviations
DTO = decision to operate; EL = emergency laparotomy

Notes
Missing = fields left blank
n = number of eligible emergency laparotomy patients or cases

The preoperative indications are shown in Table 2. These mainly consist of obstruction or perforation of the bowel.

Table 2: Preoperative indications for surgery as recorded on surgical booking form, (2022–2024)

Preoperative indications for surgery	Patients, n (%)
Obstruction – small bowel	2,497 (24.2%)
Perforation	1,868 (18.1%)
Obstruction – large bowel	797 (7.7%)
Peritonitis	788 (7.6%)
Ischaemia	676 (6.6%)
Hernia – incarcerated	590 (5.7%)
Sepsis	406 (3.9%)
Abdominal abscess	393 (3.8%)
Haemorrhage	290 (2.8%)
Hernia – internal	272 (2.6%)
Phlegmon/inflammatory mass	257 (2.5%)
Volvulus	255 (2.5%)
Pneumoperitoneum	250 (2.4%)
Hernia – incisional	192 (1.9%)
Anastomotic leak	154 (1.5%)
Necrosis	86 (0.8%)
Colitis	85 (0.8%)
Intussusception	63 (0.6%)
Iatrogenic injury	62 (0.6%)
Bile leak	60 (0.6%)
Foreign body	52 (0.5%)
Intestinal fistula	43 (0.4%)
Abdominal wound dehiscence	37 (0.4%)
Hernia – hiatus	29 (0.3%)
Pseudo-obstruction	28 (0.3%)
Acidosis	26 (0.3%)
Gastric band complication	18 (0.2%)
Planned relook	18 (0.2%)
Abdominal compartment syndrome	16 (0.2%)
Chyle leak	1 (0%)
Total	7,682 (100%)

Notes
Each patient can have more than one indication.

3.2 ANZELA-QI KPIs

The results for each KPI are discussed under the following headings:

- Importance of KPI
- Findings
- Additional analyses (if relevant)
- Clinical commentary and recommendations.

3.2.1 Radiology

PRE 1 – Proportion of all emergency laparotomy patients for whom a CT scan was performed and reported by a consultant radiologist before surgery

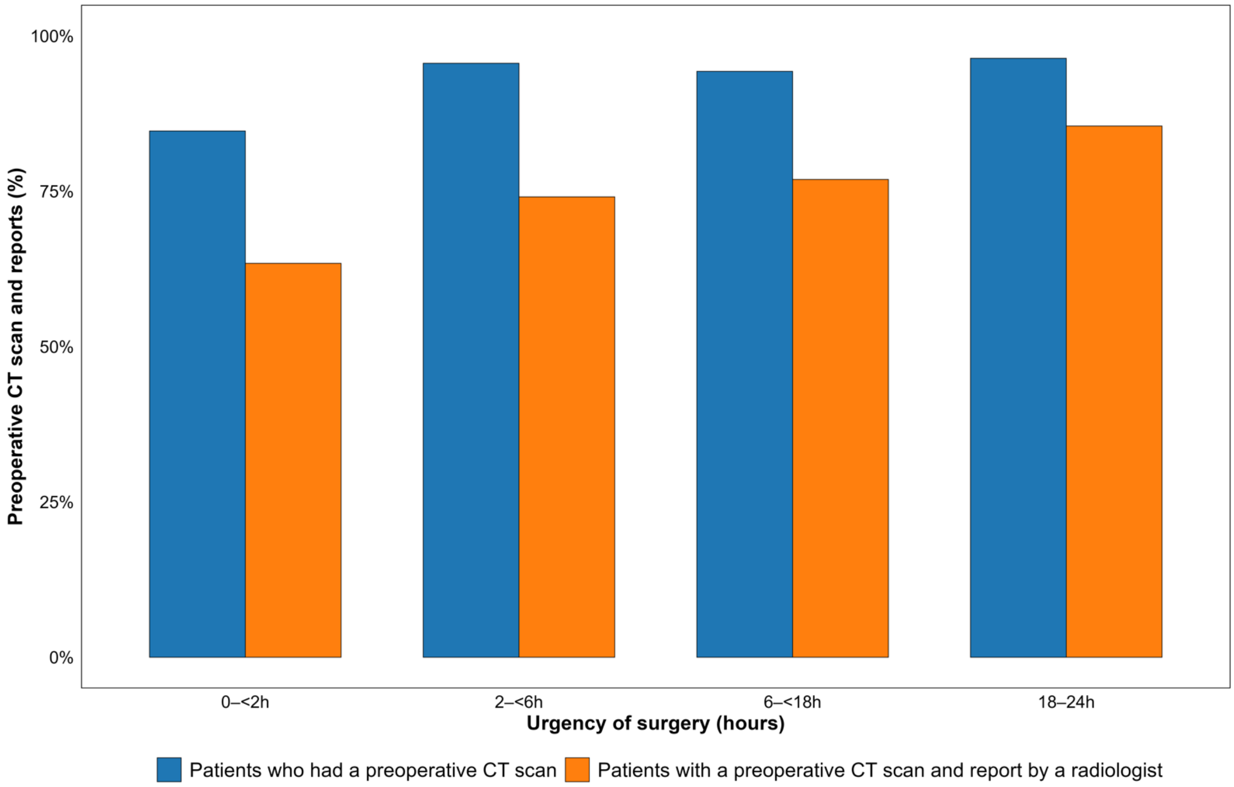
Importance of KPI

Patients being considered for an emergency laparotomy should have a preoperative CT scan.[24] Ideally, a consultant radiologist should report CT scans prior to surgery.

Findings:

- An abdominal CT scan was performed prior to surgery in 93.8% (7,205/7,682).
- Of the patients who had a CT scan prior to surgery, a report from a consultant radiologist was available for 78.3% (5,640/7,205; Figure 1).
- Only 74.9% (262/350) of CT scans in patients with an urgency of <2 hours were reported by a consultant radiologist prior to surgery.
- For patients with a surgical urgency of 18–24 hours, 88.8% (71/80) of CT scans were reported by a consultant radiologist prior to surgery (Figure 1).

Figure 1: Preoperative CT scan and report by consultant radiologist by category of surgical urgency



Abbreviations
CT = computed tomography

3.2.2 Lactate level available

PRE 2 – Lactate level available to the surgeon at the time of surgical referral for patients admitted via the emergency department (ED)

Importance of KPI

Identifying septic patients in the ED is a critical starting point. In September 2021, the availability of a lactate level to the surgeon at the time of referral for patients admitted via ED was added as a regularly reported metric. This was to align ANZELA with the Commission's Sepsis Clinical Care Standards. [25] Hospitals were unaware of their comparative performance prior to this time.

In this reporting period, 87.8% of emergency laparotomy patients were admitted via the ED.

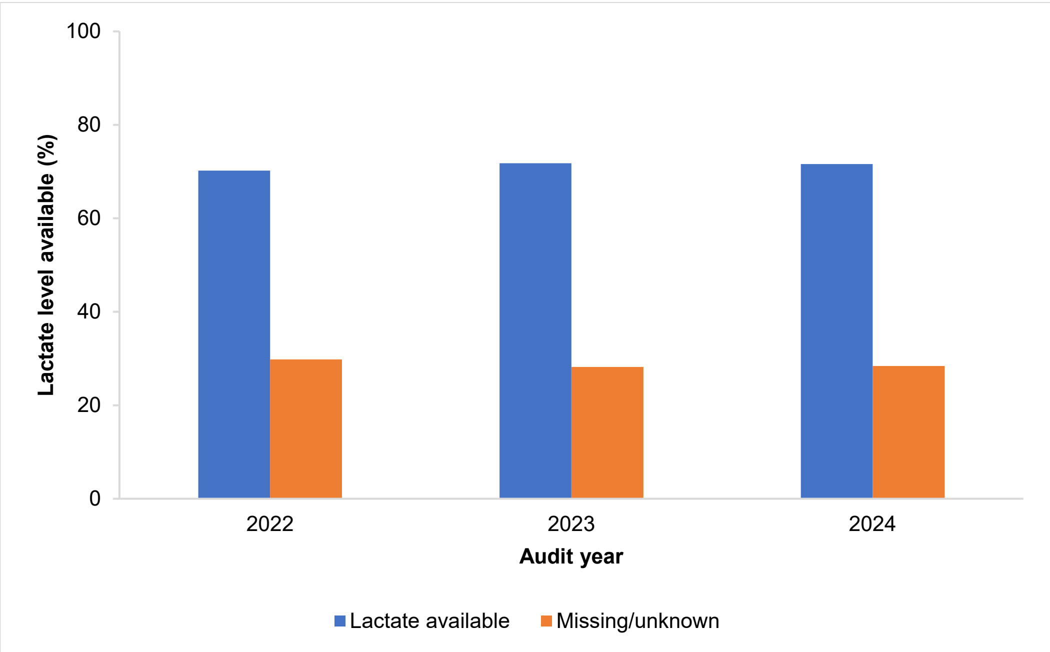
Findings

The lactate level was available at the time of surgical referral in 71.3% (4,809/6,747) of patients admitted via ED. Of these, 29.3% (1,410/4,809) had sepsis on admission, but only 9.2% (130/1,410) received antibiotics within one hour from admission.

NELA 10th report comparison

Only 15.4% of patients with suspected sepsis received antibiotics within the one-hour target.[26]

Figure 2: Lactate level available at the time of surgical referral by audit year



3.2.3 Preoperative risk assessment

PRE 3 – Proportion of patients for whom a risk assessment was performed and documented preoperatively

Importance of KPI

Identifying high-risk patients preoperatively will permit their care to be appropriately escalated. It may also aid discussion with patients, their families and carers regarding the decision to operate

(DTO), goals of care and postoperative ceilings of care. The NELA risk assessment score has been validated for Australia.[27]

Findings (Table 3):

- 43.7% (3,353/7,682) had a documented preoperative risk assessment.
- 48.2% (3,703/7,682) had a risk assessment calculated postoperatively.
- Median scores within each preoperative risk category were 1.4% (lower risk), 7.0% (high risk) and 20.0% (highest risk) (data not shown).
- There was wide inter-hospital variation in compliance (Figure 3).
- Compliance also differed with age (Figure 4).

Table 3: Documentation of NELA risk-of-death scores

		Patients	
	Predicted risk (%)	**n**	**%**
Documented preoperatively		**3,353**	**43.6**
Lower risk of death	<5	1,598	
High risk of death	5–<10	591	
	10–<25	711	
Highest risk of death	25–<50	344	
	≥50.0	109	
Documented postoperatively		**3,703**	**48.2**
Lower risk of death	<5	2,232	
High risk of death	5–<10	592	
	10–<25	548	
Highest risk of death	25–<50	232	
	≥50.0	99	
Score not documented		**407**	**5.3**
Missing		**219**	**2.9**
Total		**7,682**	**100**

Notes
n (%) = number (percentage) of patients
Percentages in this table are of the total number of subjects (n=7,682).

Figure 3: Documentation of risk assessment by hospital

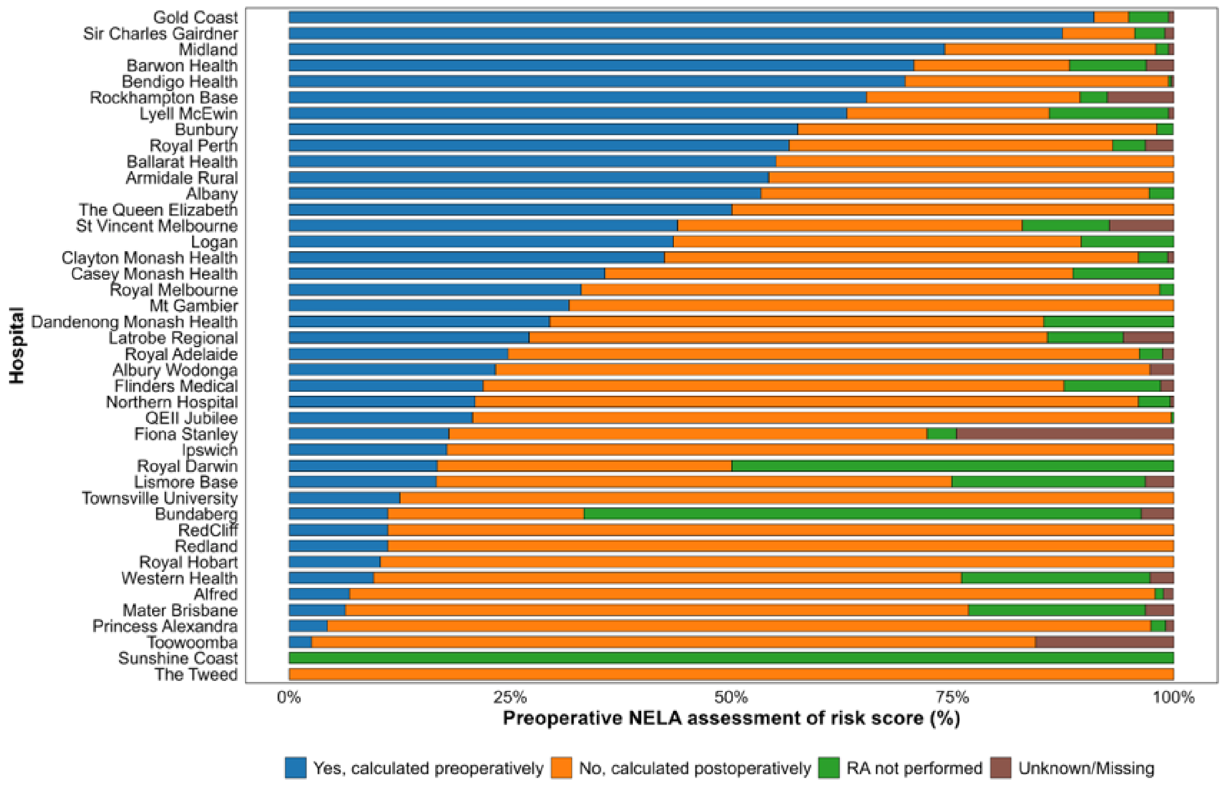
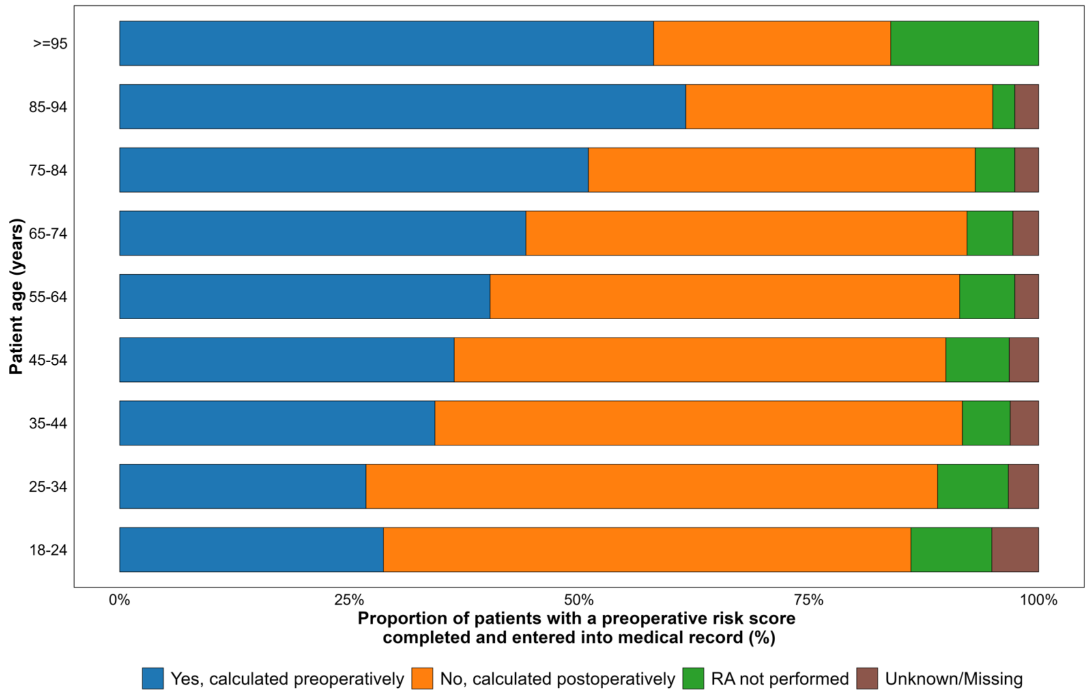
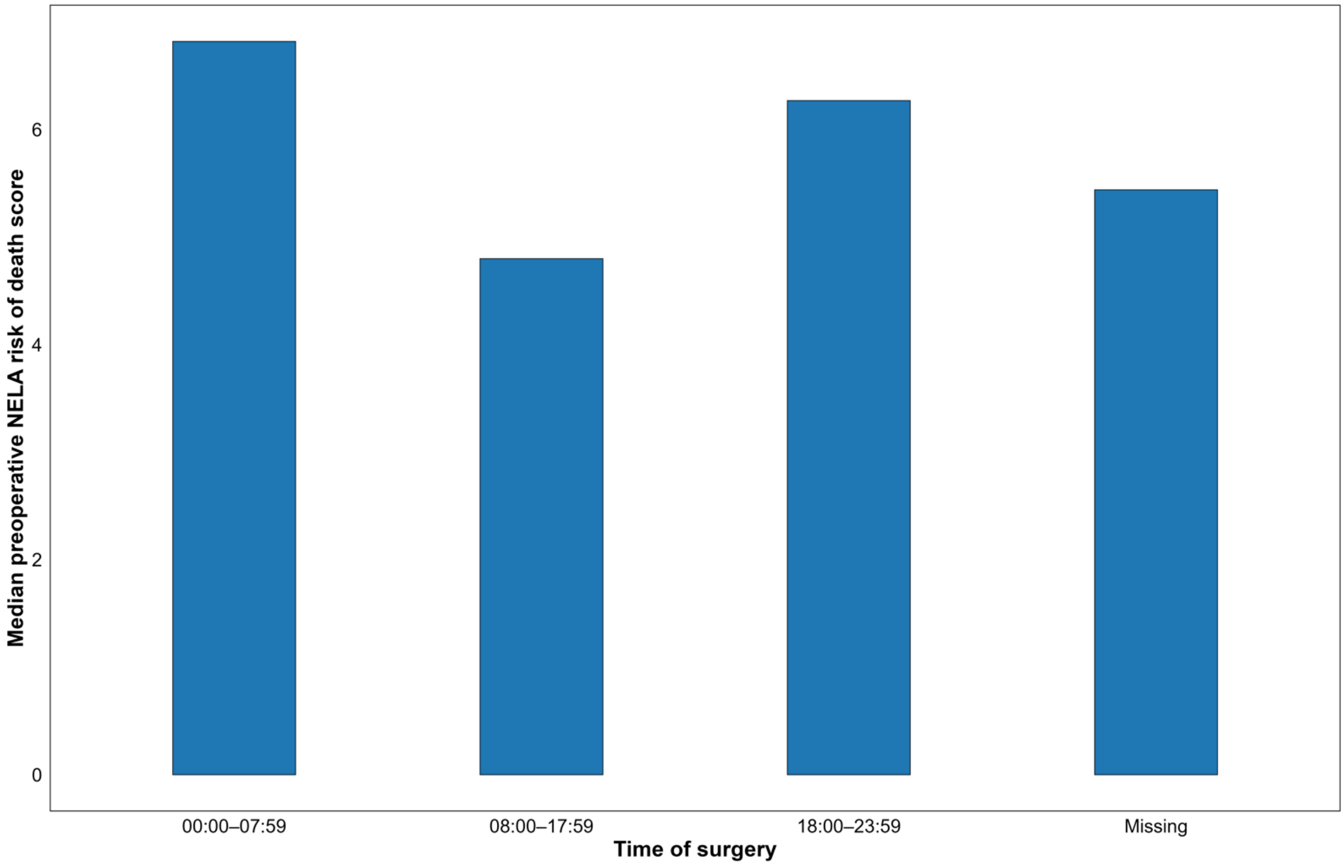


Figure 4: Risk-of-death assessment completion across different age groups



<u>Notes</u>
Missing/unknown = score is missing or field is left blank (n=219)
No = calculated and entered into the medical record postoperatively (n=3,703)
RA not performed = no, calculated but not entered into the medical records (n=13) or not calculated or no option selected (n=394)
Yes = a risk-of-death score for the patient calculated and entered into medical record preoperatively (n=3,353)

Figure 5: Median preoperative risk-of-death score, by time of surgery for emergency laparotomy



Notes

Time of surgery refers to the time of day that the surgery took place (e.g. time provided for knife to skin or wheels in operating theatre, depending on what is typically collected at each hospital).

Comment

Patients who had surgery overnight or in the evening had the highest median predicted risk (Figure 5). This may be a reflection of surgeons using the risk assessment to justify out-of-hours surgery in the highest-risk patients.

Patients who did not have a risk assessment had 8.1% mortality, so high risk.[28] A risk assessment should be a routine part of the theatre booking process.

3.2.4 Preoperative frailty assessment

PRE 4 – Preoperative frailty assessment performed for patients aged ≥65 years

Importance of KPI

Frailty is now recognised as a major determinant of outcome after emergency laparotomy. The assessment of frailty is one of the 5 key recommendations since the seventh NELA report.

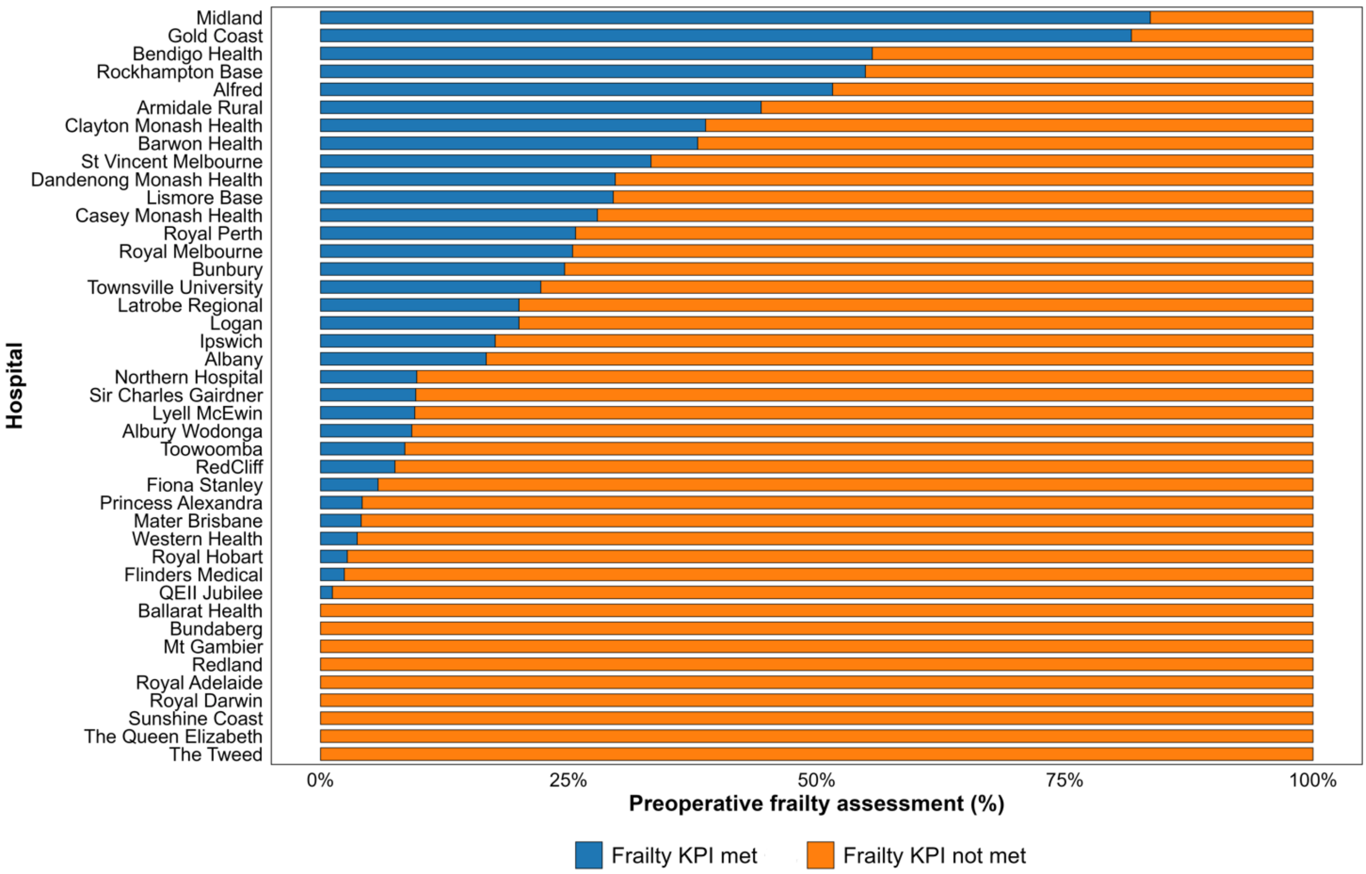
Frailty assessment has been added to ANZELA–QI monthly reporting.

Findings

Despite this KPI being formally reported only since September 2021, some hospitals were already routinely reporting it. Given this background, compliance rates prior to September 2021 are reported where available. However, these previous results should be interpreted with caution.

- Of 4,117 patients aged ≥65 years, 1,029 (25.0%) had their frailty assessment done preoperatively.
- The inter-hospital variation is shown in Figure 6.

Figure 6: Preoperative frailty assessment for patients aged ≥65 years by hospital



Abbreviations
KPI = key performance indicator

3.2.5 Timeliness of arrival in theatre

PRE 5 – Proportion of patients arriving in theatre within a time appropriate for the urgency of surgery (documented urgency 24 hours or less)

Importance of KPI

For many patients undergoing an emergency laparotomy, time to surgery has a direct impact on outcome. Septic patients should have surgery in <6 hours, and within 3 hours if there is septic shock.[1]

ANZELA–QI stratified surgical urgency into 4 categories: less than 2 hours, 2–<6 hours, 6–<18 hours and 18–24 hours from hospital admission. PRE 5 KPI is based on the 3 most urgent categories.

Findings (Figure 7):

- 73.7% (5,660/7,682) had a surgical urgency of <18 hours.
- 3,331 of 5,660 (58.9%) arrived in theatre within the appropriate timeframe
    - urgency of <2 hours: 86 of 413 (20.8%) arrived in theatre within the appropriate timeframe
    - urgency of 2–<6 hours: 1,641 of 2,929 (56.0%) arrived in theatre within the appropriate timeframe.

Figure 7: Proportion of patients arriving in theatre within the appropriate timeframe

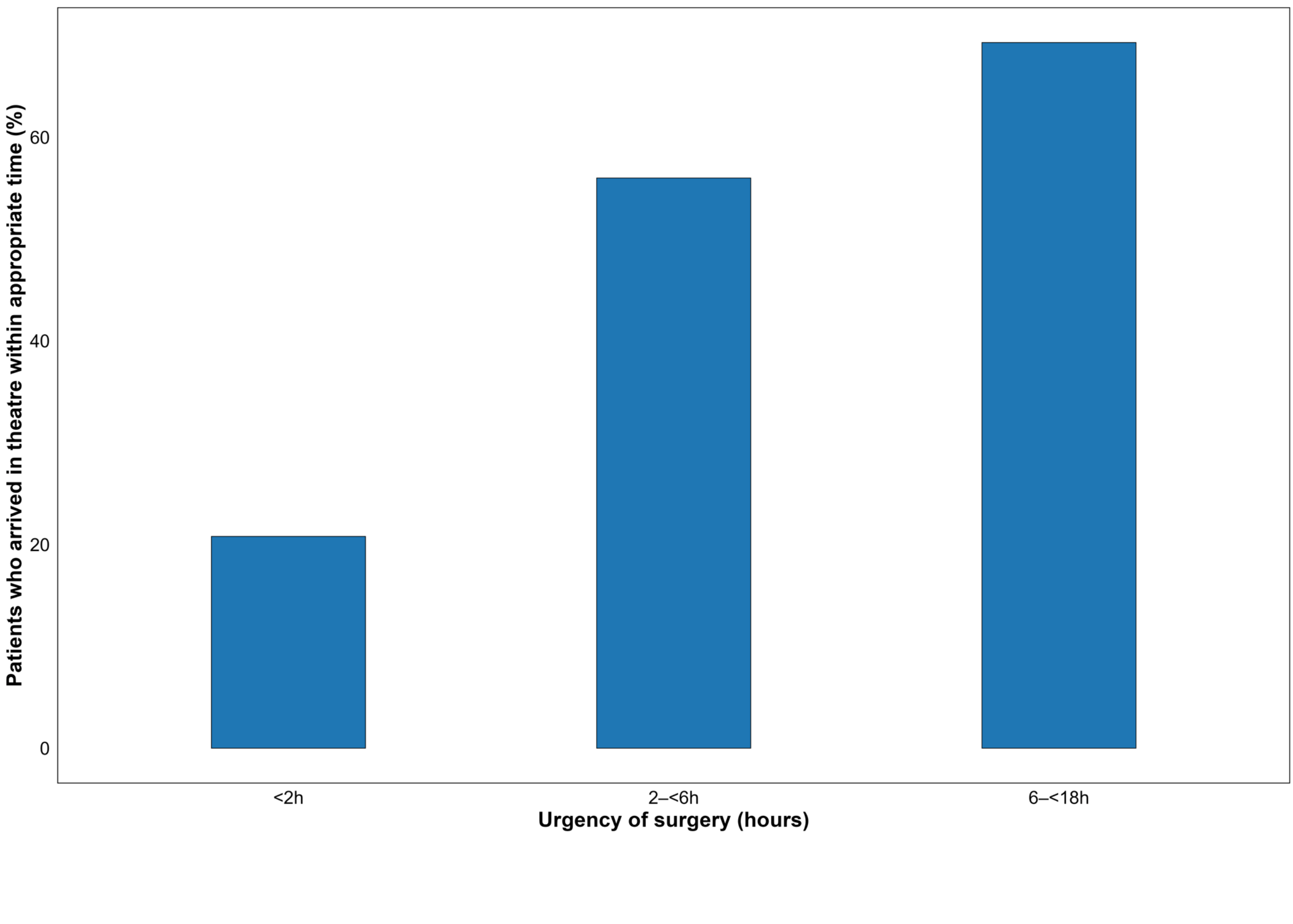


Figure 8: Proportion of patients with preoperatively documented risk of death, by documented urgency of surgery

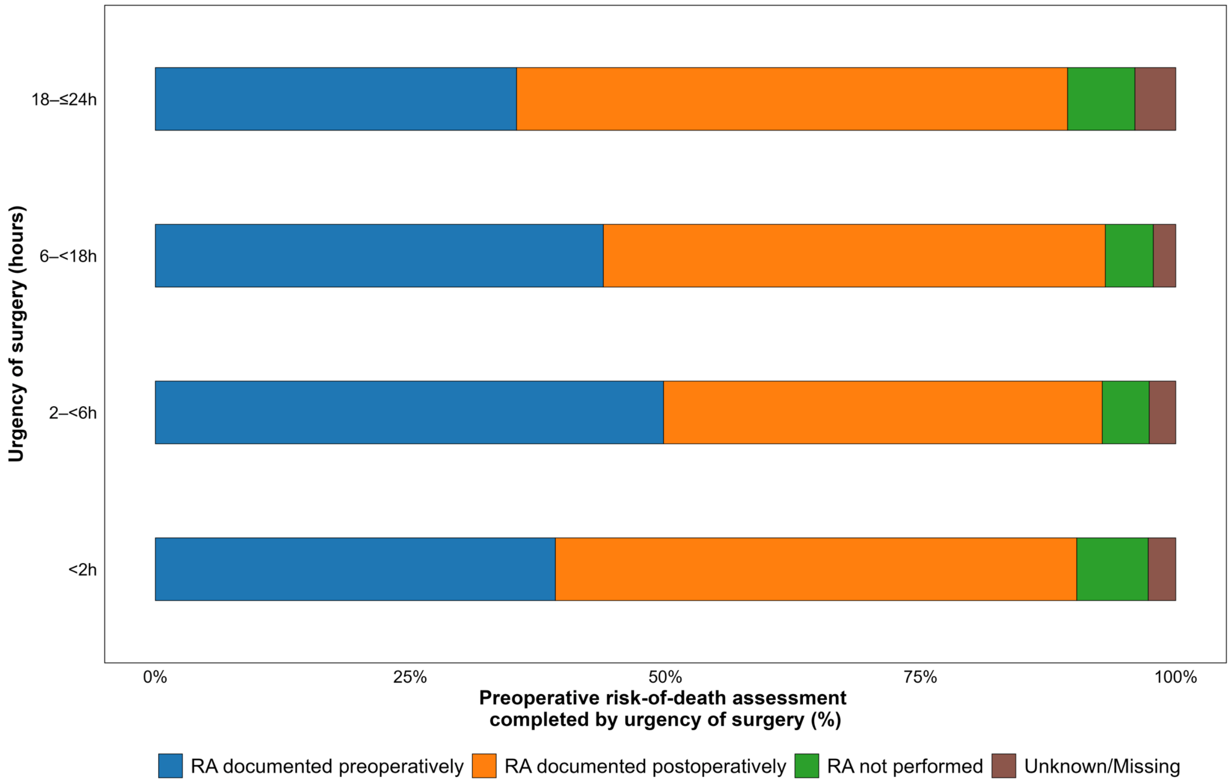
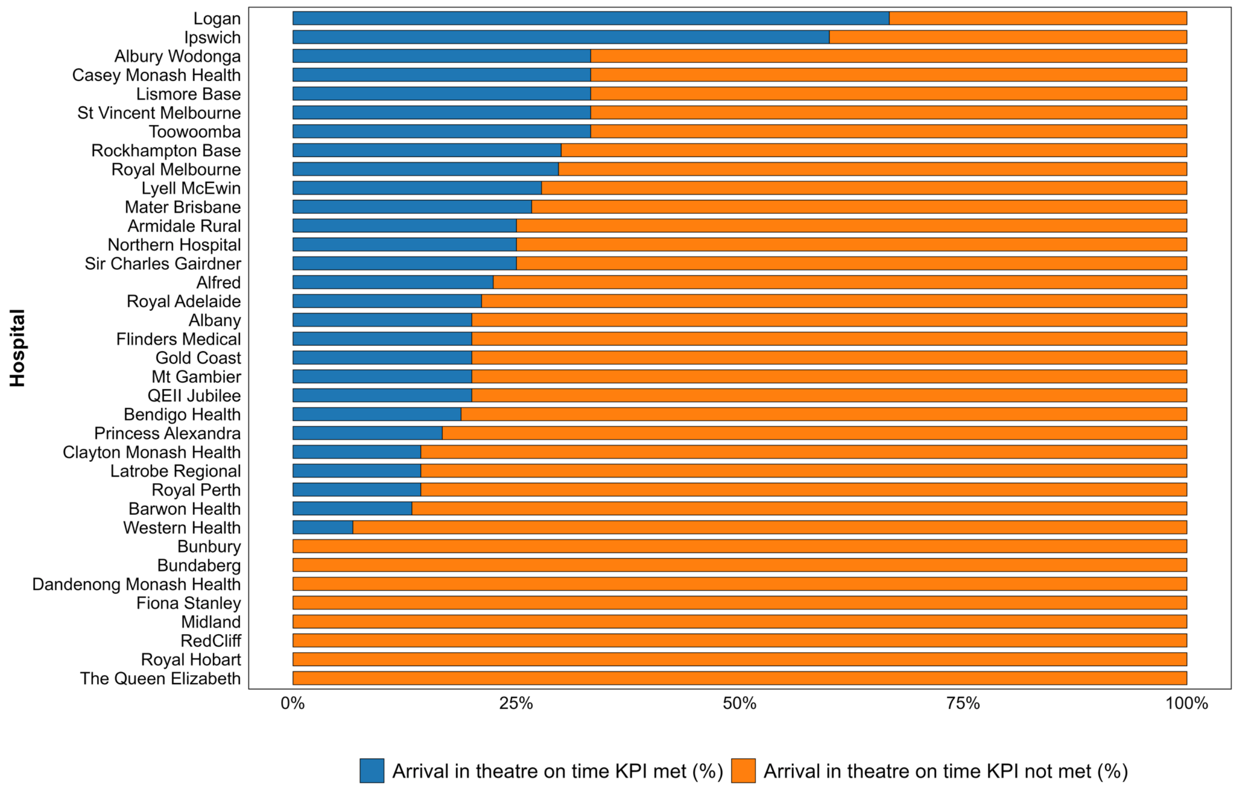


Figure 9: Proportion of patients arriving in theatre on time for urgency 0–<2 hour by hospital



Abbreviations
KPI = key performance indicator

Figure 10: Proportion of patients arriving in theatre on time for urgency 2–<6 hours by hospital

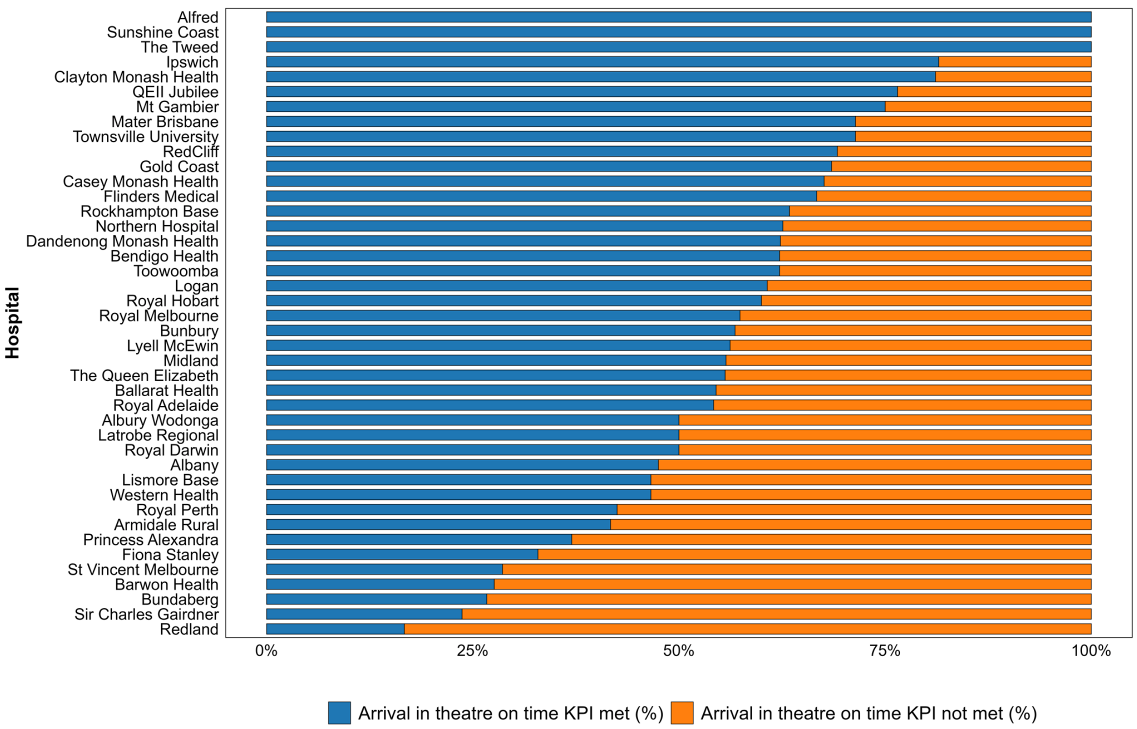
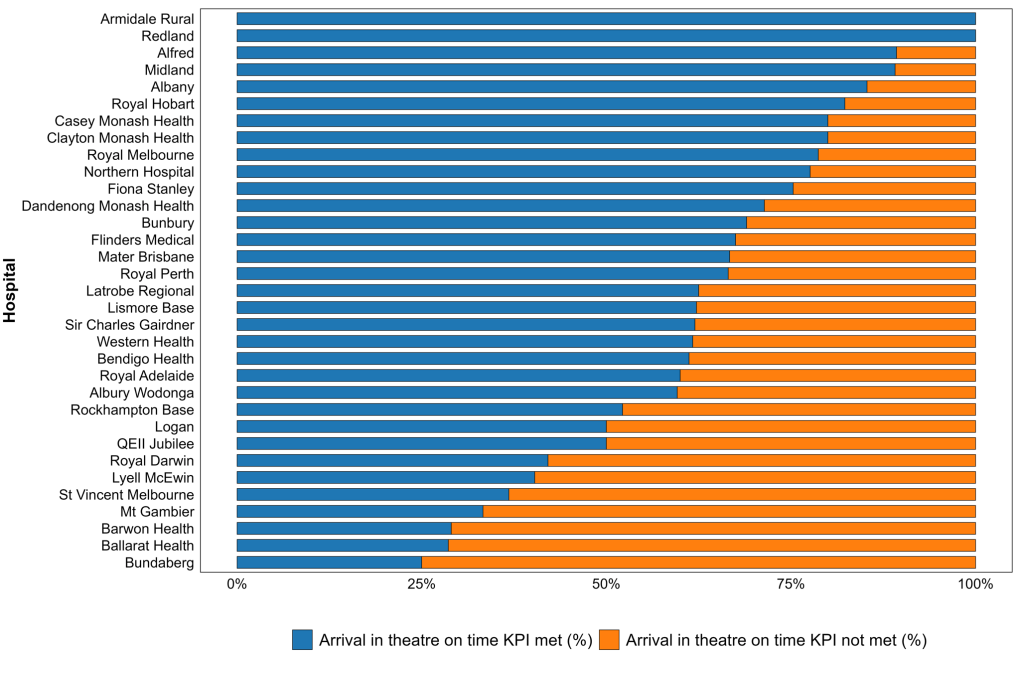


Figure 11: Proportion of patients arriving in theatre on time for urgency 6–<18 hours by hospital



<u>Abbreviations</u>
KPI = key performance indicator

Comment

In patients with sepsis, mortality rises by approximately 7% with each additional hour of delay. There are clearly defined standards of care.[24]

Only 20.8% of the most urgent patients (surgery in <2 hours), and by definition the most unwell, achieved this standard. Hospitals that have not met this KPI need to review their theatre access processes.

3.2.6 Consultant input during surgery

OP 1 – Proportion of patients with a calculated preoperative risk of death ≥5% for whom a consultant surgeon and consultant anaesthetist were present in theatre

OP 2 – Proportion of patients with a calculated preoperative risk of death ≥5% for whom a consultant surgeon was present in theatre

OP 3 – Proportion of patients with a calculated preoperative risk of death ≥5% for whom a consultant anaesthetist was present in theatre

Importance of KPI

It would be normal practice for both a consultant surgeon and a consultant anaesthetist to be present in theatre for a high-risk elective general surgical patient. The same standard of care should be delivered to high-risk emergency general surgical patients.

Findings (Table 4):

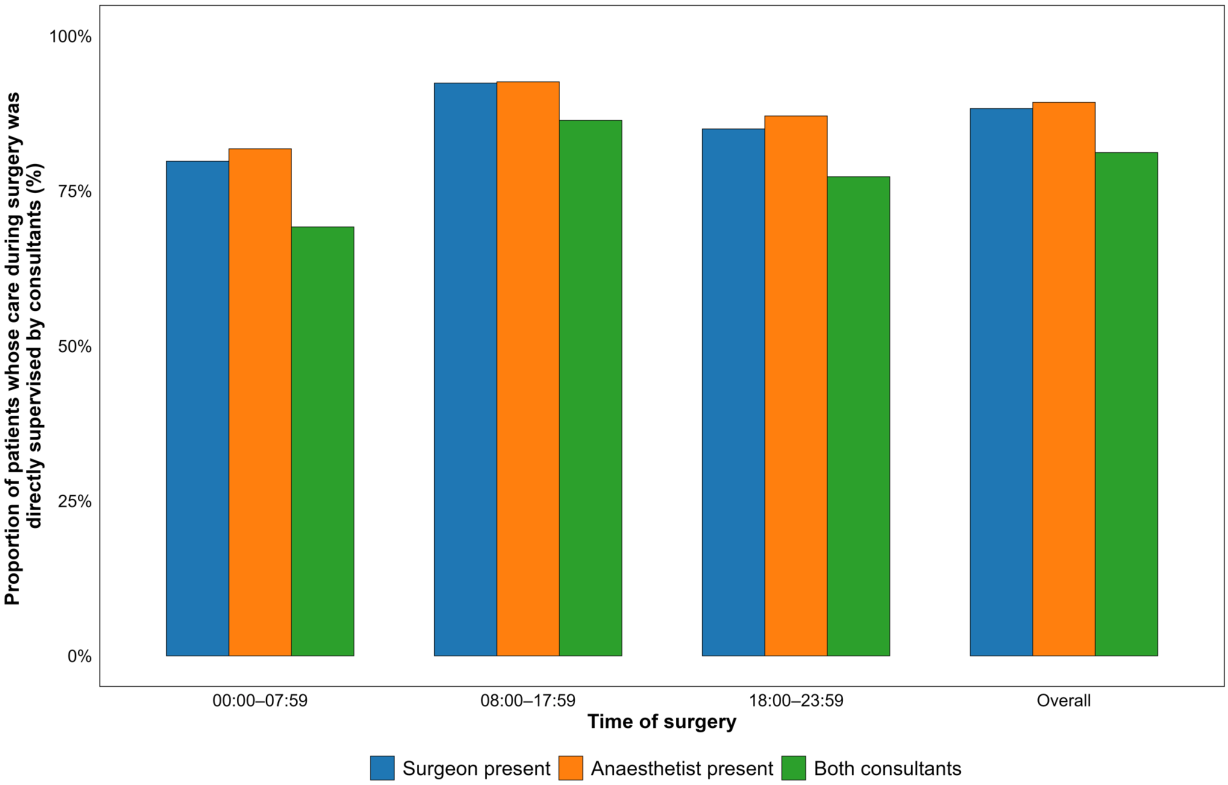
- Consultant presence in theatre was recorded for 97.4% (3,142/3,226) of those who had a documented preoperative risk of death of ≥5%.
- More patients in the highest-risk group (83.0%; 1,650/1,989) than in the high-risk group (80.5%; 928/1,1153) had both consultants present during their surgery.
- 2.8% (88/3,142) of the high- and highest-risk patients had neither consultant present during their surgery.

Table 4: Consultant presence during surgery for high-risk patients (preoperative risk-of-death score ≥5%)

		Consultant(s) present during surgery			
	Patients at risk	**Both consultants n (%)**	**Consultant surgeon n (%)**	**Consultant anaesthetist n (%)**	**Neither consultant n (%)**
High (≥5%–9.9%)	1,153	928 (80.5)	1,003 (87.0)	1,043 (90.5)	35 (3.0)
Highest (≥10%)	1,989	1,650 (83.0)	1,766 (88.8)	1,820 (91.5)	53 (2.7)
Overall	3,142	2,578 (82.0)	2,769 (88.0)	2,863 (91.1)	88 (2.8)

Notes
n (%) = number (percentage) of patients
This table does not include n = 84 patients who had a preoperative high-risk score but consultant presence during their surgery was not recorded.

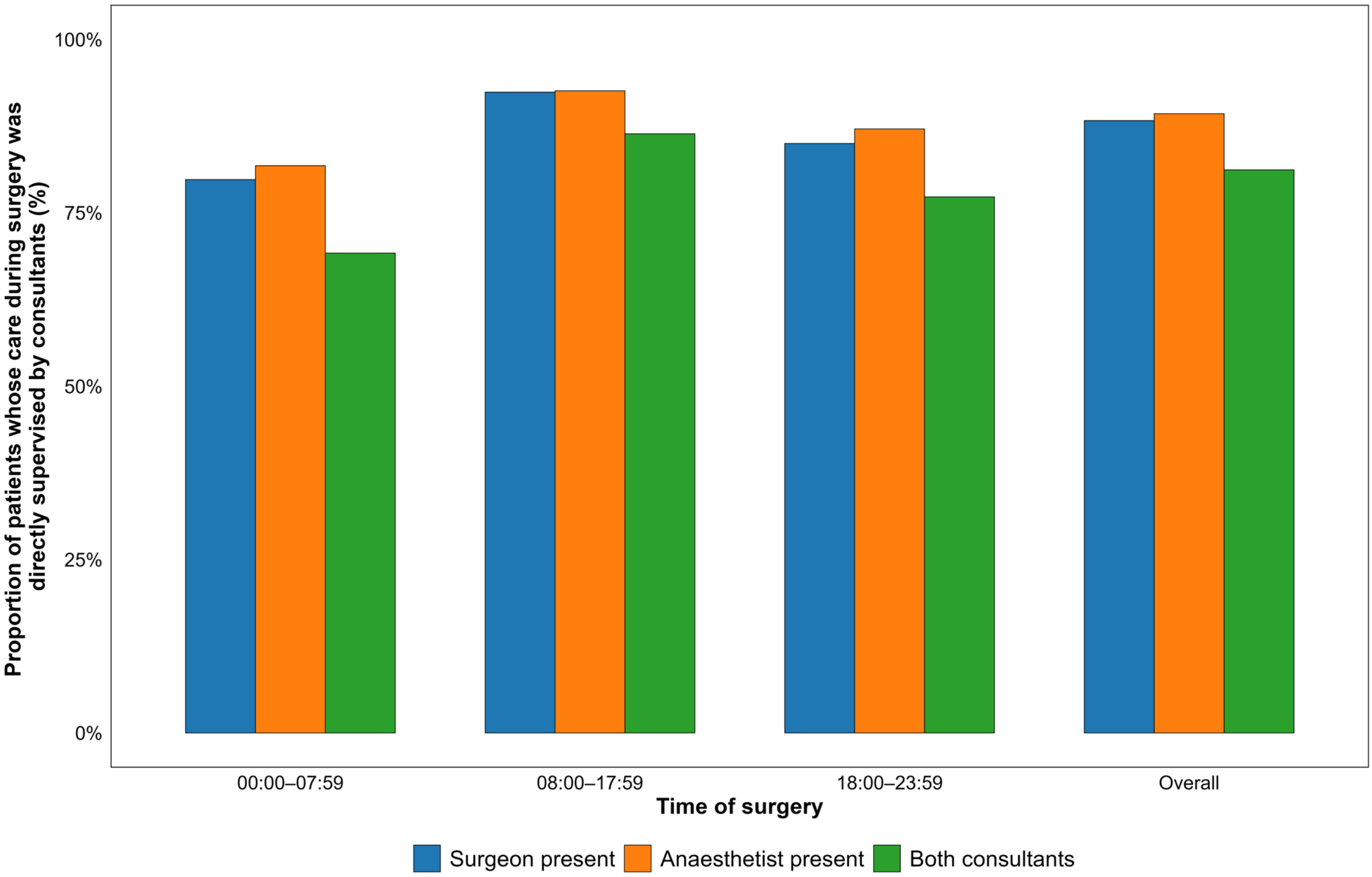
Figure 12: Consultants present in theatre on a weekday for patients with a preoperative risk-of-death score ≥5%, by time of emergency laparotomy



Notes

Time of surgery refers to the time of day that the surgery took place (e.g. time provided for knife to skin or wheels in operating theatre, depending on what is typically collected at each hospital). The overall consultant presence will be greater in hospitals where the consultants are paid fee for service, and they would attend for almost every operation. This means that in other hospitals, consultant attendance would be less than the average that appears in the figure.

Figure 13: Consultants present in theatre on a weekend for patients with a risk-of-death score ≥5%, by time of emergency laparotomy



Notes

Time of surgery refers to the time of day that the surgery took place (e.g. time provided for knife to skin or wheels in operating theatre, depending on what is typically collected at each hospital). The overall consultant presence will be greater in hospitals where the consultants are paid fee for service, and they would attend for almost every operation. This means that in other hospitals, consultant attendance would be less than the average that appears in the figure.

Comment

During the week, only patients with the greatest risk should have surgery after hours and only those requiring 'life and limb' saving surgery should have surgery overnight. These patients were the least likely to have a consultant present.

These data display the average consultant presence. In Australia, a consultant will be present for all (100%) occasions if they are paid fee for service (FFS), either because the patient is private or because they are a visiting medical officer. These cases are included in this analysis. To 'balance' this 100% attendance means that consultant attendance in many public hospitals, where consultants are not paid FFS and there are junior staff, must be less than the average. At present, ANZELA–QI is not able to undertake a more detailed analysis, but the clear implication is that consultant attendance in public hospitals could be lower than as displayed in Figures 12 and 13. As hospitals with junior staff are more likely to manage the most unwell patients, and many will have been transferred for that reason, this has important implications.

3.2.7 Postoperative admission to critical care

POST OP 1 – Proportion of patients with a preoperative risk of death ≥10% who were directly admitted to critical care postoperatively

Importance of KPI

The overall risk-adjusted mortality rate was 7.0%, and 16.0% for patients who had a predicted mortality of ≥10%. Many of these patients should have their initial postoperative care in a critical care (CCU).

Findings:

- 744 of 1,164 (63.9%) patients with a preoperative NELA risk assessment score of ≥10% were admitted to critical care following surgery. Admission to critical care after surgery was associated with higher preoperative risk-of-death scores (Figure 14).
- 140 of 7,682 (1.8%) patients had an unplanned postoperative transfer from the ward to unit CCU (data not shown). Of the patients who had a risk assessment, the highest-risk patients were most likely to be admitted to CCU (Figure 14).
- Patients who had not had a preoperative risk assessment were more likely to have an unplanned admission to CCU (Figure 15).

Figure 14: Proportion of patients admitted directly to CCU, by documented preoperative risk assessment score

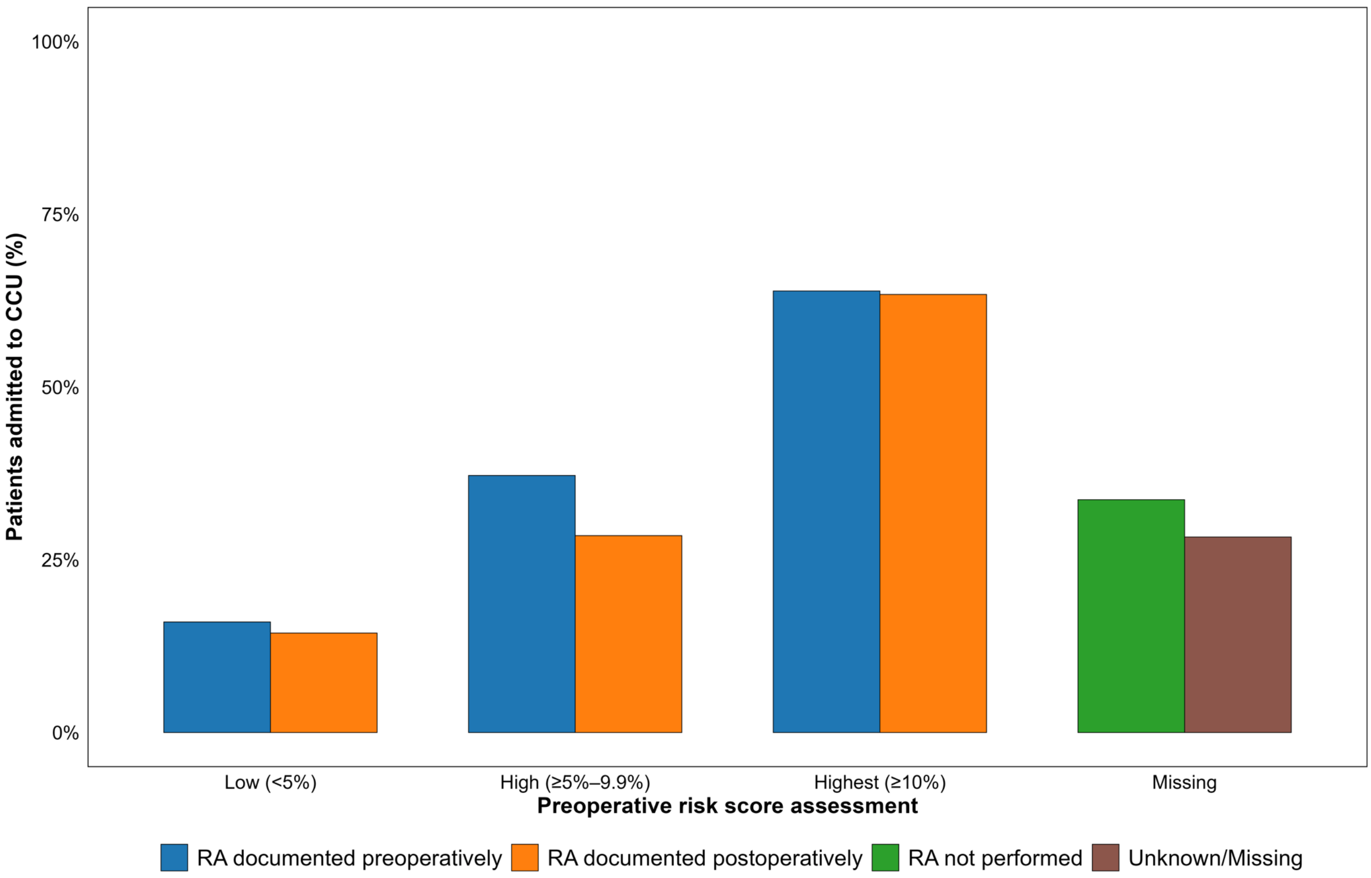
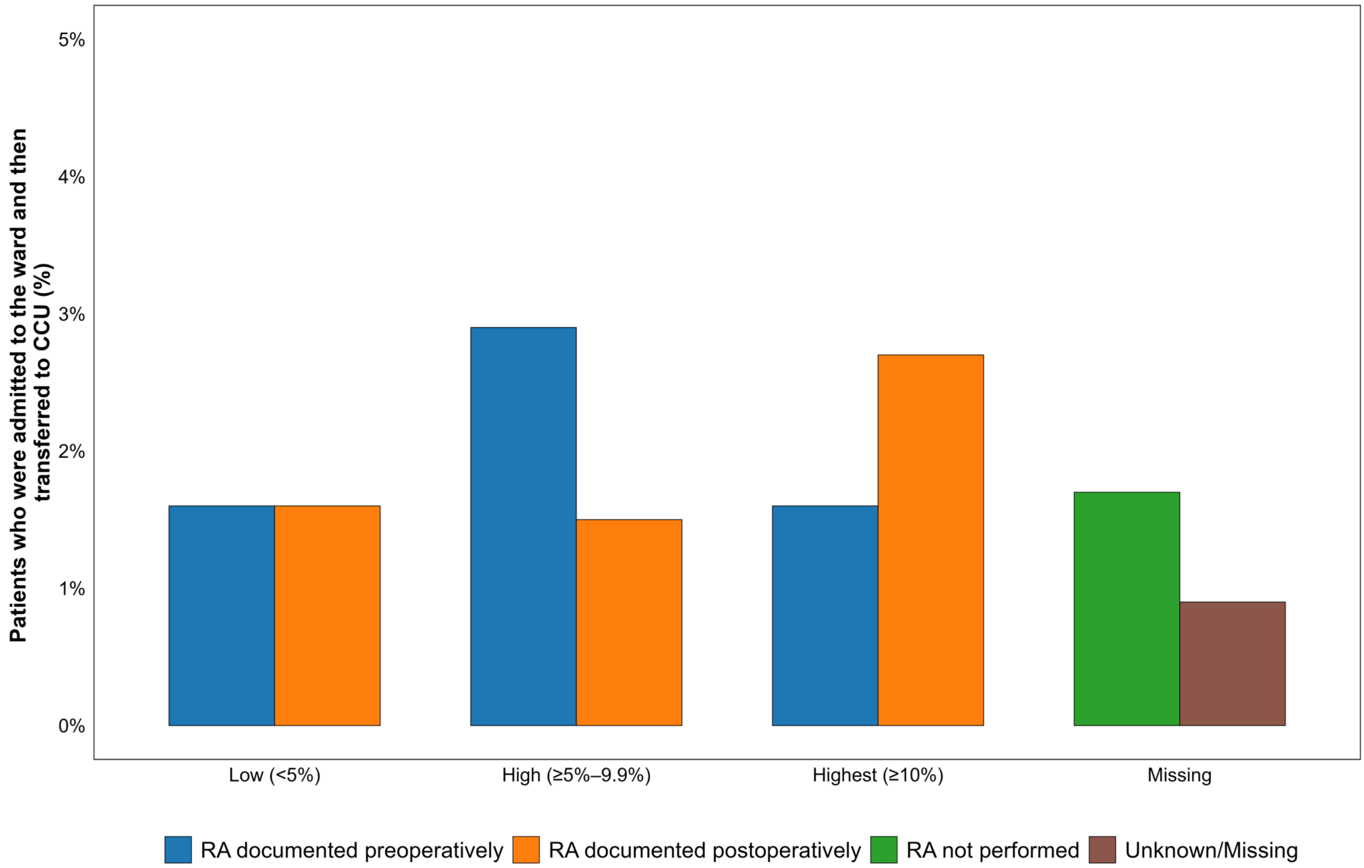


Figure 15: Proportion of high-risk patients admitted to the ward and then transferred to CCU, by preoperative risk assessment score



Comment

All patients undergoing an emergency laparotomy should have a preoperative risk assessment score and if ≥10% should be routinely considered for admission into CCU. NELA recommends that patients with a preoperative risk assessment score ≥5% should be admitted into CCU.

3.2.8 Patients aged ≥65 years having emergency laparotomy

POST OP 2 – Proportion of patients aged ≥65 years who were assessed by a specialist in elderly medicine

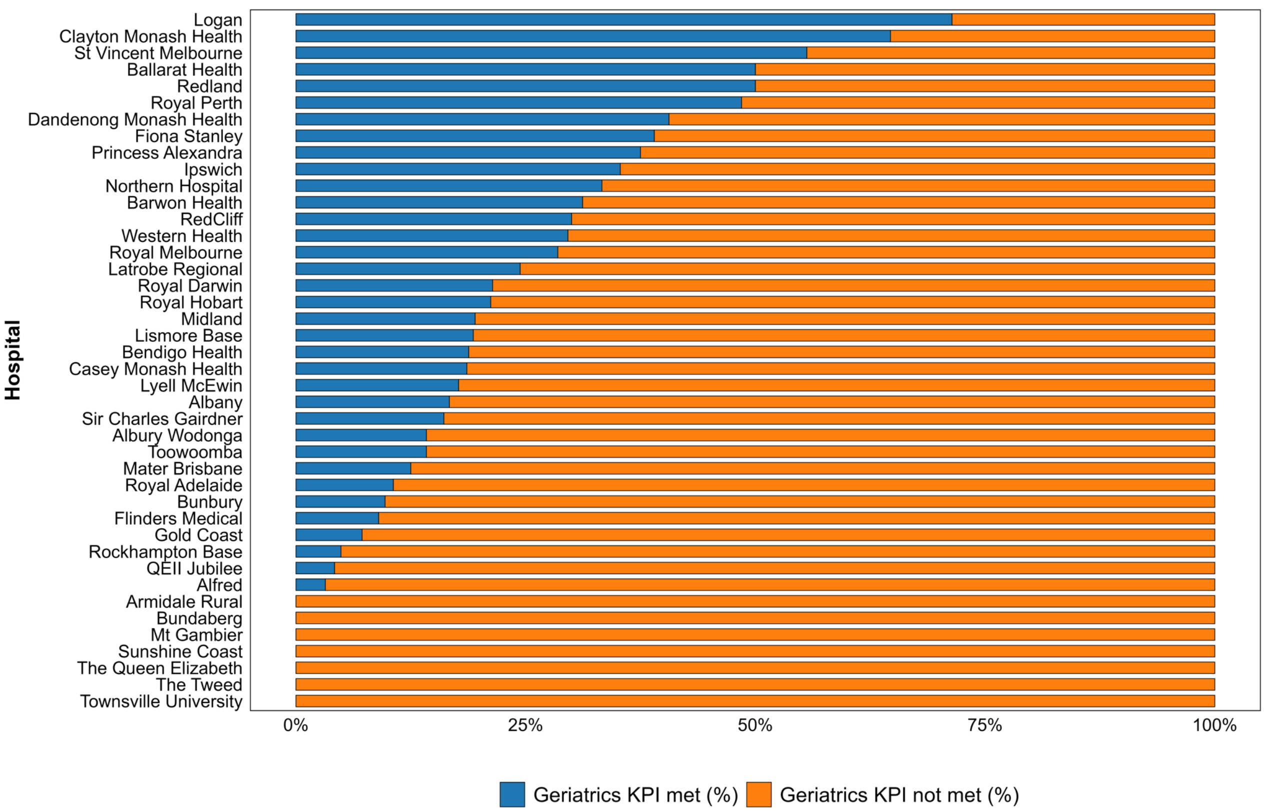
Importance of KPI

Multiple studies have shown that elderly patients benefit from pre-emptive multidisciplinary care, including input from a specialist in gerontology.

Findings (Figures 16 and 17):

- Data were collected from 4,117 patients aged ≥65 years.
- 896 (21.8%) received a postoperative assessment by a specialist in gerontology or a gerontology team.
- 242 (27.0%) had postoperative assessment by gerontology team within 72 hours from admission.
- There was wide inter-hospital variation.
- Patients aged 65 to 74 and 75 to 84 years were less likely to receive an assessment by the gerontology team compared to patients aged ≥85 years (15.9% and 23.2% vs 32.5%).

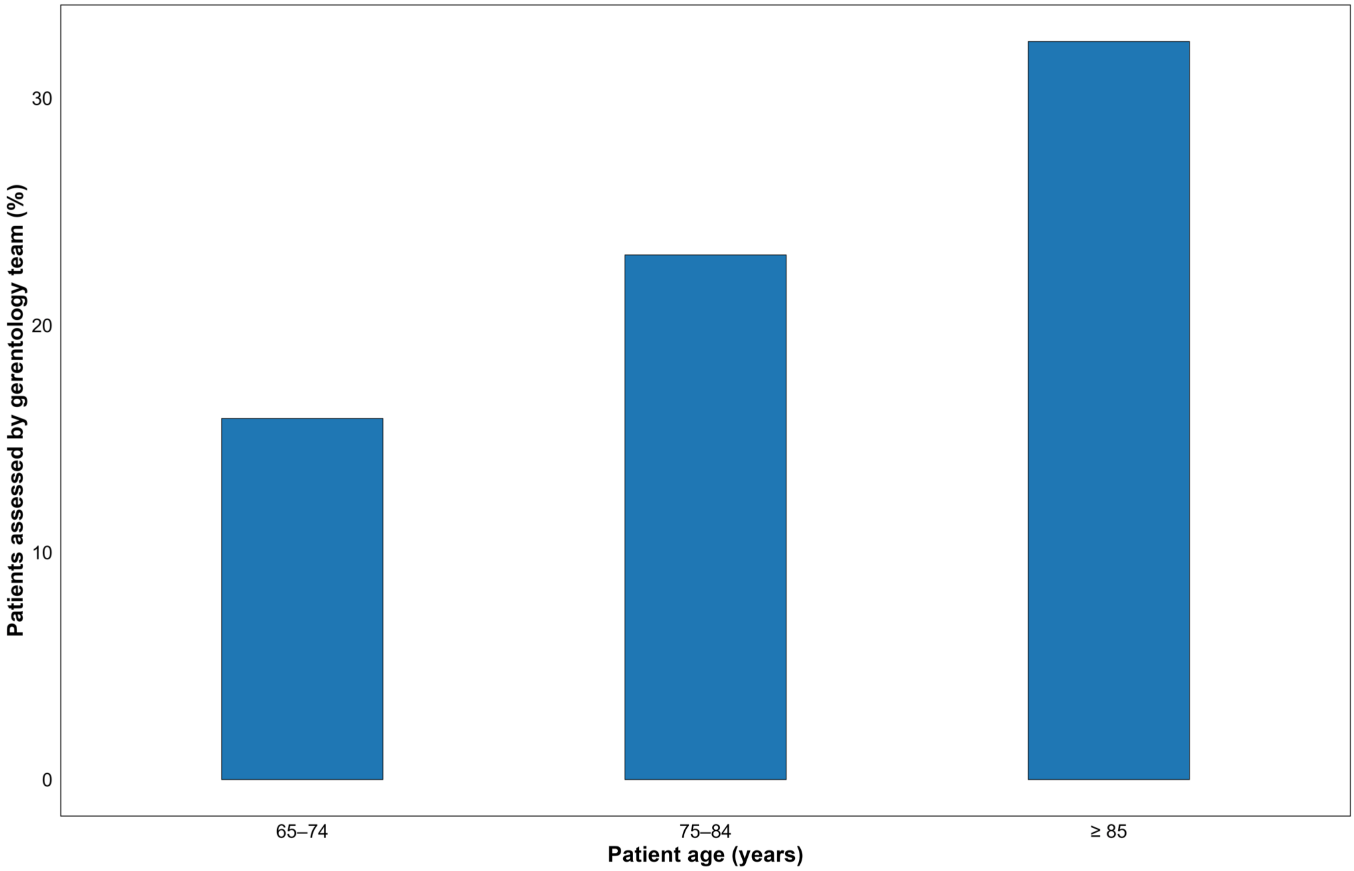
Figure 16: Proportion of patients aged ≥65 years assessed after surgery by a specialist in gerontology or a gerontology team, by hospital



Abbreviations

KPI = key performance indicator

Figure 17: Proportion of patients aged ≥65 years assessed after surgery by a specialist in gerontology or a gerontology team



Comment

Overall, this was the most poorly met KPI.

3.3 Additional patient outcomes

In addition to the 10 standard-of-care KPIs, an additional 5 outcomes were assessed:

- mortality
- LOS
- return to theatre
- Clavien-Dindo complication grade
- destination on discharge from hospital.

3.3.1 Mortality

Mortality following emergency laparotomy remains a key outcome indicator of perioperative care quality.

Findings:

- During the 2022 to 2024 period, the overall in-hospital mortality rate was 7.0% (525/7,511) (Table 5).
- After excluding hospitals with no mortality, the inter-hospital variation in adjusted mortality rate was between 2.3% and 24.8% (Table 6, Figure 18–19).
- Mortality increased with age (Figure 18).

NELA comparison

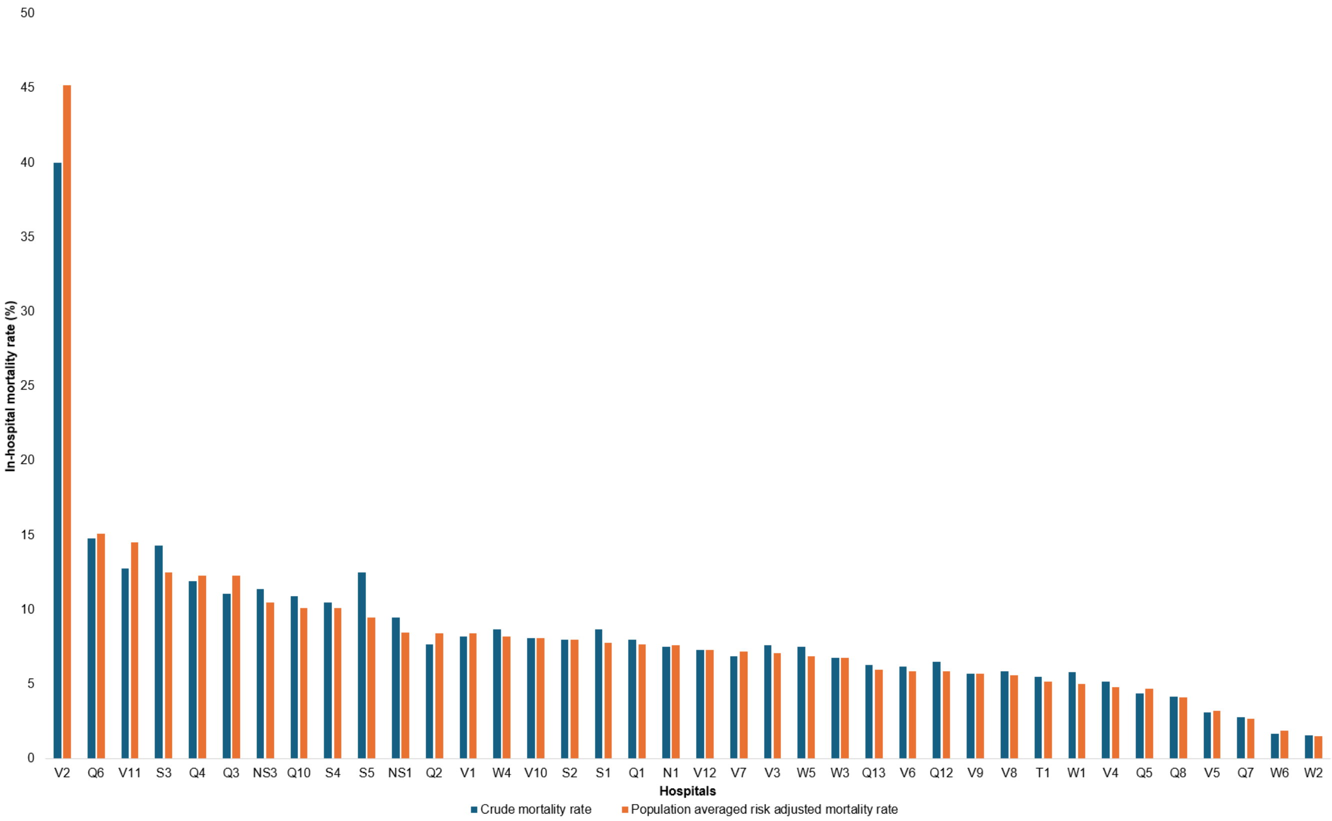
- 8.1 % mortality rate reported for the 10th year report (period April 2023 to April 2024).[26]

Table 5: Mortality rates by risk assessment

Risk assessment (RA) completed	Patients	Patients deceased on discharge, n (%)
RA documented preoperatively	3,270	277 (8.5%)
RA documented postoperatively	3,636	204 (5.6%)
RA not performed	393	32 (8.1%)
Missing/unknown	212	12 (5.7%)
Overall	**7,511**	**525 (7.0%)**

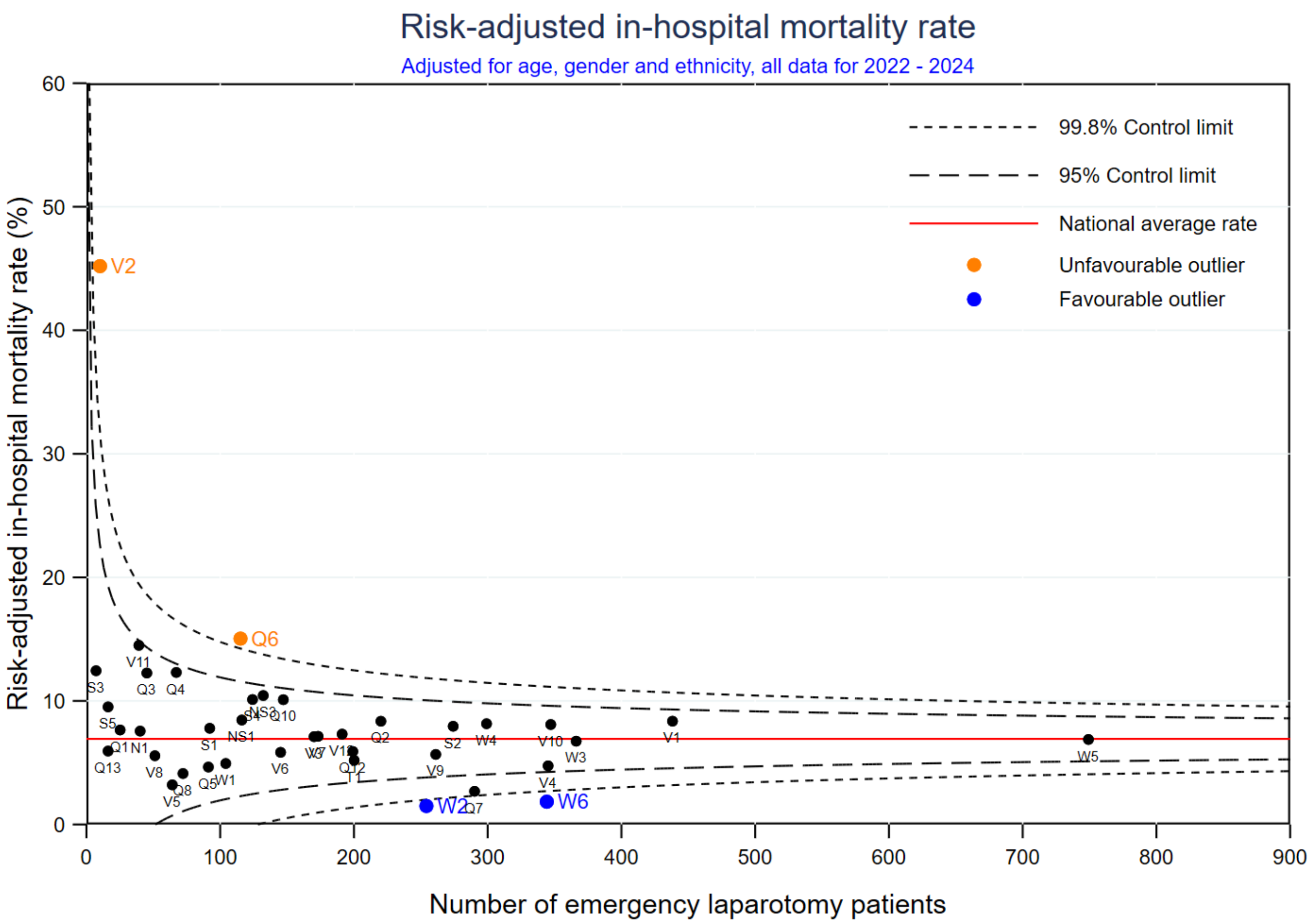
Notes
7,511 because it does not include n = 171 patients with missing discharge status

Figure 18: In-hospital mortality rate of participating hospitals



Funnel plots were constructed according to the method outlined by Spiegelhalter.[29] More detail on the method has been included in the appendix.[30-32] The resulting funnel plot is centred around the overall (population-averaged) mortality rate (Figure 19). All national data available for the reporting period (1 January 2022–31 December 2024) were used for the mortality analysis.

Figure 19: Risk-adjusted in-hospital mortality rate



Notes

Adjusted for age, gender and ethnicity, with all data for 2022–2024 included

Two hospitals had a risk-adjusted in-hospital mortality greater than the 99.8% control limit and two had rates below the 99.8% control limit (Table 6).

Note:

- No allowance has been made for transfers.
- Cases missing ethnicity (11.4%) were assumed to be non-Indigenous.

Figure 20: Proportions of patients who died, by age group

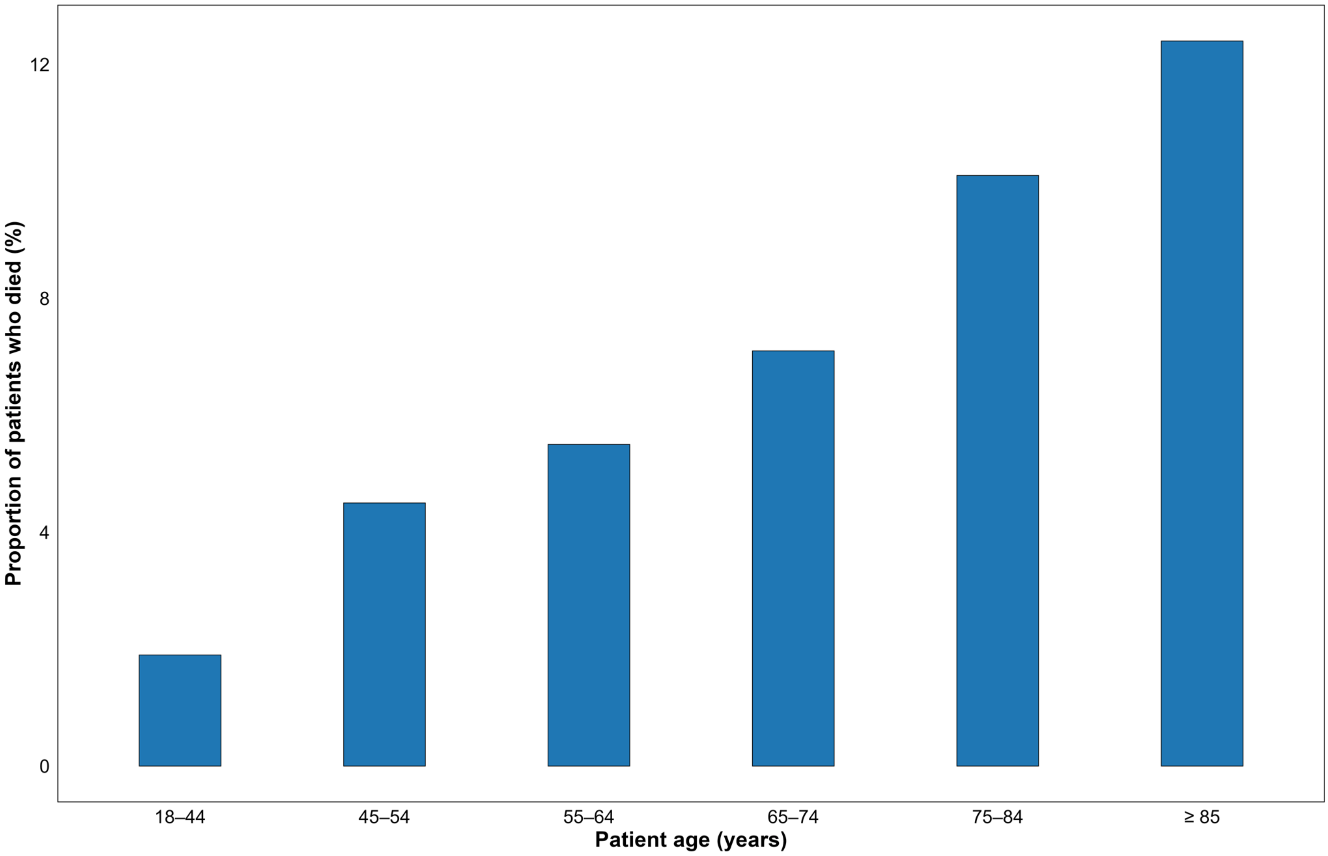


Table 6: Estimates for mortality funnel plots

Hospital name and ID	Observed	Expected	Total number of patients	Crude mortality rate	Population-averaged risk-adjusted mortality rate
Ballarat Health – V2	**4**	**0.6**	**10**	**40**	**45.2**
Princess Alexandra – Q6	**17**	**7.8**	**115**	**14.8**	**15.1**
St Vincent's Melbourne – V11	5	2.4	39	12.8	14.5
Mt Gambier – S3	1	0.6	7	14.3	12.5
Logan – Q4	8	4.5	67	11.9	12.3
Ipswich – Q3	5	2.8	45	11.1	12.3
Lismore Base – NS3	15	9.9	132	11.4	10.5
Rockhampton Base – Q10	16	11	147	10.9	10.1
Royal Adelaide – S4	13	8.9	124	10.5	10.1
The Queen Elizabeth – S5	2	1.5	16	12.5	9.5
Albury Wodonga – NS1	11	9	116	9.5	8.5
Gold Coast – Q2	17	14.1	220	7.7	8.4
Alfred – V1	36	29.8	438	8.2	8.4
Royal Perth – W4	26	22	299	8.7	8.2
Royal Melbourne – V10	28	23.9	347	8.1	8.1
Lyell McEwin – S2	22	19.1	274	8	8
Flinders Medical – S1	8	7.1	92	8.7	7.8
Bundaberg – Q1	2	1.8	25	8	7.7
Royal Darwin – N1	3	2.7	40	7.5	7.6
Western Health – V12	14	13.2	191	7.3	7.3
Dandenong Monash Health – V7	12	11.6	173	6.9	7.2
Barwon Health – V3	13	12.6	170	7.6	7.1
Sir Charles Gairdner – W5	56	56.3	749	7.5	6.9
Fiona Stanley – W3	25	25.6	366	6.8	6.8
Townsville University – Q13	1	1.2	16	6.3	6
Clayton Monash Health – V6	9	10.7	145	6.2	5.9
Toowoomba – Q12	13	15.2	199	6.5	5.9
Northern Hospital – V9	15	18.3	261	5.7	5.7
Latrobe Regional – V8	3	3.7	51	5.9	5.6
Royal Hobart – T1	11	14.6	200	5.5	5.2
Albany – W1	6	8.4	104	5.8	5
Bendigo Health – V4	18	26.2	345	5.2	4.8
Mater Brisbane – Q5	4	5.9	91	4.4	4.7
Redcliffe – Q8	3	5	72	4.2	4.1
Casey Monash Health – V5	2	4.3	64	3.1	3.2
QEII Jubilee – Q7	8	20.5	290	2.8	2.7
Midland – W6	**6**	**22.4**	**344**	**1.7**	**1.9**
Bunbury – W2	**4**	**18.3**	**254**	**1.6**	**1.5**

Abbreviations
ID = code used to identify the hospital state

Notes
Excluded: 3 hospitals with 0 observed deaths, hospitals in orange = unfavourable outliers (rate above 99.8% control limit (CL)); in blue = favourable outliers (rate below 99.8% CL); results for low-volume hospitals should be interpreted with caution.

Comment

The NELA mortality of 8.1% for the 10th audit year (period April 2023 to April 2024) is important for comparative purposes.[26] Because of the constraints imposed on ANZELA–QI, it can only report in-hospital mortality rather than 30-day mortality. Other emergency laparotomy audits have shown little difference between the two.[33]

Although the risk-adjusted mortality of 6.9% is acceptable, the almost 10-fold inter-hospital variation suggests there is much room for improvement.

3.3.2 Length of stay

Of the 7,682 patients, 89.1% were discharged alive (Table 1).

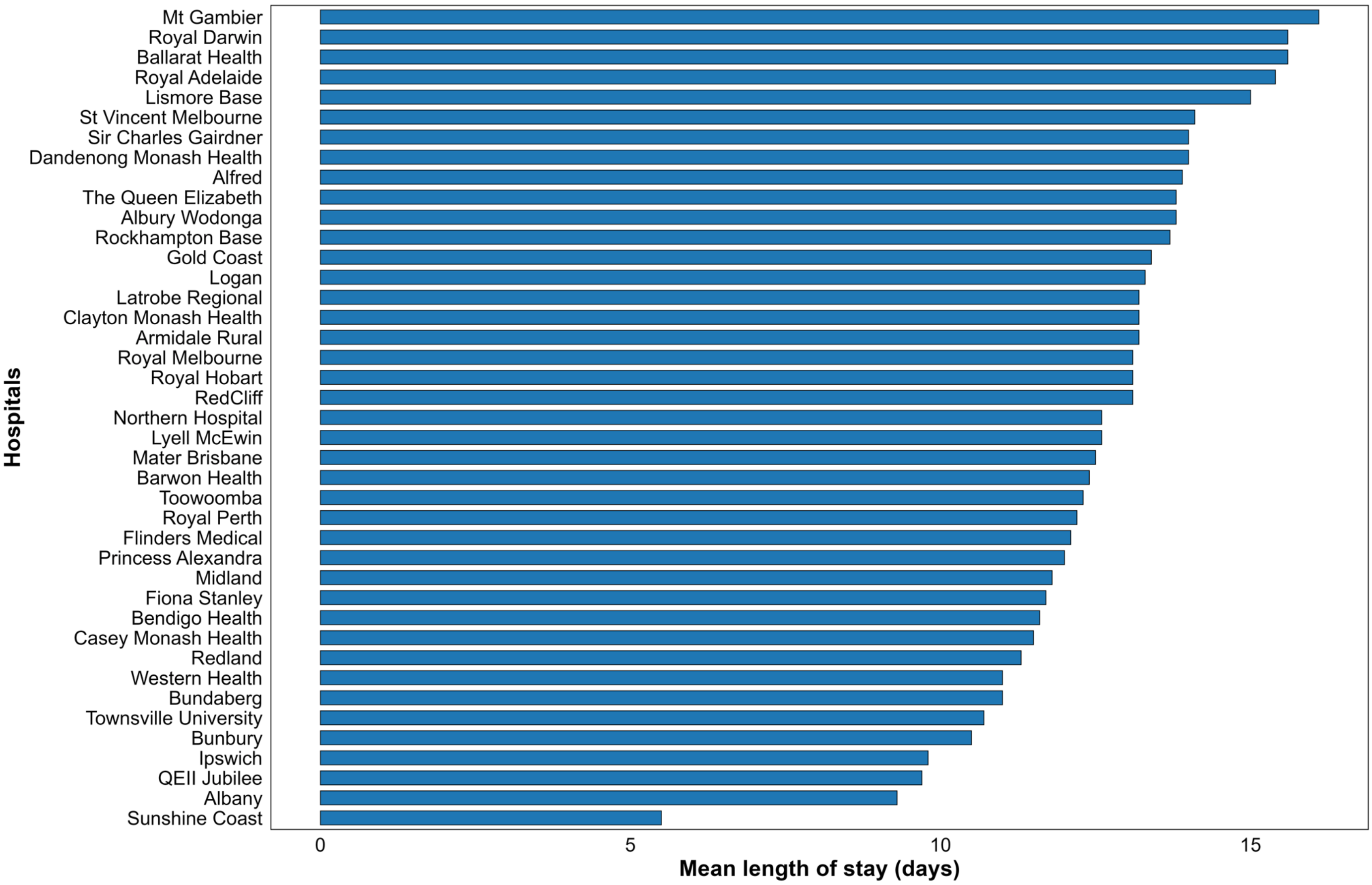
171 (2.2%) patients had missing discharge data, 525 (6.8%) died in hospital, 103 (1.3%) were still in hospital at 60 days after admission, 37 did not have a discharge date (0.5%) and 3(<1.0 %) had incorrect discharge dates resulting in negative LOS periods. Of these patients, a total of 839 were excluded from the analysis.

The distribution of LOS was strongly right-skewed due to outlier values for patients with very long LOS.

LOS varied from 0 days to 447 days across all hospitals (outliers not removed; Table 7).

Tables 7 and Figures 21–24 show the distribution of LOS at participating hospitals (outliers included), for patients with LOS <60 days compared to those with LOS ≥60 days.

Figure 21: Mean length of stay for patients who were in hospital for <60 days, by hospital (n=6,721)



Notes

Mean length-of-stay (LOS) data excludes 525 patients who died during their admission, 3 patients with LOS <0 days, 103 patients who were still admitted after 60 days in hospital, 37 who did not have a discharge date and 171 who had not had their discharge data completed.

Figure 22: Mean length of stay for patients who were in hospital for ≥60 days, by hospital (n=122)

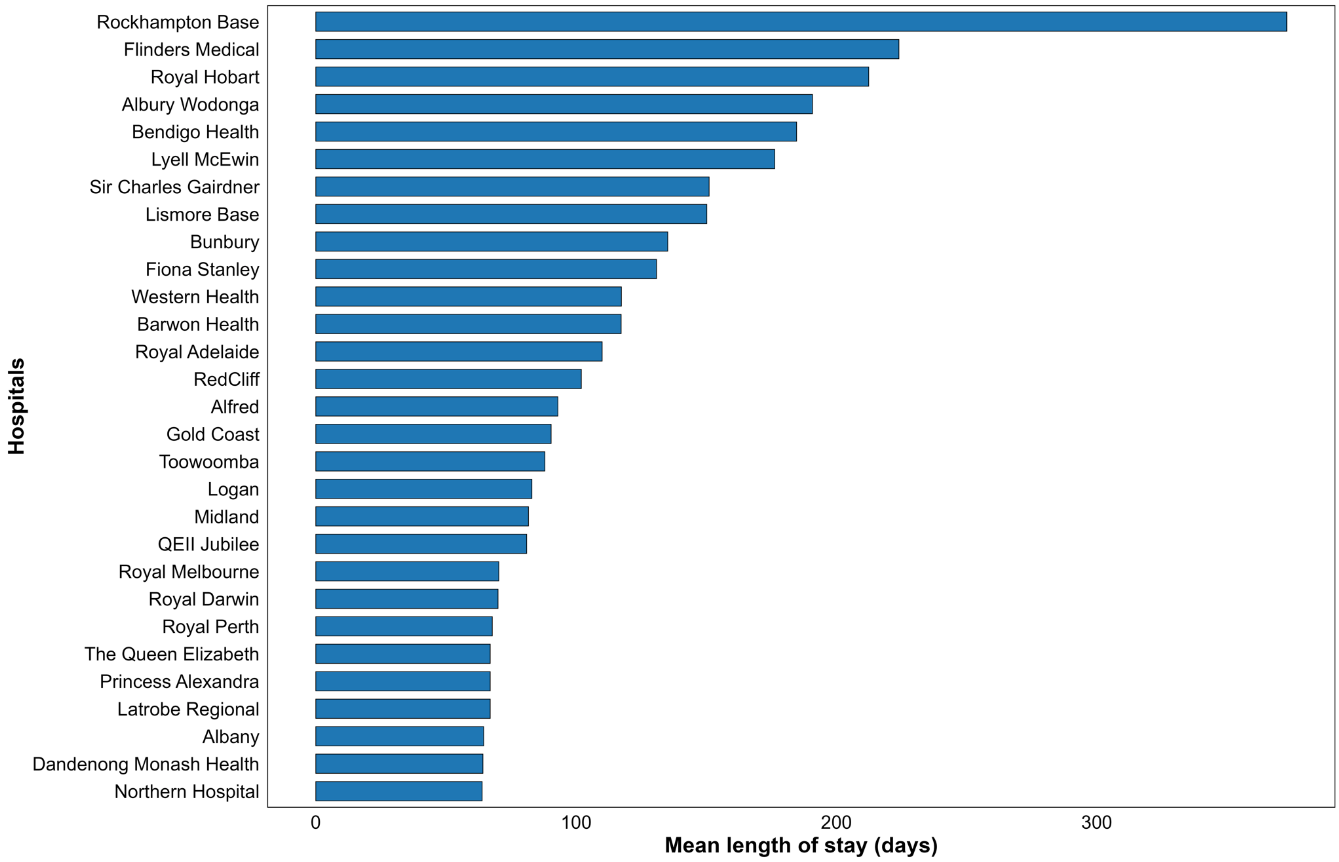
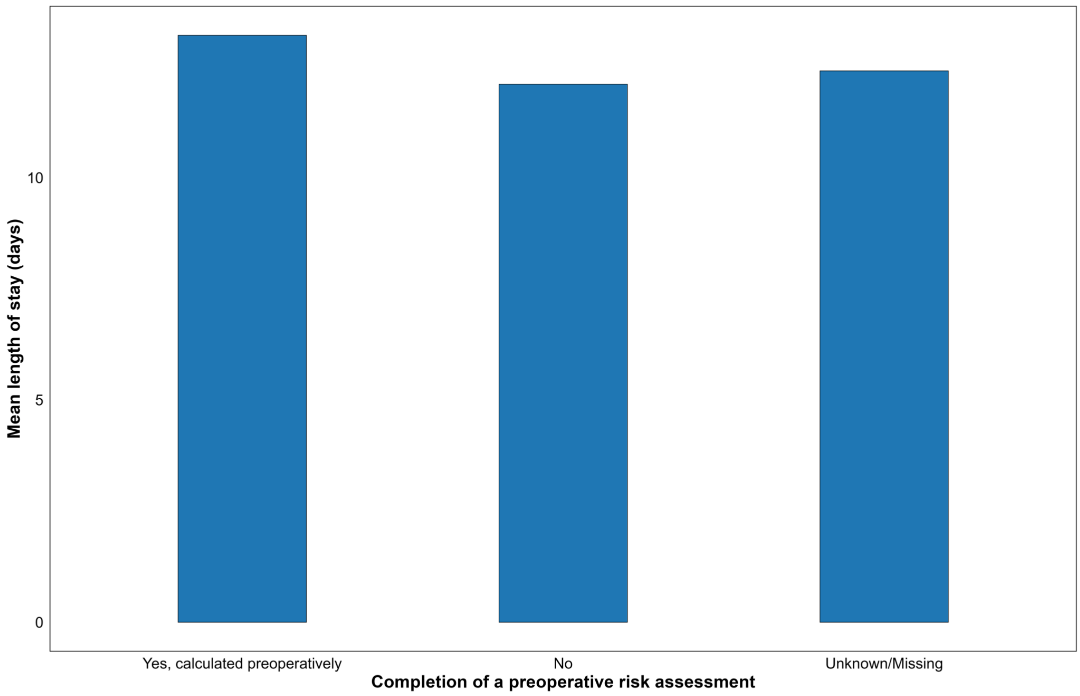


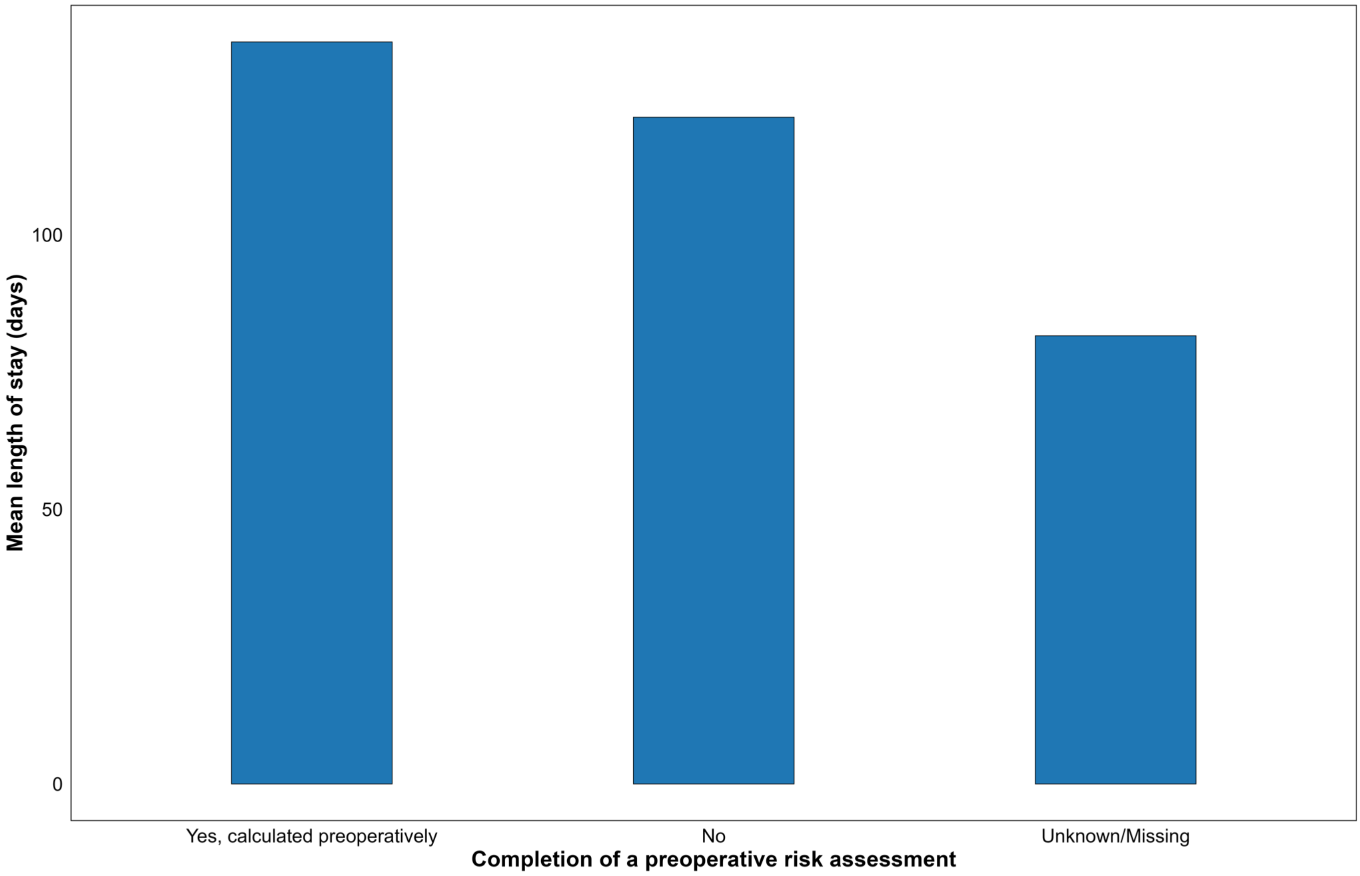
Figure 23: Mean length of stay, by risk assessment completion for patients in hospital for <60 days (n=6,721)



Notes

Mean length-of-stay (LOS) data excludes 525 patients who died during their admission, 3 patients with LOS <0 days, 103 patients who were still admitted after 60 days in hospital, 37 who did not have a discharge date and 171 who had not had their discharge data completed.

Figure 24: Mean length of stay, by risk assessment completion for patients who were in hospital for ≥60 days (n=122)



Notes
Mean length-of-stay (LOS) data excludes 525 patients who died during their admission, 3 patients with LOS <0 days, 103 patients who were still admitted after 60 days in hospital, 37 who did not have a discharge date and 171 who had not had their discharge data completed.

Table 7: Categorised length of stay for all data (2022–2024)

LOS category	n (%)	Mean	SD	Median	IQR	Min	Max
0–<60 days	6,721 (98.1%)	12.6	9.8	9.0	10.0	0	59
≥60 days	122 (1.9%)	128.2	112.1	75.5	44.0	60	447

Abbreviations
IQR = interquartile range; LOS = length of stay; SD = standard deviation

Notes
Mean length-of-stay (LOS) data excludes 525 patients who died during their admission, 3 patients with LOS <0 days, 103 patients who were still admitted after 60 days in hospital, 37 who did not have a discharge date and 171 who had not had their discharge data completed.

Comment

The impact of transfers is unknown.

A short LOS is a surrogate marker for efficient care that is not associated with complications. LOS is also the major determinant of overall cost.

3.3.3 Return to theatre

A return to theatre (RTT) is always a significant event. This may be unplanned (URTT), planned or both. It is normally associated with a worse outcome including greater mortality and long length of stay. The failure-to-rescue (FTR) rate is those who die after URTT.

Findings:

- The overall RTT rate was 12.4% (952/7,682) (Table 8).
- The overall URTT rate following the first emergency laparotomy was 6.8% (519/7,682) (Table 8).
- The overall FTR rate for those who had a RTT was 18.1% (172/952) (Table 8).
- The overall FTR rate for those who had a URTT was 12.7% (66/519) (Table 8).

Emergency admissions (excludes those with missing discharge status, invalid discharge/death dates):

- o 11.0% (768/7,012) had a RTT after an initial emergency laparotomy (Table 9).
- o The overall FTR rate for those who had a URTT following initial emergency laparotomy was 14.6% (61/418) (Table 9).

Elective admissions (excludes those with missing discharge status, invalid discharge/death dates):

- o 309 had an emergency laparotomy following an elective admission. Of these, 94(30.4%) had a RTT (Table 9).
- o The FTR in those who only had an emergency laparotomy after an elective admission was 7.0% (15/215) (Table 9).
- o The FTR in those who had an emergency laparotomy and then a URTT was 8.5% (5/59) (Tables 9 and 10).

All admissions (excludes those with missing discharge status, invalid discharge/death dates):

- o The FTR in those who had an emergency laparotomy and then a RTT was 22.7% (172/759) (Table 9).
- o The FTR in those who did not have a RTT was 5.5% (343/6,279) (Table 9).

Comment (includes all data)

The proportion of RTT (URTT, planned or both) was much lower than that reported in the previous ANZELA–QI report (12.4% for 2022–2024 vs 19.4% for 2020–2021). For patients who had a URTT, there were 15.4% in previous report compared to 6.8% in the current report (Table 8).

Table 8: Patients who had a return to theatre

Return to theatre	Alive	Died	Missing/unknown	n (%)
Yes – unplanned return	445	66	8	519 (6.8%)
Yes – planned return	279	95	8	382 (5.0%)
Both planned and unplanned return	40	11	0	51 (0.7%)
No	6,152	350	35	6,537 (85.0%)
Missing/unknown	70	3	120	193 (2.5%)
Total	**6,986**	**525**	**171**	**7,682 (100.0%)**

Notes
n (%) = number (percentage) of patients with returns to theatre, includes all patients/data.

Table 9: Categories of return to theatre by admission type and discharge status

Died = Yes				
Return to theatre	***Elective**	**Emergency**	**Missing**	**Total**
Yes – unplanned return	5	61	0	66
Yes – planned return	4	90	1	95
Both planned and unplanned return	3	8	0	11
No	15	323	2	340
Missing/unknown	0	3	0	3
Total	**27**	**485**	**3**	**515**
Died = No				
Return to theatre	***Elective**	**Emergency**	**Missing**	**Total**
Yes – unplanned return	54	357	1	412
Yes – planned return	24	226	2	252
Both planned and unplanned return	4	26	0	30
No	198	5,857	30	6,085
Missing/unknown	2	61	1	64
Total	**282**	**6,527**	**34**	**6,843**
Return to theatre = TOTAL	***Elective**	**Emergency**	**Missing**	**Total (n)**
Yes – unplanned return	59	418	1	449
Yes – planned return	28	316	3	275
Both planned and unplanned return	7	34	0	35
No	213	6,180	32	6,202
Missing/unknown	2	64	1	77
Total	**309**	**7,012**	**37**	**7,358**

Notes
n (%) = number (percentage) of patients with returns to theatre, * Elective admissions refer to cases that were initially admitted to the hospital for elective operation but ended up having an emergency laparotomy while in hospital. Any URTT = excludes the '*both planned and unplanned return'* group, excludes 171 patients with missing discharge status, 103 still in hospital after 60 days from admission, 37 missing discharge date, 10 with death date occurring before hospital admission date and 3 with discharge date before hospital admission date.

Table 10: Categories of return to theatre by FTR

Mortality (failure to rescue)				
Return to theatre	**Elective n (%)**	**Emergency n (%)**	**Missing n (%)**	**Total n (%)**
Yes - unplanned return	5 (8.5%)	61 (14.6%)	0 (0.0%)	66 (14.7%)
Yes - planned return	4 (1.3%)	90 (28.5%)	1 (33.3%)	95 (34.5%)
Both planned and unplanned return	3 (42.9%)	8 (23.5%)	0 (0.0%)	11 (31.4%)
No	15 (7.0%)	323 (5.2%)	2 (6.3%)	340 (5.5%)
Missing/unknown	0 (0.0%)	3 (4.7%)	0 (0.0%)	3 (3.9 %)
Total (died)	**27**	**485**	**3**	**515**

Abbreviations
FTR = failure to rescue

Notes
n (%) = number(percentage) of patients with returns to theatre who died. Excludes missing discharge status and incorrect discharge dates and death dates.

3.3.4 Clavien-Dindo complication grade

- Patients whose preoperative RA was unknown were twice as likely to have a Clavien-Dindo grade of V (Figure 25).
- Patients whose NELA preoperative RA was ≥10% had higher complication rates in each recorded Clavien-Dindo grade (data not shown).
- Elective admissions had lower rates of clinically significant Clavien-Dindo complications (data not shown).
- Patients with an urgency of surgery of <2 hours had the highest proportion of grade IV and V Clavien-Dindo complications.
- Patients needing the most urgent surgery had the greater number of complications (Figure 25). These patients were least likely to arrive in theatre in an appropriate timeframe (Figure 26).

Figure 25: Risk assessment completion, by clinically significant Clavien-Dindo complication grade

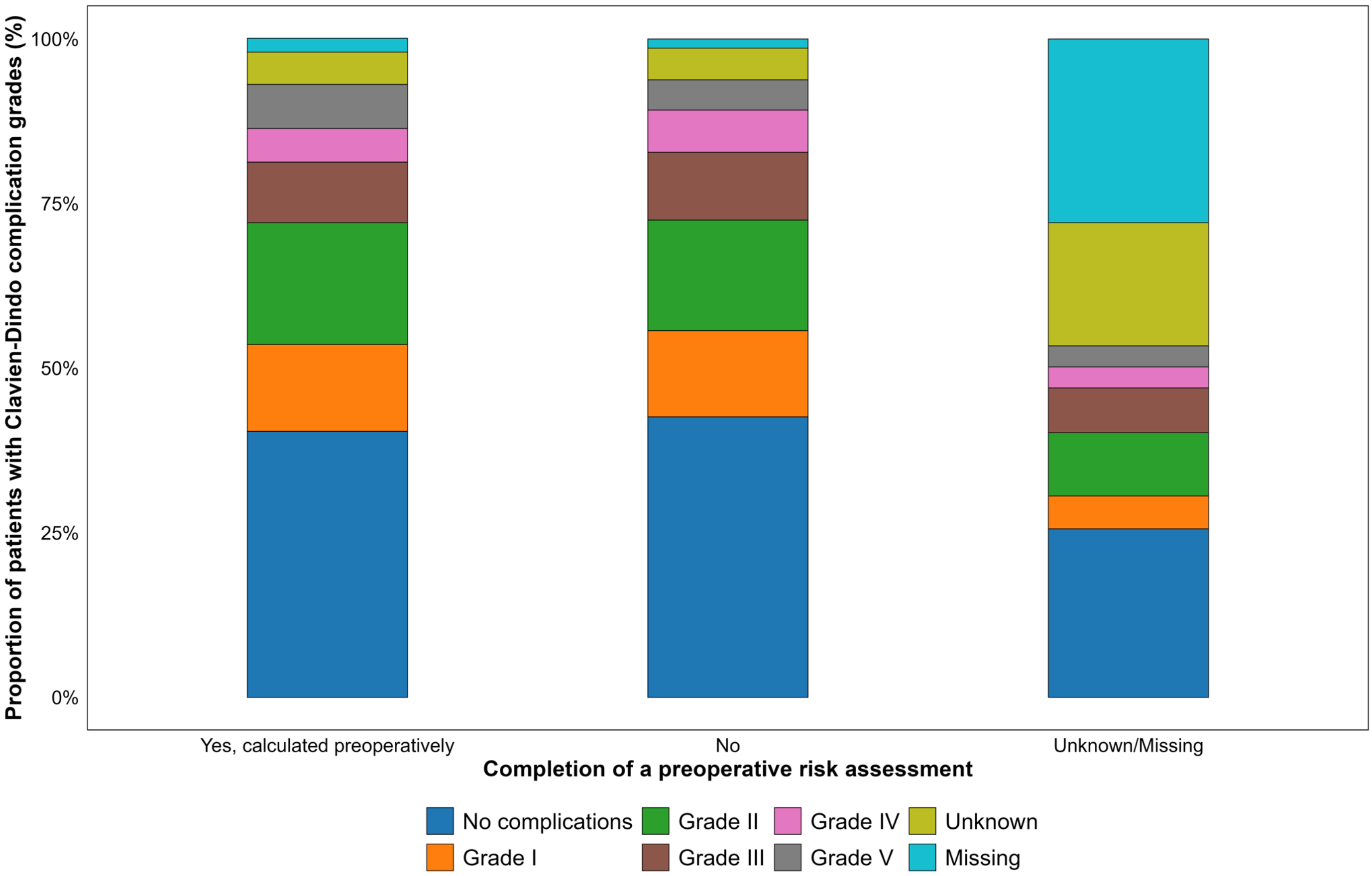
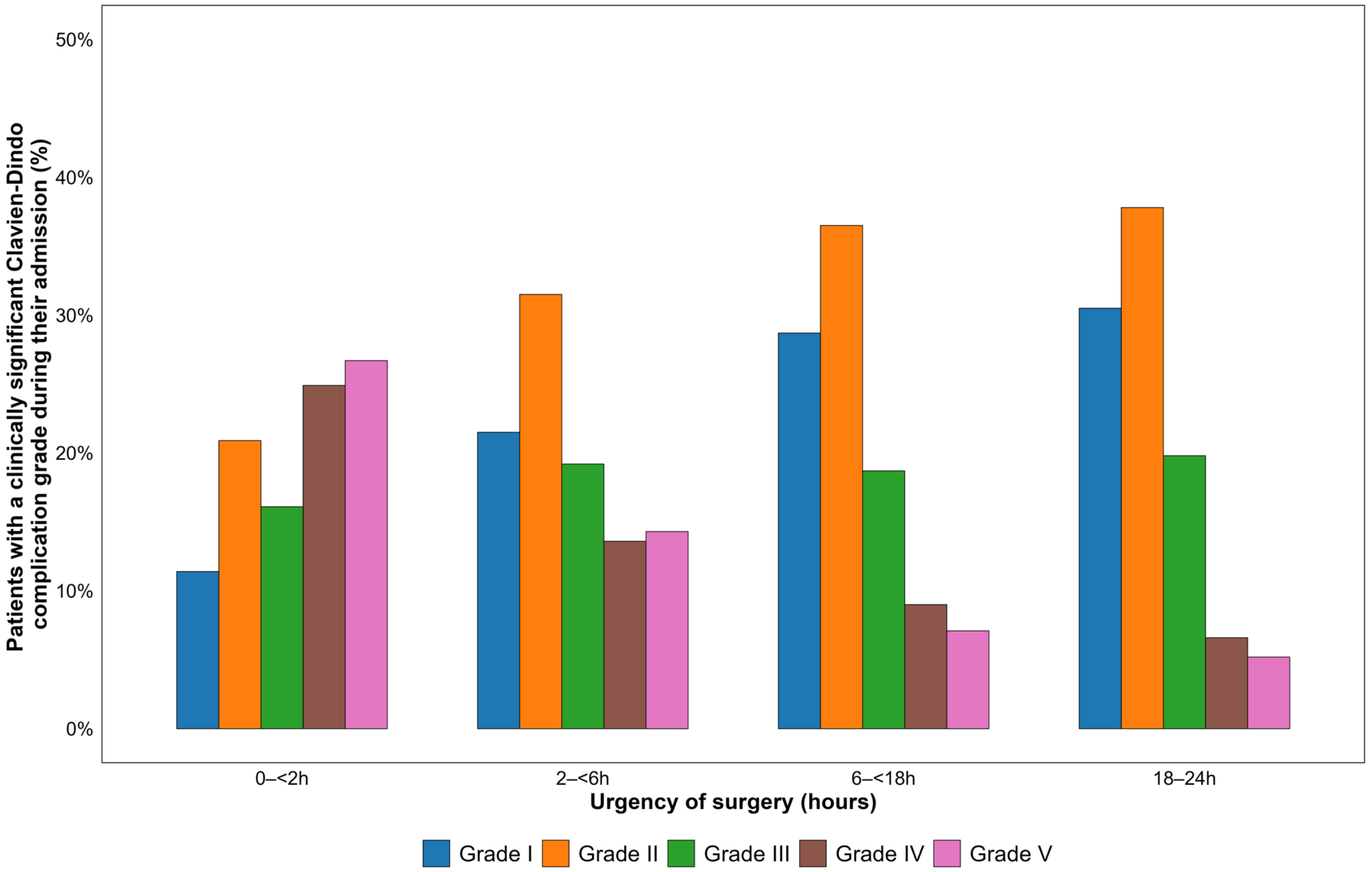


Figure 26: Documented urgency of surgery for patients who had a clinically significant Clavien-Dindo complication grade



3.3.5 Discharge destination

Of the 7,682 for whom there were data, 895 (11.7%) were not discharged to their preoperative place of residence (Table 11).

Table 11: Discharge destination of patients who did not return to prehospital residence

Did the patient return to their prehospital residence?	n	%
Yes	5,688	74.0
No	895	11.7
Missing or unknown	1,099	14.3
Total	**7,682**	**100**

Discharge destination if patient did not return to prehospital residence	n	%
Residential care	27	3.0
Nursing home	23	2.6
Rehabilitation facility (any)	434	48.5
Other public hospital for ongoing acute	313	35.0
Private hospital for ongoing acute care	43	4.8
New destination	46	5.1
Missing or unknown	9	1.0
Total	**895**	**100**

4 References

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Appendix A: Key performance indicator definitions

Key performance indicators

Key performance indicators (KPIs) continue to evolve to reflect best practice in emergency laparotomy care. The 2024 ANZELA KPIs are categorised into preoperative, perioperative and postoperative.

Preoperative

- *PRE 1*: Computed tomography (CT) scan performed and reported by a consultant radiologist before surgery
- *PRE 2*: Lactate level available to the surgeon at the time of surgical referral for patients admitted via the emergency department
- *PRE 3*: Risk-of-death assessment performed and documented preoperatively
- *PRE 4*: Preoperative frailty assessment completed for patients aged ≥65 years
- *PRE 5*: Arrival in theatre within an appropriate timeframe where urgency of surgery is ≤18 hours

Perioperative

- *OP 1*: Consultant surgeon and anaesthetist presence in theatre for patients with a preoperative risk score ≥5%
- *OP 2*: Consultant surgeon presence in theatre for patients with a preoperative risk score ≥5%
- *OP 3*: Consultant anaesthetist presence in theatre for patients with a preoperative risk score ≥5%

Postoperative

- *Post OP 1*: Direct admission to critical care after surgery for patients with a preoperative risk score ≥10%
- *Post OP 2*: Postoperative assessment by a specialist in elderly medicine for patients aged ≥65 years

This report expands ANZELA's established KPIs by incorporating the following additional quality indicators derived from audit data:

Preoperative

- Operations meeting the urgency timeframe based on time elapsed from arrival in hospital to start of surgery
- Operations meeting the urgency timeframe based on time elapsed from decision to operate to start of surgery
- Timing of CT scan
- Timing of antibiotic administration for sepsis patients on admission

Perioperative

- Time of day for emergency laparotomy commencement

Postoperative

- Proportion of emergency laparotomy patients who died in hospital
- Postoperative care immediately following surgery
- Clavien-Dindo complication grade
- Return to theatre after initial emergency laparotomy
- Postoperative length of stay by hospital

These measures help to identify variations in care but do not independently indicate poor-quality care. Current analyses offer limited risk adjustment beyond the preoperative phase.

Appendix B: Reports provided to participating hospitals and reporting format

ANZELA–QI provides the following reports to participating hospitals:

1. Individual hospital summary on 10 key performance indicators (statistical process control [SPC] charts) with an all-hospital comparison (funnel plots) and data quality, over a defined period (example in Figure B1)
2. Data completeness line charts including critical key performance indicator (KPI) fields and those required for adjusting for mortality (example in Figure B2)
3. Patient-level summary (example in Figure B3).

Reporting format

KPIs are presented using SPC charts for individual hospitals and statewide data, and funnel plots for all hospitals participating in ANZELA with data averaged over the reporting period. Hospitals within the example are marked with an **X**.

The table below summarises SPC patterns and their symbols.

Pattern	Pattern symbol	Pattern summary
SPC – Astronomical Point	≒	An identified point that exceeds 3 sigma limits from the mean
SPC – Trend (5)	ⓣ	5 consecutively increasing or decreasing points
SPC – Two in Three	⅔	2 of 3 consecutive points exceeding 2 sigma limits from the mean
SPC – Shift (7)	ⓢ	7 consecutive points above or below the mean

As far as possible, the reporting format has been standardised so there is a consistent layout. Each KPI is displayed as follows:

- Funnel plot including all hospitals participating in ANZELA (For the HTML format report, if the cursor is held over a point in the funnel plot, details of the hospital will be revealed.)
- SPC chart for individual hospitals and all hospitals within the state
- SPC chart and funnel plot showing the data completeness for all hospitals.

Multiple elements comprise the funnel plots and SPC charts:

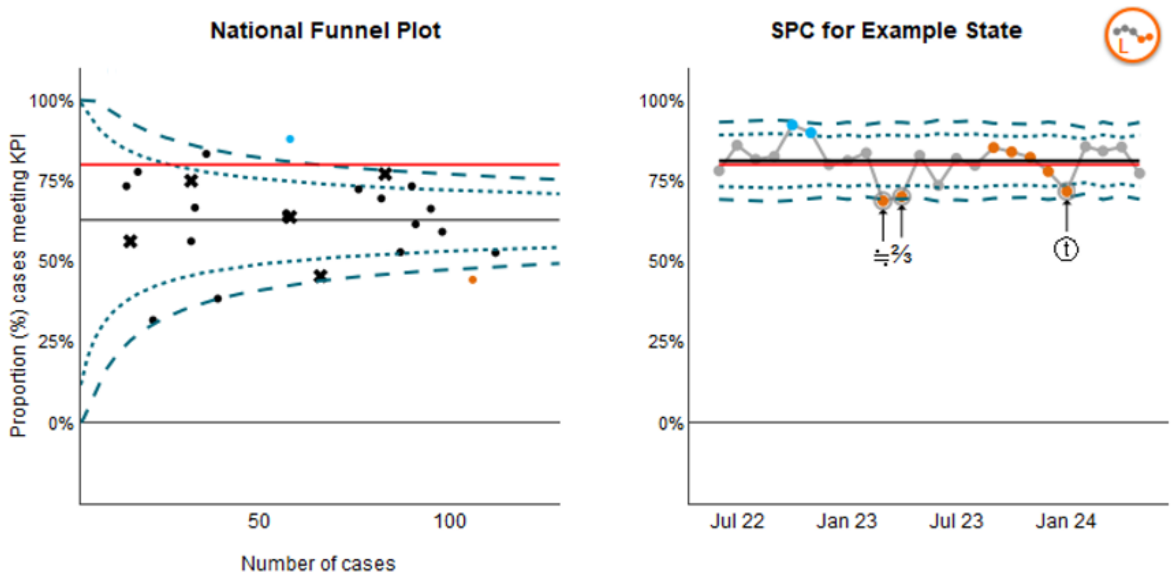
- Two sigma (2σ) limits are displayed as dotted lines, representing 95% warning limits
- Three sigma (3σ) limits are displayed as dashed lines, representing 99.8% control limits
- Dark solid line represents the centreline, indicating the mean value of observed counts for a given KPI at the named hospital
- Dark red line represents national mean value of the observed counts for a given KPI
- Red line indicates the KPI target value for funnel plots and the SPC charts (target for ANZELA KPIs is 80%)
- Blue dot represents improvement or a favourable direction for a specific KPI
- Orange dot represents an unfavourable pattern for a specific KPI
- Grey dot in the SPC chart represents the actual observed value
- Black dot in the funnel plot denotes the sites or hospitals included in the analysis
- Variation icons (located at top right corner of each SPC chart) summarise the overall performance pattern for the KPI over the entire period.
-  grey indicates no significant change (common cause variation)
-  orange indicates special cause of concerning nature or higher pressure due to (H)igher or (L)ower values
-  blue indicates special cause of improving nature or lower pressure due to (H)igher or (L)ower values.

Detailed guidance on the 'Making data count' approach can be found on the Making data count website.

Figures B1–B3 provide examples of what hospitals receive in the monthly report and how to interpret funnel plots and SPC charts. These are, by necessity, a summary. For a more detailed explanation, the NHS Making data count website offers extensive background information.[34] The data shown in these examples are fictional and do not reflect actual performance for any specific KPI.

Representative report: ANZELA-QI monthly report

Figure B1: National funnel plot (left) and state SPC chart (right) showing KPI compliance (example data)



Note: Hospitals within the example state are marked with an X.

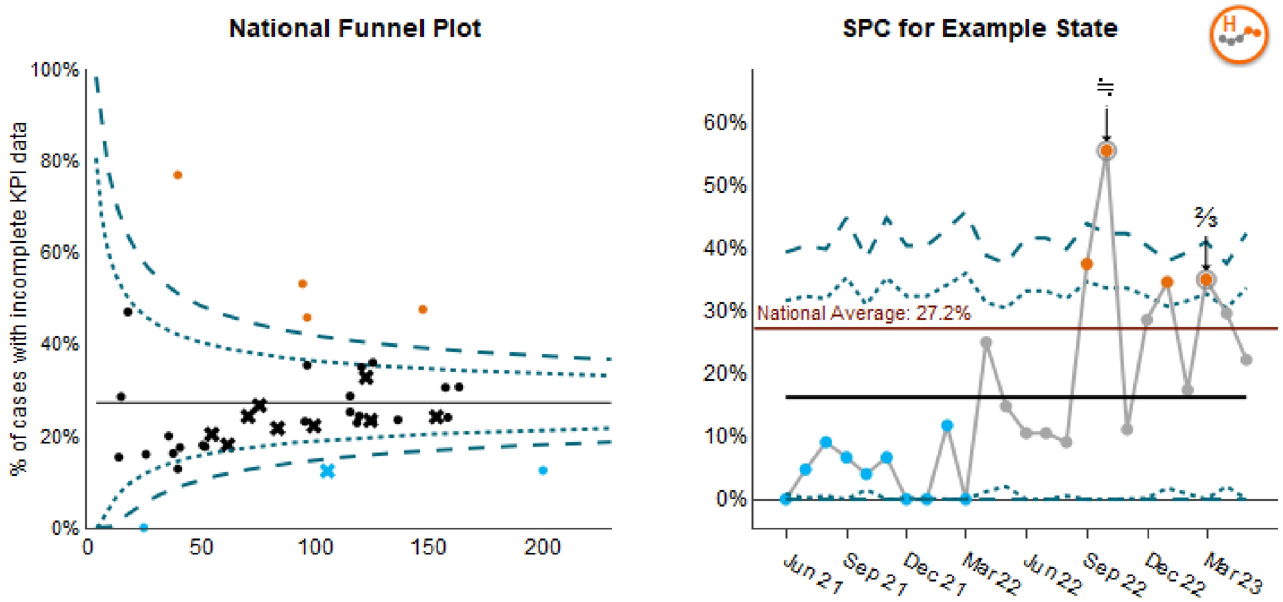
- Unfavourable
- Favourable
- Upper control limit 99.8%
- Upper warning limit 95%
- Actuals
- Centreline
- Lower control limit 99.8%
- Lower warning limit 95%
- Target (80%)

Variation icons: summarising the overall performance for the KPI over the entire period (unfavourable or favourable)

- An identified point that exceeds three sigma limits from the mean
- ⓣ Five consecutively increasing or decreasing points
- ⅔ Two out of three consecutive points exceeding two sigma limits from the mean
- ⓢ Seven consecutive points above or below the mean

Figure B1 – interpretation (example data)
The national funnel plot (Figure B1, left) shows compliance with the relevant KPI over the past 3 years. Each point represents a hospital contributing to ANZELA. Hospitals in the state relevant to the report are marked with an X (Figure B1, left). The solid black line represents the mean for this KPI, and the solid red line indicates the target compliance (e.g. 80%). Hospitals above or below the 99% (alarm) confidence limits are shown in orange and blue dots, indicating concerning or improving performance, respectively (Figure B1, left). The orange dot in the funnel plot shows one hospital as an outlier with poor performance. The SPC chart (Figure B1, right). shows monthly KPI compliance for the example state over the past 2 years. The coloured points represent statistically significant changes. During the first half of 2023, performance was poor indicated by the orange dots outside the expected limits (Figure B1, right). This was followed by a slight improvement in performance until a decline for 5 consecutive months towards the end of 2023 (Figure B1, right). Overall, the state average compliance with this KPI was slightly above the 80% target.

Figure B2: National funnel plot (left) and state SPC chart (right) for data completeness (example data)



Notes

Hospitals within example state are marked with an X.

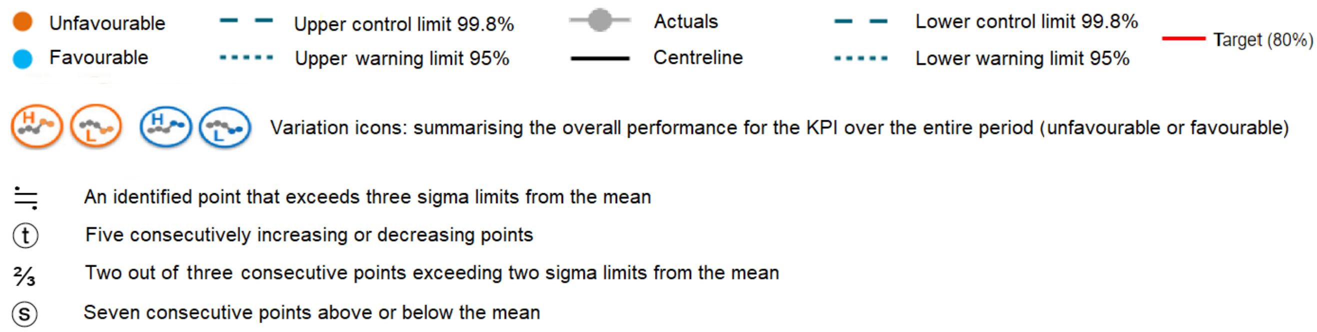
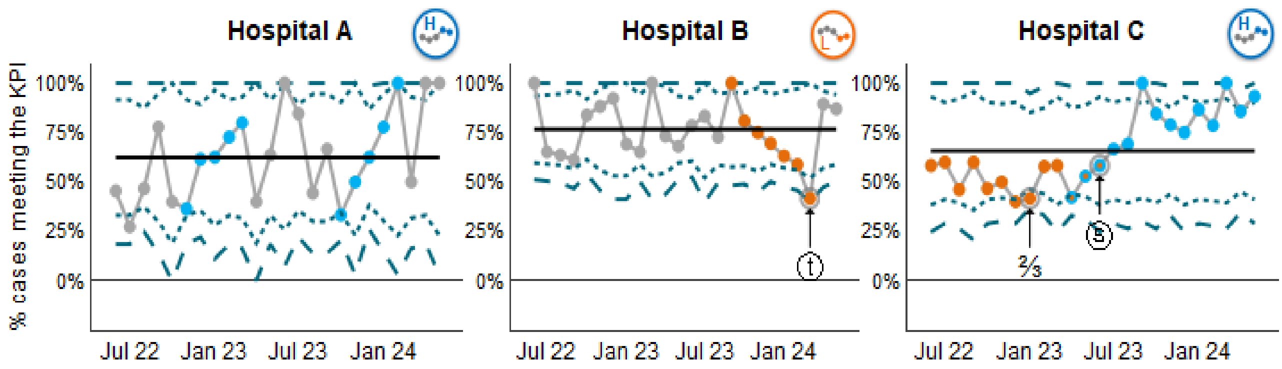


Figure B2 – interpretation (example data)
The national funnel plot shows data completeness over the past 2 years. Hospitals in the example state relevant to the report are marked with an X (Figure B2, left). In this example, 4 hospitals (orange dots) were outliers for poor data completeness. Two hospitals (blue dots), including one from this example state (blue X), were outliers for high data completeness (Figure B2, left). The data completeness SPC chart shows near-complete data entry during the first 10 months in the example state, followed by a progressive decline that worsens every consecutive month thereafter (Figure B2, right).

Figure B3: Example SPC charts for the KPI for each participating hospital in the state (example data)



Notes:

The data shown are fictional and do not reflect actual hospital performance for any specific KPI.

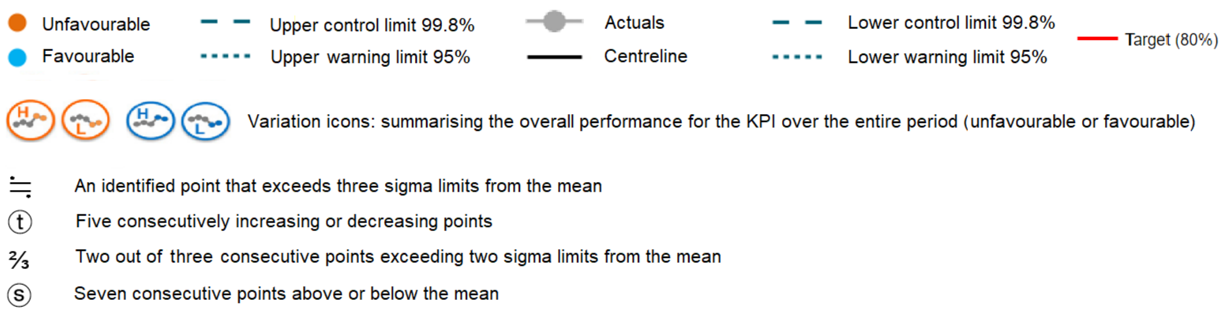


Figure B3 – interpretation (example data)
In Figure B3, the KPI SPC chart for Hospital A shows that the monthly data points generally remained within the expected range over the entire 2-year period. The blue points indicate an improving trend. However, Hospital A had the lowest average (black line) for this KPI compared to Hospitals B and C. An unfavourable trend (consecutive orange dots) was observed for Hospital B in the second half of 2023. However, performance returned within control limits during the final 2 months of 2024. Hospital C demonstrated a consistent and sustained improvement in this KPI over the past 12 months (blue points).

Table B1 presents a summary of the fictional KPI data for participating example hospitals in the example state, along with the example state and national averages (example data). An example of this table, along with guidance on how to interpret it, is provided below.

Table B1: Summary of cases meeting the KPI by hospitals within the state, and state vs national average (example data)

	Key performance indicator (KPI)			Data completeness		
Hospital	**Numerator (cases meeting KPI)**	**Denominator (cases eligible for KPI)**	**Proportion (% cases meeting KPI)**	**Numerator (missing/ unknown)**	**Denominator (emergency laparotomies)**	**Proportion (% incomplete)**
Hospital A	82	97	84.5%	15	106	14.2%
Hospital B	145	170	85.3%	25	182	13.7%
Hospital C	110	131	84.0%	21	150	14.0%
Hospital D	283	294	96.3%	11	310	3.5%
Hospital E	187	213	87.8%	26	242	10.7%
State total	*807*	*905*	*89.2%*	*98*	*990*	*9.9%*
National average			***84.7%***			***12.3%***

Table B1 – interpretation (example data)

Columns 2 to 4 show the numerator and denominator for the KPI, and the proportion of cases meeting that KPI (Table B1). The denominator is the number of eligible patients for that KPI; the numerator is the number of patients meeting the compliance criteria for that KPI. Detailed definitions of numerator and denominator by KPI are available in Appendix A).

In the example above, Hospital D has a high proportion of cases meeting the KPI criteria (Table B1). The other hospitals have lower rates. However, these are comparable to the national average. These hospitals are represented by an X in the upper funnel plot (Figure B1).

Columns 5 and 6 show the numerator and denominator for data completeness (Table B1). Hospital D has a low proportion of missing or unknown data, suggesting its KPI data is likely to be accurate. The other hospitals have slightly higher, but comparable, rates of missing data. These hospitals are represented by an X in the lower funnel plot reporting data completeness (Figure B2, left). Overall, KPI compliance of the example state hospitals is comparable to the national average. The proportion of cases with missing data for the example state was less than the national average (9.9% vs 12.3%).

Representative report: ANZELA-QI patient-level summary

The patient-level summary generated for each individual hospital shows every patient and whether the relevant KPIs were achieved. It is then possible to identify any KPI not met by an individual patient and to undertake a review of care to determine the cause. Patterns within a hospital will also emerge. Hospitals can use these monthly reports to improve care; for example, at monthly morbidity and mortality meetings while the care of a patient can still be recalled.

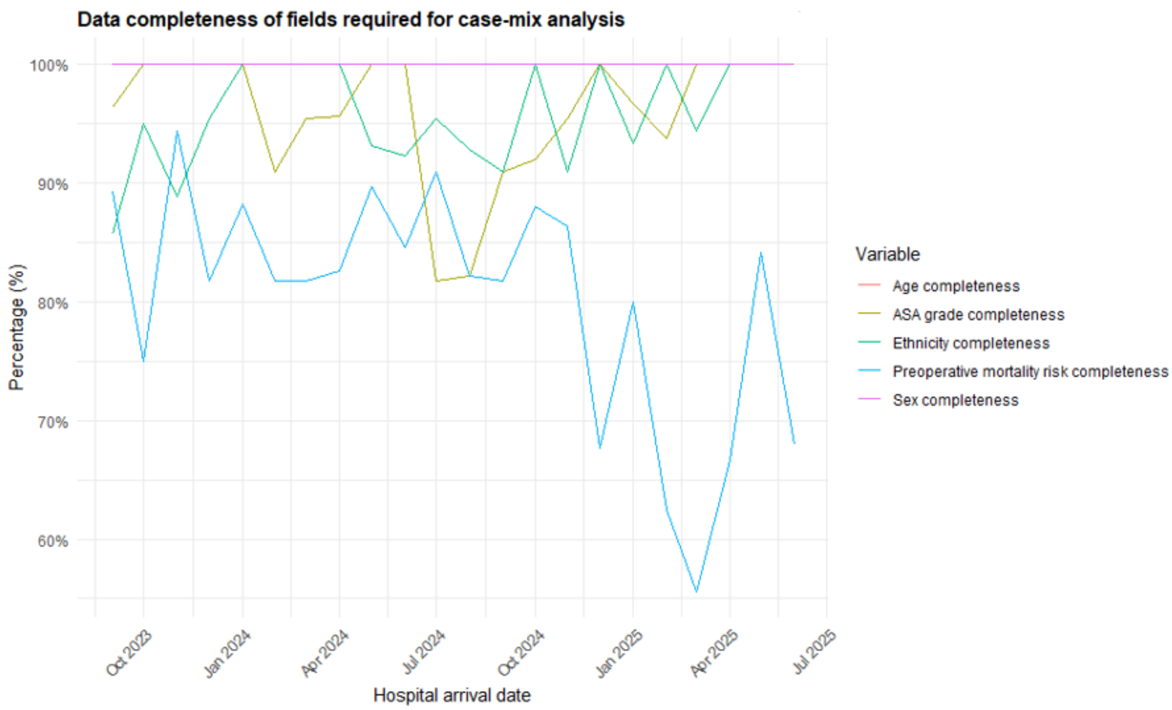
Figure B4: Representative patient summary chart for one contributing hospital

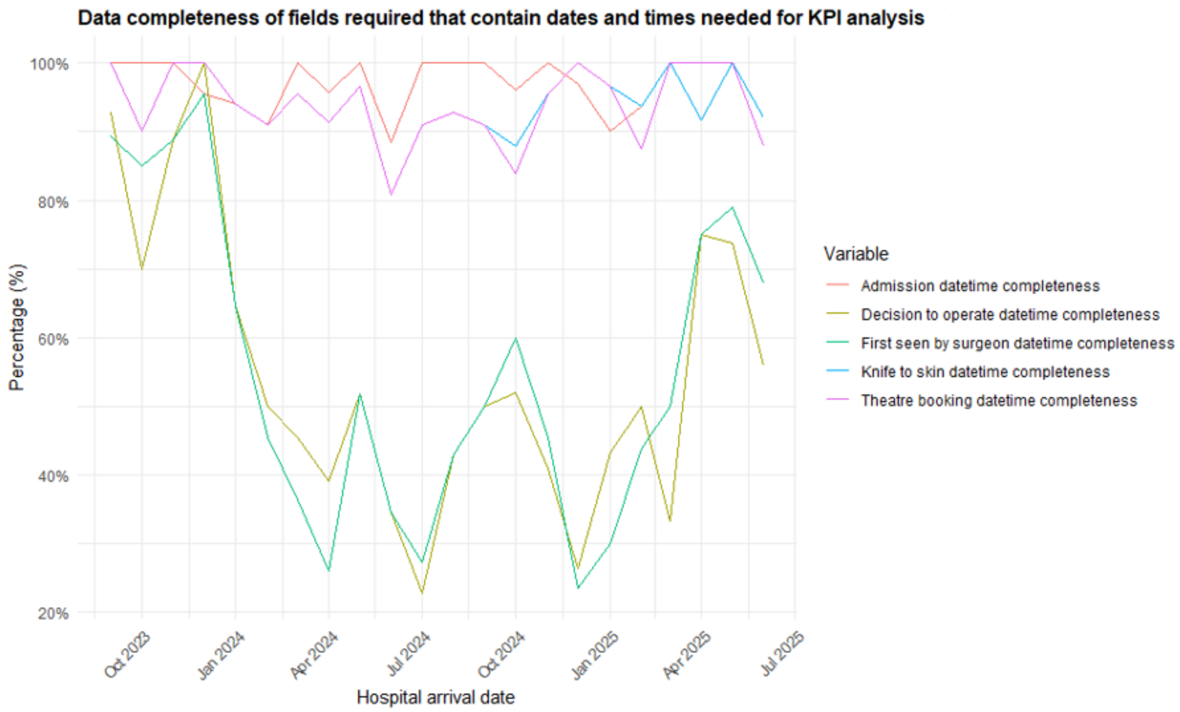
Admission date	Age (years)	NELA risk score (%)	Discharge status	CT	Lactate	NELA risk	Frailty	Theatre	Consultants Surgeon	Anaest.	CCU	Geriatrician
57	4.88	Home	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A	N/A
67		Home	Incomp	Yes	No	No	Yes	N/A	N/A	N/A	N/A	No
48	7.13	Home	Incomp	Yes	Yes	N/A	N/A	Yes	Yes	Yes	N/A	N/A
73	20.2	Rehab	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
49	13.7	Rehab	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	N/A
34	0.23	Home	Yes	Yes	Yes	N/A	Yes	N/A	N/A	N/A	N/A	N/A

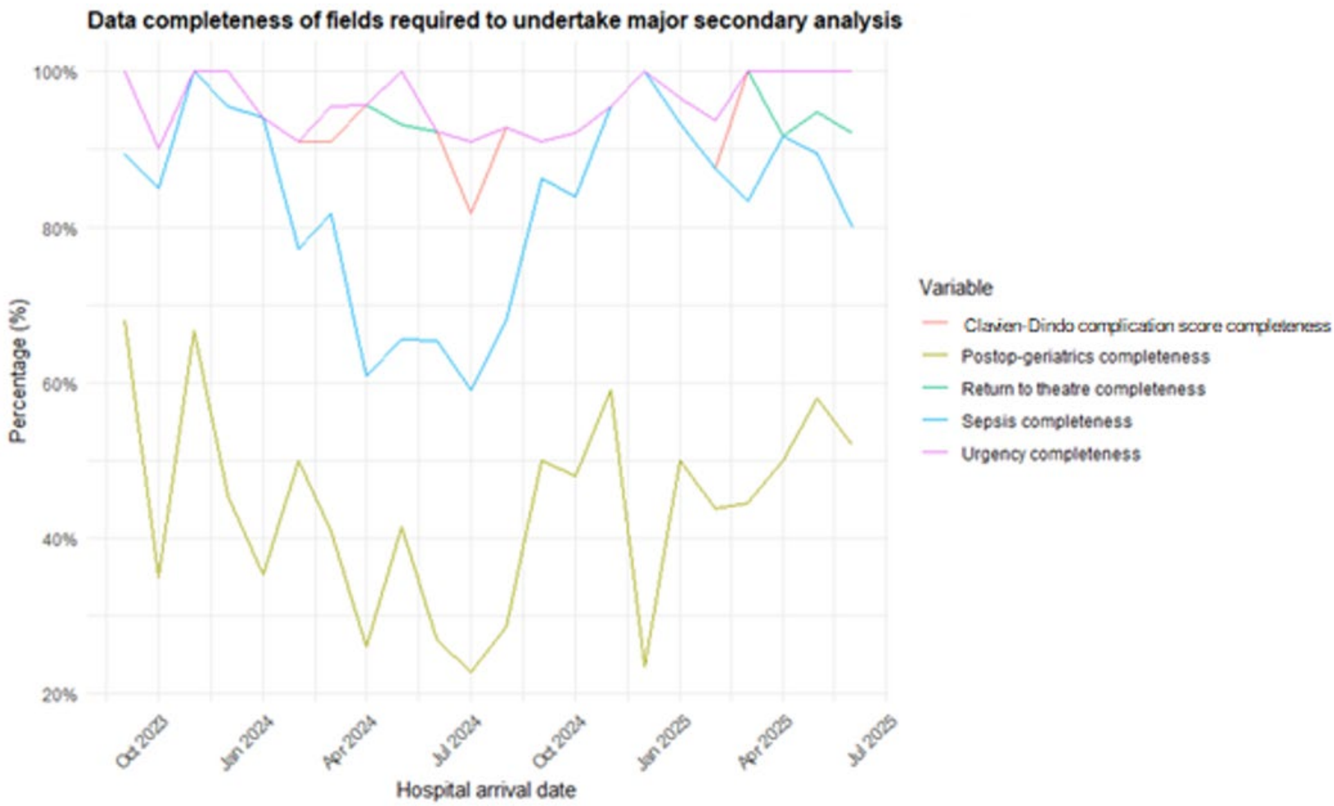
Notes
Represents 9 randomly selected patients from an individual hospital
Deceased = patient was deceased on discharge
Home = returned to prehospital residence
Rehab = rehabilitation facility (any)
No = patient did not meet KPI
Yes = patient met KPI
N/A = cases with incomplete/missing data in any of the variables defining KPI

Representative report: ANZELA-QI data completeness summary

Figure B5: Representative data completeness line charts for one contributing hospital




Data completeness of fields required that contain dates and times needed for KPI analysis
100%
80%
60%
40%
20%
Percentage (%)
Oct 2023
Jan 2024
Apr 2024
Jul 2024
Oct 2024
Jan 2025
Apr 2025
Jul 2025
Hospital arrival date
Variable
Admission datetime completeness
Decision to operate datetime completeness
First seen by surgeon datetime completeness
Knife to skin datetime completeness
Theatre booking datetime completeness


Data completeness of fields required to undertake major secondary analysis
100%
80%
60%
40%
20%
Percentage (%)
Oct 2023
Jan 2024
Apr 2024
Jul 2024
Oct 2024
Jan 2025
Apr 2025
Jul 2025
Hospital arrival date
Variable
Clavien-Dindo complication score completeness
Postop-geriatrics completeness
Return to theatre completeness
Sepsis completeness
Urgency completeness

Appendix C: Data validation processes

Prior to data extraction for each set of monthly reports, data cleansing is undertaken to ensure the reports provided to participating hospitals are representative of patient care received at each site. When data inconsistencies are identified, a case review request is sent to either the principal investigator or data manager at the participating site to investigate and reconcile the inconsistency. Typical data inconsistencies include duplicates and cases missing eligibility criteria fields. This data cleansing is crucial to ensure that the reported figures are accurate. Occasionally, the ANZELA–QI team delivers presentations on data management to participating sites.

Issues identified during the data cleansing include:

- missing data for eligibility criteria or variables used to derive mortality estimates
    - Data with missing eligibility fields cannot be included in the analysis, which impacts the true representation of cases managed by the hospital and may bias outcomes.
- missing or unknown dates of diagnostic procedures
    - Cases missing the date and/or time at which diagnostic scans were performed and reported are ineligible for inclusion to assess whether the scans were reported by a consultant prior to surgery (Preoperative [PRE] 1 KPI).
- missing or unknown dates of surgical procedures
    - Cases missing the date on which surgery was performed, or missing times such as knife-to-skin (KTS) time or wheels-in time, or the last-option procedure time, cannot be included to assess arrival in theatre within an appropriate timeframe (Operative [OP] 5 KPI).
- dates not following logical chronological order
    - If the decision to operate or date of theatre booking is recorded as occurring after KTS date/time or wheels-in date/time, or after procedure date/time, this leads to negative time lags when assessing arrival in theatre within an appropriate timeframe (OP 5 KPI)
    - Discharge dates recorded as occurring before the procedure result in negative length of stay.
- inconsistencies in the format used to create unique hospital record identifiers and/or missing identifiable variables for correct patient identification, which leads to substantial loss of data.

To improve data quality, new business rules were implemented in REDCap in July 2023 following review and approval by the ANZELA–QI Working Party. These rules prevent and/or flag invalid data entries and alert users to cases with missing data. Case status was also introduced to track incomplete cases and prevent them from being closed before all data had been entered. This has reduced the time clinicians spend cleansing records each month and ensured that complete and accurate data are submitted as early and as efficiently as possible.

Appendix D: Participating hospitals

All hospitals that have elected to contribute data to ANZELA-QI need ethics and site-specific assessment approval. This document lists the participating hospitals, grouping them in their approval status.

Table D1: Full ethical approval

Count	State	Hospital
1	ACT	Canberra Hospital
2	NSW	Albury Wodonga Health
3		Armidale Rural Referral Hospital
4		Blacktown and Mount Druitt Hospital
5		Calvary Mater Newcastle
6		Lismore Base Hospital
7		Nepean Hospital
8		Port Macquarie Base Hospital
9		St Vincent's Hospital Sydney
10		The Tweed Valley Hospital
11	NT	Royal Darwin Hospital
12	QLD	Bundaberg Hospital
13		Caboolture Hospital
14		Gold Coast University Hospital
15		Hervey Bay Hospital
16		Ipswich Hospital
17		Logan Hospital
18		Mackay Base Hospital
19		Mater Hospital Brisbane
20		Princess Alexandra Hospital
21		QEII Jubilee Hospital
22		Redcliffe Hospital
23		Redland Hospital
24		Rockhampton Base Hospital
25		Sunshine Coast University Hospital
26		Townsville Hospital
27		Toowoomba Hospital
28	SA	Mount Gambier and Districts Health Service
29		Royal Adelaide Hospital
30		The Queen Elizabeth Hospital
31		Flinders Medical Centre
32		Lyell McEwin Hospital
33		Port Augusta Hospital
34		Riverland Hospital
35		Whyalla Hospital
36	TAS	Royal Hobart Hospital
37	VIC	Ballarat Base Hospital
38		Bendigo Hospital (Bendigo Health)
39		Footscray Hospital (Western Health)
40		Latrobe Regional Hospital
41		Northern Hospital Epping
42		Royal Melbourne Hospital
43		St Vincent's Hospital Melbourne
44		The Alfred Hospital (Alfred Health)

45		University Hospital Geelong (Barwon Health)
46		Casey Hospital (Monash Health)
47		Clayton Hospital (Monash Health)
48		Dandenong Hospital (Monash Health)
49		Frankston Hospital (Peninsula Health)
50		Goulburn Valley Health
51	WA	Albany Health Campus
52		Bunbury Regional Hospital
53		Sir Charles Gairdner Hospital
54		Fiona Stanley Hospital
55		Royal Perth Hospital
56		St John of God Midland Public and Private Hospitals

Notes
Highlighted = participating but did not have enough or eligible cases for the current reporting period 1 January 2022 – 31 December 2024

Table D2: Currently seeking approvals to participate

	State	Hospital
57	NSW	Gosford Hospital
58		The Tweed Hospital
59		Wollongong Hospital
60	QLD	Royal Brisbane and Women's Hospital
61		The Prince Charles Hospital
62	VIC	Eastern Health – Box Hill Hospital
63	WA	Derby Hospital
64		Broome Hospital
65		Kununurra Hospital
66		Rockingham General Hospital

Appendix E: Method for in-hospital 30-day mortality

Outcome and/or mortality evaluation relies on risk-adjustment techniques based on logistic regression analysis, from which the predicted number of events is used to calculate the standardised mortality ratio (SMR) between the observed and predicted number of events. A naive approach for this would use the customary logistic regression model utilising the cases from all hospitals as one case mix, and in doing so, assuming all cases examined are independent of each other.

Two important statistical issues are overlooked with the above approach:

- lack of independence of observations—specifically, in the case of this report, of patient cases within the same hospital
- differences in population structures for age and sex among hospitals.

As for the first point, whenever observations are nested within a higher level of the data, the assumption of independence does not hold. Hierarchically, patients sit at a level of data under that of their hospital, and this type of data structure is called 'clustered' or 'nested'. Patients nested within a hospital are more likely to have similar outcomes than patients from different hospitals. This is for a variety of reasons, among which are age/sex structure of the population served and other demographic characteristics. Disregarding the existence of the clustering within the same hospital by pooling the data can drastically underestimate the inter-hospital variation.

As for the second point, SMRs are often used as a metric to compare hospital mortality because of their perceived simplicity. However, comparing mortality rates derived from hospitals situated within different populations requires the knowledge of the population structure. Ignoring these differences leads to erroneous conclusions due to the introduction of confounding and bias. The SMR is a single number that is obtained as a weighted average across populations strata, so it follows that it is a single number for that reference population.[30]

Further, each hospital has a unique mixture of staff, policies and operational synergies that impact upon patient outcomes in differing ways. The SMR alone effectively compares the observed outcome for the specific distribution of cases at a hospital with the predicted outcome if these patients had been treated by a typical provider in the reference population, as opposed to a suitable reference population.

When utilising funnel plots, an important additional consideration in this audit period is the relatively small number of available cases per hospital. A fundamental criterion for the meaningful use of control limits in funnel plots is having a sufficiently large sample size per hospital.[31]

In this analysis, a tailored approach was used which considered the points raised above by estimating the population-averaged risk-standardised mortality rates (RSMRs) for each hospital with the method of generalised estimating equations[32] (GEEs), a longitudinal method that allows for the correlation between patients from the same hospital and also allows for the robust estimation of the standard errors used to define the control limits of a funnel plot.

The GEE model utilised in the analysis used the logistic link function to derive risk-adjusted predictions of the number of deaths. The estimates were adjusted for age, sex and Indigenous status. When utilising a GEE estimation method, it is necessary to specify a working correlation structure. The correlation structure assumed for the model was exchangeable, which is the simplest type of structure to hypothesise that gives a good compromise between model fit and estimation with sparse data. With this type of correlation, the same correlation value was assumed for any 2 cases within the same hospital.

The estimated SMRs were multiplied by the population-averaged overall mortality rate to obtain the RSMRs for each hospital.

Appendix F: Understanding ANZELA–QI mortality analysis and case ascertainment

Mortality as a key outcome
Mortality after emergency laparotomy is a core ANZELA–QI outcome and a focus of comparison across hospitals and with international audits. The **6.9% risk-adjusted in-hospital mortality** reflects deaths during the admission, not 30-day mortality. Privacy and data-sharing limits in Australia prevent routine 30- or 90-day follow-up, though international comparisons (e.g. NELA 8.1%) suggest similar outcomes, as in-hospital rates typically undercount by <1%.

Inclusion of 'No-Lap' patients
True emergency laparotomy mortality includes all patients eligible for surgery, including those not operated on ('No-Lap'). Australian studies report higher No-Lap rates than overseas, likely reflecting the influence of the Australian and New Zealand Audit of Surgical Mortality (ANZASM), which promotes avoidance of non-beneficial surgery and may contribute to lower postoperative mortality.

Importance of complete case ascertainment
Reliable risk adjustment depends on complete data. Missing data can bias results and alter hospital comparisons. ANZELA–QI tested several imputation methods (e.g. assigning averages or exclusions), but none were ideal. Missing data were common for:

- **ASA grade** – too incomplete for adjustment
- **preoperative risk score** – missing for more than 50% of cases
- **ethnicity** – missing for 11.4%, most likely non-Indigenous.

Consequently, **ASA and risk scores were excluded** from the final model. Both adjusted and unadjusted mortality are reported for transparency.

Impact of missing data
The effect varied by hospital: some results shifted markedly depending on assumptions, while hospitals with complete data remained stable. Age and admission status were the strongest mortality predictors, and since nearly all cases were emergency admissions, adjusted and unadjusted outcomes differed little.

Summary
Accurate benchmarking requires full case capture and complete data. ANZELA–QI results highlight continued improvement in mortality and the importance of strengthening data completeness to ensure robust national comparisons.

Appendix G: Clavien-Dindo scoring system

Clavien-Dindo complication grade is a scoring system that allocates a grade of severity to the various types of complications a patient can have during hospital admission.

GRADE	DEFINITION
Grade I	Any deviation from the normal postoperative course not requiring surgical, endoscopic or radiological intervention. This includes the need for certain drugs (e.g. antiemetics, antipyretics, analgesics, diuretics and electrolytes), treatment with physiotherapy and wound infections that are opened at the bedside.
Grade II	Complications requiring drug treatments other than those allowed for grade I complications; this includes blood transfusion and total parenteral nutrition.
Grade III	Complications requiring surgical, endoscopic or radiological intervention. Grade IIIa – intervention not under general anaesthetic. Grade IIIb – intervention under general anaesthetic.
Grade IV	Life-threatening complications: this includes central nervous systems complications (e.g. brain haemorrhage, ischaemic stroke, subarachnoid haemorrhage) that require intensive care but excludes transient ischaemic attacks. Grade IVa – single-organ dysfunction (including dialysis). Grade IVb – multi-organ dysfunction.
Grade V	Death of the patient.

Appendix H: Risk assessment score categories for ANZELA-QI and NELA

Risk category label	ANZELA-QI risk threshold (%)	NELA risk thresholds (%)
Lower	<5.0	<5.0
High	5.0–9.9	5.0–10.0
Highest	≥10.0	>10.0

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