Fourth Patient Report of the National Emergency Laparotomy Audit (NELA)

December 2016 to November 2017

Royal College of Anaesthetists

NIAA National Institute of Academic Anaesthesia HSRC Health Services Research Centre

Royal College of Surgeons ADVANCING SURGICAL CARE

HQIP Healthcare Quality Improvement Partnership

NELA National Emergency Laparotomy Audit

October 2018

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Citation for this Report:
NELA Project Team. Fourth Patient Report of the National Emergency Laparotomy Audit
RCoA London, 2018

Cover: Emergency Laparotomy Team of Maidstone and Tunbridge Wells NHS Trust

The National Emergency Laparotomy Audit (NELA) is commissioned by the Healthcare Quality Improvement Partnership as part of the National Clinical Audit Programme on behalf of NHS England and the Welsh Government.

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Design and layout by the Royal College of Anaesthetists

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An emergency laparotomy (emergency bowel surgery) is a surgical operation for patients, often with severe abdominal pain, to find the cause of the problem and treat it. General anaesthetic is used and usually an incision made to gain access to the abdomen. Emergency bowel surgery can be carried out to clear a bowel obstruction, close a bowel perforation and stop bleeding in the abdomen, or to treat complications of previous surgery. It is one of the most risky types of emergency operation.

These results are from 2016-17, the 4th year of the National Emergency Laparotomy Audit.

1 **23,929 patients** were entered into the audit, from **183 hospitals** in **England** and **Wales**.

2 The number of days **a patient spends in hospital** has fallen further, to **15.6 days in 2017** down from **16.6 days in 2016** and **19.2 days in 2013**, when NELA began.

3 This saved acute **NHS Hospitals** an estimated **108,000 bed days** and **£34 million** in 2017.

£34m

4 Since 2013, national **30-day mortality rate** has fallen from **11.8% to 9.5%**

5 This means that **~700 fewer patients die each year** after emergency laparotomy surgery.

6 **77% of patients are alive** at one year post-surgery, **71%** at two years, and **66%** at three years.

1 Year	2 Years	3 Years
77%	71%	66%

7 **87% of patients received a pre-operative CT scan** compared to **80%** when NELA began, a sustained improvement.

8 **76% of patients with sepsis did not receive antibiotics within timescales** This should happen within **1 hour** of diagnosis.

9 Both a **consultant anaesthetist and surgeon** were present in theatre for **90% of patients during the daytime**, but only **66% of patients out of hours**.

90% | 66%

10 **27%** of patients needing the most urgent surgery **did not get to the operating theatre in the recommended timeframes**.

11 **25-35 critical care beds are needed every day** to care for emergency laparotomy patients. **90% of patients with a pre-operative risk score of >10%** went to critical care.

12 **~Half** of patients are **aged over 70**, but **77% were not seen by a geriatrician**

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ACKNOWLEDGEMENTS

This Report was prepared by members of the National Emergency Laparotomy Audit Project Team on behalf of the Royal College of Anaesthetists. The members of the team were

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Acknowledgements

The NELA Project Team and Board would like to express their thanks to all clinical and non-clinical staff at all NHS trusts and Welsh health boards who collected and submitted data. We recognise that many staff are collecting and entering data in their own time and without additional resources. We commend their dedication to improving patient care. In particular we would like to thank the NELA Leads for their hard work, leadership and continued enthusiasm (www.nela.org.uk/NELALeadDb); without this engagement, patients would not have benefited from improved care and NELA would not be the success it has become over the last three years.

The NELA project team and Board would like to thank the Royal College of Radiologists and The Sepsis Trust for their contributions to the report.

The NELA Project Team and Board would also like to thank the members of the NELA Clinical Reference Group for helping to shape the dataset and Report.

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National Emergency Laparotomy Audit

1 FOREWORD

Each year almost 30,000 laparotomies are performed across England and Wales. Many of these patients are at high risk of death or serious complications, and all of them warrant highly skilled teams, trained to look after them, delivering high-quality, safe, and effective care at every moment of their hospital stay.

Patients who undergo emergency laparotomy will meet many different healthcare specialists during their time in hospital, from the nurses triaging them in the emergency department, to the junior doctors clerking them on the surgical admissions unit, to the consultant anaesthetists assessing them before their surgery.

But there is also a team of dedicated staff who they will rarely have the opportunity to meet in person, including consultant radiologists and their teams who provide expert interpretation and clinical reports of their CT scans, and the operating theatre team that take care of them while they are asleep. This team includes not only anaesthetists and surgeons, but also a number of other professionals without whom emergency surgery could not be done – radiographers, operating department practitioners, anaesthetic nurses, scrub nurses, recovery nurses, healthcare assistants, and theatre porters. Each member of this wider multidisciplinary team has a fundamental role in making sure their patients have the best possible care. The patient is at the centre of their work, and it is this that drives and inspires them.

The National Emergency Laparotomy Audit not only provides the data to allow clinical teams to assess and benchmark their care against national standards, but also actively encourages teams to use their own data to drive local quality improvement (QI). NELA aims to raise awareness of QI methodology to support this, for example, by sharing learning resources on the NELA website and running a series of regional workshops in England and Wales for the multidisciplinary teams working with emergency laparotomy patients. QI is everyone's business, including the 'unsung heroes' behind the scenes. Through NELA, theatre teams have been empowered to lead and support changes, and this has been key in improving the care we can provide for our patients. This regional engagement will grow with the development of emergency laparotomy collaboratives, led by the Academic Health Science Networks (AHSNs) throughout England and Public Health Wales in 2018–2019. It is also anticipated that the introduction of radiology NELA leads at hospitals, who will work as part of this team, will bring further improvements, and lay the foundations for increasing collaboration with other specialties such as emergency medicine and with community practitioners such as GPs.

In the meantime, this means that our patients and their families can be reassured that, once they leave the more familiar environment of a hospital ward to come to the operating theatre for their emergency laparotomy surgery, they will be looked after in as caring and compassionate a manner while they are asleep as when they are awake on the wards, safe in the knowledge that all members of the theatre team from anaesthetists to scrub nurses, and operating department practitioners to surgeons, are working together to make sure patients receive the highest quality care and to contribute to the best possible patient outcomes.

NELA teams of St James's University Hospital, Leeds,
University College London Hospital, Queen Elizabeth Hospital, Birmingham
and Maidstone & Tunbridge Wells Hospital

October 2018

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2 EXECUTIVE SUMMARY

Overview

1 This is the fourth Patient Report of the National Emergency Laparotomy Audit (NELA), commissioned by the Healthcare Quality Improvement Partnership, which is an ongoing clinical audit of adult patients having emergency bowel surgery. This 'state of the nation' report which is funded by NHS England and the Welsh Government, presents information about the care received by 23,929 patients (22,173 located in England and 1,756 in Wales) who had surgery between 1 December 2016 and 30 November 2017. This represents around 83% of all patients that underwent this surgery in 179 hospitals.

2 Many of the outcomes, standards and ratings are publicly reported on an annual basis on the MyNHS website and are used by the Care Quality Commission (CQC) for hospital inspections. NELA is a mandatory clinical audit for NHS England Quality Accounts.

3 NELA is committed to supporting clinical teams and managers to apply quality improvement methods to improve care for patients undergoing emergency laparotomy.

Key points at a glance

Patient outcomes

4 30-day postoperative mortality has improved from 11.8% when the audit started in 2013, to 9.5%, representing around 700 lives now saved each year in comparison with 2013.

5 One hospital was identified as having unexpectedly high risk-adjusted mortality rates.

6 Longer-term patient survival is reported for the first time. Overall mortality rates were 23% at 1-year after surgery, 29% at 2 years, and 34% at 3 years following surgery, but were substantially higher in high risk groups.

7 Average length of stay has fallen further to 15.6 days. This fall from 19.2 days in Year 1 represents an annual saving to acute hospitals of £34million.†

8 6.3% of all emergency laparotomy patients had their surgery for a complication of a recent elective procedure within the same admission, 6.0% of all emergency laparotomy patients had an unplanned return to theatre after initial emergency laparotomy and 3.4% of patients had an unplanned admission to critical care, with variation seen between hospitals.

Patient care

9 NELA allows hospitals to quality-assure their service by comparing care against published standards that cover the timeliness of care, delivery of care according to assessment of risk, and seniority of the clinician involved. The standards reflect the multidisciplinary involvement in the care pathway, which potentially includes input from emergency departments, acute admissions units, radiology, surgery, anaesthesia, operating theatres, critical care, and elderly care. It is essential that these multidisciplinary areas collaborate to improve care.

10 The proportions of all patients receiving care that met key standards of care are summarised in Figure 2.1, and the proportion of hospitals that met key standards of care are shown in Figure 2.2. The degree to which these standards were met varied between hospitals.

11 Detailed comparative data for individual hospitals are presented throughout the main report. Individual annual and quarterly hospital reports can be downloaded here.

12 Improvement has been seen in the following areas:

a 75% of patients now receive an assessment of risk (up from 71% last year, and 56% in Year 1)

b 95% of patients had input from a consultant surgeon and 86% had input from a consultant anaesthetist prior to surgery

c consultant presence during surgery is at its highest level since the audit commenced; for high and highest risk patients, a consultant surgeon is present during surgery 92% of the time, a consultant anaesthetist 88%, and both consultants 83% of the time

d 87% of highest risk patients are admitted to critical care following surgery.

†Based on 30,000 patients annually with an excess hospital bed day cost of £313/day (page 5).

13 There are some areas that have shown little improvement over four years. We are calling for urgent action to address these areas:

- a only a quarter of patients suspected of sepsis on admission received antibiotics within the recommended 60 minutes
- b more patients are now receiving a CT scan before surgery. Of those that had a CT scan, preoperative reporting by an in-house consultant was 73% (64% of all emergency laparotomy patients). This year's report also presents new information on accuracy of reporting of CT scans for emergency laparotomy. This varied between hospitals from 100% to 78%
- c the proportion of patients arriving in the operating theatre within appropriate timeframes has remained static at 82% (almost unchanged since Year 1). Of greater concern is that the figure for the most urgent patients (requiring surgery within two hours) has fallen from 76% to 73%
- d while intraoperative consultant presence is at its highest level overall, out-of-hours presence remains lower. This is particularly concerning given that a greater proportion of high risk and highest risk patients have surgery between 6.00pm and 8.00am
- e emergency laparotomy remains a procedure that is associated with increasing age, but only 23% of patients aged over 70 received elderly care input
- f the data quality for some hospitals remains relatively poor and this is likely to hinder attempts to improve care. Some hospitals were able to provide data on timeliness of interventions for only 23% of their patients.

New developments

14 For Year 4, we developed new areas of NELA data collection, which we present in this report. These include:

- a the specialty under which patients were admitted, allowing us to comment on whether this was associated with differences in the care patients subsequently received
- b information on a patient's place of residence before surgery, and discharge destination, providing some assessment of changes to short term dependency
- c greater information on preoperative consultant input by surgeons, anaesthetists and intensive care doctors.

15 For the first time, NELA data is being published at AHSN level in England and for Public Health Wales, as well as at hospital and national levels. Such AHSN reporting will inform collaborative working by hospitals to improve care in their region, by sharing best practice.

16 We have changed the way in which we make recommendations. These are grouped into overarching themes, with accompanying actions for different audiences, against which we have set suggested timeframes by which these actions should be completed.

17 The Royal College of Surgeons 2011 document *The Higher Risk General Surgical Patient*[1] document is being reviewed in 2018, and it is anticipated that this may lead to updated standards on the way high risk patients are defined. This report has been able to include an overview of the implications of possible changes, especially with regard to admission to critical care.

18 There is a proposal to introduce an emergency laparotomy Best Practice Tariff (BPT) in 2019. The BPT draft proposal will require providers to develop and implement a multidisciplinary pathway for patients potentially undergoing an emergency laparotomy. The proposed metrics cover consultant presence in theatre and admission to critical care for high risk patients.

19 We are producing a 'how to …' guide to help providers establish patient support groups in their area for patients undergoing emergency surgery.

20 For Year 5, additional questions have been included on:

- a assessment of frailty
- b presence of learning disability among patients
- c planned and unplanned returns to theatre.

Maximising the value of NELA data

21 NELA makes data readily available to local clinicians, managers, and commissioners to support quality improvement activity, so that changes to the service can be monitored in an ongoing fashion to facilitate improvements in care.

22 We publish freely available quarterly reports showing hospital progress and performance against the national picture, to reduce the timescale for reporting, and to facilitate regular local data feedback.

23 Clinicians and audit staff can download their hospital's full dataset on demand, as an Excel spreadsheet for easy analysis and monitoring of trends in outcomes and performance.

24 Real-time dashboards are available that show the latest hospital data and enable local teams to see both temporal trends and the relationship between local and national performance. NELA will continue to develop these dashboards in collaboration with local clinicians.

25 NELA has started to produce 'Excellence and Exception' reports that allow clinicians to easily identify patients in whom all standards were met, and patients who died where standards were not met. This allows clinicians to easily review notes describing patient journeys that highlight good practice or areas for improvement. Such reports can be used to enhance hospital clinical governance and local mortality monitoring activities and to implement Learning from Deaths, and support work on the National Mortality Case Record Review programme.

26 NELA is collaborating closely with three *Getting it Right First Time (GIRFT)* initiatives for general surgery, anaesthesia and perioperative medicine, and intensive and critical care. GIRFT teams are using NELA data and reports in their 'deep dive' hospital visits, to improve understanding of care delivery at a local level. We have produced guidance to facilitate local leads in accessing and presenting their NELA data for their GIRFT 'deep dive' visit.

27 NELA ran eight regional workshops for multidisciplinary teams working on emergency laparotomy related care, to share best practice, QI methodology, and better use of NELA data for improvement. The presentations and resources from these workshops are freely available on the NELA website.

28 NELA is collaborating with the Academic Health Science Networks in England, and Public Health Wales, to work alongside the Emergency Laparotomy Collaborative. These breakthrough collaboratives will help support clinicians to work with local colleagues in their networks to share best practice and improve patient care.

29 NELA data has been linked with data from the National Bowel Cancer Audit, and the Intensive Care National Audit and Research Centre (ICNARC) casemix programme. Analysis of these linked datasets will provide a greater understanding of patients undergoing emergency laparotomy who have bowel cancer, and patients who are admitted to intensive care. These findings will appear as separate publications.

30 We continue to collaborate with other professional organisations and researchers on projects such as:

a development of Patient-Reported Outcome Measures (PROMs) for patients undergoing emergency laparotomy

b additional analyses of cohorts of patients with different diseases who undergo emergency laparotomy

c supporting research into new treatments and technologies that might benefit patients undergoing emergency laparotomy.

Figure 2.1 Proportion of all emergency laparotomy patients in Year 4, who had surgery between December 2016 and November 2017, meeting key standards

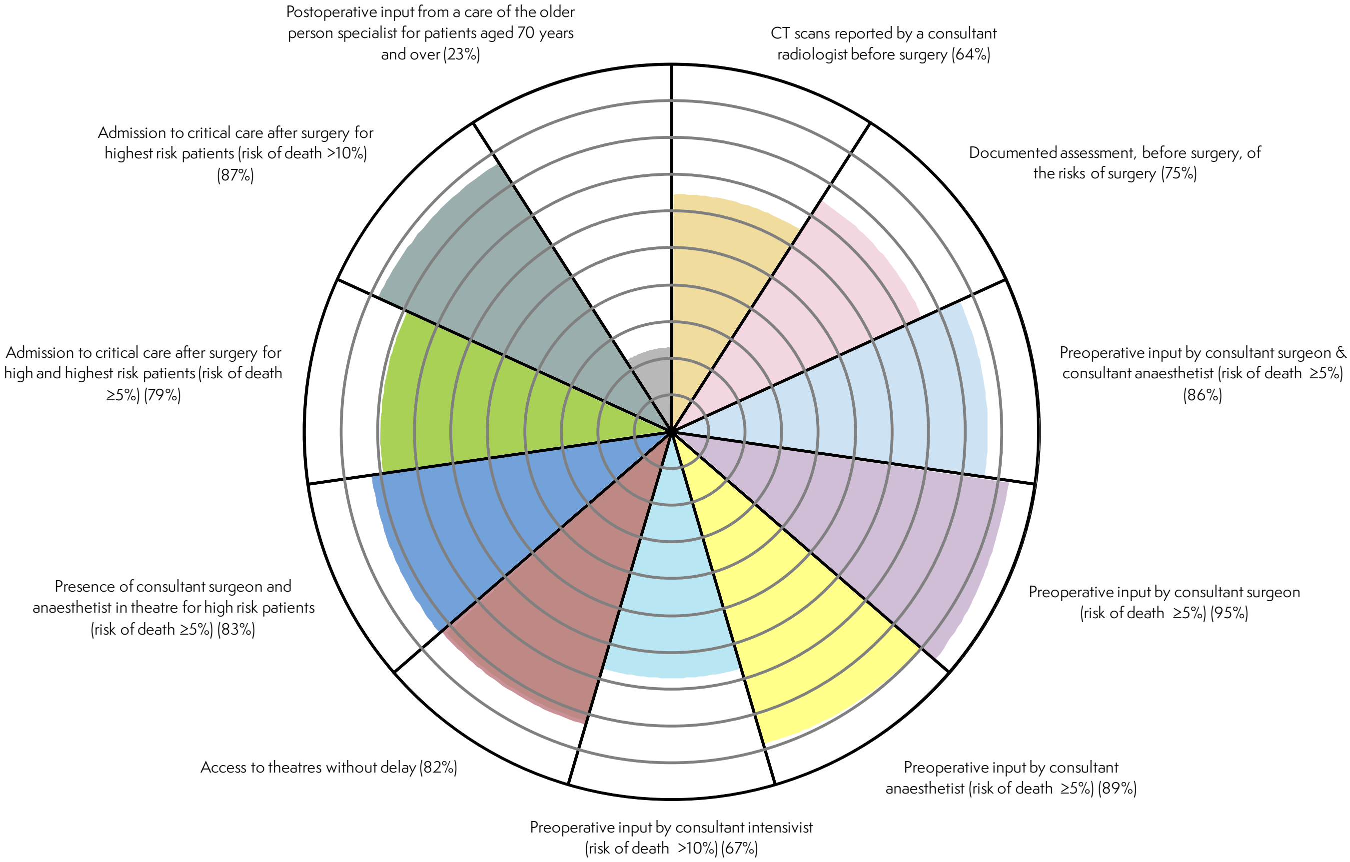

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Figure 2.2 Proportion of *hospitals* in Year 4 meeting key standards

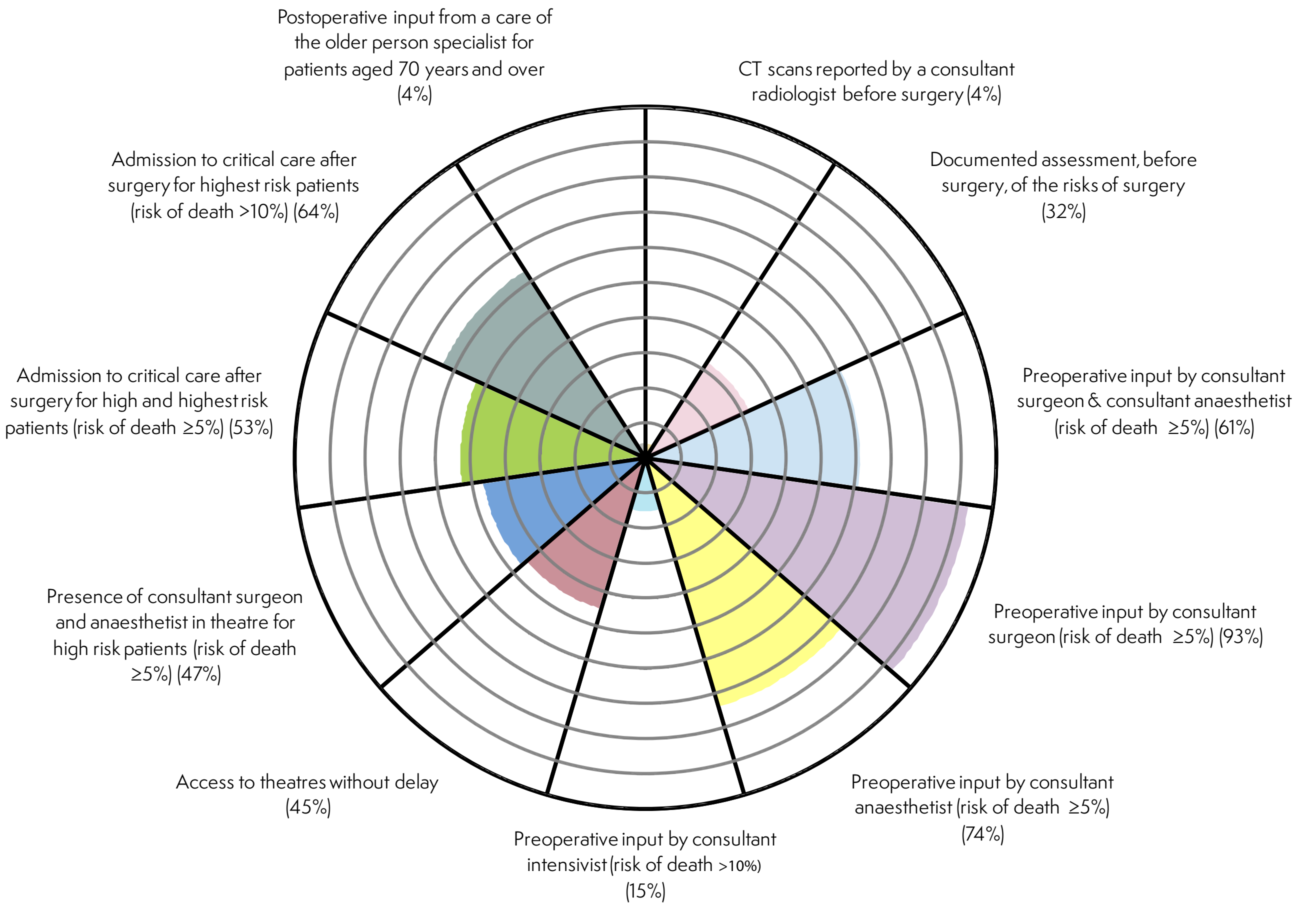
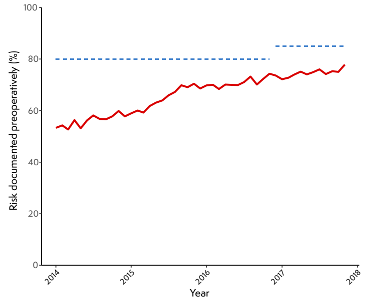
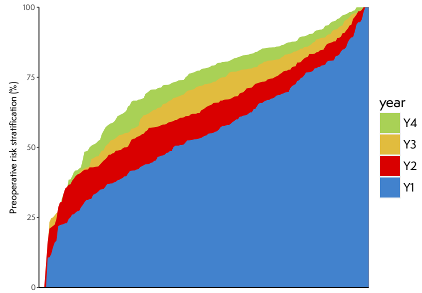


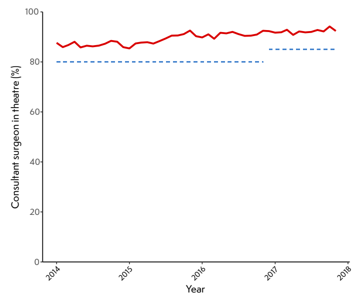
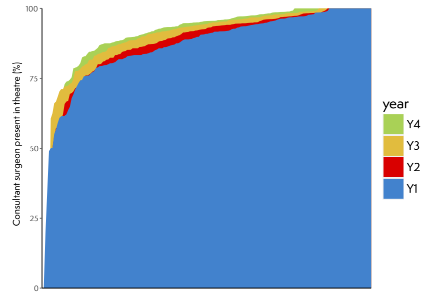
Table 2.1 Comparison of the number of hospitals rated Green* in the NELA Patient Reports for each key standard (only hospitals with at least 10 eligible cases for each standard are included)

* To describe how well hospitals are meeting standards, NELA uses a RAG-rating system (red-amber-green). In Years 1–3, a Green rating equates to the standard being achieved for ≥80% of patients. In Year 4, this has been raised to ≥85% for all standards except 'admission to critical care when risk ≥5%' (no RAG standard) and 'assessment by specialist in the care of the older person' (kept at ≥80%). Figures for ≥80% thresholds for Year 4 are presented in brackets for comparison

	Year 1	Y1%	Year 2	Y2%	Year 3	Y3%	Year 4	Y4%
CT scan reported before surgery	New data for Year 4 therefore previous years not shown						7	4%
Risk of death documented preoperatively	24	13%	39	22%	57	32%	56 (82)	32% (47%)
Arrival in theatre within a timescale appropriate to urgency	97	55%	119	67%	133	76%	77 (124)	45% (72%)
Preoperative input by consultant surgeon and anaesthetist where risk of death is ≥ 5% (P-POSSUM)	New data for Year 4 therefore previous years not shown						105	61%
Preoperative input by consultant surgeon where risk of death is ≥ 5% (P-POSSUM)	New data for Year 4 therefore previous years not shown						160	93%
Preoperative input by consultant anaesthetist where risk of death is ≥ 5% (P-POSSUM)	New data for Year 4 therefore previous years not shown						127	74%
Preoperative input by consultant intensivist where risk of death is >10% (P-POSSUM)	New data for Year 4 therefore previous years not shown						26	15%
Consultant surgeon and anaesthetist both present in theatre when risk ≥ 5% (P-POSSUM)	61	34%	76	43%	104	59%	80 (107)	47% (62%)
Consultant surgeon present in theatre when risk ≥ 5% (P-POSSUM)	146	82%	152	86%	157	89%	149 (158)	87% (92%)
Consultant anaesthetist present in theatre when risk ≥ 5% (P-POSSUM)	86	48%	104	59%	129	73%	114 (131)	66% (76%)
Admission to critical care when risk ≥ 5% (P-POSSUM)	76	43%	92	52%	96	55%	91	53%
Admission to critical care when risk >10% (P-POSSUM)	117	66%	129	75%	135	78%	109 (128)	64% (75%)
Assessment by specialist in the care of the older person for patients aged 70 and over	2	1%	3	2%	5	3%	7	4%

Table 2.2 Summary of standards, process measures, mean Years 1–4 performance, performance over time and hospital level performance

Key standard	Process measure	First NELA Patient Report (Dec 13 – Nov 14)	Second NELA Patient Report (Dec 14 – Nov 15)	Third NELA Patient Report (Dec 15 – Nov 16)	Fourth NELA Patient Report (Dec 16 – Nov 17)	Trend over time	Hospital level performance over time Horizontal axis: range of hospitals Vertical axis: proportion of patients in each hospital who received that standard of care
Hospitals which admit patients as emergencies must have access to both conventional radiology and CT scanning 24 hours per day, with immediate reporting	Proportion of all emergency laparotomy patients who received a preoperative CT report by an in-house consultant radiologist				64%		
An assessment of mortality risk should be made explicit to the patient and recorded clearly on the consent form and in the medical record	Proportion of patients in whom a risk assessment was documented preoperatively	56%	64%	71%	75%		
	Proportion of patients with a calculated preoperative P-POSSUM risk of death ≥5% who had input from a consultant surgeon prior to surgery				95%		

Key standard	Process measure	First NELA Patient Report (Dec 13 – Nov 14)	Second NELA Patient Report (Dec 14 – Nov 15)	Third NELA Patient Report (Dec 15 – Nov 16)	Fourth NELA Patient Report (Dec 16 – Nov 17)	Trend over time	Hospital level performance over time Horizontal axis: range of hospitals Vertical axis: proportion of patients in each hospital who received that standard of care
	Proportion of patients with a calculated preoperative P-POSSUM risk of death ≥5% who had input from a consultant anaesthetist prior to surgery				89%		
	Proportion of patients with a calculated preoperative P-POSSUM risk of death >10% who had input from a consultant intensivist prior to surgery				67%		
Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist.	Proportion of patients with a calculated preoperative P-POSSUM risk of death ≥5% for whom a consultant surgeon was present in theatre	87%	89%	91%	92%		

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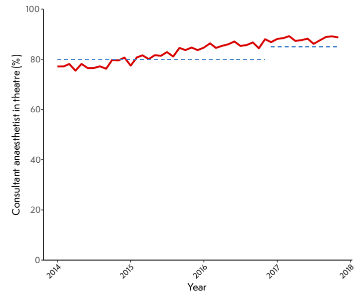
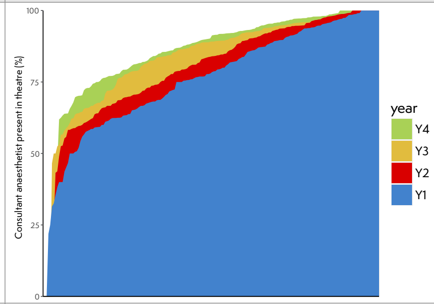
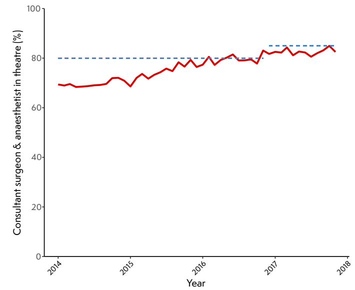
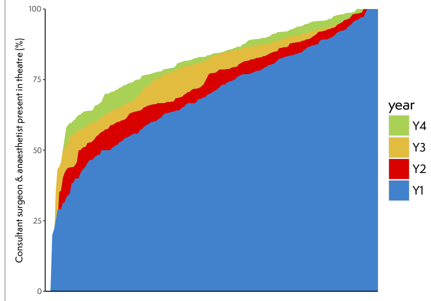
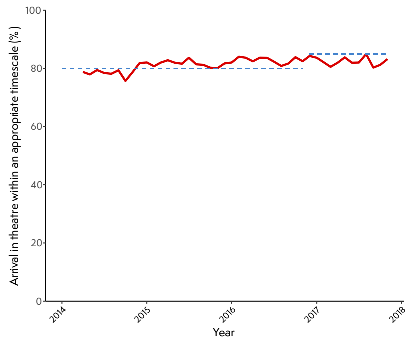
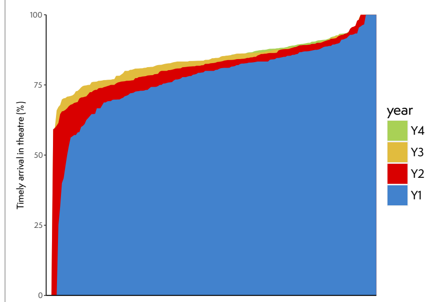
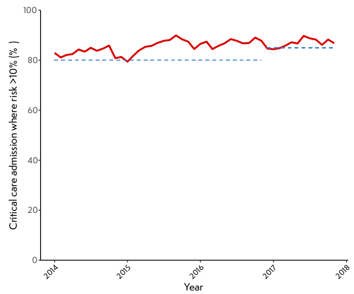
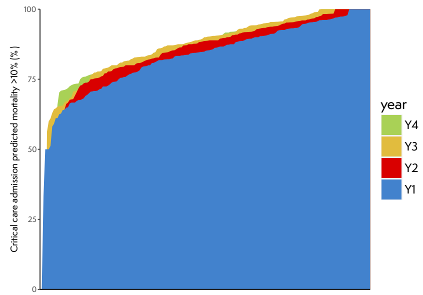
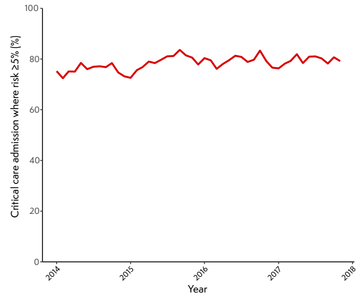
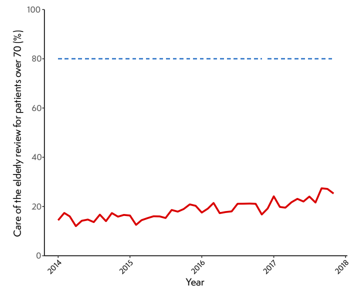
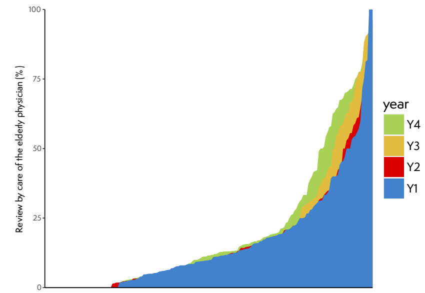
	Proportion of patients with a calculated preoperative P-POSSUM risk of death ≥5% for whom a consultant anaesthetist was present in theatre	77%	82%	86%	88%		
	Proportion of patients with a calculated preoperative P-POSSUM risk of death ≥5% for whom both consultants were present in theatre	70%	74%	79%	83%		
Trusts should ensure emergency theatre access matches need and ensure prioritisation of access is given to emergency surgical patients ahead of elective patients whenever necessary as significant delays are common and affect outcomes	Proportion of patients arriving in theatre within a time appropriate for the urgency of surgery	78%	82%	83%	82%		

Key standard	Process measure	First NELA Patient Report (Dec 13 – Nov 14)	Second NELA Patient Report (Dec 14 – Nov 15)	Third NELA Patient Report (Dec 15 – Nov 16)	Fourth NELA Patient Report (Dec 16 – Nov 17)	Trend over time	Hospital level performance over time Horizontal axis: range of hospitals Vertical axis: proportion of patients in each hospital who received that standard of care
All high risk patients should be considered for critical care and as a minimum, patients with an estimated risk of death of >10% should be admitted to a critical care location	Proportion of patients with a postoperative P-POSSUM risk of death >10% who were directly admitted to critical care postoperatively.	83%	86%	87%	87%		
	Proportion of patients with a postoperative P-POSSUM risk of death ≥5% who were directly admitted to critical care postoperatively.	76%	79%	80%	79%		Hospital level data not reported. Not currently a defined standard
Each patient aged over the age of 70 should have multidisciplinary input that includes early involvement of Medicine for the Care of Older People	Proportion of patients aged 70 years or over who were assessed by a care of the older person specialist	15%	17%	19%	23%		

3 RECOMMENDATIONS

It is clear from the NELA data presented in this report that there remain some crucial areas of care which must be improved if all patients undergoing emergency laparotomy are to receive the right care, by the right people, at the right time. In this 4th report there are six key themes which cover the standards against which NELA measures delivery of care for patients undergoing emergency laparotomy. For each theme there are associated actions allocated to specific owners; all are underpinned by the principles of quality improvement being specific, using measurable data from NELA, and are intended to be achievable tasks that are relevant and realistic to teams and patients within the defined time frame.

The six key NELA themes are:

1. improving outcomes and reducing complications
2. ensuring all patients receive an assessment of their risk of death
3. delivering care within agreed timeframes for all patients
4. enabling consultant input in the perioperative period for all high risk patients
5. effective multidisciplinary working
6. supporting quality improvement.

As in previous years, we have targeted the actions to those best placed to deliver them:

- the NELA Project Team
- Royal Colleges and other professional stakeholders
- commissioners, hospital CEO/MDs
- clinical directors and leadership teams
- NELA local leads
- multidisciplinary clinical teams
- patients, families and public.

Some actions are applicable to more than one area.

	Detailed Action and Owner	Timeframe
1 Improving outcomes and reducing complications		
Maximising the value of NELA data		
1.1	**Provider Executive Boards and Medical Directors:** review NELA annual and quarterly reports and changes in performance as a regular standing agenda item at Executive level (at least quarterly)	Commence from next Executive meeting (by January 2019 at the latest)
1.2	**Medical Directors, Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** ensure NELA outcome data (mortality, length of stay, unplanned returns to theatre and critical care and mortality) and processes of care are presented and reviewed at regular multidisciplinary governance meetings. These meetings should consider current performance and change over time, identify gaps in care and areas of good care, and develop appropriate action plans	Commence from next governance meeting (by January 2019 at the latest)
1.3	**Medical Directors, Clinical Directors, local NELA leads:** collaborate to understand how local NELA data can inform and align with other hospital improvement programmes, such as *Getting it Right First Time (GIRFT)*, Surviving Sepsis, The Deteriorating Patient, National Emergency Warning Score, and hospital flow workstreams	Develop collaboration plan by January 2019, with integration of data flows by April 2019
1.4	**Medical Directors, Trust Medical Examiners, Clinical Directors:** integrate review of patient deaths into Trust Mortality reviews and the National Mortality Case Record Review programme	Commence from next governance meeting (by January 2019 at the latest)
1.5	**NELA:** collaborate with improvement initiatives, such as *Getting it Right First Time (GIRFT)*, Surviving Sepsis, The Deteriorating Patient, and the National Emergency Warning Score, to understand how NELA data can support these initiatives at national level	Immediate
1.6	**NELA:** develop report templates (such as the Excellence and Exception report), dashboards and other reporting tools to support local teams and executive boards understand their provision of care and share best practice	Immediate
Clinical pathways		
1.7	**Medical Directors, Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** develop and agree pathways of care that apply from admission to discharge to ensure a consistent approach to care throughout the perioperative stay. Pathways should define timelines for delivery of care, diagnosis, referral and escalation pathways, seniority of clinicians, and expectations of team members	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
1.8	**NELA:** work with professional stakeholders and hospitals to define and share best practice on pathways of care for patients undergoing emergency laparotomy	December 2018

Clinical care		
1.9	**Multidisciplinary clinical teams**: ensure appropriate and timely discharge planning before stepping down patients to the ward and be alert to signs of deterioration once discharged to the ward. There should be clear referral pathways for early escalation to senior clinicians of patients who are deteriorating or failing to progress. Teams should regularly review the timeliness of referrals to ensure appropriate escalation occurs promptly. Teams should ensure safe ward staffing levels exist before discharge, especially out-of-hours	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
2 Ensuring all patients receive an assessment of their risks associated with surgery that is documented in the medical record, communicated to members of the multidisciplinary team, and used to inform clinical decision-making		
2.1	**Medical Directors and Clinical Directors:** develop policies that define allocation of resources (consultant delivered care and admission to critical care) according to a patient's risk	January 2019
2.2	**Clinical Directors, NELA leads, Multidisciplinary clinical teams:** develop and agree multidisciplinary pathways that ensure all patients receive a documented preoperative assessment of risk based on objective risk scoring and senior clinical judgement. This risk assessment should guide allocation of resources and subsequent delivery of care (recommendation 2.1). Where patients do not have a preoperative risk assessed and documented, they should be treated as if they are high risk patients and receive the appropriate standards of care for high risk (>5%) patients. Patients should only be treated as low risk if the multidisciplinary team agrees and documents that they can be considered low risk on the basis of clear and agreed clinical evidence	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
2.3	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** ensure that risk assessment is based on a combination of both clinical and formal objective assessment (in particular using the NELA risk assessment tool which is more accurate than other methods for NHS patients undergoing emergency laparotomy). Risk assessment is done to facilitate the planning of care and communication and its limitations for an individual patient should always be considered. This risk assessment should be used as part of the consent process and to enable shared decision-making for high risk patients. A risk score can be easily calculated using the standalone NELA webtool and NELA risk app	January 2019
2.4	**Local NELA leads, Multidisciplinary clinical teams:** ensure that risk assessment information is communicated between all members of the multidisciplinary clinical team, including operating theatre staff, to aid joint understanding of a patient's risk and planning of care	January 2019
2.5	**Clinical Directors, College Tutors, local NELA leads:** promote the use of the NELA risk calculator (using webtool or NELA risk app) at junior doctor induction	Commence at next Junior Doctor induction
2.6	**NELA:** continue to analyse and assess the performance of the NELA risk prediction tool. Continue to promote the importance of combining clinical judgement with objective calculation of risk as part of clinical decision-making. Continue to provide NELA risk assessment tool on website and app	Ongoing

2.7	**Patients, families and public:** expect to be clearly informed of their own individual risks associated with their surgery, as part of the shared decision-making approach to consenting for surgery, unless they have expressed the wish not to discuss this	Ongoing
3 Delivering care within agreed timeframes for all patients		
Sepsis and peritonitis		
3.1	**Provider Executive Boards, Medical Directors:** ensure a Health Board/Trust-wide approach to identify patients with sepsis, that ensures antibiotics are given within 60 minutes of recognition of sepsis	January 2019
3.2	**Medical Directors, Clinical Directors, local NELA leads:** Use local NELA data to inform the hospital's Surviving Sepsis campaign	January 2019
3.3	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** develop and agree multidisciplinary pathways for the management of sepsis and/or peritonitis to include patients who are admitted under non-surgical specialities. These should also ensure administration of antibiotics within 60 minutes of recognition of sepsis and appropriately rapid source control	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
3.4	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** audit and review peritonitis cases to assess own performance and pathways, benchmarking performance against national recognised sepsis pathway	January 2019
3.5	**Clinical Directors, College Tutors, local NELA leads**: present emergency laparotomy pathways and their links with sepsis at new staff inductions (both senior and junior, surgeons, anaesthetists, ED, radiology, relevant allied healthcare professionals including nurses and operating department practitioners), and add as a standing item agenda for surgeon and anaesthetist MDT meetings	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
3.6	**NELA:** develop report templates to support local teams and executive boards understand their performance on treatment of sepsis	December 2018
Theatre capacity		
3.7	**Commissioners, Provider Executive Boards and Medical Directors:** review adequacy of theatre capacity based on estimation of emergency surgical caseload, and work to address any shortfall. Capacity needs to be sufficient to allow patients to receive surgery within defined timeframes. The area that needs particular attention is those requiring surgery within two hours. Improvement teams should use QI methodology such as process mapping to understand where change is required	January 2019
3.8	**Medical Directors and Clinical Directors:** develop policies that define the timeline to surgery, prioritise emergency cases according to risk and surgical urgency, and deferral of elective work if theatre space is unavailable to meet clinical urgency	Policies to be in place by April 2019 in anticipation of Best Practice Tariff
3.9	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** develop and agree pathways to facilitate arrival of patients in theatre within appropriate timeframes, which define the roles of all team members and when they should be involved.	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff

3.10	**Patients, families and public:** patients and their carers can expect care to follow a defined pathway, which should include care based on appropriate timeframes for access to decision makers, diagnostics, operating theatres and therapies. Patients and their carers may request the details of their pathway timeframes to help them advocate for the best care	April 2019
The deteriorating patient		
3.11	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** develop and agree pathways to promptly identify deteriorating patients and subsequent referral to senior decision makers in pre- and postoperative periods. This will also include those admitted under non-surgical specialties	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
3.12	**Medical Directors, Clinical Directors, local NELA leads:** collaborate with hospital leads for The Deteriorating Patient and National Emergency Warning Score workstreams to ensure a uniform approach	January 2019
4 Enabling consultant input in the perioperative period for all high risk patients		
4.1	**Commissioners, Provider Executive Boards and Medical Directors:** Review adequacy of consultant staffing based on estimation of emergency surgical caseload and work to address any shortfall. Capacity must to be sufficient to allow high risk patients to receive care directly delivered and supervised by consultant surgeons and consultant anaesthetists	January 2019
4.2	**Clinical Directors from Surgery, Anaesthesia:** Review adequacy of job plans, rotas and staffing to ensure delivery of an uninterrupted consultant delivered service, 24 hours a day, seven days a week. There should be consultant presence for high risk patients regardless of urgency of surgery, time of day or day of week of surgery	January 2019
4.3	**Clinical Directors, local NELA leads, Multidisciplinary clinical teams:** develop and agree pathways of care for patients undergoing emergency laparotomy which are tailored to the hospital service and structure. Pathways must ensure consultants are informed, involved and lead in the care of patients undergoing emergency laparotomy throughout the care pathway. These should include escalation pathways for deteriorating patients and high risk patients such that they receive timely perioperative input into decision-making and clinical care by consultant surgeons, anaesthetists and intensivists. This should also cover the postoperative period to ensure the recognition, evaluation and management of complications which may result in unplanned return to theatre, or unplanned admission to critical care	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
4.4	**NELA:** further publicise the Excellence and Exception report which identifies up high risk patients where all standards were met, and those where standards were not met	Immediate

5 Effective Multidisciplinary Working		
Radiology		
5.1	**Commissioners, Provider Executive Boards and Medical Directors:** scope requirements to deliver a radiology service that provides a reported CT within a timeframe that does not delay surgery, has low discrepancy rates, and provides opportunity for meaningful senior discussion between the surgery and radiology. The NELA data suggests that an in-house consultant service provides the lowest discrepancy rate. Consideration should be given to developing local networked solutions for 24/7 consultant radiologist reporting to overcome high vacancy rates in the specialty as reported by the Royal College of Radiologists	April 2019
5.2	**Radiology and Surgery Clinical Directors, Chief CT Radiographer, local NELA leads, Multidisciplinary clinical teams:** develop and agree pathways to facilitate rapid access to reported CT scanning	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
5.3	**Radiology and Surgery Clinical Directors, clinicians:** ensure that all acute abdominal CT discrepancies are reviewed and discussed by surgery and radiology within their clinical governance programme. All discrepancy cases should be anonymised and referred to the Radiology Events and Learning Meetings following discussion between the relevant clinical teams. For most Trusts, this will be required for 1–2 scans per month	Commence from next governance meeting (by January 2019 at the latest)
5.4	**NELA, Royal College of Radiology:** develop report template to highlight patients with CT discrepancy that can be used to support radiology clinical governance programmes	April 2019
5.5	**NELA, Royal College of Radiology:** Collaborate to support the introduction of NELA Radiology leads in each hospital to facilitate improvements in the quality of local services including quality of data collection on discrepancy rates and accuracy of reporting of acute abdominal CT examinations	Immediate
Critical Care		
5.6	**Commissioners, Provider Executive Boards and Medical Directors:** review adequacy of critical care bed capacity, based on estimation of high risk patients and emergency surgical caseload, and work to address any shortfall. Capacity needs to be sufficient to admit all high risk patients (predicted mortality ≥5%) and minimise premature discharge from critical care	January 2019
5.7	**Clinical Directors from Surgery, Anaesthesia and Intensive Care, local NELA leads, Multidisciplinary clinical teams:** develop and agree multidisciplinary care pathways that include clear guidance for the clinical team as to when patients should be admitted to critical care	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
5.8	**Multidisciplinary clinical teams:** ensure that NELA data on admissions to critical care and unplanned admissions to critical care are reviewed at regular multidisciplinary governance meetings, and accompanied by actions plans to improve care	Commence from next governance meeting (by January 2019 at the latest)
5.9	**NELA:** work with other stakeholders to clarify wording around standards for admission to critical care	Anticipated that clarifications will be published by the end of 2018

5.10	**NELA, ICNARC:** work to analyse linked NELA-ICNARC database to better understand provision of care to patients undergoing emergency laparotomy	Themed report to be published in 2019
Elderly Care		
5.11	**Commissioners, Provider Executive Boards and Medical Directors:** scope requirements for Elderly Care input into patients undergoing emergency laparotomy, based on estimation of emergency surgical caseload, and work to address any shortfall	April 2019
5.12	**Clinical Directors from Elderly Care, Surgery, Anaesthesia, Intensive, local NELA leads, Multidisciplinary clinical teams:** develop and agree multidisciplinary care pathways that define when input from Elderly Care should be sought	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
5.13	**Local NELA leads, multidisciplinary clinical teams:** Ensure patients over the age of 70 have frailty, nutritional status, cognitive function and functional impairment assessed to inform decision-making and highlight those that may benefit from perioperative input by Elderly Care teams. Ensure these are embedded in clinical pathways	Pathways to be in place by April 2019 in anticipation of Best Practice Tariff
5.14	**Multidisciplinary clinical teams:** ensure that NELA data on input by Elderly Care teams is reviewed at regular multidisciplinary governance meetings	Commence from next governance meeting (by January 2019 at the latest)
5.15	**NELA:** share information on hospitals who perform well for Elderly Care input	December 2018
5.16	**NELA:** collaborate with the British Geriatric Society to raise awareness of emergency laparotomy in older people	April 2019
6 Supporting Quality Improvement		
6.1	**Royal Colleges, Postgraduate schools, College Tutors, ACRP panels:** ensure that participation in QI projects such as NELA are supported and recognised for progression in training	April 2019
6.2	**Executive Boards, Medical Directors, Clinical Directors:** Ensure infrastructure and links are in place for NELA leads to access help and support from hospital improvement or transformation teams to implement change. Ensure that time (study leave) for NELA leads and multidisciplinary teams is available (guided by appraisal) to attend workshops and training in QI methodology	April 2019
6.3	**NELA local leads/multidisciplinary clinical teams:** participate in regional and national quality improvement workshops, to improve understanding of QI methodology, share ideas and collaborate with other NELA teams	By 2019 as AHSN workshops are rolled out
6.4	**Clinical Directors, local NELA leads:** ensure job planned time and resources are available for NELA leads to carry out all expected duties, guided by the NELA local clinical lead job description	Immediate, for confirmation by NELA leads next job plan review
6.5	**NELA:** work with AHSNs to support collaborative regional working to improve emergency laparotomy care	Immediate
6.6	**Patients, families and public:** Join in with hospital projects to improve care pathways if possible, to ensure there is strong patient and public representation in the design and implementation of improvement initiatives	April 2019

NELA
National Emergency Laparotomy Audit

4 INTRODUCTION

In this, its fourth Patient Report, the National Emergency Laparotomy Audit (NELA) continues to provide a state of the nation picture of the care received by adult patients having emergency bowel surgery at 179 hospitals in England and Wales. NELA collects a comprehensive dataset that allows us to fulfil a quality assurance and quality improvement function. In addition to an annual report that benchmarks hospital performance, NELA also produces quarterly benchmarking reports for each hospital that enables them to monitor their performance across the key recommended standards of care on a more frequent basis. The National Emergency Laparotomy Audit (NELA) is commissioned by the Healthcare Quality Improvement Partnership (HQIP), and funded by NHS England and the Welsh Government.

With the awarding of a new contract in 2017, NELA's quality improvement (QI) role will be strengthened in the coming years. We will be introducing a more versatile real-time QI dashboard that will provide flexible reporting at hospital, regional and national level. NELA is also working with the Academic Health Science Networks (AHSNs) to support their Emergency Laparotomy Collaborative.

This collaboration will better support local multidisciplinary teams in using their own data in their own hospitals to drive improvements in the care and outcomes in this group of high risk patients. NELA also continues to support and collaborate with several important research projects.

This report covers the care received by patients who underwent an emergency laparotomy between 1 December 2016 and 30 November 2017. The report provides information on hospital mortality and other patient outcomes and whether NELA standards of care are being met at each hospital.

What is an emergency laparotomy?

'Emergency laparotomy' and 'emergency bowel surgery' are terms used to describe a wide range of emergency operations on the bowel and may include laparoscopic (keyhole) surgery. These may be performed for a variety of conditions, including those arising from complications of elective (planned) surgery. In England alone, approximately 30,000 emergency laparotomies are performed annually on a heterogeneous cohort of patients.[2,3]

The majority of patients undergoing emergency laparotomy have potentially life-threatening conditions that require prompt investigation and treatment. Delays can lead to increased complications and increased risk of death. Emergency bowel surgery has one of the highest death rates of all types of surgery – almost 10 times greater than for 'high risk' elective surgery such as cardiac, vascular and cancer surgery.

How does NELA assess standards of care?

Hospitals considered to have provided good quality care are rated Green, using a Red-Amber-Green (RAG) rating scale. The score required to achieve a Green rating increased to 85% from 80% for all metrics[‡] this year in pursuit of ever greater reliability and quality of care. This means that there appears to have been a fall in the quality of care (by RAG rating), although in some cases, the proportion of patients who met a standard may in fact have increased. If a hospital can meet a standard for at least 85% of patients, then this suggests that it has robust systems in place for the delivery of good quality reliable care. Hospitals that perform fewer than 10 cases per year are excluded from RAG rating.

To describe how well hospitals are meeting standards, the following RAG-rating system (Red-Amber-Green) is used:

Green: standard met for at least 85% of patients

Amber: standard met for 55–84% of patients

Red: standard met for under 55% of patients

[‡] 'Assessment by specialist in the care of the older person' remained at 80%.

The next steps

Over the next year there will be an increased focus on the use of national data at local level with more collaborative regional QI workshops being provided for NELA local leads and their teams. The aim of these is to enable teams to understand and use their data, to increase awareness of quality improvement methodology, and to offer the opportunity to learn from other hospitals, thus providing the tools to help improve some of the areas of care that remain below the expected standards. Ideally these will be for the entire team involved in the care of patients who require an emergency laparotomy, including non-clinical audit and QI teams.

How does NELA collect data?

All NHS hospitals in England and Wales that undertake emergency laparotomy are expected to participate in the NELA Patient Audit. Audit leads were identified at each hospital to coordinate collection of patient data. Specific inclusion and exclusion criteria have been developed to define exactly which patients should be included in the audit. The inclusion criteria were further refined in Year 4, and now exclude patients who require an emergency laparotomy arising from a complication of non-gastrointestinal surgery. The audit dataset was designed by the NELA Project Team with input from clinical stakeholders and was designed to collect data that will allow comparison of care with published standards and facilitate quality improvement. Data were submitted to NELA via a web tool and at the end of the data-collection window, all data were downloaded from the web tool and analysed to provide the results. Comprehensive information is available in the technical documents that accompany this report on the NELA website.

How to read this Report

The Report is divided into chapters, each covering a different part of the patient's care pathway. Each chapter shows the key questions that NELA asked and sets out the results.

Individual reports for each hospital are provided online. An example is also shown in Figure 16.1.1.

Supplementary tables providing full results are provided in a supporting document.

NELA
National Emergency
Laparotomy Audit

5 DATA QUALITY

Case ascertainment

Key process measure: Final Case Ascertainment

179 hospitals were included in this metric. Overall case ascertainment was 83%. This has increased from 82% last year. 94 (52.2%) were rated green, 19 (10.6%) were rated red.

Data from Hospital Episode Statistics (HES) for England and, for the first time, the Patient Episode Database for Wales (PEDW) are used to calculate the expected annual number of emergency laparotomies that take place in English and Welsh NHS hospitals. This allows calculation of case ascertainment rates.

In all, 23,929 patients were included in this Report – 22,173 (92.7%) located in England and 1,756 (7.3%) in Wales. This represents a case ascertainment rate of 82% for England and 104% for Wales

We have shown the case ascertainment rates for each hospital in Chapter 19. For hospitals with a high case ascertainment rate (greater than 85%), we can be reasonably confident that the results of the audit provide a good indication of the quality of care in that hospital. However, hospitals with low case ascertainment rates may not have provided information on enough patients for the audit results to accurately reflect the quality of their patient care. The expected number of cases for a hospital is derived from linkage with HES (in England) or PEDW (in Wales). A number of hospitals have case ascertainment rates in excess of 100%. Possible reasons include, inaccurate procedure coding, NELA records that do not fit inclusion criteria or a partial overlap between time periods of NELA/HES or PEDW, causing cases to be included in the NELA data set, but not yet included in HES/PEDW.

Locked cases

Locking a case means that all data points were complete (some may be entered as unknown) for the patient's episode of care. Only cases 'locked' by the deadline for case submission contribute to the annual report. A total of 747 (3%) non-locked cases were excluded from the audit this year. This increased from 2% in the Third Patient Report.

Data completeness

The timing of certain perioperative care milestones should be documented. Without accurate data, it is difficult for hospitals to improve the delivery of such time-sensitive aspects of care.

NELA collects data on the timing of antibiotic administration for patients suspected of sepsis. Data on timing were missing in 12% of all patients with sepsis. At 93% of hospitals, the timing of antibiotics was missing for at least a quarter of patients.

NELA also collects the date and time of the decision to operate (or the date and time the patient was booked for theatre). These data were missing in 12% of cases ('unknown' selected). This is similar to previous years. At 10% of hospitals the time of the decision to operate was 'unknown' for at least a quarter of patients. This also remains relatively unchanged, with a rate of 14% in Year 2 and 12% in Year 1.

The results and denominator values may vary slightly within the tables, especially when comparing results across years. This is due to missing data, changes to the dataset since the start of the audit, and timing of data entry compared to data export, especially in instances where patient data is entered for earlier years within the current reporting window.

Variables for assessment of risk

The NELA database and webtool includes two methods of assessing the risk of death within 30 days – the P-POSSUM risk calculator, and the NELA risk calculator.

When using the P-POSSUM calculator, data can be omitted and a risk score is still provided as the calculator will default to the lowest value. All preoperative and postoperative P-POSSUM variables were provided in 95% of cases. This compares to 94% in Year 3.

The NELA risk calculator was introduced in Year 4, and provides risk estimates based on the NELA risk-adjustment model. This only gives estimates where all variables are entered. In Year 4, 87% of patients had complete preoperative or postoperative NELA risk scores.

Data linkage with the Office for National Statistics

Mortality data from the Office for National Statistics (ONS) are matched to the NELA data to ensure accuracy. This allows us to report all-cause 30-day and 90-day mortality rates in the current report, and has also mortality at one, two, and three years following surgery for patients entered in earlier data collection years.

Data linkage with the Office for National Statistics (ONS) was of high quality. We were able to link 22,887 (99.8%) patients to ONS mortality data. 1,040 patients could not be linked. Patients are entitled to withhold consent for their data to be shared (known as 'type-2 opt-outs'), and these 1,040 unlinked cases could include an unknown number of such opt-outs. Where linkage to ONS data was not possible but NELA data indicated that a patient had died during the admission in which they underwent their emergency laparotomy, self-reported inpatient mortality data were used instead. Two patients were excluded from the mortality analysis as their date of death preceded the date of surgery. The total number of patients included in the mortality analysis was 23,927.

USING NELA DATA TO IMPROVE CARE

NELA case summary forms at The Royal Victoria Infirmary, Newcastle upon Tyne

'We create a specific feedback form for every NELA case. Once any missing fields in the web-platform are complete, a standalone summary form is created, which includes some of the principle NELA standards, such as time to first consultant review, time of administration of antibiotics, preoperative calculation of mortality risk, direct consultant involvement, and admission to critical care. The form includes basic case descriptors such as date, time, age, sickness severity, urgency, patient identifiers and an outline description of the case. If the patient's hospital episode is complete, we include their status at the time of discharge. Each form is distributed to the clinical theatre team (and only to those individuals).

Our principle aim has been to gently nudge improvements by promoting personal reflection on each case. To this end, we try to ensure the forms are as contemporaneous as possible. The form highlights key modifiable risk factors and a red-amber-green format, which enables rapid identification of what perhaps could have been done better. Feedback from piloting the form led us to move to a blue-amber-green chart as the red was felt to be too pejorative! Importantly, the feedback form also acts as a form of quality assurance about the data we submit. Not uncommonly the team will identify a correction to the collected data, such as the time the consultant surgeon first saw the patient.

Most colleagues seem to welcome the feedback form. Every form includes an offer not to send any further forms if desired – an offer that has never been taken up.'

Dave Saunders, Consultant Anaesthetist

Figure 5.1 Patients included in the Year 4 data analysis

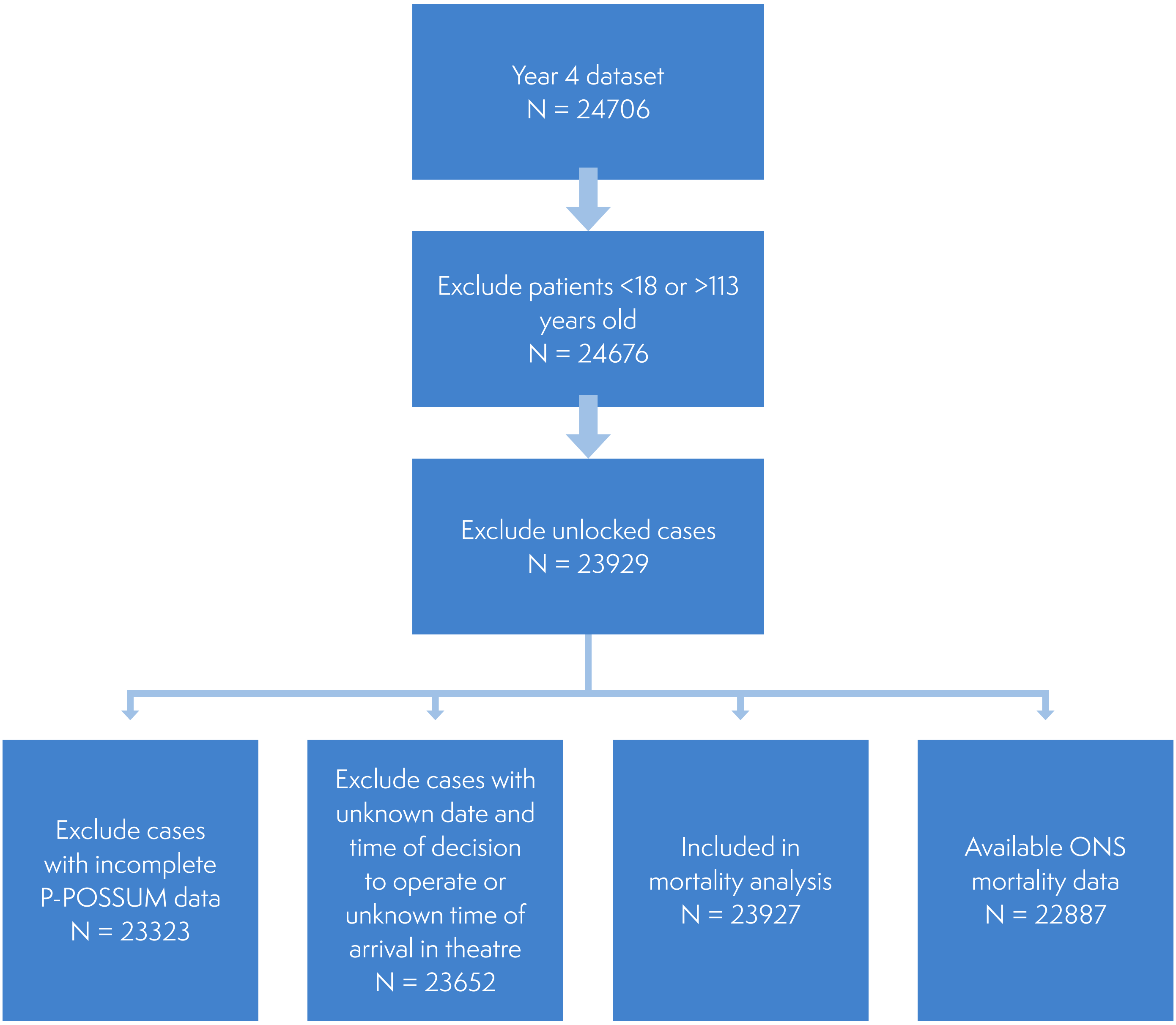


Figure 5.2 Hospitals included in the data analysis

Total hospitals in HES and PEDW with emergency laparotomy activity = 228

38 hospitals NOT included in NELA
31 with < 10 cases
7 with > 10 cases

190 hospitals with potential to submit cases to NELA

7 hospitals did not submit any cases;

- Harefield Hospital
- Kent and Canterbury Hospital
- University Hospital Llandough
- Churchill Hospital
- Leeds General Infirmary
- Dewsbury and District Hospital
- Princess Royal Hospital

(Hospitals with >10 cases identified within HES /PEDW are contacted each year to confirm eligibility to participate in NELA. Eligibility may change throughout the year due to service reconfigurations or changes in inclusion criteria)

183 hospitals submitted cases to NELA

Case ascertainment calculated for 179 hospitals (4 cardiac hospitals were excluded from case ascertainment calculations)

Cardiac hospitals:

- The Royal Brompton
- The Walton Centre
- Liverpool Heart and Chest Hospital
- Papworth Hospital

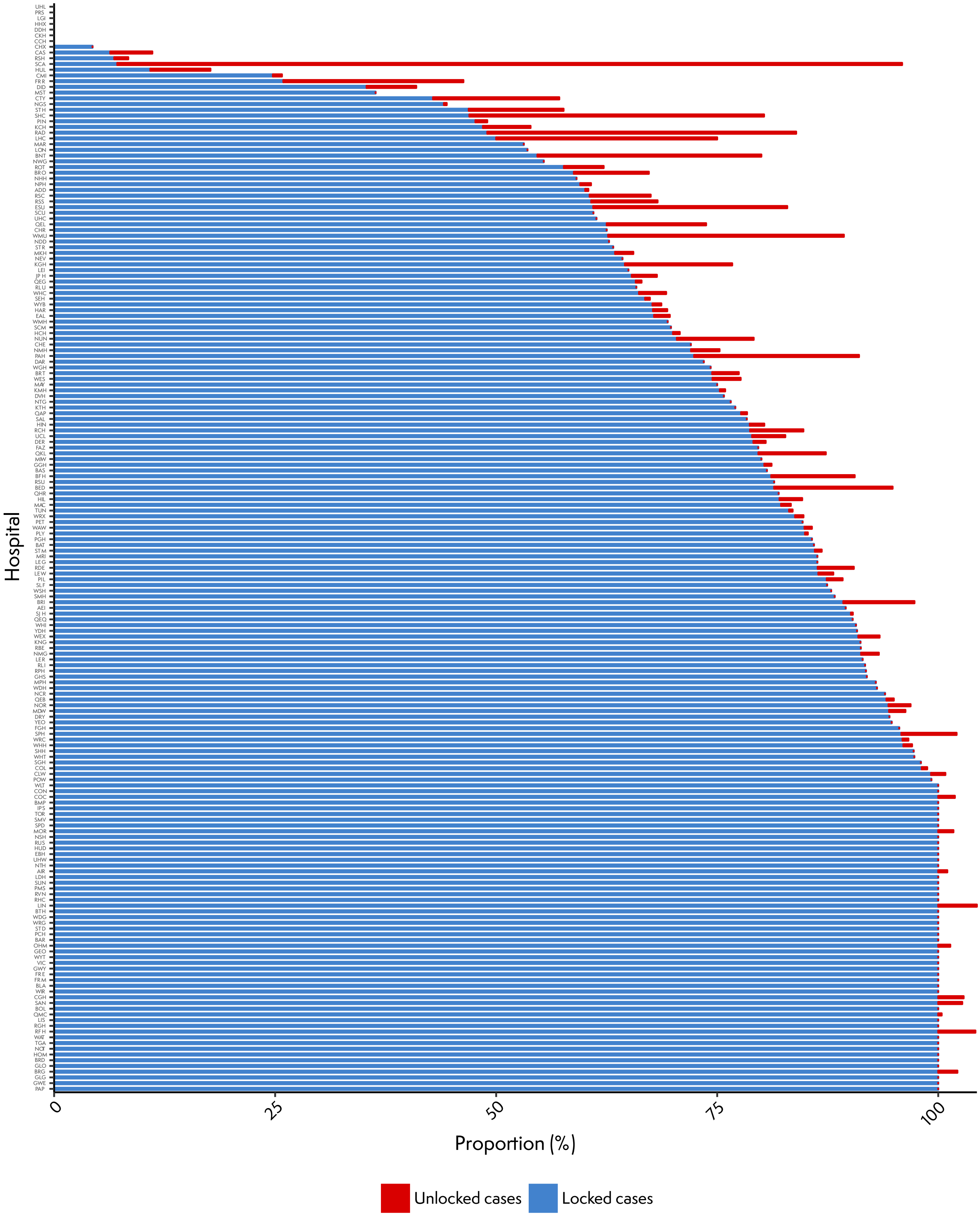
RAG ratings were provided for 174 hospitals (5 were excluded as performed <10 cases)

Hospitals with < 10 cases:

- Castle Hill
- Charing Cross
- City Hospital Birmingham
- Maidstone
- Scarborough

Each process measure denominator is calculated out of the number of hospitals at the time of reporting of HES data. This may fluctuate.

Figure 5.3 Percentage case ascertainment relative to HES algorithm estimates of annual volume of emergency laparotomies performed



6 OUTCOMES

NELA's growing cohort of patients now exceeds 90,000 patients – the world's largest group of prospectively identified patients undergoing emergency bowel surgery. The follow-up of patients who have undergone this high risk surgery provides unique insights into short- and longer-term survival after emergency laparotomy and is only possible because of the work of local NELA teams collecting this data.

In this chapter we report the following patient outcomes: risk-adjusted death within 30 days of hospital stay, length of stay, unplanned returns to theatre and unplanned admissions to critical care, and residence before and after surgery. In addition to crude 90-day mortality, for the first time we also report mortality at one, two and three years after surgery.

6.1 Risk-adjusted mortality

When NELA began in 2012, studies across the globe reported that more than 14% of patients died within 30-days of emergency laparotomy, equating to one in every six people dying within a month of these operations.[4,5] We are pleased to report that mortality within 30-days and 90-days of emergency laparotomy has continued to decrease over the four years that NELA has collected and analysed patient outcomes. This is despite the nature of the surgery, the characteristics of the population, and some patient and surgical risk factors continuing to confer a substantially increased risk of death.

Why is this important for patients?

The NELA outcome data provides information on the short- and longer-term implications of undergoing emergency bowel surgery, both in terms of the risk of death from surgery, likelihood of needing a return to theatre, and potential changes to a patient's independence and residence. This information helps patients and their clinical teams to have informed discussions about the risks and benefits of surgery and reach shared decisions about their own care, including whether having emergency laparotomy surgery is the best choice for them.

Outcome data also allows NELA to explore variation between hospitals, identify those hospitals with the best outcomes, and share best practice.

National mortality

All-cause 30-day mortality after surgery has fallen to 9.5% (from 11.8% in Year 1) and deaths within 90-days to 12.9% (from 14.5% in Year 3 and 16.2% in Year 1) (Figure 6.1.1). This represents almost 700 lives saved this year compared to when NELA commenced. However, patients undergoing an emergency laparotomy remain a group who are at high risk of death. This high risk nature of the procedure should be a starting point in treatment decisions.

Reviewing mortality trends regularly is an important monitoring process for hospitals. Of significance, is the close correlation between 30-day inpatient mortality, and 30-day ONS mortality (Figure 6.1.2). 30-day inpatient mortality was 9.6% (2,288 patients), and 30-day ONS mortality was 9.5% (2,278 patients). This creates the opportunity for Trusts and Health Boards to monitor mortality on an ongoing basis, with the knowledge that inpatient mortality is a good surrogate for ONS mortality which is only available on an annual basis. NELA will be exploring the production of rolling hospital mortality rates to facilitate earlier identification of improving or worsening mortality.

Figure 6.1.1 Trend in the overall 30-day and 90-day ONS mortality rates by NELA dataset year

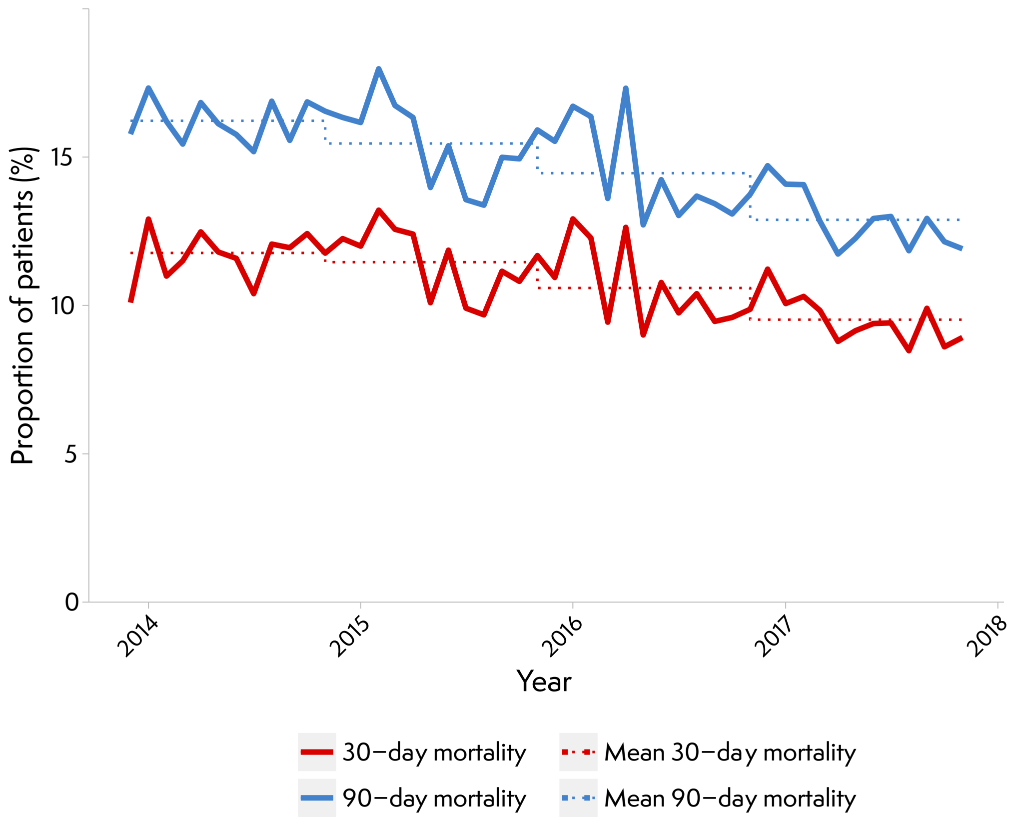
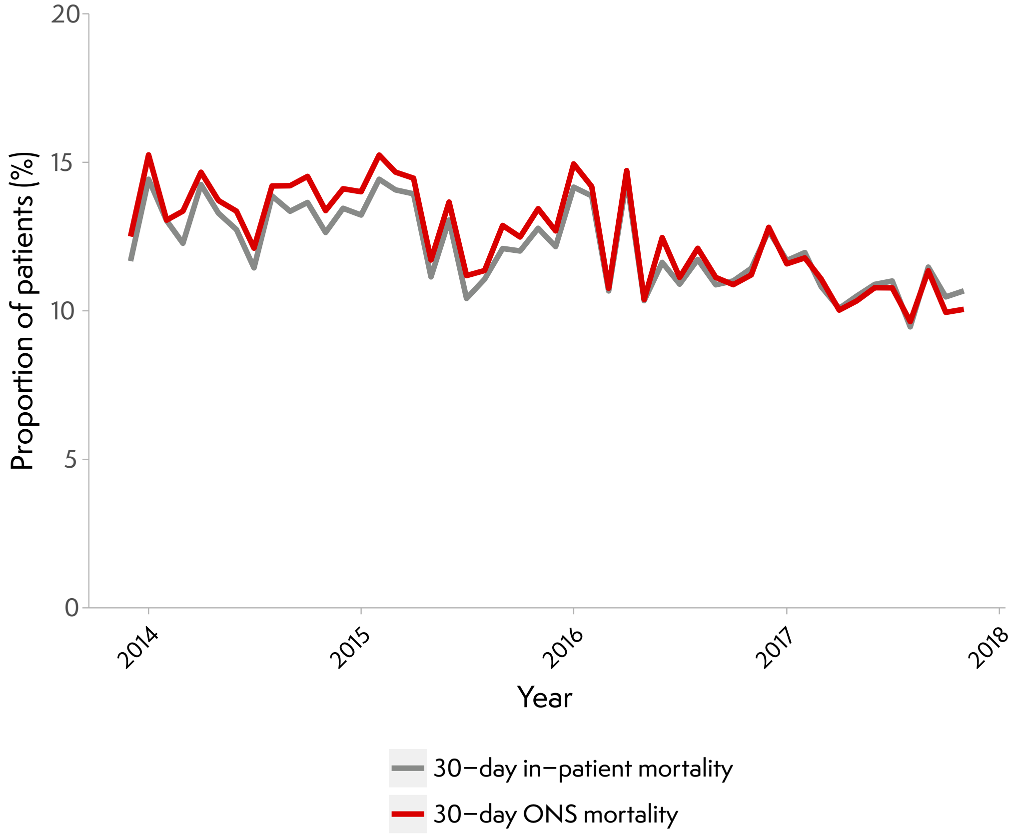


Figure 6.1.2 Trendline of 30-day inpatient and ONS mortality rates over time, by date of operation



NELA National Emergency Laparotomy Audit

Hospital-level mortality

As in previous years, NELA reports hospital-level 30-day mortality as funnel plots. These plots show whether hospital mortality rates differ from the national average by more than would be expected due to chance alone. Random variation always affects this sort of statistical information, and this is expected to be greatest at hospitals performing the fewest procedures (generating the funnel shape). Hospitals with risk-adjusted mortality rates above the 99.8% control limits ('alarm' status) are considered outlier hospitals. Hospitals with mortality between 95% and 99.8% upper control limits (alert status) for two out of three consecutive reporting cycles are also considered outlier hospitals. Statistically we might therefore expect one hospital to lie either outside upper or lower 99.8% limits.

Hospital-level mortality is adjusted for casemix using the risk model described in the First NELA Patient Report, and now published elsewhere.[6,7] The NELA risk model was developed from the NELA cohort of patients undergoing emergency laparotomy, and hence provides a better estimation of observed versus expected mortality. The use of P-POSSUM predicted risk will provide falsely reassuring adjusted mortality rates as it overestimates the risk of death particularly above 15% predicted mortality. We have presented both NELA and P-POSSUM mortality figures throughout the report to aid interpretation of the difference between these two risk calculators.

Following adjustment for casemix differences, of the 179 hospitals contributing data to this year's report, one hospital (Walsall Manor Hospital, Walsall Healthcare NHS Trust) was an outlier (alarm status with outcomes lying above the 99.8% control limits). Five hospitals triggered alert status (between 95% and 99.8% upper control limits) for this year only. There were no hospitals flagged as outliers based on alert status for two out of three consecutive reporting periods. The outlier hospital has been notified in advance of publication of this report and in accordance with NELA's outlier policy has had the opportunity to review its data and respond accordingly. Individual hospital outcomes are shown in Chapter 19.

The plots also show several hospitals with low mortality rates (lying between 2 and 3 standard deviations below the mean).

The risk-adjusted mortality for the hospitals with the lowest mortality rates (in the top quartile – excluding centres undertaking less than ten emergency laparotomies/year) is 5.77%. If this mortality rate was achieved for all sites nationally, the expected annual number of deaths from emergency laparotomy would be 1,312 deaths. This would represent an additional 991 lives saved each year.

Figure 6.1.3 Funnel plot of unadjusted ONS 30-day mortality rates

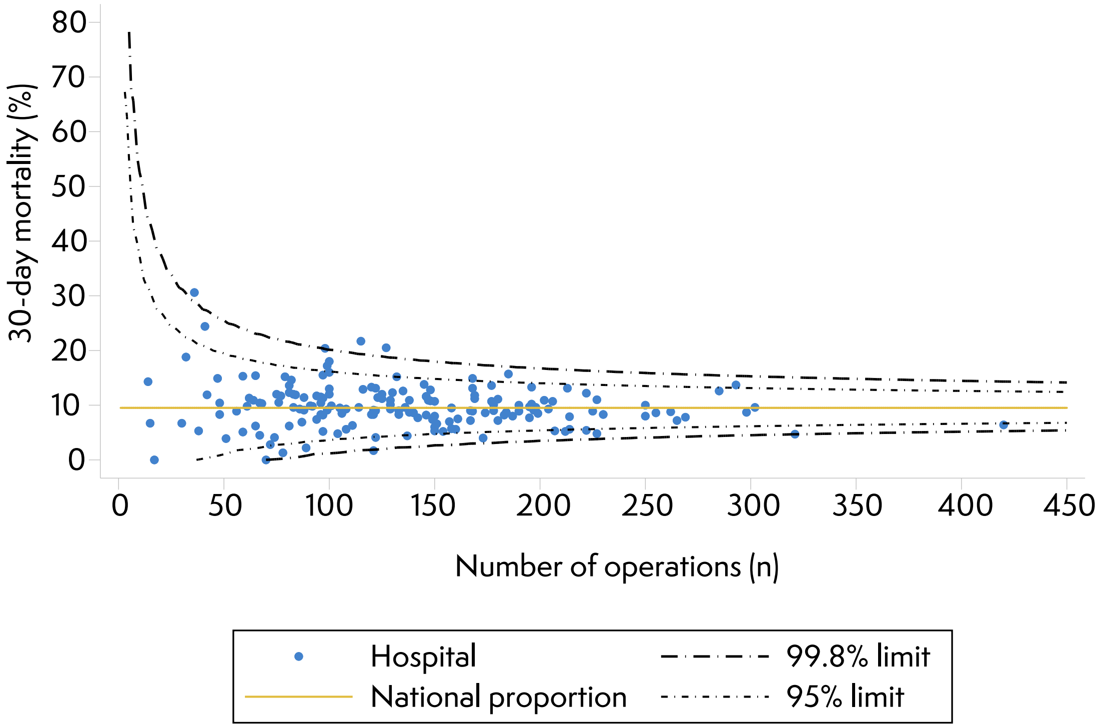
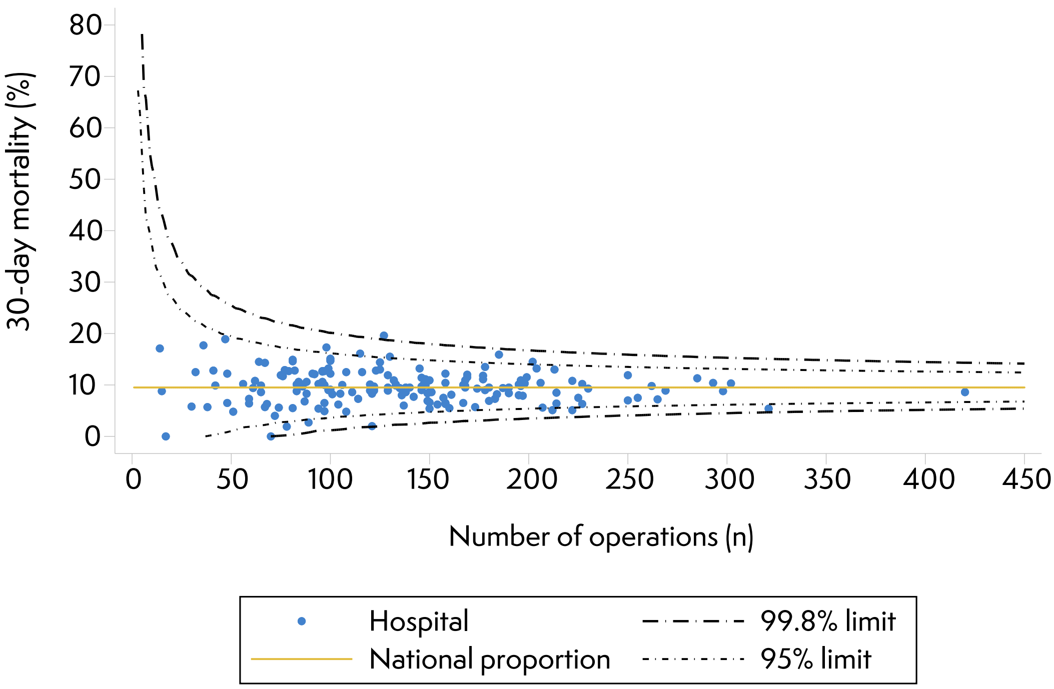


Figure 6.1.4 Funnel plot of risk-adjusted ONS 30-day mortality rates



High risk groups

Mortality rates vary markedly by patient risk factors, increasing substantially with age, co-morbidity and with urgency of surgery. In patients older than 80 years, 30-day mortality rates are twice the national average, and in patients with limiting comorbidities 30-day mortality is more than three times the national average. Similar patterns are observed with 90-day mortality (see supplementary data Tables 6.1.4, 6.1.5 and 6.1.6).

While the groups noted above represent high risk patient groups within the emergency laparotomy population, the reality is that virtually all patients who require an emergency laparotomy have a predicted mortality in excess of that which would be considered high risk for elective surgery. The original 2011 Royal College of Surgeons publication, *The Higher Risk General Surgical Patient*[1] is being updated in 2018 and includes changes to standards of care for high risk emergency patients. These proposed changes clarify that all patients with a predicted 30-day mortality of 5% or greater should be treated as high risk. The proposed new standards also state that all patients who require an emergency laparotomy should be considered high risk by default, unless both consultant opinion and objective risk scores consistently indicate low risk. Within the NELA cohort, 25% of patients did not have a risk of death documented preoperatively, but their 30-day mortality was 5.7%, indicating that they were a high risk group warranting consultant presence and critical care admission. NELA data demonstrates that regardless of indication for surgery, operative findings or surgical procedure, virtually all groups have a greater than 5% mortality (Tables 7.1, 7.2 and 7.3). In line with this, NELA has amended its reporting for patients in Year 5 such that all patients who require an emergency laparotomy are considered high risk by default, unless both consultant opinion and objective risk scores consistently indicate low risk.

Figure 6.1.5 ONS 30-day and 90-day mortality, by ASA

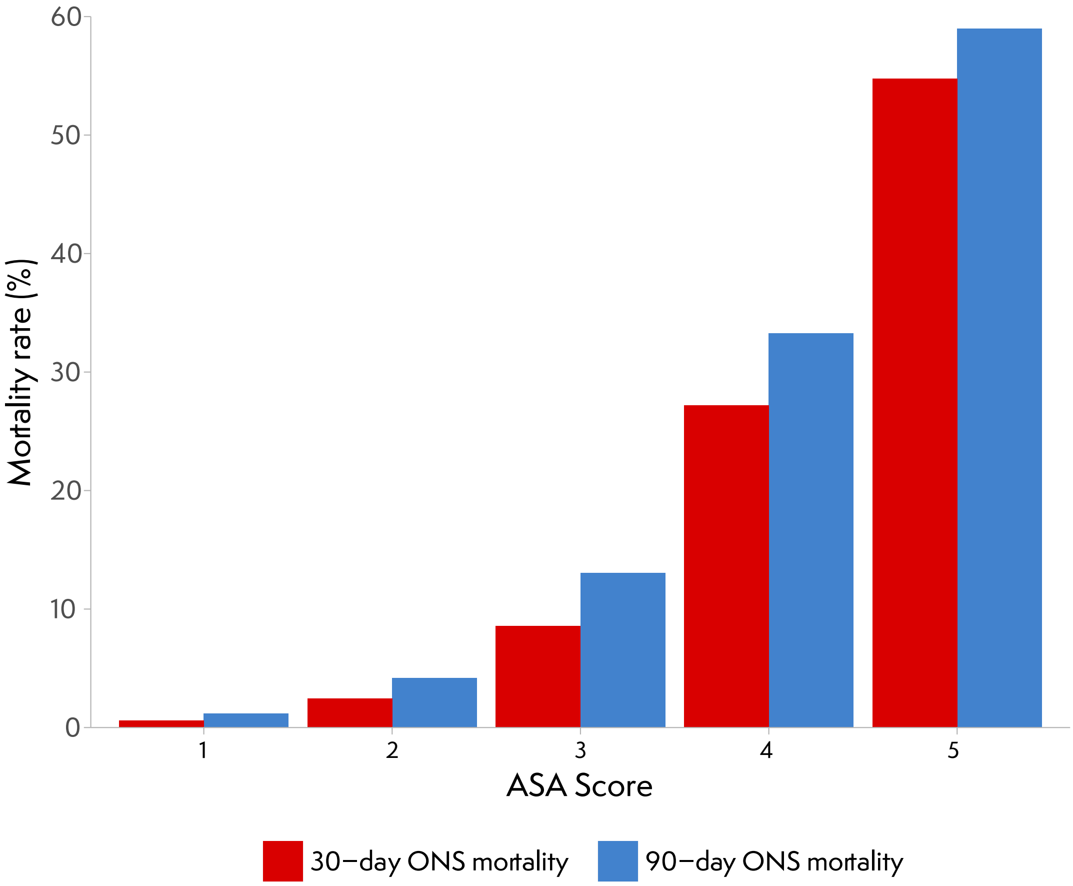


Figure 6.1.6 ONS 30-day and 90-day mortality, by urgency of surgery

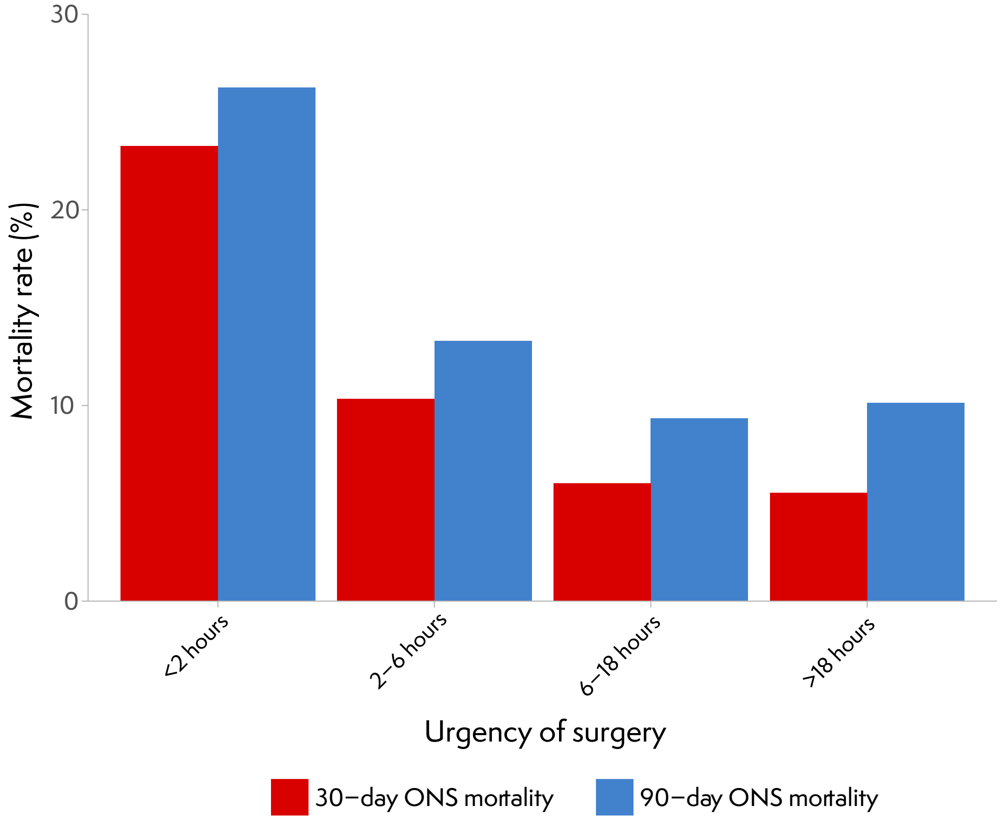
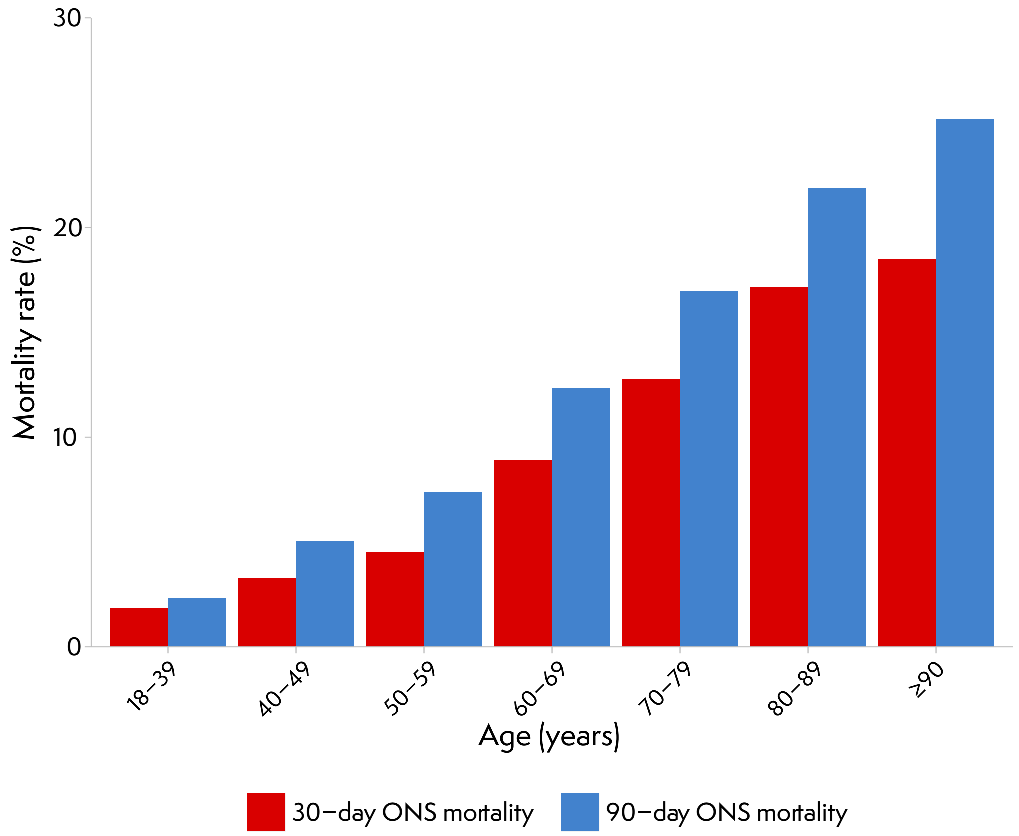


Figure 6.1.7: ONS 30-day and 90-day mortality, by age



Surgery-specific mortality

As in previous NELA reports, outcomes varied substantially depending on the indication, surgical findings and the type of surgery performed (Table 7.1, Table 7.2). Surgery where the indication was acidosis or ischaemia carried the highest 30-day mortality of 35.7% and 23.9% respectively. Excluding those cases which were not amenable to surgery, a relook laparotomy demonstrated the highest 30-day mortality at 26.7 % (28.1% in Year 3), highlighting the importance of recognising that these patients require consultant delivered care and admission to critical care. Procedure-specific mortality has remained essentially unchanged and ranged from 2.3% to 21.7% (Table 7.3). Outcomes were also examined according to the degree of intra-abdominal contamination. The highest mortality was associated with the finding of free pus, blood or bowel contents. These findings can support postoperative discussions with patients and their families (Table 7.4). Surgery-specific mortality is covered in more detail in Chapter 7.

Variation by time of day and day of surgery

Overall 30-day mortality varies substantially by time of day of surgery, with surgery performed after midnight being associated with double the mortality rate of surgery performed in the morning. But, as in previous years, patients undergoing surgery out-of-hours are at greater predicted risk of death than those requiring surgery during daytime hours. These factors are important when considering consultant presence in theatre and are discussed in Chapter 11.

The disparity previously observed between peak volume of admissions (Mondays) and peak volume of operations (Wednesday/Thursday) is again noted. However, as in previous years, mortality rates vary little by day of surgery and are not statistically significant.

Table 6.1.1 Median and mean preoperative P-POSSUM and NELA risk of death and observed ONS 30-day mortality for all patients, by time of day of arrival in operating theatre

Time of day	Number of patients n(%)	Median P-POSSUM predicted risk of death (%)	Mean P-POSSUM predicted risk of death (%)	Median NELA predicted risk of death (%)	Mean NELA predicted risk of death (%)	ONS 30-day mortality (%)	ONS 90-day mortality (%)
0800–1159	5,714 (23.9)	5.1	13.2	3.3	8.2	7.0	10.1
1200–1759	9,811 (41.0)	6	14.6	4.2	9.5	8.8	12.6
1800–2359	5,505 (23.0)	8	19.1	5.2	11.6	11.7	14.7
0000–0759	1,992 (8.3)	13	25.0	7.2	15.2	14.3	17.3
Unknown/ Missing	907 (3.7)	4.8	12.1	3.5	8.2	9.4	12.2
Total	23,929	–	–	–	–	–	–

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Table 6.1.2 ONS 30-day mortality by the day of the week of hospital admission and of surgery for patients admitted as an emergency and with a surgical urgency category <18 hours.

Day of week	Day of admission			Day of surgery		
	Number of patients admitted n(%)	ONS 30-day mortality (%)	ONS 90-day mortality (%)	Number of patients undergoing surgery (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Monday	3,994 (16.7)	8.9	12.0	2,990 (12.5)	9.7	12.7
Tuesday	3,719 (15.5)	9.4	12.8	3,575 (14.9)	10.0	13.9
Wednesday	3,606 (15.1)	9.7	13.0	3,778 (15.8)	9.7	13.2
Thursday	3,560 (14.9)	9.3	13.0	3,821 (16.0)	8.9	12.4
Friday	3458 (14.5)	9.8	13.1	3,695 (15.4)	8.4	11.6
Saturday	2,768 (11.6)	10.3	14.0	3,128 (13.1)	9.6	12.9
Sunday	2,824 (11.8)	9.6	12.6	2,942 (12.3)	10.6	13.6

Table 6.1.3 Median P-POSSUM and NELA risk of death, observed ONS 30-day and 90-day mortality by risk category based on calculated preoperative P-POSSUM risk of death

Risk category by calculated preoperative P-POSSUM risk of death	Proportion of patients in each risk category n(%)	Median P-POSSUM predicted risk of death within 30 days of surgery (%)	Median NELA risk of death within 30 days of surgery (%)	Observed 30-day mortality based on ONS data (%)	Observed 90-day mortality based on ONS data (%)
Lower (<5%)	10,039 (42.0)	2.3	1.3	1.9	3.4
High (5–10%)	4,840 (20.2)	6.8	4.7	6.3	10.2
Highest (>10%)	9,050 (37.8)	26.6	14.9	19.7	24.9
Overall	23,929	6.3	4.3	9.5	12.9

USING NELA DATA TO IMPROVE CARE

Case Vignette – Darent Valley Hospital multidisciplinary review meetings

'In our trust, we do two to three combined anaesthetic and surgical meetings a year. We present all patients entered into our NELA database in these mortality and morbidity meetings. I also present NELA data for that period. These meetings are attended by all anaesthetists, surgeons, theatre staff, radiology, some ED staff and senior ward and ICU staff – sometimes the executive team too. These meetings are very helpful to all. Each group of staff works hard to make improvements in their areas of involvement. We have our own laparotomy guidelines including a 'Code laparotomy' to expedite urgent patients for theatre. Our whole MDT is involved in decision-making for emergency laparotomy. I have an allocated trainee lead and specialty doctor lead for NELA. This has improved our case ascertainment. We have also written a successful business case for elderly care liaison to look after EL patients.'

Malli Satisha, Consultant Anaesthetist

NELA has produced an excel spreadsheet allowing local leads to create 'Excellence and Exception' reports from their local data. Local leads can use the Excel workbook to quickly create a data summary for clinical governance or 'morbidity and mortality' meetings. This will list all deaths in the chosen cohort, their age and calculated risk of death, as well as their care measured against the key standards of care as recommended by NELA. The report will also create a list of all patients whose care has met all the NELA recommended standards. The report template was sent to NELA local leads in June 2018, and is available on the NELA website.

6.2 Length of stay

Why is this important for patients?

Prolonged hospital stays are a significant burden to patients and their families, and on healthcare resources. Postoperative length of stay is a composite indicator of care processes (at hospital and community levels), outcomes and patient experience. As such, a shorter length of stay may be a marker of good care processes. This analysis only includes patients surviving to discharge, as those who die can falsely reduce the overall apparent length of stay.

Has length of stay after emergency laparotomy changed?

The mean length of stay has fallen from 19.2 days in Year 1 to 15.6 days in Year 4. Based on 30,000 emergency laparotomy cases per year, this reduced hospital stay represents a saving of 108,000 bed-days annually. This equates to a £34million cost saving associated with the acute surgical admission based on an excess hospital bed day cost of £313 per day.[8]

Figure 6.2.1 Trend in the mean length of stay over time in patients surviving to hospital discharge

The median length of stay has remained constant at 11 days over four years of data collection. While 25% of patients stay in hospital for longer than 19 days, the number of patients who have a prolonged hospital stay has reduced over time (Figure 6.2.3).

Figure 6.2.2 The proportion of patients surviving to discharge, by postoperative length of stay (days)

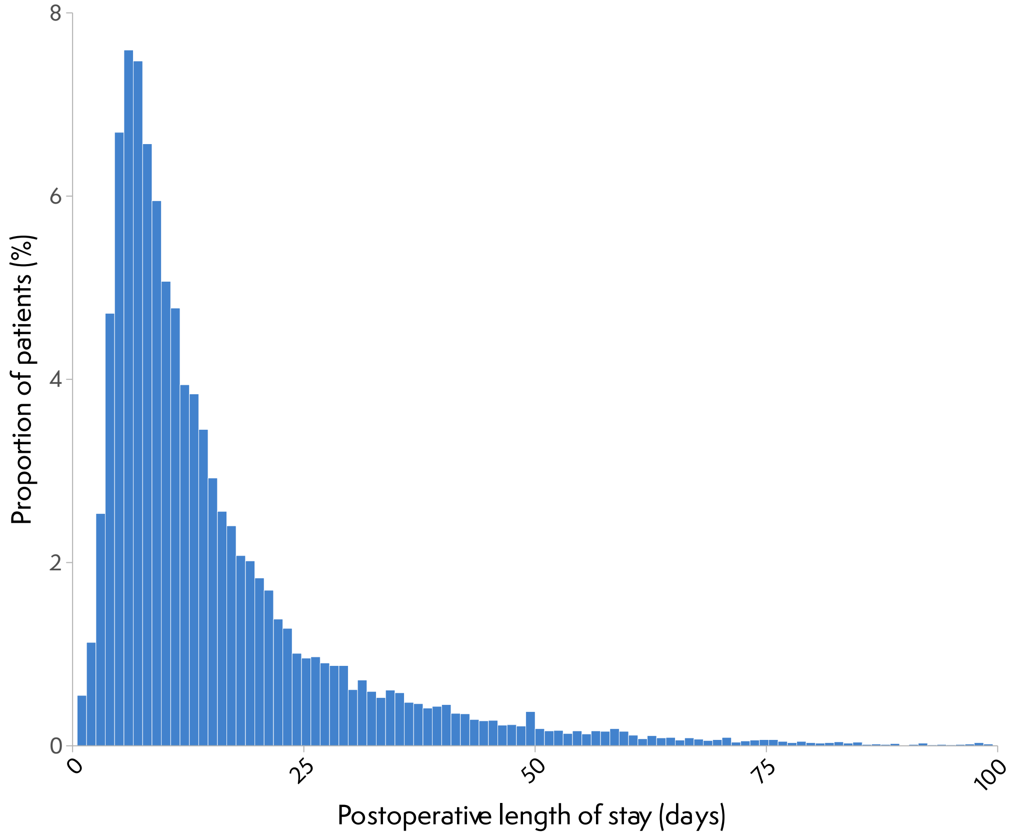
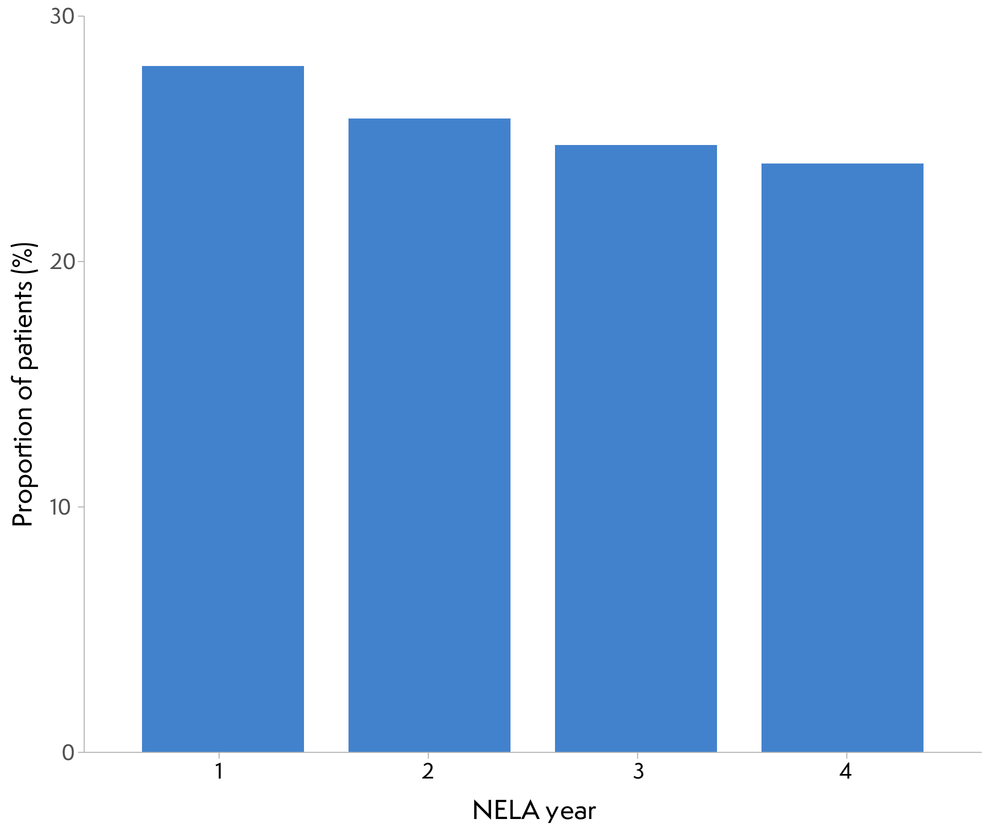


Figure 6.2.3 The proportion of patients surviving to discharge with hospital stays of 20 days or longer



What factors influence length of stay?

Length of stay increases with age, surgical urgency, higher levels of predicted risk (P-POSSUM) and comorbidities (ASA scores). Incidence of complications in such patients are more common, resulting in longer hospital stays. As was noted in the Year 3 report, patients having an emergency laparotomy as a complication of elective surgery, patients with unplanned returns to theatre, and patients having unplanned critical care admissions, have longer hospital stays (see Table 6.4.4 and supplementary data Tables 6.2.2 and 6.2.3).

In the Year 4 Audit, demographic data relating to a patient's place of residence was collected. Patients living in nursing and residential care homes have, on average, more limiting comorbidities and tend to be older than those in their own homes (see supplementary data Table 6.6.5). This is reflected in longer stays after emergency laparotomy.

Patients over the age of 70 who had a formal geriatric review appear to have a longer length of stay than those who do not benefit from this input. NELA does not collect data to explain why this might occur but it may represent situations where elderly-care input is requested for those patients who do not appear to be recovering as quickly as might be expected due to co-morbidity or frailty. Proactive input in the preoperative period may help to highlight such patients in advance and allow earlier intervention during the perioperative period. Given that so few elderly patients receive geriatric input it is difficult to draw any strong conclusion from this data.

Table 6.2.1 Median and mean postoperative length of stay (days), by postoperative P-POSSUM risk calculation

Calculated postoperative P-POSSUM risk	Median (days)	Mean (days)
Lower (<5%)	8	11.59
High (5–10%)	11	15.7
Highest (>10%)	15	20.19

Explanation of 'point and range' plots: Unless otherwise stated, the 'point and range' summary plots represent the median value by a point, with a line spanning the interval between 25th and 75th percentiles.

Figure 6.2.4 Postoperative length of stay in days, by age

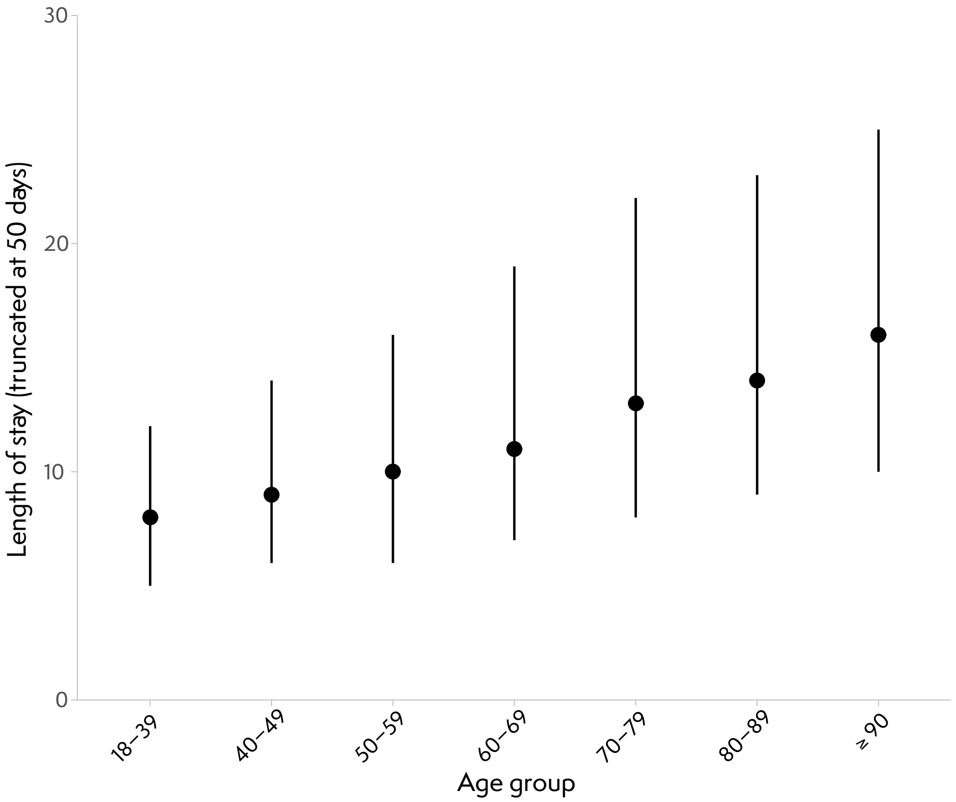


Figure 6.2.5 Postoperative length of stay in days, by ASA grade

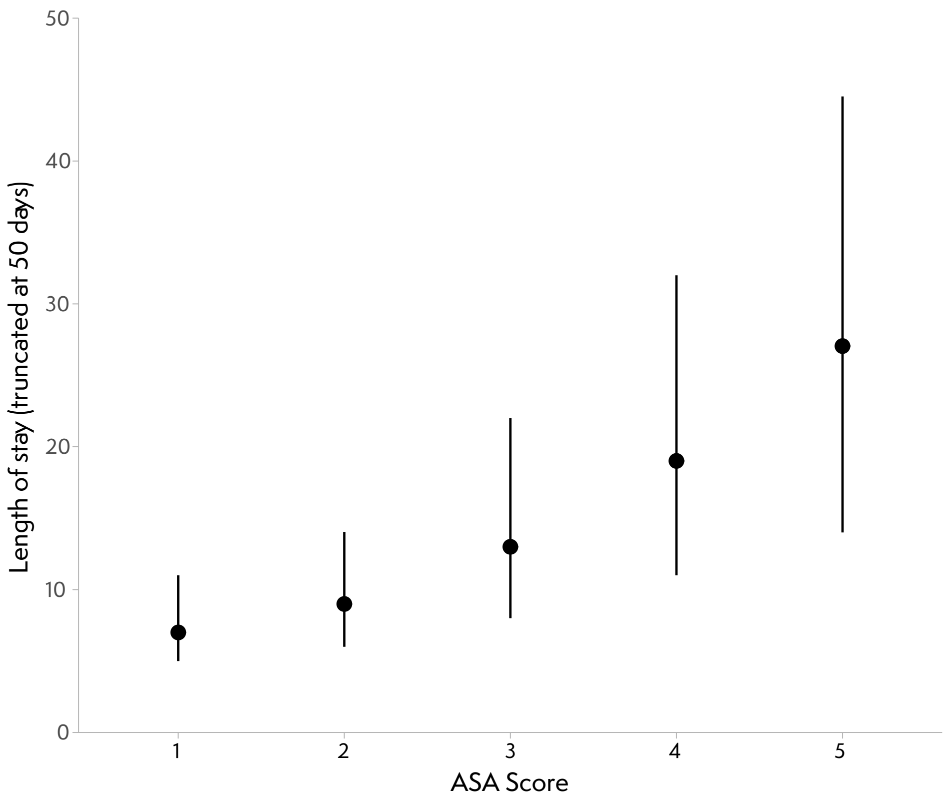


Figure 6.2.6 Postoperative length of stay in days, by preoperative place of residence

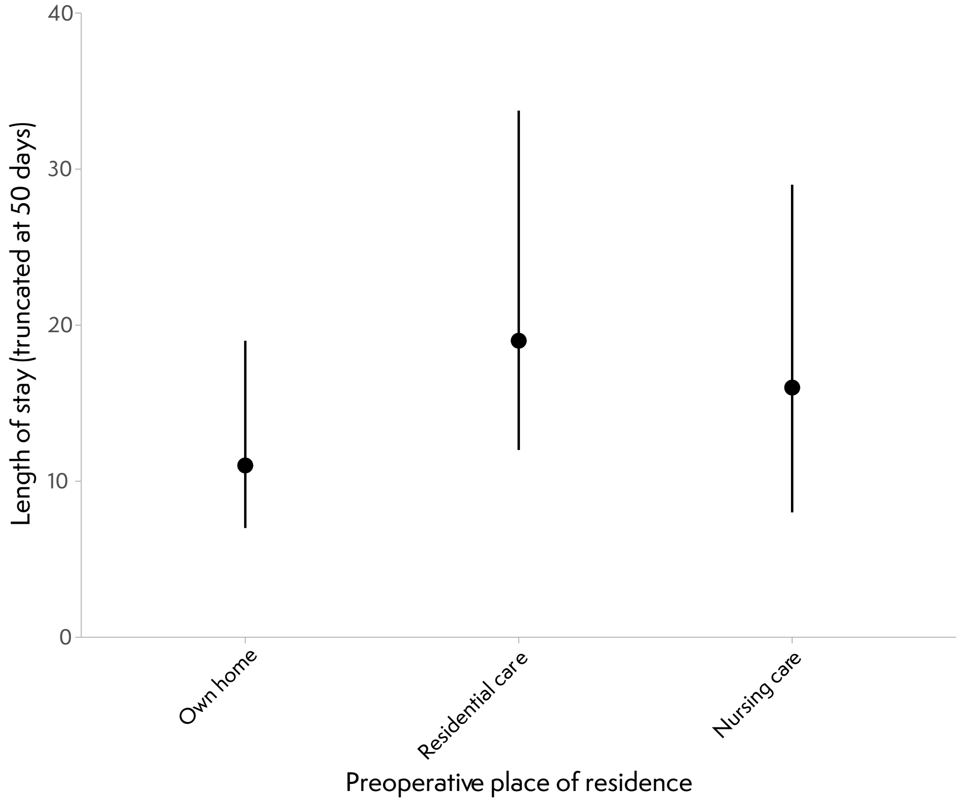


Figure 6.2.7 Postoperative length of stay in days, by care of the elderly review

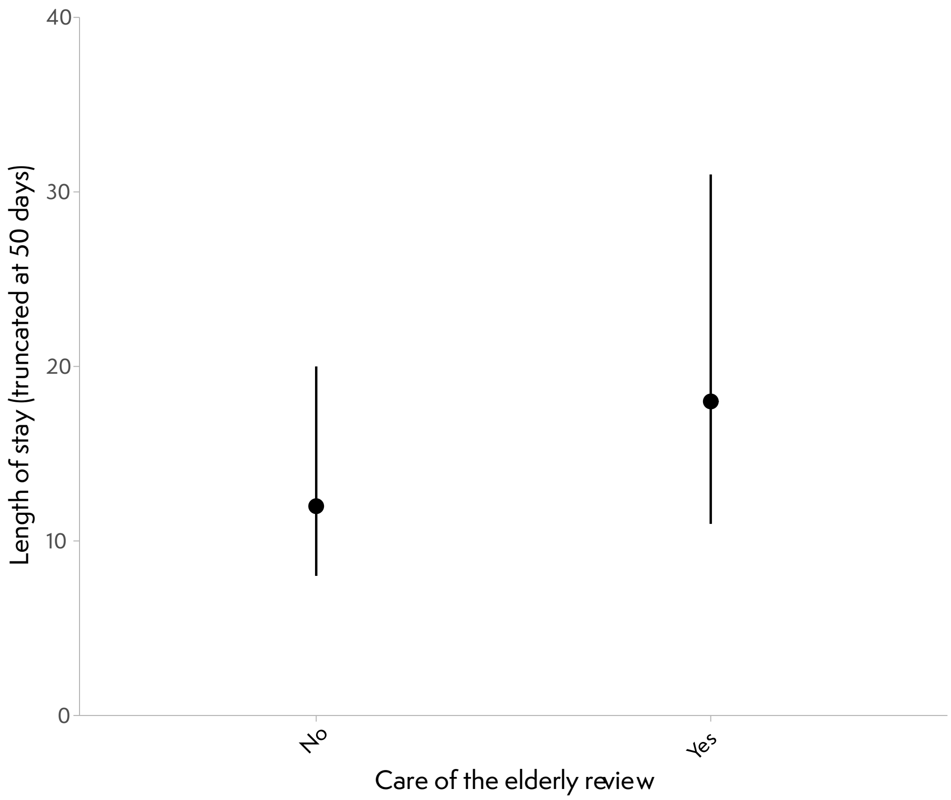


Figure 6.2.8 Postoperative length of stay in days, by type of admissions

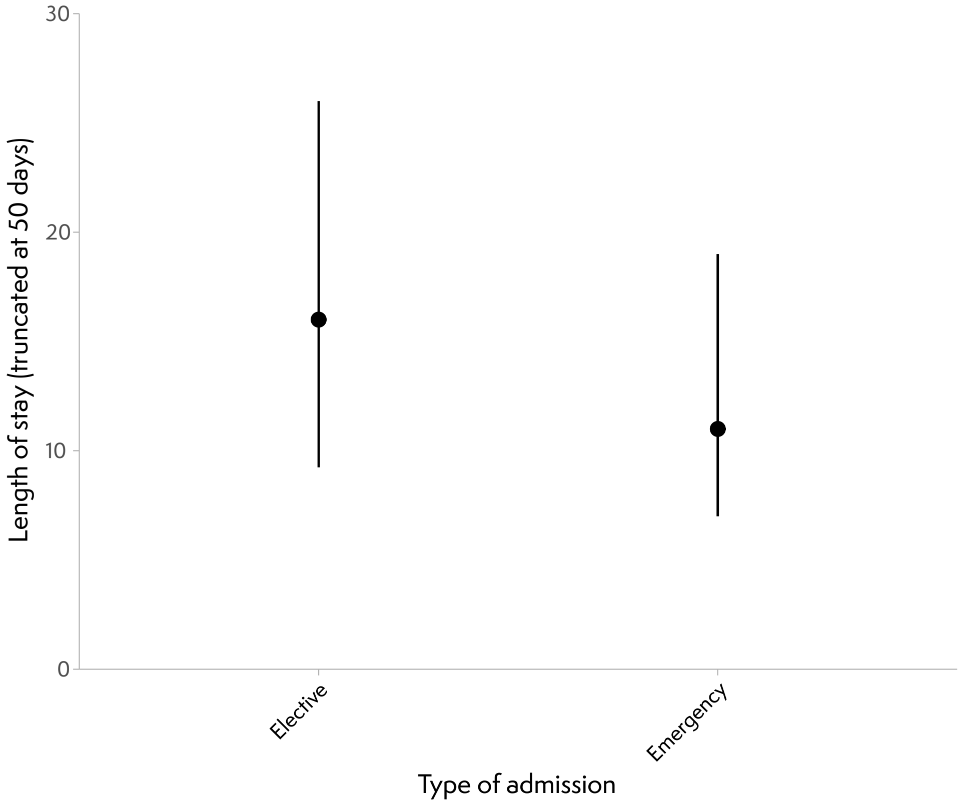


Figure 6.2.9 Postoperative length of stay in days, by unplanned return to theatre

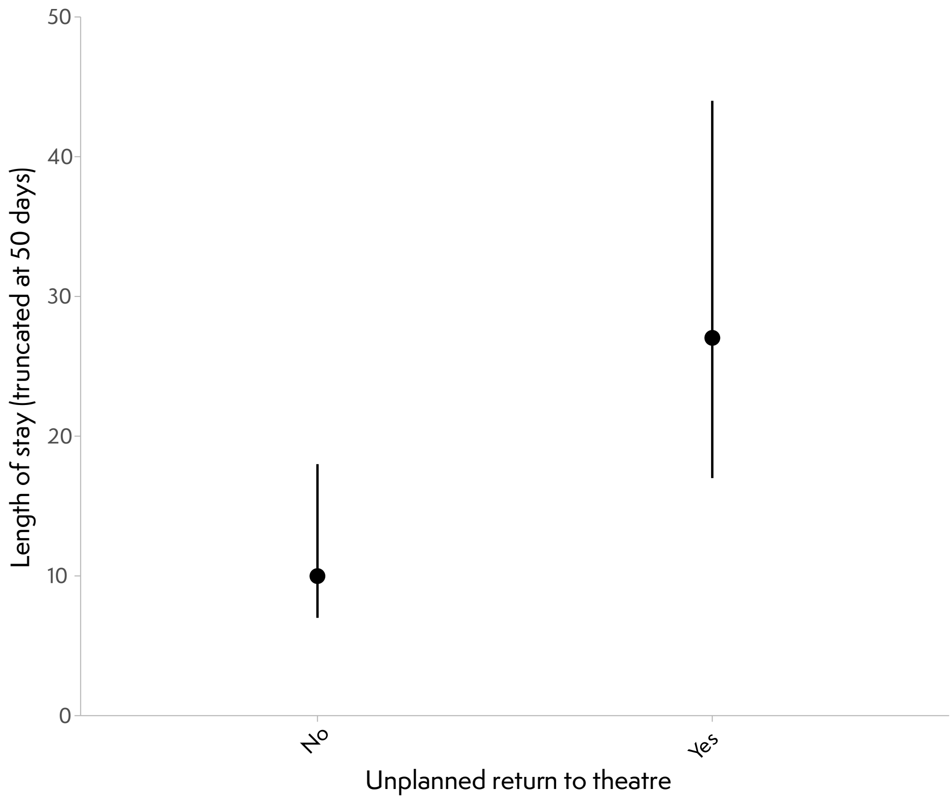
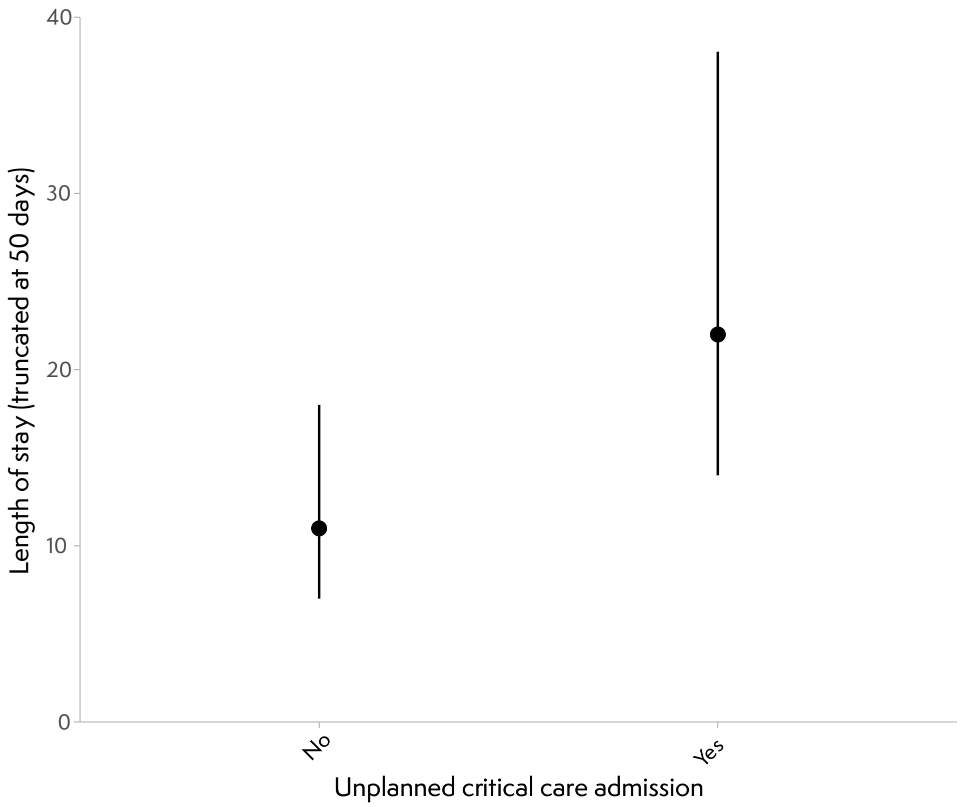


Figure 6.2.10 Postoperative length of stay in days, by unplanned critical care admission



Hospital-level variation

The median length of stay for patients varied between hospitals, from 7 to 21 days, with most hospitals having median stays of 11 days. (Figure 19.4, see supplementary data Tables 6.2.2 and 6.2.3).

USING NELA DATA AND DRIVER DIAGRAMS TO MAKE AN IMPACT ON LENGTH OF STAY

The factors influencing inpatient length of stay are complex, but nevertheless this is a common area that teams wish to improve. Many teams have found it helpful to create a driver diagram to help them decide on which areas to focus on.

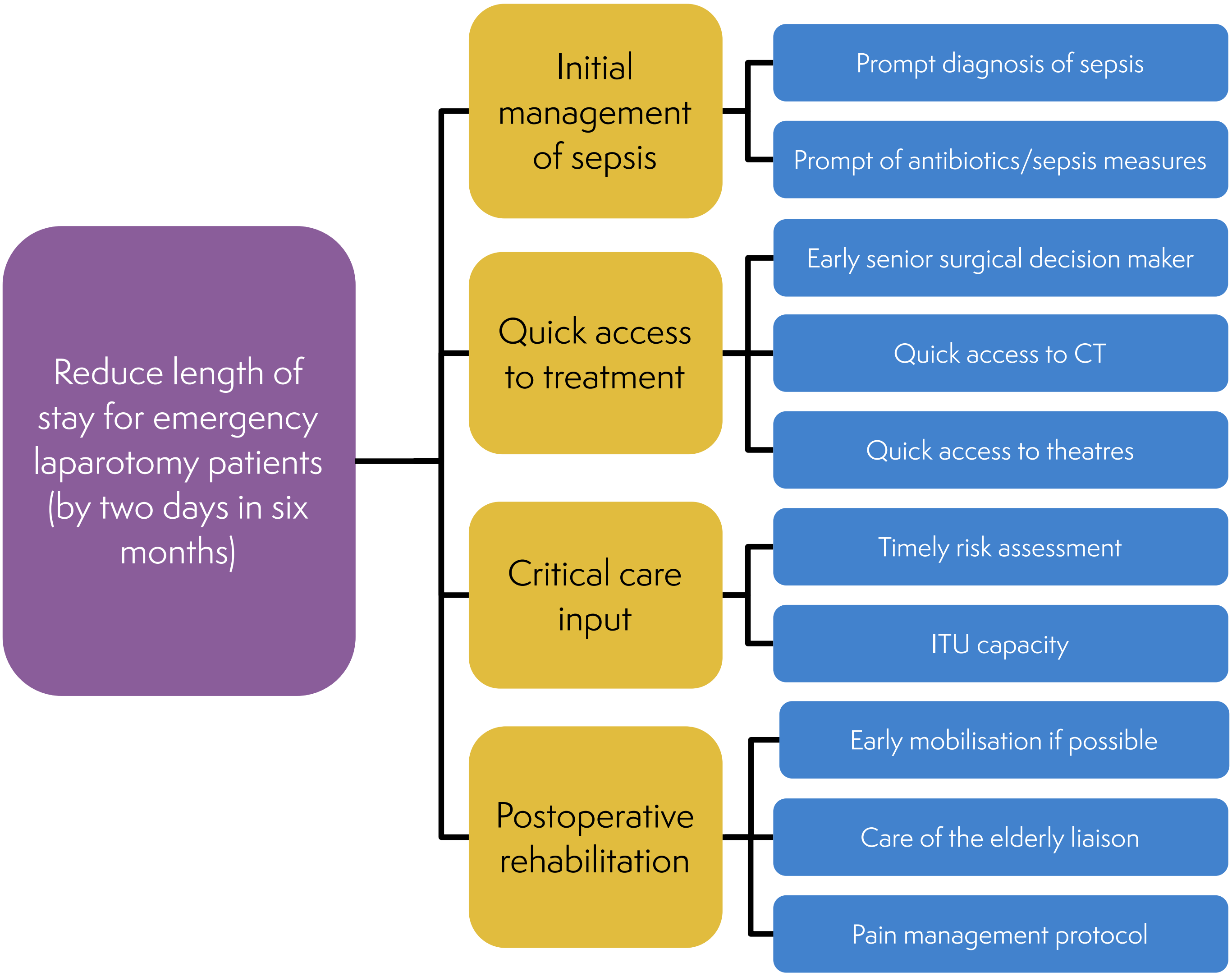
A driver diagram is a graphical representation of the key drivers (or influences) in your system, which can help 'drive' you to your aim (in the example below, the focus is on reducing length of stay, but it could be based on other outcomes or process measures). The secondary drivers influence the primary drivers, and the primary drivers influence the aims. Drivers may be the more tangible things like accuracy of booking information, or less well defined factors such as 'clinical engagement in data'. Secondary drivers are often good targets for improvement. Driver diagrams are very helpful to outline why you think a particular change idea will impact on your results – your 'theory of change'.

Once you have decided on your aim, you can produce a driver diagram in a group exercise. Ask team members to list down the factors (drivers) they think are important for meeting that particular aim on Post-it notes or pieces of paper. Gather in all these drivers together and sort them into themes. These factors can populate your driver diagram. You can consider each secondary driver as a smaller, bite-size area for improvement. A driver diagram often changes during your work, as you may learn about new drivers as you start making your changes. Although you may have similar drivers to other hospitals working in a similar area, it is important to think about which drivers are most important in your environment.

Those attending the NELA regional workshops worked together to create driver diagrams for their aims. This allowed teams to develop some change ideas to take back to test in their hospital.

An example of a driver diagram for the aim of 'reducing length of stay for patients who have had an emergency laparotomy' is shown in Figure 6.2.11.

Figure 6.2.11 Driver diagram: reducing length of stay for patients who have had an emergency laparotomy



6.3 Unplanned return to theatre

Why is this important for patients?

Some patients may return to theatre for a planned operation after their initial emergency laparotomy. This usually occurs following initial 'damage control' surgery, where patients may be too unwell to tolerate more extensive surgery during the initial operation. However, patients may have an unplanned return to theatre for a number of reasons: if they are not recovering at the expected rate and remain unwell, if they have ongoing pathology needing further treatment, or if they develop a postoperative surgical complication. This is likely to have a significant impact on a patient's experience and their outcomes – both physical and psychological.[9] There is also an economic impact on the hospital in terms of resource allocation and prolonged length of stay. Review of such patients can offer an opportunity for multidisciplinary teams to understand more about their process of care.

What was the rate of unplanned returns to theatre?

The overall rate of unplanned return to theatre after initial emergency laparotomy was 6.0% (Table 6.3.2). This is a reduction compared to previous years (10.2% in Year 1, to 9.4% in Year 2, and 9.0% in Year 3). However, the question was clarified in Year 4, and earlier years may have included patients who had a planned return to theatre. For Year 5, we ask about both planned and unplanned returns to theatre and will report on this in subsequent years.

At hospital level, the rate of unplanned return to theatre rate varied between 0% and 33%.

What are the characteristics of patients who have an unplanned return to theatre?

There are two groups of patients who have an unplanned return to theatre. The first are those whose emergency laparotomy is the 'unplanned return to theatre', required as a complication of an initial elective admission. This initial admission may have been for gastrointestinal or non-gastrointestinal surgery. In these cases, 30-day mortality is lower at 8% compared to 9.6% in those requiring an emergency laparotomy as the primary procedure. This may be because elective patients will have had the benefit of preoperative optimisation before their initial surgery, and hence are better able to tolerate a complication of surgery.

Table 6.3.1 Unadjusted ONS 30-day and 90-day mortality according to whether the emergency laparotomy was required for a complication of an elective procedure

	Number of patients (n(%))	Unadjusted ONS 30-day mortality rate (%)	Unadjusted ONS 90-day mortality rate (%)
Emergency Laparotomy as the Primary Procedure	22,399 (93.7)	9.6	13.1
Emergency Laparotomy for a complication of a recent procedure within same admission	1,512 (6.3)	8.0	10.1

The second group are those who have an emergency laparotomy (regardless of whether this was for a complication of previous surgery) and then return to theatre. ONS 30-day mortality of patients who had this type of unplanned return to theatre following an emergency laparotomy was higher at 15.3% compared to 8.9% in those that did not return (Table 6.3.2). Median length of stay post-surgery in the unplanned return to theatre group was 25 days compared with 10 days in those who did not have an unplanned return.

Table 6.3.2 Unadjusted ONS 30-day and 90-day mortality and length of stay according to unplanned return to theatre

	Number of patients (n(%))	Unadjusted ONS 30-day mortality rate (%)	Unadjusted ONS 90-day mortality rate (%)	Median postoperative length of stay (days)
No unplanned return to theatre	22,165 (94.0)	8.9	12.2	10
Unplanned return to theatre	1,423 (6.0)	15.3	20.5	25

As in previous years, the highest rates of unplanned return were seen in the patients deemed to be at highest risk and those who required their operation with greater urgency (Table 6.3.3). Elderly patients had a lower unplanned-return-to-theatre rate than younger patients. This may relate to the reduced ability of elderly patients to tolerate a repeat operation.

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Table 6.3.3 Proportion of patients who returned to theatre following their initial emergency laparotomy, by patient characteristics

	Total number of patients (n)	Proportion patients who returned to theatre following initial emergency laparotomy (%)	ONS 30-day mortality of those with an unplanned return (%)	ONS 90-day mortality of those with an unplanned return (%)
Age (years)				
18–39	2,657	5.8	3.2	3.9
40–49	2,212	5.9	7.6	11.5
50–59	3,477	6.0	6.2	13.0
60–69	4,773	7.2	15.4	20.1
70–79	5,954	6.5	20.8	26.2
80–89	3,987	4.8	27.8	36.1
≥90	528	1.5	37.5	62.5
Documented Risk				
Lower (<5%)	7,568	4.1	1.9	3.6
High (5–10%)	4,047	6.2	7.3	11.3
Highest (>10%)	6,049	8.1	24.4	29.7
Not documented	6,004	5.8	5.7	8.6
Total	23,668	5.9	–	–
Urgency				
< 2hours	2,706	9.6	9.6	26.2
2–6 hours	8,876	6.4	10.3	13.3
6–18 hours	8,022	4.7	6.0	9.3
18–24 hours	4,016	4.8	5.5	10.1
unknown	48	4.2	9.6	9.6
Total	23,668	5.9	–	–
Gender				
Male	11,464	6.7	15.6	20.8
Female	12,124	5.2	14.8	20.2

Table 6.3.4 shows that the surgical procedure with the highest unplanned-return-to-theatre rate was evacuation of haematoma (16.3%), followed by those who had a repair or revision of anastomosis (15.9%). The indications for an unplanned return to theatre are shown in Table 6.3.5. The most common reason for unplanned return to theatre after an emergency laparotomy was anastomotic leak. A significant number of returns to theatre stem from those parts of surgery performed during the latter stages of emergency laparotomy, including haemostasis, abdominal wound closure, and stoma formation. This highlights the importance of consultant surgeon presence throughout the entire procedure.

Unplanned return to theatre for anastomotic leak was most common in patients who had right hemicolectomy followed by small-bowel resection and those who had primary anastomosis, which respectively accounted for 29% and 19% of patients returning with this indication respectively.

24% of patients who had unplanned return to theatre for abdominal wall dehiscence did so after undergoing a Hartmann's Procedure at the initial emergency laparotomy.

Table 6.3.4 Proportion of patients with unplanned return to theatre, according to main procedure performed at initial emergency laparotomy and 30-day and 90-day mortality

Main procedure at initial emergency laparotomy	Total number of patients undergoing this procedure (n)	Number of patients requiring an unplanned return to theatre (n(%))	ONS 30-day mortality of those with an unplanned return (%)	ONS 90-day mortality of those with an unplanned return (%)
Small Bowel Resection	3,766	218 (5.8)	17.9	22.5
Hartman's Procedure	3,064	195 (6.4)	16.9	23.1
Colectomy: right (including ileocaecal resection)	3,207	179 (5.6)	17.8	26.9
Adhesiolysis	3,945	152 (3.9)	14.5	16.5
Colectomy: Subtotal or Panproctocolectomy	1,229	92 (7.5)	18.5	18.5
Colectomy: left (including sigmoid colectomy and anterior resection)	898	73 (8.1)	19.2	23.3
Washout only	547	63 (11.5)	4.8	7.9
Peptic ulcer-suture or repair of perforation	1,285	50 (3.9)	6.0	27.3
Defunctioning stoma via midline laparotomy	915	49 (5.4)	10.2	18.4
Drainage of abscess/collection	576	46 (8.0)	13.0	19.6
Exploratory/relook laparotomy	424	33 (7.8)	24.4	30.3
Repair of intestinal perforation	376	39 (10.4)	7.7	12.8
Colorectal resection – other	357	34 (9.5)	17.9	14.7
Repair or revision of anastomosis	157	25 (15.9)	0	4.0
Evacuation of haematoma	135	22 (16.3)	18.2	22.2
Gastric surgery-Other	290	19 (6.6)	21.1	31.6
Haemostasis	161	16 (9.9)	0	6.3
Gastrectomy: partial or total	118	15 (12.7)	6.7	13.3
Abdominal wall closure	97	15 (12.7)	8.3	22.2
Revision of stoma via midline laparotomy	154	12 (7.8)	16.7	25.0
Peptic ulcer-oversew of bleed	137	11 (8.0)	18.2	27.7
Large incisional hernia repair with division of adhesions	283	10 (3.5)	20.0	20.0
Enterotomy	264	9 (3.4)	11.1	22.2
Abdominal wall reconstruction	91	9 (9.9)	22.2	22.2
Laparostomy formation	75	9 (12.0)	22.2	22.2
Intestinal bypass	245	5 (2.0)	0	40.0
Reduction of volvulus	239	5 (2.1)	0	0
Large incisional hernia repair with bowel resection	124	5 (4.0)	20.0	30.0

Removal of foreign body	90	5 (5.6)	20.0	20.0
Resection of other intra-abdominal tumour(s)	47	4 (8.5)	25	25
Not amenable to surgery	137	3 (2.2)	66.7	66.7
Debridement	23	3 (13.0)	33.3	66.7
Repair of intestinal fistula	22	1 (4.6)	7.7	12.8

Table 6.3.5 Indication for unplanned return to theatre following emergency laparotomy

Indication for unplanned return to theatre	Number of patients for each indication (n)	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Anastomotic leak	234	13.7	19.7
Abdominal wall dehiscence	161	6.2	10.6
Bleeding or Haematoma	137	12.4	16.8
Stoma viability or retraction	104	15.4	19.2
Abscess	98	9.2	15.3
Accidental damage to bowel or other organ	28	10.7	10.7
Decompression of abdominal compartment syndrome	13	46.2	53.9
Unknown	25	28.0	32.0
Other	427	21.3	27.4
Total	1,369	–	–

Both consultant surgeon and consultant anaesthetist were present in theatre at the initial surgery of 81% of all those who required an unplanned return to theatre, compared to 77% of patients who did not need further surgery during this admission. There was no significant difference in consultant surgeon presence in theatre between patients who had an unplanned return to theatre and those who did not (present in 94.6% with no return and 92.4% in those with a second unplanned operation). A similar picture was seen regarding anaesthetic consultant presence in theatre (94% present in cases who did not have a subsequent unplanned return to theatre and 92.4% presence in the cases who did require a return to theatre).

6.4 Unplanned admission to critical care

Why is this important for patients?

Standards specify that high risk patients should be admitted directly to critical care following their surgery. If high risk patients are admitted directly to a ward after their emergency surgery they may not receive the required level of monitoring, assessment and postoperative care. Evidence shows that more patients die if they are initially cared for after surgery on a general ward and then subsequently require treatment in a critical care unit than if they are transferred directly after surgery to a critical care unit.[10,11] Patients are likely to require unplanned admission to critical care if they deteriorate on the ward or require a return to theatre following their initial emergency laparotomy.

Has there been any change in the proportion of patients who have an unplanned admission to critical care?

Out of the 23,929 patients in the Year 4 Audit, 805 (3.4%) had an unplanned critical care admission. This remains essentially unchanged from previous years (Year 2 – 2.9%, Year 3 – 3.6%).

Of these 805 patients, 582 were admitted to critical care after the original emergency laparotomy and then were readmitted to critical care after being discharged to the ward.

Of the unplanned admissions to critical care, 70% had already been admitted to critical care after their initial surgery (Table 6.4.1). Of the unplanned admissions, 40% were admitted following a 2nd return to theatre – an understandable consequence of requiring further surgery. However, 60% of patients were admitted to critical care direct from the ward, and these patients had not required subsequent surgery (Table 6.4.2). NELA does not collect data to explain this finding, however it may reflect premature initial discharge from critical care, possibly due to pressures on bed capacity. In addition to ensuring adequate critical care capacity, clinical teams should ensure appropriate discharge planning before stepping down patients to the ward, and be alert to signs of deterioration once discharged to the ward.

Table 6.4.1 Postoperative destination following original laparotomy for patients who had an unplanned admission to critical care

Postoperative destination following original laparotomy for patients with an unplanned admission to critical care	Total number of patients (n(%))
Critical care	582 (72.3)
Enhanced area	50 (6.2)
Ward	173 (21.5)

Table 6.4.2 The number of patients who had an unplanned admission to critical care who also had an unplanned return to theatre

Unplanned return to theatre	Total number of patients (n(%))
No	482 (59.9)
Yes	317 (39.4)
Unknown	6 (0.7)

Was there variation in unplanned critical care admission between hospitals?

Hospitals varied in the proportion of unplanned critical care admissions from 0% to 36% (Figure 19.6).

What was the effect of unplanned critical care admission on mortality?

Unadjusted 30-day ONS mortality was significantly higher in those with an unplanned admission to critical care (17.5% v 8.1%).

Table 6.4.3 Number of patients who had an unplanned admission to critical care and 30-day ONS mortality (excludes patients who died in theatre or where there was a decision for palliative care)

Unplanned admission to critical care	Total number of patients (n(%))	ONS 30-day mortality (n(%))
Patients without an unplanned admission to critical care	22,472 (95.9)	1,828 (8.1%)
Patients with an unplanned admission to critical care	793 (3.4)	139 (17.5%)
Unknown	170 (0.7)	22 (12.9%)

What was the effect of unplanned critical care on length of stay?

The average length of stay was double in patients who had an unplanned admission to critical care (Figure 6.2.10). This has significant impact on patient experience and on long-term recovery. There will also be an associated cost implication to the hospital.

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Table 6.4.4 Length of stay in days for those patients who had an unplanned admission to critical care (excludes patients who died as inpatients)

Unplanned admission to critical care	Length of Stay (Days)	
	Mean (days)	Median (IQR) (days)
Yes	30.3	22 (14 – 38.0)
No	15.7	11 (7 – 18)

6.5 Long-term mortality

In previous reports we advanced the understanding of survival after emergency laparotomy by reporting 30-day and 90-day mortality in large patient cohorts. Understanding of survival beyond the first three months has historically been limited to small populations. As potentially the largest prospective data set of patients who have had an emergency laparotomy in the world, NELA is able, for the first time, to report mortality rates up to three years after the index operation, linking to high-quality data from the Office for National Statistics.

Why is this important for patients?

Consent for emergency laparotomy should include discussion of likely outcomes after surgery, but the knowledge base is currently limited to short-term survival. Improved understanding of longer-term outcomes will aid discussions between clinicians, patients and their relatives, and help inform shared decision-making. Associated research to better understand the factors associated with survival beyond the first three months will improve the design and delivery of perioperative care pathways, which have already been shown to improve 30- and 90-day survival.[12]

National all-cause mortality for patients who have had an emergency laparotomy

Over the four years of the Audit, 23.2% of patients died within a year of surgery, 29.4% died within two years and 33.8% died within three years. The reasons for their deaths may not be directly related to their emergency surgery, and these figures include all causes of death.

As with 30-day mortality, the data indicate a year-on-year reduction in mortality rates since the start of the audit (1-year mortality was 24.7% in Year 1 and 21.6% in Year 3).

Table 6.5.1 Patients for whom ONS mortality data is available, by NELA year

NELA year	1-year follow-up (n)	2-year follow-up (n)	3-year follow-up (n)	ONS data not available (n)
1	19,852	19,852	19,852	1,141
2	22,356	22,356	3,778	1,431
3	23,370	4,054	–	1,950
4	3,933	–	–	1,023
Total	69,511	46,262	23,630	5,545

Table 6.5.2 ONS all-cause mortality, by NELA year

NELA year	1-year mortality (%) n=69,511	2-year mortality (%) n=46,262	3-year mortality (%) n=23,630
1	24.7	30.3	34.0
2	23.9	29.2	32.4
3	21.6	26.6	–
4	21.1	–	–
Overall	23.2	29.4	33.8

High risk groups

Longer-term mortality rates vary markedly by patient risk factors and urgency of surgery. A third of patients over 70 years old, who make up more than half of the population, die within a year of surgery, and a half within three years. Substantially increased mortality rates with increasing ASA grade are also observed over the three years (Table 6.5.3).

A different pattern was seen in the relationship between longer-term mortality and surgical urgency. Short term, 30-day mortality reduces with lower surgical urgency. However, with longer-term mortality, the least urgent cases (>18 hours) were found to have a higher 1-, 2-, and 3-year mortality than more urgent cases (with the exception of the most urgent requiring surgery in less than 2 hours). Recent research demonstrated that delaying surgery for bowel obstruction was associated with increased mortality within 30 days.[13] Whether this is also true for other patient groups over the longer-term will require further analysis.

Available tools for assessing risk are based on short-term (usually 30-day) mortality. However, with the exception of operative urgency, the patterns of variation by risk factors indicate that these measures can also be used to stratify likelihood of longer-term mortality.

Table 6.5.3 Long-term mortality, by patient characteristics

	1-year mortality (%) n=69,511	2-year mortality (%) n=46,262	3-year mortality (%) n=23,630
Age			
18–39	4.7	6.2	6.8
40–49	8.9	11.2	12.7
50–59	15.3	20.4	22.8
60–69	22.7	28.9	32.8
70–79	29.3	37.3	42.9
80–89	37.1	45.8	52.5
≥90	44.4	54.5	63.6
Overall	23.2	29.4	33.8
ASA			
1	3.7	6.2	7.8
2	10.3	15.1	18.3
3	25.8	33.7	39.1
4	48.4	55.8	60.8
5	68.7	71.6	71.7
Documented Risk			
Lower (<5%)	9.1	13.4	16.2
High (5–10%)	22.1	28.4	32.6
Highest (>10%)	43.5	50.8	56.0
Not documented	18.5	24.5	28.8
Gender			
Male	23.4	29.9	34.3
Female	23.0	29.0	33.3

Table 6.5.4 Long-term mortality, by operative urgency

Operative urgency	1-year mortality (%) n=66,937	2-year mortality (%) n=43,708	3-year mortality (%) n=21,117
<2hrs	36.1	41.2	43.9
2–6hrs	22.6	28.3	32.6
6–18hrs	18.7	25.4	30.1
>18hrs	22.9	30.3	34.6
Overall	23.2	29.6	34.0

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Surgery-specific mortality

As with shorter-term outcomes, mortality over the three years after emergency laparotomy varies according to the nature of the main surgical procedure performed (Table 6.5.5) and the degree of contamination within the peritoneal cavity found (Table 6.5.7). Of the more commonly performed procedures, mortality varies little between colorectal resections or small-bowel resection. Mortality rates are substantially higher in patients requiring de-functioning stoma (46.7% 1-year, 57.6% 2-year, 61.9% 3-year) or bypass surgery (72.7% 1-year, 84.1% 2-year 2, 86.3% 3-years) and for disease processes (including cancers) that it was not possible to remove.

Faecal contamination was associated with the highest mortality (Table 6.5.7). Procedures performed laparoscopically or converted to open from an initial laparoscopic approach had better long-term outcomes compared with open procedures (Table 6.5.6).

Table 6.5.5 Long-term mortality, by procedure

Main procedure	1-year mortality (n = subgroup total number patients, (%) mortality)	2-year mortality (n = subgroup total number patients, (%) mortality)	3-year mortality (n = subgroup total number patients, (%) mortality)
Peptic Ulcer – suture or repair of perforation	3,821 (17.9)	2,551 (21.9)	1,305 (22.7)
Peptic Ulcer – oversew of bleed	579 (28.5)	428 (33.9)	245 (40.4)
Gastric surgery – other	968 (31.8)	687 (36.8)	374 (39.6)
Small Bowel Resection	11,540 (22.6)	7,795 (28.2)	3,991 (32.8)
Colectomy: Left (including sigmoid colectomy and anterior resection)	2,269 (18.4)	1,368 (25.0)	701 (31.0)
Colectomy: Right (including ileocaecal resection)	9,217 (24.3)	6,039 (32.5)	3,028 (38.0)
Colectomy: Subtotal or Panprocotocolectomy	3,862 (24.1)	2,606 (30.1)	1,295 (33.0)
Hartmann's procedure	8,759 (20.9)	5,885 (27.7)	2,987 (32.9)
Colorectal Resection – other	1,281 (23.4)	923 (30.0)	504 (34.9)
Abdominal wall closure following dehiscience	464 (15.3)	302 (21.9)	150 (26.7)
Adhesiolysis	11,481 (13.3)	7,704 (18.1)	3,941 (21.7)
Drainage of abscess/collection	1,917 (15.0)	1,300 (19.3)	680 (23.5)
Exploratory/ relook laparotomy only	1,409 (35.2)	939 (39.2)	477 (42.4)
Haemostasis	726 (18.5)	530 (21.3)	281 (22.8)
Intestinal bypass	918 (72.7)	654 (84.1)	358 (86.3)
Laparostomy formation	229 (46.7)	158 (48.7)	83 (49.4)
Repair of intestinal perforation	1,345 (20.9)	998 (25.5)	533 (28.3)
Resection of other intra-abdominal tumour(s)	199 (24.1)	143 (32.9)	76 (32.9)
Defunctioning stoma via midline laparotomy	3,855 (46.7)	2,618 (57.6)	1,357 (61.9)
Revision of stoma via midline laparotomy	454 (18.7)	319 (25.1)	180 (30.6)
Washout only	1,670 (19.9)	1,150 (23.1)	617 (26.6)
Reduction of volvulus	384 (11.5)	165 (13.9)	27 (29.6)
Enterotomy	647 (13.3)	398 (16.6)	191 (23.0)
Stricturoplasty	29 (10.3)	10 (10.0)	2 (50.0)
Removal of foreign body	133 (7.5)	59 (13.6)	13 (15.4)

Not amenable to surgery	572 (89.5)	398 (92.7)	221 (93.7)
Gastrectomy: partial or total	156 (32.1)	26 (42.3)	–
Resection of Meckel's diverticulum	105 (8.6)	15 (0)	3 (0)
Abdominal wall reconstruction	110 (9.1)	12 (0)	–
Evacuation of haematoma	176 (14.8)	28 (25.0)	–
Debridement	35 (28.6)	10 (30.0)	2 (50.0)
Repair or revision of anastomosis	156 (13.5)	28 (25.0)	8 (37.5)
Repair of internal fistula	45 (15.6)	16 (18.8)	–
Total	69,511 (23.2)	46,262 (29.4)	23,630 (33.8)

Table 6.5.6 Long-term mortality, by operative approach

Approach	1-year mortality (n(%))	2-year mortality (n(%))	3-year mortality (n(%))
Open	59,485 (24.5)	39,967 (30.9)	20,578 (35.3)
Laparoscopic	4,877 (15.5)	3,032 (20.7)	1,428 (23.3)
Laparoscopic converted to open	4,370 (15.2)	2,783 (18.7)	1,406 (23.1)
Laparoscopic assisted	779 (16.8)	480 (24.6)	218 (25.2)
Total	69,511 (23.2)	46,262 (29.4)	23,630 (33.8)

Table 6.5.7 Long-term mortality, by degree of contamination observed intraoperatively

	1-year mortality (n(%))	2-year mortality (n(%))	3-year mortality (n(%))
None or reactive serous fluid only	41,628 (22.4)	27,623 (29.4)	14,044 (34.1)
Free gas from perforation +/- minimal contamination	2,712 (22.8)	1,798 (29.6)	927 (32.7)
Pus	8,735 (17.4)	5,822 (22.0)	2,996 (25.9)
Bile	1,087 (21.6)	754 (26.9)	412 (29.1)
Gastro-duodenal contents	2,613 (23.3)	1,728 (27.7)	867 (28.6)
Small bowel contents	2,907 (30.3)	1,969 (35.9)	1,064 (40.3)
Faeculent fluid	2,871 (31.2)	1,963 (36.7)	1,036 (42.5)
Faeces	4,191 (33.6)	2,777 (39.0)	1,403 (42.5)
Blood/haematoma	2,767 (22.9)	1,828 (27.0)	881 (31.0)
Overall	69,511 (23.2)	46,262 (29.4)	23,630 (33.8)

6.6 Residence before and after surgery

Why is this important for patients?

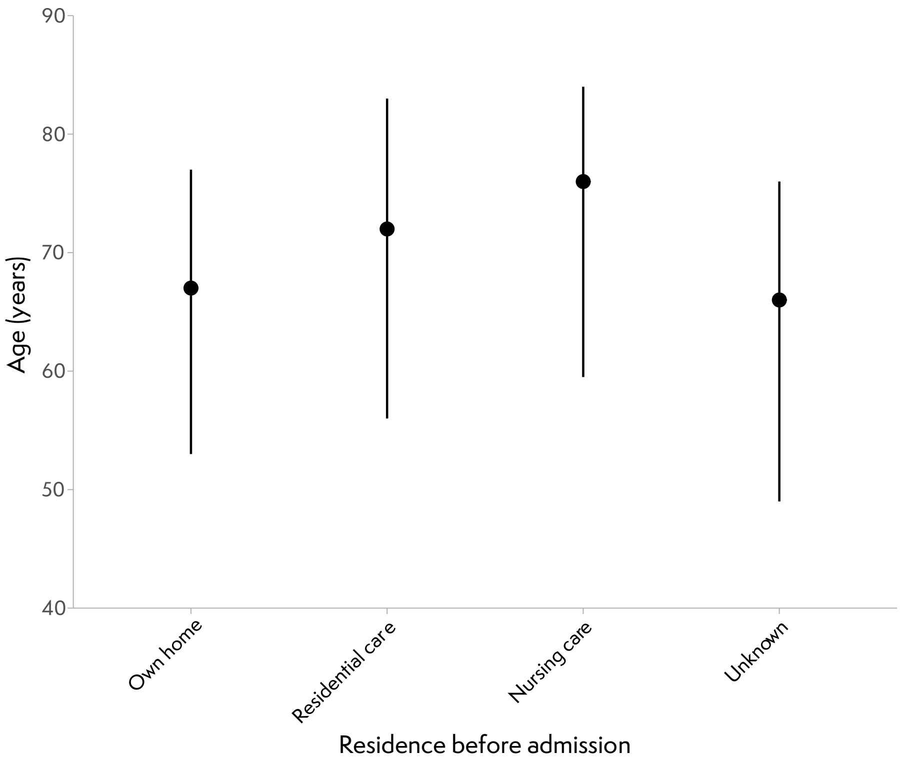
Emergency laparotomy is a procedure carrying high risks of morbidity as well as mortality. Sepsis, critical illness, and impaired mobility and nutrition can all lead to decline in the ability to perform activities of daily living. Such decline may result in a patient being unable to return to their previous residence and needing significant support following hospital discharge.

Knowing the impact that emergency laparotomy surgery has on a patient's ability to carry out their normal daily activities will help patients, their carers, and clinical teams in discussing potential impact on quality of life. It will also help those planning and delivering health and social care to understand the impact of emergency laparotomy on patients' lives following discharge.

What are the demographics of patients who have had an emergency laparotomy by residence type?

Residential and nursing home patients tended to be older than patients living in their own home prior to admission. Unsurprisingly, more older patients were admitted from either nursing or residential care (Figure 6.6.1, see supplementary data Table 6.6.3). A similar trend was seen regarding ASA grade, with patients admitted from their own homes having lower ASA grades. Patients from nursing and residential care had higher preoperative calculated risk of death scores compared to patients admitted from their own homes (see supplementary data Table 6.6.5).

Figure 6.6.1 Age in years, by place of residence prior to admission



Where do patients live before, and where are they discharged to following their emergency laparotomy?

This question was a new addition to the NELA dataset in Year 4. The data quality of the entries was relatively poor, with 15% of entries recording 'unknown' residence at discharge. 40 patients who were resident in nursing homes and 61 who were resident in residential homes were recorded as returning to their 'own' residence after emergency laparotomy. In this instance, it is assumed that the entry refers to the patients' previous residence (care home), rather than recording that that they required less support than previously and that they returned to independent living in their 'own home'. It is also possible that 'own home' was selected as the pre-admission residence for those in nursing/residential homes as these were considered to be the patient's 'own home'.

Almost all patients were recorded as coming from their 'own home' (96.1%) prior to emergency laparotomy, with less than 1% of emergency laparotomy patients shown as residing in residential homes (0.8%) or nursing homes (0.7%) prior to hospital admission. The majority of patients returned to their 'own home' (79.2%) after emergency laparotomy. Only 3.2% of patients were shown as being discharged to nursing care, and 1.2% to residential care.

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Figure 6.6.2 Place of residence on admission to hospital and on discharge

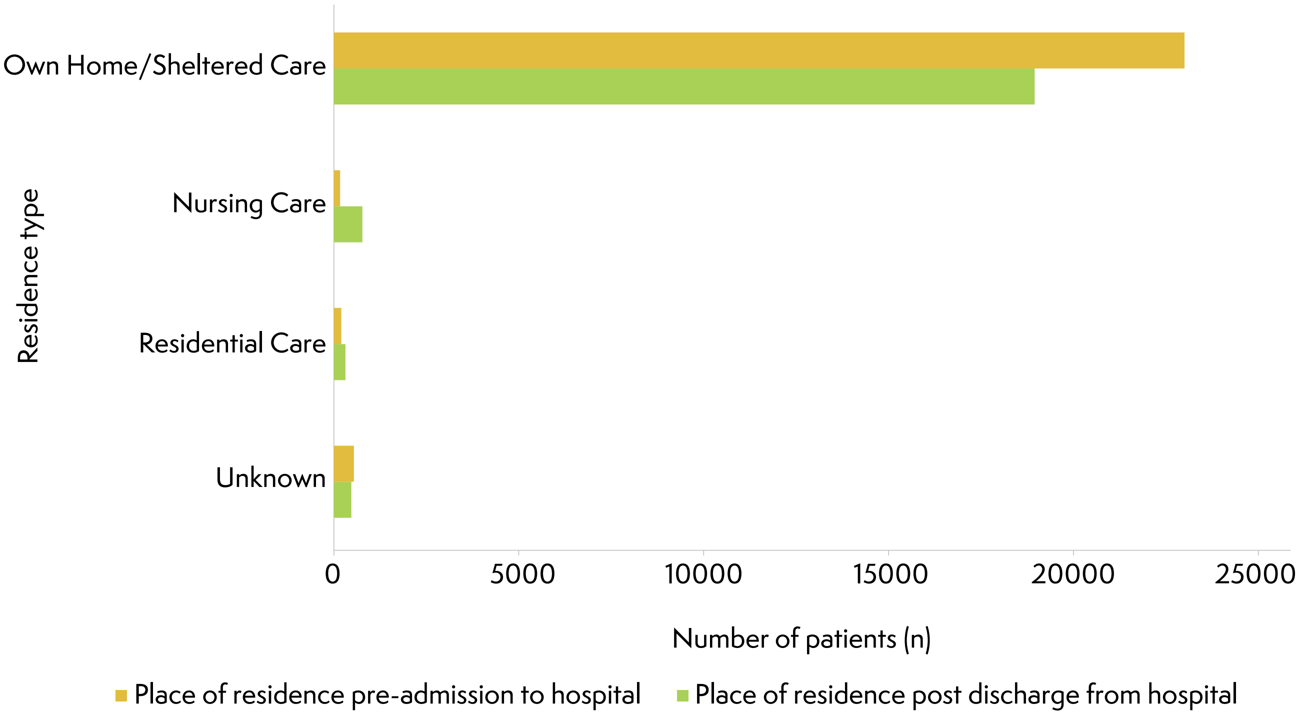


Table 6.6.1 Place of residence prior to admission

Residence prior to admission	Number of patients (n(%))
Own Home/Sheltered	23,003 (96.1)
Nursing Care	166 (0.7)
Residential Care	198 (0.8)
Unknown	541 (2.3)

How many patients experience a change of residence after emergency laparotomy?

This analysis excluded those whose discharge destination was marked as 'unknown'. Following emergency laparotomy, 236 (1.2%) patients moved from their own home to a residential home and 663 (3.4%) patients moved from their own home to a nursing home. This represents more than 900 patients who have experienced a significant change in their personal circumstances following emergency laparotomy (Table 6.6.2).

Table 6.6.2 Place of residence prior to admission and on discharge following laparotomy

Residence prior to admission	Place of residence after discharge (n)		
	Own Home	Residential Care	Nursing Care
Own Home	18,636	236	663
Residential Care	67	62	26
Nursing Care	40	11	70

7 PATIENT AND SURGICAL CHARACTERISTICS, ADMISSION PATHWAYS AND PATIENT MORTALITY

Why is this important for patients?

Understanding patient and surgical characteristics allows NELA to investigate processes of care and outcomes after surgery in different types of patient and to highlight if there is variation in care or outcomes in particular patient populations (eg older patients) or for different operations. For patients, this means that they can be assured that providers are continually assessing whether patients are receiving the best possible care.

NELA routinely collects data on age, gender, urgency of surgery, and American Society of Anesthesiologists (ASA) grade. The latter reflects a patient's co-morbidity at the time of surgery.

What types of patients undergo emergency bowel surgery?

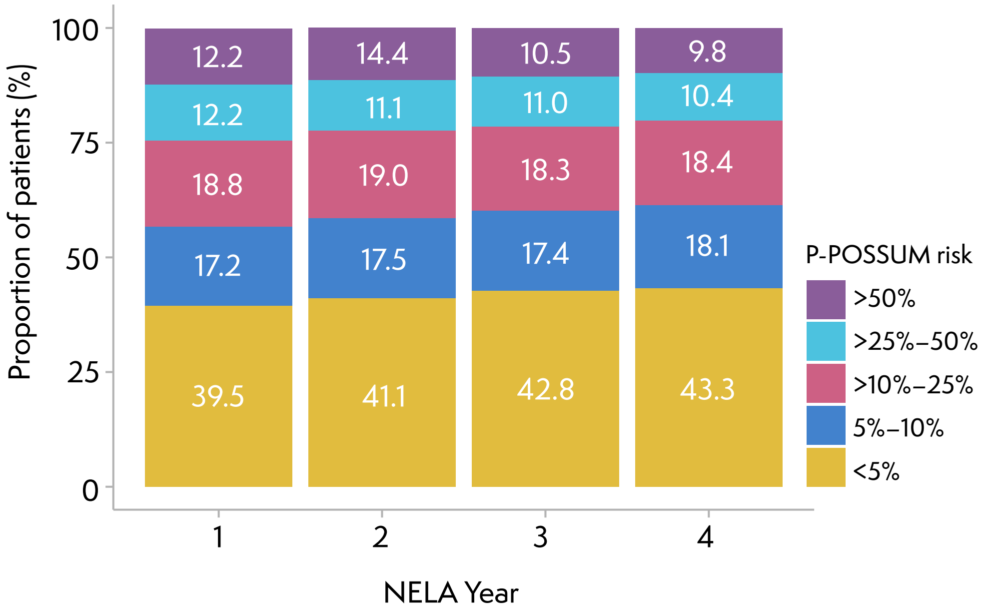
The characteristics of patients undergoing surgery have remained similar over the last four years:

- just less than half (44.5%) were over the age of 70 years (median age 67 years, mean age 63 years)
- their physical health tended to be poor – more than half were rated as suffering from a severe health condition with an ASA grade 3 or greater recorded
- most half (48%) required surgery within six hours of the decision being made to operate

57% of patients were high risk (P-POSSUM predicted mortality ≥5%). The proportion of highest risk (>10% predicted mortality) patients has fallen from 43% in Year 1 to 38.5% in Year 4, although the absolute numbers have remained similar (≈10,000 patients per year) (Figure 7.1).

There has been a continued fall in the median P-POSSUM score from 7.6% in Year 1 to 6.3% in Year 4. There are a number of possible reasons for this reduction. It may be the result of a greater number of lower-risk patients being entered into NELA as overall case ascertainment rate has risen (increased from 65% in the first Patient Report to 83% in this Report) (Figure 7.1). It may reflect a situation where very high risk patients are being offered different treatment options. It may also reflect improvements in care, such that patients are less unwell by the time they need surgery. The NELA inclusion criteria were also refined in Year 4, to exclude patients requiring emergency laparotomy following surgery under other specialties (eg urology, gynaecology). Further research is required to answer these questions.

Figure 7.1 Population risk profiles according to preoperative P-POSSUM predicted 30-day mortality, by NELA year



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What are the indications for surgery, surgical findings and surgical procedures performed for emergency laparotomy?

The indications for emergency laparotomy remain unchanged, broadly dividing into intestinal obstruction or abdominal sepsis due to intestinal perforation, peritonitis or abdominal abscess. Adhesiolysis and small-bowel resection remained the most commonly performed procedures. Colorectal resections comprised the majority of the remainder of emergency laparotomies.

The main surgical findings are also similar to previous years.

Table 7.1 ONS 30-day and 90-day mortality, by indication for surgery (more than one indication can be selected)

Indication for surgery	Number of patients (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Small bowel obstruction	8,934 (37.3)	7.2	10.6
Perforation	5,913 (24.7)	13.3	16.2
Peritonitis	4,919 (20.6)	14.1	17.3
Large bowel obstruction	3,449 (14.4)	8.4	14.3
Sepsis	1,938 (8.1)	16.7	20.1
Ischaemia	1,763 (7.4)	23.9	27.7
Abdominal abscess	1,683 (7.0)	6.4	8.6
Incarcerated hernia	1,171 (4.9)	9.1	12.0
Colitis	949 (4.0)	6.9	8.1
Volvulus	788 (3.3)	6.6	8.3
Haemorrhage	759 (3.2)	12.3	15.6
Pneumoperitoneum	621 (2.6)	13.9	18.8
Anastomotic leak	588 (2.5)	7.5	8.7
Internal hernia	588 (2.5)	5.4	6.8
Intestinal fistula	409 (1.7)	6.1	8.8
Necrosis	404 (1.7)	23.0	26.7
Phlegmon	383 (1.6)	5.7	7.1
Obstructing incisional hernia	314 (1.3)	8.0	9.9
Acidosis	297 (1.2)	35.7	41.1
Intussusception	176 (0.7)	1.1	4.0
Abdominal Wound dehiscence	133 (0.6)	6.0	10.5
Foreign body	130 (0.5)	1.5	1.5
Iatrogenic injury	113 (0.5)	7.1	8.0
Pseudo-obstruction	85 (0.4)	10.6	11.8
Planned relook	47 (0.2)	10.6	12.8
Abdominal compartment syndrome	32 (0.1)	31.3	31.3
Intestinal obstruction	1 (0.0)	0.0	0.0
Other	1 (0.0)	100.0	100.0

Table 7.2 ONS 30-day and 90-day mortality, by operative findings (more than 1 can be selected)

Operative Findings	Number of patients (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Adhesions	6,449 (27.0)	6.4	8.8
Perforation – small bowel/ colonic	5,004 (20.9)	13.8	17.0
Abscess	2,834 (11.8)	7.1	9.6
Intestinal Ischaemia	2,832 (11.8)	21.4	24.9
Malignancy – localised	2,188 (9.1)	8.1	12.9
Colorectal cancer	1,948 (8.1)	9.5	15.8
Incarcerated hernia	1648 (6.9)	10.0	12.7
Diverticulitis	1,558 (6.5)	7.9	9.7
Perforation – peptic ulcer	1,482 (6.2)	12.0	14.0
Malignancy – disseminated	1,435 (6.0)	16.0	34.0
Internal hernia	1170 (4.9)	6.4	7.4
Stricture	1,112 (4.7)	5.7	8.3
Volvulus	1,018 (4.3)	6.7	8.6
Crohn's disease	787 (3.3)	2.2	2.9
Anastomotic leak	591 (2.5)	6.9	8.3
Intestinal fistula	429 (1.8)	7.2	9.1
Ulcerative colitis	383 (1.6)	3.7	4.2
Normal intra-abdominal findings	374 (1.6)	10.4	13.9
Other colitis	298 (1.3)	14.8	16.4
Haemorrhage – intestinal	273 (1.1)	16.9	21.3
Gallstone ileus	269 (1.1)	5.6	6.7
Haemorrhage – postoperative	265 (1.1)	7.2	8.7
Stoma complications	242 (1.0)	7.9	10.7
Intussusception	213 (0.9)	2.35	5.6
Foreign body	204 (0.9)	1.5	1.5
Meckel's diverticulum	199 (0.8)	7.5	8.5
Pseudo-obstruction	170 (0.7)	10.6	14.7
Haemorrhage – peptic ulcer	155 (0.7)	19.4	23.2
Abdominal wound dehiscience	131 (0.6)	5.3	9.2
Gastric cancer	69 (0.3)	5.8	15.9
Abdominal compartment syndrome	40 (0.2)	32.5	37.5
Necrotising fasciitis	25 (0.1)	28.0	32.0
Colitis	1 (0.0)	0.0	0.0

Table 7.3 Main procedure recorded at emergency laparotomy and ONS 30-day and 90-day mortality

Main procedure recorded	Number of patients (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Adhesiolysis	3,999 (16.7)	4.7	6.3
Small bowel resection	3,812 (15.9)	10.7	14.1
Colectomy: right (including ileocaecal resection)	3,252 (13.6)	8.1	11.5
Hartmann's procedure	3093 (12.9)	9.4	11.8
Peptic ulcer – suture or repair of perforation	1,303 (5.5)	10.5	12.7
Colectomy: subtotal or panproctocolectomy	1,241 (5.2)	13.8	15.7
Defunctioning stoma via midline laparotomy	929 (3.9)	13.7	28.6
Colectomy: left (including sigmoid colectomy and anterior resection)	912 (3.8)	7.7	10.2
Drainage of abscess/ collection	583 (2.4)	7.4	10.0
Washout only	553 (2.3)	11.4	14.8
Exploratory/relook laparotomy only	435 (1.8)	26.7	31.3
Repair of intestinal perforation	381 (1.6)	11.3	12.6
Colorectal resection – other	367 (1.5)	9.0	11.4
Gastric surgery – other	300 (1.3)	11.7	18.3
Large incisional hernia repair with division of adhesions	285 (1.2)	4.9	6.7
Enterotomy	267 (1.1)	3.8	7.1
Intestinal bypass	249 (1.0)	10.8	29.7
Reduction of volvulus	243 (1.0)	4.5	5.8
Not amenable to surgery	162 (0.7)	58.6	66.1
Haemostasis	161 (0.7)	6.2	8.1
Repair or revision of anastomosis	158 (0.7)	3.2	5.1
Revision of stoma via midline laparotomy	155 (0.7)	6.5	9.7
Evacuation of haematoma	142 (0.6)	9.9	12.7
Peptic ulcer – oversew of bleed	138 (0.6)	15.9	21.0
Large incisional hernia repair with bowel resection	126 (0.5)	7.9	9.5
Gastrectomy: partial or total	118 (0.5)	20.3	24.6

Abdominal wall closure following dehiscience	100 (0.4)	5.0	7.0
Abdominal wall reconstruction	92 (0.4)	4.4	7.6
Removal of foreign body	92 (0.4)	3.3	3.3
Resection of Meckel's diverticulum	89 (0.4)	2.3	2.3
Laparostomy formation	76 (0.3)	15.8	26.3
Resection of other intra-abdominal tumour(s)	48 (0.2)	12.5	18.8
Stricturoplasty	23 (0.1)	13.0	13.0
Debridement	23 (0.1)	21.7	26.1
Repair of intestinal fistula	22 (0.1)	4.6	18.2

Table 7.4 30-day and 90-day ONS mortality rates according to level of peritoneal contamination

Contamination level	Total number with contamination (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
None	8,666 (36.2)	6.6	10.0
Serous Fluid	6,611(27.6)	9.2	12.9
Localised Pus	2570 (10.7)	5.3	7.7
Free pus, blood or bowel contents	6,016 (25.1)	15.9	19.2
Missing	66 (0.4)	10.6	13.6
Total	23,929		

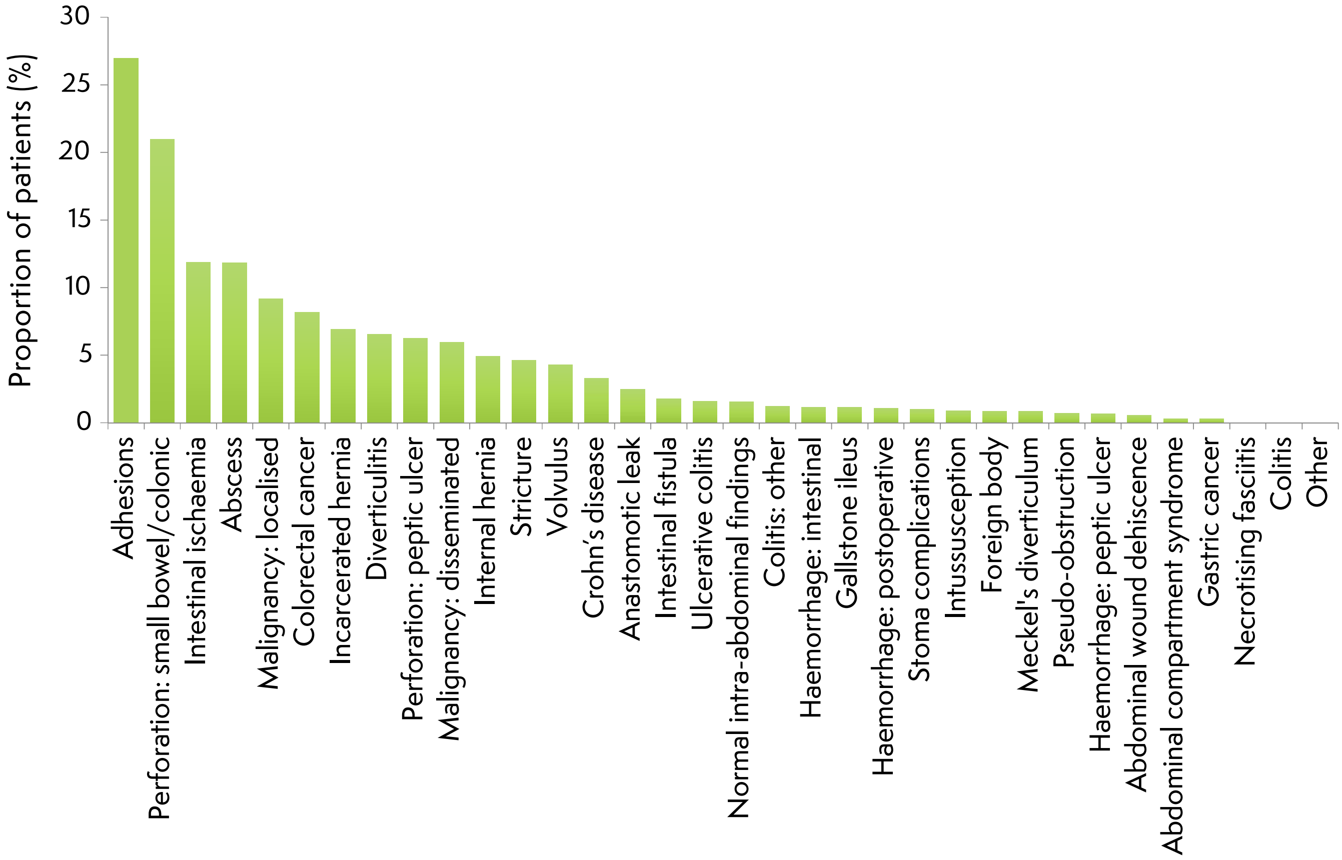
What is the main mode of surgery?

Emergency laparotomy remained a predominantly open surgery procedure. The number of cases completed laparoscopically is unchanged at only 8%.

Table 7.5 Operative approach at emergency laparotomy

Operative approach	Number of patients (n(%))
Open	19,943 (83.3)
Laparoscopic	1,938 (8.1)
Laparoscopic converted to open	1, 745 (7.3)
Laparoscopic-assisted	303 (1.3)

Figure 7.2 Rates of intraoperative findings (more than one may be selected for each patient)



Characteristics of admission

How do patients present?

The majority of patients (93.6%) undergoing emergency laparotomy did so after an unplanned (emergency) admission. The remaining 6.3% of patients had an emergency laparotomy after an elective admission, either following a complication of previous gastrointestinal surgery or after developing acute abdominal pathology during a planned inpatient stay for another purpose.

For patients who are admitted acutely there are several routes of admission. They include the Emergency Department, direct assessment on a 'front of house' Acute Surgical Assessment Unit (ASAU), direct referral to the ward by a General Practitioner, admission from the outpatient clinic or as a transfer from another hospital.

Table 7.6 Initial route of admission for all emergency admissions

Initial route of admission for all emergency admissions	Number of patients (n(%))
Emergency Department	16,679 (75.5)
Acute Surgical Assessment Unit	2,479 (11.2)
GP	1,637 (7.4)
Outpatient Clinic	706 (3.2)
Hospital Transfer	588 (2.7)
Missing data and Unknowns	328 (1.4)

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Table 7.7 Initial route of admission, by type of admission

Route of admission by type of admission	Number of patients (n(%))
Elective	1,512 (6.3)
Non-elective	22,399 (93.6)
Missing	18 (0.1)

Does the route of admission have an impact on patient care?

Patients admitted directly to the ward via general practice waited longer for review by a consultant surgeon when compared with admissions through the Emergency Department or direct to a Surgical Assessment Unit (Table 7.8). On average, GP admissions took 13 hours longer to arrive in theatre. Preoperative P-POSSUM risk assessment and the indications for emergency laparotomy remain broadly similar across the two groups (Table 7.9 and see supplementary data Tables 7.23, 7.26–7.28).

Many hospitals have pathways in place for admission through the Emergency Department, which helps improve patient flow and assists in adherence to waiting time targets. The same time-pressured national targets do not apply for admissions coming directly from General Practice and this may explain the discrepancy between the groups. However, once in the operating theatre, GP admissions are more likely to have both a consultant surgeon and consultant anaesthetist present, and just as likely to have a direct admission to critical care in the postoperative period (see supplementary data Tables 7.24 and 7.25).

While patients admitted from clinic also appear to wait longer for review by a consultant surgeon and subsequently wait longer to get to theatre, it is likely that these patients were seen by a consultant surgeon in the outpatient setting, and that any consultant level decision-making was made in the clinic prior to admission to the hospital.

Patients who are admitted via the Emergency Department have a higher mortality rate than patients admitted via any other route except for patients who are transferred from one hospital to another (Table 7.11).

Table 7.8 Number of hours to consultant surgeon review, by route of admission

Initial route of admission	Mean (hours)	Median (range) (hours)
Emergency Department	35.2	12.3 (0.3–422.5)
Acute Surgical Assessment Unit	23.0	11.3 (0–379)
GP	37.7	13.6 (0–476)
Outpatient Clinic	51.1	15.3 (0–1265.5)
Hospital Transfer	75.9	10.8 (0–1461)

Table 7.9 Calculated preoperative P-POSSUM category, by route of admission

Initial route of admission	Total number of patients (n(%))	Proportion of patients by calculated preoperative P-POSSUM risk category (%)		
		Lower risk (<5%)	High risk (5–10%)	Highest risk (>10%)
Emergency Department	16,679 (69.7)	44.3	17.9	37.8
Acute Surgical Assessment Unit	2,479 (10.4)	52.1	19.3	28.6
GP	1,637 (6.8)	43.8	21.1	35.2
Outpatient Clinic	706 (3.1)	48.3	19.7	32.0
Hospital Transfer	588 (2.4)	28.1	18.0	53.2
Unknown	1,840 (7.6)	24.1	16.4	59.4

Table 7.10 Length of stay in days, by route of admission

Initial route of admission	Mean Length of Stay (days)	Median Length of Stay (days)
Emergency Department	15.4	10
Acute Surgical Assessment Unit	13.7	9
GP	15.5	11
Outpatient Clinic	15.1	10
Hospital Transfer	18.8	13
Unknown	20.1	14

Table 7.11 Unadjusted ONS 30-day and 90-day mortality, by route of admission

Initial route of admission	Unadjusted ONS 30-day mortality (n(%))	Unadjusted ONS 90-day mortality (n(%))
Emergency Department	1,719 (10.3)	2,276 (13.7)
Acute Surgical Assessment Unit	153 (6.2)	236 (9.5)
GP	129 (7.9)	193 (11.8)
Outpatient Clinic	42 (6.0)	75 (10.6)
Hospital Transfer	79 (13.4)	107 (18.2)
Unknown	156 (8.5)	196 (10.7)

Hospital transfers prior to laparotomy

Inter-hospital transfers of patients requiring emergency laparotomy were rare, and accounted for 588 (2.7%) patients undergoing an emergency laparotomy (Table 7.6). The highest number of transfers recorded for any one hospital was three in one year. The reason for transfer is not captured in the dataset but might include transfer for specific clinical or surgical expertise, radiological or endoscopic expertise or for bed availability and specifically to facilitate admission to a critical care facility. The numbers are too small to draw any further conclusions.

Admitting specialty

Of the patients who underwent emergency laparotomy, approximately 20% were admitted under a non-surgical specialty. The reasons for this may be multifactorial. The differential diagnosis for acute abdominal pain requiring emergency laparotomy includes many medical causes, and patients may be admitted under medical specialties. Patients with an exacerbation of inflammatory bowel disease will preferentially be admitted under the gastroenterologists for a trial of medical management before emergency surgery is indicated. Almost half of the patients were more than 70 years of age and may have been admitted under elderly-care physicians.

Table 7.12 Number and percentage of patients, by admitting specialty

Admitting Specialty	Number of patients (n(%))
General Surgery	19,447 (81.2)
General Medicine	2,515 (10.5)
Gastroenterology	525 (2.2)
Elderly Care	76 (0.3)
Other	1,092 (4.6)
Unknown	274 (1.1)

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What is the impact of admitting under a non-surgical specialty?

Only one in every ten patients who are admitted with acute abdominal pain ultimately undergoes an emergency laparotomy and it is not always immediately apparent at the time of admission which patients will require surgery. However, admission under the wrong specialty may lead to delays in the patient pathway and may have a negative impact on patient outcomes. Where acute surgical pathology is suspected, prompt senior surgical review is imperative to aid complex decision-making and treatment planning and to reduce the delays in the patient pathway which are associated with impaired patient outcomes.

Time to review by a consultant surgeon

Patients admitted under general medicine or elderly-care specialties are significantly less likely to receive a consultant surgeon review in a timely fashion. On average a patient admitted under a non-surgical specialty waited more than 40 hours from the time of a consultant surgeon review to arrival in theatre, compared with an average of 15 hours between consultant review and arrival in theatre for patients admitted directly under the general surgeons.

Table 7.13 Time in hours to consultant surgeon review, by admitting specialty

Time to review by a consultant surgeon (hours)	General Surgery	General Medicine	Gastroenterology	Elderly Care	Other
Mean	24.3	108.8	136.8	111.6	137.6
Median	11.0	44.7	60.2	63.5	62
Range	0–285	1.3–861.9	0.2–1231	0–963	0–1008

Table 7.14 Time in hours to theatre, by admitting specialty

Time to theatre (hours)	General Surgery	General Medicine	Gastroenterology	Elderly Care	Other
Mean	65.9	159.6	191.7	142.6	177.9
Median	26.3	81.8	118.8	98.0	97.5
Range	2–571.5	4.5–1088	2.4–1233	5.5–1037	2.0–1139

Are patients admitted under a non-surgical specialty more unwell?

Only 69.7% of the patients admitted under gastroenterology had a preoperative risk assessment documented. Patients admitted under general medicine (78.1%) or elderly care (81.6%) were more likely to have their risk assessment documented preoperatively, compared with 74% of those admitted under the surgical team (see supplementary data Tables 7.34).

Patients who are initially admitted under a non-surgical specialty have the highest mean preoperative calculated P-POSSUM score, with the greatest proportion of patients being classified as highest risk (>10% predicted mortality).

Table 7.15 Documented preoperative P-POSSUM risk, by admission specialty

Documented risk	General Surgery (n(%))	General Medicine (n(%))	Gastroenterology (n(%))	Elderly Care (n(%))	Other (n(%))	Unknown (n(%))
Lower risk (<5%)	6,582 (33.9)	561 (22.3)	190 (36.2)	7 (9.2)	224 (20.5)	61 (22.7)
High risk (5–10%)	3,348 (17.2)	444 (17.7)	67 (12.7)	14 (18.4)	167 (15.3)	53 (19.3)
Highest risk (>10%)	4,533 (23.3)	959 (38.1)	109 (20.8)	41(54.0)	405 (37.1)	74 (27.0)
Not documented	4,984 (25.6)	551 (21.9)	159 (30.3)	14 (18.4)	296 (27.1)	86 (31.4)

Medical patients were more likely to have a major colonic resection that the those admitted under the surgical team. The most commonly performed procedure was an emergency subtotal colectomy or panproctocolectomy. This was performed in more than one-third of patients admitted under gastroenterology and 10% of those admitted under general medicine compared with 4% of patients admitted under surgery and 5% of the overall cohort (see supplementary data Tables 7.35–7.39). This may represent those patients who fail to respond to medical management of acute colitis.

Patient outcomes

Patients admitted under medical or gastroenterology specialties were more likely to have an unplanned return to theatre or an unplanned return to critical care than those admitted under surgical specialties, despite them having an increased likelihood of an initial direct critical care admission after surgery.

Table 7.16 Unplanned return to theatre by admission specialty

Unplanned return to theatre	General Surgery (n(%))	General Medicine (n(%))	Gastroenterology (n(%))	Elderly Care (n(%))	Other (n(%))	Unknown (n(%))
Unplanned return to theatre	1,096 (5.6)	160 (6.4)	40 (7.6)	0 (0.0)	99 (9.1)	28 (10.2)
No return to theatre	18,091 (93.0)	2,309 (91.8)	472 (97.4)	74 (97.4)	976 (89.4)	243 (88.7)
Unknown	260 (1.3)	46 (1.4)	13 (2.5)	2 (2.6)	17 (1.6)	3 (1.1)
Total	19,447	2,515	525	76	1,092	274

Table 7.17 Unplanned admission to critical care, by admission specialty

Unplanned admission to critical care	General Surgery (n(%))	General Medicine (n(%))	Gastroenterology (n(%))	Elderly Care (n(%))	Other (n(%))	Unknown (n(%))
Unplanned admission	629 (3.2)	96 (3.8)	22 (4.2)	0 (0.0)	45 (4.1)	13 (4.7)
No unplanned admission	18,649 (95.9)	2,392 (95.1)	496 (94.5)	75 (98.7)	1,031 (94.4)	258 (94.2)
Unknown	169 (0.9)	17 (1.1)	7 (1.3)	1 (1.3)	16 (1.5)	3 (1.1)
Total	19,447	2,515	525	76	1,092	274

72% of the patients admitted under the elderly-care physicians had a direct postoperative admission to critical care (see supplementary data Table 7.33). However, none of these patients had an unplanned return to theatre or unplanned critical care admission. This may reflect a reduced ability to tolerate further interventions, should they deteriorate or develop complications after their initial emergency laparotomy.

Patients admitted under non-surgical specialties had longer hospital stays and higher mortality (Table 7.18 and 7.19). There was, on average (median), 2.5 days before surgical review. However, some patients had in excess of 50 days stay prior to review by the surgical team. Presumably this small group of patients developed surgical pathology during an inpatient stay for a non-surgical pathology.

While it may be understandable that those admitted under the elderly-care physicians do least well, it is less clear why patients admitted under general medicine should have relatively worse outcomes. It is also not possible to ascertain whether these outcomes would have been improved if the patients had been admitted directly under the surgical team.

Patients admitted with an acute presentation or an exacerbation of known inflammatory bowel disease are more likely to require major colonic resection. It is possible that joint care between gastroenterology and surgical teams may improve time to senior surgical review and reduce delays in the emergency laparotomy pathway in the event that medical therapy fails.

Table 7.18 Length of Stay (in days) from admission, by admitting specialty

Length of stay (days)	General Surgery	General Medicine	Gastroenterology	Elderly Care	Other
Mean	16.6	25.3	25.1	27.5	27.7
Median	12	19	18	20	19
Range	1–85	2–108	3–111	3–149	2–124

Table 7.19 ONS 30-day and 90-day mortality, by admitting specialty

	Total number of patients (n(%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
General Surgery	19,447 (81.2)	8.2	11.2
General Medicine	2,515 (10.5)	16.8	22.1
Gastroenterology	525 (2.2)	7.4	9.3
Elderly Care	76 (0.3)	30.0	40.8
Other	1,092 (4.6)	16.4	21.7
Unknown	274 (1.1)	9.9	12.0

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8 RISK ASSESSMENT

Key Process Measure: the proportion of patients for whom a risk assessment was documented preoperatively

174 hospitals were included in this metric. 56 (32.2%) were rated green, 28 (16.1%) were rated red.

Why is this important for patients?

All patients should have an assessment of their individual risk of death and complications. Risk assessment allows clinicians to tailor care to the needs of each person requiring surgery and supports shared decision-making by helping guide doctors, patients, and their relatives in deciding which course of treatment is most appropriate. The Montgomery ruling of the Supreme Court has laid down the legal requirement for clinicians to discuss material risks with patients before an intervention and this discussion of risk must be individualised to the patient, as opposed to quoting population-level risks.[14]

Preoperative risk assessment for patients who may undergo an emergency laparotomy

High risk patients are those with a ≥5% (1 in 20) risk of dying within 30 days after surgery. Many of the standards against which NELA measures delivery of care are based on the patient's risk of death following surgery. For instance, high risk patients need consultant-delivered care, so it is important that these patients are identified before surgery to ensure that this happens.

Failure to assess and document risk may mean that a patient might not be recognised as being high risk and therefore not receive the level of care that they need. NELA collects data that allows the risk profile of all patients to be calculated, regardless of whether an assessment of risk was documented. Table 8.1 demonstrates that around half of patients who did not have a risk of death documented in their records, were in fact high risk patients with a predicted mortality >5%, and an observed 30-day mortality of 7.1% (Figure 8.2).

NELA launched the bespoke NELA risk prediction tool in 2017 during the Year 4 data collection period. Prior to this, P-POSSUM was the predominant objective risk calculator used by clinicians, and hence many of results and commentary are presented alongside P-POSSUM values as this was the more familiar risk calculator. NELA risk scores have also been provided in many areas to aid interpretation of results according to both NELA and P-POSSUM risk. We anticipate a transition period where both NELA and P-POSSUM calculators will be used side by side whilst the NELA risk calculator becomes more embedded into clinical practice. The NELA risk calculator is available alongside a P-POSSUM calculator on the NELA data entry webtool and is also available as an app (Android and iOS). Information describing the development of the NELA risk model has been published.[7]

The NELA risk prediction tool relies upon all data being entered to produce an accurate risk score: in the case of not all data being available no estimate of death is provided. The NELA risk calculator provides a better estimation of 30-day mortality following emergency laparotomy when compared to P-POSSUM, particularly for highest risk patients, as the latter over-estimates above 15% mortality.[15] Both risk calculators are of use in identifying if a patient is high risk with a predicted mortality of greater than 5%. However, the NELA risk calculator is able to provide a more accurate estimation of mortality to guide discussions with patients and their carers. The breakdown of distribution of risk according to P-POSSUM and NELA risk scores is shown in Tables 8.2 and 8.3 in the supplementary data tables supporting document. The NELA risk calculator also provides a better estimation of observed versus expected mortality, as P-POSSUM will provide falsely reassuring figures as it overestimates the risk of death.

Objective risk prediction using scores or calculators are not perfect and can only help guide decision-making. They should only be used in conjunction with the clinical judgement of senior clinicians. In many cases, this should also involve input from the multidisciplinary team – ideally a surgeon, an anaesthetist and critical care specialist and if appropriate an elderly care physician.

NELA data demonstrate that virtually all patient cohorts (eg indication for surgery, operative findings, surgical procedure) have a greater than 5% mortality. In the absence of a formal calculated assessment of risk, a patient should therefore be considered as high risk until both consultant opinion and objective risk scores consistently indicate low risk. For Year 5, any patient with a missing formal assessment of risk (by either objective risk scoring or clinical judgement) will be considered high risk. The original 2011 *Higher Risk Surgical Patient* standards[1] are being updated in 2018, and the proposed standards will be updated to reflect this.

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Accurate data input for predicting risk is important. Incomplete data entry means the patient, family and clinical team have poor quality information on which to make decisions regarding intervention, timing of surgery and resource allocation. While we recognise that, it is not always possible to supply the full complement of data for objective risk assessment, it is important to note that missing data may mean that a hospital's risk-adjusted mortality is less accurate.

Table 8.1 Relative proportions of patients in each risk category when preoperative documented risk is compared to preoperative calculated P-POSSUM risk of death

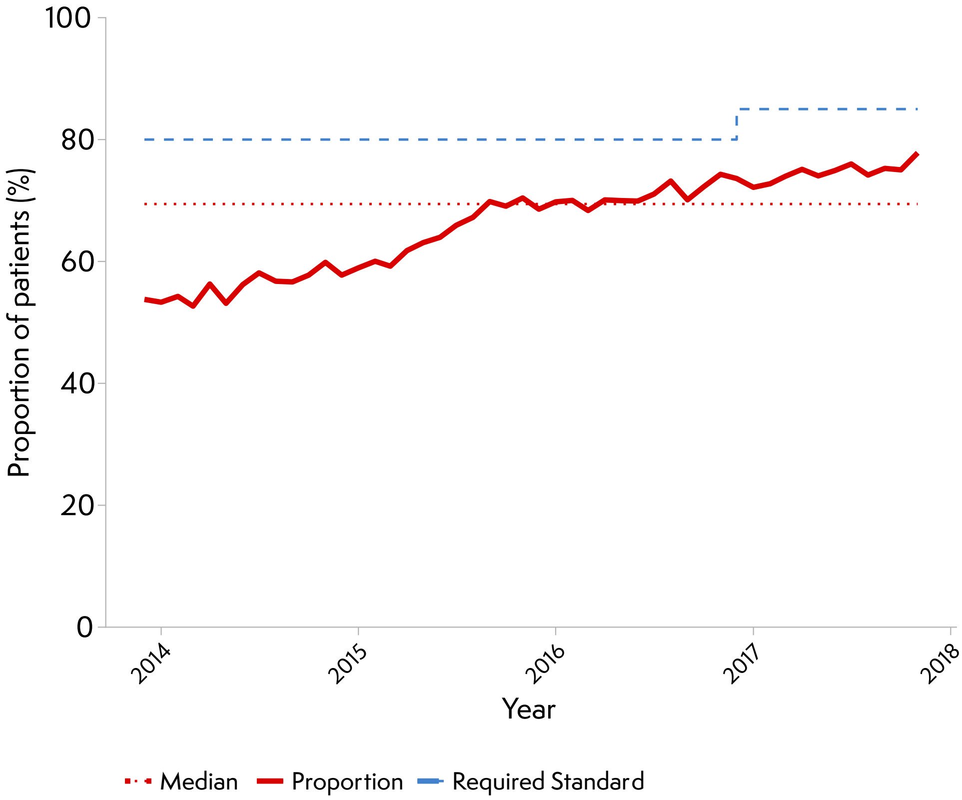
Documented preoperative risk category	Total number of patients (n(%))	Proportion of patients by calculated P-POSSUM risk of death (n(%))		
		Lower risk (<5%)	High risk (5–10%)	Highest risk (>10%)
Lower (<5%)	7,625 (31.9)	5,843 (76.6)	1,096 (14.4)	686 (9.0)
High (5–10%)	4,093 (17.1)	1,008 (24.6)	1,505 (36.8)	1,580 (38.6)
Highest (>10%)	6,121 (25.6)	344 (5.6)	622 (10.2)	5,155 (84.2)
Not documented	6,090 (25.5)	3,186 (52.3)	1,115 (18.3)	1,789 (29.4)
Overall	23,929	10,381	4,338	9,210

What questions did we ask?

What proportion of patients had an assessment of risk documented before surgery? (minimum standard 85%)

The proportion of patients who have their risk of death documented preoperatively has continued to improve, and reached 75% of patients in the Year 4 (71% in Year 3), with 61% having a formal risk calculation performed, 13% having risk assessed by clinical judgement, and the remainder having risk assessed by other means.

Figure 8.1 Trend in the overall proportion of patients whose risk was documented preoperatively



What variation existed in the proportion of patients who had a risk of death documented before surgery, according to the time of day or day of the week?

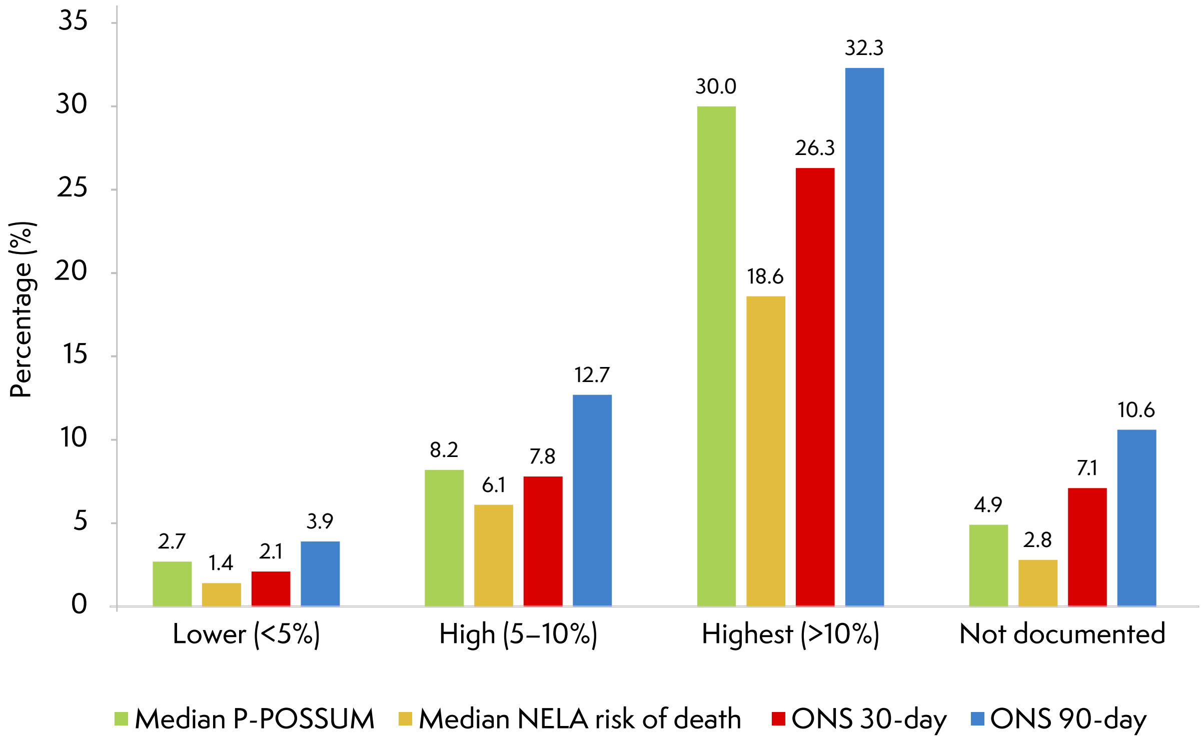
There continues to be little variation between the time of day and day of the week in the proportion of patients who have their risk assessed and documented preoperatively.

Which patients are more likely to have risk documented preoperatively?

Patients who might be perceived as being at higher risk are more likely to have their preoperative risk of death documented. These patient groups include the elderly, patient with high ASA grades and patients requiring surgery more urgently. For example, 33% of patients under the age of 40 do not have their risk documented but only 20% of those aged 80 to 89 do not have their risk documented (see supplementary data Table 8.4). Similarly, ASA grade 3, 4 and 5 patients have their preoperative risk documented more often.

Delivery of care, in terms of consultant presence and admission to critical care, also varied according to whether risk had been documented. This is covered in the relevant chapters.

Figure 8.2 Median calculated preoperative P-POSSUM and NELA risk of death, and observed ONS 30-day and 90-day mortality, by documented preoperative risk category



USING NELA DATA TO IMPROVE CARE

There is now a NELA app, to help clinicians to calculate patient risk at the bedside, to aid the consent process, and to help teams to arrange the appropriate standards of care. Clinicians can also access the NELA and P-POSSUM risk calculators on the front page of the NELA webtool to match the timing of clinical work – so risk calculation is supported before the patient gives their consent for a laparotomy and so enters the audit.

'The NELA app is a great bonus and adjunct to difficult decisions in this high risk group of patients – the app is easy to use on my mobile with the calculator inside it, I can run a quick P-POSSUM or NELA risk calculation on the ward when I see the patient. I can also read and navigate the reports easily, and then its useful reference at department meetings to pull out our hospital stats and compare them to other nearby/similar hospitals.'

Jamie Strachan, Anaesthetic Registrar, Oxford University Hospitals

'The NELA risk prediction calculator provides individualised patient-centred data to assist shared decision-making'

Kanekal Darshan, Consultant Anaesthetist, Royal Bolton Hospital

The app is available on Android and iOS

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9 CONSULTANT INPUT BEFORE SURGERY

Key Process Measure: The proportion of patients who had preoperative input by a consultant surgeon prior to surgery when calculated risk of death ≥5% (P-POSSUM)

172 hospitals were included in this metric. 160 (93%) were rated green, 0 (0%) were rated red.

Key Process Measure: The proportion of patients who had preoperative input by a consultant anaesthetist prior to surgery when calculated risk of death ≥5% (P-POSSUM)

172 hospitals were included in this metric. 127 (73.8%) were rated green, 4 (2.3%) were rated red.

Key Process Measure: The proportion of patients who had preoperative input by a consultant intensivist prior to surgery when calculated risk of death >10% (P-POSSUM)

171 hospitals were included in this metric. 26 (15.2%) were rated green, 37 (21.6%) were rated red.

Why is this important for patients?

Patients who have an emergency laparotomy are among some of the most complex and unwell patients requiring emergency anaesthesia and surgery. They should expect to receive consultant-led care throughout the perioperative period in order to benefit from the judgement, leadership and advanced clinical skills that consultants provide. These advantages also include more rapid decision-making (important both preoperatively and intraoperatively in often time critical situations), more efficient use of resources and improved outcomes.[16]

What questions did NELA ask?

In previous years, we only asked whether a patient had been seen by a consultant surgeon or anaesthetist before surgery. For Year 4, we changed the way we asked about this aspect of care (hence results are not directly comparable to previous years) to understand more about the nature of preoperative consultant input. We asked whether the consultant input was through discussion with junior members of the clinical team or whether the consultant saw the patient in person. For the first time, we have also asked about the nature of preoperative input by critical care doctors. This definition of consultant input reflects the nature of working within a clinical team.

Overall, consultant input is considered to have occurred if a patient was either seen in person by a consultant or if there was a discussion with a consultant before surgery.

Was a consultant surgeon involved in the decision to operate?

95% of patients were either seen in person, or had their case discussed with a consultant surgeon at the time decision was made for surgery; 77% of patients were seen in person at the time the decision was made for surgery, and 19% had the decision discussed with a consultant surgeon by a member of the surgical team. There was little variation with age as to whether input was 'in person' or 'by discussion'. However, consultant surgeons were slightly less likely to see in person the highest risk, ASA grade 4 and 5, or the most urgent of cases.

Junior surgical doctors rarely made an independent decision for emergency laparotomy. In only 264 (1.1%) patients was the decision to operate made by a junior surgical doctor. Junior surgeons were more likely to make the decision to proceed with surgery without senior input in the young (<39yrs) and those without co-morbidity (ASA grades 1 and 2).

Did a consultant anaesthetist provide input before surgery?

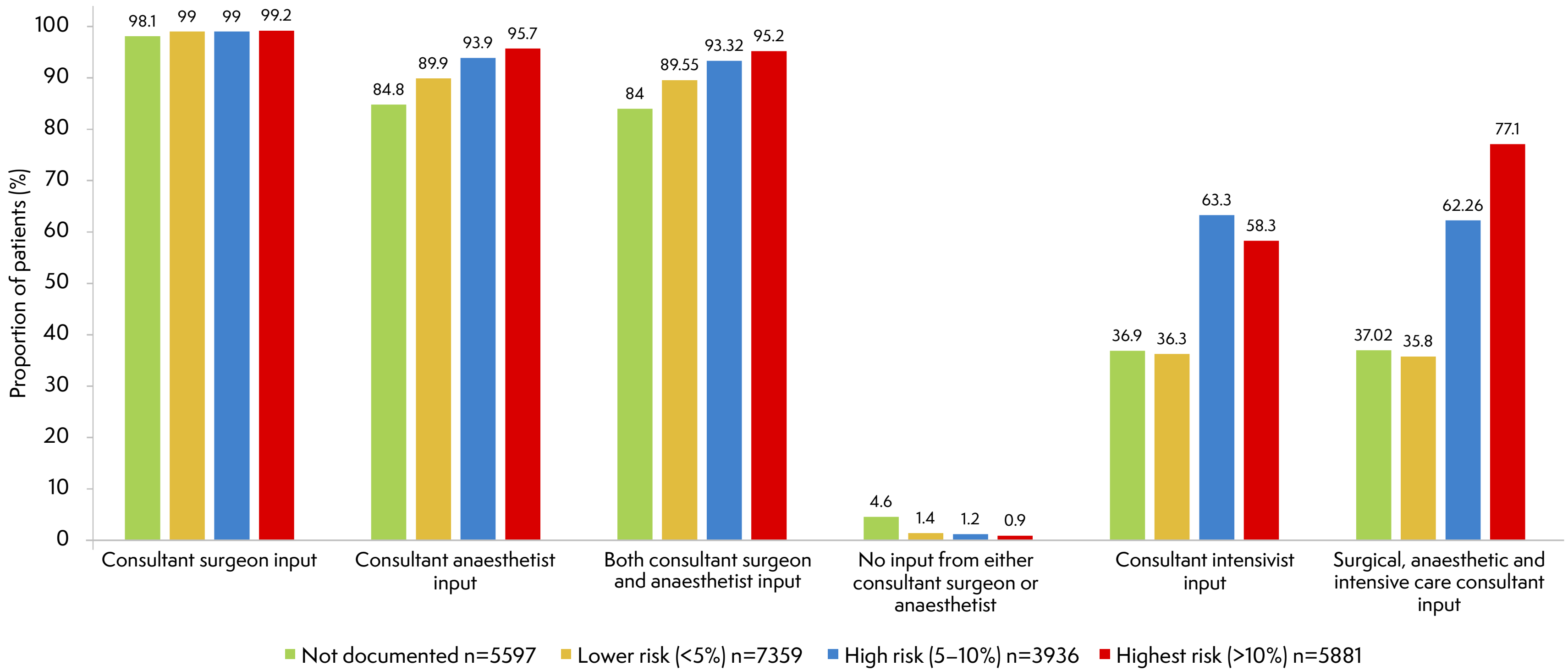
86% of patients had preoperative input by a consultant anaesthetist; 56% of patients were seen in person, and 30% had their care discussed with a consultant by a member of the anaesthetic team. In contrast to the input from consultant surgeons, patients who were at higher risk were more likely to receive input from a consultant anaesthetist, and this input was more likely to be an in-person review; this was more likely in the elderly (>70yrs), those with pre-existing co-morbidity (higher ASA grade), those with high preoperative risk score (>5%,) and patients who had emergency laparotomy after an elective admission. Those who require immediate surgery were also more likely to receive an 'in person' review. Preoperative input from junior anaesthetists only was more likely in the young (<39yrs), those without co-morbidity (ASA grades 1 and 2), and those in whom a risk assessment had not been documented.

Was an intensive care consultant involved in the perioperative care and planning?

Existing standards of care specify that patients with a risk of death greater than 10% should be admitted to critical care, and that admission should be considered for those with a predicted risk of 5% or more. Input by a consultant intensivist (a critical care specialist) reflects these standards. For highest risk patients (risk >10%), input by a consultant intensivist was 67%. Overall, 48% of patients had preoperative input by a consultant intensivist. Of these patients 14% were seen in person by a consultant and 34% had their care discussed with a member of the intensive care team.

Consultant intensivists were more likely to provide input, and more likely to see patients in person if the patients were elderly (>70yrs), undergoing more urgent surgery, had significant co-morbidity (higher ASA grade), or were undergoing emergency laparotomy after an elective admission. 6% of patients were discussed with junior members team of the intensive care team only.

Figure 9.1 Proportion of patients receiving input (seen in person or case discussed) prior to surgery by consultant surgeon, anaesthetist and intensivist, by documented preoperative risk category



What was the impact of risk assessment on consultant input before surgery?

The impact of not documenting risk in the preoperative period was again noted, particularly for non-surgical members of the multidisciplinary team. Almost 50% of the 'risk not documented' patient group had a predicted risk of greater than 5% (29% were highest risk). While a consultant surgeon provided preoperative input for 95% of patients regardless of risk documentation, this was lower for anaesthetists (85% vs 90–96% if risk documented), and intensivists (37% vs ~60% if risk documented). This group of patients were also the least likely to be seen preoperatively in person. Consultant anaesthetists saw 50% in person and consultant intensivists 11%. Patients for whom there was no documented risk assessment were almost four times as likely to have been seen by a junior doctor only. This suggests that documentation and communication of risk remains an important aspect of ensuring consultant input for high risk patients.

What variation was there according to the time of day/day of week?

Between 8.00am and midnight, approximately 95% of patients received preoperative input from the consultant surgeon, either by in-person review or by discussion; after midnight the proportion fell to around 89%. For input from consultant anaesthetists the proportion was around 88%, falling to 82% after midnight. For consultant intensivists the figure was around 50% dropping to 42% after midnight. However, there was little variation between weekdays and weekends.

10 RADIOLOGY

Key Process Measure: The proportion of patients who received a CT scan which was reported by a consultant radiologist before surgery

174 hospitals were included in this metric. 7 (4%) were rated green, 34 (19.5%) were rated red.

The Royal College of Radiologists (RCR) welcomes the opportunity to comment on the findings of the fourth NELA audit.

Computed Tomography (CT) is fundamental to providing a preoperative diagnosis in patients presenting with acute abdominal symptoms. In patients at high preoperative risk, any delays in acquiring or reporting the scan can adversely affect patient outcomes. Increased CT scanning capacity is required to facilitate rapid access for patients who may require emergency laparotomy.

Reporting in-house appears to result in fewer discrepancies and an in-house consultant radiological opinion should be sought where there is doubt about the initial report or there are multiple differentials.

The development of regional networks for out-of-hours reporting may provide quality improvement where in-house reporting is not available 24/7.

The RCR is supporting the introduction of Radiology NELA leads to improve data collection on discrepancy rates and to try to further improve the quality of reporting of acute abdominal CT examinations.

Dr Caroline Rubin
Vice-President, Clinical Radiology
The Royal College of Radiologists

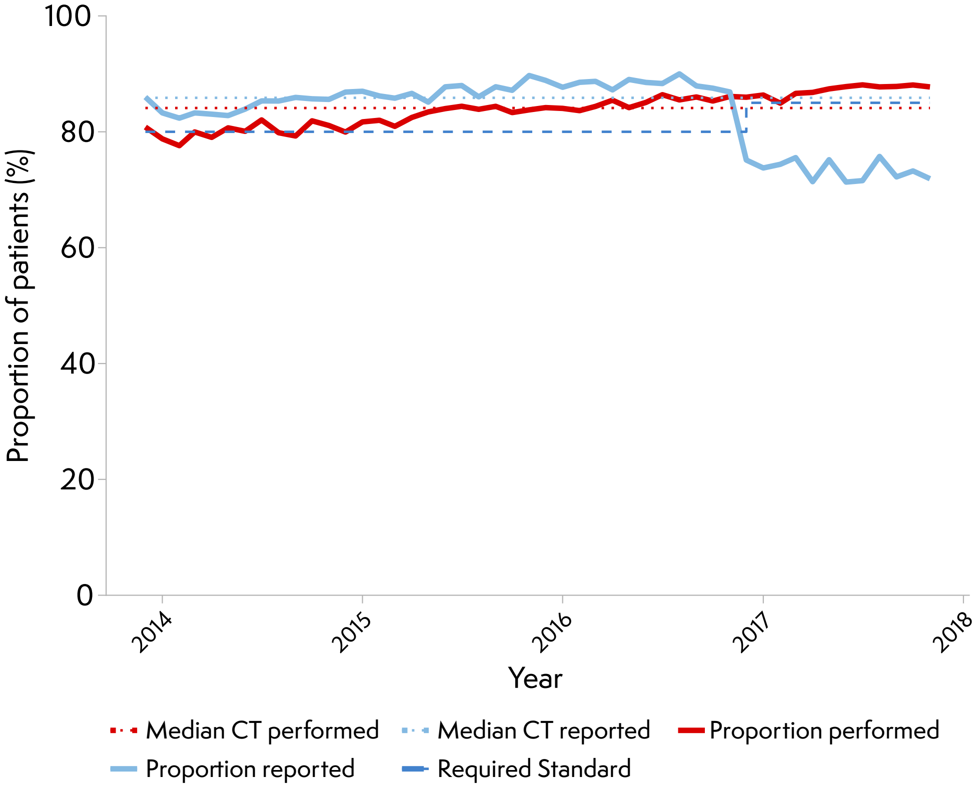
Why is this important for patients?

Computed Tomography (CT) is an important part of the diagnostic process for patients who may require an emergency laparotomy and can support decision-making when utilised as part of the initial management plan of patients presenting with an acute abdomen.[17] CT scanning has a fundamental role in facilitating the timely diagnosis, appropriate resuscitation, and prioritisation of patients requiring emergency surgery.

How many patients had a CT scan preoperatively as part of their diagnostic work up?

There has been a sustained increase in the number of patients who have a preoperative CT scan from 80% in Year 1 to 87% in Year 4.

Figure 10.1 Trend in the overall proportion of patients receiving a CT scan preoperatively and CT scans being reported by a consultant radiologist preoperatively (note, this metric only includes in-house consultant for Year 4, whereas year 1–3 also included out-sourced reporting)



How does preoperative risk assessment influence the use of CT scanning?

Of the 6,090 patients in the NELA dataset who did not have their risk assessed formally and did have a CT scan performed preoperatively, 25 (0.5%) did not have their CT scan reported before their surgery. Formal risk assessment does not appear to influence patient access to reported preoperative CT scanning (see supplementary data Table 10.8).

Elderly patients were more likely than those in other age groups to have their scan reported by a consultant preoperatively. This finding is consistent with other standards reported, which may reflect the increasing awareness that this group of patients have complex requirements and require comprehensive assessment to aid decision-making for their surgical options.

How does urgency of surgery affect the use of CT scanning?

Those patients requiring immediate surgery were less likely to have a CT scan performed in the preoperative period than those with less urgent indications for theatre, if performed, the CT was less likely to be reported as those performed in less urgent cases (Table 10.1). In those cases where the need for rapid intervention is certain, the clinical team should not necessarily wait for a CT scan report. However, it is noteworthy that a reported CT scan (within 60 minutes – preferably 30 minutes – of arrival in hospital, with an initial checklist report and then access to a verified report within 60 minutes of completion of the scan) is a standard of care achievable for trauma patients, and therefore should be achievable for patients requiring emergency laparotomy. It is accepted that a specialist verified report may take longer. This will become important as hospitals develop their own local care pathways to support the Best Practice Tariff for patients requiring an emergency laparotomy.

NELA
National Emergency Laparotomy Audit

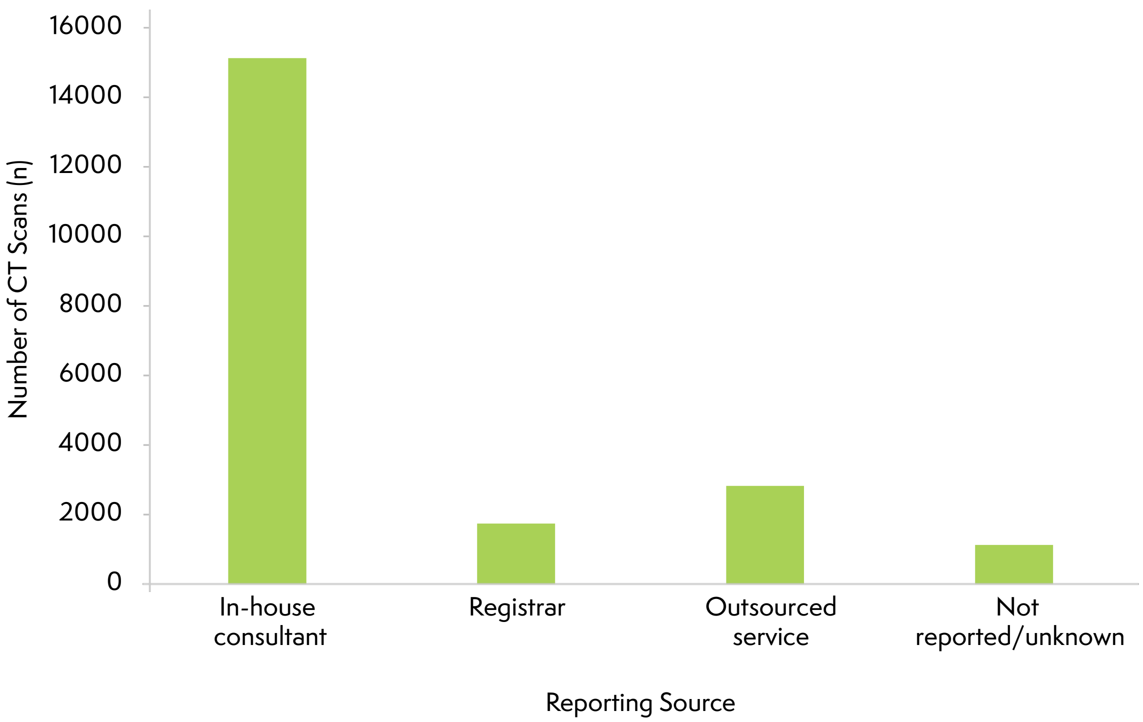
Table 10.1 Preoperative CT scanning and reporting, by urgency of surgery

Urgency of surgery	Total number of patients who had a CT scan before surgery (n(%))	Total number of patients who had their CT scan reported before surgery (n(%))
<2 hours	2,179 (79.9)	1,727 (63.3)
2–6 hours	7,958 (88.9)	6,768 (75.6)
6–18 hours	7,226 (89.2)	6,465 (79.8)
18–24 hours	3,440 (83.9)	3,141 (76.7)
Missing	38 (73.1)	28 (53.9)

CT Reporting: who reports CT scans and does this vary with the time and day of admission?

NELA collects data on who reports the scan preoperatively. Out of the 20,841 CT scans performed in Year 4, 95% were reported by a radiologist before the patient had their surgery. 15,132 (73%) were reported by an in-house consultant radiologist, 1,737 (8%) by an in-house registrar and 2,818 (14%) by an outsourced service. 1,127 (5%) were either not reported preoperatively or had unknown reporting status.

Figure 10.2 The number of reported preoperative CT scans, by reporting radiologist

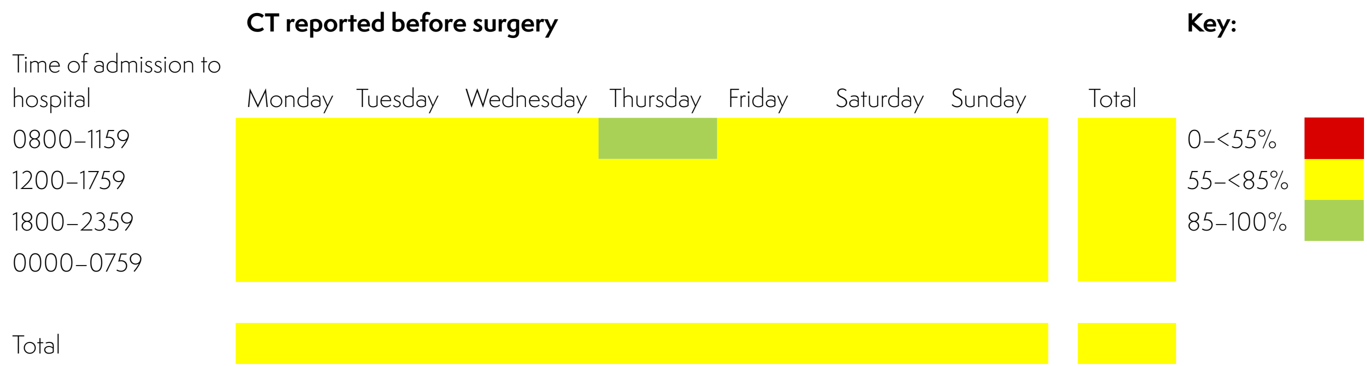


There is variation in who reports scans between, out-of-hours, weekdays and the weekends, with lower levels of in-house consultant reporting after 6.00pm on weekdays, and on a Saturday or Sunday. Outsourced reporting of scans is more frequent at weekends and after 6.00pm on weekdays.

Table 10.2 Preoperative CT scan, by reporting radiologist and time of day of admission

	Monday–Friday						Saturday–Sunday					
	Consultant (n(%))	Registrar (n(%))	Outsourced (n(%))	No Preoperative CT report (n(%))	Unknown (n(%))	Missing (n(%))	Consultant (n(%))	Registrar (n(%))	Outsourced (n(%))	No Preoperative CT report (n(%))	Unknown (n(%))	Missing (n(%))
0800–1159	2,448 (70.3)	170 (4.9)	205 (5.9)	11 (0.3)	131 (3.8)	517 (14.9)	689 (66.7)	85 (8.2)	105 (10.2)	4 (0.4)	33 (3.2)	117 (11.3)
1200–1759	4,257 (65.0)	465 (7.1)	630 (9.6)	10 (0.2)	238 (3.6)	950 (14.5)	1,048 (59.7)	177 (10.1)	246 (14.0)	2 (0.1)	68 (3.9)	215 (12.2)
1800–2359	2,620 (58.0)	367 (8.1)	757 (16.8)	15 (0.3)	165 (3.7)	592 (13.1)	859 (56.5)	112 (7.4)	321 (21.1)	3 (0.2)	57 (3.8)	168 (11.1)
0000–0759	2,403 (64.3)	2,34 (6.2)	363 (9.6)	18 (0.5)	138 (3.6)	598 (15.8)	773 (60.3)	127 (9.9)	191 (14.9)	3 (0.2)	42 (3.3)	147 (11.5)

Figure 10.3 Variation in the proportion of patients that had a CT scan reported by a consultant radiologist (of all CT scans performed), by day and time of admission to hospital



Are CT scans discussed preoperatively between radiologists and surgeons?

Preoperative discussion between multidisciplinary teams varies between 23.7% and 52% of all the CT scans that were reported preoperatively. In 20-50% of cases there was no documented discussion between the radiology and surgical teams (Table 10.4).

Discrepancy rates

Accepted discrepancy rates from the Royal College of Radiologists' standards should be less than 5% regardless of who reports the scan. For the purposes of NELA a discrepancy is described as a difference between the CT report and the surgical findings that altered or delayed the diagnosis or surgical management. In-house consultants had the lowest discrepancy rate (5.2%) and outsourced scans had the highest (6.2%). Registrar reports had a discrepancy rate between that of the in-house consultant and the outsourced service. This finding is consistent with recently published figures.[18] Discrepancy rates ranged between hospitals from 0% to 22%. Hospital-level discrepancy rates have been RAG rated (Green<5%, Amber >5%–7%, Red >7%) and are shown in Chapter 19.

Table 10.3 The incidence of discrepancy between CT report and surgical findings, by reporting radiologist

	Consultant (n(%))	Registrar (n(%))	Outsourced (n(%))	Not reported preoperatively (n(%))	Unknown who reported the scan (n(%))	Missing (n(%))
Discrepancy	783 (5.2)	92 (5.3)	174 (6.2)	3 (4.6)	19 (2.2)	0
No discrepancy	12,712 (84.0)	1,440 (82.9)	2,358 (83.7)	47 (71.2)	428 (49.1)	1(0.5)
Unknown if discrepancy	1,637 (10.8)	205 (11.8)	286 (10.2)	16 (24.2)	425 (48.7)	0
Missing	0	0	0	0	0	215 (99.5)
Total	15,132	1,737	2,818	66	872	216

What factors affect discrepancy rates?

The discrepancy rates increased with the most urgent cases, even though these are more likely to be discussed preoperatively.

Discrepancy rates also vary according to the underlying pathology, with some of the higher discrepancies apparent in the more unusual underlying diagnoses.

Table 10.4 Rates of CT report discrepancy and rates of CT report discussions, by surgical urgency

Urgency of Surgery	Report Discrepancy				Report Discussion			
	Discrepancy (%)	No discrepancy (%)	Unknown (%)	Missing (%)	Discussed (%)	No discussion (%)	Unknown (%)	Missing (%)
<2 hours	6.3	82.0	10.9	0.7	52.0	27.2	20.0	0.8
2–6 hours	5.4	82.1	11.6	0.8	47.1	29.4	22.7	0.8
6–18 hours	4.8	81.2	13.1	0.9	42.9	29.4	26.8	0.9
18–24 hours	4.6	80.6	12.9	1.9	45.6	26.9	25.6	1.9
Not documented	2.6	57.9	31.5	7.9	23.7	18.4	50.0	7.9

Table 10.5 Preoperative CT scan report discrepancy rates by top 10 operative findings

Operative Finding	Discrepancy Rate (%)	No discrepancy (%)	Unknown if there was a discrepancy (%)
Normal intra-abdominal findings	15.5	71.1	13.4
Haemorrhage – Peptic Ulcer	14.3	73.8	11.9
Meckel's diverticulum	10.8	85.6	3.4
Necrotising Fasciitis	10.0	80.0	10.0
Abdominal Compartment Syndrome	9.7	83.9	6.5
Haemorrhage – Postoperative	8.4	81.7	9.9
Foreign Body	7.5	76.0	16.4
Haemorrhage – Intestinal	7.8	79.8	12.4
Pseudo-Obstruction	7.4	76.4	16.2
Intestinal Ischaemia	7.5	80.3	12.2

Note: discrepancy reporting in NELA compared to RCR definitions.

There can be many factors contributing to discrepancies, but, for the purpose of this report, NELA 'discrepancy' refers to a discrepancy between the reported CT and the surgical findings as reported by the surgical team. This definition was developed in consultation with the RCR and is slightly different to the Royal College Radiologists' definition of 'major or minor' discrepancy. In addition, we are unable to state whether the discrepancies are related to the initial CT report or to any subsequent addendum report due to the nature of the NELA data collection tool, which does not record when addenda were reported or the timing of the CT scan itself.

NELA
National Emergency Laparotomy Audit

11 CONSULTANT PRESENCE IN THEATRE

Key Process Measure: The proportion of patients who had a consultant surgeon and anaesthetist present in theatre when risk of death ≥5% (P-POSSUM)

172 hospitals were included in this metric. 80 (46.5%) were rated green, 3 (1.7%) were rated red.

Key Process Measure: The proportion of patients who had a consultant surgeon present in theatre when risk of death ≥5% (P-POSSUM)

172 hospitals were included in this metric. 149 (86.6%) were rated green, 0 (0%) were rated red.

Key Process Measure: The proportion of patients who had a consultant anaesthetist present in theatre when risk of death ≥5% (P-POSSUM)

172 hospitals were included in this metric. 114 (66.3%) were rated green, 1 (0.6%) were rated red.

Why is this important for patients?

Patients undergoing any form of high risk elective or emergency surgery should expect their care to be directly supervised by a consultant surgeon and consultant anaesthetist. The intraoperative management of patients having emergency bowel surgery may be challenging as the clinical situation may change rapidly and patients are often extremely unwell. Hence experience is required for the complex decision-making required to identify the next steps in care and lead the team to deliver these.

What questions did we ask?

What proportion of high risk patients (preoperative P-POSSUM risk of death ≥5%) had a consultant surgeon and a consultant anaesthetist directly supervising care during surgery? (minimum standard 85%)

Overall 78% of all patients, and 83% of patients with a risk above 5%, had a consultant surgeon and anaesthetist present in theatre during their surgery. There has been a steady improvement since the start of NELA and it is now unusual for patients undergoing an emergency laparotomy to have their surgery without any consultant present in the operating theatre.

As seen last year, consultant presence was higher in patients known to be at higher risk, or with higher ASA grade. There was very little difference according to age or surgical urgency (see supplementary Tables 11.3, 11.4 and 11.5). However, the impact of failure to document an assessment of patient risk on consultant presence is again highlighted. Where risk had not been documented before surgery, the proportion of patients who received consultant delivered care was the same as the low risk group of patients. However, almost 50% of this 'not documented' group have a predicted risk of ≥5% (29% are highest risk) (Table 8.1). Therefore, these high risk patients are not getting the benefit of consultant delivered care. Anaesthetic consultant presence continues to remain lower than surgical consultant presence, although the difference is less marked for higher risk patients.

Figure 11.1 Proportion of patients whose care during surgery was directly supervised by a consultant surgeon and consultant anaesthetist, by documented preoperative risk category

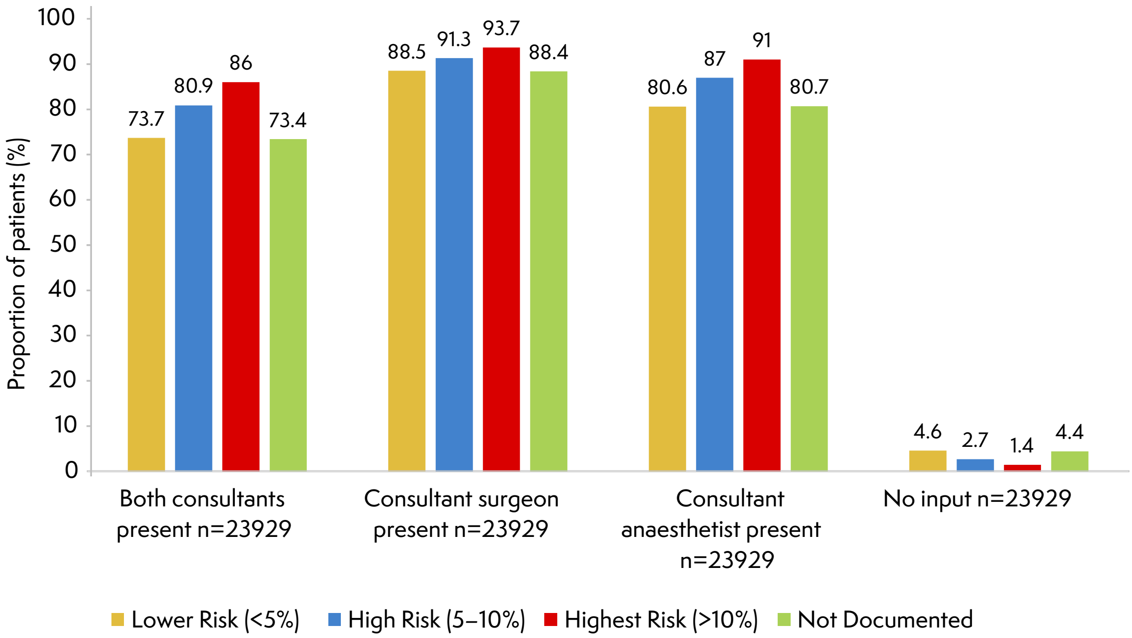
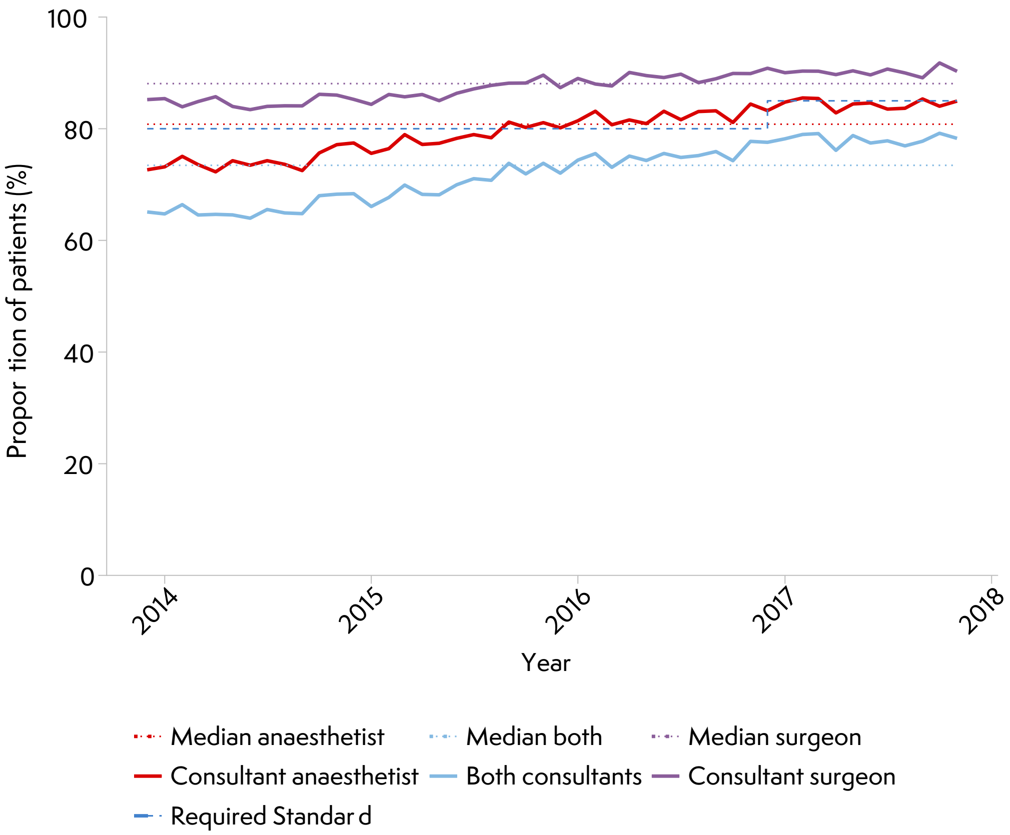


Figure 11.2 Trends in the proportions of high risk patients (preoperative P-POSSUM risk of death ≥5%) for whom a consultant surgeon, consultant anaesthetist and both consultants, were present in theatre



How does this vary by time of day, and day of week?

The attendance for weekday day-time hours has improved slightly with both consultants in attendance almost 90% of the time for high risk patients (~86% last year). Daytime presence for consultant surgeons or anaesthetists individually is around 94%.

In contrast to weekday daytime hours, consultant presence after midnight is lower. This is despite these patients having the highest risk profile compared to patients needing surgery at other times of the day. During daytime hours, around 50% of patients having surgery are low risk, compared to less than 30% after midnight. In contrast, 55% of patients having surgery after midnight are highest risk (predicted mortality >10%) compared to around 35% during daytime hours (Table 11.1).

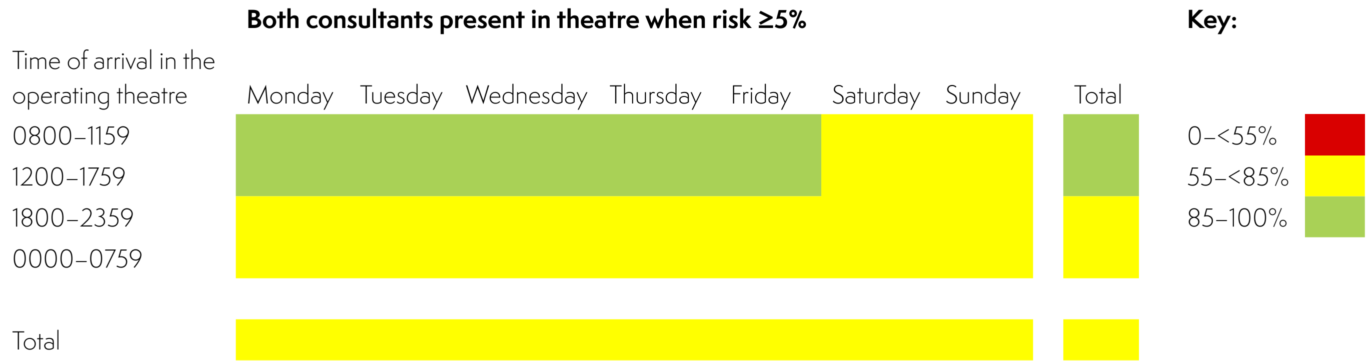
After midnight both consultant surgeon and anaesthetist are present together for around 70% of high risk patients (~63% last year). Individually, consultant surgeon presence falls to around 87%, and consultant anaesthetist presence falls to around 77%, although these figures have also improved slightly from last year (see supplementary data Table 11.2).

The high weekday, daytime presence may reflect emergency lists with job-planned consultant sessions. Out of hours attendance relies on appropriate communication of risk between multidisciplinary team members, adequate staffing for the workload to allow consultant presence, and recognition of the high risk profile of patients having surgery out-of-hours.

Table 11.1 Relative proportions in each risk category based on calculated preoperative P-POSSUM risk of death, by time of arrival in operating theatre

Time of day	Total number of patients (n(%))	Proportion of patients by calculated preoperative P-POSSUM risk category (%)		
		Lower risk (<5%)	High risk (5–10%)	Highest risk (>10%)
0800–1159	5,714 (23.9)	49.8	17.9	32.4
1200–1759	9,811 (40.0)	45.0	19.1	35.9
1800–2359	5,505 (23.0)	37.8	17.5	44.7
0000–0759	1,992 (8.3)	28.8	15.5	55.8
Unknown	907 (3.8)	5.0		
Overall	23,929	10,381	4,338	9,210

Figure 11.3 Variation in the proportion of patients for whom both consultants are present in theatre when calculated P-POSSUM risk of death ≥ 5%, by day and time of surgery



12 TIMELINESS OF CARE FOR PATIENTS WITH PERITONITIS AND SEPSIS

THE UK SEPSIS TRUST

Commentary from The UK Sepsis Trust

Sepsis is one of the most significant causes of deterioration and avoidable harm at home and abroad. Of the estimated 250,000 patients developing sepsis each year in the United Kingdom, approximately 25–35,000 develop it as a response to an infection in the abdominal organs or peritoneal space. Whilst not all of these patients will require laparotomy, the influential work of the National Emergency Laparotomy Audit shines a welcome light on the quality of care for patients with sepsis requiring source control.

It's clear that the past four years have seen significant improvements in patients undergoing emergency laparotomy – better risk assessment, the increasing tendency toward in-theatre presence of senior staff and other factors have resulted in a marked improvement in survival and reduction in length of stay. However, as the report acknowledges, there remains a way to go.

In sepsis, the rapid administration of antibiotics, identification of the pathogen, and control of the source of infection are of equal and time-critical importance in securing the patient's survival. For emergency surgical admissions we have seen little improvement since 2014 in the times taken for these patients from admission or from the decision to operate, to their arrival in the operating theatre. Only 24% of patients with sepsis suspected at presentation to hospital received antibiotics within the internationally recommended first hour – which is at odds with national NHS England data showing that, across all specialties, 80% of patients with suspected sepsis receive first-hour antibiotics.

It is likely that improving rapid administration of antibiotics and prompt access to theatre for people needing emergency laparotomy will improve survival and reduce adverse consequences of sepsis in this group.

Dr Ron Daniels, The Sepsis Trust

Why is this important for patients?

Many patients requiring emergency bowel surgery have signs of sepsis which may be life threatening. Two aspects of care have been shown to improve the likelihood of survival:

- early administration of antibiotics before surgery
- urgent surgery to remove the source of the sepsis.

The delivery of effective antibiotics is part of the first-line management of sepsis. There have been overall improvements in the management of sepsis for all patients nationally (not only patients having an emergency laparotomy) with the introduction of the 'Sepsis 6' bundle and with related improvements in pathways of care and awareness of sepsis generally in both patients and clinicians.

NELA
National Emergency
Laparotomy Audit

What did NELA study?

In Year 4 we have collected data on two (not mutually exclusive) groups of patients:

- as with previous NELA Patient Reports, patients admitted as an emergency with the diagnosis of peritonitis who were subsequently deemed to require surgery within six hours of a decision being made to operate, and who had surgery within 24 hours of admission are reported. This constitutes a relatively clearly defined group that requires both urgent antibiotic therapy and urgent surgery as source control, who were likely to have signs of sepsis on admission. We reviewed the time frames in which they received antibiotics, how quickly surgery for definitive source control was carried out and whether there were any variations in care with time of day or day of the week
- we also studied how quickly antibiotics were administered to a larger group of patients who were suspected clinically of having sepsis.

Patients admitted with a diagnosis of peritonitis

On reviewing in detail this subset of 5,265 patients in detail, we asked:

How quickly was the source of sepsis treated with surgery in patients with peritonitis?

On average, patients with peritonitis took 8.3 hours to reach theatre after they were first admitted to hospital (see supplementary data Table 12.4). Typically, this was only 1.8 hours after the decision was made to operate (the longest was 2.3 hours in those over 90 years old).

How quickly did these patients receive antibiotics?

In this group, the timeliness of antibiotics after admission is far outside the 60minute goal at a median time of three hours (IQR 1.3–5.5).

Has there been any improvement in meeting standards for patients with peritonitis since 2014?

The median time for antibiotics to be administered after admission for peritonitis has reduced slightly to three hours, although this is still far short of the recommended 60 minutes. The slowest quartile have also improved but these patients still wait more than five hours for antibiotics. There has been no improvement in the timeliness of surgery for source control (Figure 12.1, see supplementary data Table 12.3). The greatest opportunity for improvement lies in ensuring prompt delivery of antibiotics during the admission and initial assessment pathway.

What variation is there with time of day or day of the week?

Patients admitted overnight appear to wait longer for antibiotics (median ~2.5 hours vs 3.2 hours) and for surgery (median 7.5 vs 8.6 hours) (Tables 12.1 and 12.2).

Figure 12.1 Intervals between key milestones in the care of patients admitted as an emergency who were scheduled for emergency laparotomy within six hours and underwent surgery within 24 hours of admission to hospital for suspected peritonitis: comparisons over time, 2014–2017.

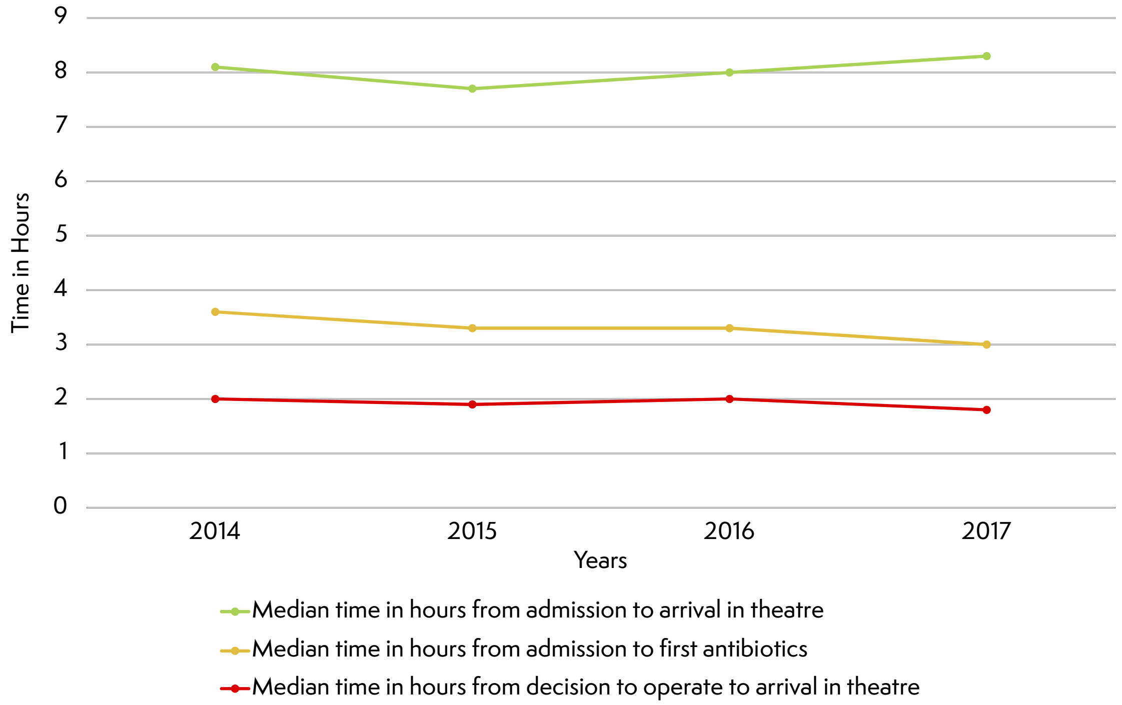


Table 12.1 Interval between admission to first dose of antibiotics for patients admitted as an emergency with suspected peritonitis, by time of day and day of week of emergency hospital admission (limited to patients who were scheduled for emergency laparotomy within six hours and underwent surgery within 24 hours of admission to hospital)

Time of emergency admission to hospital	Number of hours from admission to first antibiotics	
	Monday–Friday Median (IQR) time (hours)	Saturday–Sunday Median (IQR) time (hours)
0800–1159	2.4 (1.0–5.2)	2.5 (1.0–5.5)
1200–1759	2.8 (1.3–5.2)	3.3 (1.9–5.8)
1800–2359	3.2 (1.5–5.5)	3.3 (1.1–5.9)
0000–0759	3.2 (1.4–5.8)	2.7 (1.7–6.0)
Overall	2.9 (1.3–5.3)	3.0 (1.3–5.7)

Table 12.2 Intervals between admission to arrival in theatre, and decision to operate to arrival in theatre, for patients admitted as an emergency with suspected peritonitis, by time of day and day of week of emergency hospital admission (limited to patients who were scheduled for emergency laparotomy within six hours and underwent surgery within 24 hours of admission to hospital)

Time of emergency admission to hospital	Monday–Friday Median (IQR) time (hours)		Saturday–Sunday Median (IQR) time (hours)	
	Number of hours from admission to arrival in theatre	Number of hours from decision to operate to arrival in theatre	Number of hours from admission to arrival in theatre	Number of hours from decision to operate to arrival in theatre
0800–1159	7.6 (5.5–10.2)	1.8 (1.3–3.0)	8.0 (6.0–11.4)	2.0 (1.3–3.0)
1200–1759	7.5 (5.3–11.5)	2.0 (1.3–2.8)	7.6 (4.8–11.5)	1.5 (1.0–2.3)
1800–2359	8.5 (5.3–15.0)	1.5 (1.0–2.8)	10.7 (5.7–16.0)	1.9 (1.3–3.3)
0000–0759	8.8 (5.8–12.2)	2.0 (1.3–3.0)	8.5 (6.2–12.2)	2.0 (1.0–3.5)
Overall	8.1 (5.5–12.5)	1.8 (1.3–3.0)	8.5 (5.8–13.0)	1.8 (1.0–3.0)

Patients with sepsis suspected at time of admission or at the time of decision for surgery

How quickly did these patients receive their antibiotics?

Studying septic patients among the emergency laparotomy patient cohort brings challenges, as some patients with certain diagnoses (eg diverticulitis) are intentionally treated initially with antibiotics and not surgery. In addition, some patients only show themselves to be septic as their clinical course unfolds.

There were 7,162 (32%) patients considered septic at the time of admission, and among these, 24% received antibiotics within 1 hour of admission (see supplementary data Tables 12.5 and 12.6)

By the time of the decision to operate, there were a further 1,336 patients considered to be septic (representing 6% of the total laparotomy group). Among this group, now totalling 8,498 (38%) patients out of the total laparotomy group studied, 77% had received antibiotics within 60 minutes of that decision (see supplementary data Tables 12.7 and 12.8) but 23% had not. From available information, decision to operate typically follows some 6 hours after admission. It is unknown whether it is the senior input to the decision or simply the time elapsed for care to be given which results in the higher rate of antibiotic administration by the second time point.

Data quality

Data on timing were missing in 12% of all septic patients. At 93% of hospitals, the timing of antibiotics was missing for at least a quarter of patients. Without this information, it is extremely difficult for hospitals to improve the delivery of their care.

13 TIMELINESS OF ARRIVAL IN THEATRE

Key Process Measure: The proportion of patients arriving to theatre in a timescale appropriate for the urgency of surgery.

172 hospitals were included in this metric. 77 (44.8%) were rated green, 0 (0%) were rated red.

Why is this important for patients?

A delay to a patient undergoing their emergency surgery has been associated with lower rates of survival.[19,20,21] The urgency with which surgery is required varies between patients and is based on an evaluation of their clinical condition, surgical disease, and individual risk. Some patients may require surgery within two hours, whereas others may be able to wait for 18 hours.

Surgical urgency is categorised as follows:

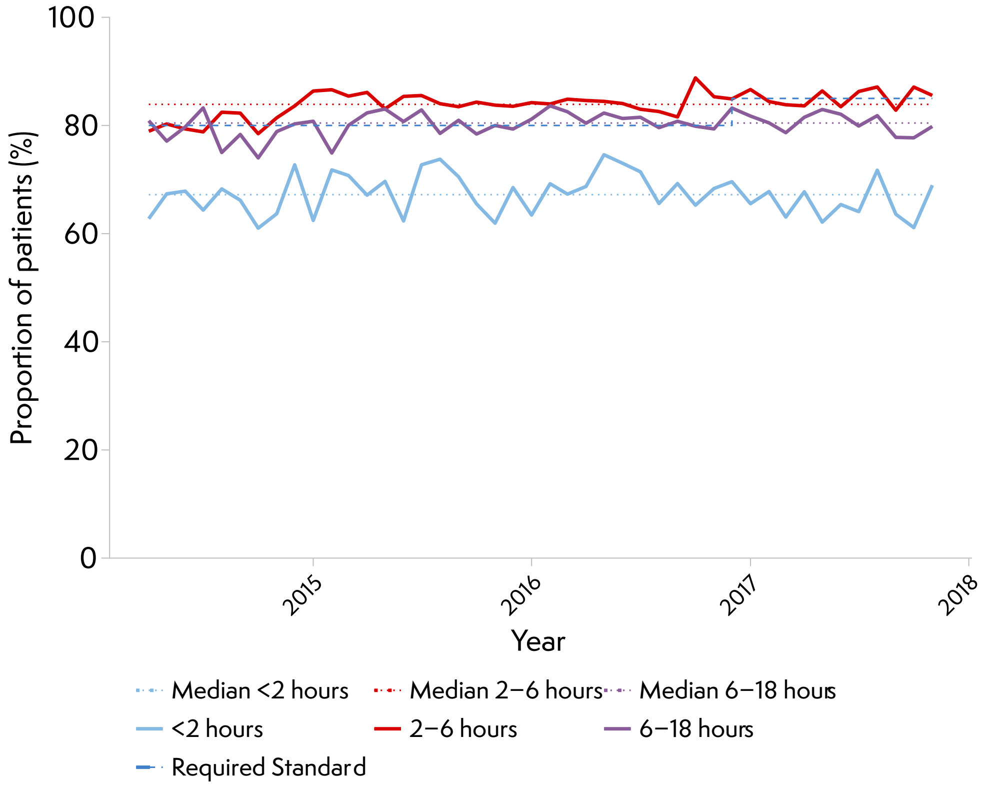
- 1 – immediate (<2 hours)
- 2A – urgent (2–6 hours)
- 2B – urgent (6–18 hours)

What questions did we ask?

What proportion of patients arrived in theatre within a timescale appropriate to their operative urgency? (minimum standard 85%)

Overall, 82% of patients arrived in theatre without delays. This figure is unchanged from last year. The data shows that the group of patients requiring surgery within two hours (the most urgent category) were still the least likely to arrive in theatre within their stated timeframe, regardless of time of day or day of week. This has dropped to 73% this year (76% in Year 3). The highest risk (>10% predicted mortality) group of patients were the most likely to reach theatre within the time frame required. Within this most urgent two-hour category, the elderly were more likely to suffer delays than younger patients (18–39 year olds 78.3% vs. 80–89 year olds 69.2%) a similar finding to last year (see supplementary data Table 13.2). NELA does not collect data to explain this observation, but it may reflect the greater co-morbidity of the elderly, or be an understandable consequence of shared decision-making in a high risk patient group. We did not include those patients who were categorised as expedited surgery (>18 hours) in this analysis.

Figure 13.1 Trend in the overall proportion of patients arriving in theatre within an appropriate timeframe for their level of urgency (surgery within 2 hours, 2–6 hours, and 6–18 hours)



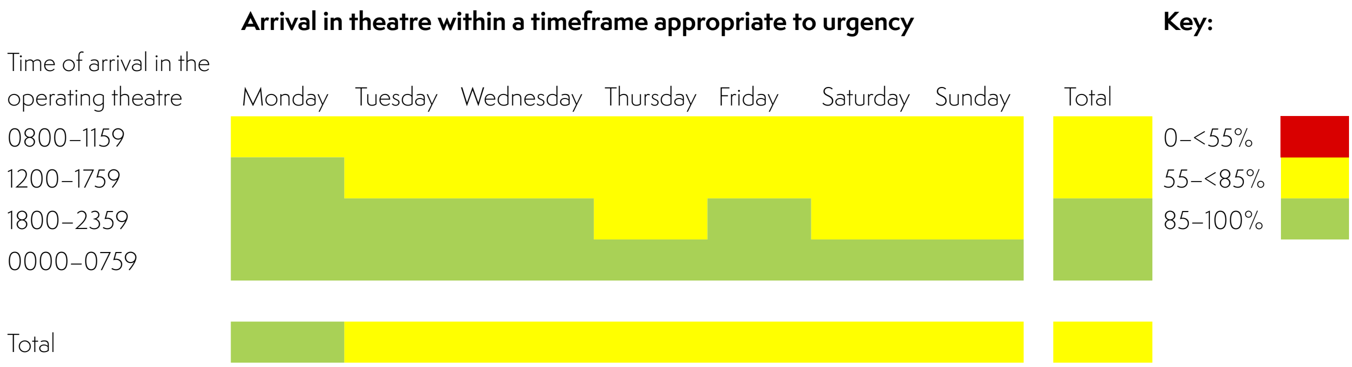
Does the proportion of patients arriving in theatre within a timescale appropriate to their operative urgency vary according to time of day and day of the week?

Patients are more likely to arrive in theatre in an appropriate timeframe in the evenings and overnight. This is particularly pronounced in the most urgent category (see supplementary data Table 13.1). The longest delays are seen in those patients who undergo emergency surgery in daytime hours, particularly in the afternoon (1200–1759). NELA does not collect information to explain these delays, but this finding may reflect the pressures on operating theatre capacity and flow that exists during day time hours when elective cases are scheduled. The 2017 Organisational Audit found that many hospitals suffer delays due to overrunning elective lists.[15]

Data quality

13.4% of cases had missing data, meaning it was not possible to determine if these patients suffered delays. This missing data is not included in the current data analysis but may be included in future reports. At hospital level, missing data can make it more difficult for hospitals to determine how and why delays might have occurred, and so limit the ability to improve timeliness of care.

Figure 13.2 Variation in arrival in theatre within a timeframe appropriate to urgency, by day and time of operation



USING NELA DATA TO UNDERSTAND PROCESSES AND REASONS FOR DELAYS

Process maps

A process map (an example is shown in Figure 13.3) is a graphical representation of a pathway, similar to a flow chart. It can be high level (for example, the whole patient pathway, from entrance to Emergency Department to hospital discharge) or it can focus on a smaller part of the pathway (for example, the process for booking an urgent patient for the operating theatres).

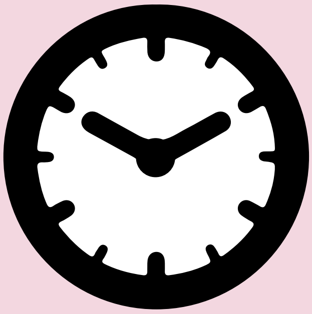
Process mapping is a helpful tool for improving the timeliness of a patients' surgery. Many teams have mapped out the patient pathway from arriving in hospital to arriving in the operating theatre and as a result have been able to understand what parts of this affect delays. Then these 'bottleneck' areas can be streamlined or changed to make the pathway to theatre more efficient.

How do we construct a process map?

It is helpful to draw a process map using lots of different points of view, and crucial to have patients included in the process – they will often highlight parts of the pathway that clinical teams do not easily see. Asking a member of the team to shadow a patient along their pathway can also be very helpful for building understanding of the pathway from the patient's perspective.

Teams often gather together and draw out a process map in a formal meeting. If it isn't feasible to gather the whole team together, it is pragmatic to gather a small number of people together to form a skeleton map, and then ask for contributions from other team members afterwards to fill in the details.

The team should agree the scope of the process – its start and end point and the level of detail expected.



Times recorded in NELA dataset:

Time of admission

Time of first consultant review

Time of first antibiotics

Time of decision to surgery

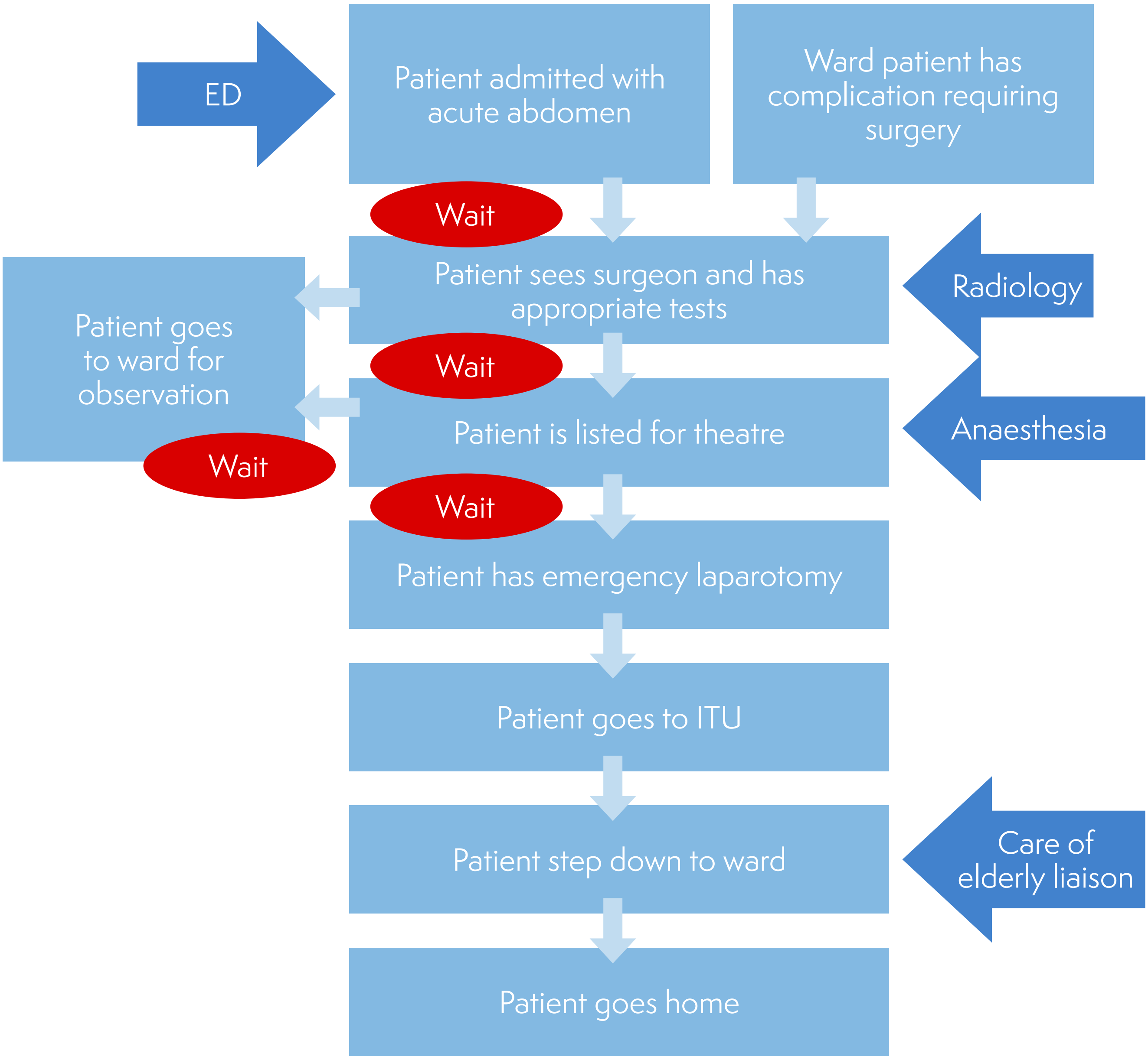
Time of entry to operating theatres

Hospital discharge (date, not time)

NELA process measures can be added in, which will give more information to the process map. For example, if a wait between decisions to operate, and arrivals into theatre is documented, the NELA dataset can tell you the average length and the range of those waits.

Once the process map has been drawn out, it may show obvious parts of the pathway that are duplicated, unnecessary tasks, long waits, or common mistakes that can be improved upon. Parts of the process where 'work as done' is different to 'work as imagined' or different to 'work as prescribed' (what the task is supposed to be, according to hospital policy or guidelines) should be reviewed and their impact assessed; if they are detrimental they can be a focus of quality improvement work to improve the pathway.

Figure 13.3 An example of a high-level process map outlining the path of the emergency laparotomy patient



14 CRITICAL CARE

Key Process Measure: The proportion of patients who were admitted directly to critical care when risk of death >10% (P-POSSUM)

171 hospitals were included in this metric. 109 (63.7%) were rated green, 2 (1.2%) were rated red.

Why is this important for patients?

Critical care provides patients with advanced treatments and organ support that are not possible on ordinary wards. These treatments are frequently required by patients having emergency bowel surgery. Evidence shows that more patients die if they are initially cared for after their surgery on a general ward and then subsequently require treatment in a critical care unit than if they are transferred directly to a critical care unit after their surgery.[10,11]

Admission to critical care should be guided by a risk assessment carried out prior to surgery, which is also repeated at the end of surgery, to identify high risk individuals who need to be cared for on a critical care unit and to ensure that they are transferred there directly after surgery.

What questions did NELA ask?

What proportion of highest risk (>10% predicted mortality) patients were admitted to critical care directly after surgery? (minimum standard 85%)

What proportion of high risk (≥5% predicted mortality) patients were admitted to critical care directly after surgery?

60.8% of all patients regardless of risk category, were admitted to a critical care unit after surgery (see supplementary data Tables 14.2 and 14.3). The mean and median length of stay in critical care was 5.5 and three days respectively.

The 3rd NELA Organisational Audit Report[15] found that 44% of hospitals had an enhanced care area, such as a post-anaesthesia care unit (PACU). However only 1,090 (4.7%) patients were admitted to such unit.

The overall proportion of highest risk (>10% P-POSSUM) patients that were admitted to critical care has remained similar to previous reports at 87%. The number of patients admitted directly to critical care in the 5–10% high risk category has is 63% (unchanged from Year 3), and overall 79% of all patients with predicted 30-day mortality ≥5% were admitted to critical care directly after surgery (this is unchanged from Year 3).

Figure 14.1 Trends in the proportions of patients with a calculated postoperative P-POSSUM risk of death 5–10% and >10% admitted directly to critical care after surgery (excluding 51 patients who died in theatre and 480 patients with the decision for palliative care)

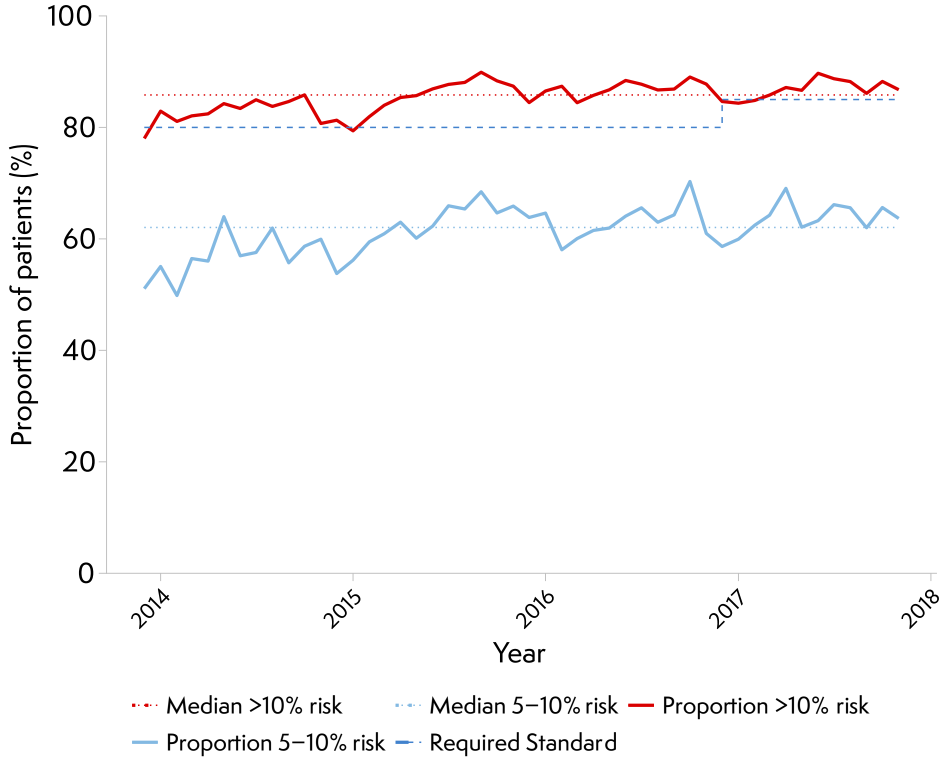
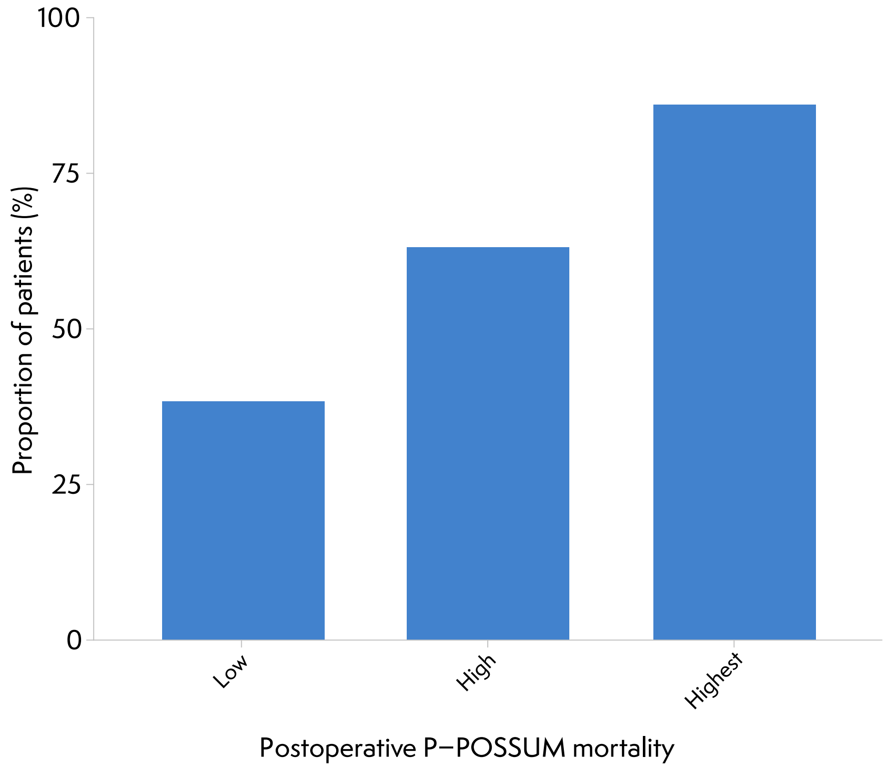


Figure 14.2 Proportion of patients admitted directly to a critical care bed after surgery based on calculated postoperative P-POSSUM risk of death



The Royal College of Surgeons 2011 document *The Higher Risk General Surgical Patient* is being reviewed in 2018.[1] The proposed standards clarify that all patients with predicted 30-day mortality of 5% or greater should be treated as high risk and should be admitted to critical care. The implications of this for hospital RAG rating are shown in Table 14.1.

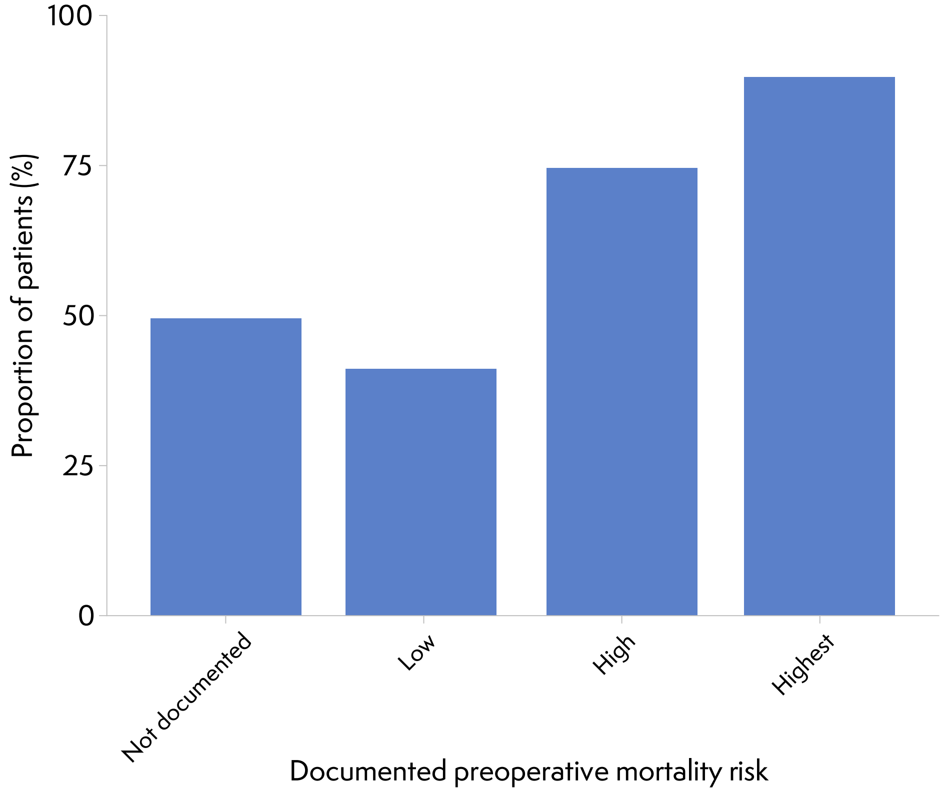
Table 14.1 Hospital RAG-ratings for rates of direct postoperative admission to critical care according to calculated postoperative P-POSSUM category

RAG rating	All patients (number of hospitals (%))	P-POSSUM ≥5% (number of hospitals (%))	P-POSSUM >10% (number of hospitals (%))
Green (Direct postoperative critical care admission for ≥85% of patients)	22 (12.2%)	97 (53.9%)	117 (65.0%)
Amber (Direct postoperative critical care admission for ≥55% to < 85% of patients)	88 (48.9%)	41 (22.8%)	60 (33.3%)
Red (Direct postoperative critical care admission for < 55% of patients)	64 (35.6%)	2 (1.1%)	2 (1.1%)
Not rated (Insufficient data available at hospital level)	5 (2.8%)	8 (4.4%)	10(5.6%)

What variation existed in the proportion of patients admitted directly to critical care unit following surgery?

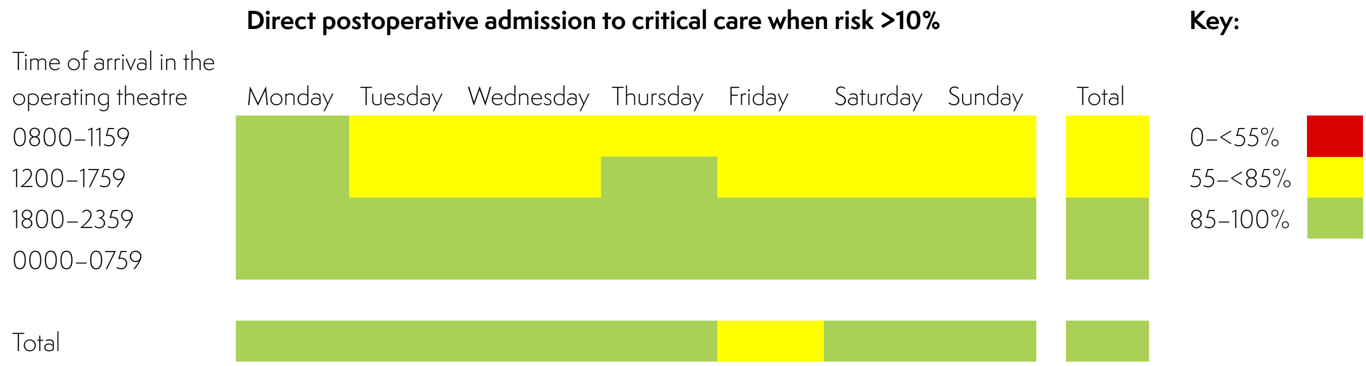
Patients from certain high risk groups were more likely to be admitted to critical care, such as the elderly, ASA grade, greater surgical urgency, and those having out-of-hours surgery (see supplementary data Tables 14.4 and 14.5). The importance of preoperative risk assessment is again highlighted when considering critical care admission. Those patients who did not have a risk assessment documented before surgery had a lower rate of critical care admission, despite their risk profile being similar to the high risk group (see supplementary data Table 14.3).

Figure 14.3 Proportion of patients admitted directly to a critical care bed after surgery based on documented preoperative risk category



There was a difference in the proportion of patients admitted directly to critical care depending on the time of their surgery. 68% of all patients undergoing surgery between midnight and 8.00am were admitted to critical care, compared with around 55% if surgery was started during the day (see supplementary data Table 14.6). To some extent this is likely to reflect the higher risk profile of patients who are operated on at night. However, standards of care for critical care admission were more likely to be met at night. There are lower absolute numbers of high risk patients who undergo surgery at night, and hence there may be less demand for critical beds from elective surgery compared to that seen during the daytime.

Figure 14.4 Variation in the proportion of patients with a calculated postoperative P-POSSUM risk of death >10% admitted directly to critical care after surgery, by day and time of operation



15 CARE OF THE ELDERLY PATIENT REQUIRING EMERGENCY LAPAROTOMY SURGERY

Key Process Measure: The proportion of patients aged 70 years or over who were assessed by a care of the older person specialist.

165 hospitals were included in this metric. 7 (4.2%) were rated green, 136 (82.4%) were rated red.

Why is this important for patients?

Patients aged over 70 years account for 44.5% of all emergency laparotomy surgery, and they have the longest length of stay and highest mortality at 30 and 90-days of any age group. Therefore, these patients account for a significant health burden in terms of deaths, complications and length of stay. Elderly patients have specific medical and social needs that may be different from those of younger patients. Those that are frail, malnourished or have functional or cognitive impairment are at greater risk of complications and poor outcomes.[22]

A range of scoring systems are available to assess the factors of frailty, nutritional status, cognition and functional status for patients over the age of 70, although not all scoring systems cover the same areas. These factors are associated with an increase in morbidity and mortality, and early recognition of their presence may allow clinicians to better tailor perioperative care to the specific needs of the patient.[23,24] NELA is asking about frailty in the current year of data collection and proposes reporting on this in Year 5.

What questions did NELA ask?

How did the outcomes of older patients compare with those of younger age?

The 30 and 90-day mortality after emergency laparotomy surgery is higher in elderly patients than in younger patients, increasing by about 5% per ten years above 50 years. The length of stay for elderly patients is almost twice that for younger patients with an average length of stay from 13 to 16 days (see supplementary data Tables 6.1.4 and 6.2.2). This reflects the comorbidities and generally higher ASA status of patients over the age of 70 years.

Figure 15.1 ONS 30-day and 90-day mortality, by age

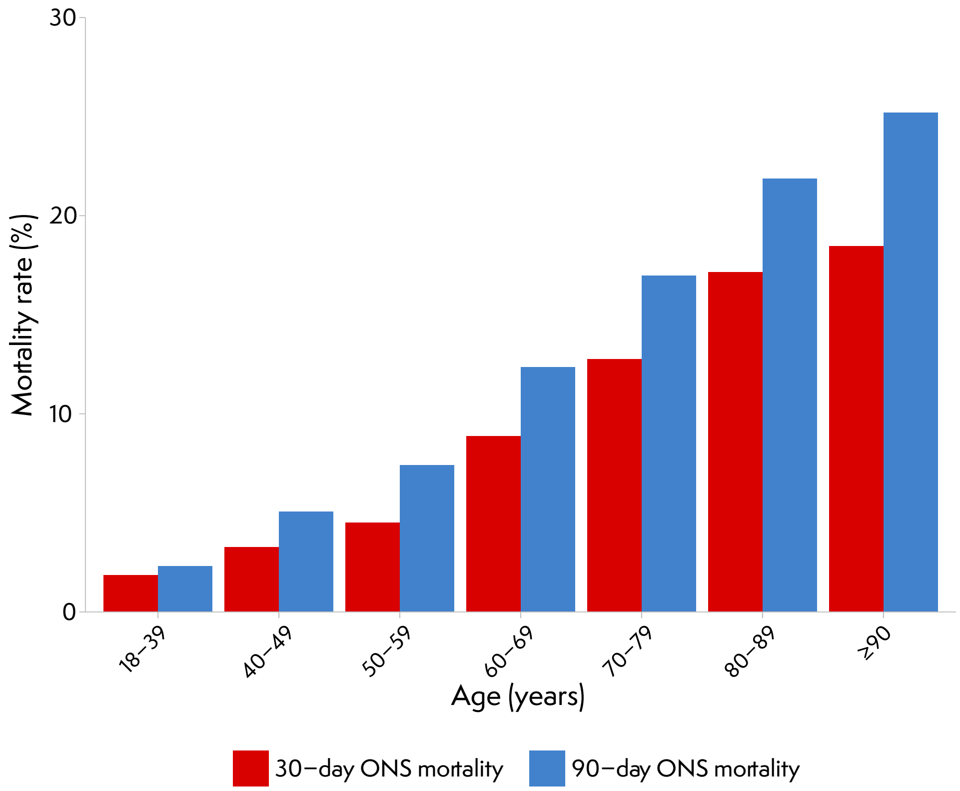
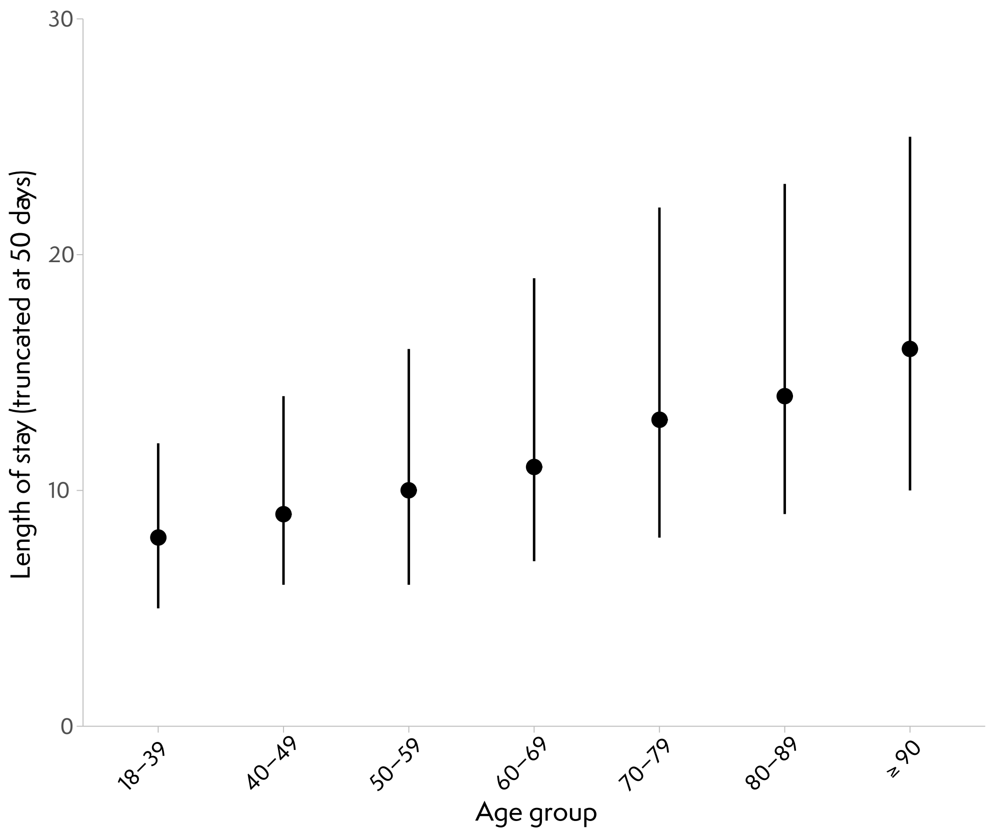


Figure 15.2 Postoperative length of stay in patients surviving to hospital discharge, by patient age



How did consultant delivered perioperative care vary with older age?

Patients over the age of 70 were more likely to have a consultant anaesthetist review them preoperatively in person (~63% compared to ~53% in younger patients) and more likely to have one present in theatre (~87% compared to 82% in younger patients). There was little difference for consultant surgeons (preoperative review ~80% and presence in theatre ~90% across all ages). Consultant intensivist input was higher for elderly patients (~65% compared to ~40% for younger patients). Overall, elderly patients are more likely to have perioperative input by all consultants for their emergency laparotomy.

What proportion of patients over the age of 70 were seen by a Care of the Elderly specialist?

The proportion of patients seen by a geriatrician remains low (23%) and there has been little improvement from the Year 3 report (19%). Between the ages of 70–79 only 18.9% are seen and this proportion increases to 34.1% of patients over the age of 90. This is in stark contrast with the achievements in geriatric care for older patients[25] with hip fractures where only 3% of units report that they have no orthogeriatrician input,[26] despite the mortality for hip fracture patients being lower than that for elderly patients having an emergency laparotomy. Investment in providing geriatric specialist teams who can actively look after elderly laparotomy patients may not only improve mortality and morbidity, but also reduce length of stay.[26]

Table 15.1 Proportion of patients aged 70 years or over assessed after surgery by a geriatrician following emergency laparotomy

Age (years)	Total number of patients (n)	Proportion of patients assessed after surgery by a care of the older person specialist (%)
70–79	4,721	18.9
80–89	3,164	27.3
≥90	417	34.1
Overall	8,302	22.8

Figure 15.3 Trend in the overall proportion of patients aged 70 years or older assessed after surgery by a geriatrician

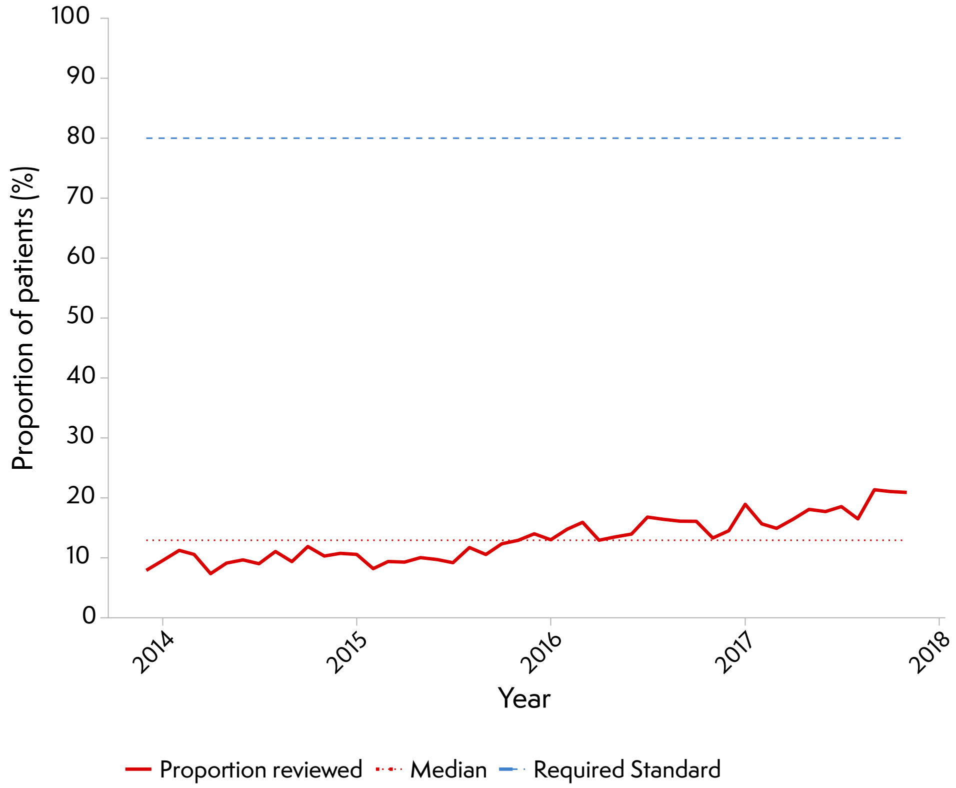
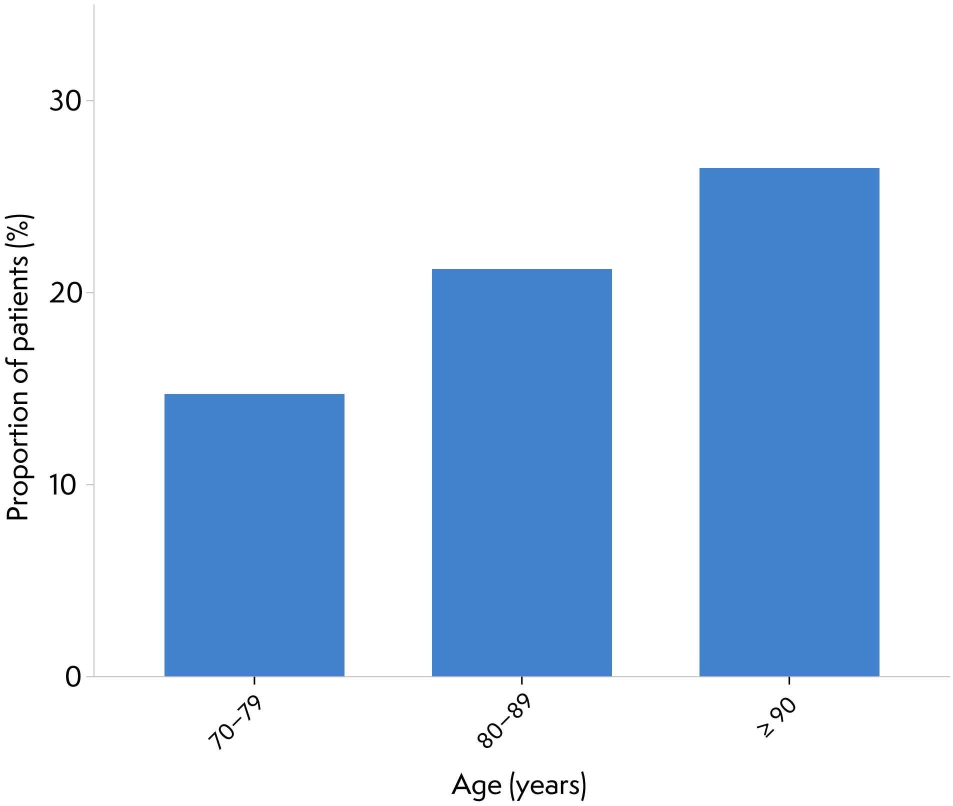


Figure 15.4 The proportion of patients aged 70 years or older assessed after surgery by a geriatrician



USING NELA DATA TO IMPROVE CARE

Case Vignette – Salford Royal Hospital: improving access to elderly care liaison

'At Salford Royal, we have a checkbox on the theatre booking form which asks whether the booking is for an emergency bowel operation. The care of the elderly team are able to filter the emergency bowel op list by age to identify patients who need to be followed up by them post-op. A poster has been designed for the surgical wards, asking staff to contact the care of the elderly team for a pre-op discussion of patients over 70 who may require emergency bowel surgery. We liaise with one main consultant from our care of the elderly team, plus a helpful colleague. We noticed from our data that our compliance was going down based on their availability, so we are training an advanced practitioner, who will be able to pick up some cases soon to help this. At present, the post-op reviews take place when the patient is stepped down from critical care to a ward. It was a general consensus that this was the optimum time for review.'

Claire Riley, Clinical Audit Facilitator, Salford Royal NHS Foundation Trust

16 MAXIMISING USE OF NELA DATA

NELA data represents an important repository of information that can help improve the care of patients. We are committed to ensuring that the data is used to maximum effect, rather than just supporting the production of annuals reports. We achieve this by supporting Quality Improvement (QI) initiatives, and through research.

16.1 Quality improvement

QI focus: Using accurate NELA data to improve care

Feedback of NELA data to teams is an important task for increasing awareness of local performance, for improving case submissions, and for informing teams of the impact of any improvement efforts. NELA makes data readily available to local clinicians, managers, and commissioners for supporting quality improvement activity, so that changes to the service can be monitored in an ongoing fashion to facilitate improvements in care. Clinicians and audit staff can download their hospital's full dataset on demand, as an Excel spreadsheet for easy analysis.

Real-time dashboards are available that show the latest hospital data and enable local teams to see both temporal trends and the relationship between local and national performance. NELA will continue to develop these dashboards in collaboration with local clinicians.

We publish publicly available quarterly reports showing hospital progress and performance against the national picture. We do this to reduce the timescale for reporting, and facilitate regular local data feedback.

NELA ran eight regional workshops for multidisciplinary teams working with patients having an emergency laparotomy, to share best practice, QI methodology and the better use of NELA data for improvement. The presentations and resources from these workshops are freely available on the NELA website. NELA is collaborating with the Academic Health Science Networks in England, and Public Health Wales, to work alongside the Emergency Laparotomy Collaborative. These breakthrough collaborations will help support clinicians to work with local colleagues in their network to share best practice and improve patient care.

NELA has started to produce 'Excellence and Exception' reports that allow clinicians to easily identify patients in whom all standards were met, and patients who died where standards were not met. This allows clinicians to easily review notes describing patient journeys that highlight good practice or areas for improvement. NELA data should also be used for describing the context of serious incident or complaint investigations – and can help the review panels to understand whether failure to meet standards of care are wider than the particular incident/complaint in under investigation.

Emergency laparotomy will cross several hospital departments during their inpatient stay, and so NELA data can also be of use to other departments outside general surgery and anaesthetics. For example, the NELA webtool includes preoperative questions on antibiotic administration times and sepsis, which can be used by emergency departments and in ward deteriorating patient improvement programmes, and the radiology questions include evidence on discrepancy between reporting and operative findings which can be used in radiology quality assurance audits.

Alongside using NELA data to drive improvements to meet the NELA standards of care, there are several notable NHS programmes which may include patients having an emergency laparotomy and therefore find NELA data analysis helpful. Sites that use and discuss NELA data in a variety of forums may find that care of patients having an emergency laparotomy is better represented across the pathway, as clinical and management teams will become more familiar with discussing the needs of these high risk patients.

The *Getting It Right First Time (GIRFT)* programme is funded by the Department of Health and aims to improve care by focusing on unwarranted variations in the way services are delivered in English hospitals. NELA data is used as part of a number of GIRFT workstreams, including general surgery, anaesthetics, and intensive and critical care. NELA is collaborating closely with three GIRFT initiatives for general surgery, anaesthesia and perioperative medicine, and Intensive and critical care. GIRFT teams are using our data and reports in their 'deep dive' hospital visits, to improve understanding of care delivery at a local level. We have produced guidance to facilitate local leads in accessing and presenting their NELA data for their GIRFT 'deep dive' visit.

The National Mortality Case Record Review Programme aims to develop and implement a national standardised methodology for reviewing the case records of adults who have died in acute hospitals across England and Scotland and many hospitals are monitoring and investigating in-hospital deaths already, including deaths after emergency laparotomy surgery. To help teams do this easily using their NELA data, NELA provides an easy to use template that will create instant exception reports listing which standards of care have/

have not been met for patients who have died in hospital. This information can be integrated into hospitals mortality review processes or easily reported to clinical governance or quality committees. The NELA Project Team also provide another tool complementary to the exception report – an excellence report, showing all patients who have met all NELA core standards of care, allowing teams to easily report their best practice too.

NELA data can be used to support the national Learning from Deaths programme by informing case record reviews. Data can support the systematic analysis of how and why a death occurred in addition to benchmarking the care that was provided. By using the NELA exception reporting tool, deaths that resulted from a problem in care, and that may have been avoidable, can be identified and reported upon.[27]

NELA data has been linked with data from the National Bowel Cancer Audit, and the Intensive Care National Audit and Research Centre (ICNARC) casemix programme. Analysis of these linked datasets will provide a greater understanding of the care of patients undergoing emergency laparotomy who have bowel cancer, and of patients who are admitted to intensive care.

Figure 16.1.1 An example of a quarterly performance report sent to local hospitals by the NELA Project Team

	1 June 2017 - 31 August 2017
Estimated number of cases expected per quarter (based on historical HES data):	33
Total number of cases entered into the National Emergency Laparotomy Audit in this quarter:	30
Cases locked:	22
Cases unlocked:	8

Criterion	Patients included	Data completeness (%)	Hospital value (%)	National mean (%)	Overall performance
Estimated case ascertainment (Overall performance labled as n/a may indicate unavailable data, or uncertainty over data accuracy)			90.9	69.4	
CT scan reported before surgery by a consultant radiologist	28	93	46.4	79.5	
Risk of death documented before surgery	30	100	66.7	77.4	
Arrival in theatre within a timescale appropriate for urgency	23	88	87.0	81.9	
Consultant surgeon and anaesthetist present in theatre when the risk of death ≥5%	18	100	88.9	83.8	
Consultant surgeon present in theatre when the risk of death ≥5%	18	100	88.9	92.0	
Consultant anaesthetist present in theatre when the risk of death ≥5%	18	100	100.0	89.2	
Admitted to critical care following surgery when the risk of death ≥5% (Excludes patients who died in theatre or with a decision to palliate)	17	100	100.0	81.0	
Admitted to critical care following surgery when the risk of death >10% (Excludes patients who died in theatre or with a decision to palliate)	11	100	100.0	87.4	
Assessment by elderly medicine specialist in patients aged 70 years and over	10	77	0.0	18.8	

16.2 Research

We continue to collaborate with other professional organisations and researchers on projects such as:

- development of Patient Reported Outcome Measures (PROMS) for patients having an emergency laparotomy
- additional analyses of cohorts of patients with different diseases who undergo emergency laparotomy
- supporting research into new treatments and technologies that might benefit patients having an emergency laparotomy.

In its fourth year of patient data collection, NELA has continued to actively support research using the patient audit datasets and projects using the NELA data collection platform to collect additional patient-level data.

Research studies that use NELA data do so through one of five channels, reflecting methods of data collection and the approvals required from the data controllers (HQIP) in order to access data.

1 Projects outside of the scope of the Audit, which are usually undertaken by researchers outside of the NELA Project Team (PT). In this route, applicants submit a data access request form (DARF) which is reviewed by the NELA Project Team and requires approval by the HQIP data access request group (DARG). When successful, a reduced dataset of approved fields is transferred securely. ONS mortality data is not available. Supporting materials are available on the NELA webpage and we advise applicants to contact the Project Team at an early stage.

2 'Section 8' projects. These use the NELA data collection platform itself to collect patient-level data over and above that required by the Audit. Section 8 is the last part of the NELA data collection web tool and can be adapted on request to show questions outside of the core data set for local use or other groups to use. There are several projects ongoing including the fluid optimisation in emergency laparotomy trial (FLO-ELA) and completed studies, including the enhanced perioperative care for high risk patients trial (EPOCH) and the Pan-London (PLAN) trainee-led lung ventilation study ALPINE.[28]

EPOCH and FLO-ELA have also utilised patient-level NELA data and have been through HQIP's DARG process.

3 Collaborative projects between Project Team members and external researchers. Here analysis is performed by Project Team members and data are not transferred out of the secure servers. Composite ONS mortality data may be available but is not available at patient-level. A data access request (DARF) form must be submitted, but approvals are likely be more straightforward given that there is no flow of individual-level data.

Example:
Peacock O et al. Thirty-day mortality in patients undergoing laparotomy for small bowel obstruction. *Br J Surg* 2018;**105(8)**:1006–1313.[13]

4 Projects within the scope of the Audit, usually undertaking by researchers on the NELA Project Team. This research aligns with NELA's aims. Approvals are required from data controllers including HQIP and the ONS.

Examples:
Eugene N et al. Development and internal validation of a novel risk adjustment model for adult patients undergoing emergency laparotomy surgery: the NELA risk model. *Br J Anaesth* 2018 (In press).[7]

Oliver CM et al. Organisational factors and mortality after emergency laparotomy: Multilevel analysis of 39,903 National Emergency Laparotomy Audit patients. *Br J Anaesth* 2018 (In press).[12]

5 Local-level data analysis. NELA Leads across England and Wales, who have access to their own patient datasets, have been extracting and analysing these data to improve quality of care and efficiency since the beginning of the patient audit.

If you are interested in collaborating or gaining access to the datasets, please contact us as soon as possible. You will find this information helpful. More information on ongoing research projects can be found here.

USING NELA DATA TO IMPROVE CARE

The Mersey experience

'The Mersey Anaesthetic Group for Improving Quality (MAGIQ) is a group led by anaesthetists in training that seeks to promote, support, and coordinate junior doctors training to be anaesthetists participation in quality improvement. Over the past two years we have taken NELA to be a focal point for our organisation which has paralleled the move of the national project towards an ongoing QI project.

There exists a natural synergy between trainee QI and NELA. Anaesthetists in training form the foundation for most hospital's emergency theatre teams. We are a significant stake-holder in laparotomy care; a patient's first point of contact with our specialty is often the junior anaesthetist reviewing them on the ward or emergency department. We contribute a great deal to preoperative optimisation, risk assessment and timely arrival in theatre – all key NELA standards of care.

Our first objective was to improve the relationship between anaesthetists in training and the NELA data itself. Many centres in our region still utilised paper forms, so we created our own (information governance compliant) NELA data collection mobile app. Data could be entered using your phone, with an interface optimised for mobile devices. The app was freely distributed amongst trainees, greatly simplifying data entry, while still offering quality assurance.

We were able to create real-time dashboards and so increase the visibility of NELA data to junior doctors and the whole emergency surgery team. Previously, there was a significant lag between entering data and seeing the collated results which leads anaesthetists in training to devalue NELA data entry. We created live dashboards of NELA key performance indicators for distribution amongst clinicians. As trainees on training programs across the region, we naturally have a perspective that spans beyond one hospital. Therefore, benchmarks of regional performance are important components of our dashboards and this has led to closer networking between hospitals and sharing of data outside of that collected in the app.

Trainees' rotating between hospitals are well placed to see the contrast in cultures between hospitals. Parallel to our work with data, we created a laparotomy teamwork evaluation tool to understand the social dimension of the laparotomy care process and this tool looks at areas such as communication, coordination of tasks, and interpersonal climate. Taking NELA as a platform for change, it is these insights into an organisation's social processes that we are developing that will facilitate meaningful improvement.

Overall, NELA is an excellent opportunity for trainees to develop skills in QI. As trainees, we can feel disempowered within an organisation and unable to make change, however, we have found working with the National Emergency Laparotomy Audit offers real legitimacy to initiatives for improvement. As part of our work we have collaborated with a range of professionals from surgeons to patient experience managers to information governance officers. With NELA data we have gained experienced in improvement science and the use of data for change. Trainees involved with the project have now qualified as consultants, armed with the skills and experience gained from their involvement with NELA. NELA offers a massive opportunity to synergize improvements in laparotomy care with training junior anaesthetists in Quality Improvement that will save countless lives in the near and the long term future.'

Matt Bridges and Nick Lown, MAGIQ

'Interrogation of the NELA dataset from a surgical perspective is currently being undertaken. Specifically, this is focusing on improving general surgical training and service provision around the care of patients having Emergency Laparotomies. Over the last twenty years there has been a shift towards development of special interest for consultant surgeons within their elective practice. However recently there has been an emergence and growth of 'emergency general surgery,' as special interest for trainees. We are currently investigating the impact of consultant surgeon special interest on outcomes following emergency laparotomy. The paper is currently submitted for publication'.

Boyd-Carson H et al (submitted for publication). Association between Surgeon Special interest and mortality after Emergency Laparotomy: Analysis of the National Emergency Laparotomy Audit: 2013–2016

Hannah Boyd-Carson, NELA Surgical Research Fellow

NELA
National Emergency
Laparotomy Audit

USING NELA DATA TO IMPROVE CARE

'Work is being undertaken to explore the relationship between socioeconomic deprivation, attainment of the key standards of care, and outcomes. To support this, a systematic review of the influence of deprivation on mortality after colorectal surgery has been published. Given the potential that comorbidity has to confound analysis of socioeconomic deprivation, an investigation into the use of comorbidity indices generated from linked patient-level administrative data for the purposes of risk adjustment and risk prediction is currently undergoing peer review.'

Poulton TE et al. Systematic review of the influence of socioeconomic deprivation on mortality after colorectal surgery. *Br J Surg* 2018;**105(8)**:959–70.[29]

Thomas Poulton, NELA Research Fellow

'The work led by researchers at the Clinical Effectiveness Unit of the Royal College of Surgeons' which informed the casemix adjustment of hospital-level mortality rates presented in the NELA reports, also produced the NELA risk model. This model is already available to clinicians through the patient data-entry web browser and the mobile platform application, and the scientific manuscript will be published in coming months.[7]

Differences in hospital-level mortality rates might be explained, at least in part, by differences in the way care is delivered (and availability of supporting infrastructure). Research has been carried out to examine associations between mortality rates and these processes and structures, using the NELA patient and first organisational audit datasets. This work provides new and exciting insights into the structures and processes associated with improved survival after emergency laparotomy. This scientific manuscript will be published in coming months.'[12]

Charles (Matt) Oliver, NELA Research Lead, NIHR Academic Clinical Lecturer

'It is possible that patient and hospital geographic factors may affect outcomes following surgery and this may explain some inter-hospital variation. An analysis is currently underway to investigate the association between distance travelled to hospital and outcome following emergency general surgery.'

Tom Salih, NELA Fellow

'The high risk of mortality and morbidity for patients requiring emergency laparotomy surgery affects their postoperative care. Many are admitted to critical care units where high levels of monitoring and advanced support are available. How postoperative care influences outcomes is a complex question due to multiple disparate factors. Work is ongoing to describe the nature of this care and unpick how these factors interact. The insights gained from this will help optimise the treatment that future patients will require and enable the most effective use of hospital resources.'

Leigh-James Spurling, NELA Research Fellow

17 GLOSSARY

AAA
Age Anaesthesia Association

AAGBI
Association of Anaesthetists of Great Britain and Ireland

Abdomen/Abdominal
Anatomical area between chest and pelvis, which contains numerous organs, including the bowel

Adhesiolysis
Surgical procedure to remove intra-abdominal adhesions that often cause bowel obstruction

ALPINE
Adoption of lung protective ventilation in patients undergoing emergency laparotomy

Anastomotic Leak
Leak from a join in the bowel

APP
Association for Perioperative Practice

ARCP
Annual Review of Competence Progression the annual assessment of doctors in training

ASA
American Society of Anesthesiologists Physical Status score (ASA-PS)

ASGBI
Association of Surgeons of Great Britain and Ireland

Average
A number to describe a series of observations. Depending on the pattern of these observations, the median/or mean will better describe the series

BGS
British Geriatric Society

Bowel
Part of the continuous tube starting at the mouth and finishing at the anus. It includes the stomach, small intestine, large intestine and rectum

CEU
Clinical Effectiveness Unit of the Royal College of Surgeons of England

Colitis
Inflammation of the colon

Colon
Part of the large intestine

Colorectal Resection
Surgical procedure to remove part of the bowel

Colostomy
Surgical procedure to divert one end of the large intestine (colon) through an opening in the abdominal wall (tummy). A colostomy bag is used to collect bowel contents

CRG
Clinical Reference Group. Consists of representatives from partner organisations, stakeholders and patients, acting in an advisory capacity to the NELA Project Team

CT
Computed tomography – a very advanced form of X-ray used in diagnosis and treatment

DARG
Data access request group

EGS
Emergency General Surgery. Often refers to the group of patients admitted to hospital with conditions that require the expertise of general surgeons. 10% require emergency bowel surgery

Elective
In this Report, refers to both to mode of hospital admission and to urgency of surgery. The timing of elective care can usually be planned to suit both patient and hospital (can be weeks to months). In contrast, urgent/ emergency care usually has to take place within very short timescales (hours)

ELN
Emergency Laparotomy Network

ELPQuIC
Emergency Laparotomy Pathway Quality Improvement Care Bundle

Emergency laparotomy
Bowel surgery that, due to underlying conditions, must be carried out without undue delay

EPOCH
Enhanced perioperative care for high risk patients

FICM
Faculty of Intensive Care Medicine.

FLOELA
Fluid Optimsaion in Emergency Laparotomy Trial

GCS/Glasgow Coma Scale
An assessment tool that is used to objectively measure a patient's conscious state

GI
Gastrointestinal

GIRFT
Getting it Right First Time programme

Hartmann's Procedure
Surgical procedure to remove part of the large bowel resulting in the formation of an end colostomy, and leaving part of the rectum in-situ

HES
Hospital Episode Statistics

HQIP
Healthcare Quality Improvement Partnership

HSRC
Health Services Research Centre

ICNARC
Intensive Care National Audit and Research Centre

ICS
Intensive Care Society

NELA
National Emergency Laparotomy Audit

Ileostomy
Surgical procedure to divert one end (or two ends in a loop colostomy) of the small intestine (small bowel) through an opening in the abdomen (tummy). An ileostomy bag is used to collect bowel contents

Intestine
Part of the bowel

Intra-abdominal
Inside the abdomen/tummy

Intraoperative
During surgery

IQR
Interquartile range – the middle 50% of observations either side of the median

IR
Interventional Radiology

Ischaemia
Loss of, or insufficient blood supply to an affected area or organ

Laparoscopic
Keyhole surgery

MDT
Multidisciplinary team

Mean
Mathematical average

Median
Midpoint of all observations when ranked in order from smallest to largest (see average)

NCAAG
National Clinical Audit Advisory Group

NCEPOD
National Confidential Enquiry into Patient Outcome and Deaths

NELA
National Emergency Laparotomy Audit

NIAA
National Institute of Academic Anaesthesia

NIGB
National Information Governance Board

NQB
National Quality Board

OJEU
Official Journal of the European Union

Non-operative
Treatment options that do not require surgery

Obstruction
Blockage of the bowel. It can be caused by a variety of conditions and can cause the bowel to burst (perforate). It has the potential to make people very unwell and can be life threatening

ONS
Office for National Statistics

PEDW
Patient Episode Database of Wales

Perforation
One or more holes in the wall of the bowel. It can be caused by a variety of conditions. It has the potential to make people very unwell very quickly and can be life threatening

Perioperative
Around the time of surgery (incorporating preoperative, intraoperative and postoperative)

Peritonitis
Infection or inflammation within the abdomen, causing severe pain. It has the potential to make people very unwell very quickly and can be life threatening

Postoperative
After surgery

P-POSSUM
A tool that has been validated for estimating an individual patient's risk of death within 30 days of emergency general surgery[4]

Preoperative
Before surgery

Radiological imaging
Diagnostic techniques including X-ray and CT

RCN
Royal College of Nursing

RCoA
Royal College of Anaesthetists

RCR
Royal College of Radiologists

RCS
Royal College of Surgeons of England

Rectum
The final section of the large intestine

Sepsis
Widespread, severe inflammation in the body resulting from infection

Section 8
The final data entry section on the NELA webtool which can be adapted by local teams to collect relevant data of their specific design

SIRS
Systemic Inflammatory Response Syndrome

Small Bowel Resection
Surgical procedure to remove part of the small bowel (small intestine)

Stoma
Surgical opening in the abdominal wall for the bowel to terminate. See also colostomy and ileostomy

STP
Sustainability and Transformation Plan

Subtotal Colectomy
Surgical procedure to remove part of the large bowel except the very lowest part or 'rectum' of the large bowel

NELA National Emergency Laparotomy Audit

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NELA
National Emergency Laparotomy Audit

19 HOSPITAL LEVEL DATA

Table 19.1 Participating hospitals and case ascertainment key

Green = Hospital with ≥85% case ascertainment
Amber = Hospital with 55–85% case ascertainment
Red = Hospital with <55% case ascertainment
Black = Hospital with <10 cases in the year

Hospital	Identifier	Hospital	Identifier
Addenbrookes Hospital	ADD	Colchester General Hospital	COL
Aintree University Hospital	FAZ	Conquest Hospital	CON
Airedale General Hospital	AIR	Countess of Chester Hospital	COC
Arrowe Park Hospital	WIR	Croydon University Hospital	MAY
Barnet Hospital	BNT	Cumberland Infirmary	CMI
Barnsley Hospital	BAR	Darent Valley Hospital	DVH
Basildon University Hospital	BAS	Darlington Memorial Hospital	DAR
Basingstoke and North Hampshire Hospital	NHH	Derriford Hospital	PLY
Bedford Hospital	BED	Dewsbury and District Hospital	DDH
Birmingham Heartlands Hospital	EBH	Diana Princess of Wales Hospital	GGH
Blackpool Victoria Hospital	VIC	Doncaster Royal Infirmary	DID
Bradford Royal Infirmary	BRD	Dorset County Hospital	WDH
Bristol Royal Infirmary	BRI	Ealing Hospital	EAL
Bronglais General Hospital	BRG	East Surrey Hospital	ESU
Broomfield Hospital	BFH	Freeman Hospital	FRE
Castle Hill Hospital	CAS	Friarage Hospital	FRR
Charing Cross	CHX	Frimley Park Hospital	FRM
Chelsea and Westminster Hospital	WES	Furness General Hospital	FGH
Cheltenham Hospital	CGH	George Eliot Hospital	NUN
Chesterfield Royal Hospital	CHE	Glan Clwyd District General Hospital	CLW
Churchill Hospital	CCH	Glangwili General Hospital	GLG
City Hospital	CTY	Gloucestershire Royal Hospital	GLO

Hospital	Identifier	Hospital	Identifier
Good Hope Hospital	GHS	Maidstone Hospital	MST
Harefield Hospital	HHX	Manchester Royal Infirmary	MRI
Harrogate District Hospital	HAR	Medway Maritime Hospital	MDW
Hereford County Hospital	HCH	Milton Keynes Hospital	MKH
Hillingdon Hospital	HIL	Morriston Hospital	MOR
Hinchingbrooke Hospital	HIN	Musgrove Park Hospital	MPH
Homerton Hospital	HOM	Nevill Hall Hospital	NEV
Huddersfield Royal Infirmary	HUD	New Cross Hospital	NCR
Hull Royal Infirmary	HUL	Newham University Hospital	NWG
Ipswich Hospital	IPS	Norfolk and Norwich University Hospital	NOR
James Paget University Hospital	JPH	North Devon District Hospital	NDD
John Radcliffe Hospital	RAD	North Manchester General Hospital	NMG
Kent and Canterbury Hospital	CKH	North Middlesex University Hospital	NMH
Kettering General Hospital	KGH	Northampton General Hospital	NTH
King's College Hospital	KCH	Northern General Hospital	NGS
King George Hospital	KNG	Northumbria Specialist Emergency Care Hospital	NSH
Kings Mill Hospital	KMH	Northwick Park/St Marks Hospital	NPH
Kingston Hospital	KTH	Nottingham City Hospital	NOT
Leeds General Infirmary	LGI	Papworth Hospital	PAP
Leicester General Hospital	LEI	Peterborough City Hospital	PET
Leicester Royal Infirmary	LER	Pilgrim Hospital	PIL
Leighton Hospital	LEG	Pinderfields Hospital	PIN
Lincoln County Hospital	LIN	Poole Hospital	PGH
Lister Hospital	LIS	Prince Charles Hospital	PCH
Liverpool Heart and Chest Hospital	LHC	Princess Alexandra Hospital	PAH
Luton and Dunstable Hospital	LDH	Princess of Wales Hospital	POW
Macclesfield District General Hospital	MAC	Queen's Hospital – Burton	BRT

Hospital	Identifier	Hospital	Identifier
Queen's Hospital – Romford	QHR	Royal Sussex County Hospital	RSC
Queen Alexandra Hospital	QAP	Royal United Hospital	BAT
Queen Elizabeth Hospital – Gateshead	QEG	Royal Victoria Infirmary	RVN
Queen Elizabeth Hospital (Lewisham and Greenwich NHS Trust)	QEL	Russells Hall Hospital	RUS
Queen Elizabeth Hospital Birmingham	QEB	Salford Royal Hospital	SLF
Queen Elizabeth The Queen Mother Hospital	QEQ	Salisbury District Hospital	SAL
Queens Medical Centre – Nottingham	QMC	Sandwell General Hospital	SAN
Rotherham Hospital	ROT	Scarborough Hospital	SCA
Royal Albert Edward Infirmary	AEI	Scunthorpe General Hospital	SCU
Royal Berkshire Hospital	RBE	South Tyneside District Hospital	STD
Royal Blackburn Hospital	BLA	Southampton General Hospital	SGH
Royal Bolton Hospital	BOL	Southend University Hospital	SEH
Royal Brompton Hospital	BMP	Southmead Hospital	SMH
Royal Cornwall Hospital	RCH	Southport District General Hospital	SPD
Royal Derby Hospital	DER	St George's Hospital	GEO
Royal Devon and Exeter Hospital	RDE	St Helier Hospital	SHC
Royal Free Hospital	RFH	St James's University Hospital	SJH
Royal Glamorgan	RGH	St Mary's Hospital	STM
Royal Gwent Hospital	GWE	St Mary's Hospital – IOW	MIW
Royal Hampshire County Hospital	RHC	St Peter's Hospital	SPH
Royal Lancaster Infirmary	RLI	St Richards Hospital	STR
Royal Liverpool University Hospital	RLU	St Thomas' Hospital	STH
Royal Marsden Hospital	MAR	Stepping Hill Hospital	SHH
Royal Preston Hospital	RPH	Stoke Mandeville Hospital	SMV
Royal Shrewsbury Hospital	RSS	Sunderland Royal Hospital	SUN
Royal Stoke University Hospital	RSH	Tameside General Hospital	TGA
Royal Surrey County Hospital	RSU	The Christie	CHR

Hospital	Identifier	Hospital	Identifier
The Great Western Hospital	PMS	Whittington Hospital	WHT
The James Cook University Hospital	SCM	William Harvey Hospital	WHH
The Princess Royal Hospital	PRS	Withybush General Hospital	WYB
The Princess Royal University Hospital	BRO	Worcestershire Royal Hospital	WRC
The Queen Elizabeth Hospital – King's Lynn	QKL	Worthing Hospital	WRG
The Royal Bournemouth Hospital	BTH	Wrexham Maelor Hospital	WRX
The Royal London Hospital	LON	Wexham Park Hospital	WEX
The Royal Oldham Hospital	OHM	Wythenshawe Hospital	WYT
The Walton Centre	WLT	Yeovil District Hospital	YEO
Torbay District General Hospital	TOR	York Hospital	YDH
Tunbridge Wells Hospital	TUN	Ysbyty Gwynedd Hospital	GWY
University College Hospital	UCL		
University Hospital Lewisham	LEW		
University Hospital Llandough	UHL		
University Hospital North Durham	DRY		
University Hospital of North Tees	NTG		
University Hospital of Wales	UHW		
University Hospital, Coventry	UHC		
Walsall Manor Hospital	WMH		
Warrington Hospital	WDG		
Warwick Hospital	WAW		
Watford General Hospital	WAT		
Weston General Hospital	WGH		
West Middlesex University Hospital	WMU		
West Suffolk Hospital	WSH		
Whipps Cross University Hospital	WHC		
Whiston Hospital	WHI		

Figure 19.1 Achievement of key processes in each hospital. Hospital size: 1=smallest quartile, 4=largest

Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
National Mean				9.5						82.7	64.4	5.3	74.6	82.5	85.7	95.4	88.8	67.5	82.5	92.3	88.0	79.3	62.9	86.8	22.9	10.4	6.0	3.4	
London – North Central	BNT	Royal Free London NHS Foundation Trust	Barnet Hospital	12.8	21.5	16.9	0.4	3.0	82	54.7	64.6	10.5	69.5	90.0	95.9	98.0	98.0	83.3	93.8	97.9	95.8	78.3	50.0	93.3	21.2	11.8	9.8	4.9	1
London – North Central	NMH	North Middlesex University Hospital NHS Trust	North Middlesex University Hospital	5.7	23.0	17.8	0.0	2.2	67	72.0	70.1	10.2	26.9	74.2	78.8	97.0	81.8	55.0	78.8	78.8	100.0	76.5	61.5	85.7	8.7	9.9	7.5	4.5	3
London – North Central	RFH	Royal Free London NHS Foundation Trust	Royal Free Hospital	7.3	19.4	15.7	1.8	4.0	114	120.0	60.2	10.8	87.7	70.2	89.9	98.6	91.3	77.6	71.4	90.0	77.1	68.3	50.0	75.0	42.2	12.5	15.9	9.7	2
London – North Central	UCL	University College London Hospitals NHS Foundation Trust	University College Hospital	8.3	19.9	16.0	1.3	3.8	105	78.9	36.2	0.0	78.1	77.4	78.3	90.0	83.3	48.9	81.4	91.5	88.1	63.8	50.0	67.4	0.0	12.6	6.7	4.8	3
London – North Central	WHT	Whittington Health	Whittington Hospital	12.5	19.7	15.9	1.5	3.9	108	97.3	53.7	4.8	62.0	93.3	57.8	92.2	60.9	28.9	79.7	100.0	79.7	82.3	76.9	86.1	12.1	9.6	3.8	4.8	1
London – North East	HOM	Homerton University Hospital NHS Foundation Trust	Homerton Hospital	12.6	20.5	16.3	1.1	3.5	96	126.3	78.1	5.0	85.4	78.9	95.9	98.0	98.0	81.8	95.8	97.9	97.9	97.9	91.7	100.0	62.5	8.2	4.2	4.2	2
London – North East	KNG	Barking Havering and Redbridge Univ Hosps NHS Trust	King George Hospital	10.1	21.4	16.8	0.4	3.0	83	91.2	71.1	2.8	27.7	93.2	46.7	97.8	48.9	43.3	66.7	95.6	66.7	82.6	73.3	87.1	68.2	8.2	9.6	4.8	1
London – North East	LON	Barts Health NHS Trust	The Royal London Hospital	6.3	22.9	17.7	0.0	2.3	68	53.5	57.4	6.6	55.9	64.9	87.2	91.5	93.6	76.5	73.9	80.4	87.0	83.7	60.0	90.9	10.0	11.7	8.8	1.5	3
London – North East	NWG	Barts Health NHS Trust	Newham University Hospital	17.7	29.0	21.6	0.0	0.0	36	55.4	55.6	6.5	33.3	81.8	61.5	92.3	61.5	38.9	80.8	100.0	80.8	66.7	20.0	77.3	33.3	10.3	5.6	11.1	2
London – North East	QHR	Barking Havering and Redbridge Univ Hosps NHS Trust	Queen's Hospital – Romford	10.9	17.5	14.5	3.0	5.0	168	82.0	61.3	0.0	35.1	92.2	45.0	93.7	48.6	25.6	79.3	99.1	79.3	90.1	83.8	93.8	88.4	13.1	6.6	4.2	4
London – North East	WHC	Barts Health NHS Trust	Whipps Cross University Hospital	9.7	21.1	16.8	0.6	3.2	86	66.2	66.3	14.5	52.3	80.0	85.4	97.9	87.5	79.3	93.3	95.6	93.3	86.8	83.3	89.7	21.7	11.4	11.8	2.4	2
London – North West	EAL	London North West Healthcare NHS Trust	Ealing Hospital	5.7	28.4	21.0	0.0	0.1	38	67.9	81.6	0.0	31.6	95.7	66.7	100.0	66.7	50.0	40.0	93.3	46.7	80.0	60.0	90.0	0.0	10.3	7.9	2.6	1
London – North West	HHX	Royal Brompton and Harefield NHS Foundation Trust	Harefield Hospital	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA
London – North West	HIL	The Hillingdon Hospitals NHS Foundation Trust	Hillingdon Hospital	12.7	20.5	16.3	1.1	3.5	96	82.1	80.2	3.2	38.5	82.8	59.6	94.7	61.4	40.0	59.6	82.5	70.2	76.9	56.3	86.1	70.7	10.5	4.2	3.1	2
London – North West	NPH	London North West Healthcare NHS Trust	Northwick Park/St Marks Hospital	10.1	18.1	14.9	2.5	4.7	147	59.5	57.2	6.8	85.7	80.0	79.5	90.4	84.3	65.6	70.7	85.4	74.4	59.8	33.3	70.7	15.8	11.8	11.1	5.7	4
London – North West	STM	Imperial College Healthcare NHS Trust	St Mary's Hospital	8.6	19.6	15.8	1.6	3.9	111	86.0	41.8	3.5	39.6	81.7	63.0	85.2	64.8	32.3	83.0	98.1	84.9	73.1	53.3	81.1	37.5	8.0	6.3	4.5	1
London – North West	WMU	Chelsea and Westminster Hosp NHS Foundation Trust	West Middlesex University Hospital	18.9	26.0	19.8	0.0	0.8	47	62.7	72.3	7.1	78.7	87.9	90.0	100.0	90.0	85.7	70.0	95.0	75.0	100.0	100.0	100.0	11.8	10.2	8.5	4.3	1
London – South East	BRO	King's College Hospital NHS Foundation Trust	The Princess Royal University Hospital	4.9	20.4	16.3	1.1	3.5	97	58.8	47.4	6.8	67.0	94.9	81.6	95.9	81.6	73.3	89.8	95.9	89.8	78.3	77.8	78.6	17.0	11.5	8.5	4.3	2
London – South East	KCH	King's College Hospital NHS Foundation Trust	King's College Hospital	5.5	21.6	17.0	0.3	2.9	81	48.5	69.1	4.1	97.5	62.1	90.0	100.0	90.0	82.1	75.0	97.5	75.0	89.5	63.6	100.0	87.0	14.0	2.5	1.2	4
London – South East	LEW	Lewisham and Greenwich NHS Trust	University Hospital Lewisham	4.8	25.2	19.3	0.0	1.1	51	86.4	49.0	2.4	82.4	80.4	95.7	100.0	95.7	66.7	82.6	100.0	82.6	91.7	80.0	100.0	13.3	7.6	2.0	3.9	2
London – South East	QEL	Lewisham and Greenwich NHS Trust	Queen Elizabeth Hospital (Lewisham and Greenwich NHS Trust)	15.1	20.1	16.1	1.2	3.6	100	62.5	48.0	5.8	65.0	85.9	67.2	98.4	67.2	43.5	63.9	86.9	72.1	71.9	58.8	77.5	11.5	9.7	5.3	3.2	2
London – South East	STH	Guy's and St Thomas' NHS Foundation Trust	St Thomas' Hospital	8.8	21.4	16.8	0.4	3.0	83	46.9	67.5	4.1	78.3	83.9	82.1	98.5	82.1	68.0	68.8	89.6	72.9	77.3	64.3	100.0	71.4	14.2	2.5	7.3	3
London – South West	BMP	Royal Brompton and Harefield NHS Foundation Trust	Royal Brompton Hospital	NA	NA	NA	NA	NA	1	100.0	100.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	NA	100.0	0.0	21.2	0.0	0.0	n/a
London – South West	CHX	Imperial College Healthcare NHS Trust	Charing Cross	NA	NA	NA	NA	NA	3	4.3	100.0	0.0	100.0	100.0	100.0	100.0	100.0	NA	100.0	100.0	100.0	100.0	NA	100.0	0.0	17.5	33.3	33.3	3
London – South West	GEO	St George's Healthcare NHS Trust	St George's Hospital	9.5	17.5	14.5	3.0	5.0	168	107.7	52.7	3.8	51.2	76.0	86.2	91.7	91.7	58.9	87.6	90.5	96.2	95.0	85.3	100.0	5.7	11.0	8.4	5.5	4
London – South West	KTH	Kingston Hospital NHS Trust	Kingston Hospital	10.2	20.6	16.4	1.1	3.4	94	77.0	60.6	2.4	98.9	87.2	95.8	95.8	100.0	97.0	95.7	97.9	97.9	100.0	100.0	100.0	70.2	12.5	8.5	7.4	3
London – South West	MAR	The Royal Marsden NHS Foundation Trust	Royal Marsden Hospital	0.0	40.4	28.7	0.0	0.0	17	53.1	94.1	0.0	100.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	13.0	11.8	6.3	NA
London – South West	MAY	Croydon Health Services NHS Trust	Croydon University Hospital	1.9	21.7	17.2	0.2	2.8	78	75.0	73.1	4.2	38.5	88.2	86.8	97.4	86.8	61.3	94.7	97.4	97.4	94.6	100.0	92.0	11.5	10.4	6.4	3.8	2
London – South West	SHC	Epsom and St Helier University Hospitals NHS Trust	St Helier Hospital	10.8	23.6	18.3	0.0	2.0	62	47.0	57.6	8.5	48.4	90.0	92.3	97.4	92.3	72.0	94.7	94.7	100.0	92.3	84.6	96.2	3.4	12.0	0.0	3.4	1
London – South West	WES	Chelsea and Westminster Hosp NHS Foundation Trust	Chelsea and Westminster Hospital	0.0	22.6	17.7	0.0	2.4	70	74.5	50.7	11.7	77.1	82.8	92.9	96.4	92.9	92.3	95.8	100.0	95.8	95.8	90.9	100.0	38.9	11.2	4.3	5.7	2

Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
Central – East Midlands	CHE	Chesterfield Royal Hospital NHS Foundation Trust	Chesterfield Royal Hospital	8.5	19.0	15.5	1.9	4.2	121	72.0	72.7	5.8	73.6	75.3	97.3	100.0	97.3	72.5	98.6	98.6	100.0	95.2	95.5	95.1	25.0	11.3	6.7	5.0	3
Central – East Midlands	DER	Derby Hospitals NHS Foundation Trust	Royal Derby Hospital	6.3	16.2	13.7	3.8	5.6	227	79.1	61.2	8.9	45.4	77.6	87.9	93.3	94.6	57.1	77.2	98.7	77.9	71.9	52.4	79.8	90.0	10.6	4.4	2.2	4
Central – East Midlands	KGH	Kettering General Hospital NHS Foundation Trust	Kettering General Hospital	9.9	18.6	15.2	2.3	4.5	133	64.6	67.4	7.2	72.9	82.7	84.7	91.5	88.1	73.5	87.9	91.4	93.1	77.0	59.1	87.2	0.0	8.6	3.8	5.4	3
Central – East Midlands	KMH	Sherwood Forest Hospitals NHS Foundation Trust	Kings Mill Hospital	14.4	18.9	15.4	2.0	4.3	125	75.3	60.0	1.9	94.4	88.4	97.5	100.0	97.5	84.3	98.7	98.7	100.0	86.7	72.4	95.7	55.8	9.3	3.2	0.8	3
Central – East Midlands	LEI	University Hospitals of Leicester NHS Trust	Leicester General Hospital	2.7	20.9	16.6	0.8	3.3	89	65.0	51.1	2.8	66.3	83.3	84.8	100.0	84.8	75.0	60.5	69.8	83.7	93.6	95.5	92.0	0.0	9.4	3.4	3.4	1
Central – East Midlands	LER	University Hospitals of Leicester NHS Trust	Leicester Royal Infirmary	5.4	15.1	13.0	4.7	6.3	321	91.5	55.1	11.2	67.6	82.4	75.5	97.9	77.1	79.5	62.6	87.7	69.7	97.9	98.0	97.8	1.0	9.2	6.3	3.4	4
Central – East Midlands	LIN	United Lincolnshire Hospitals NHS Trust	Lincoln County Hospital	12.0	17.5	14.5	3.0	5.0	169	105.6	47.3	2.4	83.4	75.0	82.5	91.8	87.6	86.8	92.6	94.7	97.9	91.0	85.7	93.1	6.9	10.4	10.1	1.8	3
Central – East Midlands	NOT	Nottingham University Hospitals NHS Trust	Nottingham City Hospital	12.8	27.4	20.8	0.0	0.3	41	124.2	68.3	3.8	80.5	90.5	66.7	93.9	69.7	80.8	63.6	87.9	72.7	77.8	57.1	85.0	40.0	17.5	26.8	7.3	NA
Central – East Midlands	NTH	Northampton General Hospital NHS Trust	Northampton General Hospital	10.4	16.6	14.0	3.5	5.4	206	103.0	58.3	3.4	80.6	86.7	94.2	96.2	98.1	80.3	98.1	100.0	98.1	79.2	61.1	88.6	19.2	8.2	4.9	2.9	3
Central – East Midlands	NUN	George Eliot Hospital NHS Trust	George Eliot Hospital	14.9	21.6	17.0	0.3	2.9	81	70.4	77.8	8.0	66.7	93.9	95.2	97.6	95.2	72.0	84.6	92.3	92.3	86.0	73.3	92.9	3.4	7.4	7.4	1.2	1
Central – East Midlands	PIL	United Lincolnshire Hospitals NHS Trust	Pilgrim Hospital	12.7	20.4	16.3	1.1	3.5	97	87.4	77.3	22.2	94.8	89.0	97.1	100.0	97.1	87.2	77.9	100.0	77.9	83.6	66.7	89.1	26.4	8.5	6.3	5.3	1
Central – East Midlands	QMC	Nottingham University Hospitals NHS Trust	Queens Medical Centre – Nottingham	8.8	15.3	13.1	4.5	6.1	299	117.3	87.3	0.8	85.6	88.2	53.5	90.0	58.0	38.4	74.7	93.4	79.3	79.8	61.1	88.6	31.0	9.3	5.7	4.1	4
Central – East of England	ADD	Cambridge University Hosps NHS Foundation Trust	Addenbrookes Hospital	6.5	17.5	14.5	3.0	5.0	167	60.1	77.8	3.2	70.7	75.4	77.8	98.8	79.0	75.9	70.0	98.8	70.0	76.8	51.9	89.1	16.4	10.0	5.4	2.4	4
Central – East of England	BAS	Basildon and Thurrock University Hospitals NHS Foundation Trust	Basildon University Hospital	9.5	18.7	15.3	2.1	4.3	129	80.6	60.5	3.6	70.5	86.0	78.9	97.2	81.7	56.8	91.3	92.8	94.2	57.5	25.0	73.5	41.7	10.6	4.7	3.1	3
Central – East of England	BED	Bedford Hospital NHS Trust	Bedford Hospital	12.7	21.7	17.1	0.3	2.9	79	81.4	58.2	5.0	98.7	77.3	64.2	79.2	67.9	54.3	90.2	98.0	92.2	71.2	58.8	77.1	0.0	12.4	5.1	2.5	1
Central – East of England	BFH	Mid Essex Hospital Services NHS Trust	Broomfield Hospital	9.0	18.1	14.9	2.5	4.7	146	81.1	53.4	8.2	74.0	77.5	90.8	95.4	94.3	91.7	76.5	85.9	85.9	87.7	76.0	92.9	15.5	11.5	6.3	2.8	3
Central – East of England	COL	Colchester Hospital University NHS Foundation Trust	Colchester General Hospital	12.2	17.7	14.6	2.7	4.9	158	98.1	59.9	6.3	90.5	83.1	95.6	97.8	97.8	89.5	95.4	97.7	97.7	79.3	64.7	88.7	9.5	9.5	8.2	4.4	3
Central – East of England	HIN	Hinchingbrooke Health Care NHS Trust	Hinchingbrooke Hospital	12.2	25.9	19.7	0.0	0.8	48	78.7	61.7	4.9	50.0	89.5	92.0	100.0	92.0	61.5	61.9	100.0	61.9	50.0	16.7	78.6	4.5	9.1	4.3	2.1	1
Central – East of England	IPS	Ipswich Hospital NHS Trust	Ipswich Hospital	7.3	17.1	14.2	3.2	5.2	183	100.5	59.1	6.2	89.6	76.6	79.0	91.1	86.3	54.1	87.5	95.8	90.0	65.8	51.2	74.3	50.6	9.3	9.3	5.5	3
Central – East of England	JPH	James Paget University Hosps NHS Foundation Trust	James Paget University Hospital	16.1	19.3	15.6	1.8	4.0	115	65.3	77.2	6.3	59.1	87.3	94.4	95.8	98.6	71.7	81.7	84.5	97.2	73.6	52.2	83.7	0.0	11.3	11.3	5.2	2
Central – East of England	LDH	Luton and Dunstable Hospital NHS Foundation Trust	Luton and Dunstable Hospital	11.5	16.8	14.0	3.5	5.4	199	103.6	66.5	1.9	41.2	74.8	77.8	93.5	80.6	70.7	89.5	97.1	91.4	75.2	62.2	84.4	7.8	9.5	2.5	1.0	3
Central – East of England	LIS	East and North Hertfordshire NHS Trust	Lister Hospital	13.2	18.2	14.9	2.5	4.7	165	118.7	38.2	2.9	33.9	96.4	50.7	100.0	50.7	55.3	73.1	95.5	76.1	68.4	47.8	82.4	0.0	10.3	3.7	4.3	3
Central – East of England	NOR	Norfolk and Norwich University Hospitals NHS Foundation Trust	Norfolk and Norwich University Hospital	10.3	15.3	13.1	4.5	6.2	302	94.4	68.5	6.3	98.3	76.1	77.0	99.4	77.6	44.6	58.0	79.0	70.4	55.2	32.3	70.0	11.2	9.5	5.0	3.3	4
Central – East of England	PAH	The Princess Alexandra Hospital NHS Trust	Princess Alexandra Hospital	10.0	20.4	16.3	1.1	3.5	97	72.4	53.7	2.5	73.2	88.1	82.0	90.2	88.5	76.3	89.1	92.7	92.7	70.0	50.0	83.3	13.2	11.2	4.3	2.2	3
Central – East of England	PAP	Papworth Hospital NHS Foundation Trust	Papworth Hospital	NA	NA	NA	NA	NA	9	900.0	88.9	12.5	22.2	100.0	75.0	75.0	100.0	100.0	25.0	100.0	25.0	100.0	NA	100.0	0.0	22.6	11.1	0.0	NA
Central – East of England	PET	Peterborough and Stamford Hosps NHS Foundation Trust	Peterborough City Hospital	8.4	18.0	14.8	2.6	4.7	149	84.7	54.1	4.3	81.9	83.6	85.2	92.6	90.1	81.3	83.8	83.8	100.0	96.3	100.0	94.3	67.6	9.3	8.1	5.4	3
Central – East of England	QKL	The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust	The Queen Elizabeth Hospital – King's Lynn	5.4	20.6	16.4	1.1	3.4	94	79.7	60.6	4.1	97.9	93.2	62.3	96.2	66.0	40.0	98.1	100.0	98.1	96.1	92.9	97.3	0.0	9.5	3.2	2.1	2
Central – East of England	SEH	Southend University Hospital NHS Foundation Trust	Southend University Hospital	12.8	19.0	15.4	1.9	4.2	123	66.8	63.9	6.2	58.5	87.5	83.3	90.9	90.9	57.5	74.2	84.8	83.3	64.6	50.0	73.2	0.0	10.6	5.1	4.2	3
Central – East of England	WAT	West Hertfordshire Hospitals NHS Trust	Watford General Hospital	14.5	16.7	14.0	3.5	5.4	202	122.4	51.3	3.4	71.3	73.6	55.6	83.3	61.1	47.8	88.7	97.2	91.5	70.1	51.4	79.2	4.8	10.2	6.9	5.4	3
Central – East of England	WSH	West Suffolk NHS Foundation Trust	West Suffolk Hospital	10.0	17.5	14.5	3.0	5.0	167	87.9	76.6	7.4	95.2	86.0	96.0	100.0	96.0	49.0	93.0	93.0	100.0	81.3	71.8	88.5	64.3	10.2	4.8	1.8	2
Central – West Midlands	BRT	Burton Hospitals NHS Foundation Trust	Queen's Hospital – Burton	13.2	20.2	16.1	1.2	3.6	99	74.4	46.5	8.0	100.0	73.6	95.7	97.1	98.6	72.7	95.7	98.6	97.1	66.7	52.4	73.3	19.0	7.4	4.1	7.1	2
Central – West Midlands	CTY	Sandwell and West Birmingham Hospitals NHS Trust	City Hospital	NA	NA	NA	NA	NA	3	42.9	66.7	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	NA	100.0	0.0	21.6	0.0	0.0	NA
Central – West Midlands	EBH	Heart of England NHS Foundation Trust	Birmingham Heartlands Hospital	10.8	16.3	13.8	3.7	5.6	222	102.3	63.5	9.0	72.5	83.5	82.5	89.5	88.1	53.3	89.1	94.2	94.2	80.0	55.6	94.5	13.0	9.6	8.1	2.7	3
Central – West Midlands	GHS	Heart of England NHS Foundation Trust	Good Hope Hospital	10.0	18.1	14.8	2.6	4.7	148	91.9	68.2	4.1	52.7	92.7	97.7	98.9	98.9	57.9	92.0	95.4	95.4	61.3	28.6	72.9	54.3	10.3	4.1	4.7	2

Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
Central – West Midlands	HCH	Wye Valley NHS Trust	Hereford County Hospital	12.2	20.7	16.5	0.9	3.4	91	70.0	67.0	2.6	42.9	91.5	85.5	100.0	85.5	73.3	73.6	96.2	77.4	63.2	46.4	79.3	2.1	8.9	9.9	5.5	1
Central – West Midlands	NCR	The Royal Wolverhampton Hospitals NHS Trust	New Cross Hospital	11.9	15.9	13.5	4.1	5.8	250	94.0	65.1	1.8	23.2	86.2	98.6	100.0	98.6	71.7	97.9	100.0	97.9	68.6	47.5	77.0	8.8	11.5	7.2	2.4	4
Central – West Midlands	PRS	The Shrewsbury and Telford Hospital NHS Trust	The Princess Royal Hospital	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	
Central – West Midlands	QEB	University Hosp Birmingham NHS Foundation Trust	Queen Elizabeth Hospital Birmingham	7.5	16.3	13.7	3.8	5.6	225	94.1	56.9	4.6	80.4	65.5	94.4	98.6	95.8	72.1	78.7	88.7	84.4	82.7	67.3	92.9	49.1	15.0	9.0	4.0	4
Central – West Midlands	RSH	University Hospitals of North Midlands NHS Trust	Royal Stoke University Hospital	5.8	31.3	22.9	0.0	0.0	30	6.8	82.8	0.0	73.3	65.2	87.5	93.8	93.8	18.2	75.0	87.5	81.3	81.3	60.0	90.9	71.4	10.2	3.3	6.7	4
Central – West Midlands	RSS	The Shrewsbury and Telford Hospital NHS Trust	Royal Shrewsbury Hospital	13.5	17.2	14.3	3.1	5.1	178	60.8	64.2	7.6	50.6	89.7	60.2	81.8	65.9	45.8	76.8	82.9	90.2	51.1	27.1	78.6	10.0	7.3	6.2	2.8	3
Central – West Midlands	RUS	The Dudley Group NHS Foundation Trust	Russells Hall Hospital	8.4	16.9	14.1	3.3	5.3	190	102.2	72.1	3.8	77.4	88.5	85.7	91.3	93.7	22.4	91.1	96.8	93.5	97.6	97.3	97.7	0.0	9.6	3.2	4.0	4
Central – West Midlands	SAN	Sandwell and West Birmingham Hospitals NHS Trust	Sandwell General Hospital	11.5	17.5	14.5	3.0	5.0	169	115.0	58.6	6.6	82.8	85.9	85.9	95.7	88.0	66.7	83.0	98.9	84.1	63.3	37.5	77.6	19.6	8.5	3.6	1.8	1
Central – West Midlands	UHC	University Hospitals Coventry and Warwickshire NHS Trust	University Hospital, Coventry	11.4	18.1	14.9	2.5	4.7	146	61.3	67.8	5.6	63.0	76.5	80.0	92.9	84.3	61.0	70.0	78.6	85.7	69.0	45.8	80.9	64.8	9.8	13.9	35.7	4
Central – West Midlands	WAW	South Warwickshire NHS Foundation Trust	Warwick Hospital	8.2	20.1	16.1	1.2	3.7	101	84.9	86.1	4.5	72.3	93.5	93.4	95.1	98.4	52.5	83.6	91.8	91.8	70.3	50.0	82.5	1.8	8.5	3.0	1.0	2
Central – West Midlands	WMH	Walsall Healthcare NHS Trust	Walsall Manor Hospital	19.6	18.8	15.3	2.0	4.3	127	69.4	61.4	1.9	61.4	81.2	95.8	100.0	95.8	16.7	83.1	94.4	88.7	69.1	40.0	81.3	4.3	12.3	11.1	4.8	2
Central – West Midlands	WRC	Worcestershire Acute Hospitals NHS Trust	Worcestershire Royal Hospital	11.3	15.4	13.2	4.4	6.1	285	96.0	62.9	4.7	85.3	81.0	94.9	96.0	98.9	73.2	81.6	84.5	94.8	90.0	80.7	94.7	11.2	10.1	2.9	4.2	2
North – North East	DAR	County Durham and Darlington NHS Foundation Trust	Darlington Memorial Hospital	6.5	20.4	16.3	1.1	3.5	97	73.5	24.7	5.6	69.1	86.2	98.3	100.0	98.3	86.7	100.0	100.0	100.0	78.7	65.0	85.4	7.9	9.6	5.2	2.1	1
North – North East	DRY	County Durham and Darlington NHS Foundation Trust	University Hospital North Durham	6.0	18.4	15.1	2.3	4.5	137	94.5	34.1	2.9	57.7	89.9	74.4	79.1	87.2	57.7	97.6	100.0	97.6	69.0	58.8	75.5	96.9	9.4	2.9	1.5	2
North – North East	FRE	The Newcastle upon Tyne Hospitals NHS Foundation Trust	Freeman Hospital	10.6	21.3	16.8	0.5	3.1	84	109.1	60.7	3.0	77.4	72.5	84.7	88.1	94.9	86.5	98.3	100.0	98.3	72.1	51.9	88.2	10.0	20.2	13.3	4.8	NA
North – North East	NSH	Northumbria Healthcare NHS Foundation Trust	Northumbria Specialist Emergency Care Hospital	8.9	15.6	13.3	4.2	6.0	269	101.1	67.3	2.5	87.7	87.4	99.3	99.3	99.3	72.8	98.6	100.0	98.6	79.2	64.4	88.4	73.0	7.0	9.1	2.0	1
North – North East	NTG	North Tees and Hartlepool NHS Foundation Trust	University Hospital of North Tees	8.6	18.0	14.8	2.7	4.7	150	76.5	75.0	4.6	70.7	84.9	93.3	96.6	94.4	71.7	89.8	95.5	92.0	66.7	43.3	78.3	80.5	7.8	3.3	2.7	3
North – North East	QEG	Gateshead Health NHS Foundation Trust	Queen Elizabeth Hospital – Gateshead	14.7	20.1	16.1	1.2	3.6	100	65.8	76.0	3.4	92.0	91.0	100.0	100.0	100.0	83.7	83.1	89.8	93.2	98.2	93.3	100.0	12.8	9.4	7.0	4.0	3
North – North East	RVN	The Newcastle upon Tyne Hospitals NHS Foundation Trust	Royal Victoria Infirmary	8.5	16.5	13.9	3.7	5.5	214	104.4	57.0	1.7	85.5	90.4	95.6	99.1	96.5	90.9	89.3	95.5	92.9	95.5	86.7	98.8	63.0	10.5	8.0	2.8	4
North – North East	SCM	South Tees Hospitals NHS Foundation Trust	The James Cook University Hospital	10.9	18.0	14.8	2.7	4.7	150	69.8	69.8	3.0	66.7	89.6	87.6	92.1	94.4	62.5	85.4	93.3	89.9	86.4	76.2	90.0	11.8	11.5	4.0	2.7	4
North – North East	STD	South Tyneside NHS Foundation Trust	South Tyneside District Hospital	12.9	21.9	17.2	0.2	2.8	77	106.9	74.0	3.0	76.6	92.0	96.1	100.0	96.1	64.0	91.8	100.0	91.8	64.6	31.8	92.3	19.5	10.6	2.6	2.6	1
North – North East	SUN	City Hospitals Sunderland NHS Foundation Trust	Sunderland Royal Hospital	9.8	16.8	14.1	3.4	5.3	196	103.7	59.2	4.3	93.4	86.6	94.4	96.8	96.8	77.0	96.0	99.2	96.8	86.8	71.1	93.4	0.0	9.6	5.6	4.6	4
North – North West	AEI	Wrightington, Wigan and Leigh NHS Foundation Trust	Royal Albert Edward Infirmary	6.2	17.9	14.7	2.7	4.8	154	89.5	65.6	8.1	93.5	88.8	86.5	97.3	87.8	62.3	76.4	98.6	77.8	77.6	71.0	82.2	6.8	8.4	4.6	1.3	1
North – North West	BLA	East Lancashire Hospitals NHS Trust	Royal Blackburn Hospital	10.2	16.2	13.7	3.8	5.6	227	111.8	72.2	4.8	80.2	78.0	84.8	96.0	88.7	71.6	91.8	96.6	94.6	88.2	86.7	88.9	12.5	12.3	4.9	2.2	3
North – North West	BOL	Bolton NHS Foundation Trust	Royal Bolton Hospital	9.3	17.3	14.4	3.0	5.1	174	116.8	82.2	6.9	97.1	80.9	98.0	99.0	99.0	69.8	94.9	94.9	100.0	87.6	65.6	97.3	6.3	10.5	2.3	3.4	3
North – North West	CHR	The Christie NHS Foundation Trust	The Christie	8.8	43.3	30.7	0.0	0.0	15	62.5	100.0	20.0	66.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	75.0	60.0	100.0	0.0	16.9	0.0	0.0	NA
North – North West	CMI	North Cumbria University Hospitals NHS Trust	Cumberland Infirmary	6.5	25.9	19.7	0.0	0.8	48	24.7	81.3	9.3	64.6	83.3	96.4	100.0	96.4	66.7	100.0	100.0	100.0	96.2	100.0	93.8	5.6	10.1	10.4	0.0	1
North – North West	COC	Countess of Chester Hospital NHS Foundation Trust	Countess of Chester Hospital	10.0	19.8	15.9	1.4	3.8	106	100.0	68.9	12.6	80.2	76.6	93.4	100.0	93.4	73.2	76.7	95.0	81.7	78.3	64.7	83.7	6.4	10.3	2.8	1.9	3
North – North West	FAZ	Aintree University Hospitals NHS Foundation Trust	Aintree University Hospital	9.5	17.2	14.3	3.2	5.2	180	79.6	59.9	6.9	71.1	80.4	78.6	81.2	95.7	67.5	66.1	68.7	91.3	73.5	64.3	76.5	18.2	11.3	8.0	2.8	4
North – North West	FGH	University Hospitals of Morecambe Bay NHS Foundation Trust	Furness General Hospital	9.9	23.1	18.0	0.0	2.1	65	95.6	75.4	15.0	83.1	80.4	89.6	100.0	89.6	81.3	77.1	100.0	77.1	87.2	68.4	100.0	2.8	10.0	4.6	0.0	1
North – North West	LEG	Mid Cheshire Hospitals NHS Foundation Trust	Leighton Hospital	8.9	19.1	15.5	1.8	4.2	120	86.3	79.2	2.8	79.2	87.0	65.0	96.7	66.7	34.3	81.7	93.3	88.3	63.5	37.5	79.5	15.7	13.0	3.4	1.7	3
North – North West	LHC	Liverpool Heart and Chest Hospital NHS Foundation Trust	Liverpool Heart and Chest Hospital	NA	NA	NA	NA	NA	2	50.0	0.0	NA	100.0	50.0	0.0	0.0	100.0	NA	50.0	50.0	100.0	100.0	NA	100.0	0.0	14.6	0.0	0.0	NA
North – North West	MAC	East Cheshire NHS Trust	Macclesfield District General Hospital	5.6	22.2	17.4	0.1	2.7	74	82.2	90.5	2.9	97.3	89.6	89.7	100.0	89.7	76.2	82.1	100.0	82.1	70.3	60.0	77.3	5.4	8.6	8.1	5.4	1
North – North West	MRI	Central Manchester University Hospitals NHS Foundation Trust	Manchester Royal Infirmary	10.1	19.1	15.5	1.8	4.2	120	86.3	64.1	8.7	51.7	75.0	81.5	85.2	93.8	78.6	93.8	97.5	96.3	95.8	95.0	96.2	6.7	13.4	10.4	3.7	4

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Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
North – North West	NMG	The Pennine Acute Hospitals NHS Trust	North Manchester General Hospital	8.0	18.4	15.1	2.3	4.5	136	91.3	57.8	12.0	61.8	79.0	82.6	96.5	83.7	61.2	100.0	100.0	100.0	62.4	38.2	78.4	0.0	11.2	3.0	0.7	2
North – North West	OHM	The Pennine Acute Hospitals NHS Trust	The Royal Oldham Hospital	7.5	17.8	14.6	2.7	4.8	157	107.5	56.7	9.9	93.6	81.2	85.4	90.6	90.6	64.9	98.9	100.0	98.9	77.1	54.1	91.5	NA	12.6	3.2	3.2	2
North – North West	RLI	University Hospitals of Morecambe Bay NHS Foundation Trust	Royal Lancaster Infirmary	8.9	19.0	15.4	1.9	4.2	122	91.7	73.8	9.0	83.6	88.0	90.1	95.8	91.5	72.2	85.5	100.0	85.5	78.8	63.6	93.9	16.7	11.0	2.5	2.5	1
North – North West	RLU	Royal Liverpool and Broadgreen Univ Hospitals NHS Trust	Royal Liverpool University Hospital	9.4	18.5	15.1	2.3	4.5	135	65.9	50.8	5.3	57.0	86.5	64.0	86.0	73.3	45.3	54.1	72.9	72.9	81.0	61.5	89.7	31.7	12.7	6.1	1.5	4
North – North West	RPH	Lancashire Teaching Hospitals NHS Foundation Trust	Royal Preston Hospital	9.7	18.1	14.9	2.5	4.7	146	91.8	75.9	1.6	80.8	67.4	89.2	95.7	93.5	68.3	73.1	82.8	86.0	81.5	58.1	93.4	87.7	12.5	2.1	0.7	4
North – North West	SHH	Stockport NHS Foundation Trust	Stepping Hill Hospital	9.5	18.3	15.0	2.4	4.6	140	97.2	50.0	6.2	76.4	69.7	89.2	97.6	90.4	82.0	98.6	100.0	98.6	88.0	82.4	91.8	0.0	12.4	1.5	0.0	4
North – North West	SLF	Salford Royal NHS Foundation Trust	Salford Royal Hospital	5.5	17.7	14.6	2.8	4.9	160	87.4	39.4	0.0	90.6	81.4	94.7	98.9	95.7	42.6	95.7	100.0	95.7	96.7	93.9	98.3	75.8	10.8	5.0	0.6	4
North – North West	SPD	Southport and Ormskirk Hospital NHS Trust	Southport District General Hospital	6.2	19.9	16.0	1.3	3.8	104	101.0	64.4	4.3	77.9	87.5	85.1	91.0	92.5	84.1	59.7	65.7	88.1	97.0	89.5	100.0	5.3	11.5	2.9	1.9	1
North – North West	TGA	Tameside Hospital NHS Foundation Trust	Tameside General Hospital	12.5	19.3	15.6	1.8	4.1	116	123.4	80.2	4.1	91.4	96.0	95.3	100.0	95.3	86.8	85.7	87.3	93.7	64.7	46.2	76.2	33.3	8.2	6.0	3.4	2
North – North West	VIC	Blackpool Teaching Hospitals NHS Foundation Trust	Blackpool Victoria Hospital	6.9	17.2	14.3	3.2	5.2	180	109.1	62.0	12.3	95.0	88.9	97.3	98.2	99.1	81.5	99.1	100.0	99.1	95.4	90.6	97.4	15.7	10.5	7.8	2.2	4
North – North West	WDG	Warrington and Halton Hospitals NHS Foundation Trust	Warrington Hospital	9.5	18.4	15.1	2.3	4.5	138	106.2	65.2	4.3	89.1	83.5	93.7	98.7	93.7	84.9	92.2	94.8	96.1	86.1	64.0	96.3	17.5	12.2	5.1	1.4	2
North – North West	WHI	St Helens and Knowsley Teaching Hospitals NHS Trust	Whiston Hospital	8.0	16.8	14.1	3.4	5.3	195	90.7	62.1	5.7	80.0	80.2	94.4	96.3	95.4	64.2	70.8	74.5	92.5	69.9	55.9	76.8	3.4	10.3	4.1	2.1	4
North – North West	WIR	Wirral University Teaching Hospital NHS Foundation Trust	Arrowe Park Hospital	7.9	16.8	14.1	3.4	5.3	197	111.9	57.4	7.6	78.2	83.3	96.4	97.3	99.1	68.4	95.5	98.2	97.3	67.0	25.0	84.4	6.7	13.1	4.1	1.0	4
North – North West	WLT	The Walton Centre NHS Foundation Trust	The Walton Centre	NA	NA	NA	NA	NA	1	100.0	100.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	NA	100.0	NA	27.0	0.0	0.0	NA
North – North West	WYT	University Hospital of South Manchester NHS Foundation Trust	Wythenshawe Hospital	5.4	18.0	14.8	2.7	4.7	150	107.9	76.7	5.2	86.0	82.8	96.4	100.0	96.4	84.3	84.3	98.8	85.5	88.0	75.0	96.1	75.0	9.8	2.7	0.7	4
North – Yorkshire and Humber	AIR	Airedale NHS Foundation Trust	Airedale General Hospital	12.2	20.1	16.1	1.2	3.6	100	103.1	71.0	6.3	83.0	83.3	91.5	98.3	93.2	75.0	83.1	88.1	91.5	71.0	61.9	75.6	NA	10.5	6.1	3.0	1
North – Yorkshire and Humber	BAR	Barnsley Hospital NHS Foundation Trust	Barnsley Hospital	15.5	18.7	15.2	2.2	4.4	130	107.4	73.8	7.5	70.0	80.6	91.7	100.0	91.7	71.1	86.7	88.3	95.0	93.1	92.3	93.8	4.3	11.3	10.9	2.3	1
North – Yorkshire and Humber	BRD	Bradford Teaching Hospitals NHS Foundation Trust	Bradford Royal Infirmary	11.8	17.2	14.3	3.1	5.1	177	126.4	54.2	6.8	72.3	86.6	90.3	96.1	93.2	72.5	90.1	96.0	92.1	77.1	58.1	85.1	28.3	12.3	4.0	2.4	3
North – Yorkshire and Humber	CAS	Hull and East Yorkshire Hospitals NHS Trust	Castle Hill Hospital	NA	NA	NA	NA	NA	4	6.3	50.0	0.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	NA	16.2	0.0	0.0	NA
North – Yorkshire and Humber	DDH	The Mid Yorkshire Hospitals NHS Trust	Dewsbury and District Hospital	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA
North – Yorkshire and Humber	DID	Doncaster and Bassetlaw Hosps NHS Foundation Trust	Doncaster Royal Infirmary	6.8	21.1	16.7	0.6	3.2	88	35.3	67.0	7.5	48.9	90.7	82.7	96.2	82.7	50.0	77.6	89.8	87.8	60.0	40.0	71.4	6.5	9.0	4.5	2.3	2
North – Yorkshire and Humber	FRR	South Tees Hospitals NHS Foundation Trust	Friarage Hospital	17.1	43.8	31.6	0.0	0.0	14	25.9	64.3	0.0	85.7	92.3	100.0	100.0	100.0	33.3	77.8	88.9	88.9	100.0	100.0	100.0	0.0	8.0	0.0	0.0	1
North – Yorkshire and Humber	GGH	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust	Diana Princess of Wales Hospital	17.3	20.3	16.2	1.2	3.5	98	80.3	50.5	0.0	80.6	75.4	71.4	82.1	82.1	90.2	58.9	87.5	67.9	80.7	57.9	92.1	2.4	14.1	3.1	5.1	1
North – Yorkshire and Humber	HAR	Harrogate and District NHS Foundation Trust	Harrogate District Hospital	9.9	27.3	20.6	0.0	0.4	42	67.7	81.0	0.0	90.5	87.9	83.3	83.3	100.0	94.7	95.8	95.8	100.0	93.3	77.8	100.0	16.7	12.1	7.3	4.8	1
North – Yorkshire and Humber	HUD	Calderdale and Huddersfield NHS Foundation Trust	Huddersfield Royal Infirmary	9.4	17.0	14.2	3.3	5.2	187	102.2	71.1	7.6	86.1	90.9	90.4	100.0	90.4	61.0	97.9	100.0	97.9	59.4	43.9	70.9	13.3	10.8	2.2	2.2	3
North – Yorkshire and Humber	HUL	Hull and East Yorkshire Hospitals NHS Trust	Hull Royal Infirmary	12.5	30.5	22.4	0.0	0.0	32	10.9	37.5	5.0	62.5	84.2	75.0	93.8	81.3	76.9	62.5	87.5	62.5	100.0	100.0	100.0	15.4	14.7	10.0	6.3	4
North – Yorkshire and Humber	LGI	The Leeds Teaching Hospitals NHS Trust	Leeds General Infirmary	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	
North – Yorkshire and Humber	NGS	Sheffield Teaching Hospitals NHS Foundation Trust	Northern General Hospital	8.6	18.4	15.1	2.3	4.5	138	44.1	47.9	3.8	58.7	77.3	69.2	74.7	76.9	56.5	67.1	75.3	87.7	75.9	65.9	86.8	0.0	14.3	5.1	8.0	4
North – Yorkshire and Humber	PIN	The Mid Yorkshire Hospitals NHS Trust	Pinderfields Hospital	7.7	18.2	15.0	2.4	4.6	142	47.7	69.0	4.0	48.6	73.3	88.9	96.3	91.4	56.3	63.3	98.7	63.3	60.3	33.3	77.1	18.0	12.2	3.6	0.7	4
North – Yorkshire and Humber	ROT	The Rotherham NHS Foundation Trust	Rotherham Hospital	14.5	23.3	18.1	0.0	2.1	64	57.7	79.7	1.7	85.9	84.4	93.3	100.0	93.3	42.1	86.7	100.0	86.7	85.7	76.9	93.3	0.0	10.3	3.2	0.0	2
North – Yorkshire and Humber	SCA	York Teaching Hospital NHS Foundation Trust	Scarborough Hospital	NA	NA	NA	NA	NA	7	7.1	85.7	0.0	100.0	100.0	100.0	100.0	100.0	75.0	100.0	100.0	100.0	80.0	50.0	100.0	33.3	12.6	0.0	0.0	1
North – Yorkshire and Humber	SCU	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust	Scunthorpe General Hospital	9.4	23.8	18.3	0.0	1.9	61	61.0	37.7	3.6	13.1	81.6	95.7	100.0	95.7	95.1	66.0	93.6	70.2	53.1	33.3	55.8	0.0	11.8	1.6	4.9	1

![NELA National Emergency Laparotomy Audit]

Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
North – Yorkshire and Humber	SJH	The Leeds Teaching Hospitals NHS Trust	St James's University Hospital	8.6	14.3	12.5	5.3	6.7	420	90.1	67.3	2.0	51.0	75.4	78.8	89.9	86.9	58.6	42.6	58.4	64.0	63.4	34.9	78.3	29.9	8.7	5.0	3.3	4
North – Yorkshire and Humber	YDH	York Teaching Hospital NHS Foundation Trust	York Hospital	9.0	17.2	14.3	3.1	5.1	178	90.8	77.0	10.3	81.5	92.7	97.1	99.0	98.1	70.0	96.0	97.0	99.0	75.7	66.7	82.0	23.3	8.4	8.4	4.5	3
South – South Central	CCH	Oxford University Hospitals NHS Trust	Churchill Hospital	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA
South – South Central	MIW	Isle of Wight NHS Trust	St Mary's Hospital – IOW	10.2	24.5	18.8	0.0	1.7	56	80.0	67.9	4.4	87.5	88.2	75.8	100.0	75.8	85.0	65.6	100.0	65.6	90.9	81.8	95.5	10.3	15.4	8.9	3.6	1
South – South Central	MKH	Milton Keynes Hospital NHS Foundation Trust	Milton Keynes Hospital	12.1	20.6	16.5	1.0	3.4	92	63.4	64.1	4.8	82.6	82.4	74.0	100.0	74.0	68.6	64.0	100.0	64.0	67.3	54.5	71.1	12.1	8.0	3.3	3.3	2
South – South Central	NHH	Hampshire Hospitals NHS Foundation Trust	Basingstoke and North Hampshire Hospital	8.6	23.1	18.0	0.0	2.1	65	59.1	76.6	6.8	78.5	85.7	96.8	100.0	96.8	76.2	96.8	100.0	96.8	96.9	90.0	100.0	13.0	9.3	0.0	0.0	2
South – South Central	QAP	Portsmouth Hospitals NHS Trust	Queen Alexandra Hospital	9.3	16.2	13.7	3.9	5.7	230	77.7	47.8	9.3	73.9	78.2	79.8	97.4	81.6	47.1	75.2	94.7	78.8	71.2	51.6	77.7	2.9	9.4	5.7	1.7	4
South – South Central	RAD	Oxford University Hospitals NHS Trust	John Radcliffe Hospital	9.7	19.0	15.4	1.9	4.2	122	49.0	71.1	9.2	41.8	82.6	59.1	81.8	68.2	30.4	79.1	88.4	81.4	39.1	26.1	52.2	77.5	6.5	5.0	5.7	4
South – South Central	RBE	Royal Berkshire NHS Foundation Trust	Royal Berkshire Hospital	10.3	16.8	14.1	3.5	5.4	198	91.2	77.2	4.8	84.8	91.3	94.0	96.6	96.6	81.0	84.5	94.8	89.7	75.6	50.0	86.7	70.0	7.4	7.6	6.1	4
South – South Central	RHC	Hampshire Hospitals NHS Foundation Trust	Royal Hampshire County Hospital	9.0	20.2	16.1	1.2	3.6	99	105.3	73.7	0.0	81.8	97.3	94.7	100.0	94.7	93.2	96.5	100.0	96.5	96.6	88.9	100.0	23.5	10.3	6.1	1.0	1
South – South Central	SGH	University Hospital Southampton NHS Foundation Trust	Southampton General Hospital	7.0	15.9	13.5	4.1	5.8	250	98.0	68.0	2.4	79.2	72.3	84.3	96.7	86.3	63.7	80.9	89.5	85.5	90.2	81.0	94.1	2.5	11.3	3.6	2.0	4
South – South Central	SMV	Buckinghamshire Healthcare NHS Trust	Stoke Mandeville Hospital	11.1	18.1	14.8	2.6	4.7	148	100.7	61.4	14.7	72.3	74.5	89.8	92.9	95.9	82.5	84.4	87.5	94.8	85.2	71.0	93.0	27.7	12.3	6.1	3.4	3
South – South Central	WEX	Frimley Health NHS Foundation Trust	Wexham Park Hospital	8.6	17.9	14.8	2.7	4.8	151	91.0	78.1	0.8	84.1	82.8	88.4	95.7	92.8	70.6	81.2	97.1	81.2	57.6	37.5	76.5	15.0	10.1	2.0	3.3	3
South – South East Coast	CKH	East Kent Hospitals University NHS Foundation Trust	Kent and Canterbury Hospital	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	
South – South East Coast	CON	East Sussex Healthcare NHS Trust	Conquest Hospital	8.1	17.7	14.6	2.8	4.9	161	100.0	61.0	5.5	89.4	89.2	97.7	97.7	98.9	66.2	92.0	98.9	93.2	77.5	47.6	86.8	18.4	14.4	3.1	0.6	4
South – South East Coast	DVH	Dartford and Gravesham NHS Trust	Darent Valley Hospital	13.0	18.9	15.4	2.0	4.3	125	75.8	64.0	3.4	96.0	84.8	100.0	100.0	100.0	94.9	93.8	98.5	95.4	93.8	89.5	100.0	67.5	11.4	4.0	1.6	2
South – South East Coast	ESU	Surrey and Sussex Healthcare NHS Trust	East Surrey Hospital	9.1	20.1	16.1	1.2	3.6	100	61.0	55.0	7.4	74.0	89.4	86.8	98.1	86.8	72.7	90.6	92.5	98.1	87.0	63.6	93.0	0.0	12.1	10.3	2.0	3
South – South East Coast	FRM	Frimley Health NHS Foundation Trust	Frimley Park Hospital	5.1	16.5	13.9	3.6	5.5	212	111.6	70.8	2.7	87.3	82.7	96.8	98.4	98.4	95.0	92.0	93.6	97.6	83.8	75.6	88.2	13.0	9.4	7.5	2.8	4
South – South East Coast	MDW	Medway NHS Foundation Trust	Medway Maritime Hospital	13.2	16.6	14.0	3.5	5.4	204	94.4	50.0	3.6	75.5	76.3	53.4	96.1	54.4	42.6	86.1	96.0	89.1	99.1	97.8	100.0	2.9	8.6	5.9	1.0	3
South – South East Coast	MST	Maidstone and Tunbridge Wells NHS Trust	Maidstone Hospital	NA	NA	NA	NA	NA	8	36.4	25.0	0.0	75.0	100.0	87.5	87.5	100.0	80.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	23.4	25.0	0.0	NA
South – South East Coast	QEQ	East Kent Hospitals University NHS Foundation Trust	Queen Elizabeth The Queen Mother Hospital	9.8	17.5	14.5	3.0	5.0	168	90.3	70.2	7.9	95.8	89.1	97.2	100.0	97.2	67.8	84.2	90.1	90.1	63.9	44.9	79.7	3.7	8.4	5.4	2.4	2
South – South East Coast	RSC	Brighton and Sussex University Hospitals NHS Trust	Royal Sussex County Hospital	6.9	18.0	14.8	2.6	4.7	149	60.6	66.4	1.5	84.6	58.6	53.0	83.1	62.7	45.6	63.9	79.5	77.1	73.4	50.0	84.9	4.3	11.2	10.1	0.7	2
South – South East Coast	RSU	Royal Surrey County Hospital NHS Foundation Trust	Royal Surrey County Hospital	6.5	17.7	14.6	2.7	4.9	158	81.4	70.7	0.0	41.8	87.1	79.5	91.6	86.7	82.1	94.0	95.2	98.8	94.8	85.2	100.0	0.0	10.9	3.2	1.9	2
South – South East Coast	SPH	Ashford and St Peter's Hospital NHS Foundation Trust	St Peter's Hospital	8.2	17.1	14.2	3.3	5.2	184	95.8	68.0	1.9	79.3	83.1	85.2	91.7	91.7	76.1	89.8	90.7	97.2	98.0	100.0	97.0	4.1	11.5	3.3	5.5	2
South – South East Coast	STR	Western Sussex Hospitals NHS Trust	St Richards Hospital	8.9	18.7	15.3	2.1	4.3	129	63.2	81.4	3.6	71.3	87.9	95.8	98.6	97.2	89.4	94.4	97.2	97.2	87.5	79.2	91.7	20.0	11.9	8.5	3.1	2
South – South East Coast	TUN	Maidstone and Tunbridge Wells NHS Trust	Tunbridge Wells Hospital	5.6	16.6	13.9	3.5	5.5	207	83.1	62.7	2.0	76.8	83.5	89.5	94.0	92.5	88.6	77.9	91.0	86.9	98.5	98.1	98.8	19.4	12.6	5.9	1.5	2
South – South East Coast	WHH	East Kent Hospitals University NHS Foundation Trust	William Harvey Hospital	10.1	16.8	14.1	3.4	5.3	195	96.1	56.5	10.1	85.6	85.2	95.6	97.8	97.8	76.1	100.0	100.0	100.0	81.2	67.7	94.1	4.0	8.2	3.6	5.7	2
South – South East Coast	WRG	Western Sussex Hospitals NHS Trust	Worthing Hospital	6.6	18.0	14.8	2.7	4.7	150	106.4	76.7	9.5	67.3	90.4	96.3	96.3	100.0	70.2	84.8	97.5	86.1	78.9	57.1	91.7	4.6	13.5	9.3	5.3	3
South – South West	BAT	Royal United Hospital Bath NHS Trust	Royal United Hospital	6.4	16.5	13.9	3.7	5.5	214	85.9	68.6	7.9	86.9	87.6	91.1	97.6	93.5	85.7	71.3	93.4	74.6	97.6	97.7	97.6	6.1	9.5	12.1	3.7	3
South – South West	BRI	University Hospitals of Bristol NHS Foundation Trust	Bristol Royal Infirmary	10.1	18.6	15.2	2.3	4.5	133	89.3	59.4	2.8	86.5	82.6	88.2	98.5	89.7	72.5	72.1	89.7	73.5	88.1	76.0	95.2	50.0	10.4	4.6	1.5	2
South – South West	BTH	The Royal Bournemouth and Christchurch Hosps NHS Foundation Trust	The Royal Bournemouth Hospital	5.7	17.3	14.4	3.0	5.1	173	106.1	78.5	2.0	76.3	82.7	84.9	90.4	94.5	65.3	72.6	95.9	75.3	78.1	50.0	95.6	4.3	11.3	8.7	6.9	4
South – South West	CGH	Gloucestershire Hospitals NHS Foundation Trust	Cheltenham Hospital	6.3	17.7	14.6	2.7	4.9	158	113.7	75.2	3.9	92.4	84.3	84.8	98.9	85.9	84.3	79.1	95.6	80.2	86.8	81.6	90.6	0.0	9.4	4.5	1.9	1
South – South West	GLO	Gloucestershire Hospitals NHS Foundation Trust	Gloucestershire Royal Hospital	9.8	15.7	13.4	4.2	5.9	262	126.6	68.6	4.5	72.1	87.9	90.5	98.0	92.6	73.0	78.9	95.2	81.6	72.2	45.5	87.5	13.0	8.5	8.4	4.2	3

Region	Hospital code	Trust/health boards	Hospital name	Adjusted mortality rate (%)	99.8% upper limit (%)	95% upper limit (%)	99.8% lower limit (%)	95% lower limit (%)	Total number of cases in Year 4	Final Case Ascertainment	CT reported before surgery	Discrepancy between surgical findings and CT report	Risk documented preoperatively	Arrival in theatre in timescale appropriate to urgency	Preoperative input by a consultant surgeon and anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant surgeon when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant anaesthetist when risk of death >=5% (P-POSSUM)	Preoperative input by a consultant intensivist when risk of death >10% (P-POSSUM)	Consultant surgeon and anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Consultant surgeon present in theatre when risk of death >=5% (P-POSSUM)	Consultant anaesthetist present in theatre when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death >=5% (P-POSSUM)	Admitted to critical care post op when risk of death 5-10% (P-POSSUM)	Admitted to critical care post op when risk of death >10% (P-POSSUM)	Assessment by eldery medicine specialist in patients > 70 years	Median post-op length of stay in patients surviving to hospital discharge (days)	Proportion returning to theatre after emergency laparotomy (%)	Proportion with unexpected critical care admission from the ward < 7 days post op (%)	Quartile (based on total number of hospital beds)
South – South West	MPH	Taunton and Somerset NHS Foundation Trust	Musgrove Park Hospital	10.4	17.7	14.6	2.7	4.9	158	92.9	51.6	5.5	82.9	78.4	82.5	99.0	83.5	80.4	96.6	100.0	96.6	83.9	75.6	91.7	77.8	9.6	6.3	1.3	3
South – South West	NDD	Northern Devon Healthcare NHS Trust	North Devon District Hospital	6.4	23.9	18.5	0.0	1.9	59	62.8	81.4	12.2	98.3	69.6	100.0	100.0	100.0	94.1	92.9	100.0	92.9	84.0	75.0	88.2	57.7	7.6	1.7	0.0	1
South – South West	PGH	Poole Hospital NHS Foundation Trust	Poole Hospital	10.6	20.5	16.3	1.1	3.5	96	85.7	85.4	4.5	89.6	78.1	91.4	100.0	91.4	80.6	76.8	98.2	76.8	79.7	55.6	90.2	13.2	13.1	9.5	3.2	2
South – South West	PLY	Plymouth Hospitals NHS Trust	Derriford Hospital	7.2	15.7	13.4	4.2	5.9	265	84.9	67.7	5.1	60.0	76.7	90.9	99.4	91.6	64.4	70.5	90.6	76.5	55.0	17.9	79.8	5.7	9.4	3.0	0.4	4
South – South West	PMS	Great Western Hospitals NHS Foundation Trust	The Great Western Hospital	15.9	17.1	14.2	3.3	5.2	185	103.9	75.0	4.1	88.1	90.9	89.6	96.2	93.4	78.5	85.7	88.6	97.1	100.0	100.0	100.0	50.0	12.1	2.8	1.7	2
South – South West	RCH	Royal Cornwall Hospitals NHS Trust	Royal Cornwall Hospital	5.1	16.3	13.8	3.7	5.6	222	78.7	74.8	4.7	58.1	87.7	88.6	99.3	88.6	46.7	89.3	97.1	92.1	45.4	22.5	54.5	21.3	8.2	7.2	5.4	3
South – South West	RDE	Royal Devon and Exeter NHS Foundation Trust	Royal Devon and Exeter Hospital	9.5	16.9	14.1	3.3	5.3	190	86.4	61.9	6.5	54.7	75.9	96.5	96.5	100.0	75.7	89.4	91.2	97.3	68.7	52.3	78.9	41.9	10.4	8.4	5.3	4
South – South West	SAL	Salisbury NHS Foundation Trust	Salisbury District Hospital	11.7	22.0	17.2	0.2	2.8	76	78.4	80.3	8.1	67.1	93.3	95.5	100.0	95.5	75.0	81.8	93.2	88.6	72.5	46.2	85.2	16.3	9.0	2.6	1.3	2
South – South West	SMH	North Bristol NHS Trust	Southmead Hospital	10.9	16.8	14.1	3.4	5.3	196	88.3	71.8	6.7	91.8	84.8	90.4	97.4	93.0	81.8	82.3	96.5	84.1	84.6	61.8	94.0	58.0	8.8	13.9	1.0	4
South – South West	TOR	South Devon Healthcare NHS Foundation Trust	Torbay District General Hospital	11.1	17.2	14.3	3.1	5.1	177	100.6	55.2	4.8	70.6	91.1	81.9	94.7	85.1	89.7	77.5	95.5	82.0	73.5	51.3	88.1	12.8	9.5	5.2	0.6	3
South – South West	WDH	Dorset County Hospital	Dorset County Hospital	2.0	19.0	15.5	1.9	4.2	121	93.1	77.7	5.8	91.7	95.2	92.5	98.5	92.5	94.6	89.4	100.0	89.4	97.1	100.0	94.7	13.0	9.4	1.7	2.5	1
South – South West	WGH	Weston Area Health NHS Trust	Weston General Hospital	11.9	22.1	17.3	0.1	2.8	75	74.3	56.0	3.2	84.0	91.1	97.6	100.0	97.6	66.7	97.6	97.6	100.0	77.3	50.0	90.0	8.3	10.5	13.4	6.3	1
South – South West	YEO	Yeovil District Hospital NHS Foundation Trust	Yeovil District Hospital	4.0	22.3	17.6	0.1	2.6	72	94.7	83.3	6.3	61.1	86.1	69.4	97.2	72.2	52.4	63.9	100.0	63.9	73.7	57.1	83.3	5.0	11.4	5.6	6.9	1
Wales	BRG	Hywel Dda Health Board	Bronglais General Hospital	7.3	23.9	18.5	0.0	1.9	59	128.3	30.5	10.4	89.8	94.6	97.6	97.6	100.0	96.9	73.8	73.8	95.2	91.7	83.3	93.3	96.9	13.6	5.1	0.0	1
Wales	CLW	Betsi Cadwaladr University Health Board	Glan Clwyd District General Hospital	9.4	19.0	15.4	1.9	4.2	122	99.2	77.0	4.9	81.1	83.7	84.0	97.3	85.3	71.7	86.7	93.3	92.0	86.8	72.7	92.6	26.1	11.4	4.1	1.6	2
Wales	GLG	Hywel Dda Health Board	Glangwili General Hospital	10.9	18.6	15.2	2.3	4.4	132	141.9	33.8	12.7	42.4	83.3	57.5	67.8	85.1	30.5	86.2	89.7	95.4	90.4	82.6	93.3	0.0	13.3	11.5	7.6	1
Wales	GWE	Aneurin Bevan Health Board	Royal Gwent Hospital	13.0	16.5	13.9	3.6	5.5	213	144.9	44.6	0.7	87.8	79.1	67.7	83.1	79.0	63.0	61.0	74.0	76.4	83.2	80.0	84.7	0.0	11.2	5.7	1.4	3
Wales	GWY	Betsi Cadwaladr University Health Board	Ysbyty Gwynedd Hospital	4.8	19.7	15.9	1.5	3.9	108	109.1	67.6	2.4	83.3	83.7	88.3	98.7	89.6	62.5	84.4	96.1	87.0	75.0	65.0	79.2	17.0	12.3	3.7	8.3	2
Wales	MOR	Abertawe Bro Morgannwg University Health Board	Morriston Hospital	10.4	15.3	13.2	4.5	6.1	293	101.0	78.2	6.7	85.3	74.2	83.9	94.1	87.6	54.1	64.1	70.7	87.3	55.0	21.5	72.6	18.6	11.6	10.3	4.1	4
Wales	NEV	Aneurin Bevan Health Board	Nevill Hall Hospital	14.6	21.6	17.0	0.3	2.9	81	64.3	64.2	8.7	74.1	94.6	89.1	89.1	100.0	46.7	82.6	84.8	95.7	91.1	83.3	96.3	5.3	12.5	8.6	4.9	2
Wales	PCH	Cwm Taf Health Board	Prince Charles Hospital	10.6	21.0	16.7	0.7	3.3	88	107.3	46.6	8.5	96.6	82.3	100.0	100.0	100.0	82.8	83.7	91.8	91.8	78.3	53.3	90.3	3.0	8.4	4.6	2.3	1
Wales	POW	Abertawe Bro Morgannwg University Health Board	Princess of Wales Hospital	11.9	18.7	15.3	2.1	4.3	129	99.2	62.8	4.7	82.2	74.2	84.8	97.5	86.1	63.3	78.5	94.9	82.3	66.2	40.0	83.0	11.1	9.2	8.6	5.5	1
Wales	RGH	Cwm Taf Health Board	Royal Glamorgan	8.3	19.0	15.5	1.9	4.2	121	119.8	47.9	1.0	90.1	71.0	95.9	100.0	95.9	85.1	91.9	97.3	91.9	70.4	45.5	81.6	10.7	10.2	9.1	2.5	1
Wales	UHL	Cardiff and Vale University Health Board	University Hospital Llandough	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	NA	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA
Wales	UHW	Cardiff and Vale University Health Board	University Hospital of Wales	7.5	15.8	13.5	4.1	5.9	255	102.8	68.2	6.3	87.5	58.0	73.1	96.2	76.3	70.9	72.3	87.1	79.4	52.3	13.5	71.8	4.3	10.2	7.5	3.9	4
Wales	WRX	Betsi Cadwaladr University Health Board	Wrexham Maelor Hospital	8.3	21.0	16.7	0.7	3.3	88	83.8	63.6	3.8	92.0	86.1	96.5	100.0	96.5	78.0	91.2	94.7	93.0	80.7	52.9	92.5	14.7	8.9	4.5	0.0	2
Wales	WYB	Hywel Dda Health Board	Withybush General Hospital	14.3	23.0	17.8	0.0	2.2	67	67.7	94.0	4.5	86.6	69.6	78.0	97.6	78.0	45.5	85.0	100.0	85.0	80.0	66.7	90.0	0.0	11.6	4.5	6.0	1

Figure 19.2 Proportion of included cases in each hospital where the time of decision to operate (or the time of booking for theatre) was not entered. Black bars indicate hospital with fewer than ten cases in this analysis

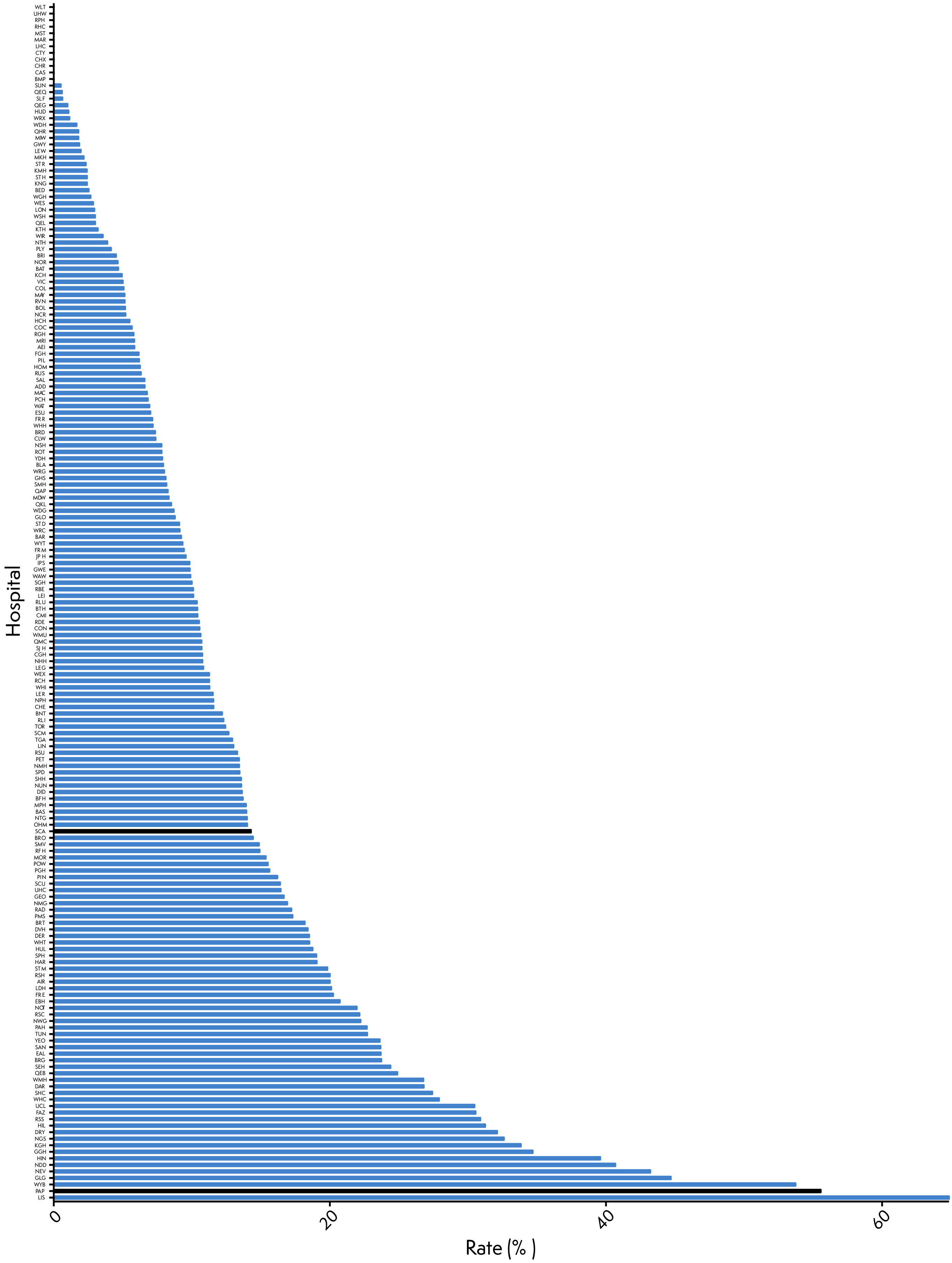


Figure 19.3 Proportion of submitted cases in each hospital with missing preoperative and postoperative P-POSSUM fields. Black bars indicate hospitals with fewer than ten cases in this analysis

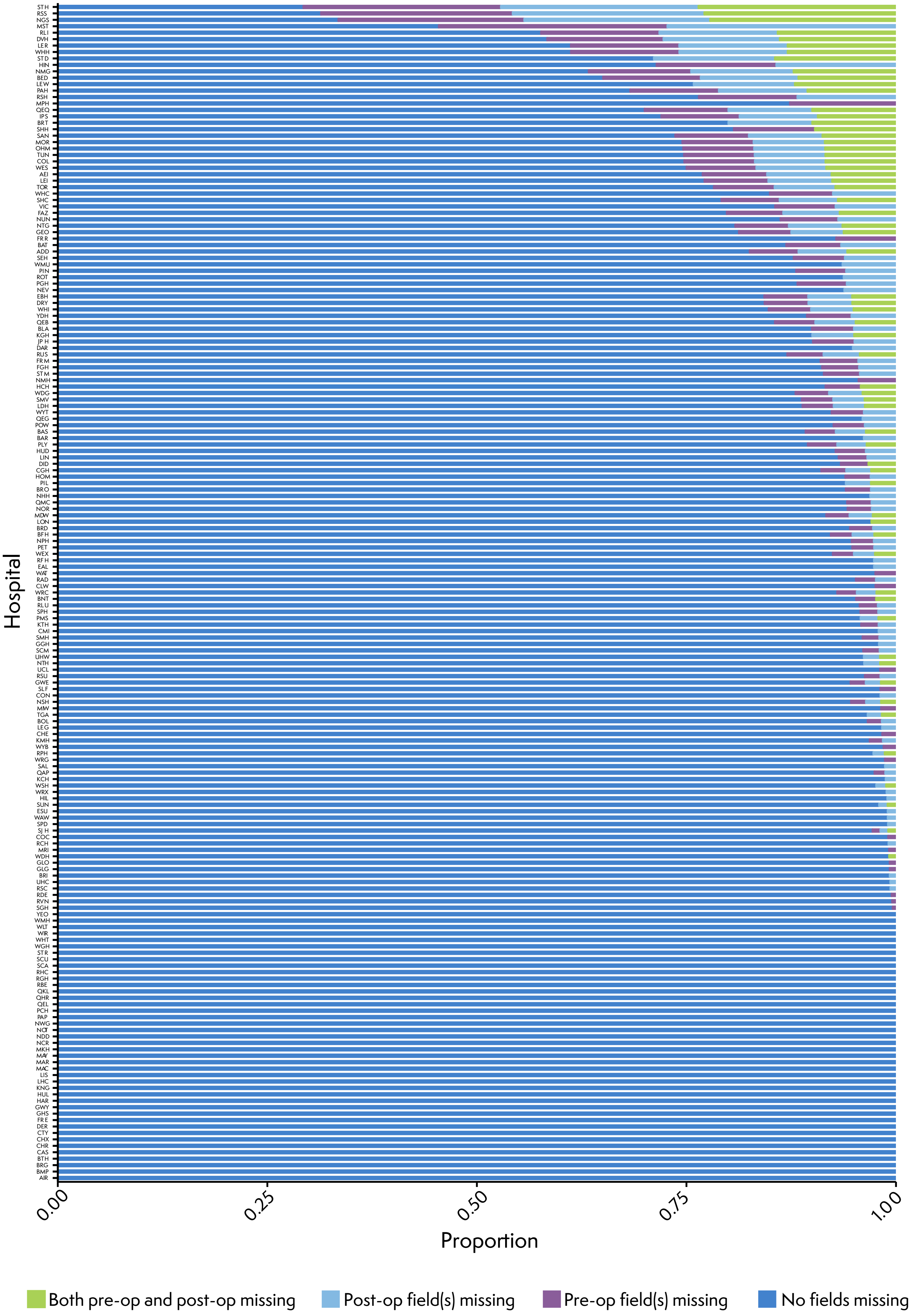


Figure 19.4 Median postoperative length of stay (days) of patients surviving to hospital discharge. Black bars indicate hospitals with fewer than ten cases in this analysis

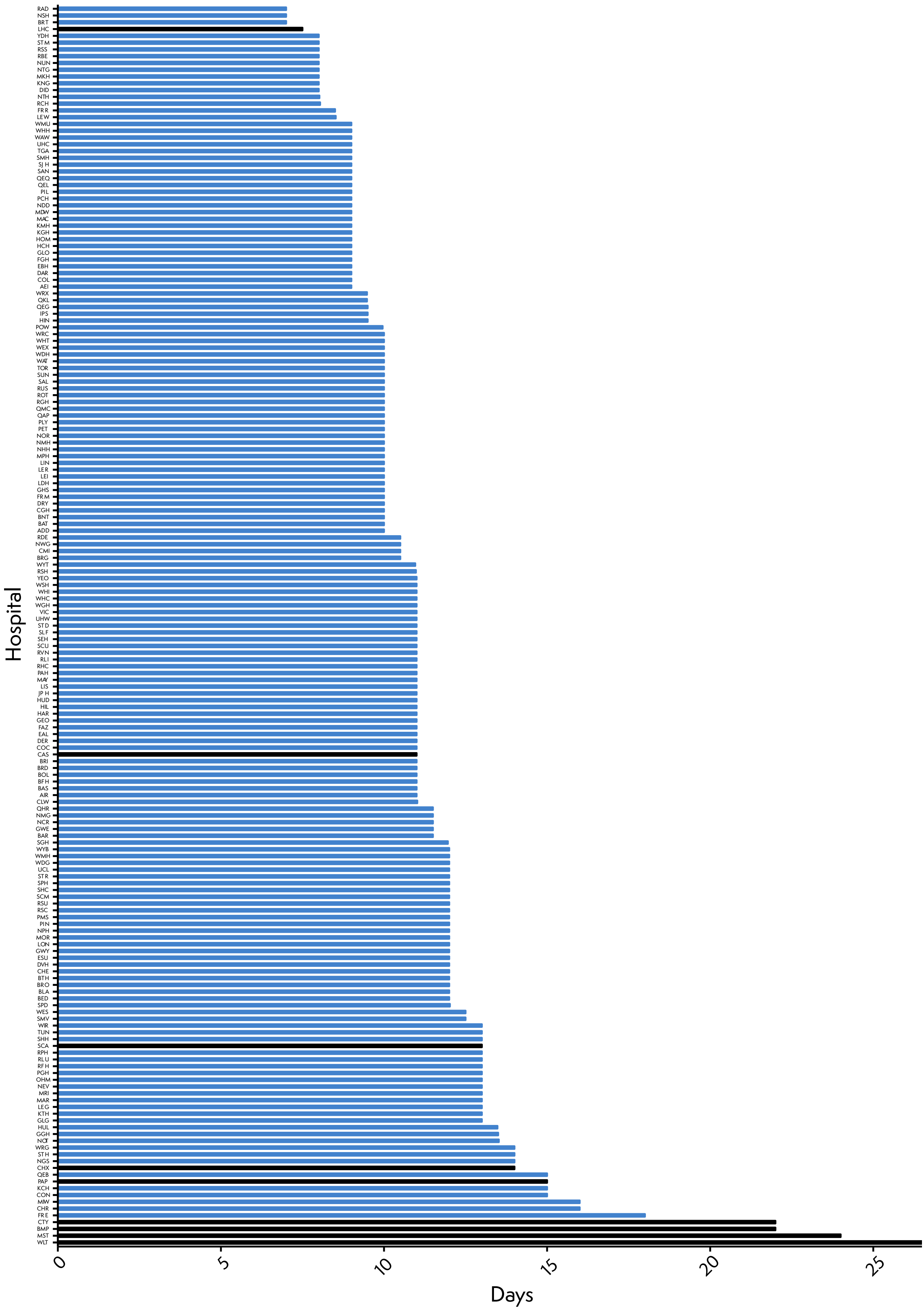


Figure 19.5 Proportion of patients with an unplanned return to theatre following an initial emergency laparotomy. Black bars indicate hospitals with fewer than ten cases in this analysis

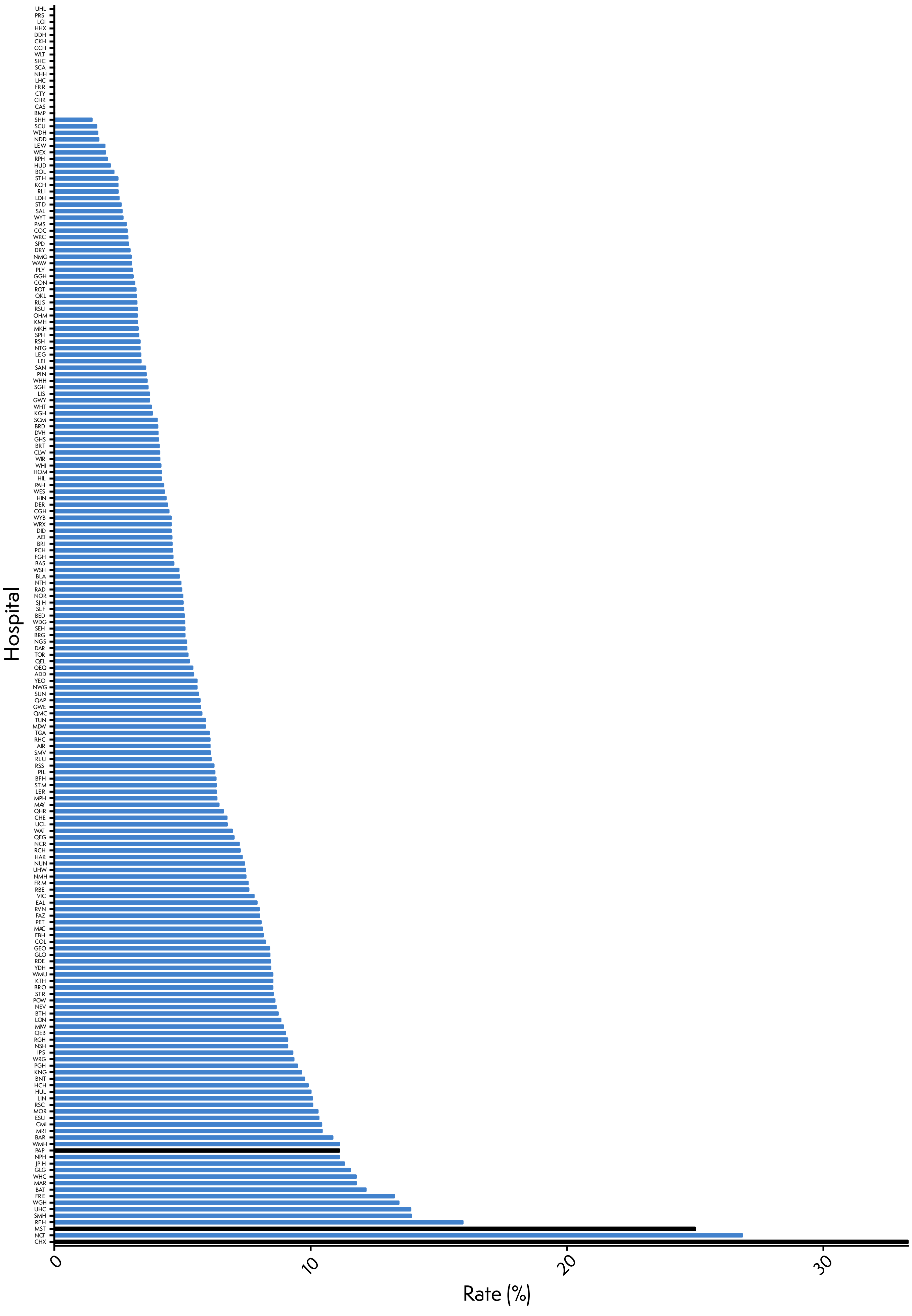


Figure 19.6 Proportion of patients that had an unplanned admission to critical care from the ward within seven days of their emergency laparotomy across all hospitals. Black bars indicate hospitals with fewer than ten cases in this analysis

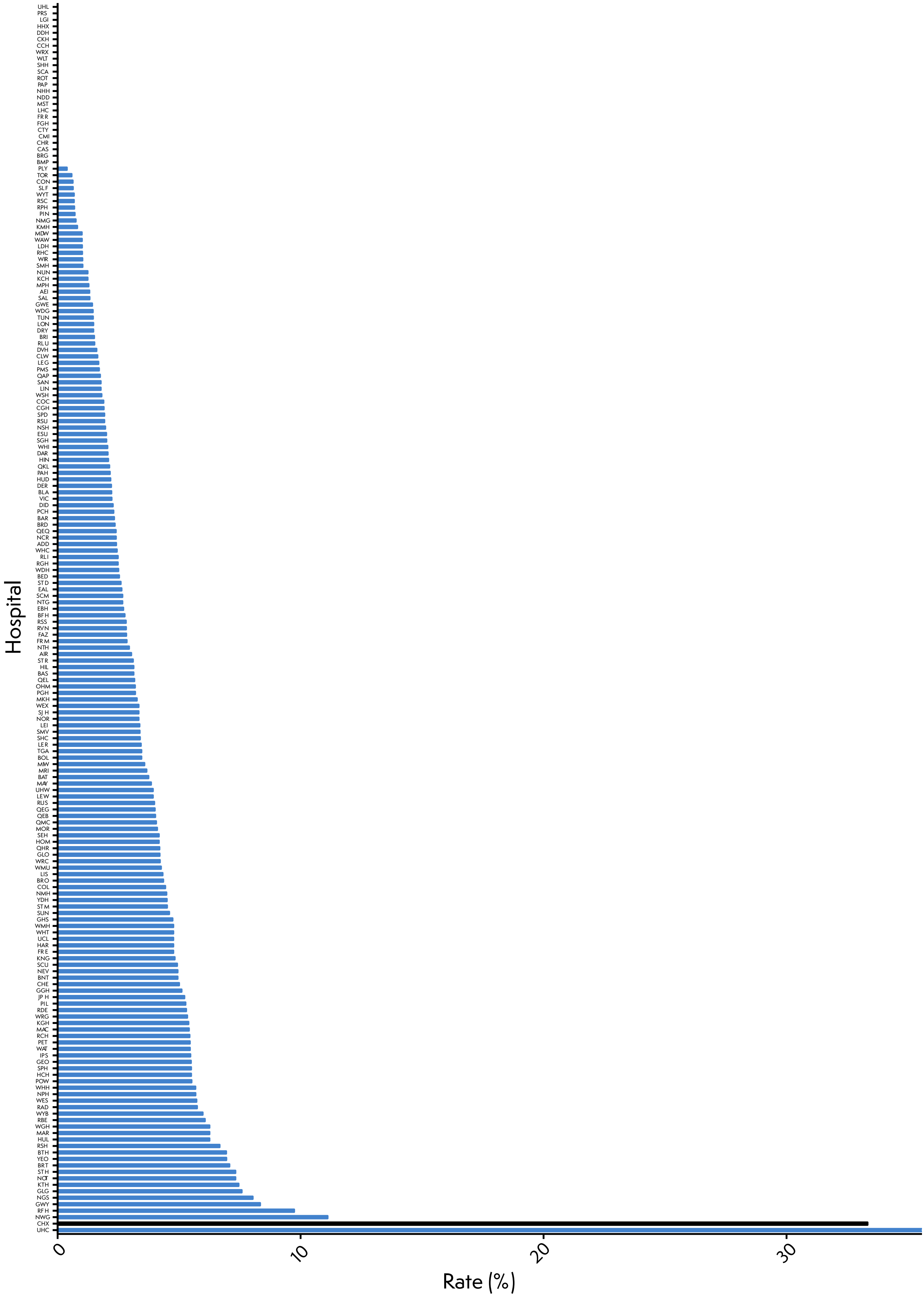


Figure19.7 Proportion of patients in each operative urgency category by hospital. Black bars indicate hospitals with fewer than ten cases in this analysis

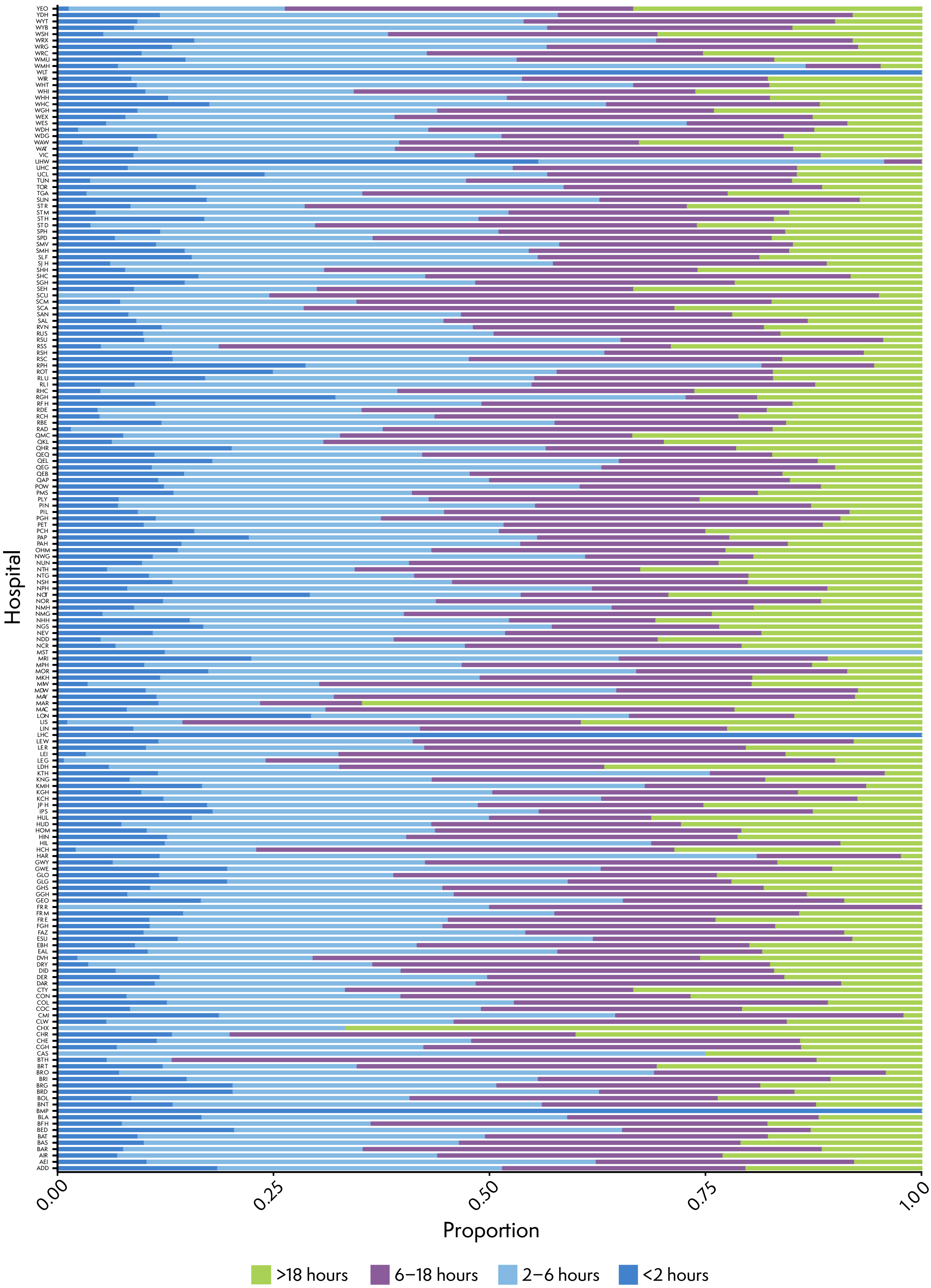


Figure 19.8 Proportion of patients in each hospital who had risk documented preoperatively. Black bars indicate hospitals with fewer than ten cases in this analysis

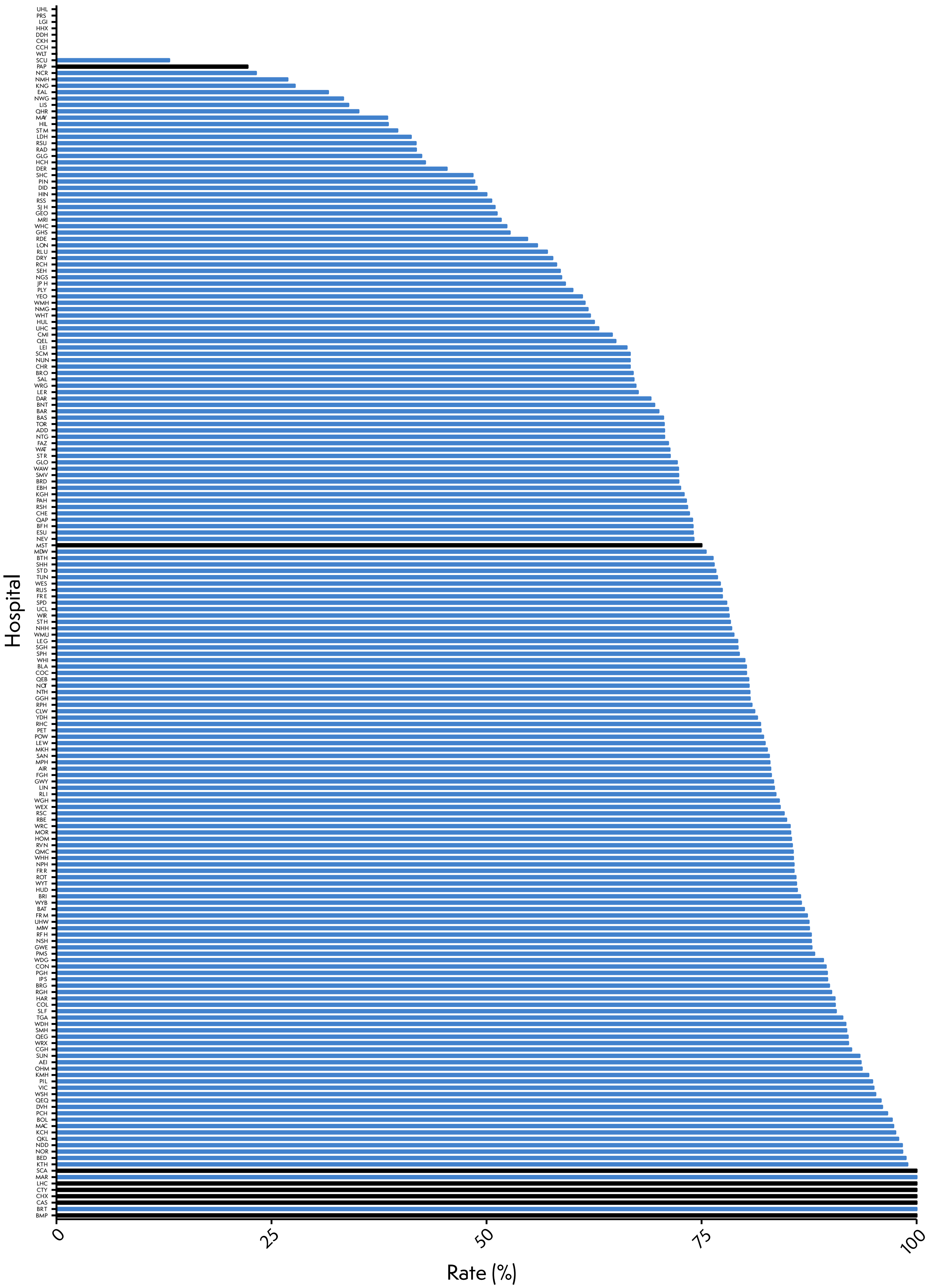


Figure 19.9 Proportion of patients in each hospital with a calculated preoperative P-POSSUM risk of death ≥5% who had input from a consultant surgeon and consultant anaesthetist before emergency laparotomy. Black bars indicate hospitals with fewer than ten cases in this analysis

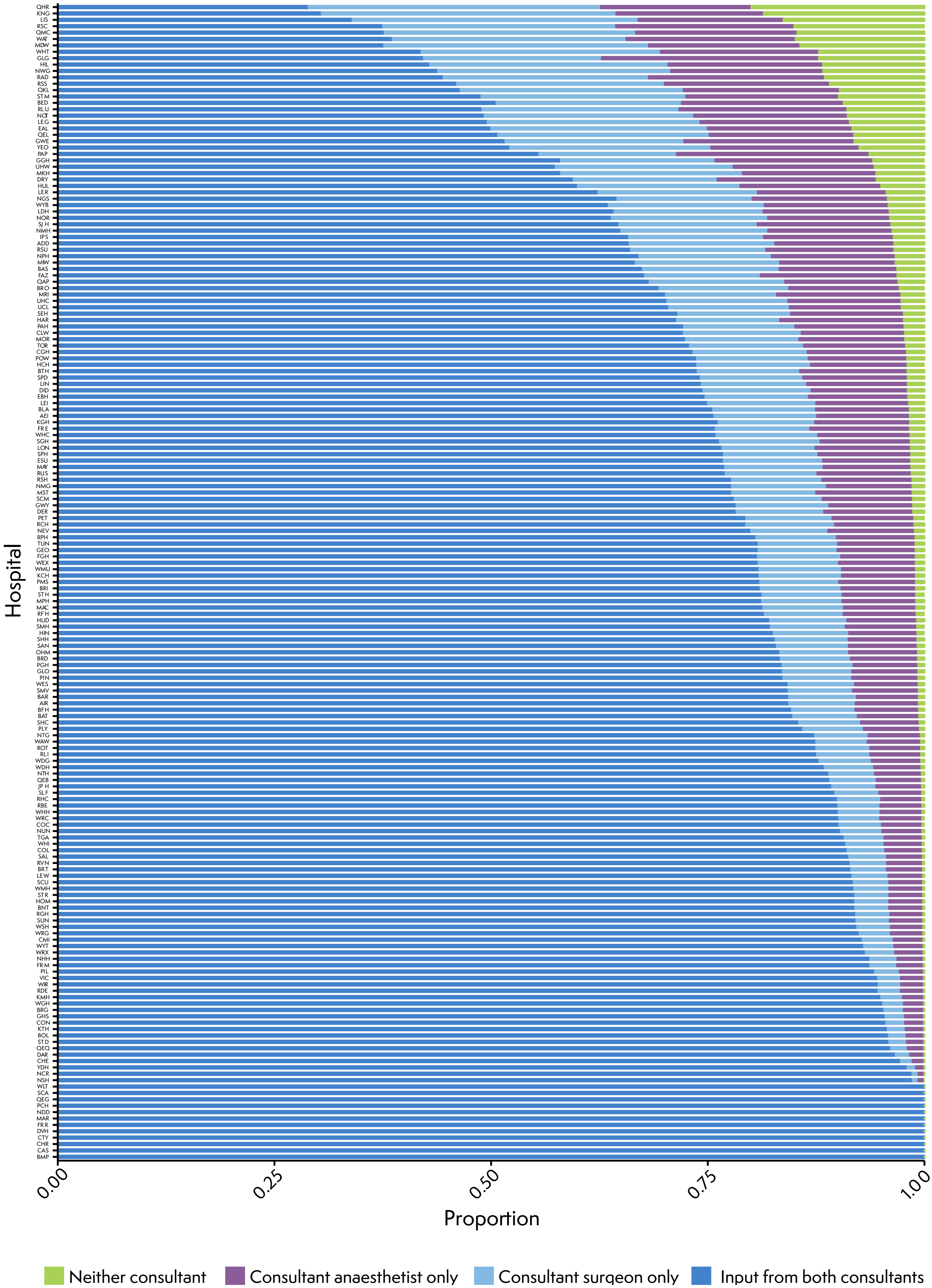


Figure 19.10 Proportion of patients in each hospital who had a CT scan performed and reported by a consultant radiologist before emergency laparotomy. Black bars indicate hospitals with fewer than ten cases in this analysis

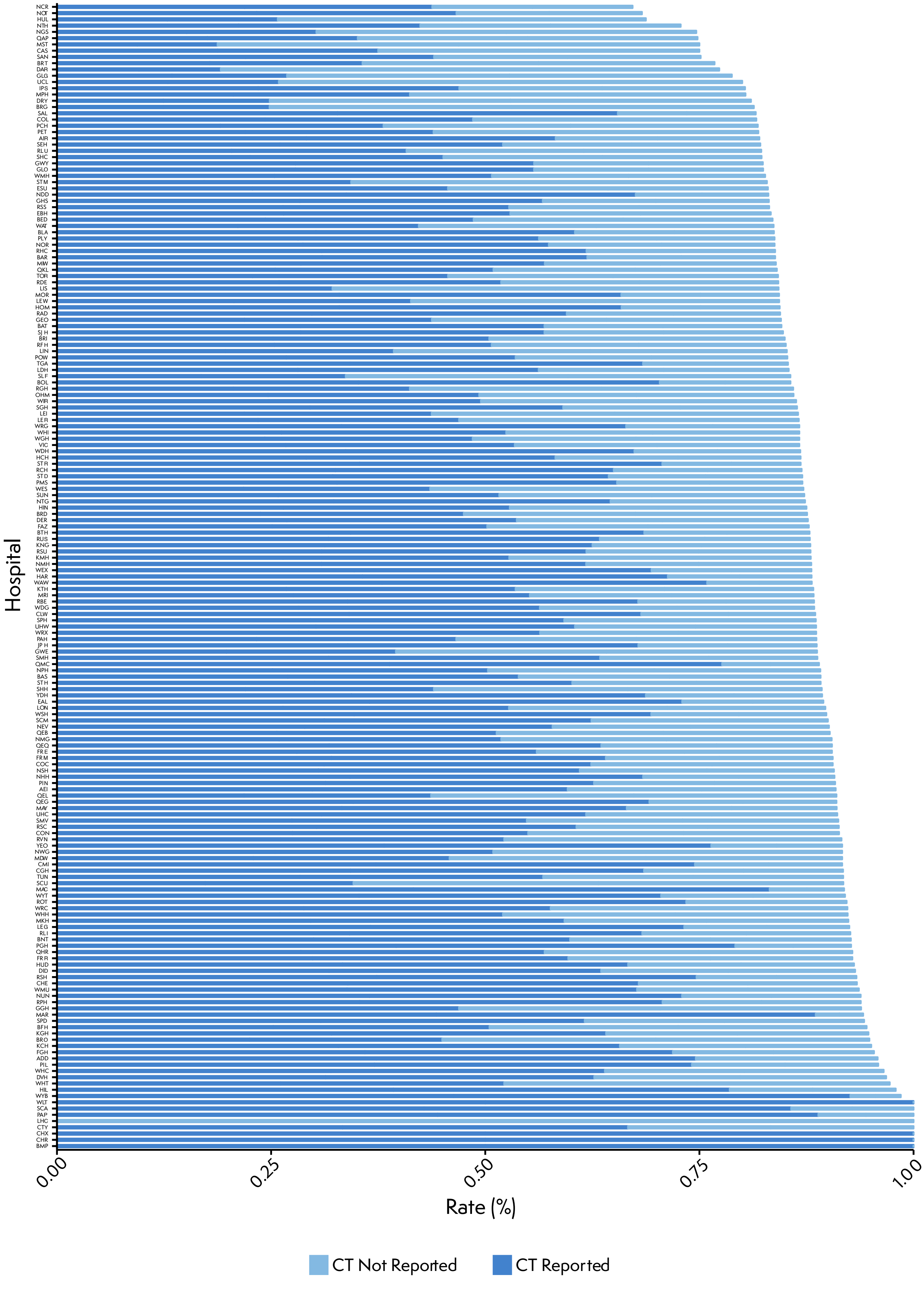


Figure 19.11 Proportion of patients in each hospital with a calculated preoperative P-POSSUM risk of death ≥5% for whom surgery was directly supervised by a consultant surgeon and consultant anaesthetist. Black bars indicate hospitals with fewer than ten cases in this analysis

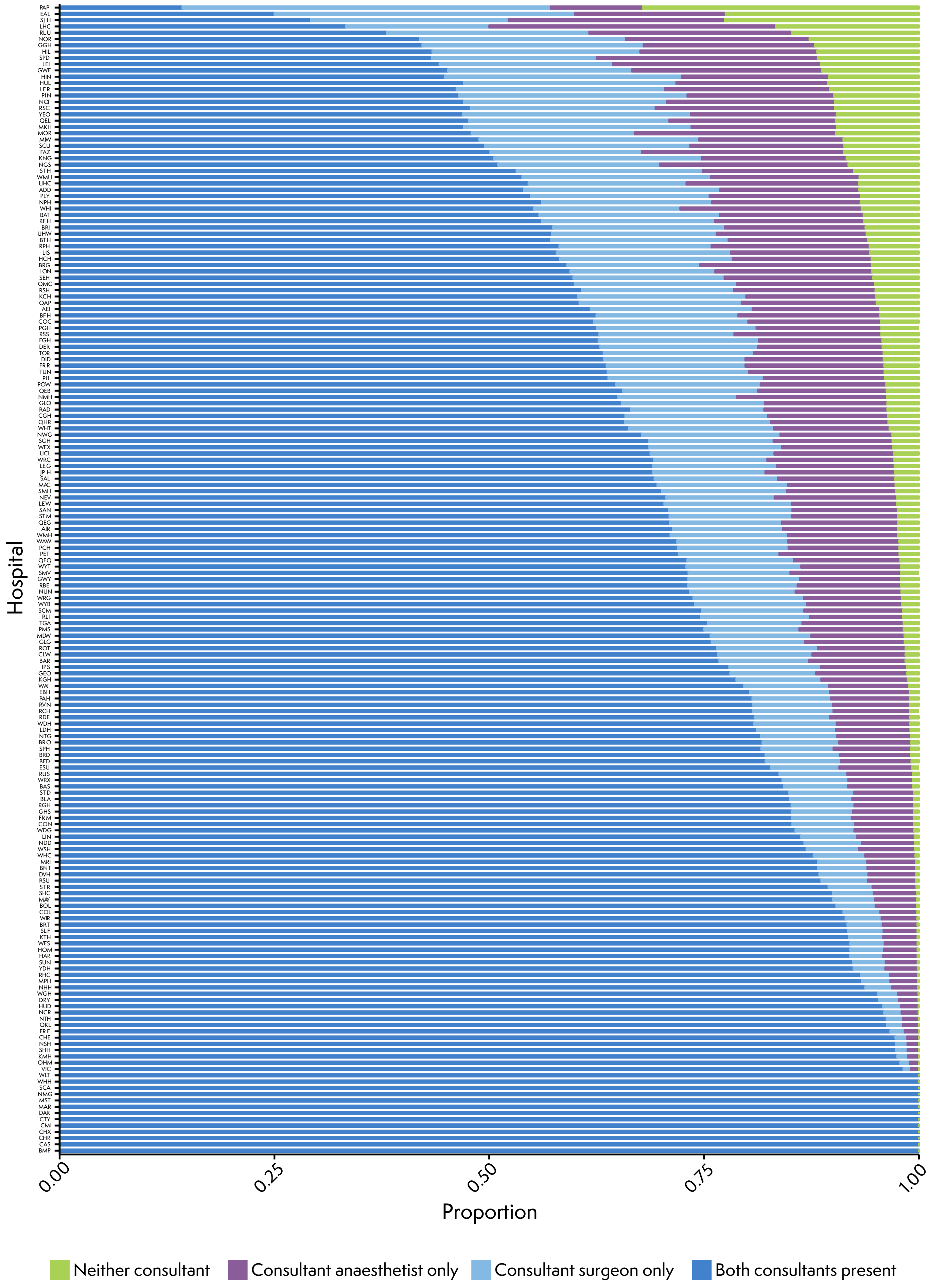


Figure 19.12 Proportion of patients in each hospital where the interval from decision to operate (or time of booking) to arrival in theatre was appropriate to operative urgency. This excludes Expedited cases. Black bars indicate hospitals with fewer than ten cases in this analysis

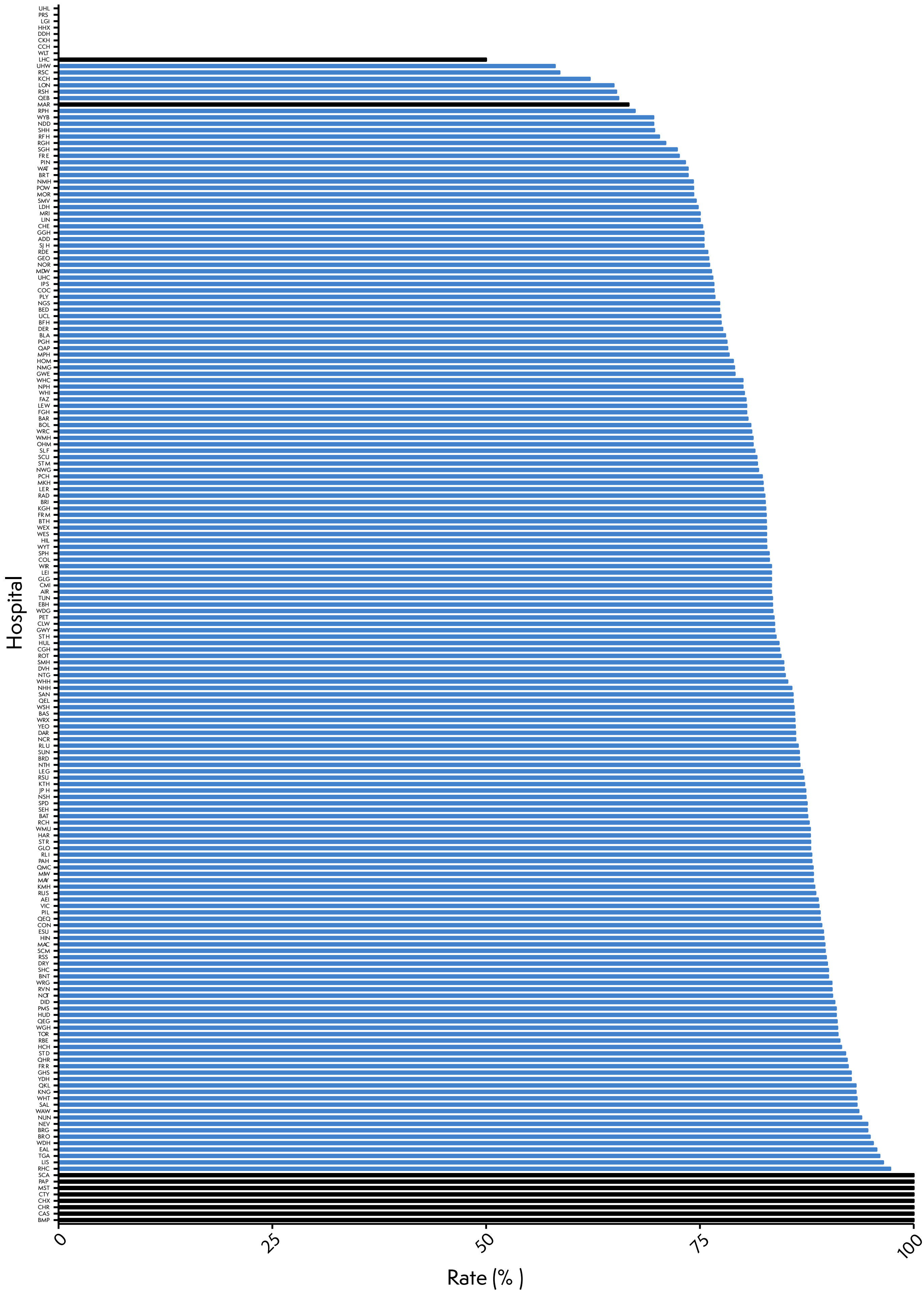


Figure 19.13 Proportion of patients in each hospital with a calculated postoperative P-POSSUM risk of death 5–10% who were admitted directly to a critical care unit from theatre following emergency laparotomy. Black bars indicate hospitals with fewer than ten cases in this analysis

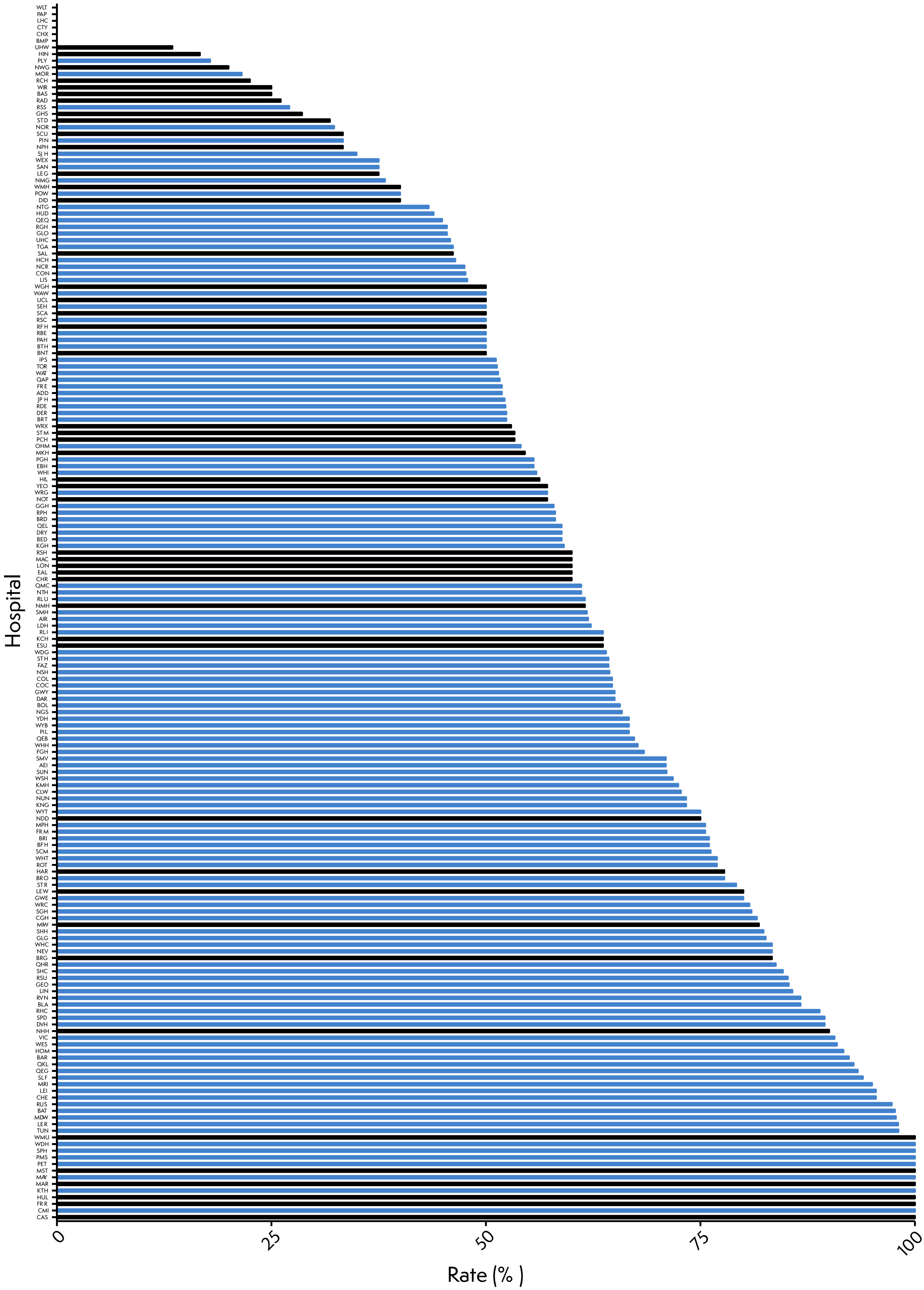


Figure 19.14 Proportion of the patients in each hospital with a calculated postoperative P-POSSUM risk of death >10% who were admitted directly to a critical care unit from theatre following emergency laparotomy. Black bars indicate hospitals with fewer than ten cases in this analysis

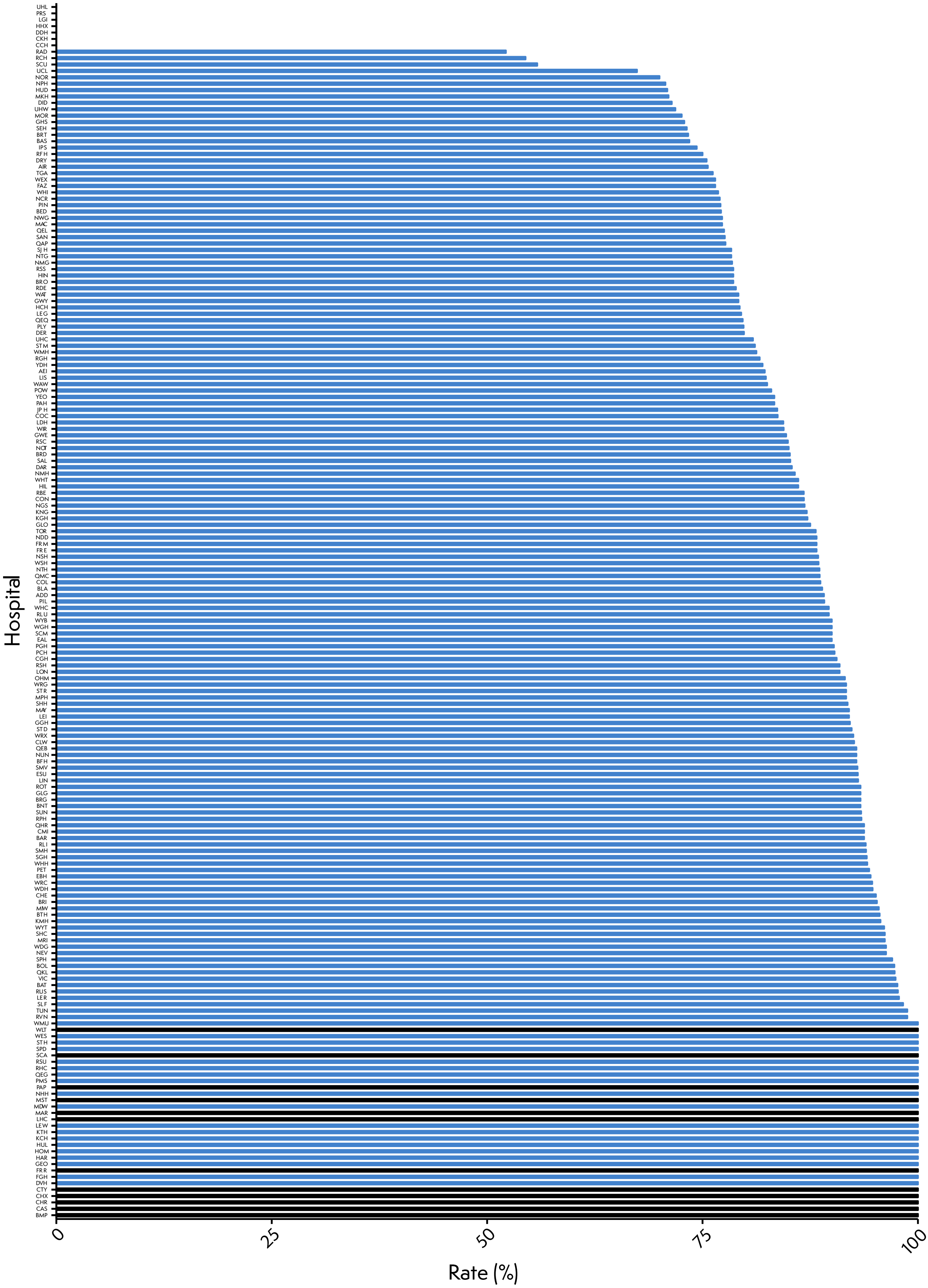


Figure 19.15 Proportion of patients in each hospital aged 70 or over who were assessed by a care of the older person specialist after surgery. Black bars indicate hospitals with fewer than ten cases in this analysis

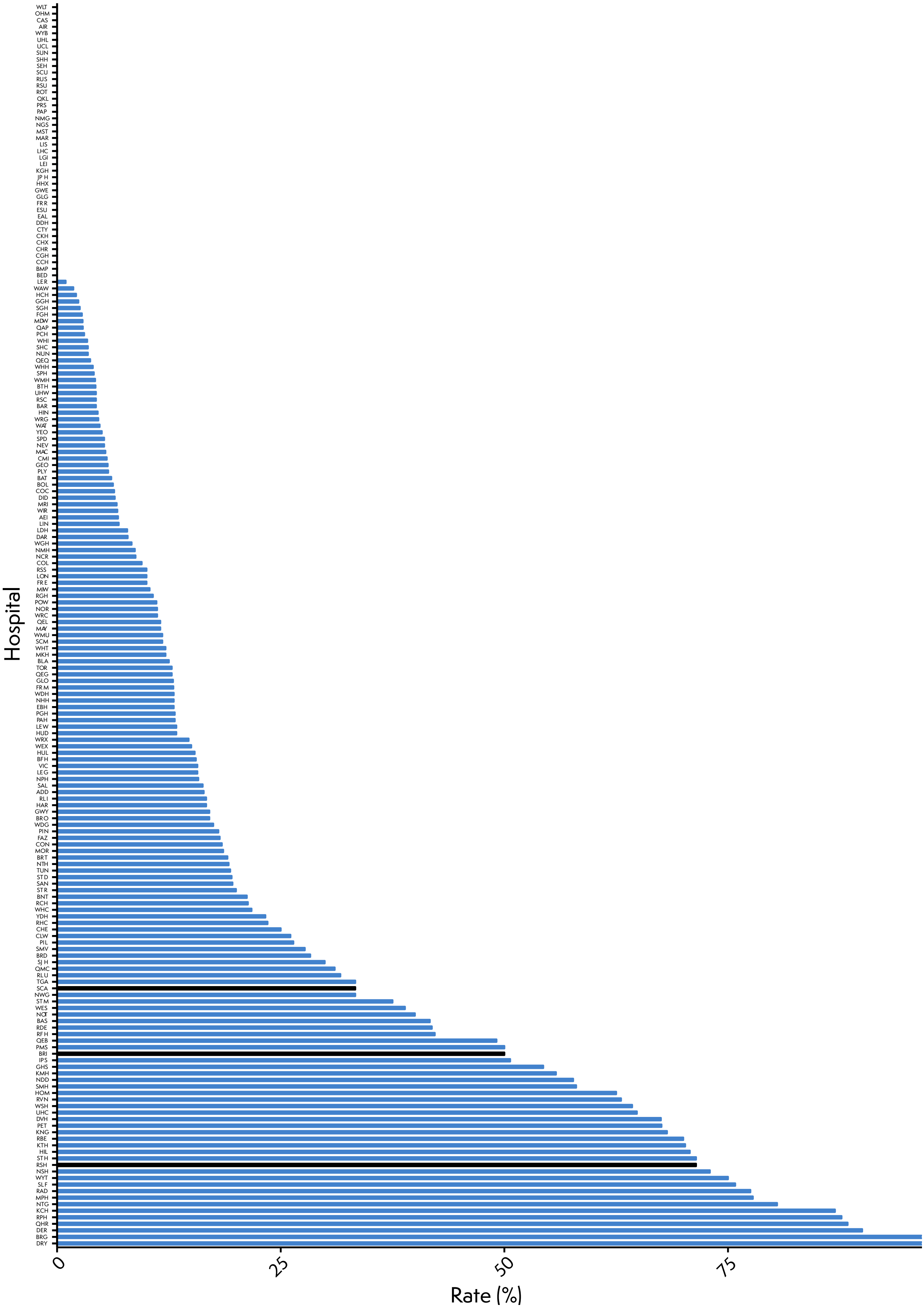


Figure 19.16 Proportion of patients in each hospital who were reviewed by a consultant surgeon within 14 hours of emergency admission to hospital. Black bars indicate hospitals with fewer than ten cases in this analysis

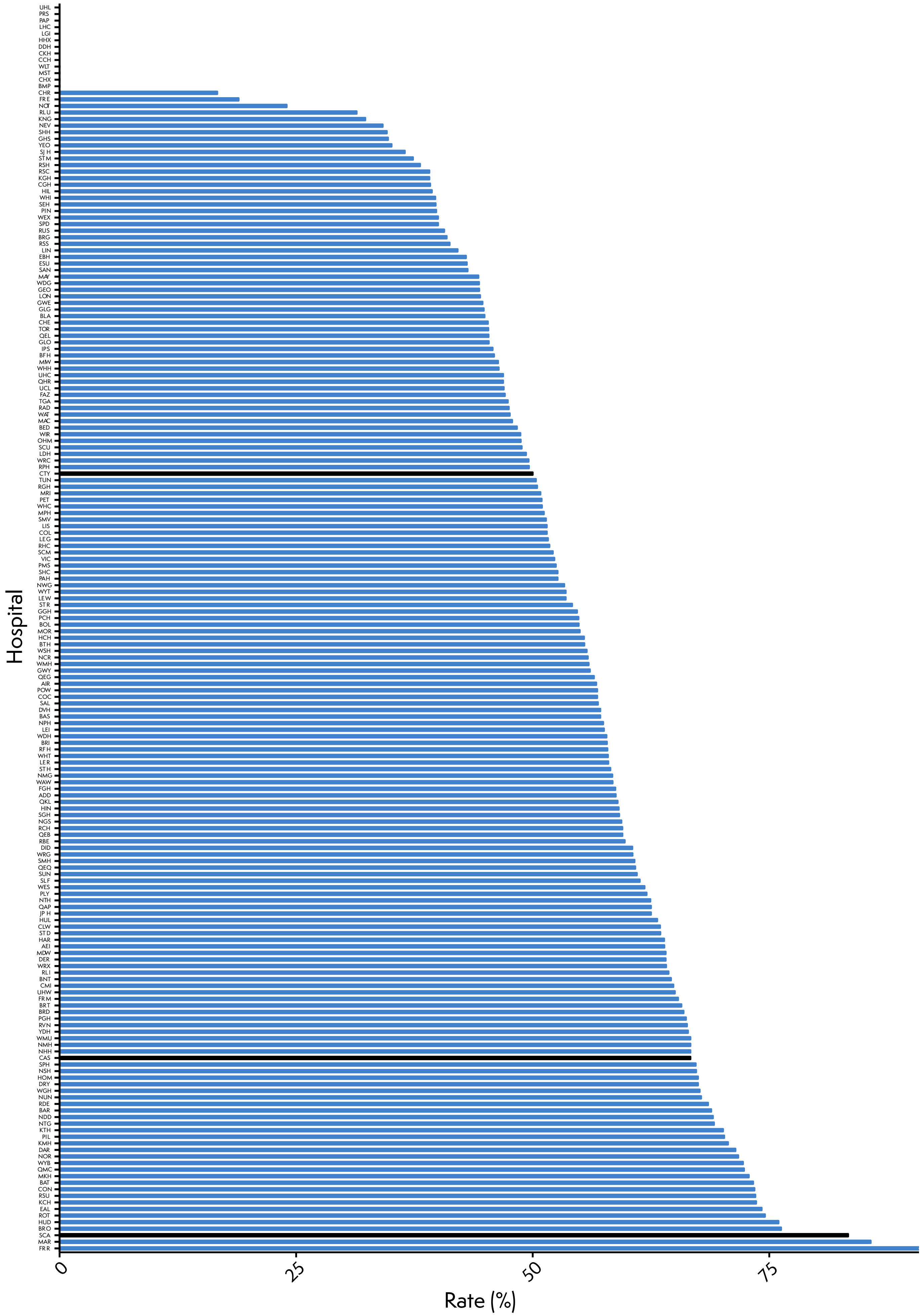
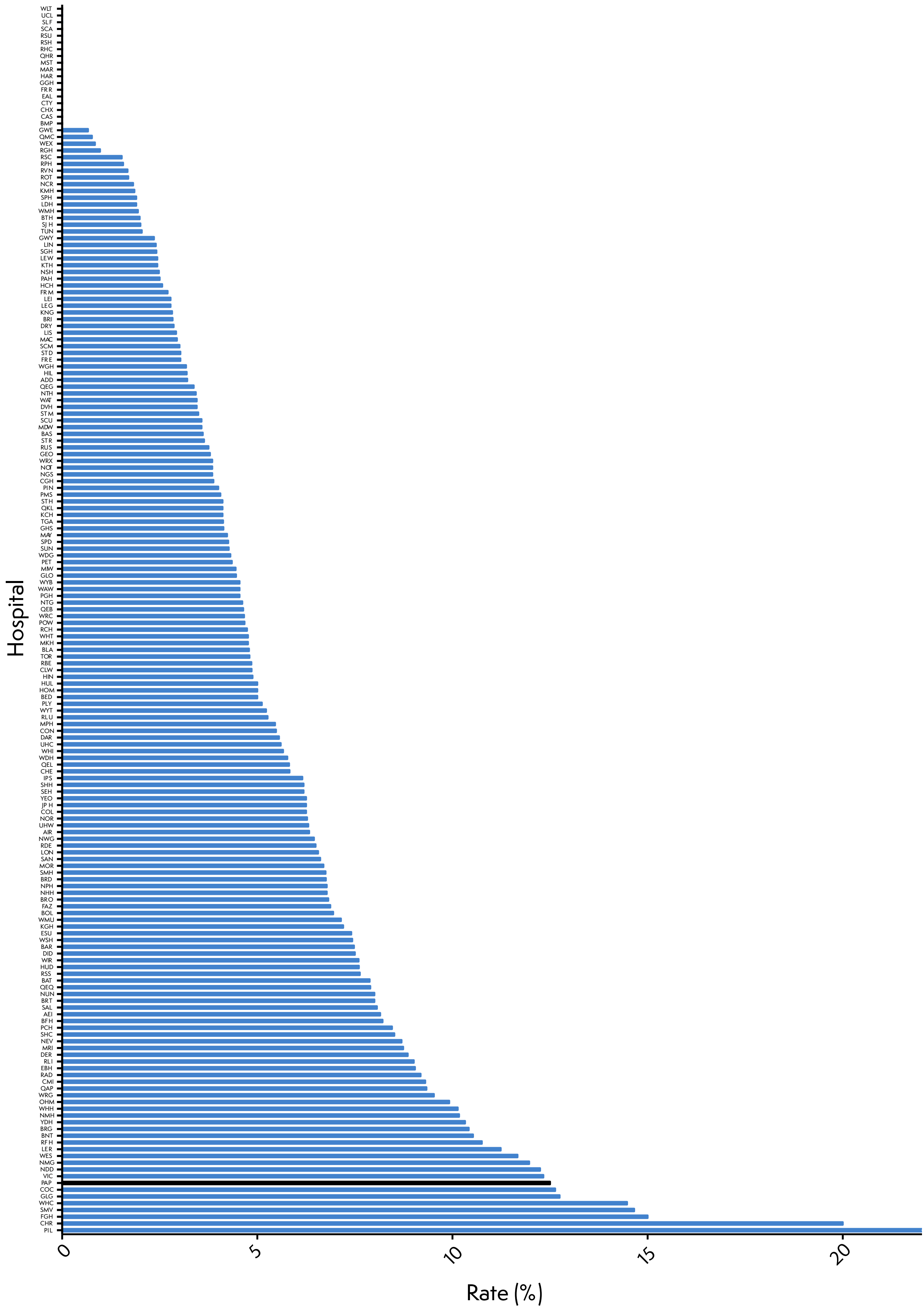


Figure 19.17 Discrepancy rates in each hospital between CT scan report and surgical findings. Black bars indicate hospitals with fewer than ten cases in this analysis



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Information correct as at October 2018