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

The Second Patient Report of the National Emergency Laparotomy Audit (NELA)

December 2014 to November 2015

July 2016

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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.

1 FOREWORD

We welcome the Second Patient Report from the National Emergency Laparotomy Audit (NELA), describing the care given to adult patients having emergency bowel surgery.

The Report builds on The First Patient Report of the National Emergency Laparotomy Audit (2015) and details data on over 23,000 additional patients, bringing the total number of patients over the two years of the NELA Patient Audit to 44,000. Data have been provided from 186 hospitals, representing the overwhelming majority of hospitals in England and Wales that perform emergency laparotomy. The continuing high level of engagement with NELA is testament to the importance that clinicians place on this landmark project, as it drives changes in practice for some of the sickest patients requiring emergency surgery. We thank and congratulate all those involved locally for their efforts.

A key inclusion within this Report is the risk-adjusted, hospital-level mortality rates for these 44,000 patients. The Report found that 30-day mortality rates for individual hospitals were within the range expected. However large differences remain across a number of important standards of care, suggesting there is significant potential for improvement.

This year's data reinforce previous findings that patients whose individualised risk assessment is documented before surgery were more likely to receive consultant-delivered care, by both surgeons and anaesthetists, and to be admitted to a critical care unit. Care has improved since the First Report, particularly with regard to the number of patients with a documented risk assessment and the level of consultant delivered care. All members of the clinical team are to be applauded for this, and we hope to see this positive trend continue in subsequent years.

Emergency laparotomy remains a complex procedure performed with very limited time for planning and patient optimisation compared with elective surgery – and the mortality rate still far exceeds that of elective bowel surgery. Organisational change such as improving access to operating theatres and critical care remains a challenge. We call upon those responsible for commissioning and delivering healthcare to consider how best to improve these aspects of care, such that patients requiring emergency laparotomy are cared for by adequately resourced multidisciplinary teams.

Data collection continues for year three of the Patient Audit. Much of the NELA data can be viewed in real-time on the NELA web tool. This in turn facilitates local quality improvement programmes that drive improved care for patients requiring emergency bowel surgery.

This Report is aimed at commissioners, NHS trusts and Welsh health boards, and clinicians. It highlights the main findings from the Audit as well as making key recommendations, which will help hospitals ensure that they are meeting the current published standards of clinical care.

We hope that commissioners, NHS trust boards and clinicians will engage closely with the findings of this Report and use them in their local settings to make changes and deliver improved care and better outcomes for this very vulnerable group of patients.

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2 EXECUTIVE SUMMARY

1 Overview

1.1 This is the Second Patient Audit Report of the National Emergency Laparotomy Audit (NELA). It covers patients who underwent emergency bowel surgery (emergency laparotomy) between December 2014 and November 2015. It describes the care received by these patients within English and Welsh NHS hospitals as well as hospital-level patient mortality.

1.2 NELA was established to describe the processes of care and outcomes of patients undergoing emergency bowel surgery in England and Wales in order to promote quality improvement. NELA was commissioned by the Healthcare Quality Improvement Partnership (HQIP) and commenced in 2012, with patient data collection from December 2013.

1.3 More than 30,000 patients undergo an emergency laparotomy each year in NHS hospitals within England and Wales.[1,2] The majority of patients undergoing emergency bowel surgery have potentially life-threatening conditions requiring prompt investigation and management. These procedures are associated with high rates of postoperative complications and death; recent studies have reported that overall 15% of patients die within one month of having an emergency laparotomy.[1,3,4,5]

1.4 The clinical pathway for patients undergoing emergency bowel surgery is complex, and requires input from clinicians from several specialties including emergency departments, acute admissions units, radiology, surgery, anaesthesia, operating theatres, critical care and elderly care. Unlike elective (planned) care, there is often limited time to investigate and prepare these patients before surgery. This creates challenges in the delivery of care on a day-to-day basis and in bringing about long-term service improvement.

1.5 A number of recommendations and standards have been published to safeguard and improve the quality of care received by patients undergoing emergency laparotomy (Chapter 21.4). NELA names all participating hospitals and reports their outcomes and performance against published standards of care (Chapters 17 and 21.1). This allows the best performing hospitals to be identified in order that good practice can be disseminated. It also allows hospitals to see areas in which they can bring about improvement through local quality improvement (QI) initiatives. Differences in the structure of hospitals mean that it is unlikely that generic solutions will be applicable to all circumstances. Each hospital should examine its own results to identify reasons for their current situation and develop solutions to bring about improvement.

1.6 The aim of this executive summary is to provide an overview of findings from the second year of patient data collection (December 2014 to November 2015), to summarise key themes and to make recommendations for commissioners, hospitals and clinicians. Detailed comparative data for individual hospitals is presented throughout the main Report.

2 Data quality and case ascertainment

2.1 Data was entered into NELA from more patients this year compared to last year (23,000 compared to 21,000). Case ascertainment increased from 65% to 70%, with data from 186 of the 191 eligible NHS hospitals in England and Wales. Data completeness has also improved.

3 Processes of care

3.1 The following key processes are drawn from published standards, and adherence to them 24 hours a day, seven days a week, constitutes delivery of high-quality care:

Timeliness of care

- Review by a consultant surgeon within 14 hours of admission.
- Prompt administration of antibiotics (when indicated).
- CT scans reported by a consultant radiologist before surgery.
- Access to theatres without delay.

Appropriate level of care guided by assessment of risks of complications and death:

- Documented assessment, before surgery, of the risks of surgery.
- Review before surgery by consultant surgeon and anaesthetist for high-risk patients.
- Presence of consultant surgeon and anaesthetist in theatre for high-risk patients.
- Admission to critical care after surgery for high-risk patients.
- Input from Elderly Medicine specialists in the care of older patients.

3.2 The degree to which these standards were met by hospitals varied. Over 80% of patients had access to theatres without delay, but delay was more common for patients who required surgery most urgently. There has been improvement (64% compared to 56%) in the proportion of patients who had a risk assessment documented. There have been improvements in consultant delivered care, although 'out of hours' presence is still lower than 'in hours'. There has been modest improvement (85% compared to 83%) in the proportion of highest risk patients admitted directly to critical care after surgery. The proportions of all patients receiving treatment that met key standards of care are summarised in Figure 1.

3.3 Standards of care at hospital level were reported using a RAG (Red-Amber-Green) rating. The proportions of hospitals that met these standards (rated Green, where standards were met in ≥80% of patients) are summarised in Figure 2. More hospitals received a Green rating this year compared to last year, particularly for reporting of CT scans, risk assessment and consultant-delivered care. Many other hospitals currently meet standards of care for 60–70% of patients and are close to achieving a Green rating. This is expanded upon throughout the Report.

3.4 The Summary Table (Table 1) shows the key standards of care with their respective process measures, results for Year 1 and Year 2 of the Audit Report, with information on how this has changed over time, and an indication of hospital-level performance.

Figure 1 Proportion of *all patients* in Year 2 (who had surgery between December 2014 and November 2015) meeting the required standard

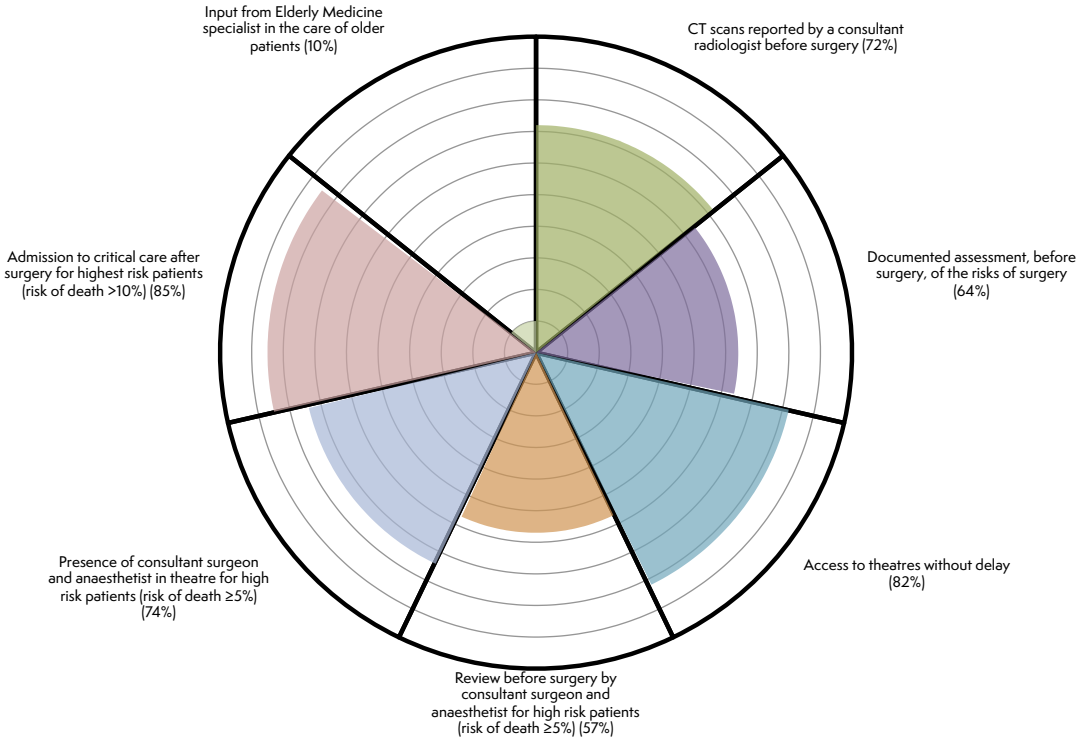
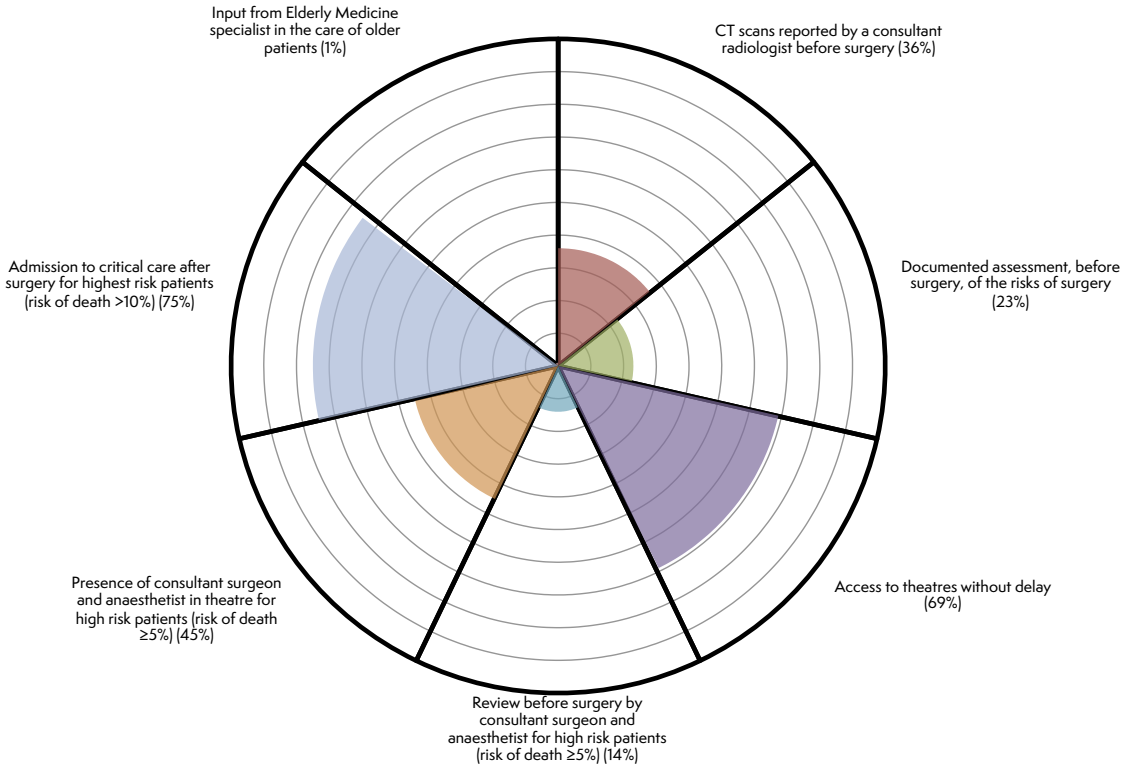


Figure 2 Proportion of *hospitals* in Year 2 rated 'Green' for each process measure ('Green' equates to the standard being met for at least 80% of patients)



4 Patient outcomes

4.1 Postoperative mortality

The proportion of patients that died within 30 days of surgery (observed 30-day mortality) was 11.7% in Year 1 and 11.1% in Year 2. This confirms the high-risk nature of emergency bowel surgery. These figures are based on linking patients in the NELA database with independently verified mortality data from the Office for National Statistics (ONS). There was variation in risk-adjusted 30-day mortality between hospitals ranging from around 5% to 17%. No hospitals fell outside the range used to identify 'outliers' with unexpectedly high mortality rates.

4.2 Length of hospital stay

More than half of patients who survived to leave hospital were in hospital for less than 11 days after surgery, but more than a quarter remained in hospital 20 days after surgery. Older patients were more likely to remain in hospital longer after surgery. Indicative figures based on government costings suggest that the cost of ward care alone for these patients is in excess of £200 million annually.[a] However there has been an improvement in average length of stay of almost two days, from 18.1 days in Year 1, to 16.3 days in Year 2. This represents an annual cost saving of over £22 million.

5 Key themes and the path to improvement

5.1 Compared to the First NELA Patient Report, improved clinician engagement has resulted in a greater number of patients being entered into NELA.

5.2 Improvements in processes of care have been seen since the First NELA Patient Report. More patients now receive a preoperative assessment of their risk of complications and death, and consultant presence during surgery has increased. Perioperative care is now largely consultant-driven, a substantial change from historical norms. However, there remain differences in consultant presence depending on the time of the day, or the day of the week, that surgery is undertaken.

5.3 This year's results again confirm the importance of preoperative risk assessment. Where risks had been documented, patients were more likely to receive subsequent levels of care that met standards.

5.4 More hospitals are consistently delivering very high levels of service: around 30 more hospitals were rated Green for key metrics compared to last year. This demonstrates that it is possible to improve the care of emergency surgical patients within the NHS.

5.5 In general, improvement has taken place in areas that require change at the level of individual clinician and team behaviours (e.g. risk assessment and consultant presence). Clinicians should be commended for this, and encouraged to continue this improvement across other areas.

5.6 There has been little improvement across indicators that require change at an organisational level (e.g. access to theatres, critical care, and input from Elderly Medicine specialists). Rectifying this will require greater engagement between clinicians, managers and commissioners.

5.7 Inter-hospital variation in the provision of important elements of care is substantial. In many hospitals, provision of care (such as consultant presence and critical care admission) falls short of that provided for patients undergoing major elective surgery of comparable or lesser risk.

5.8 Older people continue to be the group that are at the highest risk, the longest length of stay and the highest mortality. Despite this we have not seen an improvement in collaborative working, with Elderly Medicine specialists being involved in fewer than 10% of older patients undergoing emergency laparotomy.

5.9 As continued effort is made to improve care, we expect to see a reduction in mortality. Many of the observed improvements in standards began during the current audit period. It is likely that any impact occurred too late to be reflected in this year's mortality figures.

[a]Based on the cost of a hospital stay being estimated at £400/day (https://data.gov.uk/data-request/nhs-hospital-stay).

5.10 As standards of care improve, we would also expect to see a reduction in the length of stay for many patients. The reduction in length of stay seen in Year 2 represents a saving to the NHS of over £22 million. Investing in resources to bring about improvement and deliver high-quality care is therefore likely to be cost effective.

5.11 Examples of good practice have been collated within this Report and on the NELA website so that hospitals can adapt them for their own use. Several hospitals have made their pathways available to NELA. These are provided on the NELA website: www.nela.org.uk/pathway-examples.

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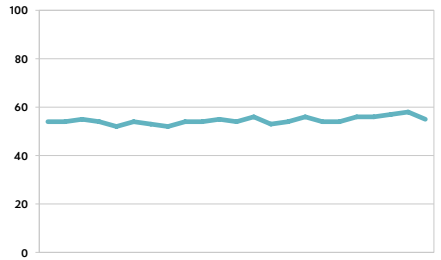
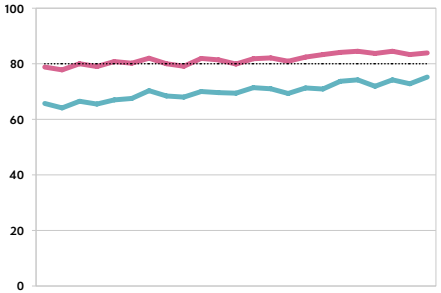
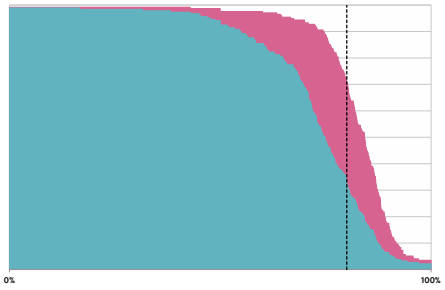
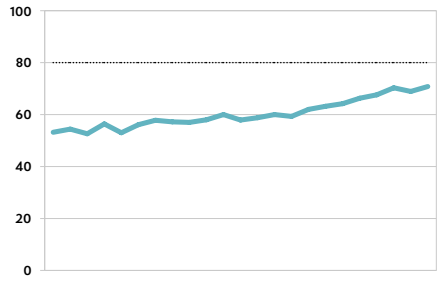
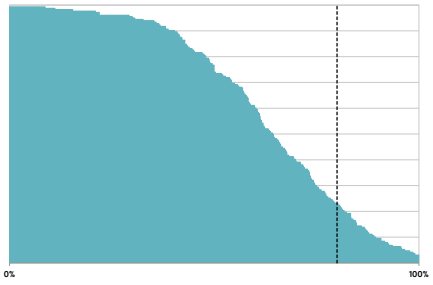
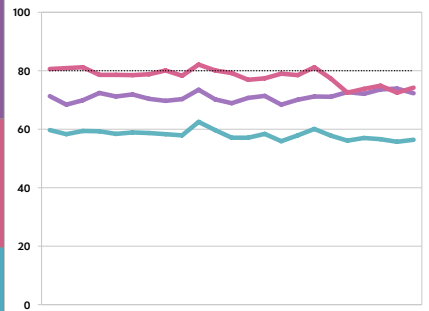
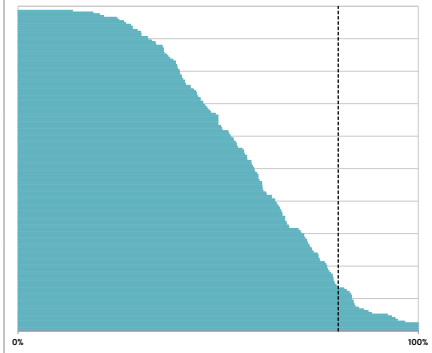
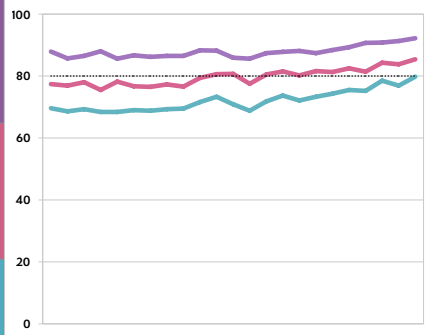
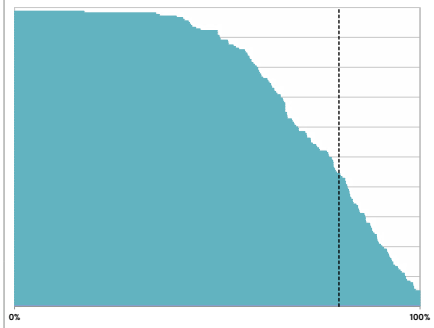
Table 1 Summary of standards, process measures, First and Second NELA Patient Reports performance, performance over time and hospital level performance

Key standard	Process measure	First NELA Patient Report	Second NELA Patient Report	Trend over time Vertical axis =% of all patients receiving this standard of care Horizontal axis = time since start of Audit	Hospital-level performance (Year 2 data) Vertical axis: each horizontal line represents a hospital. 0% axis: proportion of patients in each hospital that received this standard of care. Dashed line: target for acceptable care
All emergency admissions must be seen and have a thorough clinical assessment by a suitable consultant as soon as possible but at the latest within 14 hours from the time of arrival at hospital.	Proportion of patients who were reviewed within 14 hours of hospital admission by a consultant surgeon	54%	55%		Hospital level performance not reported
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 patients who received a CT scan before surgery	81%	83%		
	Proportion of patients who received a CT scan which was reported by a consultant radiologist before surgery	68%	72%		
We recommend that objective risk assessment become a mandatory part of the preoperative checklist to be discussed between surgeon and anaesthetist for all patients. This must be more detailed than simply noting the ASA score.	Proportion of patients in whom a risk assessment was documented preoperatively	56%	64%		

Key standard	Process measure		First NELA Patient Report	Second NELA Patient Report	Trend over time Vertical axis =% of all patients receiving this standard of care Horizontal axis = time since start of Audit	Hospital-level performance (Year 2 data) Vertical axis: each horizontal line represents a hospital. 0% axis: proportion of patients in each hospital that received this standard of care. Dashed line: target for acceptable care
Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist.	Proportion of patients with preoperative P-POSSUM risk of death ≥5% who were reviewed by a consultant surgeon, a consultant anaesthetist, and both consultants, before surgery	Preoperative review by a consultant surgeon	71%	71%		
		Preoperative review by a consultant anaesthetist	80%	77%		
		Preoperative review by both consultants	59%	57%		
	Proportion of patients with preoperative P-POSSUM risk of death ≥5% for whom a consultant surgeon, a consultant anaesthetist, and both consultants, were present in theatre	Consultant surgeon present in theatre	87%	89%		
		Consultant anaesthetist present in theatre	78%	82%		
		Both consultants present in theatre	70%	74%		

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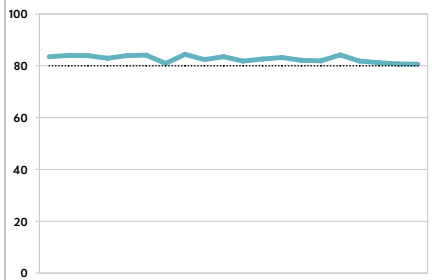
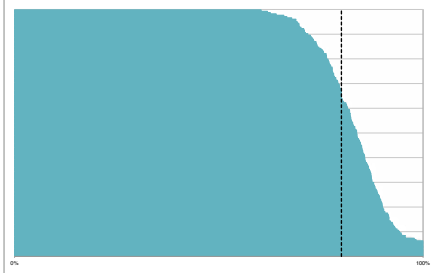
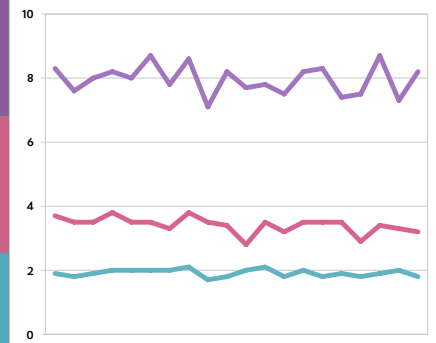
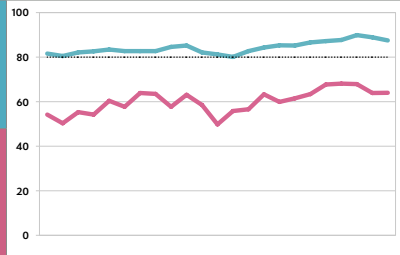
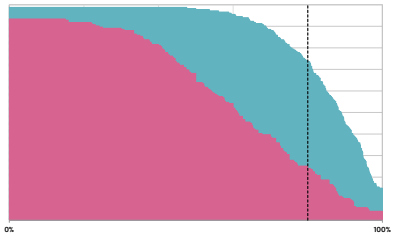
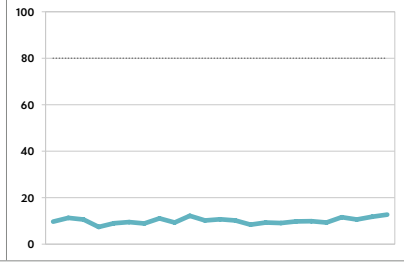
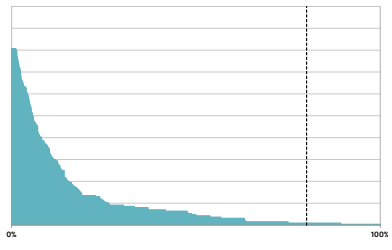
Key standard	Process measure		First NELA Patient Report	Second NELA Patient Report	Trend over time Vertical axis =% of all patients receiving this standard of care Horizontal axis = time since start of Audit	Hospital-level performance (Year 2 data) Vertical axis: each horizontal line represents a hospital. 0% axis: proportion of patients in each hospital that received this standard of care. Dashed line: target for acceptable care
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		84%	82%		
Providers are expected to screen for sepsis all those patients for whom sepsis screening is appropriate, and to rapidly initiate intravenous antibiotics, within 1 hour of presentation, for those patients who have suspected severe sepsis, Red Flag Sepsis or septic shock 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.	Timeliness of care for patients undergoing emergency surgery for suspected peritonitis (median time in hours (IQR))	Time from admission to arrival in theatre (hrs)	8.1 (5.0-13.3)	7.7 (4,8-12.8)		Hospital level performance not reported
		Time from admission to first dose of antibiotics (hrs)	3.6 (1.8-7.0)	3.3 (1.4-6.6)		
		Time from decision to operate to arrival in theatre (hrs)	2.0 (1.3-3.5)	1.9 (1.1-3.0)		

Key standard	Process measure		First NELA Patient Report	Second NELA Patient Report	Trend over time Vertical axis =% of all patients receiving this standard of care Horizontal axis = time since start of Audit	Hospital-level performance (Year 2 data) Vertical axis: each horizontal line represents a hospital. 0% axis: proportion of patients in each hospital that received this standard of care. Dashed line: target for acceptable care
Note: due to limited evidence base, there are no relevant standards against which this process measure is reported.	Proportion of patients receiving goal directed fluid therapy		52%	54%		Hospital level performance not reported
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 who were directly admitted to critical care postoperatively	Highest risk patients (postoperative P-POSSUM risk of death >10%)	83%	85%		
		High risk patients (postoperative P-POSSUM risk of death 5–10%)	58%	62%		
Comorbidity, disability and frailty need to be clearly recognised as independent markers of risk in the elderly. This requires skill and multidisciplinary input, including early involvement of Medicine for the Care of Older People.	Proportion of patients aged 70 years or over who were assessed by an Elderly Medicine specialist		10%	10%		

3 RECOMMENDATIONS

Using the Audit's findings to improve care

Process measures

Process measures are sensitive indicators of performance, and serve to highlight where specific actions are required to bring about improvements in care. Many hospitals currently meet standards of care for 60–70% of patients and are close to achieving a 'Green' rating. Clinicians, hospital managers and commissioners should examine their results. They should determine why standards are met for some of their patients, but not others, and seek to achieve more consistent delivery of high-quality care. They should monitor measures over time to assess the impact of any changes.

Mortality and other outcomes

Clinicians, hospital managers and commissioners also need to examine their hospital's 30-day mortality and length of stay figures. The variation between hospitals in these measures suggests that there is room for improvement in many hospitals, especially where standards of care are not being reliably met. Whilst no hospitals were statistical 'outliers' for 30-day postoperative mortality, several had figures approaching a level that causes concern ('alert' status) – Commissioners, Chief Executives Medical and Clinical Directors, and Multidisciplinary Teams of such hospitals should make particular efforts to address any shortfalls in standards of care (Chapter 17.1).

The following 12 recommendations are aimed at addressing the key themes identified in this NELA Patient Report. Specific recommendations are highlighted in the relevant chapters.

Improvements since last year have predominantly been seen in areas involving a change in individual clinicians' and teams' behaviour. This needs to continue, but a more sustained effort is required to bring about the organisational change necessary to prioritise emergency care.

Commissioners

1 Commissioners should review the Audit results for hospitals from which they commission services, to assure themselves of the quality of care provided to patients undergoing emergency laparotomy. Where hospitals fall short of standards, or where mortality is of concern, **commissioners should ensure that there is adequate commissioning of**:

- **Multidisciplinary input** across the whole of the patient pathway (Chapters 8, 9, 13, 15 and 16).
- **Capacity to deliver consultant-delivered care** and other services, such as **CT scanning** and reporting regardless of the time of the day or the day of the week (Chapters 8, 9 and 13).
- **Theatre capacity** to prevent delays for patients requiring emergency bowel surgery. Some hospitals may require the capacity for emergency and elective care to continue in parallel (Chapter 12).
- **Critical care capacity** to match high-risk caseload, such that all high-risk emergency laparotomy patients can be cared for on a critical care unit after surgery (Chapter 15).
- **Elderly Medicine services** to provide input for older patients (Chapter 16).

Providers (Chief Executives and Medical Directors)

In order to deliver high-quality care to high-risk emergency patients that meets standards, attention should be directed at organisational change in the following areas:

2 Patients undergoing emergency bowel surgery require **consultant involvement in their care** 24 hours per day, seven days per week. Rotas, job plans and staffing levels for surgeons and anaesthetists should reflect this. The workload may require an increase in the number of consultants available for emergency work. In some hospitals, this may require separation of elective and emergency care so that both services can continue in parallel without competing for resources. Delivery of high-quality care can be facilitated by reconfiguring services to locate acute surgical patients within a single area. (Chapters 8 and 13).

3 Policies should be developed and implemented which use **individual risk assessment to guide allocation of resources** (e.g. critical care) appropriate to the patient's needs (Chapters 10, 15 and 17). This can also help with capacity planning by defining a hospital's expected caseload and resource requirements.

4 Provision of **emergency theatre capacity** needs to be sufficient to enable patients to receive emergency surgical treatment without undue delay, and may require capacity to allow emergency and elective care to continue in parallel. Where capacity is limited, prioritisation of time-sensitive emergency surgery can be facilitated by policies to defer elective activity (Chapters 11 and 12).

5 National standards for **postoperative critical care admission** should be adhered to. This may require an increase in critical care capacity so that emergency and elective care can continue in parallel (Chapter 15).

6 Data collected from NELA has the potential to inform NHS trust boards of many different aspects of emergency care provision. Local NELA Leads and perioperative teams must have **adequate time and resources to support accurate data collection, review adverse patient outcomes**, and to feed this back to clinical teams and hospital management including NHS trust boards. Such resources include **access to individuals with audit and quality improvement skills** throughout the NHS trust, allocated (job-planned) time to support data collection and analysis, and protected time for presentation of data in departmental meetings. Effort should be invested in ensuring clinical coding is accurate (Chapters 5, 17 and 18).

Clinical Directors and Multidisciplinary Teams

Patients undergoing emergency bowel surgery will receive care from a variety of clinical specialties, including the emergency department or acute admissions unit, radiology, surgery, anaesthesia, operating theatres, critical care and elderly care. These recommendations apply across these areas, as in many cases the need for change is not confined to a single area or specialty.

7 In order to reduce variation in care and minimise delays, hospitals should implement appropriate pathways for the care of emergency General Surgical patients, starting at the time of admission to hospital or referral by another team. Where pathways of care do already exist, Multidisciplinary Teams (MDT) should examine these in the light of audit data to determine their effectiveness, and identify why standards are still not met. Care pathways should ensure patients are admitted under the most appropriate specialty, aid communication within the MDT, prioritise emergency resources, and aim to ensure that all processes of care are provided for each patient. Standardised pathways of care also facilitate audit and thereby highlight key areas for improvement. **Pathways should cover the following areas**:

- Referral of patients for General Surgical review if they have been admitted under non-surgical specialties.
- Identification of patients with signs of sepsis and prompt prescription and administration of antibiotics.
- Identification and escalation of care of patients who would benefit from the opinion of a consultant surgeon before the next scheduled ward round.
- Rapid request, conduct, and reporting of CT scans.
- Routine documented assessment of the risk of complications and death from surgery.
- Presence of consultant surgeon and consultant anaesthetist for high-risk patients with a predicted mortality ≥5%.
- Admission to critical care for patients with a predicted mortality >10%.
- Identification of patients who would benefit from input from Elderly Medicine specialists in their perioperative care.

8 **Multidisciplinary Teams should hold regular joint meetings** to continuously review essential processes of care (for instance, using the NELA Quality Improvement Dashboard) and review perioperative morbidity (including unplanned returns to theatre and admissions to critical care) and mortality following emergency laparotomy. This should include formal collaboration with hospital mortality review panels in order to bring about greater understanding of where improvement is needed (Chapters 17 and 18).

9 **Continuous quality improvement informed by local data** should involve monitoring the impact of pathway and process changes with time-series data (run charts). The NELA web tool provides automated dashboards that can be used for this purpose. Multidisciplinary Teams should ensure that they include members with a good understanding of quality improvement principles, such as the Model for Improvement and good data feedback practices (Chapter 18).

NELA Leads

We are grateful to NELA participants for increasing case ascertainment and ensuring that data completeness was generally good. However, at some hospitals, data entry for many cases was started but not completed. In addition, fields relating to the timing of key points in the patient pathway (e.g. time of consultant surgeon review, decision to operate) were poorly completed by many hospitals (Chapter 5). Collection and feedback of high-quality data is vital to bring about improvements in care.

10 NELA Leads should review their local data to **ensure case-submission and data completeness**. Where data collection and entry is a problem, NELA Leads, supported by NHS trust resources, should work with clinical teams to improve this, to facilitate future audit and quality improvement (Chapter 5).

11 NELA Leads should actively promote **completion of P-POSSUM data fields** to ensure that risk estimation is accurate and avoid falsely elevated risk-adjusted hospital mortality rates (Chapter 5). This is in addition to the finding that standards of care were better met where risk assessment had been carried out.

Professional Stakeholder Organisations

12 Professional stakeholders, such as Royal Colleges and Specialist Societies, should collaborate to:

- Improve clarity and remove ambiguity in the wording of standards of care. This would be particularly welcome for standards for admission to critical care (Chapter 15).
- Bring together standards in a single, unified document.
- Highlight the issues to their members to ensure appropriate engagement.

4 INTRODUCTION TO THE SECOND NELA PATIENT AUDIT REPORT

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. These may be performed for a variety of conditions, including complications of elective (planned) surgery. Approximately 30,000 emergency laparotomies are performed annually in England alone.[1,2]

The majority of patients undergoing emergency laparotomy have potentially life-threatening conditions that require prompt investigation and treatment. Unlike elective surgery, there is often limited time to carry out investigations. These operations frequently need to be performed at short notice, and delays can lead to increased complications and risk of death.

Death, complications, prolonged in-hospital recovery, and long-term debilitation are far more common after emergency bowel surgery than after many other operations.[6,7] Data from across the world have consistently shown that about 15% of patients die within a month of emergency bowel surgery.[1,3,4,5] This is five to ten times greater than for 'high-risk' elective surgery such as cardiac, vascular and cancer surgery, including elective bowel surgery.

Why was the Audit commissioned?

The National Emergency Laparotomy Audit (NELA) was commissioned by the Healthcare Quality Improvement Partnership (HQIP), and funded by NHS England and the Welsh Government. Its aims are to collect and publish high-quality comparative information from all hospitals in England and Wales at which emergency laparotomies are performed, in order to drive quality improvement in the care of these patients. It was established in response to the comparatively high death rate after emergency laparotomy, and the substantial variation in this rate between hospitals.[3] Groups of doctors, including the Emergency Laparotomy Network, had become concerned that variation in the quality of delivered care might explain these figures and lobbied for a national audit.

The contract to run NELA was awarded to the Royal College of Anaesthetists (RCoA). The Audit commenced in December 2012 and is currently funded to run until November 2017. It is being run with significant input from the Clinical Effectiveness Unit of the Royal College of Surgeons of England (RCS). Additional information about its governance and organisational arrangements are presented in Chapter 21.5.

What contributes to patient outcomes?

Adverse patient outcomes after emergency laparotomy (such as death and complications) may result from pre-existing health conditions of the patient having surgery, the nature of the surgery, or a variety of factors that affect the quality of care administered.[8] The latter may relate to the facilities available within a hospital (structural factors), or the process of delivery of care (process measures).

Structural factors include both the presence and prompt availability of hospital facilities and the appropriately trained personnel who are required to staff them. Without timely access to essential staffed facilities, a patient's treatment options may be limited and essential care delayed. NELA's first Report was an Organisational Report that highlighted variation in the provision of facilities for emergency laparotomy provided by hospitals across England and Wales and was published in May 2014.[9]

Process measures describe the quality and speed with which assessments, diagnoses and treatments are made or delivered to individual patients. These may include:

- The type of operation performed, how promptly it is arranged after admission to hospital, and the seniority of supervising surgeons and anaesthetists.
- How quickly antibiotics are given.
- Whether patients are cared for in a critical care unit directly after surgery.

Underpinning all these decisions is the assessment, interpretation, and communication of the risks of death and serious complications for each individual patient. Communication is important both between clinicians to ensure that the best care is delivered, and between clinicians and patients and their next of kin, to ensure that the right decisions are agreed for each patient in the context of their individual situation.

A variety of standards exist that set out how these processes should be delivered in hospitals in order that patients receive high-quality care. NELA assesses delivery of care against these standards. A full list of these standards is provided in the relevant tables in each chapter.

What are the overall aims of the Patient Audit?

The Audit's aims are:

- To audit the delivery of key processes of care for patients undergoing emergency laparotomy, and to report hospital-level information in order to:
  - Highlight variation.
  - Identify hospitals providing high levels of compliance with existing standards of care.
  - Share best practice.
  - Support quality improvement efforts locally, regionally and nationally.
- To report outcomes for patients undergoing emergency laparotomy in England and Wales at hospital level, including:
  - 30-day mortality.
  - Length of postoperative hospital stay.
  - Unplanned returns to theatre.
  - Unplanned escalation in the level of postoperative care.

What does this Second NELA Patient Report cover?

This is the Second NELA Patient Report, and covers the care received by patients who underwent an emergency laparotomy between 1 December 2014 and 30 November 2015.

Without robustly collected process and outcome data it has, until now, been difficult to know where improvement work should be focused. This Report describes how well NHS hospitals in England and Wales are providing care, and provides each hospital with an individual breakdown of performance against published standards. This allows the best performing hospitals to be identified so that good practice can be disseminated. It also allows hospitals to see areas where they can improve. Differences in the structure of hospitals mean that it is unlikely that generic solutions will be applicable in all circumstances. Each hospital should examine its own structures, processes and outcomes to identify areas for improvement and develop local quality improvement initiatives.

In addition to the process measures described above, this Report also includes hospital-level postoperative mortality figures based on data from the national death register provided by the Office for National Statistics (ONS), covering patients who underwent surgery from December 2013 to November 2015. Hospital-level risk-adjusted 30-day mortality figures have been presented to allow comparisons between hospitals with different case-mix (Chapter 17.1). This has been subject to an outlier analysis to detect hospitals that have outcomes that are statistically different from their peers. The collection of patient-level data is ongoing, with results published annually.

Overview of the First NELA Patient Report

The First NELA Patient Report published hospital-level data on process measures, and information on the overall mortality of patients who had an emergency laparotomy. The Report found wide variation in the degree to which standards of care were met, with some hospitals providing high levels of care. We were able to contact these hospitals and disseminate information on what they were doing well, to aid quality improvement elsewhere. The overall 30-day inpatient mortality was 11%. One of the key messages to arise from the First Report was the role that risk assessment played in delivery of care. Those patients with a documented assessment of risk from emergency laparotomy were more likely to receive a subsequent level of care that met standards. This formed a key message in various publications and communication with professional stakeholders.

Overview of audit methods

All NHS hospitals in England and Wales that undertake emergency laparotomy were invited 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 were developed to define exactly which patients should be included in the Audit. 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. Data were submitted to NELA via a web tool (https://data.nela.org.uk). 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 (www.nela.org.uk/reports).

Participating hospitals and case ascertainment

The Audit collects data on all patients aged 18 years or over undergoing emergency bowel surgery in an NHS hospital in England and Wales. Of the 191 hospitals that perform emergency laparotomy surgery, data were received from 186. A list of these hospitals is shown in Table 2 below.

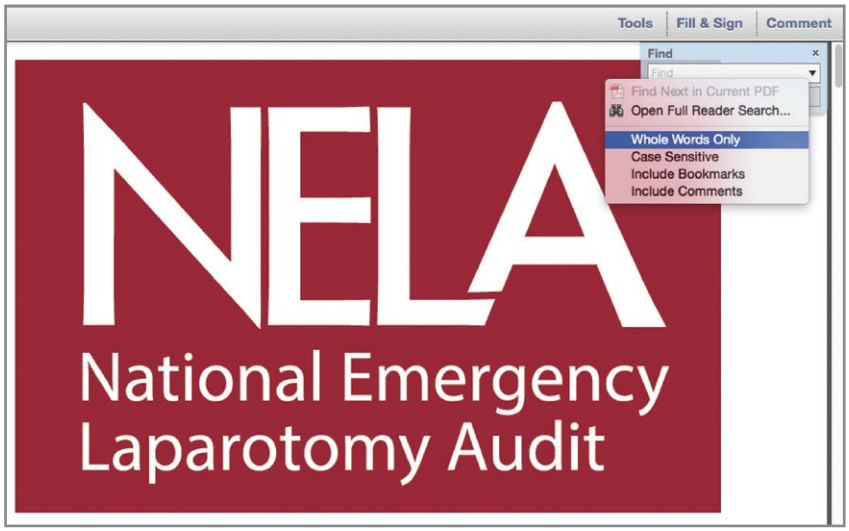
Case ascertainment describes the proportion of emergency laparotomy patients on whom data were received, compared to the total number of emergency laparotomies performed. A high case ascertainment rate means that we can be more confident that the Audit's results accurately describe the quality of care received by patients. This Report includes details for 23,138 patients, representing a high case ascertainment rate of approximately 70% of all patients that underwent emergency bowel surgery. We would urge caution when interpreting results from hospitals with low case ascertainment rates, as they may not have provided sufficient data to accurately describe the quality of patient care. Additional information on case ascertainment is provided in Chapter 5, Figure 41, and the Technical Documents accompanying this Report on the NELA website (www.nela.org.uk/reports).

How to read this Report

The Report is divided into chapters, each covering a different part of the patient's care pathway.

- Key process measures are described in Chapters 7 to 16, and patient outcomes are described in Chapter 17.
- These chapters provide:
  - A description of the standards against which processes of care were measured, and the audit question being asked.
  - An overall description of the extent to which a standard was met for all patients.
  - A description of the results at hospital level, including comment on variability of care.
  - A clinical commentary explaining the implications of the results.
  - A time-series 'run chart' illustrating change in proportion of patients meeting each standard since the start of patient data collection. Although the Audit started collecting patient data in December 2013, these charts commence from January 2014 as there were relatively limited data available in the first month of the Audit.
- In general, we have reported the number of hospitals that have achieved a standard of care using a RAG rating, where provision of care to at least 80% of patients constitutes an acceptable standard of care. Further information on the RAG rating is provided in Chapter 7.
- The majority of percentage figures in the table columns have been rounded to the nearest whole number, as a result some columns may not total 100% when the individual rounded percentages are summed.

We have produced graphs that show each hospital's performance against its peers. Each hospital has been allocated an individual three-letter code. The list of hospitals and codes is shown in Table 2. In order to find each hospital within the Report, we recommend that the reader views an electronic version of the document and uses the 'find' function found in most PDF readers. This can usually be accessed by pressing 'Ctrl' + 'F' key, typing the three letter code into the box and pressing the 'Enter' key. Please also use the dropdown under the search box to select 'whole words only'. This will indicate the position of a hospital within various hospital-level graphs and tables throughout the Report. This function may only work if the Report is downloaded rather than viewed within a web browser.



NELA National Emergency Laparotomy Audit

Table 2 Participating hospitals and case ascertainment key (Year 2 data)

Hospital	Identifier	Hospital	Identifier
Addenbrookes Hospital	ADD	Doncaster Royal Infirmary	DID
Aintree University Hospital	FAZ	Dorset County Hospital	WDH
Airedale General Hospital	AIR	Ealing Hospital	EAL
Arrowe Park Hospital	WIR	East Surrey Hospital	ESU
Barnet Hospital	BNT	Freeman Hospital	FRE
Barnsley Hospital	BAR	Friarage Hospital	FRR
Basildon University Hospital	BAS	Frimley Park Hospital	FRM
Basingstoke & North Hampshire Hospital	NHH	Furness General Hospital	FGH
Bedford Hospital	BED	George Eliot Hospital	NUN
Birmingham Heartlands Hospital	EBH	Glan Clwyd District General Hospital	CLW
Blackpool Victoria Hospital	VIC	Glangwili General Hospital	GLG
Bradford Royal Infirmary	BRD	Gloucestershire Royal Hospital	GLO
Bristol Royal Infirmary	BRI	*Good Hope Hospital*	*GHS*
Bronglais General Hospital	BRG	*Harefield Hospital*	*HHX*
Broomfield Hospital	BFH	Harrogate District Hospital	HAR
Calderdale Royal Hospital	*CAL*	Hereford County Hospital	HCH
Castle Hill Hospital	*CAS*	Hillingdon Hospital	HIL
Charing Cross	CHX	Hinchingbrooke Hospital	HIN
Chelsea and Westminster Hospital	*WES*	Homerton Hospital	HOM
Cheltenham Hospital	CGH	Huddersfield Royal Infirmary	HUD
Chesterfield Royal Hospital	CHE	Hull Royal Infirmary	HUL
Churchill Hospital	*CCH*	Ipswich Hospital	IPS
City Hospital	CTY	James Paget University Hospital	JPH
Colchester General Hospital	COL	John Radcliffe Hospital	RAD
Conquest Hospital	CON	*Kent and Canterbury Hospital*	*CKH*
Countess of Chester Hospital	COC	Kettering General Hospital	KGH
Croydon University Hospital	MAY	King George Hospital	KNG
Cumberland Infirmary	CMI	King's College Hospital	KCH
Darent Valley Hospital	DVH	Kings Mill Hospital	KMH
Darlington Memorial Hospital	DAR	Kingston Hospital	KTH
Derriford Hospital	PLY	*Leeds General Infirmary*	*LGI*
Dewsbury and District Hospital	DDH	Leicester General Hospital	LEI
Diana Princess of Wales Hospital	GGH	Leicester Royal Infirmary	LER

Key

Green
Case ascertainment ≥70%

Amber
Case ascertainment 50% to 69%

Red
Case ascertainment <50%

Purple
Case ascertainment unknown

Black
No cases entered

Italicised
Fewer than ten cases included in year 2 NELA patient dataset

* Northumbria Specialist Emergency Care Hospital was formed when North Tyneside General Hospital and Wansbeck General Hospital merged during Year 2 of the Patient Audit

NELA
National Emergency Laparotomy Audit

Hospital	Identifier	Hospital	Identifier
Leighton Hospital	LEG	Princess of Wales Hospital	POW
Lincoln County Hospital	LIN	Queen Alexandra Hospital	QAP
Lister Hospital	LIS	Queen Elizabeth Hospital – Gateshead	QEG
Liverpool Heart and Chest Hospital	*LHC*	Queen Elizabeth Hospital (Lewisham and Greenwich NHS Trust)	QEL
Luton & Dunstable Hospital	LDH	Queen Elizabeth Hospital Birmingham	QEB
Macclesfield District General Hospital	MAC	Queen Elizabeth The Queen Mother Hospital	QEQ
Maidstone Hospital	*MST*	Queen's Hospital – Burton	BRT
Manchester Royal Infirmary	MRI	Queen's Hospital – Romford	QHR
Medway Maritime Hospital	MDW	Queens Medical Centre – Nottingham	QMC
Milton Keynes Hospital	MKH	Rotherham Hospital	ROT
Morriston Hospital	MOR	Royal Albert Edward Infirmary	AEI
Musgrove Park Hospital	MPH	Royal Berkshire Hospital	RBE
Nevill Hall Hospital	NEV	Royal Blackburn Hospital	BLA
New Cross Hospital	NCR	Royal Bolton Hospital	BOL
Newham University Hospital	*NWG*	*Royal Brompton Hospital*	*BMP*
Norfolk and Norwich University Hospital	NOR	Royal Cornwall Hospital	RCH
North Devon District Hospital	NDD	Royal Derby Hospital	DER
North Manchester General Hospital	NMG	Royal Devon & Exeter Hospital	RDE
North Middlesex University Hospital	NMH	Royal Free Hospital	RFH
Northampton General Hospital	NTH	Royal Glamorgan	RGH
Northern General Hospital	NGS	Royal Gwent Hospital	GWE
Northumbria Specialist Emergency Care Hospital*	NSH	Royal Hampshire County Hospital	RHC
Northwick Park/St Marks Hospital	NPH	Royal Lancaster Infirmary	RLI
Nottingham City Hospital	NOT	Royal Liverpool University Hospital	RLU
Papworth Hospital	PAP	Royal Marsden Hospital	MAR
Peterborough City Hospital	PET	Royal Preston Hospital	RPH
Pilgrim Hospital	PIL	Royal Shrewsbury Hospital	RSS
Pinderfields Hospital	PIN	Royal Stoke University Hospital	RSH
Poole Hospital	PGH	Royal Surrey County Hospital	RSU
Prince Charles Hospital	PCH	Royal Sussex County Hospital	RSC
Princess Alexandra Hospital	PAH	Royal United Hospital	BAT

Key

Green
Case ascertainment ≥70%

Amber
Case ascertainment 50% to 69%

Red
Case ascertainment <50%

Purple
Case ascertainment unknown

Black
No cases entered

Italicised
Fewer than ten cases included in year 2 NELA patient dataset

* Northumbria Specialist Emergency Care Hospital was formed when North Tyneside General Hospital and Wansbeck General Hospital merged during Year 2 of the Patient Audit

NELA
National Emergency Laparotomy Audit

Hospital	Identifier	Hospital	Identifier
Royal Victoria Infirmary	RVN	The Royal Oldham Hospital	OHM
Russells Hall Hospital	RUS	*The Walton Centre*	*WLT*
Salford Royal Hospital	SLF	Torbay District General Hospital	TOR
Salisbury District Hospital	SAL	Tunbridge Wells Hospital	TUN
Sandwell General Hospital	SAN	University College Hospital	UCL
Scarborough Hospital	SCA	University Hospital Lewisham	LEW
Scunthorpe General Hospital	SCU	*University Hospital Llandough*	*UHL*
South Tyneside District Hospital	STD	University Hospital North Durham	DRY
Southampton General Hospital	SGH	University Hospital of North Tees	NTG
Southend University Hospital	SEH	University Hospital of Wales	UHW
Southmead Hospital	SMH	University Hospital, Coventry	UHC
Southport District General Hospital	SPD	Walsall Manor Hospital	WMH
St George's Hospital	GEO	Warrington Hospital	WDG
St Helier Hospital	SHC	Warwick Hospital	WAW
St James's University Hospital	SJH	Watford General Hospital	WAT
St Mary's Hospital	STM	West Middlesex University Hospital	WMU
St Mary's Hospital – IOW	MIW	West Suffolk Hospital	WSH
St Peter's Hospital	SPH	Weston General Hospital	WGH
St Richards Hospital	STR	Wexham Park Hospital	WEX
St Thomas' Hospital	STH	Whipps Cross University Hospital	WHC
Stepping Hill Hospital	SHH	Whiston Hospital	WHI
Stoke Mandeville Hospital	SMV	Whittington Hospital	WHT
Sunderland Royal Hospital	SUN	William Harvey Hospital	WHH
Tameside General Hospital	TGA	Withybush General Hospital	WYB
The Christie	CHR	Worcestershire Royal Hospital	WRC
The Great Western Hospital	PMS	Worthing Hospital	WRG
The James Cook University Hospital	SCM	Wrexham Maelor Hospital	WRX
The Princess Royal Hospital	*PRS*	Wythenshawe Hospital	WYT
The Princess Royal University Hospital	BRO	Yeovil District Hospital	YEO
The Queen Elizabeth Hospital – King's Lynn	QKL	York Hospital	YDH
The Royal Bournemouth Hospital	BTH	Ysbyty Gwynedd Hospital	GWY
The Royal London Hospital	LON		

Key

Green
Case ascertainment ≥70%

Amber
Case ascertainment 50% to 69%

Red
Case ascertainment <50%

Purple
Case ascertainment unknown

Black
No cases entered

Italicised
Fewer than ten cases included in year 2 NELA patient dataset

* Northumbria Specialist Emergency Care Hospital was formed when North Tyneside General Hospital and Wansbeck General Hospital merged during Year 2 of the Patient Audit

5 DATA QUALITY AND CASE ASCERTAINMENT

Case ascertainment

Using historical data from Hospital Episode Statistics (HES), it is possible to calculate the total number of emergency laparotomies that are expected to take place annually in the NHS and also in each hospital in England (equivalent data were not available for Wales). This calculation also allows comparison of the total number of cases submitted by each hospital with the total number expected, known as the case ascertainment rate (see the Technical Documents on the NELA website (www.nela.org.uk/reports) for more information about HES). This Report includes details for 23,138 patients, representing a case ascertainment rate of 70%, an increase from 65% seen in the First Audit Report.

Hospital-level case ascertainment was RAG rated according to the proportion of cases submitted compared to the expected caseload, where Green ≥70%, Amber 50–69%, Red, <50%. There was wide variation between hospitals: 88 hospitals (47%) were rated Green, and 36 (19%) rated Red. This has important implications when attempting to assess the quality of care provided by each hospital. For hospitals with a high case ascertainment rate (greater than 70%), 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. We have shown the case ascertainment rates for each hospital in Figure 41.

Locked cases

Just over one thousand (1,046) cases were started during the period of data collection but were not locked by the deadline for case submission and were therefore not eligible for inclusion in this Report. These cases represent 4% of records opened during the second year of data collection (compared to 5% in Year 1). The failure to lock cases is likely to have significant implications for case ascertainment rates at certain hospitals.

Cases excluded based on operative procedure inclusion criteria

The option 'Other' was selected as the primary procedure for 2,152 (9%) locked submissions (compared to 2,017 (10%) in Year 1). Review of accompanying free-text demonstrated that the primary surgical procedure was ineligible for inclusion in 722 of these cases (755 in Year 1) (www.nela.org.uk/criteria). These cases, representing 3% of locked cases (compared to 4% in Year 1), were then excluded from analyses and assessment of case ascertainment. The number of ineligible submitted cases varied between hospitals (Figure 42). No cases were excluded for ineligibility at 32 hospitals (17%) (compared to 10% in Year 1). However at two hospitals (1%) at least 10% of submitted cases were ineligible for inclusion in the Audit (compared to 4% of hospitals in Year 1).

Data completeness

Time and date values

The timing of certain perioperative care milestones should be documented, and documentation is necessary for departments to audit key processes of care. This year the Audit recorded the date and time of the decision to operate, with the date and time of booking recorded only if this could not be provided. Thus only one time point was required in Year 2, compared to both time points in Year 1.

Accurate times for the decision to operate (or the time of theatre booking if the time of decision to operate was not available) were missing in 14% of cases. This represents an improvement on data completeness when compared to Year 1 where the time of decision to operate was not provided for 18% of submitted cases, the time of theatre booking was not provided for 22% of submitted cases, and both times were missing in 12% of cases.

At 14% of hospitals the time of the decision to operate or the time of theatre booking was missing for at least a quarter of submitted cases (in Year 1, 12% of hospitals provided neither time point for more than a quarter of cases) (Figure 43). The absence of these data effectively excluded these patients from analysis of this key process measure.

P-POSSUM variables

The NELA web tool collects P-POSSUM[10] data for two purposes: to aid clinicians in providing an assessment of risk as part of the decision making process; and to support risk adjustment of hospital-level outcomes.

Complete preoperative and postoperative P-POSSUM data were submitted for 93% of all submitted cases (this is the same as the figure from Year 1). 28% of hospitals achieved full completion of all fields for every case (Figure 44).

Data linkage

The NELA dataset has been linked with other datasets. This serves two purposes: to reduce the burden of data collection by utilising data already collected elsewhere; and to enhance the analysis of NELA data by providing additional information about patients undergoing emergency laparotomy.

Data linkage with ONS was of high quality. Across both years of the Patient Audit, we have been able to link 99% patients to ONS (607 patients could not be linked). Due to differences in the way data have been exported for each year of the Patient Audit, there are slight differences between the denominator used for process and outcome measures. For mortality figures, the final number of patients matched between ONS and NELA was 23,177. For process measures, the figure is 23,138.

The quality of data linkage with HES at procedure level is less robust. We have been able to link around 32,500 of the 40,600 patients (80%) that underwent emergency laparotomy in England since December 2013 to an emergency laparotomy procedure on the recorded NELA operation date. This is likely to be due to accuracy of hospital coding, timing of the HES extract and the complexity associated with identifying patients who underwent an emergency laparotomy within HES. This has had implications for our ability to analyse some process measures, for instance contemporaneous case ascertainment and consultant review within 14 hours for patients admitted to hospital. Further information is provided in the Technical Documents that accompany this Report (www.nela.org.uk/reports).

Commentary

The staff and NELA Leads in hospitals are commended for their role in supplying the data used in Year 2 of the NELA Patient Report, which was of good quality overall. At present, case ascertainment is based on historical HES data. However, HES data that covers the NELA data collection periods have now become available. Work is currently underway to update the case ascertainment algorithm and provide more accurate case ascertainment figures. Year 2 also saw a reduction in the amount of data collected, and it is likely that this contributed to increased case ascertainment by reducing the burden of data collection.

QUALITY IMPROVEMENT VIGNETTE

Collecting data can be a burden, particularly if this falls on a small number of people. Many successful NHS trusts have improved their data by involving other parties to help the NELA Lead. You may use the help of audit, governance or research departments, or perhaps quality or patient safety teams if you have them. Other hospitals have engaged other resources such as sepsis nurses or enhanced recovery nurses.

Royal Sussex hospital more than doubled their case ascertainment between Year 1 and Year 2 of the Audit, by enlisting the help of their hospital Quality and Safety Team:

'Our rapid increase in case ascertainment was due to the engagement of our trusts Quality and Safety Team. This was a compulsory national audit to improve quality and safety so there was good justification in securing the services of a clinical audit officer…. the clinical audit officer retrospectively fills in the form from the patients notes and then two of the anaesthetic consultants fill in the remaining clinical information. This works well and ensures an accurate dataset.'

If the data collection falls to one person, this can be very time consuming, particularly catching data retrospectively, as described by the Worthing NELA Lead:

'I would rather tell you that we found a 'magic potion' which allowed us to achieve the improvement in case ascertainment. Unfortunately it was just down to my own hard work…. Completing all outstanding cases retrospectively turned out to be an extremely tedious/ painstaking task. I was fortunate that my department was very supportive and was able to free myself from clinical work whenever possible during this period. Long term our aim is to improve the 'real-time' data input by everybody involved in the care of these patients. In addition we also acquired the help of one of our Specialty Doctors who is keen on making a contribution.'

Worthing improved their case ascertainment from 6% to 71%. NHS trusts must give the NELA Leads adequate time and support for this important task.

RECOMMENDATIONS

Local NELA Leads and perioperative teams must have adequate time and resources to support data collection, and to feed this back to clinical teams and hospital management including NHS trust boards. The time required should be reflected in job plans (Chief Executives, Medical and Clinical Directors).

NELA Leads should review their local data to ascertain case-submission and data completeness (NELA Leads).

NELA Leads should actively promote completion of P-POSSUM data fields to ensure that risk estimation is accurate (NELA Leads).

Where data completeness is a problem, NELA Leads should work with clinical teams to improve this, to facilitate future audit and quality improvement (NELA Leads, MDT).

6 PATIENT AND SURGICAL CHARACTERISTICS

Descriptive information, including age, urgency of surgery and American Society of Anesthesiologists (ASA) Physical Status classification[b] are used throughout this Report to stratify processes of care and outcomes after surgery so that patterns can be investigated. In the supplementary information chapters, we present tables and figures that summarise the characteristics of the patients included in this Report, their predicted risk of death, and patterns of emergency hospitalisation. The commentary below summarises relevant differences in patient and surgical characteristics between those data published in the First NELA Patient Report (December 2013 to November 2014) and this year's data (December 2014 to November 2015).

In both years, the patients undergoing surgery tended to be older people; almost half were over the age of 70 years at the time of hospital admission (median age 67 years). The physical health of patients tended to be poor, with many rated as suffering from a severe health condition (more than half were scored as ASA 3 or above) and more than half required surgery within six hours of the decision being made to operate. Almost half of patients were calculated to have a greater than 10% likelihood of death within 30 days of surgery.

The distribution of gender, age, and ASA grade was essentially unchanged between the first and second year of data collection. The proportions of those admitted as an emergency, and those having emergency surgery for a complication of a previous surgical procedure within same admission, were identical between the two years. There were no substantial differences between the documented urgency of surgery. The median P-POSSUM predicted risk of death was slightly lower in Year 2 (7%) compared to Year 1 (8%). Full details for Year 2 data are given in Table 3.

[b]The American Society of Anaesthesiologists Physical status classification (commonly referred to as ASA grade) is a subjective score that ranges from 1–5 and is commonly collected in clinical practice. It is used to classify the disease-status of patients from: the absence of systemic disease (1) to the presence of severe and life-threatening disease (5).

Patient characteristics

Table 3 Characteristics of patients included in this Report (Year 2 data)

Characteristic	Group		Number of patients	Frequency (%)
Gender	Female		12,044	52
	Male		11,094	48
Age in years	18–39		2,452	11
	40–49		2,265	10
	50–59		3,253	14
	60–69		4,796	21
	70–79		5,767	25
	80–89		4,068	18
	≥90		537	2
Hospital admission type	Emergency		21,552	93
	Elective		1,586	7
ASA grade	1		2,381	10
	2		7,990	35
	3		8,161	35
	4		4,141	18
	5		465	2
Urgency of surgery	<2 hours		2,943	13
	2–6 hours		8,948	39
	6–18 hours		7,273	31
	18–24 hours		3,869	17
Procedure	Primary procedure		20,832	90
	Surgery for a complication of a recent procedure		2,306	10
Preoperative predicted risk of death within 30 days of surgery (P-POSSUM)	<5%	Lower risk	9,536	41
	5.0–10.0	High risk	4,039	18
	10.1–25.0%	Highest risk	4,398	19
	25.1–50.0%		2,550	11
	>50%		2,615	11

Surgical characteristics

For each patient, hospital staff selected the indication for surgery from a list of common indications (Table 58). More than one indication could be selected and some are likely to co-exist, for example perforation and peritonitis.

Patients undergoing emergency laparotomy constitute a markedly heterogeneous population in terms of diagnosis and outcome. This makes study more difficult but the group does broadly divide into those with intestinal obstruction and those with intestinal perforation, ischaemia, or abdominal sepsis of another cause where the required degree of urgency is even greater. The distribution of recorded indication for emergency laparotomy is unchanged between the two years. Intestinal obstruction remains the most common indication for surgery, occurring in half of patients. Abdominal sepsis due to intestinal perforation, peritonitis or abdominal abscess remains common, being included as an indication for surgery on 11,349 occasions (36%). 3% of emergency laparotomies (630 cases) are performed as a result of anastomotic leak following prior gastrointestinal surgery, a similar proportion to the results from Year 1.

The primary operative procedure was selected from a list of commonly performed emergency gastrointestinal procedures (Table 4). Only one option could be chosen, although secondary and tertiary procedures could be selected in subsequent questions, and limited free text was available for primary procedures not listed. Again, there was no difference in the distribution of primary procedure between the two years. The most commonly performed procedures were adhesiolysis and small bowel resection, which were performed with equal frequency. Colorectal resections comprised the majority of the remainder of emergency laparotomies. A minority of procedures were upper gastrointestinal subspecialty specific; however this in part reflects the NELA exclusion criteria, as laparotomy for pathology of the oesophagus, gallbladder, biliary tree, liver, pancreas and spleen are all excluded from the Audit.

Between the two years, there has been only a minimal increase in the number of cases managed laparoscopically. In Year 1, 13% were commenced laparoscopically, with 7% completed by this technique. In Year 2, 14% were commenced laparoscopically with still only 8% completed by this technique. The vast majority of emergency laparotomies in England and Wales remain primary open procedures (Table 5).

Finally, participants could select more than one option from a list of common operative findings (Table 59). Once more, these are identical between the two years. Adhesions remain the most commonly found pathology (27%), although this may reflect a common secondary finding co-existing with another primary pathology. Intestinal (peptic, small bowel or colonic) perforation was found in a quarter of emergency laparotomies. Localised or disseminated malignancy was found in a fifth of cases.

The cases submitted to NELA represent a huge resource of surgical and physiological data, and detailed subgroup analysis (for example small bowel obstruction secondary to adhesions, malignant colonic obstruction, or Hartmann's procedure) is currently ongoing in conjunction with the respective surgical subspecialty associations.

Table 4 Recorded primary surgical procedure at emergency laparotomy (Year 2 data)

Primary operative procedure	Number of patients	Frequency (%)
Adhesiolysis	3,918	17
Small bowel resection	3,889	17
Colectomy: right	3,013	13
Hartmann's procedure	2,952	13
Colectomy: subtotal	1,336	6
Stoma formation	1,330	6
Peptic ulcer – suture or repair of perforation	1,305	6
Colectomy: left (including anterior resection)	670	3
Drainage of abscess/collection	650	3
Washout only	565	2
Repair of intestinal perforation	518	2
Exploratory/relook laparotomy only	448	2
Colorectal resection – other	437	2
Gastric surgery – other	329	1
Intestinal bypass	304	1
Enterotomy	255	1
Haemostasis	249	1
Peptic ulcer oversew of bleed	191	1
Not amenable to surgery	190	1
Abdominal wall closure	161	1
Stoma revision	149	1
Reduction of volvulus	134	1
Resection of other intra-abdominal tumour(s)	78	<1
Laparostomy formation	64	<1

Table 5 Operative approach at emergency laparotomy (Year 2 data)

Operative approach	Number of patients	Frequency (%)
Open	19,887	86
Laparoscopic	1,636	7
Laparoscopic converted to open	1,367	6
Laparoscopic-assisted	248	1

7 SUMMARY OF STANDARDS OF CARE AND PROCESS MEASURES

This chapter briefly describes overall performance of hospitals against published standards of care. The process measures reflect key stages in the pathway of care, from the first review by a consultant surgeon, through perioperative care and into the postoperative period.

Due to the heterogeneity of the patient population, it is not appropriate to expect 100% compliance with all standards. Some standards are only applicable to particularly urgent surgery or to patients at high risk of complications and death. It should not be assumed that, because data are being collected on a particular measure, 100% compliance is required. We have taken 80% compliance as an indication that a hospital was reliably meeting a standard of care (with the exception of case ascertainment, where a value of 70% was used). In order to report hospital performance against standards, the following RAG rating is used:

Green: Standard met for at least 80% of patients (70% for case ascertainment)

Amber: Standard met for 50–79% of patients (50–69% for case ascertainment)

Red: Standard met for fewer than 50% of patients

Table 6 and Table 7 summarise the headline figures in both the First NELA Patient Report (December 2013 to November 2014) and this year's data (December 2014 to November 2015). Full details of each process measure, including the standards of care, and any additional analysis can be found in the relevant chapters.

Some of the metrics have been refined since the First Report to reflect a greater understanding of the dataset and delivery of care. In order to make comparisons between the first- and second-year Reports, some of the Year 1 metrics have been recalculated. Hence some of the figures will appear to be different to those published in the First Report.

Table 6 Comparison of key process measures between the First and Second NELA Patient Reports

Process Measure		First NELA Patient Report	Second NELA Patient Report	Change from Year 1 to Year 2 (p value)
Proportion of patients reviewed within 14 hours of hospital admission by a consultant surgeon		54%	55%	0.044
Preoperative imaging	Proportion of patients receiving a CT scan before surgery	81%	83%	<0.001
	Proportion of patients who had a CT scan which was reported by a consultant radiologist before surgery	68%	72%	<0.001
Proportion of patients with risk assessment before surgery		56%	64%	<0.001
Timeliness of care for patients undergoing emergency surgery for suspected peritonitis (median (IQR))	Time from admission to first dose of antibiotics	3.6 hrs (1.8–7.0)	3.3 hrs (1.4–6.6)	–
	Time from admission to arrival in theatre	8.1 hrs (5.0–13.3)	7.7 hrs (4.8–12.8)	–
	Time from decision to operate to arrival in theatre	2.0 hrs (1.3–3.5)	1.9 hrs (1.1–3.0)	–
Preoperative consultant involvement as a proportion of all patients	Decision to operate made in person by a consultant surgeon and patient reviewed preoperatively by a consultant anaesthetist	58%	56%	<0.001
	Decision to operate made in person by a consultant surgeon	72%	72%	0.975
	Preoperative review by a consultant anaesthetist	77%	74%	<0.001
Preoperative consultant involvement as a proportion of patients with a preoperative P-POSSUM risk of death ≥5%	Decision to operate made in person by a consultant surgeon and patient reviewed preoperatively by a consultant anaesthetist	59%	57%	0.001
	Decision to operate made in person by a consultant surgeon	71%	71%	0.44
	Preoperative review by a consultant anaesthetist	80%	77%	<0.001
Proportion of patients who arrived in theatre within a time appropriate to their degree of urgency (assessed as requiring surgery in less than 18 hours)		84%	82%	0.007

Consultant presence in theatre as a proportion of all patients	Both a consultant surgeon and a consultant anaesthetist	65%	70%	<0.001
	Consultant surgeon	85%	87%	<0.001
	Consultant anaesthetist	74%	78%	<0.001
Consultant presence in theatre as a proportion of patients with a preoperative P-POSSUM risk of death ≥5%	Both a consultant surgeon and a consultant anaesthetist	70%	74%	<0.001
	Consultant surgeon	87%	89%	<0.001
	Consultant anaesthetist	78%	82%	<0.001
Proportion of patients with **no preoperative** and **no intraoperative** consultant involvement	All patients	2.9%	2.3%	<0.001
	Patients with a preoperative P-POSSUM risk of death ≥5%	2.4%	1.8%	0.001
Proportion of patients who received goal directed fluid therapy	Cardiac output monitor	37%	39%	<0.001
	Other method	15%	15%	0.7
	Overall	52%	54%	<0.001
Proportion of high and highest risk patients who were admitted directly to critical care after surgery	Patients with a postoperative P-POSSUM risk of death 5–10%	58%	62%	0.001
	Patients with a postoperative P-POSSUM risk of death >10%	83%	85%	<0.001
Proportion of patients aged 70 years or over who were assessed by an Elderly Medicine specialist		10%	10%	0.642

Table 7 Comparison of change in the number of hospitals rated Green (standard achieved for ≥80% of patients) for each key process measure between the First and Second NELA Patient Reports

Process Measure	Number of hospitals rated Green		Change (+ve represents improvement)
	First NELA Patient Report	Second NELA Patient Report	
CT scan reported before surgery	50	67	17
Risk assessment before surgery	25	43	18
Arrived in theatre within appropriate timeframe	133	129	-4
Preoperative consultant surgeon and anaesthetist involvement for patients with a preoperative P-POSSUM risk of death ≥5%	24	26	2
Consultant surgeon and anaesthetist present in theatre for patients with a preoperative P-POSSUM risk of death ≥5%	65	83	18
Consultant surgeon present in theatre for patients with a preoperative P-POSSUM risk of death ≥5%	155	158	3
Consultant anaesthetist present in theatre for patients with a preoperative P-POSSUM risk of death ≥5%	96	112	16
Highest risk patients (P-POSSUM risk of death >10%) admitted directly to critical care after surgery	126	138	12
Patients aged of 70 years or over assessed by an Elderly Medicine specialist	2	2	0

8 REVIEW WITHIN 14 HOURS OF HOSPITAL ADMISSION BY A CONSULTANT SURGEON

Why is this important?

Emergency General Surgical admissions constitute a large workload in comparison to the number of patients requiring surgery. 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 which patients require surgery at admission. Prompt senior review of emergency General Surgical patients is vital because complex decision making and treatment planning may be required within hours of presenting to hospital. Timely review has been shown to be associated with improved outcomes.[11] Sicker patients require early review, but it is good practice for all patients to be reviewed within 12 or 14 hours and not longer than 24 hours following admission.

Limitations of data linkage

Whilst patients requiring an emergency laparotomy may have been admitted to hospital under both medical and surgical specialties, the process measure for this standard of care only applies to those admitted as an emergency under General Surgical specialties. In line with HQIP requirements to reduce the burden of data collection, we chose to obtain admitting specialty from HES rather than ask this as separate question.

For the First Patient Report HES data was not available, so we reported this process measure for all patients regardless of admitting specialty, with the intention of updating this once HES data became available. Subsequent data linkage with HES has been less robust than anticipated (around 32,500 out of 43,600 patients in England across both years of the Audit). It is therefore inappropriate to report hospital-level performance against this standard of care. The standards have been included for information only.

KEY STANDARDS

Patients admitted as an emergency should be seen by a consultant at the earliest opportunity. Ideally this should be within 12 hours and should not be longer than 24 hours.
NCEPOD EA

All emergency admissions must be seen and have a thorough clinical assessment by a suitable consultant as soon as possible but at the latest within 14 hours from the time of arrival at hospital.
NHS 7 Day Services

AUDIT QUESTIONS

What proportion of patients was reviewed by a consultant surgeon within 14 hours of emergency presentation at hospital?

What variation existed in the proportion of patients reviewed by a consultant surgeon within 14 hours of emergency presentation, by:

1 Hospital?
2 Urgency of surgery?
3 Day and time of admission to hospital?
4 Under which specialities are patients requiring emergency laparotomy initially admitted to hospital?

KEY FINDINGS

Over half (55%) of patients who were admitted as an emergency and subsequently underwent an emergency laparotomy were reviewed by a consultant surgeon within 14 hours of admission at hospital (Table 8).

A review by a consultant surgeon within 14 hours of admission occurred in a higher proportion of patients requiring more urgent surgery when compared to those requiring less urgent surgery (Table 8).

The proportion of patients who were reviewed by a consultant surgeon within 14 hours of emergency admission varied by the time of day that the patients were admitted to hospital (Table 9).

Overall 75% of patients were admitted under General Surgery, 13% under General Medicine and Gastroenterology, and 12% under 'Other' specialties. This varied between hospitals (Figure 5).

Clinical commentary

There has been minimal change (from 54% to 55%) in the proportion of patients who are assessed by a consultant surgeon within 14 hours of admission. Patients who needed to go to theatre more urgently were more likely to be seen within 14 hours of admission compared to those with less clinical urgency (67% of <2 hour urgency category compared to 51% of 6–18 hour category), suggesting that in many cases the sicker patients are being identified successfully on admission by members of the clinical team (Table 8).

The First Patient Audit found variation in this measure associated with the time of day that patients were admitted. Those admitted between midnight and 8am were the most likely to be seen by a consultant surgeon within 14 hours; this observation remains unchanged (Table 9). This finding supports the notion that consultant-led ward rounds of new acute surgical admissions occur predominantly in the morning, and often only once daily.

Patients admitted in the late morning or afternoon are more likely to wait longer than 14 hours to be reviewed by a consultant surgeon, unless greater clinical urgency is highlighted by the on-call team. Of patients admitted between midday and 6pm, the proportion seen within 14 hours has improved between Year 1 and Year 2; this may suggest that in some NHS trusts there has been an increase in evening ward rounds of acute surgical admissions.

Given that 75% of patients were admitted under General Surgery, it is likely that the proportion of patients seen within 14 hours of admission is considerably higher than currently reported. It is likely that the NELA dataset will be adjusted to collect information on admitting specialty so that this process measure can be reported at hospital level in future reports.

Despite the limitations of data linkage with HES, the information obtained does shed light on the admission pathways within hospitals. There was a wide range seen in the proportion of patients admitted under General Surgery (50% to 93%). Patients requiring an emergency laparotomy may have been appropriately admitted under a number of differing specialties:

- General Surgery, if presenting to hospital with clear signs of an acute abdomen.
- General Medicine and Gastroenterology, particularly for patients with inflammatory bowel disease, and those thought to have gastroenteritis.
- Other specialties, particularly in specialist hospitals.

In some cases, admission under specialties other than General Surgery may reflect poor admission pathways, and it is likely that there may be some delay in patients receiving appropriate surgical care. Alternatively, some of the variation seen within the HES database at hospital level may reflect inaccurate clinical coding.

Hospital-level information on admitting specialty has been provided to allow hospitals to better understand their provision of care, and help determine whether clinical coding could be improved (Figure 5).

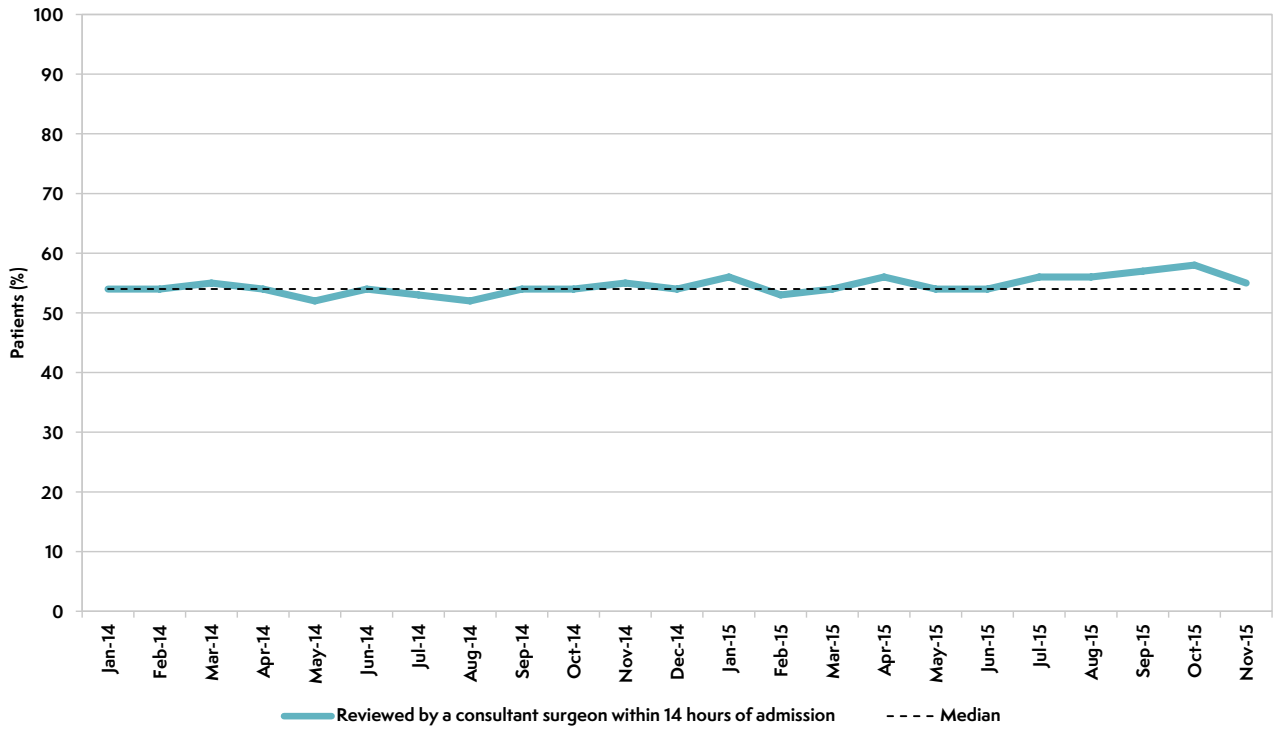
Table 8 Proportion of patients reviewed by a consultant surgeon within 14 hours of admission to hospital by operative urgency (Year 2 data)

Operative urgency	Total number of patients	Proportion reviewed by a consultant surgeon within 14 hours of emergency admission (%)
<2 hours	1,845	67
2–6 hours	6,250	61
6–18 hours	5,613	51
18–24 hours	2,941	43
Overall	**16,649**	**55%**

Table 9 Proportion of patients reviewed by a consultant surgeon within 14 hours of admission to hospital by time-of-day and day-of-week of emergency hospital admission (Year 2 data)

Time of emergency admission to hospital	Proportion reviewed by a consultant surgeon within 14 hours of emergency admission	
	Monday–Friday (%)	Saturday–Sunday (%)
0800–1159	56	47
1200–1759	40	35
1800–2359	63	65
0000–0759	73	71
Overall	**55%**	**54%**

Figure 3 Trend in the overall proportion of patients reviewed by a consultant surgeon within 14 hours of admission to hospital (due to uncertainty over the accuracy of HES data, no target is specified)



Additional analyses

The proportion of patients who were reviewed by a consultant surgeon within 14 hours of emergency admission to hospital was also assessed against patient age, ASA and preoperatively documented risk (Table 37).

RECOMMENDATIONS

Departments of surgery should use local NELA data to determine if the availability of duty consultant surgeons could be improved. Consultant surgeon rota patterns and job plans should be reviewed to ensure a consultant surgeon is always available to see patients within 14 hours of emergency admission, seven days per week. This may involve a second scheduled ward round. This would be facilitated by locating acute surgical patients within a single ward as a priority (Medical and Clinical Directors).

Pathways for the identification and escalation of care of patients who would benefit from the opinion of a consultant surgeon before the next scheduled ward round should be implemented. In almost all units, this will require duty consultant surgeons to be freed from routine commitments such as clinics or elective operating lists. Forward thinking units manage this through a modern structure of Emergency General Surgery delivery featuring active ongoing senior input and a strong, well-functioning admission pathway (Medical and Clinical Directors).

Hospitals should review the quality of their clinical coding to ensure accuracy (Medical and Clinical Directors).

Hospitals who admit a high proportion of emergency laparotomy patients under specialties other than General Surgery should review their admission and referral pathways to ensure that patients requiring emergency laparotomy receive appropriate surgical input (Medical and Clinical Directors).

Figure 4 Proportion of cases reviewed by a consultant surgeon within 14 hours of emergncy admission to hospital. Black bars indicate hospitals with less than ten cases in this analysis

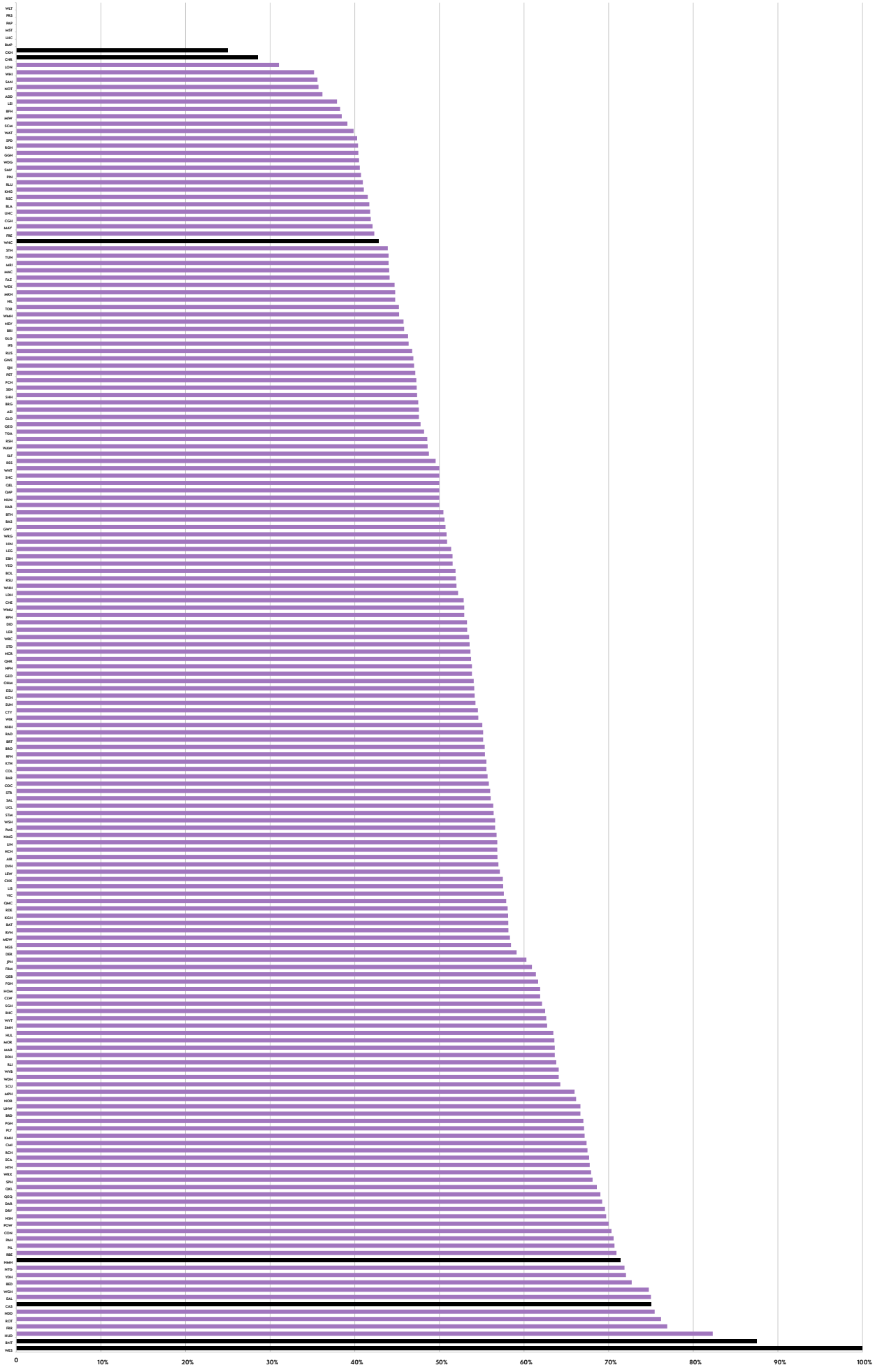
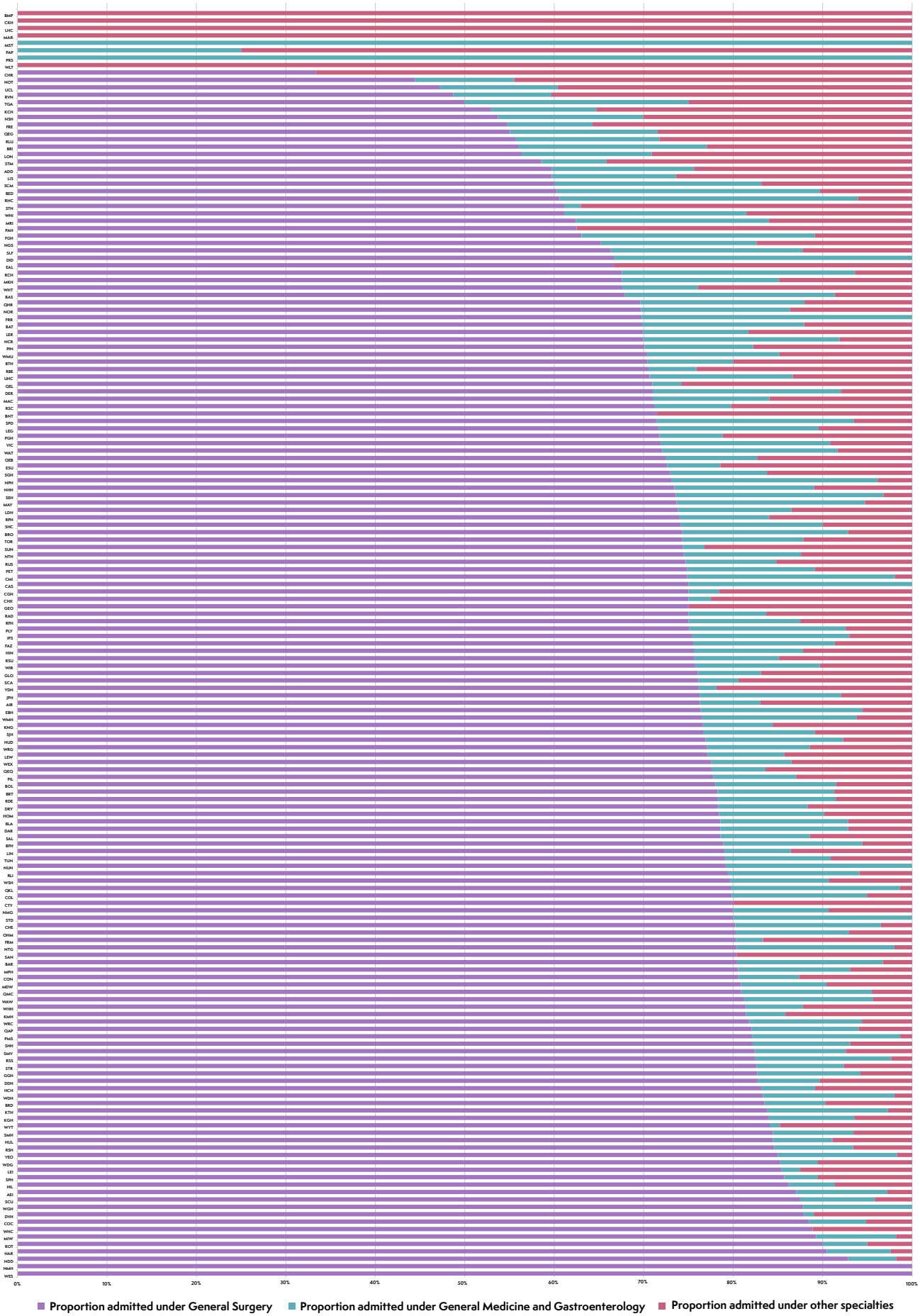


Figure 5 Proportion of patients admitted to general surgical and non-general surgical specialties by hospital in year 2



9 PREOPERATIVE IMAGING

Why is this important?

Radiological imaging is a fundamental component of clinical practice that can help clinicians to make diagnoses and formulate treatment plans with patients and their relatives. Modern abdominal CT scanning is extremely accurate and underpins acute surgical practice. Even when the need for surgery is obvious, reported scans can refine disease extent and inform operative urgency, the nature of likely surgery, and even the advisability of having an operation. The latter may include patients who have pathology that is not amenable to surgery, and hence prevent an unnecessary operation.

Many emergency General Surgical conditions require immediate treatment (which may be surgical or non-surgical) to prevent clinical deterioration. Timely reporting by a consultant radiologist may avoid delayed or inappropriate treatment resulting from misinterpretation of scans by non-specialist radiologists or other clinicians.[12,13] The quality of the information provided by CT scanning can be enhanced by discussion between surgical and radiology colleagues in order to better understand the clinical context.

CT scanning is most informative if performed early in the management of acute conditions. Imaging facilities and staff should therefore be available 24 hours per day to ensure patients who require scanning 'out of hours' are not disadvantaged.

Follow up of the NELA Organisational Audit by the Royal College of Radiologists determined that 24-hour contemporaneous CT reporting by a radiologist was available at all hospitals at which emergency laparotomies were performed. The disparity between apparent availability of facilities and variation in clinical practice may therefore reflect local differences in workload, commitments, or formalised pathways of care.

KEY STANDARDS

Hospitals which admit patients as emergencies must have access to both conventional radiology and CT scanning 24 hours per day, with immediate reporting.
NCEPOD EA

Consultant-directed diagnostic tests and completed reporting will be available seven days a week, within 1 hour for critical patients (i.e. those for whom the test will alter their management at the time).
NHS 7 Day Services

The delivery of quality clinical care is dependent on access to supporting facilities. Rapid access to CT imaging, U/S [ultrasound] scanning and laboratory analyses are critical to the efficient diagnosis, resuscitation and prioritisation of these patients.
ASGBI EGS

AUDIT QUESTIONS

What proportion of patients had a CT scan before surgery? (Target ≥80%)

What proportion of patients had a CT scan reported by a consultant radiologist before surgery? (Target ≥80%)

What variation existed in the proportion of patients who had a CT scan that was reported by a consultant radiologist before surgery, by:

1 Hospital?
2 Urgency of surgery?
3 Patient characteristics, including documented risk of death?
4 Day and time of admission to hospital?

KEY FINDINGS

83% of all patients had a CT scan before surgery (Table 10).

72% of all patients had a CT scan which was reported by a consultant radiologist before surgery (Table 10). 67 hospitals (36%) were rated Green, whereas 11 hospitals (6%) were rated Red (Figure 7).

A consultant reported scan was available before surgery for only 57% of patients requiring immediate surgery, despite 71% of these patients being scanned before surgery (Table 10).

There was little variation across the week for CT scanning and reporting (Table 38).

Clinical commentary

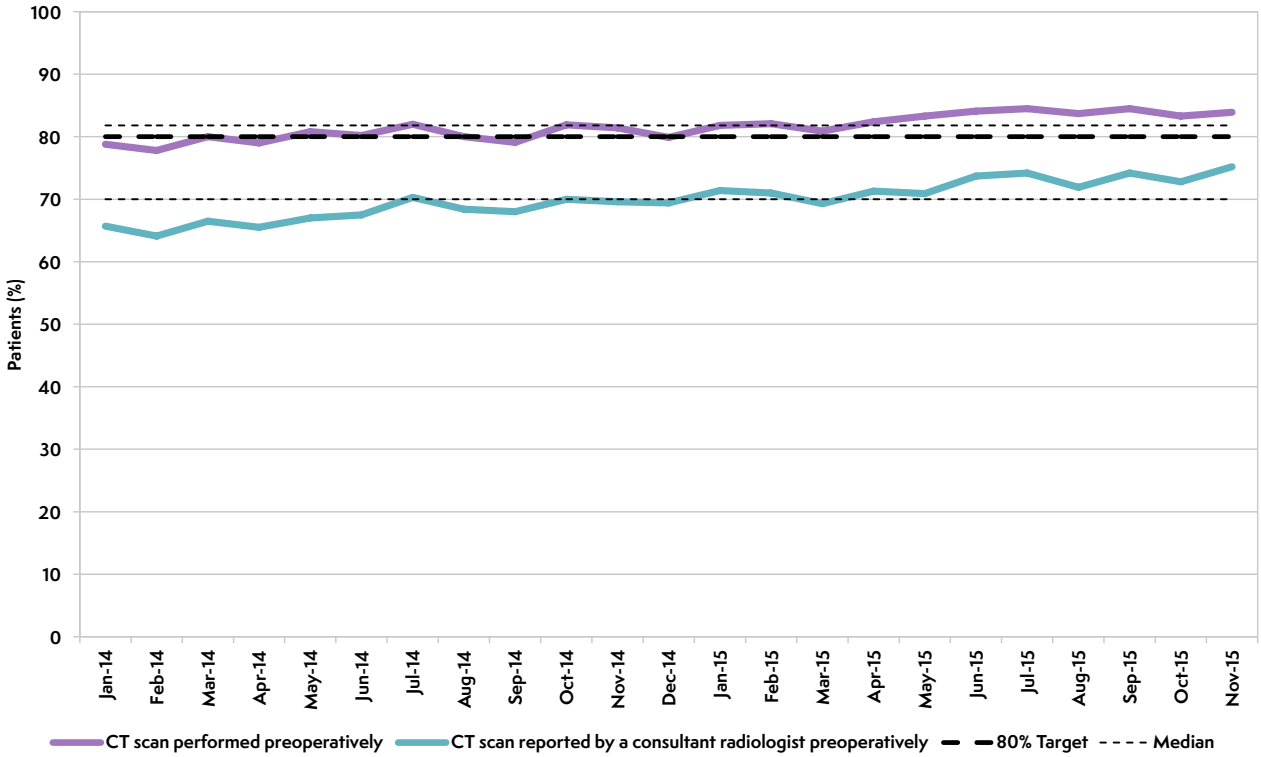
There has been improvement both in the proportion of patients receiving a CT scan before surgery (from 81% to 83%) and a bigger increase in the proportion of scans reported by a consultant radiologist (from 68% to 72%) (Table 10 and Figure 6).

A lower proportion of the more urgent patients were scanned compared to less urgent patients (71% of the <2 hour urgency category compared to 84% of the 2–6 hour category). Whilst this may minimise delays to surgery, CT is still a valuable diagnostic tool in urgent cases, and this most urgent group also had the lowest proportion of scans reported by a consultant radiologist. This contrasts with the care of patients who have suffered major trauma for whom a reported scan within one hour is the gold-standard as part of a consultant-based pathway.[14] Work should continue to address this issue to ensure that scans are reported within a timeframe that does not delay surgery.

Table 10 Preoperative CT scanning and reporting by a consultant radiologist by documented urgency of surgery (Year 2 data)

Urgency of surgery	Total number of patients	CT scan before surgery (%)	CT scan reported by a consultant radiologist before surgery (%)
<2 hours	2,943	71	57
2–6 hours	8,948	84	70
6–18 hours	7,273	87	78
18–24 hours	3,869	83	77
Overall	**23,033**	**83%**	**72%**

Figure 6 Trend in the overall proportion of patients receiving a CT scan preoperatively, and CT scans being reported by a consultant radiologist preoperatively



Additional analyses

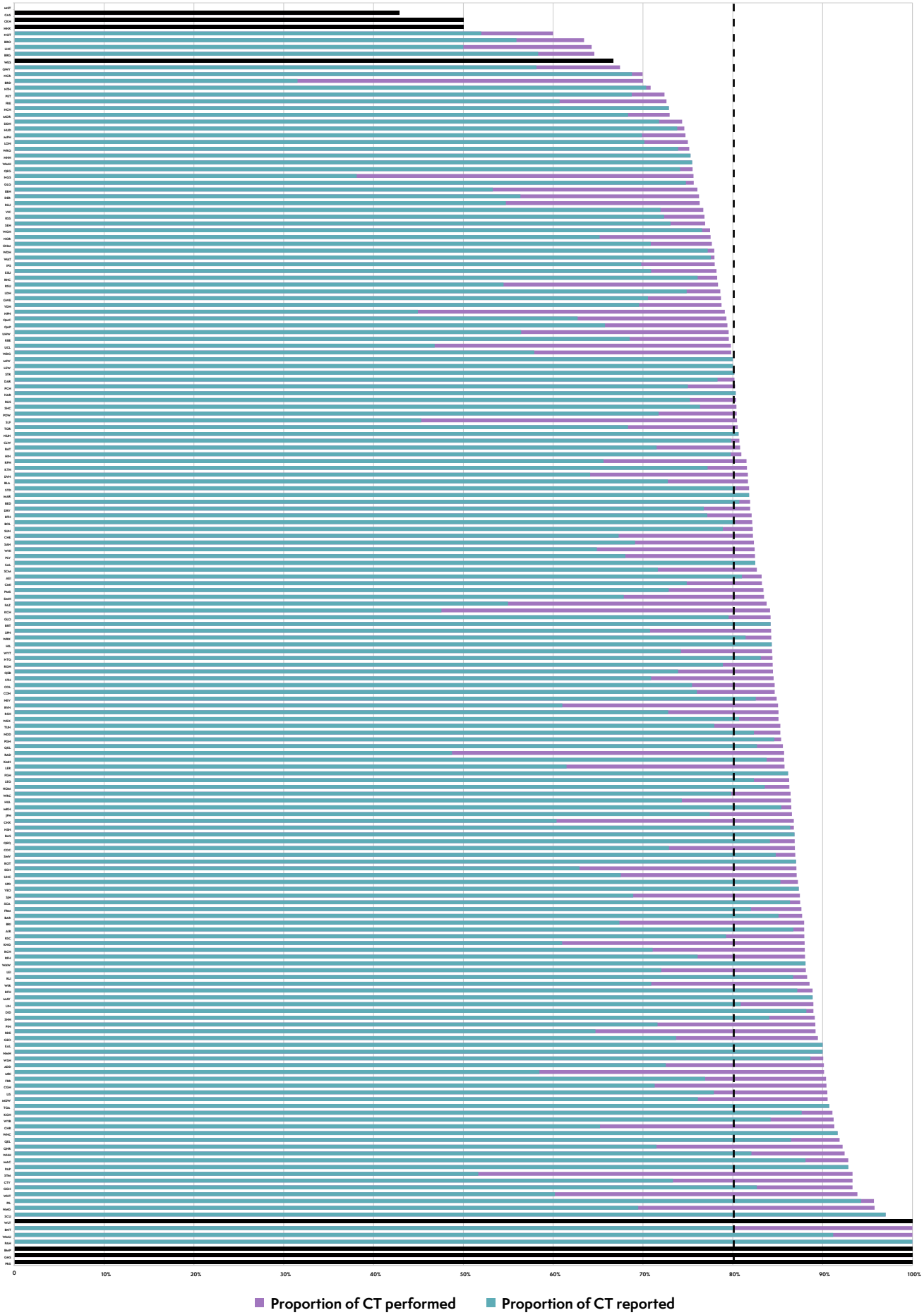
The proportion of patients who had a CT scan and for whom that CT was reported by a consultant radiologist before surgery was also assessed against the time of day and the day of week of hospital admission (Table 38), and patient age, ASA, admission type and preoperatively documented risk (Table 39).

RECOMMENDATIONS

Pathways should be implemented to facilitate rapid request and conduct of CT scans for patients who may require emergency laparotomy. These pathways should also support contemporaneous reporting by consultant or senior radiologists with expertise in interpreting emergency abdominal CT scans, so as not to delay subsequent treatment (Medical and Clinical Directors, MDT).

Multidisciplinary pathways should be established to prevent inappropriate delays to a patient undergoing surgery, especially once a consultant decision has been made. This will require cross-disciplinary cooperation between surgeons, anaesthetists, radiological and laboratory services and theatre and critical care staff (MDT).

Figure 7 Proportion of patients who had a CT scan performed and reported by a consulant radiologist before emergency laparotomy. Black bars indiate hospitals with less than ten cases in this analysis (--- 80% target)



10 PREOPERATIVE DOCUMENTATION OF RISK

Why is this important?

Death, complications, long-term debilitation, and prolonged in-hospital recovery are far more common after emergency bowel surgery than after many other operations, including elective bowel surgery.[6,7]

Since the risks of adverse outcomes vary between individuals, and because the risks posed by an operation sometimes outweigh proposed benefits, it is essential that they are quantified and documented before surgery for every patient. Assessment of risk can entail calculating a percentage risk of death using a variety of risk scores (e.g. P-POSSUM),[15] or allocating a patient to a specific higher or lower risk category. Doing so helps guide doctors, patients, and their relatives in deciding which course of treatment is most appropriate, and allows clinicians to tailor care to the needs of each person requiring surgery. If risk has not been evaluated, it makes it harder for patients to reach an informed decision and for clinicians to target appropriate specialist care to high risk and highest risk patients.

It is possible that where risk has not been documented, potential adverse outcomes may not have been appreciated by clinicians, or discussed with the patient as part of the consent process.

Figure 8 Categories of risk

The following categories are used in the Audit:

Highest risk	(>10% risk of death)
High risk	(5–10% risk of death)
Lower risk	(<5% risk of death)

KEY STANDARDS

An assessment of mortality risk should be made explicit to the patient and recorded clearly on the consent form and in the medical record.
NCEPOD KTR

Patients must be actively involved in shared decision making and supported by clear information from healthcare professionals to make fully informed choices about treatment and ongoing care that reflect what is important to them. This should happen consistently, seven days a week.
NHS 7 Day Services

We recommend that objective risk assessment become a mandatory part of the preoperative checklist to be discussed between surgeon and anaesthetist for all patients. This must be more detailed than simply noting the ASA score.
RCS HR

Patients with a predicted mortality ≥5% should be managed as 'high risk'.
RCS HR

AUDIT QUESTIONS

What proportion of patients had an assessment of risk documented before surgery? (Target ≥ 80%)

What variation has been seen over time?

What were the relative proportions of patients documented to be at lower, high and highest risk of death, and how did this vary according to the time of day that surgery was performed?

What was the observed mortality rate for each risk category?

How did care vary according to whether risk had been documented in the preoperative period?

What variation existed in the proportion of patients who had a risk of death documented before surgery by:

1 Hospital?
2 Urgency of surgery?
3 Patient characteristics?

How accurate is P-POSSUM at predicting a patient's risk of death?

KEY FINDINGS

Risk of death was documented before surgery for nearly two-thirds of all patients (64%) (Table 11). This is an improvement on last year where risk was documented in 56% of patients. 43 hospitals (23%) were rated Green, whereas 42 hospitals (23%) were rated Red (Figure 13).

Overall, 41% were lower risk, 18% high risk and 41% highest risk (Table 12). Patients having surgery after midnight had a higher median P-POSSUM predicted mortality (6.0% 8am to 6pm, 9.0% 6pm to midnight, 15.2% after midnight) (Table 13)

Of the 36% of patients for whom no risk assessment had been documented:

- 34% of patients were highest risk (calculated P-POSSUM risk of death >10%) (Table 14).
- 19% were high risk (calculated P-POSSUM risk of death 5%–10%).
- 47% were lower risk (calculated P-POSSSUM risk of death <5%).

Where risk was documented before surgery, a higher proportion of patients received other key process measures such as consultant presence in theatre and admission to critical care after surgery (Figure 10).

P-POSSUM is accurate up to ~15% predicted mortality; above this it tends to overestimate a patient's risk of death (Figure 11).

Clinical commentary

Risk of death should be estimated and documented in the medical record for all patients, and risks should be discussed with patients and their relatives to inform shared decision making. It is therefore encouraging that there has been an increase in the proportion of patients whose risk of death from surgery was assessed and documented in the preoperative period (from 56% to 64%) (Figure 12). Those who tend to have worse outcomes (e.g. due to age, ASA or increasing surgical urgency) were more likely to have risk documented, suggesting that clinicians use formal risk scoring to augment clinical judgement (Table 15 and Table 16). However, 36% of patients still do not have a documented risk assessment.

Participants provided sufficient data to allow us to calculate the P-POSSUM predicted risk of death for 93% of all patients, including those who had no risk documented prior to surgery (Table 11). For the 7% of patients with missing P-POSSUM data, we calculated the P-POSSUM risk of death in keeping with accepted methodology by assigning the missing variables to the lowest risk category.[16] This allowed us to examine how the standards of care provided to this latter group compared to an equivalent group of patients in whom the risk of death had been documented before surgery. Where there was no documented risk before surgery, the median predicted risk of death (based on P-POSSUM score) was 5.6%, meaning they fall into the high risk (5–10%) group (Table 11). Observed 30-day mortality in the 'not documented' group was also similar to the high risk group (7.3% and 7.1% respectively) (Figure 9).

The First NELA Patient Report found that standards of care (including presence of a consultant surgeon and a consultant anaesthetist for surgery) were better met and appropriate levels of care (e.g. critical care admission) were better provided if a risk assessment had been documented. This trend has continued, emphasising the fact that risk assessment appears to drive more appropriate clinical management. This is summarised in Figure 10 and expanded upon in relevant chapters (Chapters 13 and 15) throughout this Report.

Table 11 P-POSSUM risk of death, observed ONS 30-day and 90-day mortality by *documented preoperative risk category* (Year 2 data)

Documented preoperative risk category	Proportion of patients (%)	Median P-POSSUM 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%)	24	2.7	1.7	4.1
High (5–10%)	14	7.4	7.1	11.7
Highest (>10%)	26	29.1	26.9	33.1
Not documented	36	5.6	7.3	10.5
Overall	**100%**	**7.0%**	**11.1%**	**15.1%**

Table 12 Relative proportions in each risk category (based on *calculated preoperative P-POSSUM risk of death*) by time of arrival in operating theatre (Year 2 data)

Time of day	Total number of patients	Proportion of patients (%)		
		Lower risk (<5%)	High risk (5–10%)	Highest risk (>10%)
0800–1759	14,718	45	18	37
1800–2359	5,517	36	17	47
0000–0759	1,920	26	15	59
(missing)	983	44	18	38
Overall	**23,138**	**41%**	**18%**	**41%**

Table 13 Median preoperative *calculated P-POSSUM* risk of death by time of day of arrival in operating theatre (Year 2 data)

Time of day	Total number of patients	Median P-POSSUM risk of death (%)
0800–1759	14,718	6.0
1800–2359	5,517	9.0
0000–0759	1,920	15.2
(missing)	983	6.3
Overall	**23,138**	**7.0%**

Table 14 Relative proportions of patients in each risk category when preoperative documented risk is compared to preoperative calculated P-POSSUM risk of death (Year 2 data)

Documented preoperative risk category risk	Total number of patients	Proportion of patients by calculated P-POSSUM risk of death (%)		
		Lower risk (P-POSSUM risk of death <5%)	High risk (P-POSSUM risk of death 5–10%)	Highest risk (P-POSSUM risk of death >10%)
Lower (<5%)	5,504	77	14	9
High (5–10%)	3,196	30	32	38
Highest (>10%)	6,105	7	11	82
Not documented	8,333	47	19	34
Overall	**23,138**	**41%**	**18%**	**41%**

Table 15 Proportion of patients for whom risk was documented before surgery by patient characteristics (Year 2 data)

	Total number of patients	Proportion of patients who had risk documented before surgery (%)
Age (years)		
18–39	2,452	56
40–49	2,265	58
50–59	3,253	61
60–69	4,796	64
70–79	5,767	66
80–89	4,068	71
≥90	537	76
ASA		
1	2,381	59
2	7,990	59
3	8,161	63
4	4,141	77
5	465	84
Admission type		
Emergency	21,552	64
Elective	1,586	60
Overall	**23,138**	**64%**

Table 16 Proportion of patients for whom risk was documented preoperatively by documented urgency of surgery (Year 2 data)

Urgency of surgery	Total number of patients	Proportion of patients who had risk documented before surgery (%)
<2 hours	2,943	73
2–6 hours	8,948	66
6–18 hours	7,273	60
18–24 hours	3,869	60
Overall	**23,033**	**64%**

Figure 9 Median calculated preoperative P-POSSUM risk of death, and observed ONS 30-day and 90-day mortality by *documented preoperative risk category* (Year 2 data)

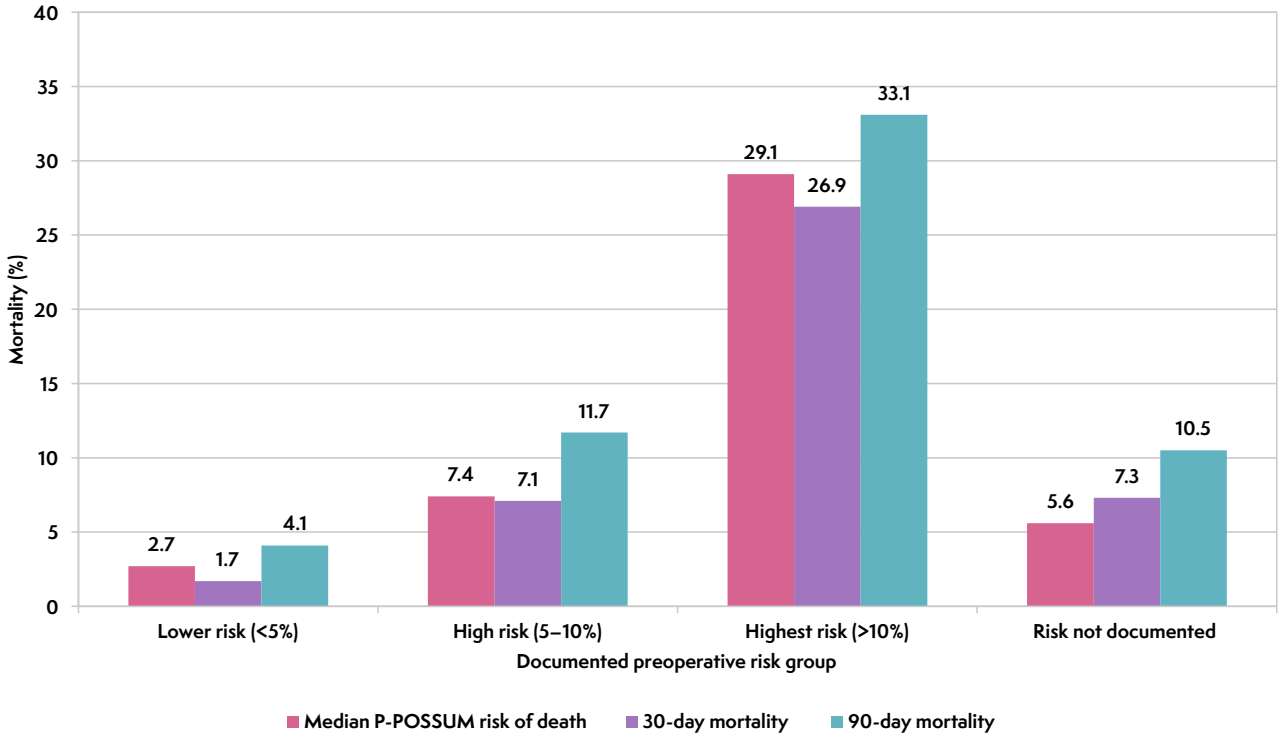
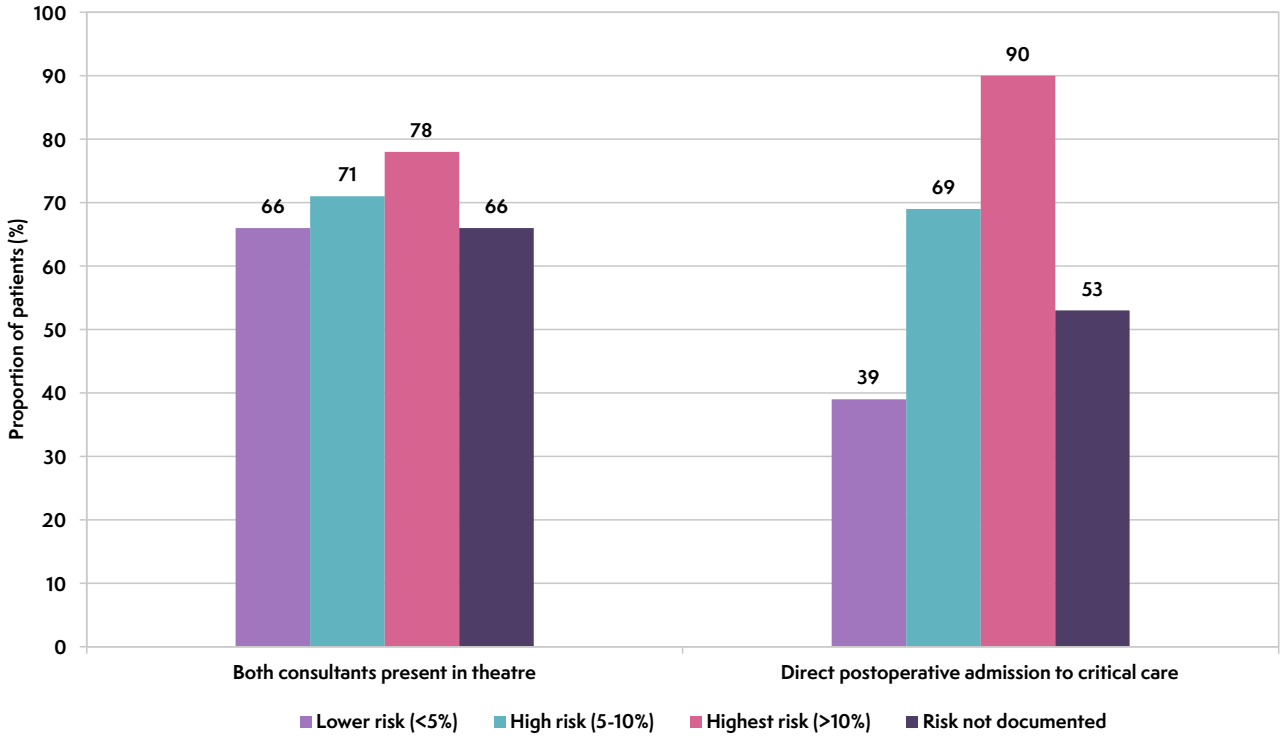


Figure 10 Intraoperative presence of both a consultant surgeon and consultant anaesthetist, and direct postoperative admission to critical care by *documented preoperative risk category* (Year 2 data)



How well does P-POSSUM predict risk?

The estimate of risk of death provided by P-POSSUM is reasonably accurate below around 15%. However above this, P-POSSUM tends to overestimate risk. This is illustrated in Figure 11 (further information is provided in chapter 21.3). With regard to use of P-POSSUM in clinical situations, P-POSSUM is still useful for identifying patients who fall in a lower, high or highest risk category, in order to make decisions about the need for resources such as critical care. However we urge caution in reliance on P-POSSUM when used to guide clinical decision making at high levels of predicted mortality as it overestimates risk of death by a factor of approximately two.

Figure 11 Calibration plot comparing the observed ONS 30-day mortality against that predicted by P-POSSUM in deciles of predicted risk (Year 1 and Year 2 data combined)

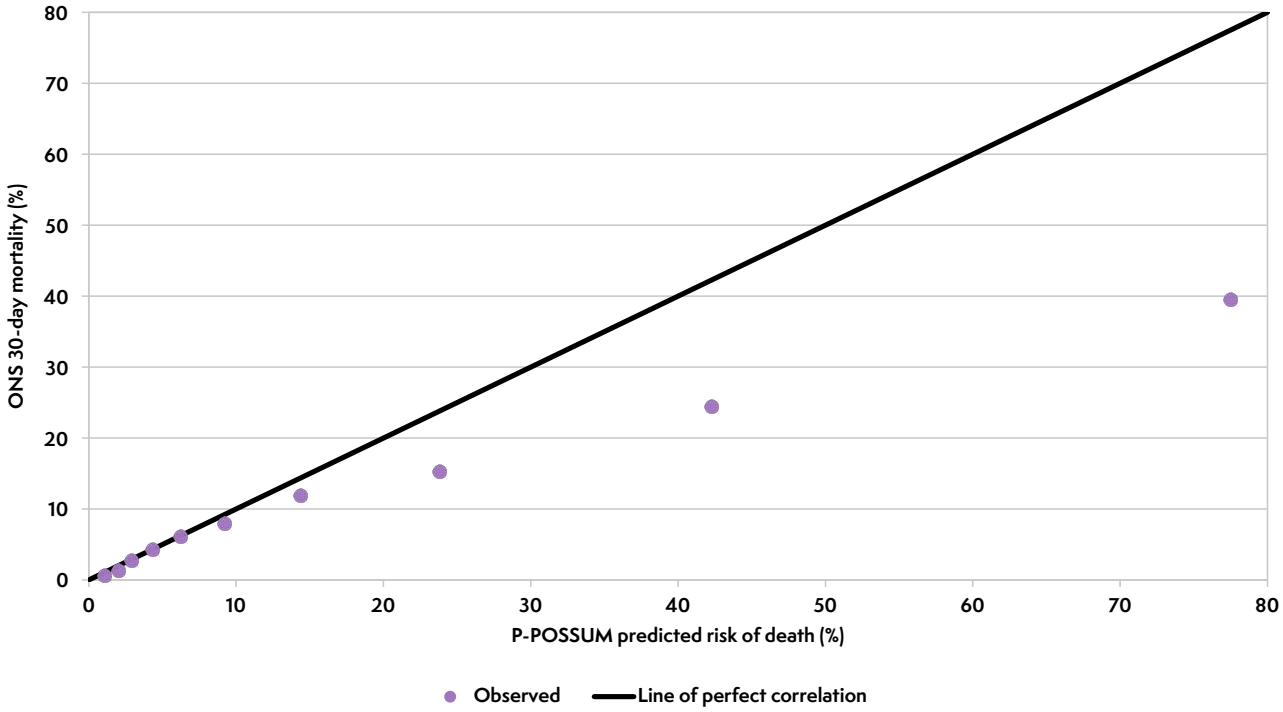
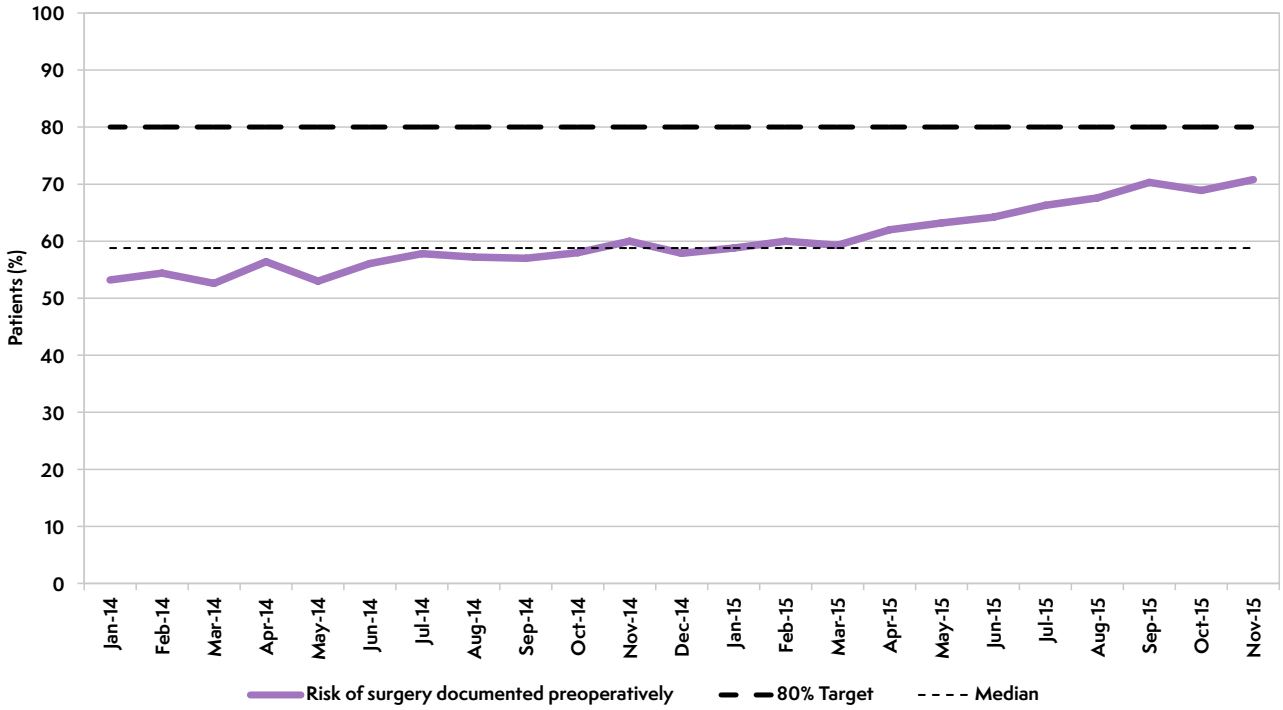


Figure 12 Trend in the overall proportion of patients whose risk of death from surgery was documented preoperatively



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QUALITY IMPROVEMENT VIGNETTE

Many hospitals improved their preoperative risk assessment with changes to booking processes to include prompts.

Southport District General hospital has a new *'laparotomy pathway that is now compulsory to complete at the point of booking a laparotomy in the theatre complex. Part of the data to complete for the single-sheet laparotomy booking form is a section for P-POSSUM with the necessary requirements of surgical and anaesthetic staff being clearly stated on the form.'* This led to a 6-fold improvement in risk documentation.

The Queen Elizabeth Hospital, King's Lynn achieved 99% of patients undergoing preoperative risk assessment with the 'implementation of an Emergency Theatre Booking System which requires surgeons to enter physiological and laboratory data (which make up the P-POSSUM score). When a patient is then booked they appear on our booking screen with their P-POSSUM mortality risk displayed.'

As with all improving hospitals, leadership and teamwork is also important.

In Furness hospital they had: *'Strong, passionate and enthusiastic leadership highly motivated for quality improvement. Team work and co-operation in particular the middle grade doctors. Successfully raised awareness across all departments that emergency laparotomy patients matter and need to be given priority especially amongst the junior surgical doctors.'*

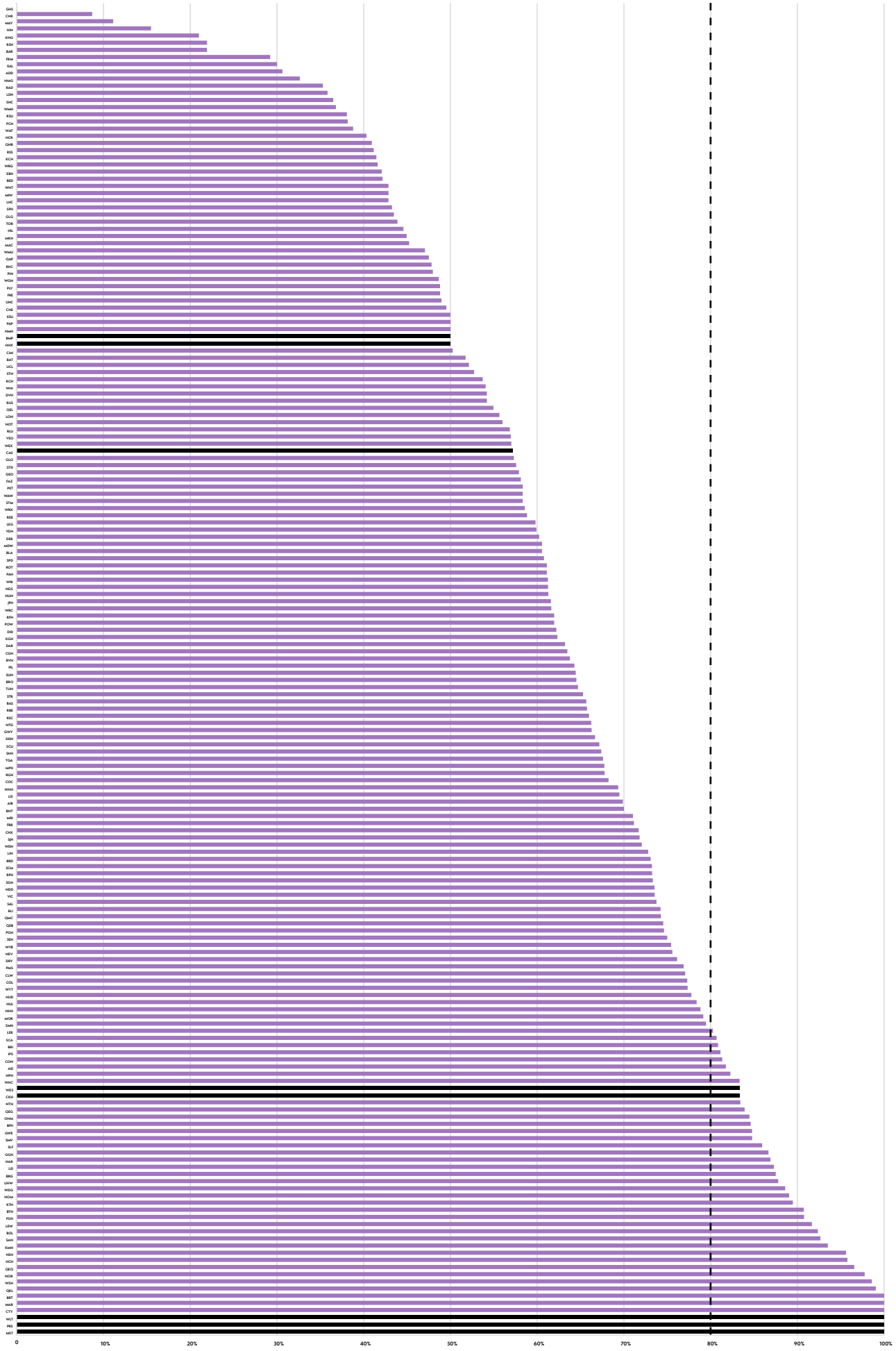
RECOMMENDATIONS

Policies should be developed and implemented which use individual risk assessment to allocate resources (e.g. critical care) appropriate to the patient's need (Medical and Clinical Directors).

When surgery is contemplated, a formal assessment of the risk of death and complications should be undertaken by a clinician and documented in the patient record. This information should be communicated to all members of the MDT in order to prioritise care and allocate appropriate resources. If surgery is undertaken, this risk assessment should be documented on the patient consent form (MDT).

P-POSSUM should continue to be used to assess risk. However clinicians should be aware that it over-predicts above ~15% risk and should not rely solely on P-POSSUM assessments of risk when deciding on benefits of treatment (MDT).

Figure 13 Proportion of patients who had risk documented preoperatively. Black bars indicate hospitals with less than ten cases in this anlysis (--- 80% target)



11 TIMELINESS OF CARE FOR PATIENTS UNDERGOING EMERGENCY SURGERY FOR SUSPECTED PERITONITIS

Why is this important?

Many patients requiring an emergency laparotomy have signs of sepsis. Sepsis is a term used to describe widespread, severe inflammation in the body resulting from infection. Intra-abdominal sepsis is life-threatening and early administration of antibiotics before surgery has been shown to improve the likelihood of survival.[17,18] The delivery of effective antibiotics is part of the first-line management of sepsis and remains part of resuscitation within the first hour of diagnosis of sepsis.[19] The ability of a hospital to deliver this treatment rapidly is dependent on reliable pathways of care and good communication between staff across different departments. The second part of the treatment process which these patients require is urgent surgical control of the source of the sepsis. It is well established that more rapid control of the source of peritonitis correlates with increased survival rates.

As with the First NELA Patient Report, in order to evaluate this, we selected the group of 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. This constitutes a relatively clearly defined group that requires both urgent antibiotic therapy and urgent surgery, and who were likely to have signs of sepsis on admission. This allows us to analyse how effective clinical teams were at delivering key interventions rapidly.

KEY STANDARDS

Those with septic shock require immediate broad-spectrum antibiotics with fluid resuscitation and source control.
RCS HR

Providers are expected to screen for sepsis all those patients for whom sepsis screening is appropriate, and to rapidly initiate intravenous antibiotics, within 1 hour of presentation, for those patients who have suspected severe sepsis, Red Flag Sepsis or septic shock.
CQUIN 2015/2016

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.
RCS HR

AUDIT QUESTIONS

For patients admitted as an emergency who were scheduled for emergency laparotomy for suspected peritonitis within six hours of the decision to operate and underwent sugery within 24 hours of admission to hospital:

1 What was the interval between admission to hospital and administration of antibiotics?
2 What was the interval between antibiotic administration and arrival in an operating theatre?
3 What was the interval between admission to hospital and arrival in an operating theatre?

KEY FINDINGS

2,056 patients were scheduled for emergency laparotomy for suspected peritonitis within six hours of a decision to operate and underwent surgery within 24 hours of admission to hospital (Table 40).

99% patients in this cohort received antibiotics. Over half of patients had received the first dose of an antibiotic within three and a half hours of emergency admission to hospital, but almost a quarter had yet to receive antibiotics six and a half hours after admission. When analysed according to time of arrival in theatre, 17% (319 of 1825 patients where all time data were available) received the first dose of antibiotics at the same time as or after their arrival in theatre.

Over half of patients arrived in theatre for surgery within two hours of the decision being made to operate, and three-quarters of patients arrived in theatre within three hours of the decision.

However, eight hours after admission just under half of these patients had not yet arrived in theatre for surgery, and a quarter waited over 12.5 hours.

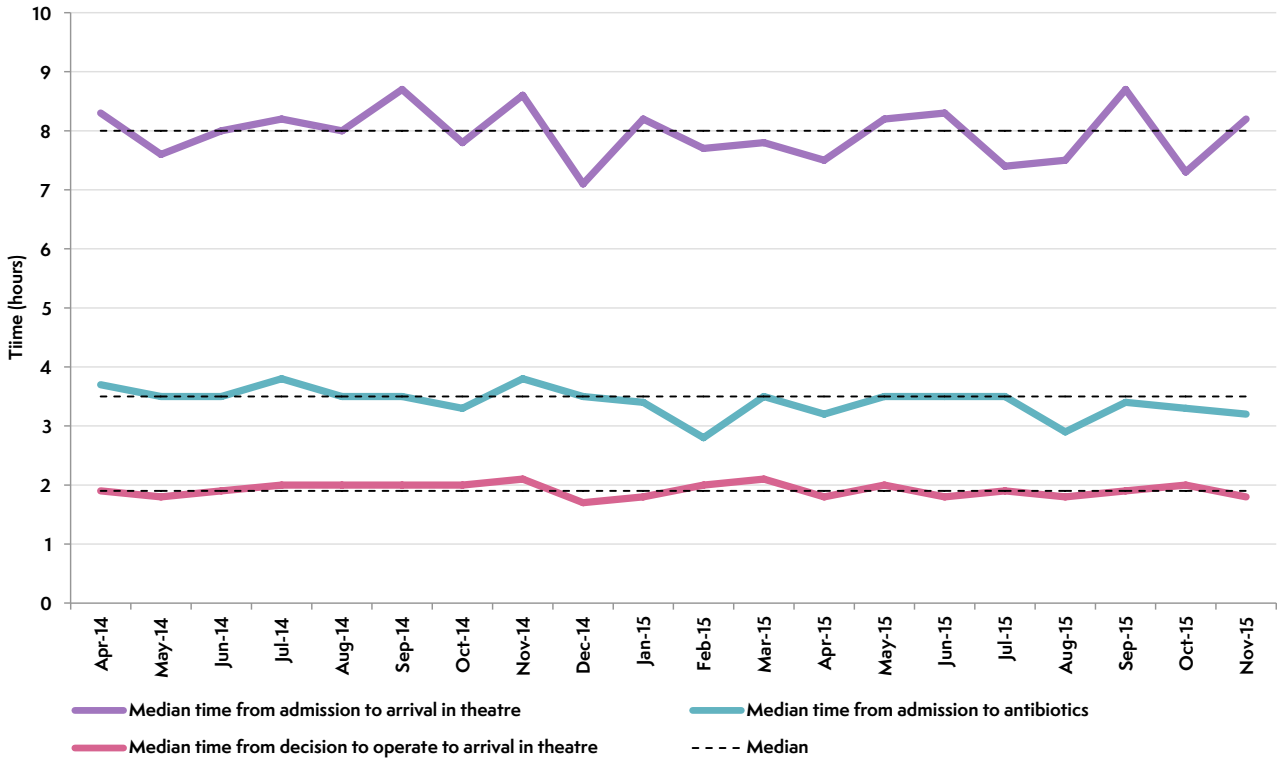
Clinical commentary

Selecting this specific subgroup, where surgery within six hours was considered necessary for the treatment of peritonitis and underwent surgery within 24 hours of admission to hospital, allowed us to look at the speed with which time-critical elements of care had been delivered. It is likely that many patients should have received antibiotics earlier, rather than on arrival in theatre. The slight improvement in time from 3.6 hours (IQR 1.8 to 7.0 hours) to 3.3 hours (IQR 1.4 to 6.6 hours) for delivery of antibiotics is encouraging, as early antibiotic therapy is known to be associated with improved mortality. Nevertheless, the fact that almost 25% of these patients still waited over 6.5 hours for antibiotics requires further examination and local case-specific review. We would hope to see continued improvement, especially given the concurrent CQUIN surrounding the treatment of sepsis.

Also of concern is the median time of 7.7 hours that it takes for these patients to reach the operating theatre, as a shorter time to achieve control of the source of sepsis is known to be associated with improved mortality.[18] Over 25% of patients waited more than 12.5 hours. For these patients the greater part of the delay appears to reside within the admission and decision process, as time from decision to operation is typically much shorter. Local case review could help NHS trusts focus on the specific bottlenecks in their pathway of care.

Due to the small numbers within this cohort, we have been unable to produce hospital-level results for these process measures.

Figure 14 Trends in the median times from admission to administration of antibiotics, admission to arrival in theatre, and decision to operate to arrival in theatre in patients with peritonitis



Additional analyses

The interval between admission to hospital and administration of antibiotics, and between admission and the decision to operative and arrival in theatre was assessed against patient age, ASA, documented risk and operative urgency (Table 40), and the day and time of admission (Table 41 and Table 42).

RECOMMENDATIONS

Any areas of the hospital that admit emergency General Surgical patients need to have robust mechanisms in place to identify patients with signs of sepsis and ensure prompt prescription and administration of antibiotics (Medical and Clinical Directors, MDT).

Medical and Clinical Directors should examine their emergency theatre provision in the context of their local Audit results, in order to determine whether sufficient resources are available to enable patients to receive emergency surgical treatment without undue delay (Medical and Clinical Directors).

Multidisciplinary Teams, including emergency departments and acute assessment units, should review their pathways of care for the administration of antibiotics in order to identify why delays occur (MDT).

Clinicians should regularly review Audit data on timing of administration of antibiotics and time to theatre in order to ensure that aims are being achieved (MDT).

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12 TIMELINESS OF ARRIVAL IN AN OPERATING THEATRE

Why is this important?

Delay to emergency surgery is associated with lower rates of survival.[18] Once patients and their doctors have agreed to proceed to emergency laparotomy, it is essential that patients arrive in theatre for surgery without undue delay. The urgency with which surgery is required varies between individuals and is based on evaluations of clinical condition, surgical disease, and individual risk. Surgeons frequently report difficulties gaining timely access to theatre for sick patients that require urgent surgery.[20]

Figure 15 Operative urgency categories

The following operative urgency categories are used in the NELA Patient Audit:

1 Immediate (<2 hours)

2A Urgent (2–6 hours)

2B Urgent (6–18 hours)

3 Expedited (>18 hours)

KEY STANDARDS

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.
RCS HR

The time from decision to operate to actual time of operation is recorded in patient notes and audited locally.
RCS USC

Delays in surgery for the elderly are associated with poor outcome. They should be subject to regular and rigorous audit and this should take place alongside identifiable agreed standards.
NCEPOD Age

AUDIT QUESTIONS

What proportion of patients arrived in theatre within a timescale appropriate to their operative urgency? (Target ≥ 80%)

What variation existed in the proportion of patients arriving in theatre within a timescale appropriate to their operative urgency, by:

1 Hospital?
2 Urgency of surgery?
3 Patient characteristics, including documented risk of death?
4 Day and time of admission to hospital and of surgery?

KEY FINDINGS

Where the necessary data were available, the arrival in theatre was delayed for 18% of patients overall. 129 hospitals (69%) were rated Green (no delay for >80% of patients), and no hospitals were rated Red (Figure 17).

When assessed against documented operative urgency, the proportion of patients arriving within an appropriate timescale was:

- 71% – 1: Immediate (<2 hours).
- 86% – 2A: Urgent (2–6 hours).
- 81% – 2B: Urgent (6–18 hours).

Arrival in theatre was therefore most frequently delayed in patients requiring immediate surgery.

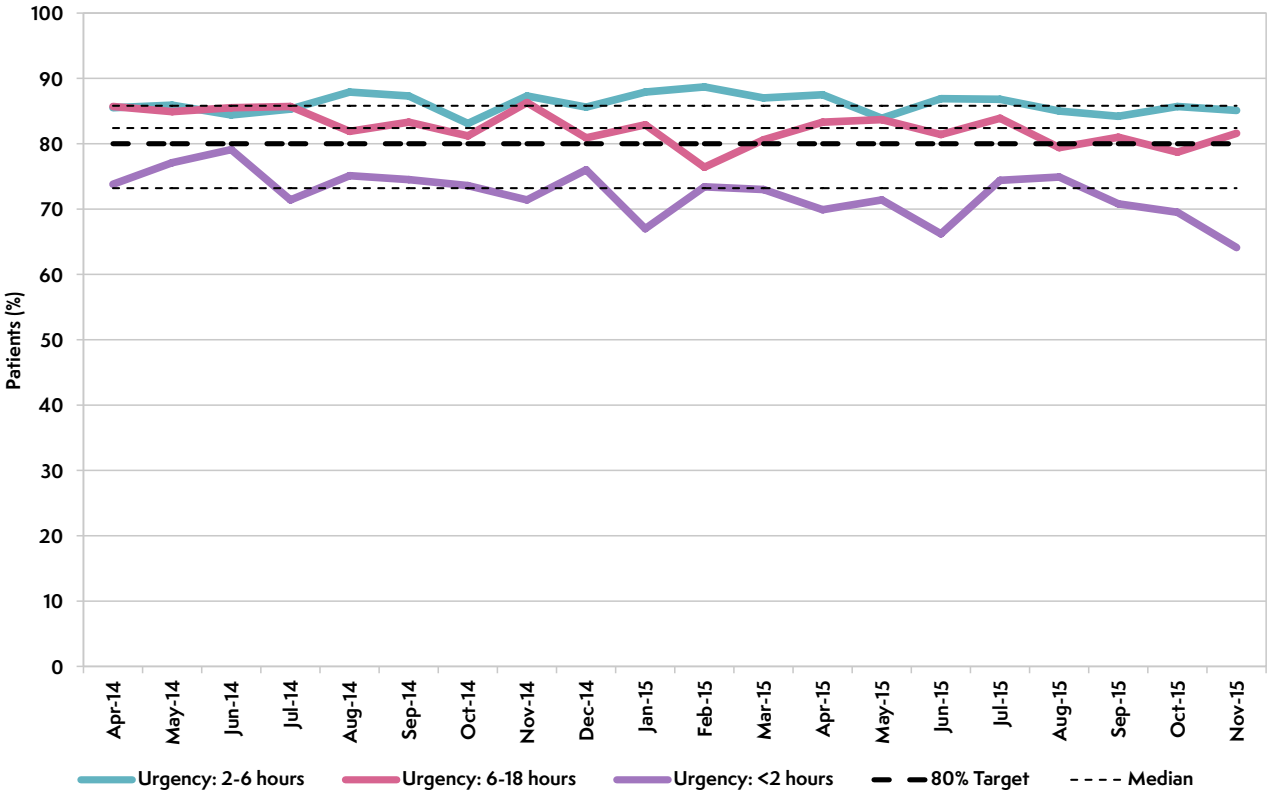
The proportions of patients in the various operative urgency categories varied between hospitals (Figure 18).

Clinical commentary

There has been a drop (from 84% to 82%) in the overall proportion of patients who arrive in theatre within a timeframe appropriate to their assessed level of urgency. Worryingly, it is the most urgent patients (i.e. those assessed as needing to arrive in theatre within 2 hours) that have the highest proportion of delays and have seen the largest drop since last year (from 77% to 71%).

The most urgent patients present the greatest logistical challenge in arriving in theatre in an appropriate timeframe. A series of small delays may be inconsequential in less urgent cases. However, these may add up to have a more significant impact in more urgent cases where there is less room for delay. The NELA Organisational Audit[9] found that theatre capacity was unlikely to be sufficient in at least a fifth of hospitals routinely admitting emergency General Surgical patients. It also found that policies for the timing of surgery according to clinical urgency were not available at two-thirds of hospitals, and that formal arrangements for the deferment of elective activity in order to appropriately prioritise unscheduled admissions were available at only a third of hospitals. An NHS Services 7 Days a Week Forum survey identified theatre capacity as the principal cause of delayed emergency surgery.[21] Clinical teams must work with management and commissioners to ensure all processes are streamlined and that theatre capacity is optimal to ensure delays for urgent cases do not occur. This may require an increase in emergency theatre capacity so that elective and emergency surgical services can continue in parallel. Where capacity is limited, time-sensitive emergency surgery should be prioritised over elective activity.

Figure 16 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)



Additional analyses

Timeliness of arrival in theatre was assessed against patient age, ASA, admission type, documented risk and operative urgency (Table 43), and the day and time of surgery (Table 44).

QUALITY IMPROVEMENT VIGNETTE

Several hospitals improved the timeliness of access to theatres with streamlined booking processes. Great Western Hospital moved into the top performing quartile:

'In the last year we have adopted a boarding card where the surgical team need to specify a classification of urgency of surgery prior to booking the case. This has required some education which has improved awareness of urgency and we now have more objective data to scrutinise.'

RECOMMENDATIONS

Medical and Clinical Directors should examine their emergency theatre provision in the context of their local Audit results, in order to determine whether sufficient resources are available to enable patients to receive emergency surgical treatment without undue delay (Medical and Clinical Directors).

Multidisciplinary pathways should be established to prevent inappropriate delays in a patient undergoing surgery, especially once a consultant decision has been made. This will require cross-disciplinary cooperation between surgeons, anaesthetists, radiological and laboratory services, and theatre and critical care staff (MDT).

Theatre capacity should be sufficient to allow emergency and elective surgery to continue in parallel. Where capacity is limited, prioritisation of time-sensitive emergency surgery can be facilitated by policies to defer elective activity (Medical and Clinical Directors).

Commissioners should work with local providers to determine whether theatre capacity is sufficient to prevent potentially harmful delays to surgery in patients requiring emergency bowel operations. Some hospitals may require the capacity for emergency and elective care to continue in parallel (Commissioners and provider Chief Executives).

Figure 17 Proportion of cases where interval from decision to oprate (or time of booking) to arrival in theatre was appropriate to operative urgency. This excludes expedited cases (category 3). Black bars indicate hospitals with less than ten cases in this analysis (--- 80% target)

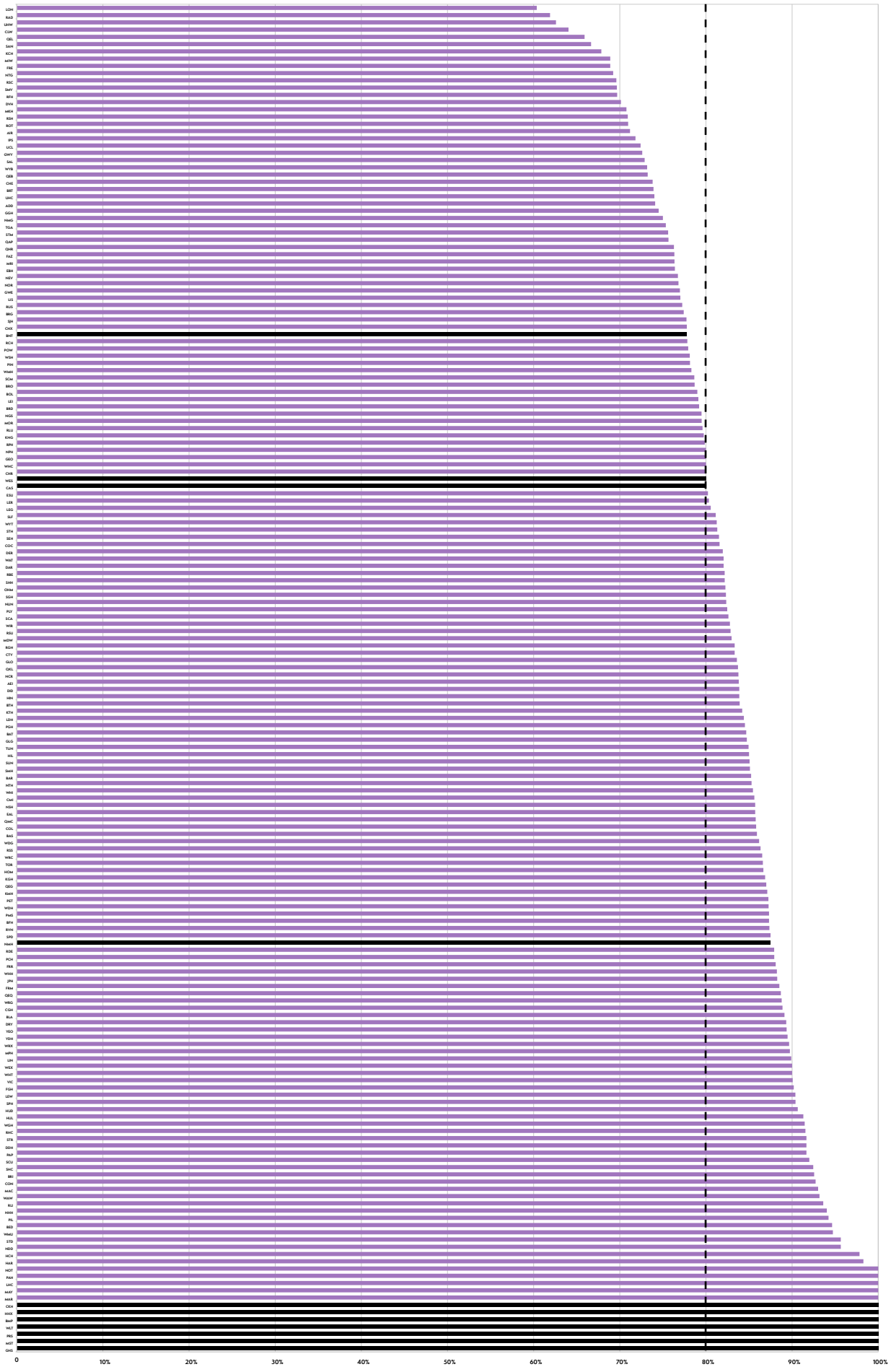


Figure 18 Proportion of cases in each operative urgency category by hospital. Black bars indicate hospitals with less than ten cases in this analysis

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13 CONSULTANT-DELIVERED PERIOPERATIVE CARE

Why is this important?

Consultant delivered care for any high-risk surgical procedure is a cornerstone of high-quality practice; hence, the management of patients requiring emergency bowel surgery should be directed by consultant surgeons and consultant anaesthetists throughout the perioperative period. These principles are reflected in the standards of care against which we audit, and are in keeping with the level of service provided to high-risk patients undergoing planned (elective) surgery.

Preoperative care

Consultant expertise is required for the complex and individualised management of patients before surgery, including attention to patient and carer wishes alongside the risks and benefits of different treatment options. In some cases, this may lead to a decision that an operation is inappropriate or likely to be futile. It is therefore important that consultant surgeons and consultant anaesthetists have the opportunity to review patients before surgery.

Intraoperative care

The management of patients during emergency bowel surgery can be challenging and experience is required for the complex decision making required to identify and deliver the next steps in care. Patients can deteriorate very quickly during surgery and these time-pressured situations require consultant presence.

KEY STANDARDS

Preoperative care

Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist.
RCS HR

Intraoperative care

A consultant surgeon (CCT holder) and consultant anaesthetist are present for all cases with predicted mortality ≥10% and for cases with predicted mortality >5% except in specific circumstances where adequate experience and manpower is otherwise assured.
RCS USC

Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist. Surgical procedures with a predicted mortality of ≥10% should be conducted under the direct supervision of a consultant surgeon and a consultant anaesthetist unless the responsible consultants have actively satisfied themselves that junior staff have adequate experience and manpower and are adequately free of competing responsibilities.
RCS HR

AUDIT QUESTIONS

Preoperative care

What proportion of patients was reviewed before surgery by a consultant surgeon (in person when making the decision to operate) and a consultant anaesthetist? (Target ≥ 80%)

Intraoperative care

What proportion of patients had a consultant surgeon and a consultant anaesthetist directly supervising care during surgery? (Target ≥ 80%)

What variation in these process-measures existed, by:

1 Hospital?
2 Patient characteristics, including documented risk of death?
3 Day and time of surgery?

KEY FINDINGS

Preoperative care

All patients

Overall, 56% of patients were reviewed in person by both a consultant surgeon and a consultant anaesthetist before emergency laparotomy (Table 17).

60% of patients were reviewed in person by both a consultant surgeon and a consultant anaesthetist if an assessment of risk had been documented before surgery; if risk was not documented, only 49% were reviewed by both consultants (Table 17).

Overall, the decision to operate was made in person by a consultant surgeon for 72% of patients, and 74% of patients were reviewed by a consultant anaesthetist before surgery (Table 17).

High and highest risk patients (preoperative P-POSSUM risk of death ≥5%)

57% of high and highest risk patients were reviewed in person by both a consultant surgeon and consultant anaesthetist before surgery (Table 18). 26 hospitals (14%) were rated Green, whereas 62 hospitals (33%) were rated Red (Figure 21).

The decision to operate was made in person by a consultant surgeon for 71% of high and highest risk patients, and 77% of high and highest risk patients were reviewed by a consultant anaesthetist before surgery (Table 18).

Intraoperative care

All patients

Overall, care during surgery was directly supervised by both a consultant surgeon and a consultant anaesthetist for 70% of patients (Table 19).

Overall, consultant surgeons directly supervised 87% of operations and consultant anaesthetists directly supervised care during surgery for 78% of patients (Table 19).

Both consultants were present for 73% of operations during the week and 63% at the weekend. Within this there was variation by the time of day and between specialities (Table 21).

High and highest risk patients (preoperative P-POSSUM risk of death ≥5%)

Care during surgery was directly supervised by both a consultant surgeon and a consultant anaesthetist for 74% of high and highest risk patients (Table 20). 83 hospitals (45%) were rated Green, whereas 14 hospitals (8%) were rated Red (Figure 22).

Consultant surgeons directly supervised 89% of operations for high and highest risk patients (Table 20).

Consultant anaesthetists directly supervised the intraoperative care of 82% of high and highest risk patients (Table 20).

Both consultants were present for 76% of operations during the week and 68% at weekends. Again there was variation by the time of day and between specialities (Table 22).

Clinical commentary

The proportion of patients that underwent surgery under the direct supervision of a consultant surgeon and consultant anaesthetist increased from 65% in Year 1 to 70% in Year 2. Greater consultant presence was associated with a higher preoperative predicted risk of death, with fewer than 3% of the highest risk patients (>10% risk) undergoing surgery with no consultant present (Table 19 and Table 20). This increase in consultant presence was seen at all times of the day, with the greatest increase being 'out of hours' (including after midnight, and weekends). The greatest 'out of hours' increase was seen for consultant anaesthetists whose presence increased from 50% to 60%.

This increase in consultant delivered care is welcomed, and suggests a greater awareness of the high-risk nature of emergency bowel surgery. This improvement in consultant delivered care may be linked to the improvement in the proportion of patients who underwent a formal documented risk assessment. As found in both the Year 1 and the present Year 2 Audit Reports, for equivalent categories of risk and mortality, consultant input was better where an assessment of risk had been documented preoperatively (Table 17 and Table 19).

The Audit found that, regardless of the day of surgery, the highest-risk patients undergo surgery between midnight and 8am (Table 13): this is in keeping with previous recommendations that only life- or limb-saving surgery should occur at this time.[22]

There was little variation in the proportion of high and highest risk patients (P-POSSUM risk of death ≥5%) undergoing surgery under the direct supervision of a consultant surgeon according to day of surgery; however fewer high and highest risk patients had surgery under the direct supervision of a consultant anaesthetist at the weekend (75%) compared to weekdays (84%) (Table 22). Patients undergoing surgery which started between midnight and 8am were more likely to have consultant delivered care at the weekends than on weekdays (Table 21 and Table 22). This finding requires further examination – for example, to explore the possibility that the need to undertake elective duties (on weekdays) after a night on-call may influence whether a consultant attends overnight emergency surgery.

Evidence from Acute Medicine suggests that work patterns, rather than just numbers of on-call consultants, influence patient outcomes: reduced mortality rates have been observed at hospitals where on-call consultants were free from fixed-commitments, were on-call for blocks of at least two consecutive days or where at least two consultant ward rounds occurred every day.[23]

The higher levels of consultant input during daytime hours are likely to be in part a reflection of the availability of dedicated emergency theatres staffed by consultants with job-planned sessions.

It is likely that a multitude of factors are responsible for the varying degrees of consultant input found across hospitals, by the day of the week and by time of the day. Each hospital will need to determine its own reasons for any shortfall in provision. This may include exploring the impact of elective commitments on the ability of consultants to provide direct input into the care of emergency patients.

Table 17 Proportion of patients receiving *input before surgery* by consultant surgeons and consultant anaesthetists by *documented preoperative risk category* (Year 2 data)

Documented preoperative risk category	Total number of patients	Decision to operate made in person by a consultant surgeon and patient reviewed preoperatively by a consultant anaesthetist (%)	Decision to operate made in person by a consultant surgeon (%)	Preoperative review by a consultant anaesthetist (%)	Decision to operate not made in person by a consultant surgeon and patient not reviewed preoperatively by a consultant anaesthetist (%)
Lower (<5%)	5,504	58	76	74	9
High (5–10%)	3,196	61	76	77	8
Highest (>10%)	6,105	61	71	81	8
Not documented	8,333	49	69	68	12
Overall	**23,138**	**56%**	**72%**	**74%**	**10%**

Table 18 Proportion of patients receiving *input before surgery* by consultant surgeons and consultant anaesthetists by *calculated preoperative P-POSSUM risk of death* (Year 2 data)

Risk category by calculated preoperative P-POSSUM risk of death	Total number of patients	Decision to operate made in person by a consultant surgeon and patient reviewed preoperatively by a consultant anaesthetist (%)	Decision to operate made in person by a consultant surgeon (%)	Preoperative review by a consultant anaesthetist (%)	Decision to operate not made in person by a consultant surgeon and patient not reviewed preoperatively by a consultant anaesthetist (%)
Lower (<5%)	9,536	54	73	71	10
High (5–10%)	4,039	57	75	74	8
Highest (>10%)	9,563	57	70	78	10
(All patients with risk ≥5%)	(13,602)	(57)	(71)	(77)	(9)
Overall	**23,138**	**56%**	**72%**	**74%**	**10%**

Table 19 Proportion of patients whose *care during surgery* was directly supervised by consultant surgeons and consultant anaesthetists by *documented preoperative risk category* (Year 2 data)

Documented preoperative risk category	Total number of patients	Both consultants present in theatre (%)	Consultant surgeon present (%)	Consultant anaesthetist present (%)	Neither consultant present in theatre (%)
Lower (<5%)	5,504	66	84	75	6
High (5–10%)	3,196	71	87	80	4
Highest (>10%)	6,105	78	90	85	3
Not documented	8,333	66	86	74	6
Overall	**23,138**	**70%**	**87%**	**78%**	**5%**

Table 20 Proportion of patients whose *care during surgery* was directly supervised by consultant surgeons and consultant anaesthetists by *calculated preoperative P-POSSUM risk of death* (Year 2 data)

Risk category by calculated preoperative P-POSSUM risk of death	Total number of patients	Both consultants present in theatre (%)	Consultant surgeon present (%)	Consultant anaesthetist present (%)	Neither consultant present in theatre (%)
Lower (<5%)	9,536	64	84	73	7
High (5–10%)	4,039	70	87	78	5
Highest (>10%)	9,563	76	89	83	3
(All patients with risk ≥ 5%)	(13,602)	(74)	(89)	(82)	(4)
Overall	**23,138**	**70%**	**87%**	**78%**	**5%**

Table 21 Proportion of *all patients* whose care during surgery was directly supervised by consultant surgeons and consultant anaesthetists by time of day and day of week of arrival in operating theatre (Year 2 data)

Time of arrival in operating theatre	Monday–Friday (%)			Saturday–Sunday (%)		
	Both consultants	Consultant surgeon	Consultant anaesthetist	Both consultants	Consultant surgeon	Consultant anaesthetist
0800–1159	78	88	89	66	90	72
1200–1759	79	90	87	66	89	72
1800–2359	64	84	73	60	85	66
0000–0759	49	73	59	50	77	60
Overall	**73%**	**87%**	**82%**	**63%**	**87%**	**69%**

Table 22 Proportion of *patients with a calculated preoperative P-POSSUM risk of death ≥5%* whose care during surgery was directly supervised by consultant surgeons and consultant anaesthetists by time of day and day of week of arrival in operating theatre (Year 2 data)

Time of arrival in operating theatre	Monday–Friday (%)			Saturday–Sunday (%)		
	Both consultants	Consultant surgeon	Consultant anaesthetist	Both consultants	Consultant surgeon	Consultant anaesthetist
0800–1159	82	89	91	73	93	78
1200–1759	83	91	90	72	90	78
1800–2359	70	87	78	66	88	71
0000–0759	55	79	63	55	80	67
Overall	**76%**	**89%**	**84%**	**68%**	**89%**	**75%**

Figure 19 Trends in the proportions of patients with calculated preoperative P-POSSUM risk of death ≥5% who were reviewed preoperatively by a consultant surgeon, consultant anaesthetist and both consultants

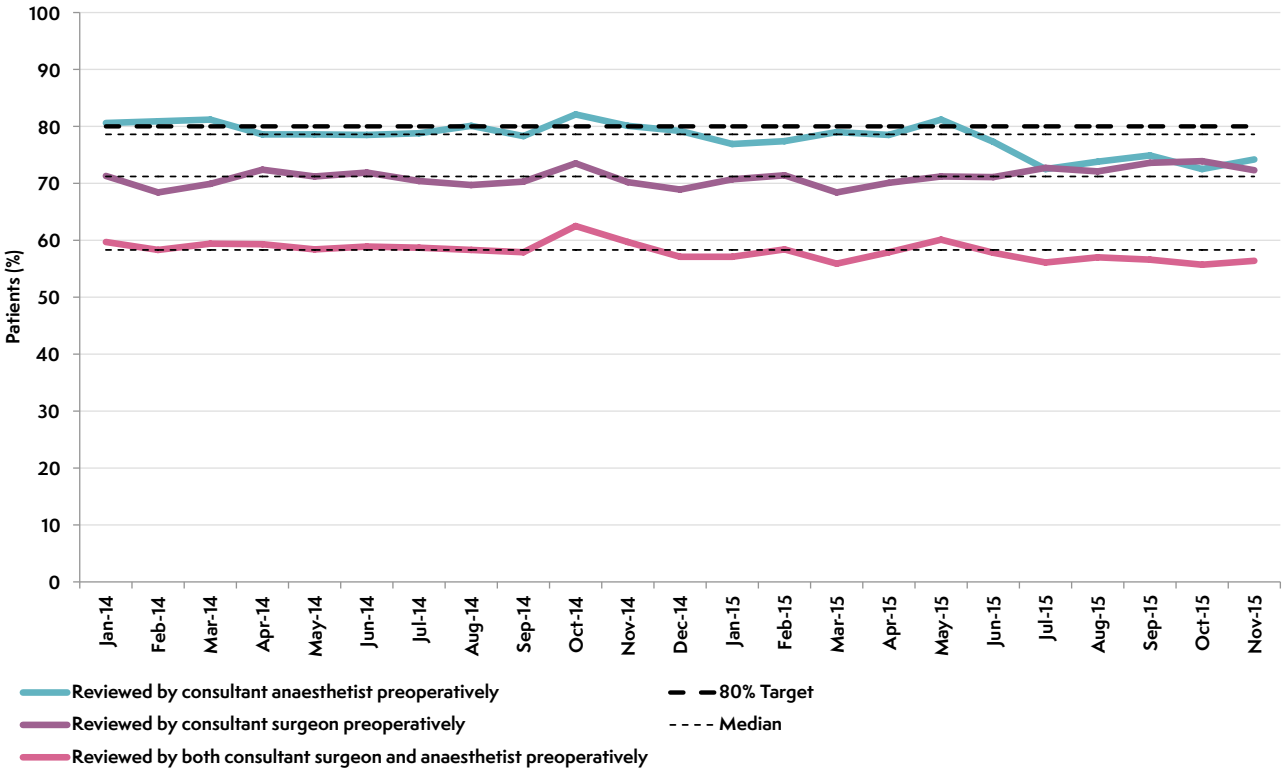
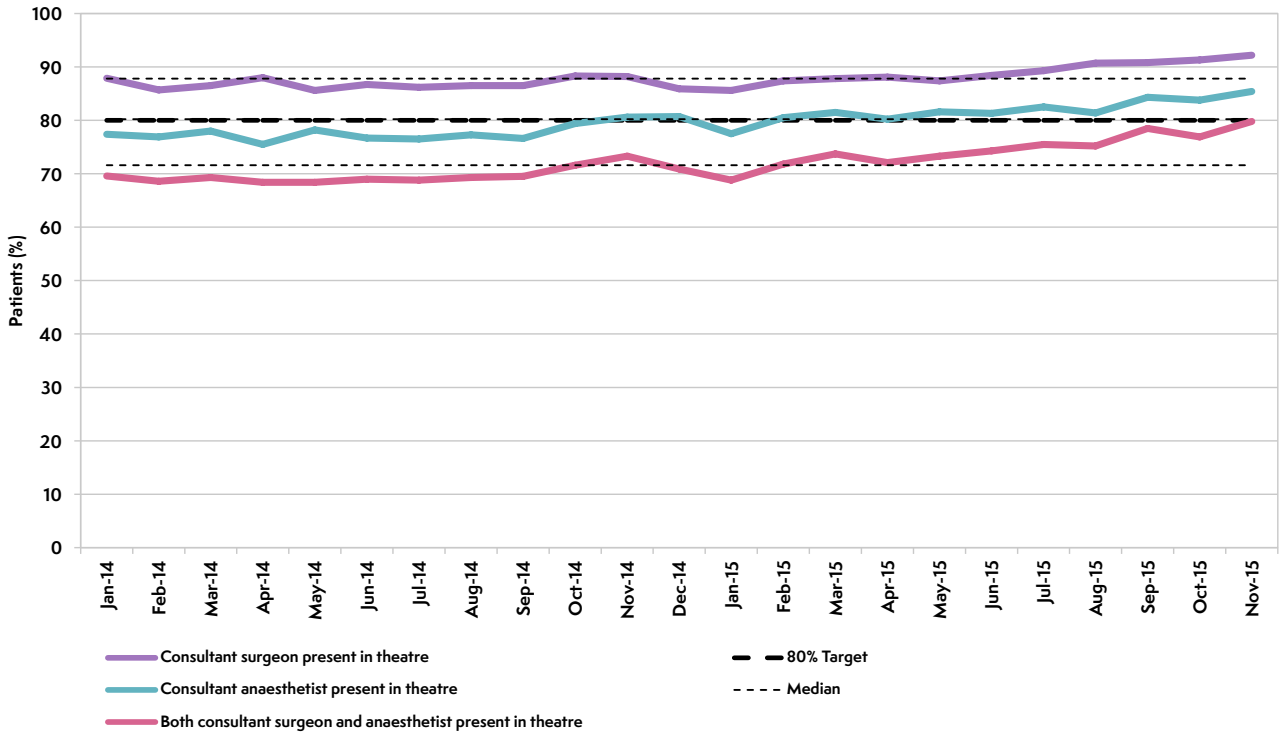


Figure 20 Trends in the proportions of patients with calculated preoperative P-POSSUM risk of death ≥5% for whom a consultant surgeon, consultant anaesthetist and both consultants, were present in theatre



Additional analyses

These markers of consultant-led care before and during surgery were also assessed against patient age, ASA and admission type (Table 45 and Table 46). The proportion of patients who received direct consultant input before surgery was assessed by time of day and day of week (Table 47). Direct consultant input during surgery was also assessed by day of week (Table 48).

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QUALITY IMPROVEMENT VIGNETTE

Improving consultant presence requires strong leadership and communication from within the surgical team. Medway Maritime hospital achieved 84% consultant presence in theatres:

'[Our] lead surgeon for NELA is willing to lead by example and strongly believes in the project. Identify who are the other surgeons that will be early adopters.'

They used data intelligently and in detail:

'[We] review the individual cases that died in the previous 12 months. Identify common trends; look in particular for unnecessary delays. Take time to present this data back to the operating surgeons. Dwell upon the old idea that consultant-led surgery during the day, improves outcomes when compared to inexperienced registrars at night. If this is then extended to the consultant operating at night when patients have suffered less of a physiological insult, the outcomes will improve.'

Changing working patterns may also increase consultant presence in emergency care including emergency laparotomy, as demonstrated by Royal Preston hospital (91% consultant presence in theatres):

'We brought in our SOTW [surgeon of the week]/Duty system in September 2013….since then there has been one SOTW and two duty surgeons during the week and two surgeons at the weekend… having more consultants involved in acute care has probably facilitated increased consultant presence, even for more 'simple' cases. It also allows discussion of complex/sub-specialist cases which is of great benefit. Use of 'fallow' elective theatres that become available….mean that more laparotomies are done in daytime hours and with a surgical consultant presence.'

RECOMMENDATIONS

Local protocols should be developed which ensure a consultant-delivered service for emergency laparotomy patients. Rotas, job plans and staffing levels for surgeons and anaesthetists should allow a consultant-delivered service 24 hours per day, seven days per week (Medical and Clinical Directors).

Consideration should be given to increasing the number of consultants available for emergency surgical work as required to facilitate a consultant-delivered anaesthetic service 24 hours per day, seven days per week. This may be of particular relevance to hospitals in which on-call anaesthetists also cover other emergency services such as trauma, maternity or critical care (Medical and Clinical Directors).

Figure 21 Proportion of patients with a preoperative P-POSSUM mortality risk of ≥5% reviewed by consultant surgeons and consultant anaesthetists before emergency laparotomy. Black bars indicate hospitals with less than ten cases in this analysis (--- 80% target)

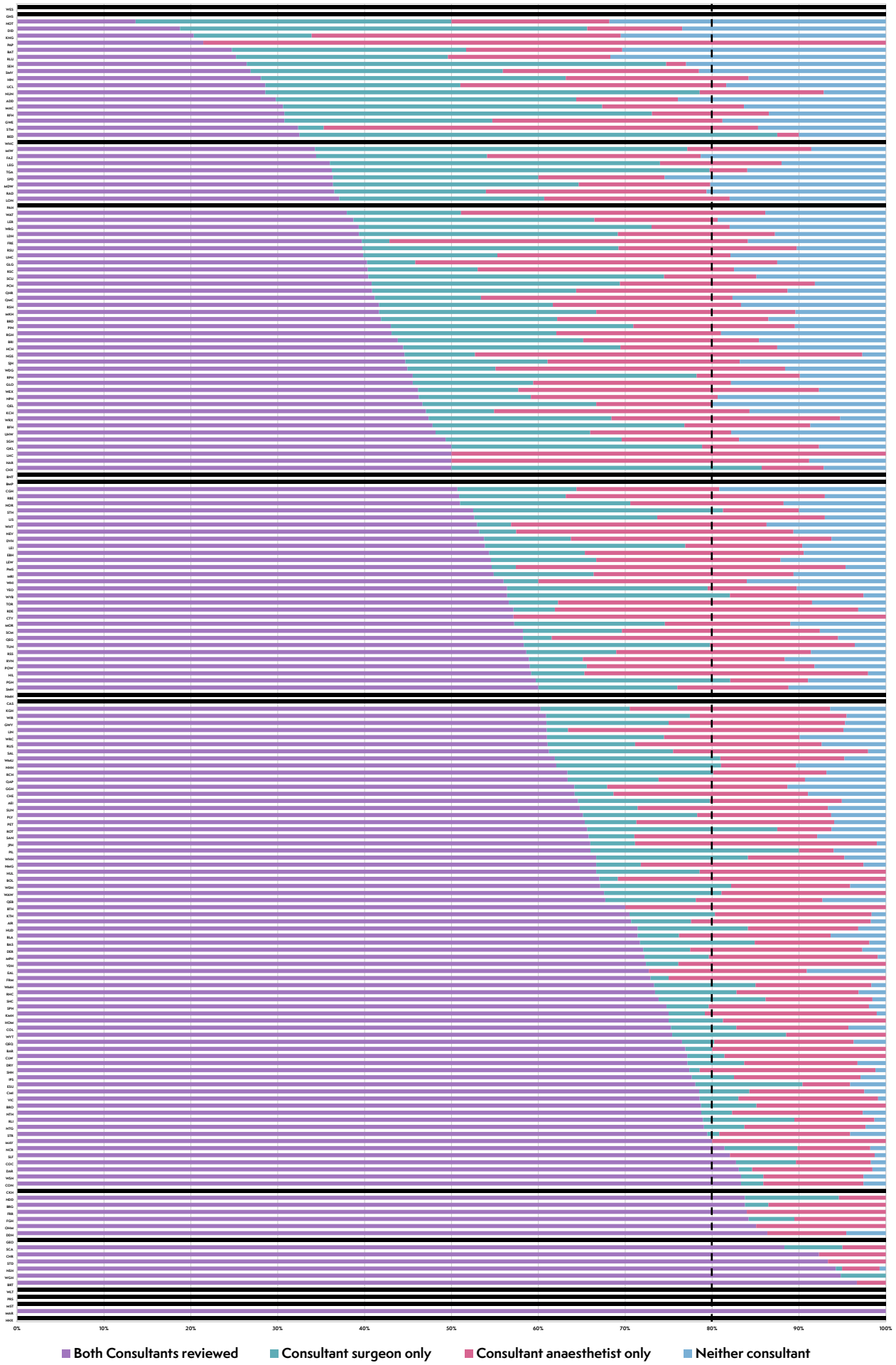
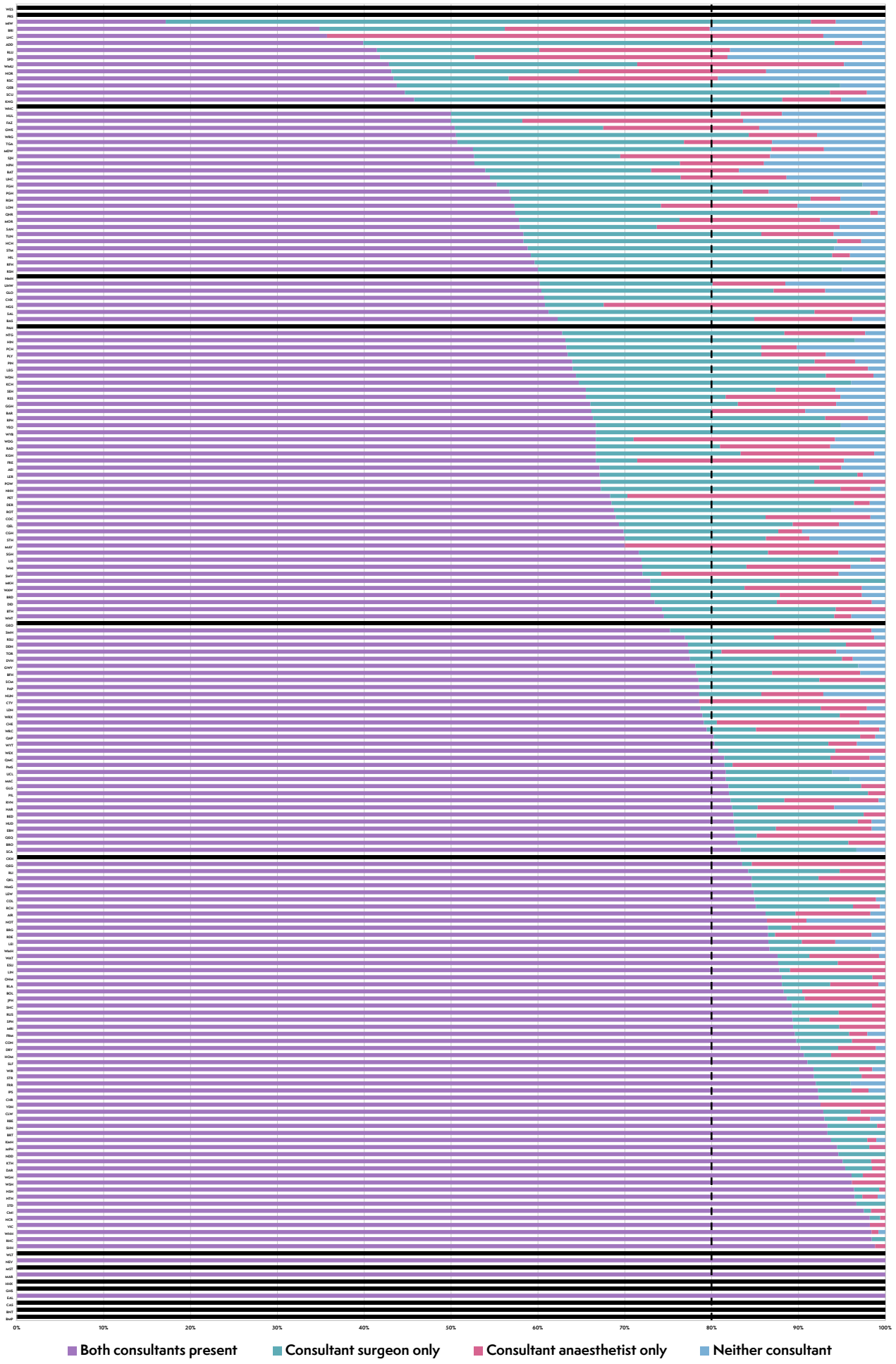


Figure 22 Proportion of patients with a preoperative P-POSSUM mortality risk of ≥5% for whom surgery was directly supervised by consultant surgeons and consultant anaesthetists. Black bars indicate hospitals with less than ten cases in this analysis (--- 80% target)



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14 GOAL DIRECTED FLUID THERAPY

Why is this important?

Goal directed fluid therapy (GDFT) describes a variety of techniques for administering intravenous fluids during surgery based on the individual needs of each patient defined by measured physiological goals. Reported benefits include fewer complications after surgery and reduced length of hospital stay, but these data are mainly derived from studies of patients undergoing elective surgery.[24] The evidence base for GDFT in patients undergoing emergency laparotomy is very limited and because of this we report use of GDFT but have not made firm recommendations over its use.

KEY STANDARDS

Due to limited evidence base, it is not appropriate to compare practice against any standards.

AUDIT QUESTIONS

What proportion of patients received goal directed fluid therapy during surgery?

Which methods of goal directed fluid therapy were used?

What variation existed in the proportion of patients who received goal directed fluid therapy during surgery, by:

1 Hospital?
2 Patient characteristics, including documented risk of death?

KEY FINDINGS

Goal directed fluid therapy was used in the care of 54% of patients during surgery.

A cardiac output monitor was used in the intraoperative management of 39% of patients, whereas alternative methods were used for the remaining 15%.

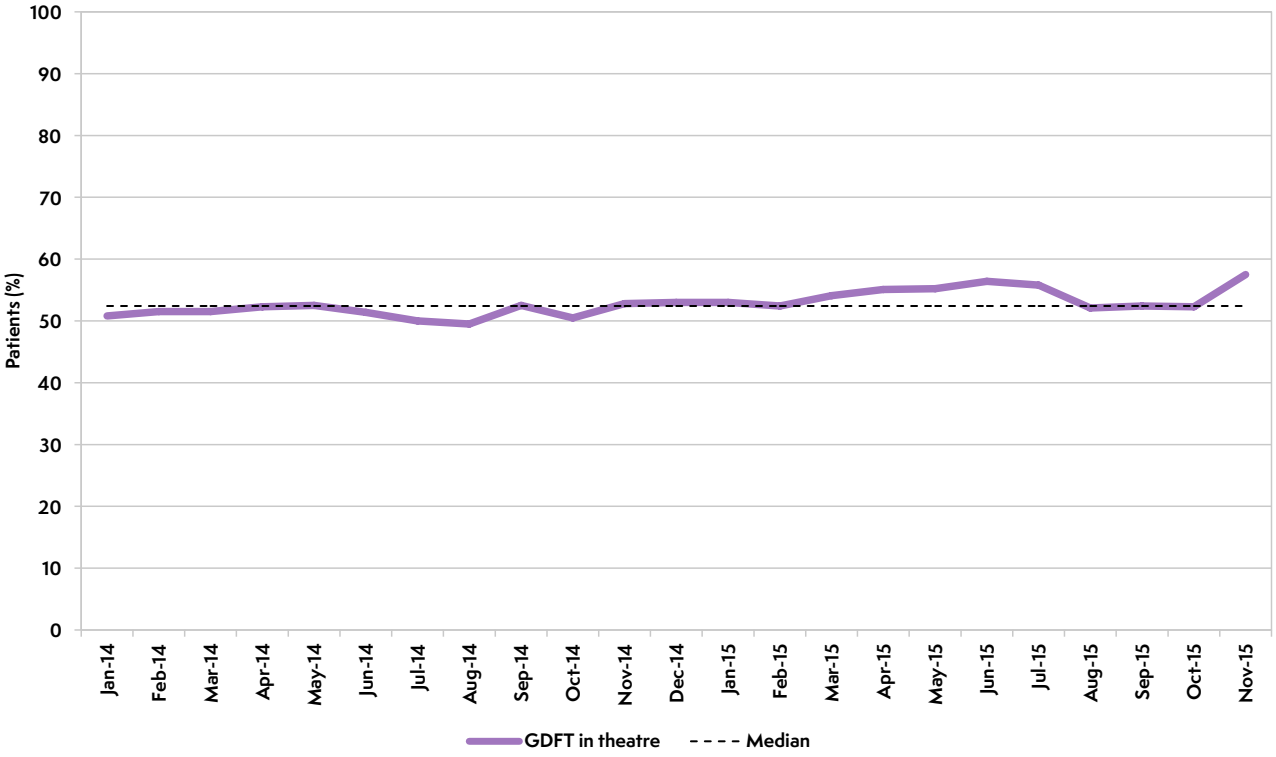
Goal directed fluid therapy was more commonly used in the care of higher risk patients (Table 49 and Table 50):

- 57% of patients aged over 80 years.
- 68% of patients documented preoperatively to be highest risk.
- 64% of those requiring immediate surgery.

Clinical commentary

The overall use of goal directed fluid therapy (GDFT) has remained similar to last year at 54%; however use has increased in higher risk patients (Table 49 and Table 50). As the evidence base has not altered, and clinical equipoise appears to exist, we have not produced hospital level ratings for the use of GDFT.

Figure 23 Trend in the overall proportion of patients receiving intraoperative goal directed fluid therapy (due to clinical equipoise no target is specified)



Additional analyses

Goal directed fluid therapy was also assessed against patient age, ASA, admission type and operative urgency (Table 49 and Table 50).

RECOMMENDATIONS

Until the evidence base is better defined, it is difficult to make firm recommendations about the use of GDFT in emergency laparotomy. Further analysis of the ONS outcome data may provide useful information on the role of GDFT in this group of patients.

15 DIRECT POSTOPERATIVE ADMISSION TO CRITICAL CARE

Why is this important?

The definition of critical care used in this Audit encompasses both Level 2 and Level 3 care (high dependency and intensive care units).[25] These are designated wards that can provide patients with advanced treatments to support life and/or the function of bodily organs. These treatments are frequently required by patients having emergency bowel surgery, and cannot be provided on general wards. Some patients are admitted to critical care units because they need these treatments immediately. Others are at high risk of deteriorating to a point where they may require such treatment, and should therefore be admitted for close observation and to avoid delay if treatment is subsequently required.

There is evidence that more patients die if they are initially cared for on a general ward and then subsequently require treatment on a critical care unit, than if they are transferred directly to a critical care unit.[4,7,26] Therefore, standards state that clinicians should, at the time of surgery, assess risk for all patients in order to identify individuals who need to be cared for on a critical care unit, and ensure that those in need of this are transferred there directly after surgery. The first year of the Patient Audit found that some hospitals admitted all of their emergency laparotomy patients to critical care following surgery.

The Audit has shown across a variety of measures that half of patients who had an emergency laparotomy were at greater than 10% risk of death within 30 days of surgery (Table 3, Table 11, Table 25, Figure 9, Figure 29, Figure 30, and Figure 31). Standards state that these patients should be admitted to a critical care unit. An even greater number were classified as high risk (≥5% risk of death), for whom critical care admission after surgery should be considered.

KEY STANDARDS

Patients with a predicted mortality ≥5% should be managed as 'high risk'.
RCS HR

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.
RCS HR

Intensive care requirements are considered for all patients needing emergency surgery. There is close liaison and communication between the surgical, anaesthetic and intensive care teams perioperatively with the common goal of ensuring optimal safe care in the best interests of the patient.
RCS USC

The outcome of high-risk General Surgical patients could be improved by the adequate and effective use of critical care in addition to a better preoperative risk stratification protocol.
ASGBI PS

AUDIT QUESTIONS

What proportions of high and highest risk patients were admitted directly to a high dependency or intensive care unit following surgery? (Target ≥ 80% for highest risk patients)

What was the length of stay in critical care?

What variation existed in the proportion of patients admitted directly to a high dependency or intensive care unit following surgery, by:

1 Hospital?
2 Assessed risk of death?
3 Day and time of surgery?

KEY FINDINGS

All patients

The median length of stay in critical care for those admitted directly from theatres was three days (IQR 2–6 days).

The proportion of patients admitted directly to critical care varied according to the category of risk documented before surgery. A greater proportion of high and highest risk patients were admitted compared to lower risk, and those in whom risk had not been documented (Table 23).

75% of patients undergoing surgery which started between midnight and 8am were admitted to critical care, compared to 60% of patients whose operations started between 8am and midnight (Table 24).

Patients with a P-POSSUM risk of death ≥5%

Overall, 78% of patients with a risk of death ≥5% were admitted directly to a critical care bed after surgery (Table 25).

High risk (P-POSSUM risk of death 5–10%) patients as identified at the end of surgery

18% of patients were identified as being high risk. 62% of these were admitted directly to a critical care bed after surgery (Table 25).

Highest risk (P-POSSUM risk of death >10%) patients as identified at the end of surgery

41% of patients were identified as being at highest risk. 85% of these were admitted directly to a critical care bed after surgery (Table 25). 138 hospitals (75%) were rated Green, whereas two hospitals (1%) were rated Red (Figure 26).

Clinical commentary

The overall rate of direct postoperative admission to critical care is similar to Year 1 (61% in Year 2, 60% in Year 1). The proportion of patients admitted to critical care after surgery in all three risk groups has risen: from 33% to 36% in the lower risk group, 58% to 62% in the high risk group, and 83% to 85% in the highest risk group (risk categorisation based on end of surgery P-POSSUM mortality risk estimate). 78% of patients with a predicted mortality ≥5% (i.e. high and highest risk) were admitted to critical care after surgery. Three-quarters of hospitals were able to admit at least 80% of their highest risk patients to critical care postoperatively. Patients for whom the decision to palliate had been made at the end of surgery (471 patients) and those who died in theatre (69 patients) have been excluded from these calculations.

A higher proportion of patients whose surgery was started between midnight and 8am were admitted to critical care regardless of the day of the week, in keeping with their higher level of predicted risk (Table 26). Critical care admission after surgery was broadly similar across the days of the week (Table 27).

It is encouraging that there has been some improvement in these figures. Nevertheless, we encourage hospitals to examine their own data to check local compliance, and if applicable, to understand the reasons why some of the highest risk patients may not be admitted to critical care after surgery. This is particularly important in the 25% of hospitals that did not achieve 80% compliance with this measure for highest risk patients.

As highlighted in Chapter 10, 46% of patients did not receive a preoperative assessment of risk. The predicted and observed mortality of these patients was equivalent to the high risk (P-POSSUM risk of death 5–10%) group of patients (Table 11 and Table 56). However, rates of critical care admission were lower in the group of patients for whom risk had not been documented before surgery (Table 23). This highlights the role of risk assessment in allocation of resources such as critical care to high-risk patients.

The definition of critical care used in this Audit encompasses both Level 2 and Level 3 care. It is possible that some hospitals have also created enhanced care areas outside the critical care unit which have increased staffing and technical resources to manage high-risk postoperative patients.

The NELA Organisational Report highlighted variation in the provision of critical care outreach teams and critical care consultant support. Clinical teams and managers should examine their local structures and service provision to ensure that emergency laparotomy patients receive the level of care appropriate to their risk of deterioration or death.

The existing standards of care have the potential to be interpreted in different ways, due to the varying definitions of high-risk (either meaning >5% or >10% risk of death). We have reported hospital-level data for both groups of patients, but have only RAG rated hospital performance for the highest risk group. Clarification of definitions and consistency in the wording of standards in this area would be welcome. This would provide clarity for clinicians, and allow better planning of capacity for commissioners and hospital managers, in order to deliver high-quality care.

Table 23 Proportion of patients admitted directly to a high dependency or intensive care bed after surgery *based on documented preoperative risk category* (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Documented preoperative risk category	Total number of patients	Frequency (%)	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
Lower (<5%)	5,473	24	39
High (5–10%)	3,137	14	69
Highest (>10%)	5,778	26	90
Not documented	8,210	36	53
Overall	**22,598**	**100%**	**61%**

Table 24 Proportion of all patients admitted directly to a high dependency or intensive care bed after surgery *by the time that surgery was commenced* (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Time of arrival in operating theatre	Total number of patients	Frequency (%)	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
0800–1159	5,197	24	56
1200–1759	9,215	43	58
1800–2359	5,372	25	67
0000–0759	1,857	9	75
Overall	**21,641**	**100%**	**61%**

Table 25 Proportion of patients admitted directly to a high dependency or intensive care bed after surgery *based on calculated postoperative P-POSSUM risk of death* (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Risk category by calculated postoperative P-POSSUM risk of death	Total number of patients	Frequency (%)	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
Lower (<5%)	9,014	41	36
High (5–10%)	4,010	18	62
Highest (>10%)	9,101	41	85
(All patients with risk ≥5%)	(13,111)	(59)	(78)
Overall	**22,125**	**100%**	**61%**

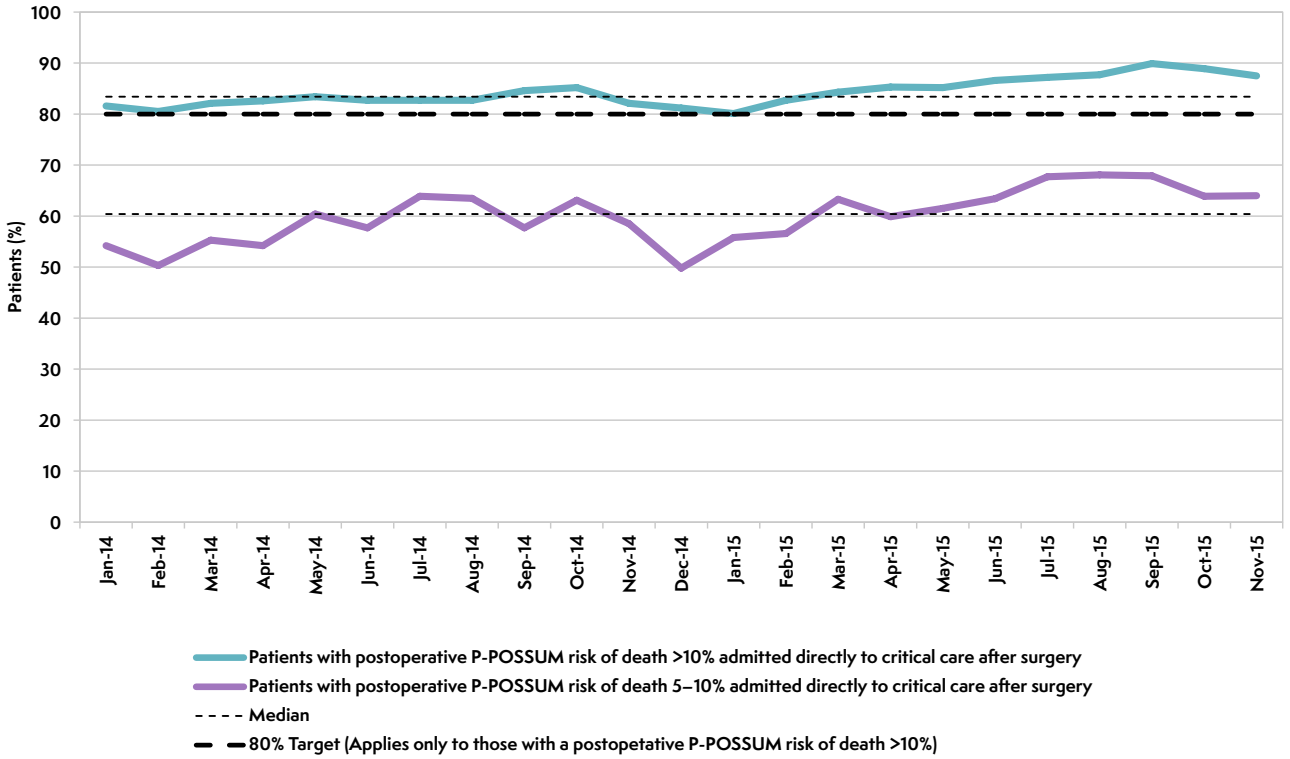
Table 26 Proportion of patients with a *calculated postoperative P-POSSUM risk of death >10%* admitted directly to a high dependency or intensive care bed after surgery by time of day and day of week that surgery was commenced (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Time of arrival in operating theatre	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)	
	Monday–Friday (%)	Saturday–Sunday (%)
0800–1159	81	83
1200–1759	82	86
1800–2359	89	90
0000–0759	91	93
Overall	**86%**	**88%**

Table 27 Proportion of patients with a *calculated postoperative P-POSSUM risk of death >10%* admitted directly to a high dependency or intensive care bed after surgery by the day that surgery was commenced (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Day of arrival in operating theatre	Total number of patients	Frequency (%)	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
Monday	1,228	13	86
Tuesday	1,402	15	85
Wednesday	1,474	16	85
Thursday	1,451	16	83
Friday	1,407	15	84
Saturday	1,164	13	86
Sunday	1,127	12	88
Overall	**9,253**	**100%**	**85%**

Figure 24 Trends in the proportions of patients with a calculated postoperative P-POSSUM risk of death 5–10% and >10% admitted directly to a high dependency or intensive care bed after surgery (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care)



Additional analyses

The proportion of patients admitted directly to a high dependency or intensive care bed after surgery was also assessed against patient age, ASA, admission type and operative urgency (Table 51 and Table 52), time of day and day of week of surgery (Table 53 and Table 54).

RECOMMENDATIONS

Local audit data should be examined to determine if national standards for postoperative critical care admission are being met. Where compliance is poor, a change of local policies and reconfiguration of services should be considered to enable all high-risk emergency laparotomy patients to be cared for on a critical care unit after surgery (Commissioners and provider Chief Executives).

When surgery is contemplated, a formal assessment of the risk of death and complications should be undertaken by a clinician and documented in the patient record. This information should be communicated to all members of the MDT in order to prioritise care and allocate appropriate resources. If surgery is undertaken, this risk assessment should be documented on the patient consent form (MDT).

Professional stakeholders, such as Royal Colleges and Specialist Societies, should collaborate to improve clarity and remove ambiguity in the wording of standards of care for high-risk patients (Professional Stakeholder Organisations).

Figure 25 Proportion of patients with a postoperative P-POSSUM mortality risk of 5–10% admitted directly to a critical care unit following emergency laparotomy. Cases that died in theatre or where an active decision was made not to send the patient to critical care are excluded. Black bars indicate hospitals with less than ten cases in this analysis

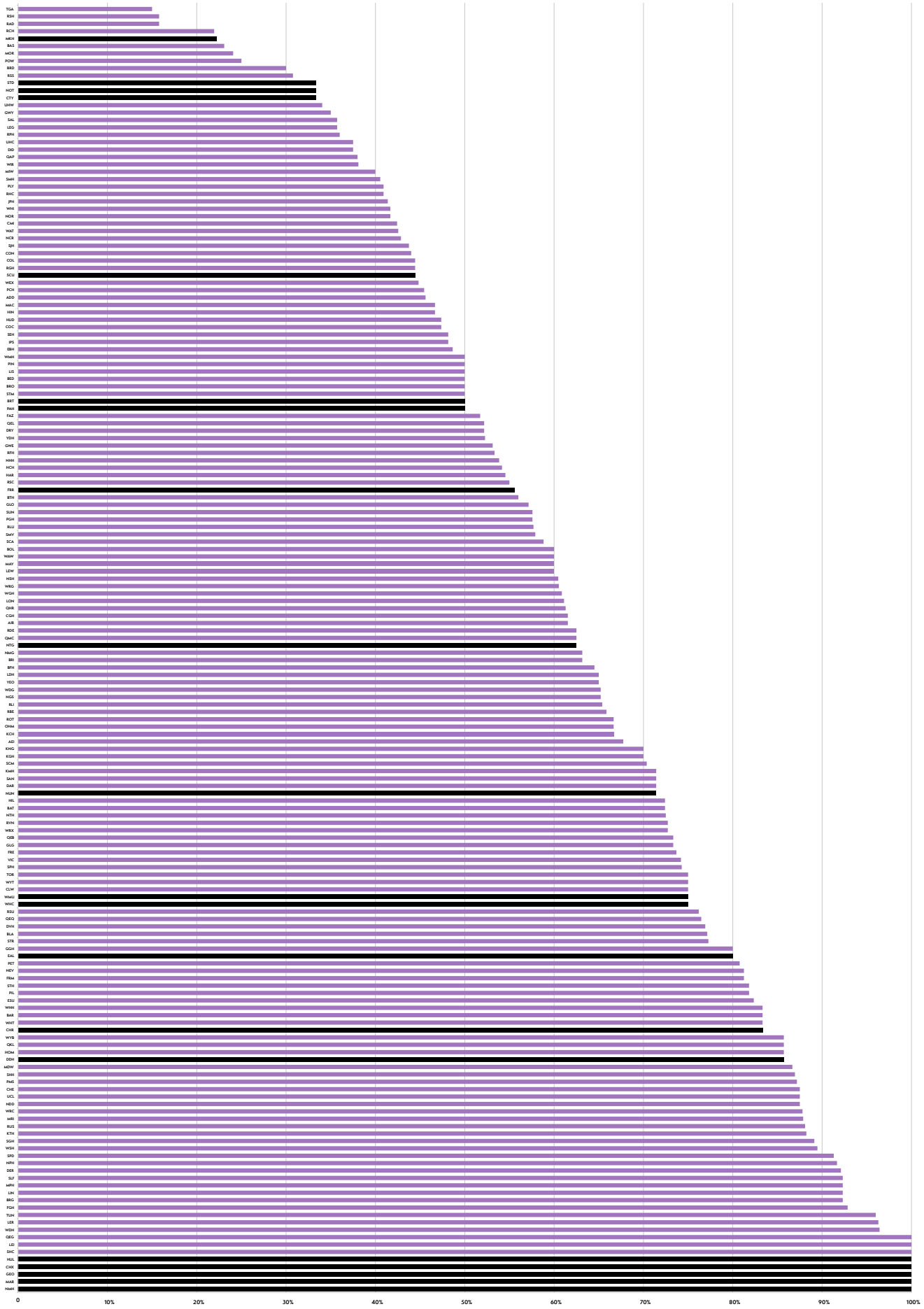
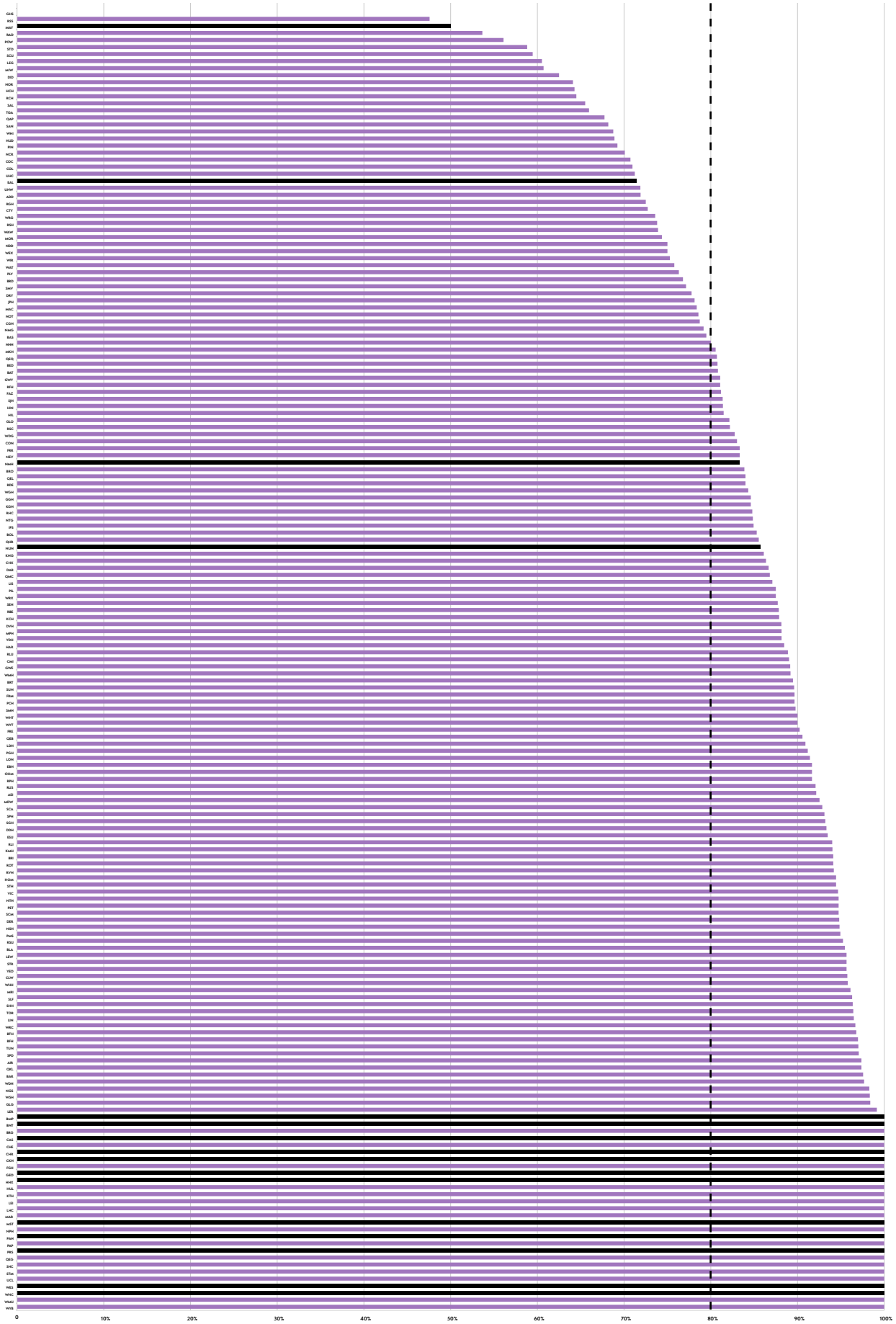


Figure 26 Proportion of the patients in each hospital with a calculated postoperative P-POSSUM risk of death >10% who were admitted directly to a critical care unit from theatre following emergency laparotomy. Cases that died in theatre or where an active decision was made not to send the patient to critical care are excluded. Black bars indicate hospitals with less than ten cases in this analysis (--- 80% target)



16 ASSESSMENT BY AN ELDERLY MEDICINE SPECIALIST

Why is this important?

Ageing is associated with reduced physiological reserve, increasing multimorbidity and increasing prevalence of frailty.[27] All of these factors reduce the ability of older people to compensate for the physiological stress of surgery and anaesthesia, and increase the risk of an adverse outcome after major emergency surgery.[28] Almost half the patients undergoing emergency laparotomy are over the age of 70. Therefore efforts to improve care for this group of patients are therefore likely to bring about considerable benefits.

As increasing numbers of older people undergo emergency surgery, and because they present with complex medical, nursing and social issues, the need for specialist input by Elderly Medicine teams in the perioperative period is increasingly being recognised.[27]

Whilst there is no standard definition of older age, the Audit has used 70 years as the lower limit to explore postoperative assessment by an Elderly Medicine specialist.

KEY STANDARDS

Clear protocols for the postoperative management of elderly patients undergoing abdominal surgery should be developed which include, where appropriate, routine review by an MCOP [Medicine for Care of Older People] consultant and nutritional assessment.
NCEPOD Age

Comorbidity, disability and frailty need to be clearly recognised as independent markers of risk in the elderly. This requires skill and multidisciplinary input, including early involvement of Medicine for the Care of Older People.
NCEPOD Age

All emergency inpatients must have prompt assessment by a multi-professional team to identify complex or on-going needs, unless deemed unnecessary by the responsible consultant.
NHS 7 Day Services

AUDIT QUESTIONS

What proportion of patients undergoing emergency laparotomy was aged 70 years or over?

How did outcomes of patients aged 70 years or over compare with those of younger patients?

What proportion of patients aged 70 years or over was assessed by an Elderly Medicine specialist following surgery? (Target ≥ 80%)

Is there variation between hospitals in the proportion of patients aged 70 years or over who were assessed postoperatively by an Elderly Medicine specialist?

KEY FINDINGS

10% of patients aged 70 years or over and 18% of patients aged 90 years or over were assessed by an Elderly Medicine specialist after surgery (Table 28). Two hospitals (1%) were rated Green, whereas 174 hospitals (95%) were rated Red (Figure 28).

Clinical commentary

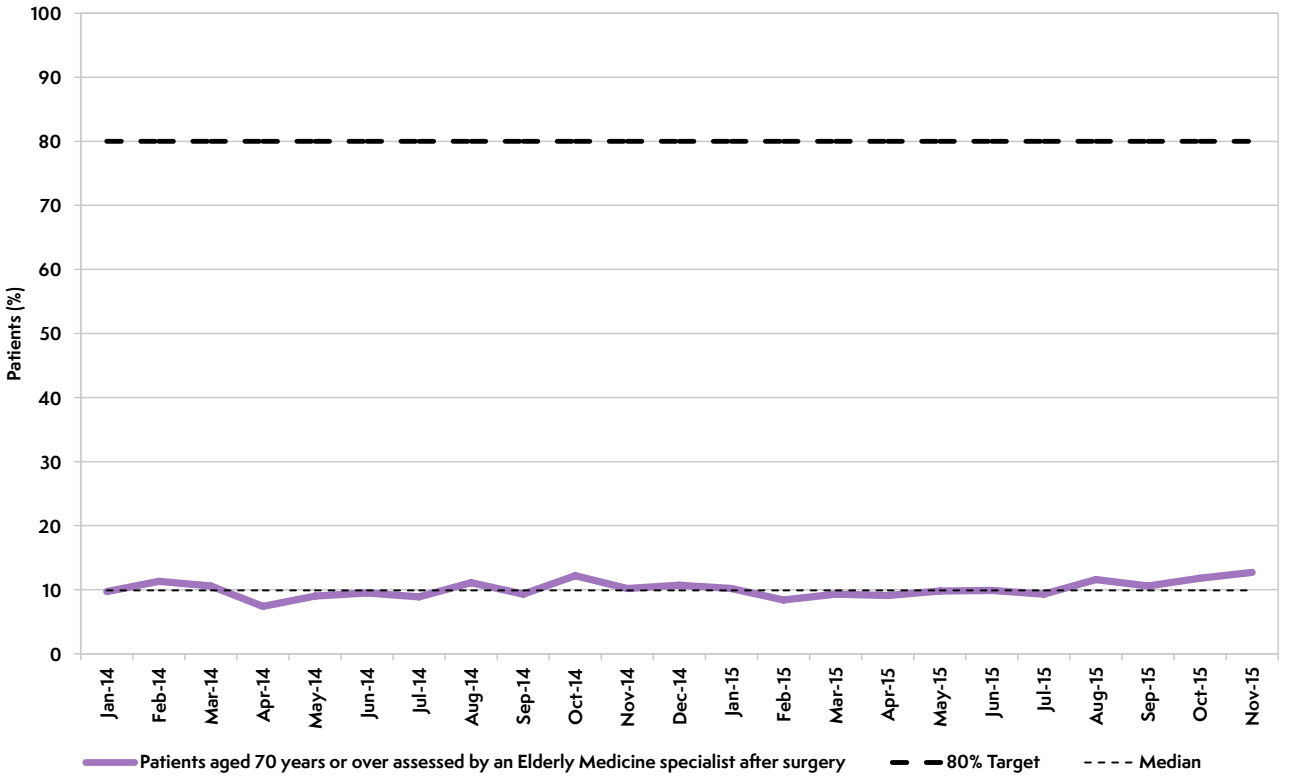
The Audit has shown that around half of all patients undergoing an emergency laparotomy are aged 70 years or over (Table 3). 30-day mortality and hospital length of stay are also much higher in older patients compared to younger cohorts (Figure 29 and Figure 36). It is therefore concerning that the proportion of older patients who receive a postoperative review from an Elderly Medicine specialist remains so low. Overall this has not changed compared to the First Report, and even seems to have worsened for the oldest patients, although it is acknowledged that the numbers are small (Table 28).

Evidence from elderly patients undergoing emergency hip fracture surgery suggests that perioperative involvement of an Elderly Medicine specialist can improve outcomes. Given the longer length of stay seen in the elderly, increasing Elderly Medicine involvement may be a cost effective way of improving care. The NELA Organisational Audit suggested that Elderly Medicine specialists were available at 98% of participating hospitals. The apparent disparity between clinical need, service availability and what is actually provided continues to suggest there are barriers to routine Elderly Medicine involvement in older emergency laparotomy patients. The circumstances are likely to differ between hospitals, but any local barriers should be urgently addressed to improve the care of this high-risk population.

Table 28 Proportion of patients aged 70 years or over assessed after surgery by an Elderly Medicine specialist following emergency laparotomy by patient age (Year 2 data)

	Total number of patients	Proportion of patients assessed after surgery by an Elderly Medicine specialist (%)
70–79	5,767	7
80–89	4,068	13
≥90	537	18
Overall	**10,372**	**10%**

Figure 27 Trend in the overall proportion of patients aged 70 years or over assessed after surgery by an Elderly Medicine specialist



Additional analyses

The proportion of patients aged 70 years or over was also assessed against ASA, admission type and documentation of risk (Table 55).

QUALITY IMPROVEMENT VIGNETTE

Improving Elderly Medicine specialist review requires NHS trusts to engage with Elderly Medicine colleagues to develop an interest in surgical patients.

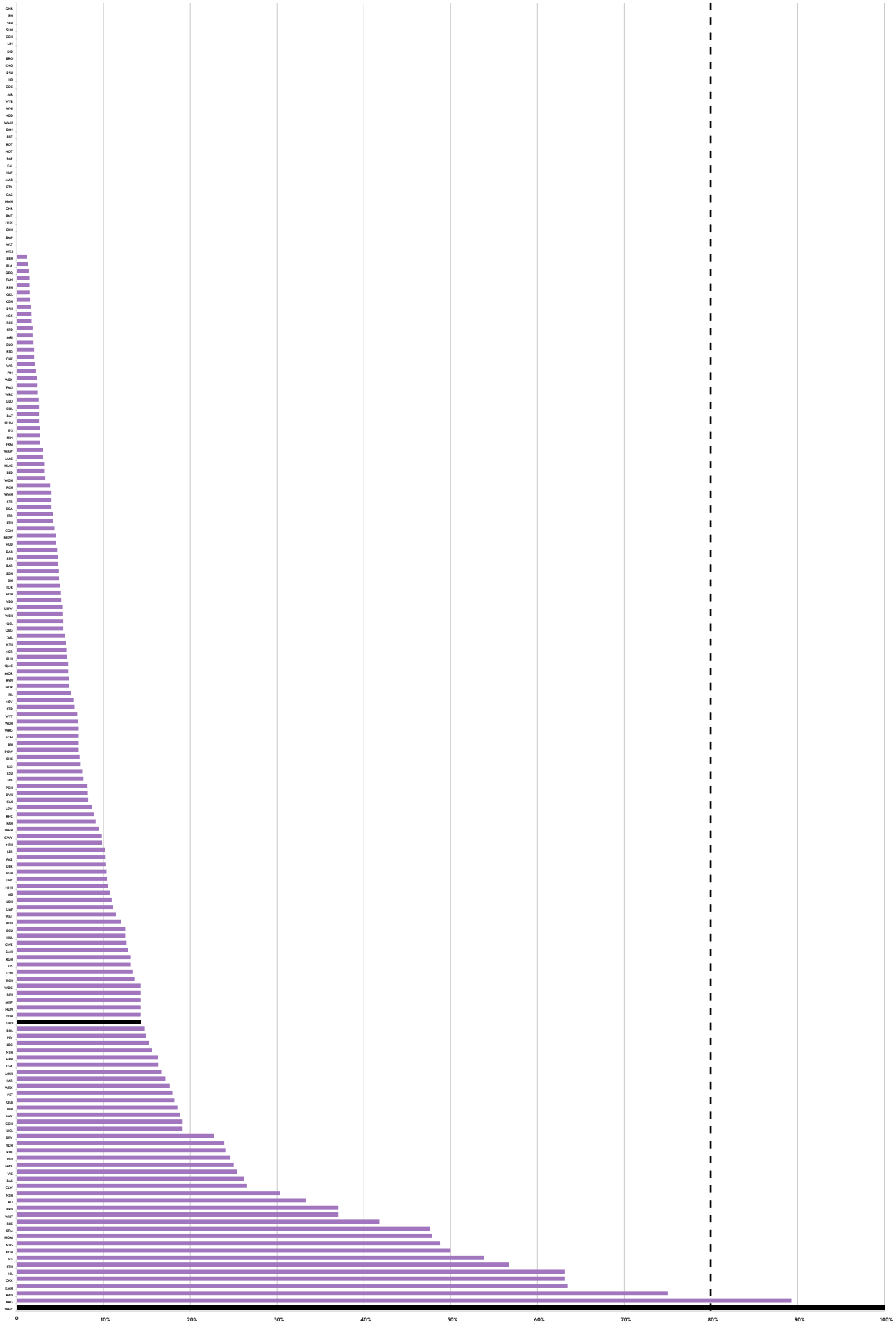
Kings Mill hospital has the highest proportion of patients assessed by Elderly Medicine in the country. Their approach was to *'have face-to-face meetings with Elderly Medicine colleagues and explain the NELA standards of care/rationale behind them. The trust Elderly Medicine clinical lead was already familiar with Jugdeep Dhesi's POPS (Proactive care of Older People going to have Surgery) work and was fully supportive of the NELA initiative. Colleagues from Surgery and Elderly Medicine also attended a Royal College of Surgeons one-day regional workshop 'Meeting the needs of an ageing population' in November 2014 which helped promote multidisciplinary working.'*

RECOMMENDATIONS

Increased Elderly Medicine input may require specific commissioning for this service (Commissioners and provider Chief Executives).

Pathways should be implemented to ensure that all patients aged 70 years or over, who undergo an emergency laparotomy, receive an assessment of multimorbidity, frailty and cognition to guide further input from an Elderly Medicine specialist (MDT).

Figure 28 Proportion of patients over the age of 70 that were assessed by an elderly medicine specialist after surgery. Black bars indicate hospitals with less than ten cases in this analysis (--- 80% target)



17 OUTCOMES

Why is this important?

Previous studies from the UK and other countries have shown mortality rates following emergency laparotomy of 13–18% at 30 days, equating to one in every five to six people who undergo these procedures dying within a month of surgery.[3,4,5]

NELA is one of several audit and quality improvement projects currently running across the world to improve patient outcomes after surgery.[29,30,31] This cohort of more than 40,000 individuals represents the largest group of patients undergoing emergency laparotomy to have been followed prospectively.

At present, little is known about patients' postoperative course in hospital (including location of care, length of stay and the development of complications) or after discharge from hospital, other than survival beyond the first month after surgery.[32] It is therefore essential that, in addition to assessing variation between hospitals and patient groups, the Audit should establish baseline measures of patient outcomes for this group of patients. This information will be helpful for patients and clinicians when discussing treatment options.

Mortality data from the Office for National Statistics (ONS) have been matched to the NELA data, so it has been possible to report all-cause 30-day and 90-day mortality rates, as opposed to the inpatient mortality that was reported in Year 1. ONS mortality data only became available after the publication of the First Patient Report, and so 30-day and 90-day mortality has been reported for both years, covering patients who underwent surgery from December 2013 to November 2015. Using these figures it has also been possible to develop a model to assess hospital-level risk-adjusted outcomes.

AUDIT QUESTIONS

What proportion of patients who underwent an emergency laparotomy died within 30 and 90 days of surgery?

What variation was seen between hospitals, and were there any outliers?

For patients who survived surgery, what was the length of hospital stay?

What proportion of patients returned to theatre for further surgery?

What proportion of patients had an unplanned admission to critical care following surgery?

What variation existed in the above outcomes, by:

1 Patient characteristics, including documented risk of death?
2 Operative urgency?
3 Surgical characteristics, including operation performed?
4 Day of week?

17.1 DEATH WITHIN 30 DAYS AND 90 DAYS OF SURGERY ACORDING TO ONS DATA

KEY FINDINGS

During the combined Year 1 and Year 2 period 11.4% of patients died within 30 days of surgery. 90-day mortality was 15.6%.

30-day mortality was 11.7% in Year 1, and 11.1% in Year 2.

Mortality increased with:

- Increasing risk category (Table 29)
- Increasing age (Figure 29)
- Increasing ASA grade (Figure 30)
- Increasing surgical urgency (Figure 31)

Mortality rates varied substantially by the operative procedure performed at emergency laparotomy (Table 30).

Risk-adjusted 30-day postoperative mortality rates among hospitals for the two-year period varied from around 5% to 17%. These values reflect the relatively small number of cases on which the figures were derived, and the size of the differences is within the range expected from random variation. No hospitals had 30-day mortality rates that fell outside the expected range (based on 99.8% control limits) (Figure 34).

Clinical commentary

Overall, 30-day mortality derived from ONS data was lower than previously reported 30-day in-hospital mortality following emergency laparotomy.[3,4,5] These data again confirm that death after emergency bowel surgery is far more common than after elective operations that are considered to be high-risk.[6,7] Subgroups of patients, such as those over the age of 70, those requiring immediate surgery, and for some surgical conditions, have substantially higher mortality rates.

The observed difference in mortality rates, in comparison to previous reports, may reflect a genuine overall improvement in patient outcomes after surgery over time.[33] This may in turn be a consequence of the interest and activity generated around NELA and several major quality improvement projects including EPOCH and ELPQuIC.[34,35] The NELA data relate to around 70% of all estimated emergency laparotomy activity in England and Wales during the audit period and is very likely to be an accurate estimate of current mortality following this procedure. The availability and publication of 90-day mortality data is also helpful in providing a greater understanding of longer-term outcomes following emergency laparotomy and provides greater information to patients and clinicians.

Outcomes varied substantially by the main operation performed (Table 30):

- Over half of the procedures were colonic and small bowel resections, and were associated with an ONS 30-day mortality of between 9.0% and 15.3%.
- Particularly high 30-day mortality rates were noted after several procedures including: formation of laparostomy (25.0%), exploratory or relook laparotomy (23.9%), and pathologies not amenable to surgery (74.7%). The latter group will include patients for whom palliation was the only appropriate clinical option.
- No emergency laparotomy should be considered low risk, but the raw 30-day and 90-day mortality rates suggest that outcomes may be better if bowel resection is not required.

Patients having surgery after 6pm had higher predicted and observed 30-day mortality compared with those having surgery during daytime hours. For those having surgery after midnight, predicted and observed mortality was higher still (Table 31). Table 32 shows 30-day mortality by day of week of admission for those patients admitted as an emergency who required surgery within 18 hours (representing a more urgent group). There appears to be little variation across the week, additional analysis is ongoing to clarify the implications of the results.

It is notable that the mortality in patients for whom risk assessment was not documented was higher than that seen in patients with an equivalent risk profile who had received preoperative assessment of risk (Table 11). Furthermore, in this 'risk not documented' group, fewer standards of care were met (Table 17, Table 19, Table 39 and Table 49). The starkest contrast was in postoperative critical care admission where 69% of those who were documented to be high risk (P-POSSUM risk of death 5–10%) were admitted directly to critical care, compared to 53% of those for whom preoperative risk was not documented but who were in fact high risk patients from their calculated P-POSSUM risk of death (Table 23).

As noted in Chapter 10, P-POSSUM predicted risk of death showed close alignment with observed ONS 30-day mortality rates up to ~15% predicted mortality (2.2%, 6.6% and 21.9% for lower, high and highest risk respectively) (Table 29). Above 15%, P-POSSUM over-predicts risk by a factor of approximately two. However this should still reassure clinicians of the value of carrying out a formal assessment of risk to aid the consent process and plan appropriate care.

Table 29 Median P-POSSUM risk of death, observed ONS 30-day and 90-day mortality by risk category based on *calculated preoperative P-POSSUM risk of death* (Year 2 data)

Risk category by calculated preoperative P-POSSUM risk of death	Proportion of patients (%)	Median P-POSSUM 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%)	41	2.3	2.2	4.2
High (5–10%)	18	7.0	6.6	11.3
Highest (>10%)	41	28.0	21.9	27.5
Overall	**100%**	**7.0%**	**11.1%**	**15.1%**

Figure 29 ONS 30-day and 90-day mortality by age group (Year 1 and Year 2 data combined)

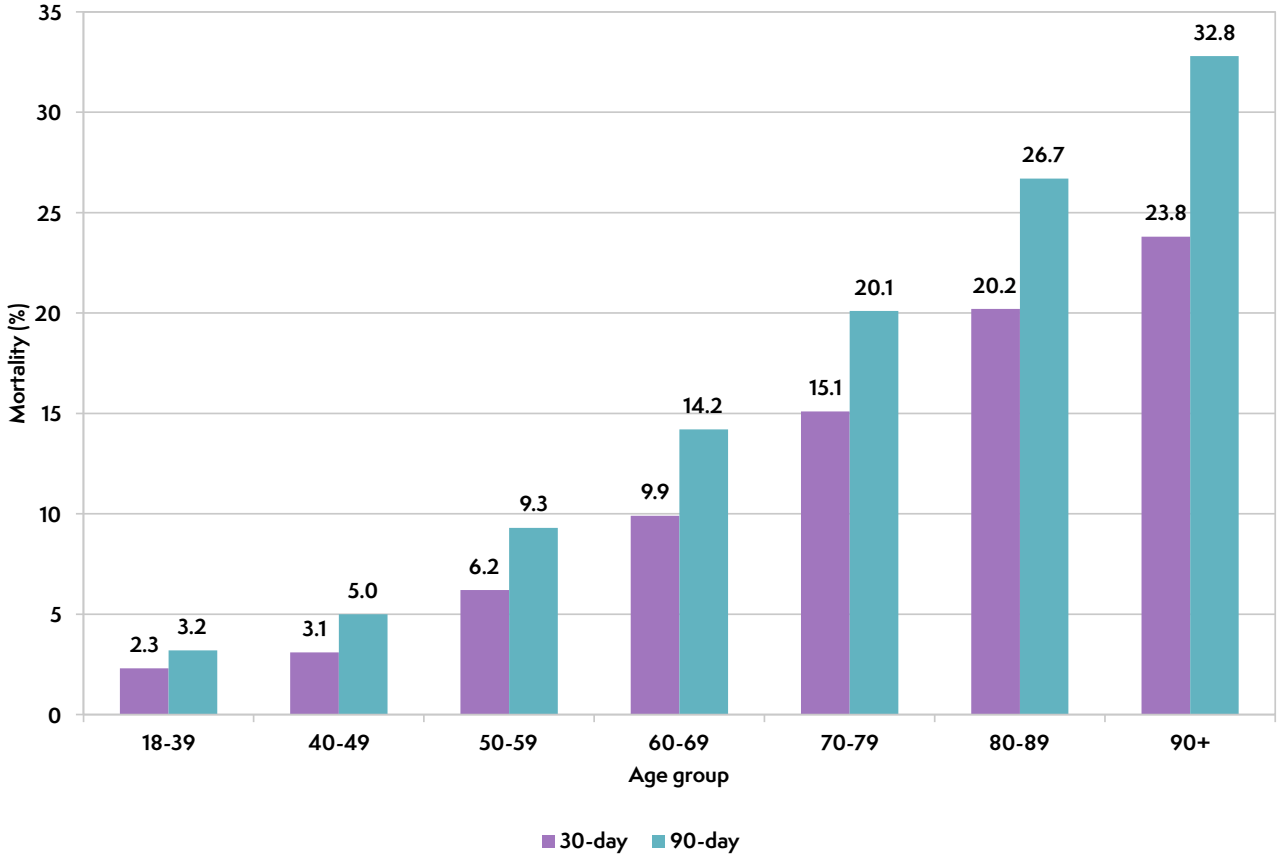


Figure 30 ONS 30-day and 90-day mortality by ASA (Year 1 and Year 2 data combined)

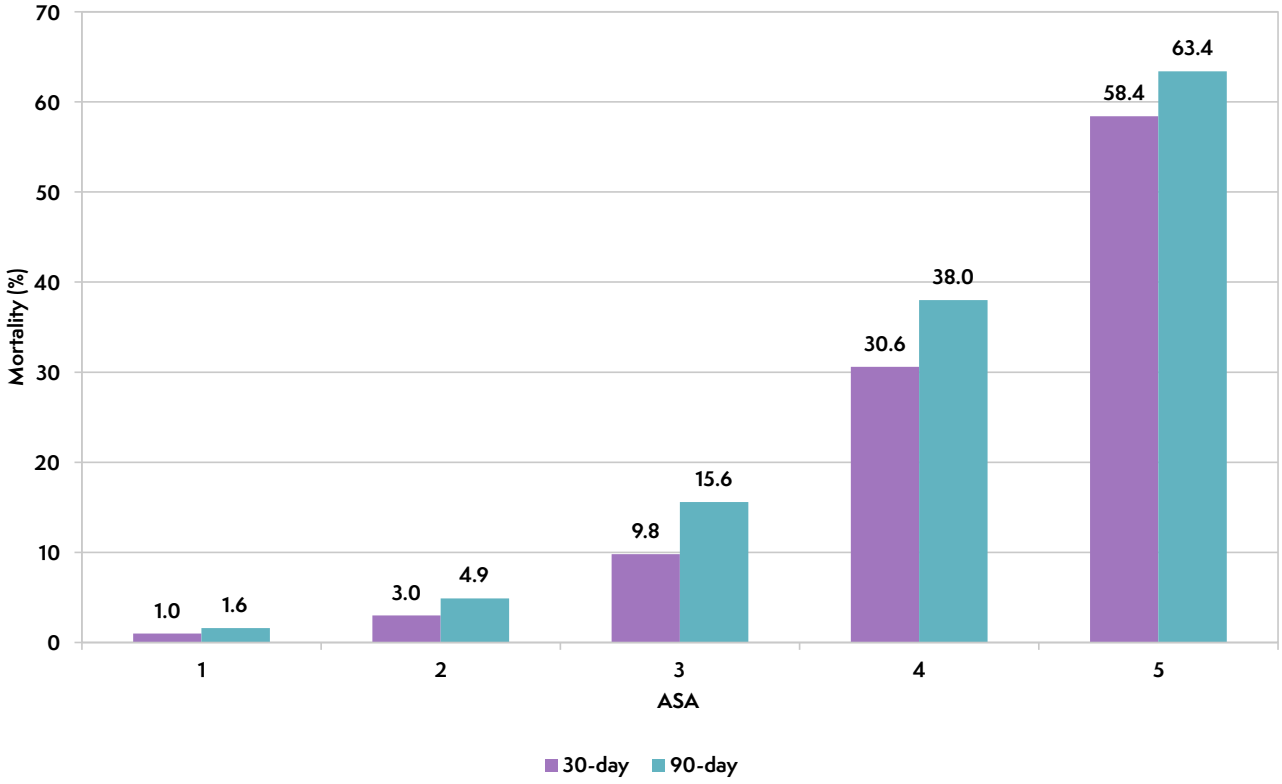


Figure 31 ONS 30-day and 90-day mortality by urgency of surgery (Year 1 and Year 2 data combined)

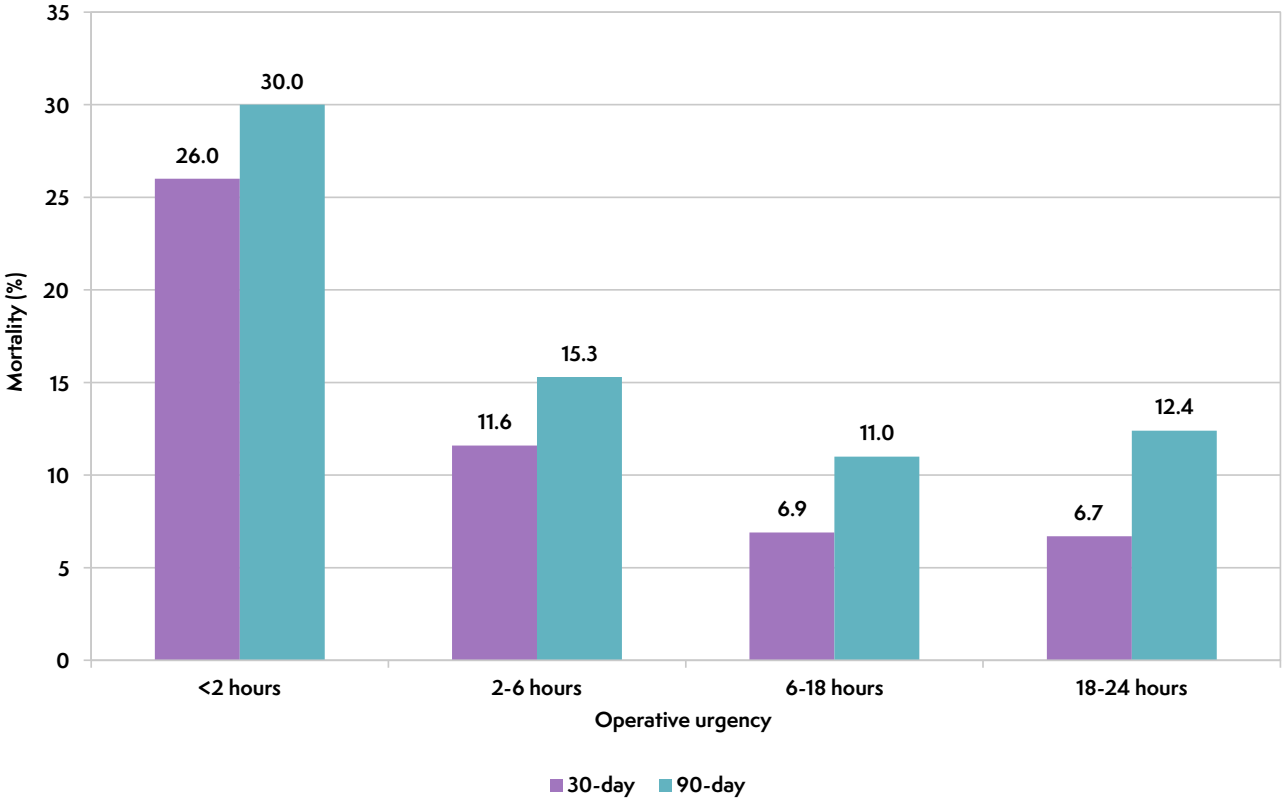


Table 30 ONS 30-day and 90-day mortality by primary operative procedure performed at emergency laparotomy (Year 2 data)

Primary operative procedure	Number of patients (frequency (%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Adhesiolysis	3,918 (17)	5.4	7.8
Small bowel resection	3,889 (17)	11.5	15.2
Colectomy: right	3,013 (13)	9.0	13.0
Hartmann's procedure	2,952 (13)	11.0	14.2
Colectomy: subtotal	1,336 (6)	15.3	17.9
Stoma formation	1,330 (6)	12.1	25.3
Peptic ulcer – suture or repair of perforation	1,305 (6)	13.0	14.3
Colectomy: left (including anterior resection)	670 (3)	9.6	12.7
Drainage of abscess/collection	650 (3)	8.9	11.2
Washout only	565 (2)	11.9	14.3
Repair of intestinal perforation	518 (2)	11.6	15.6
Exploratory/relook laparotomy only	448 (2)	23.9	27.0
Colorectal resection – other	437 (2)	12.4	16.2
Gastric surgery – other	329 (1)	12.5	18.8
Intestinal bypass	304 (1)	21.1	38.8
Enterotomy	255 (1)	5.5	7.8
Haemostasis	249 (1)	9.2	12.0
Peptic ulcer oversew of bleed	191 (1)	16.2	20.9
Not amenable to surgery	190 (1)	74.7	84.2
Abdominal wall closure	161 (1)	5.0	7.5
Stoma revision	149 (1)	9.4	10.7
Reduction of volvulus	134 (1)	6.0	7.5
Resection of other intra-abdominal tumour(s)	78 (<1)	10.3	12.8
Laparostomy formation	64 (<1)	25.0	35.9

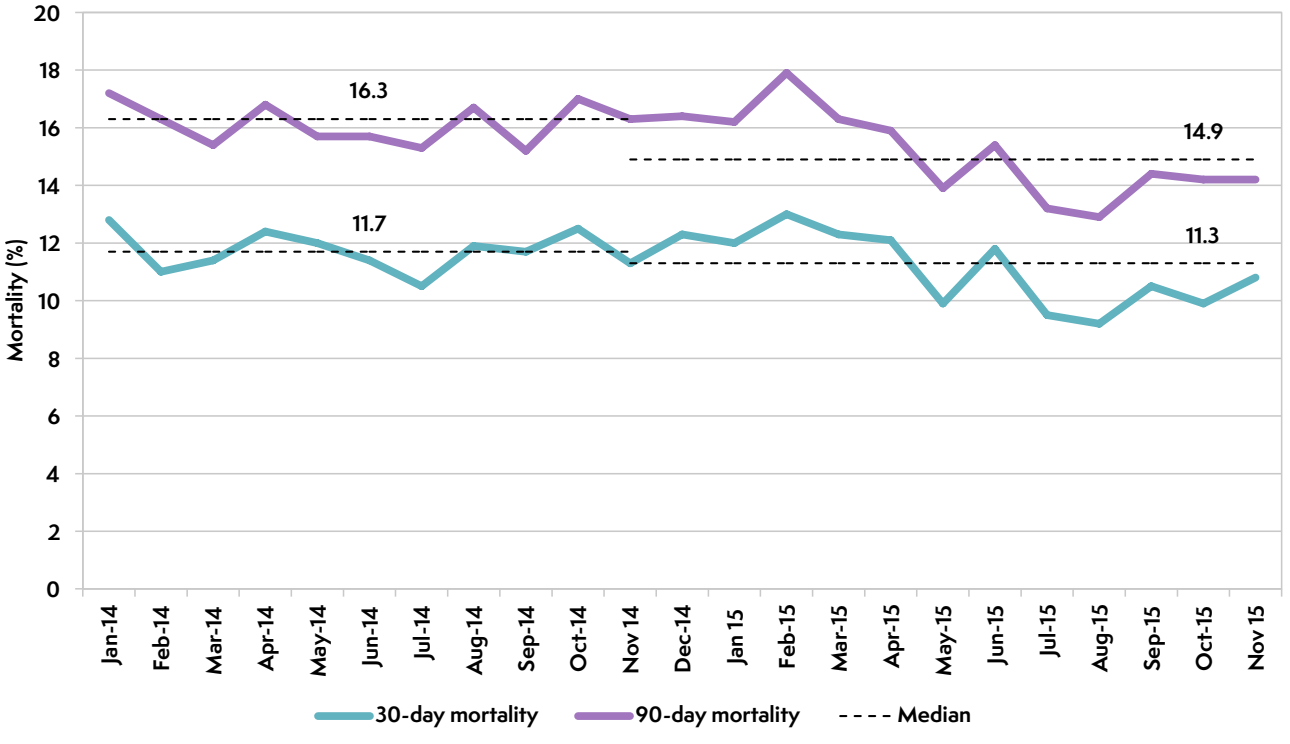
Table 31 Median preoperative P-POSSUM risk of death and observed ONS 30-day mortality *for all patients* by time of day of arrival in operating theatre (Year 2 data)

Time of day	Median P-POSSUM risk of death (%)	ONS 30-day mortality (%)
0800–1159	5.7	8.8
1200–1759	6.1	9.7
1800–2359	9.0	13.0
0000–0759	15.2	16.9
Overall	**7.0%**	**11.1%**

Table 32 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* (Year 2 data)

Day of week	Day of admission		Day of surgery	
	Number of patients (frequency (%))	ONS 30-day mortality (%)	Number of patients (frequency (%))	ONS 30-day mortality (%)
Monday	2,898 (16)	13.3	2,364 (13)	13.5
Tuesday	2,714 (15)	11.2	2,740 (15)	11.6
Wednesday	2,581 (14)	11.7	2,745 (15)	12.8
Thursday	2,630 (15)	11.4	2,778 (16)	10.4
Friday	2,600 (15)	13.0	2,702 (15)	11.8
Saturday	2,190 (12)	10.9	2,299 (13)	12.1
Sunday	2,266 (13)	11.9	2,251 (13)	11.6

Figure 32 Trend in the overall ONS 30-day and 90-day mortality percentage rate (split medians denoting the change from Year 1 to Year 2)



Risk-adjusted hospital-level mortality

NELA was provided with date of death by the ONS, from which it has been possible to calculate all-cause 30-day postoperative mortality for individual hospitals. We have presented these figures using a funnel plot. This is a widely used graphical method for comparing outcome information across hospitals. In the plots, each dot represents an NHS hospital. The mortality rate is shown on the vertical axis, with dots higher up the axis showing higher values. The horizontal axis shows surgical activity, with dots further to the right showing NHS hospitals that perform more operations.

The benefit of funnel plots is that they show whether the mortality rates of hospitals differ from the national average by more than would be expected due to random variation. Random variation will always affect statistical information like mortality rates, and its influence is greater among hospitals that perform smaller numbers of procedures. This is shown by the curved 'funnel' limits. We have followed the standard approach of using 99.8% control limits to define the region within which we would expect the mortality rates of hospitals to fall if their values only differed from the national rate because of random variation. These are the outer limits of the funnel plot, and hospitals above this line are considered to be 'outliers' for mortality. The inner funnel limits are defined as 95% control limits, and hospitals above this line but below the 99.8% outer limits have 'alert' status.

The unadjusted 30-day mortality rates are shown in Figure 33. This appears to show a number of hospitals with higher than expected 30-day mortality rates, especially among those with lower case numbers. However, these unadjusted figures do not take into account the risk profile of the patients treated at particular hospitals. Using patient demographic, surgical, and physiological variables in the NELA dataset, a statistical model was created to determine whether an individual was at high- or low-risk of death after surgery, and this was used to derive risk-adjusted hospital 30-day mortality rates (see the Technical Documents section of the NELA website (www.nela.org.uk/reports) for full methodology).

The funnel plot in Figure 34 shows the risk-adjusted 30-day mortality rate for each hospital. No hospitals have rates that fall outside the 99.8% control limit.

Figure 34 also illustrates that, using two years of data, there is still a degree of statistical uncertainty around the mortality rates of hospitals, with individual values typically falling between 5% and 17%. This is a consequence of the relatively low volumes, and with more years of data we will be able to produce more precise mortality rates. Nonetheless, it illustrates a limitation of outcome indicators like 30-day mortality, and highlights the importance of hospitals using the information presented in this Report on both the process of care and postoperative outcomes to examine their local practice.

P-POSSUM can also be used to calculate observed versus expected mortality rates for a particular hospital, and many hospitals currently do this. As previously reported in Chapter 10 and Chapter 21.3, P-POSSUM overestimates the predicted mortality among higher risk patients. This means that the use of P-POSSUM to calculate observed to expected mortality ratios will be falsely reassuring.

Figure 33 Funnel plot of *unadjusted* ONS 30-day mortality rates (Year 1 and Year 2 data combined)

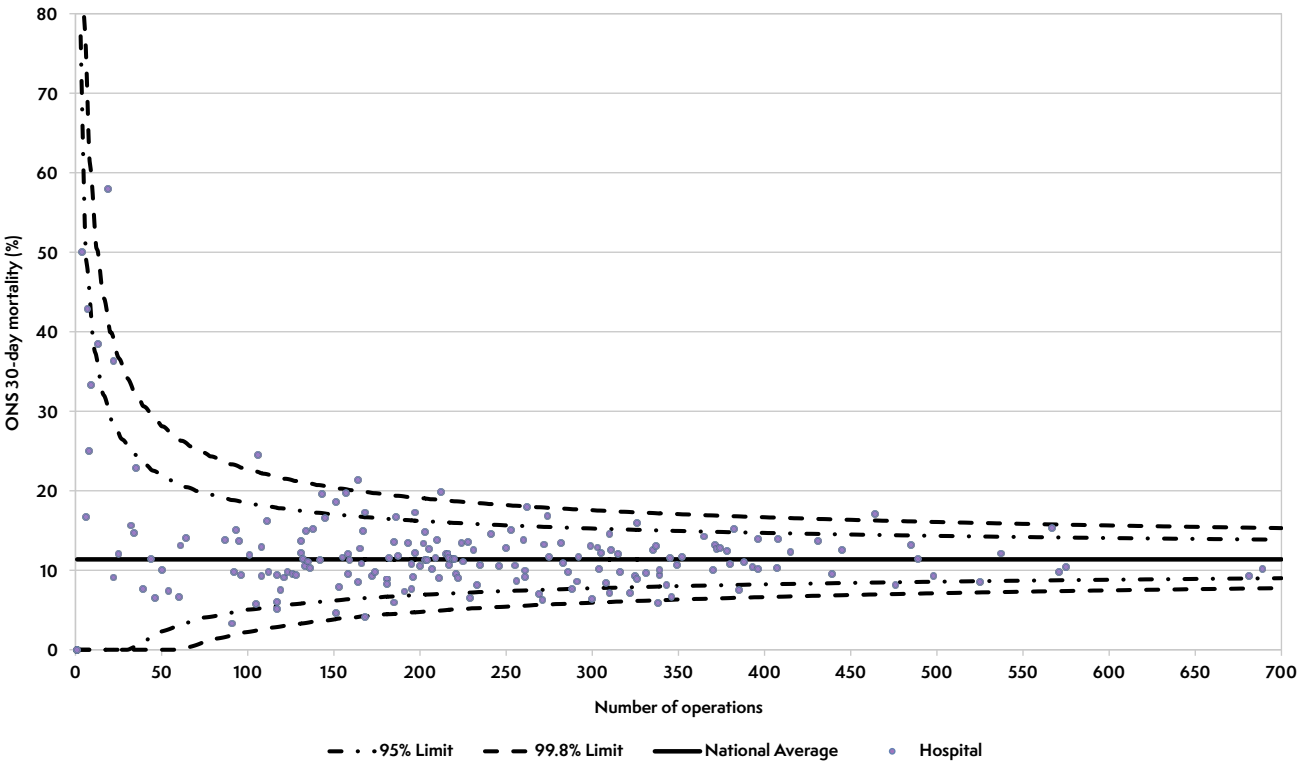
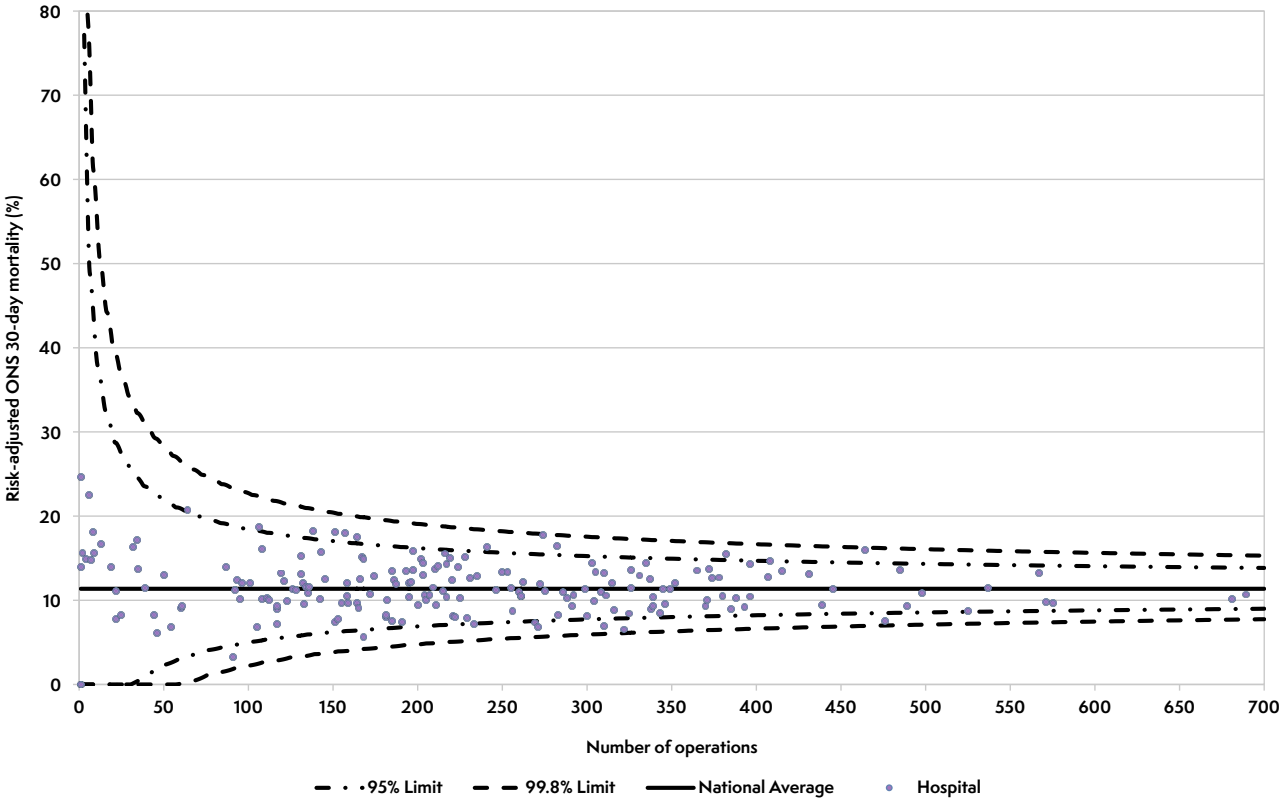


Figure 34 Funnel plot of *risk-adjusted* ONS 30-day mortality rates (Year 1 and Year 2 data combined)



Additional analyses

ONS 30-day mortality was also assessed against patient characteristics, operative urgency, recorded indication for surgery and operative findings (Table 56, Table 57, Table 58 and Table 59). ONS 30-day and 90-day mortality across both Year 1 and Year 2 combined was assessed against age group (Table 60).

17.2 LENGTH OF HOSPITAL STAY AFTER SURGERY

Prolonged length of stay after an emergency laparotomy is a substantial burden on patients, who are removed from their normal home environments, and on health service resources. Postoperative length of hospital stay is a measure of patient experience, outcome and resource utilisation. A short duration of postoperative hospital stay may reflect efficient care pathways and reduced complications.

KEY FINDINGS

Overall, half of patients had been discharged within 11 days of surgery (Table 33 and Figure 35).

More than a quarter of patients had left hospital within seven days of surgery, but a quarter were still in hospital more than 19 days after their initial operation (Table 33 and Figure 35).

Length of stay after surgery increased with age. Half of patients under the age of 40 left hospital by day seven after surgery, whereas half of patients over the age of 80 were still in hospital more than 14 days after surgery (Table 33 and Figure 36).

Length of stay after surgery increased with markers of sickness (e.g. ASA status, risk category and urgency of surgery) (Table 33 and Table 34)

There was considerable variation in the median postoperative length of stay between hospitals, ranging from around 7 to 18 days (Figure 38).

Clinical commentary

Since patient deaths while in hospital can falsely reduce length of stay, only patients who survived to leave hospital were included in the following analyses in this chapter.

The time patients spend in hospital after an emergency laparotomy varies by operative urgency and patient characteristics (Table 33 and Table 34). It is not surprising that length of stay increases with markers of sickness as these patients are more likely to suffer postoperative complications. Of note is the higher postoperative length of stay for patients whose emergency laparotomy was a consequence of prior elective surgery, confirming that complications of surgery are associated with increased healthcare burden. There is a marked difference in length of stay between older and younger age groups. Investment in Elderly Medicine physicians to manage complex older patients may not only improve outcomes but could also reduce length of stay.

The mean length of stay of all patients has reduced from 18.1 days in Year 1, to 16.3 days in Year 2 ($p<0.001$). Using the Government's estimated costs of £400 for a day in hospital,[36] this suggests that the financial burden of length of stay alone is in excess of £200 million per year for all 30,000 patients undergoing emergency laparotomy in England and Wales. However the improvement in length of stay seen from Year 1 to Year 2 represents an annual saving of around £22 million.

There was variation in length of stay at hospital level, with a median postoperative length of stay ranging from around 7 days to 18 days (Figure 38). Some of this variation may be due to patient characteristics and shorter durations of stay for patients who died in hospital. However it is probable that this is due in part to variation in the delivery of care. Hospital teams should review their length of stay in the context of the Audit's other local results. As standards of care improve, we would expect to see a reduction in the length of stay for many patients. Investing in resources to bring about improvement and deliver high-quality care is therefore likely to be cost effective.

Table 33 Postoperative length of stay in patients surviving to hospital discharge by patient characteristics (Year 2 data)

	Number of patients	Median (IQR) postoperative length of stay (days)
Age (years)		
18–39	2,356	7.3 (4.9–12.5)
40–49	2,147	8.4 (5.3–14.3)
50–59	2,971	9.4 (5.8–16.2)
60–69	4,192	10.6 (6.5–19.2)
70–79	4,747	12.4 (7.4–22.1)
80–89	3,144	14.9 (9.2–25.2)
≥90	406	15.6 (10.3–26.0)
ASA		
1	2,349	6.4 (4.4–10.0)
2	7,682	8.6 (5.5–14.3)
3	7,153	13.3 (8.1–22.4)
4	2,628	19.6 (11.5–34.1)
5	151	26.2 (15.0–43.3)
Admission type		
Emergency	18,653	10.5 (6.4–18.6)
Elective	1,310	15.0 (8.6–26.5)
Documented risk		
Lower	5,346	7.8 (5.3–12.6)
High	2,911	12.2 (7.4–20.3)
Highest	4,140	18.1 (10.7–31.3)
Not documented	7,566	10.0 (6.2–17.4)
Return to theatre after initial operation		
No return to theatre	18,414	10.2 (6.3–17.4)
One or more returns	1,549	26.0 (15.9–44.5)
Overall	**19,963**	**10.6 (6.4–19.3)**

Table 34 Postoperative length of stay in patients surviving to discharge from hospital by operative urgency (Year 2 data)

Urgency of surgery	Number of patients	Median (IQR) postoperative length of stay (days)
<2 hours	1,999	15.0 (8.3–28.6)
2–6 hours	7,642	11.4 (6.5–20.9)
6–18 hours	6,678	9.6 (6.2–16.5)
18–24 hours	3,559	10.0 (6.4–17.2)
Overall	**19,878**	**10.6 (6.4–19.3)**

Figure 35 Distribution in the duration of postoperative length of stay in patients surviving to hospital discharge (curtailed at 100 days) (Year 2 data)

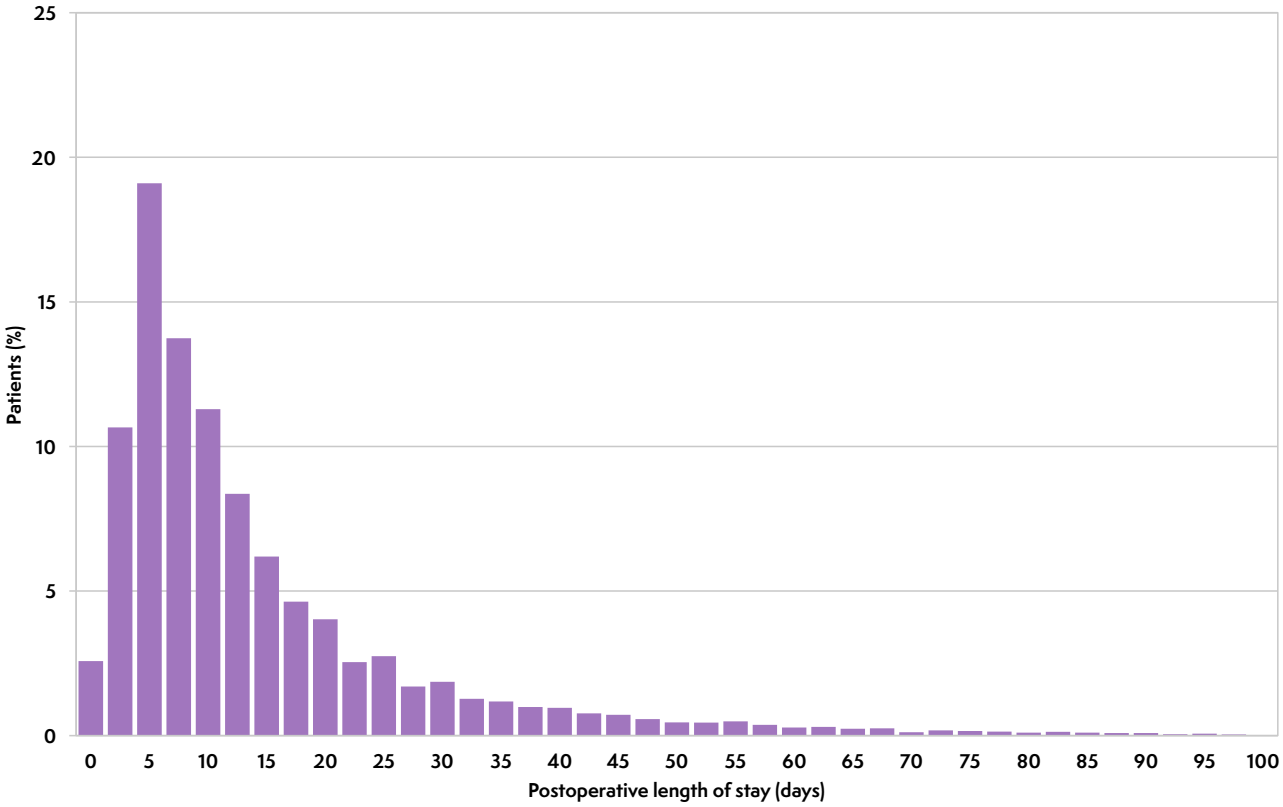


Figure 36 Median postoperative length of stay in patients surviving to hospital discharge by age category on the day of admission (Year 2 data)

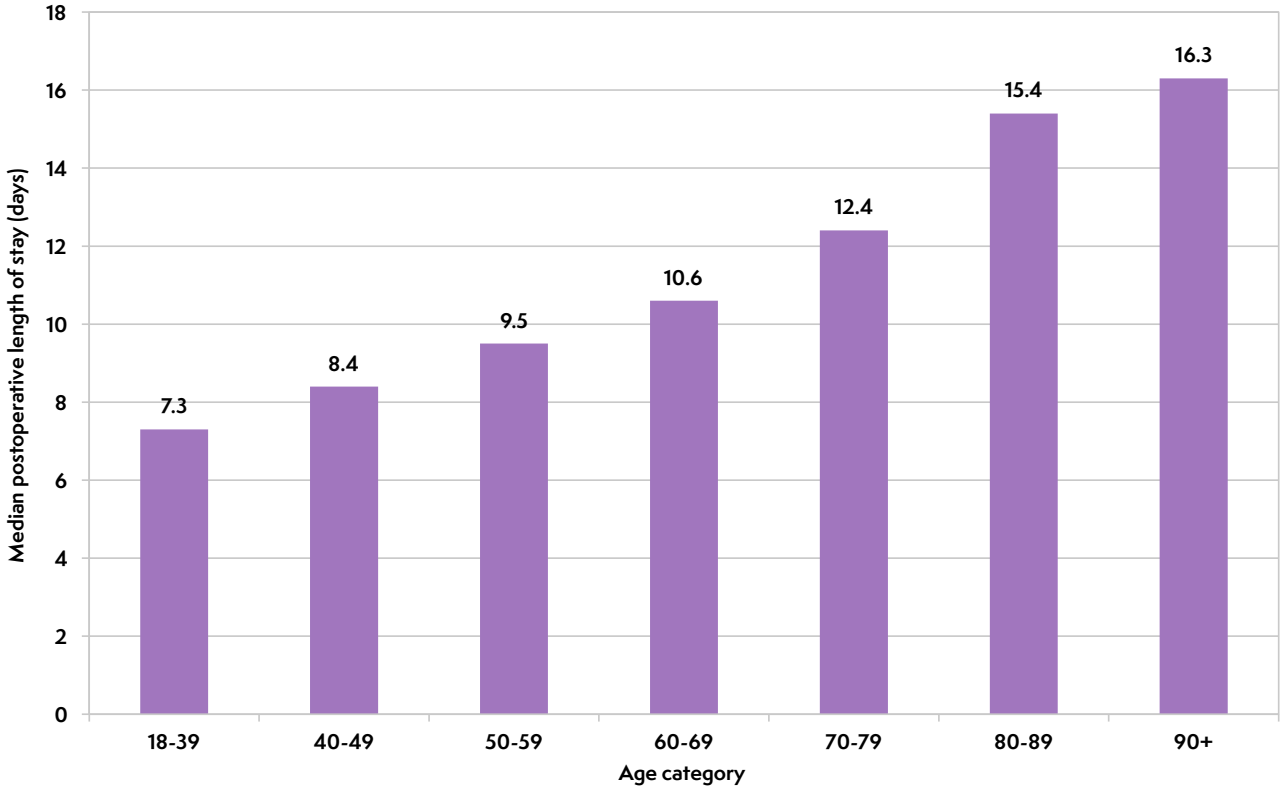


Figure 37 Trend in the median postoperative length of stay

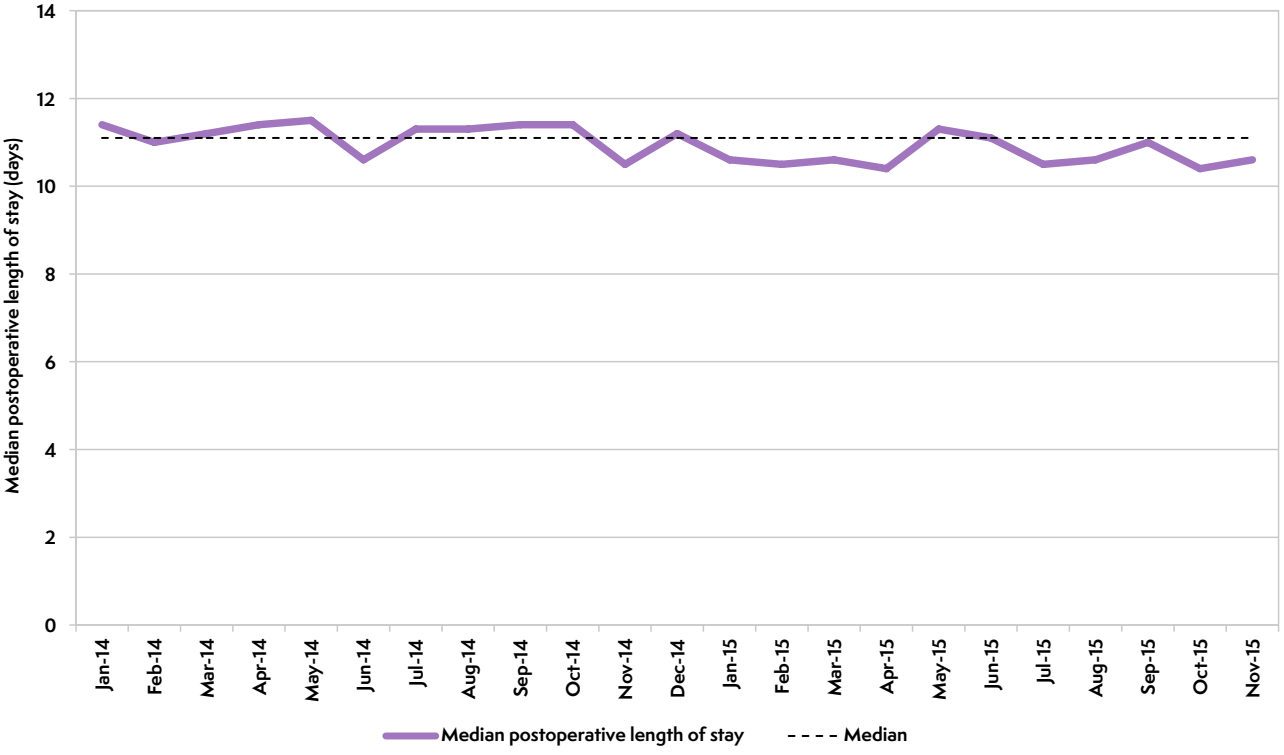
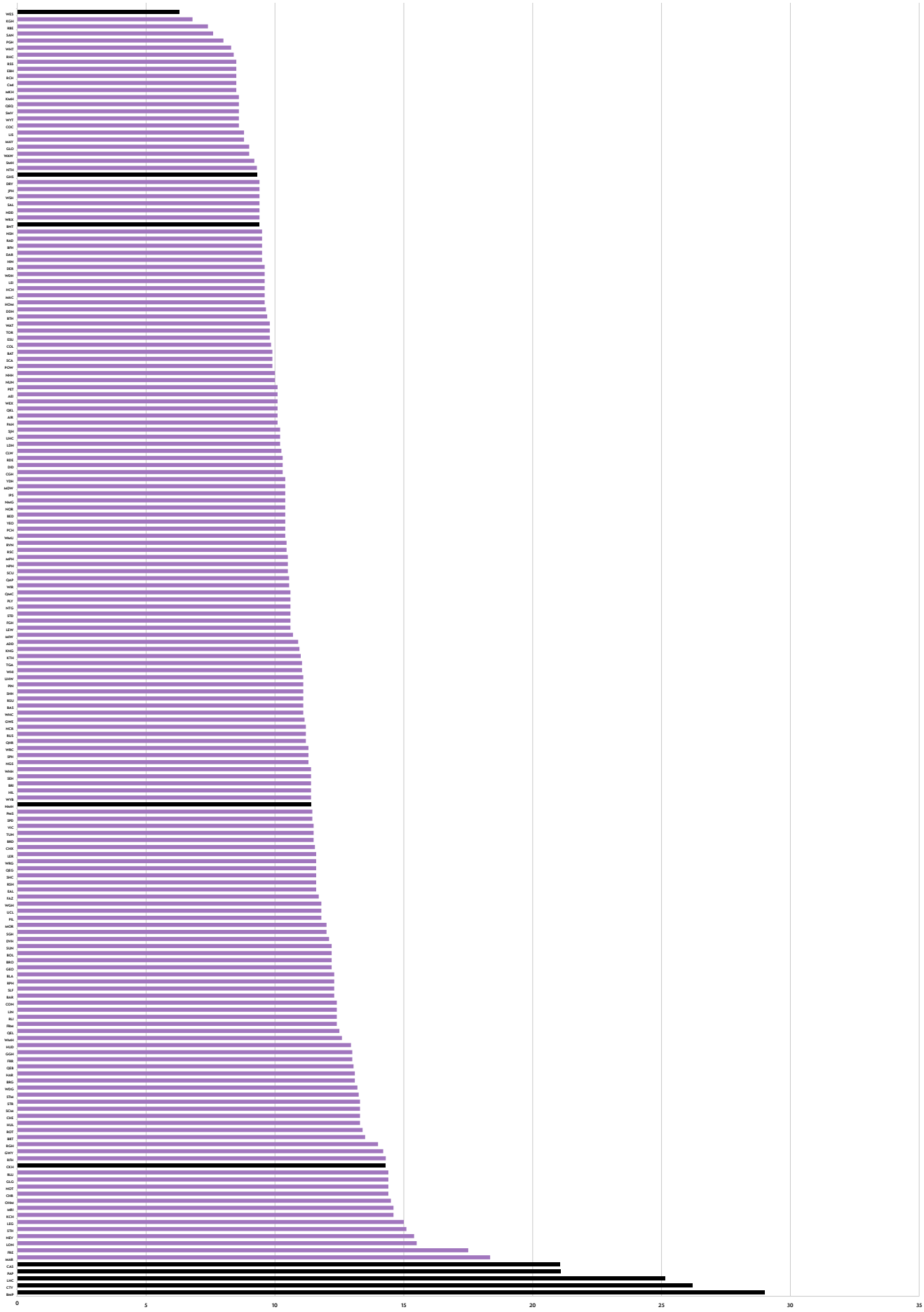


Figure 38 Median postoperative length of stay (days) by hospital in patients surviving to discharge. Black bars indicate hospitals with less than ten cases in this analysis



17.3 RETURN TO THEATRE FOLLOWING INITIAL EMERGENCY LAPAROTOMY

Return to theatre following emergency laparotomy may be an indicator of an unsuccessful initial procedure or of a complication that has occurred. It may also reflect a judicious and cautious approach in a patient who may have been too unwell to tolerate more extensive initial surgery. This may reflect severity of the original illness but may also reflect the quality of the care the patient has received.

This group comprises all patients who underwent an emergency laparotomy, regardless of whether it was a primary procedure, including those whose initial emergency laparotomy was performed for a complication of prior elective surgery.

KEY FINDINGS

Overall, 9% of patients returned to theatre at least once after their initial operation (Table 35).

The most marked variation was observed by admission type (Table 35). Returns to theatre following an emergency laparotomy were more frequent if the initial emergency laparotomy had been for a complication of elective surgery.

The proportion of patients who returned to theatre also varied with increasing risk and operative urgency (Table 35 and Table 36).

Patients who returned to theatre had a longer postoperative length of stay (Table 33), and a higher 30-day and 90-day mortality rate (Table 56).

There was considerable variation between hospitals in the proportion of their patients returning to theatre, ranging from around 2% to 20% (Figure 39).

Clinical commentary

Overall, 2,146 patients (9%) returned to theatre on at least one occasion after their initial emergency laparotomy. Of the patients who were initially admitted electively to hospital, a fifth (21%) returned to theatre on at least one occasion after their initial emergency laparotomy. In contrast, 8% of emergency admissions did so (Table 35).

Mortality was higher in patients who returned to theatre: 16.9% of patients who returned to theatre died within 30 days of their initial operation, compared to 10.2% in those who did not return to theatre (Table 56).

Postoperative length of stay was also considerably longer, at 26.0 days in those that returned to theatre, compared to 10.2 days in those that did not (Table 33).

It is clear from the above results that patients who returned to theatre have a worse outcome than those who did not. Higher predicted risk of death and increasing operative urgency were both associated with an increased risk of return to theatre (Table 35 and Table 36). This finding is not surprising, given the potential reasons why a patient may return to theatre: for example, it may represent prudent decision making in a patient who was too unwell to undergo more extensive surgery at the outset. The variation in return to theatre rate at hospital level is shown in Figure 39. Some of this variation may be due to patient characteristics. However it may also be a consequence of failure to deliver appropriate care. It is therefore important that hospital teams review their returns to theatre to identify the underlying reasons.

Table 35 Proportion of patients who returned to theatre following their initial emergency laparotomy by admission type and documented risk (Year 2 data)

	Total number of patients	Proportion patients who returned to theatre following initial emergency laparotomy (%)
Admission type		
Emergency	21,552	8
Elective	1,586	21
Documented risk		
Lower	5,504	5
High	3,196	8
Highest	6,105	13
Not documented	8,333	10
Overall	**23,138**	**9%**

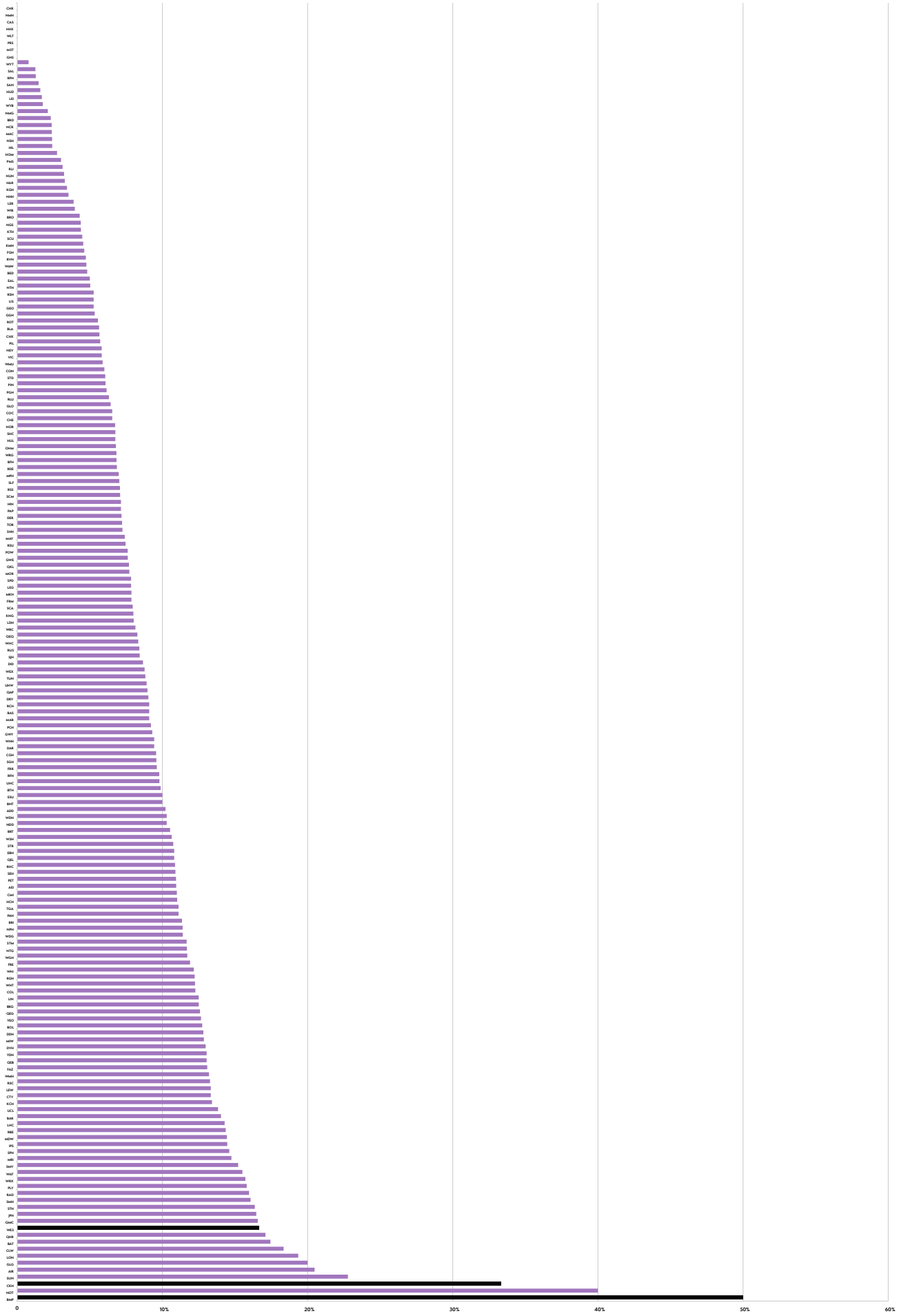
Table 36 Proportion of patients who returned to theatre following their initial emergency laparotomy by documented urgency of surgery (Year 2 data)

Urgency of surgery	Total number of patients	Proportion patients who returned to theatre following initial emergency laparotomy (%)
<2 hours	2,943	16
2–6 hours	8,948	10
6–18 hours	7,273	7
18–24 hours	3,869	6
Overall	**23,033**	**9%**

Additional analyses

The proportion of patients who returned to theatre following their initial emergency laparotomy was also assessed against patient age and ASA (Table 61).

Figure 39 Proportion of patients that returned to theatre in the initial post operative period after emergency laparotomy. Black bars indicate hospitals with less than ten cases in this analysis



17.4 UNPLANNED ADMISSION TO CRITICAL CARE

Standards state that high-risk patients should be admitted to critical care following surgery. It is likely that patients admitted to the ward rather than to critical care may deteriorate because they do not receive the required level of care from the outset. Data from other literature suggest that these patients have a higher mortality than if they had been admitted to critical care from the outset.[4,7,26]

KEY FINDINGS

Overall, 879 patients (3.8%) required an escalation of care, and were admitted from a ward to critical care following surgery. This is relatively unchanged from last year (4%).

636 patients (2.7%) had been admitted to critical care directly from theatres, but returned to critical care having been discharged to the ward.

231 patients (1.0%) were admitted from the ward having never been admitted to critical care, of whom 125 were in the highest risk category (P-POSSUM risk of death >10%), meaning they should have been admitted directly to critical care after surgery rather than from the ward.

There was wide variation between hospitals, ranging from zero to more than 15% (Figure 40).

Clinical commentary

Hospitals varied in the proportion of their patients who had an unplanned admission to critical care. Whilst the median rate was 3.2% this ranged from zero to greater than 15%. Only 125 (0.5%) patients had an unplanned admission when they should have received postoperative critical care from the outset.

Despite the relatively small numbers within this cohort, hospitals can still use these cases as an opportunity to review how care is delivered at patient level. Hospital teams should review unplanned admission to critical care to determine if any are due to unrecognised deterioration on the ward, premature discharge from critical care, or if patients were inappropriately sent to the ward from theatres.

The numbers of patients in this cohort are too small to undertake any meaningful analysis of mortality. High rates of unplanned critical care admissions may be due to insufficient critical care capacity, or alternatively may reflect inadequate assessment of risk before surgery leading to inappropriate allocation of beds. The magnitude of variation between hospitals is shown in Figure 40. Hospitals with high rates of unplanned admissions should review their local policies and procedures, and determine whether they have sufficient critical care capacity.

RECOMMENDATIONS

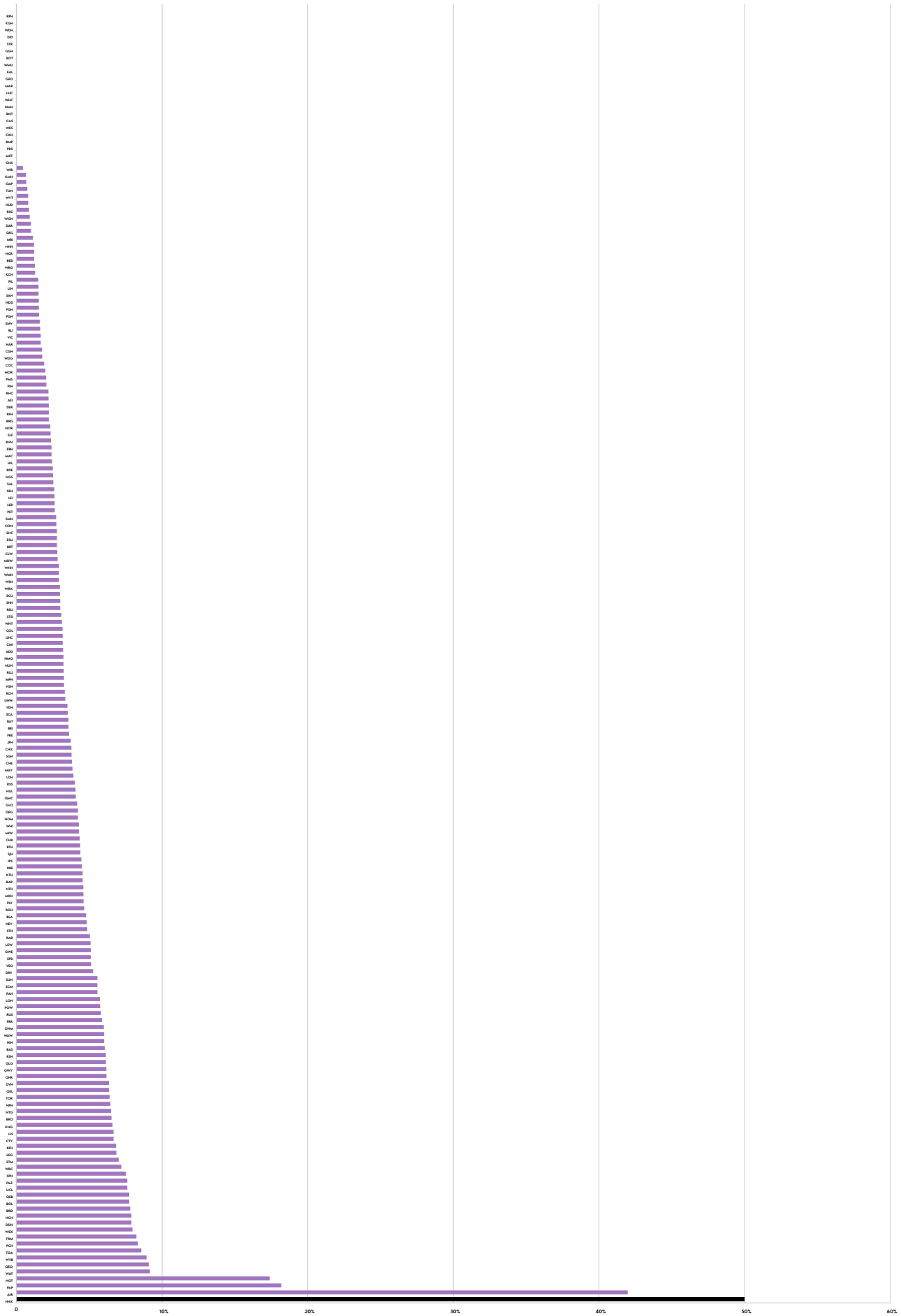
Hospital teams should review the care received by patients who suffer adverse outcomes. This includes: (MDT)

- Those who died following surgery.
- Those who returned to theatre following their emergency laparotomy.
- Those who had an unplanned escalation of care in the postoperative period.

The results of these reviews should be discussed at multidisciplinary meetings, and cascaded to those involved in the planning and delivery of care to drive improvements (MDT, Medical and Clinical Directors).

Hospitals should ensure they have policies in place for the allocation of critical care resources according to risk, and clear escalation protocols for patients who deteriorate on the ward (Medical and Clinical Directors).

Figure 40 Proportion of patients that had an unplanned admission to critical care from the ward within seven days of their emergency laparotomy. Cases that died in theatre or where an active decision was made not to send to critical care postoperatively are excluded. Black bars indicate hospitals with less than ten cases in this analysis



18 HOW IMPROVEMENT HAS BEEN ACHIEVED

There have been significant improvements since the initiation of the Audit, and individual units who have achieved widespread adoption and implementation of NELA recommendations have been able to demonstrate reductions in their crude mortality. Around 30 more hospitals now meet key standards of care compared to last year. A review of NELA projects presented at scientific meetings and discussions with top performing units have provided some of the insight into how clinical improvements have been achieved. Many of these have been presented within the quality improvement vignettes throughout the report.

While the second year of data collection was in progress, there have been two major studies running which have worked at large scale to improve care for patient undergoing emergency laparotomy. The 'EPOCH' (Enhanced PeriOperative Care for High risk surgical patients) study was a multi-centre, stepped wedge cluster randomised trial conducted in 90 NHS hospitals (including six Scottish hospitals) over an 85 week period.[34] Data collection ceased at the end of October 2015. The EPOCH trial intervention comprised two components: an evidence-based integrated care pathway and a quality improvement package to support effective implementation of the pathway into clinical practice. EPOCH used the NELA dataset for its process and outcome measures. Teams within the study have seen success at a local level. At the time of writing this report, the EPOCH results are still being analysed. As part of EPOCH, an ethnographic study was undertaken to assess how change happened at individual sites, and detailed exit questionnaires will also inform how we understand the facilitators and barriers to improvement for these high-risk surgical patients. A second study, the Emergency Laparotomy Collaborative, is taking place across the South of England and involves 24 acute hospitals. This project is scaling up the work done in the ELPQuIC study[35] and aims to deliver six key themes using a care bundle approach. Again this study uses NELA data for its process and outcome measures. Additionally the study will focus on two areas for improvement, care of the older patient undergoing emergency laparotomy and the management of sepsis, both problems highlighted in the First NELA Patient Report.

The importance of data

Collection of performance and outcome data of the emergency laparotomy pathway is now 'business as usual' for most centres. This data is being used in a number of ways to aid improvement.[37]

The NELA Quality Improvement Dashboard enables NHS trusts to view their data in time series or run chart format. Displaying data changes over time is a fundamental tool for monitoring the impact of changes, as part of an iterative improvement cycle. The Quality Improvement Dashboard run charts will also demonstrate sustained improvement more effectively than using limited 'before and after' collection periods often seen in traditional audit. Furthermore, clinical processes have natural variation over time. Plotting data over time in relation to the median value can also allow units to identify non-random variation, using a set of simple rules.[38]

There are many cases of NELA data being used to evaluate service changes **using historic NELA data against prospectively recorded data**, for example after the introduction of new consultant job plans or roles such as emergency surgery coordinators. NELA data has been used to strengthen the case for emergency service changes by allowing units to **compare their data against national performance standards**. It is often difficult to make a case for additional resources in emergency surgical care, in comparison to elective care where services are easier to plan and evaluate. NELA data has helped clinicians to build a case for investment in service improvements for non-elective care, particularly for funding the additional posts required to allow early consultant review and presence in operating theatres.

As well as allowing peer comparisons, NELA data has helped units pin point which improvements are most pressing within their own service, **by recording performance across a range of measures in the whole patient pathway**. This is particularly important when financial and time resources are constrained. For example units have developed emergency laparotomy priority slots for imaging, or expanded critical care provision for laparotomy patients when the data demonstrated that these were the areas which required most improvement within their pathway.

In addition to using NELA data to inform change, many units are **using NELA recommendations as a template to develop innovative working practices** to make widespread improvement along the emergency laparotomy pathway. There are numerous examples of new surgical clerking proformas, operating theatre booking procedures, emergency team meetings and multidisciplinary data review practices that encompass a range of NELA recommendations. Teams have also used NELA data to monitor the effectiveness of their innovations. Many of these have been collated on the NELA website and are available for download (www.nela.org.uk/Pathway-Examples).

Whilst widespread and significant improvements have been seen in many process measures, there has been limited success in some areas. In general improvement has taken place at level of clinician and service, but has been slower in system-wide change. The message from units which perform well on establishing Elderly Medicine postoperative review suggest that this is wholly dependent on finding a clinician within the Elderly Medicine services with the suitable skill set to perform the role. Such skills are still not commonplace, and so improvement has been limited despite NHS trusts knowing that this gap in provision exists. It will require system-wide development of 'Proactive care of older people going to have surgery' (POPS)[39] or similar training to fill this gap before widespread improvements are seen.

Moving from knowing what we are doing, to knowing how to improve

Several NHS trusts were able to improve over a range of measures simultaneously, by using their NELA data within an overarching quality improvement initiative. Many NHS trusts emphasised the importance of having quality improvement skills within their project group, either as part of the EPOCH study, Emergency Laparotomy Collaborative, or with general training on quality improvement skills. Successful project teams sought widespread engagement and had leadership or 'NELA champions' shared beyond one specialty. Many set up regular multidisciplinary team meetings to look at data and reduce internal variation by targeting underlying causes when care deviated from best practice recommendations. NELA data formed an important part of the Plan-Do-Study-Act cycle used to refine and monitor improvements. Many commented that this was a long journey, but once good working relationships and improvement habits were established, using data as a driver for improvement became 'business as usual'.

Dissemination of best practice

NELA awards trainee poster prizes at ASGBI and AAGBI conferences, to encourage units to showcase their best practice developments. There is also a section of the NELA website which holds examples of care pathways developed to support the NELA recommendations (www.nela.org.uk/Pathway-Examples).

The NELA Lead database contains contact details of leads in each NHS trust. We will be building on our quality improvement resources to help individual leads make the most of their data, and to encourage peers to learn from each other to improve care and reduce variation.

NELA has focused the attention of clinicians and those managing clinical services on the pathway of a single type of procedure. It is likely that there have been benefits to other patients using similar pathways, such as conservatively managed surgical patients who may benefit from early consultant review, even if they do not go for surgery and are therefore not included in the NELA dataset.

QUALITY IMPROVEMENT VIGNETTE

Kingston hospital was in the top quartile over a range of measures. They described their improvement journey as: 'Dedication to quality improvement. Never stop. Allow time to embed changes in clinical practise and produce results. Continuing leadership, teamwork. EPOCH gave us an evidenced structure and 'buy in' from other specialties... regular meetings and specific results discussed. Success celebrated. Shortfalls reminded team about adherence. Trainee involvement – enthuse them, encourage and support presentation of results to appropriate national meetings. It was/is the perseverance of the team to continue and keep up the standard of care.'

RECOMMENDATIONS

NHS trusts should review their data in run charts using the NELA Quality Improvement Dashboard to monitor performance and inform them about the impact of organisational changes over time (Chief Executives, Medical and Clinical Directors, MDT).

Teams should endeavour to use quality improvement methodology such as the Model For Improvement when planning and executing changes to patient pathways or organisational processes (MDT, Medical and Clinical Directors).

Improvement teams should be multidisciplinary, and use good engagement and data feedback practices to implement changes. Patients' or carers' views and involvement should be sought at all stages of developing and making improvements (MDT, Medical and Clinical Directors).

NELA National Emergency Laparotomy Audit

19 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

Anastomotic Leak
Leak from a join in the bowel

APP
Association for Perioperative Practice

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

CQUIN
Commissioning for Quality and Innovation. A system of linking healthcare providers' income to achievement of local quality improvement goals

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

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 the 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

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

FICM
Faculty of Intensive Care Medicine

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

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

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

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)

NCEPOD
National Confidential Enquiry into Patient Outcome and Deaths

NELA
National Emergency Laparotomy Audit

NIAA
National Institute of Academic Anaesthesia

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 which has been validated for estimating an individual patient's risk of death within 30 days of emergency General Surgery.[10]

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

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

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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21 APPENDICES

21.1 HOSPITAL LEVEL DATA

Figure 41 Percentage case ascertainment at English hospitals, relative to HES algorithim estimates of annual volume of emergency laparotomies performed. Hospitals where this data is uncertain are excluded from this analysis

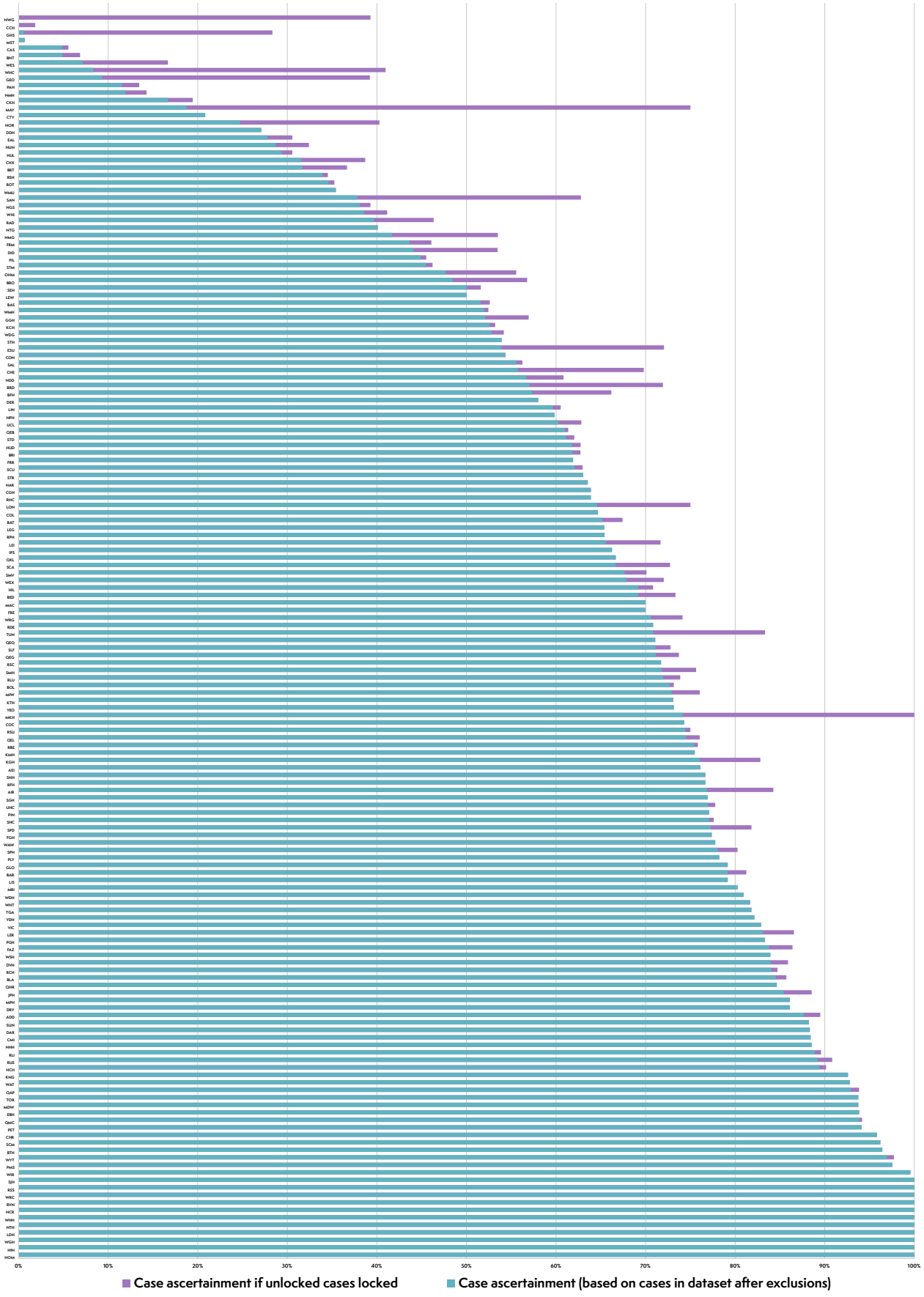

Figure 42 Proportion of submitted cases that were excluded due to ineligibility of surgical procedure(s) performed by hospital

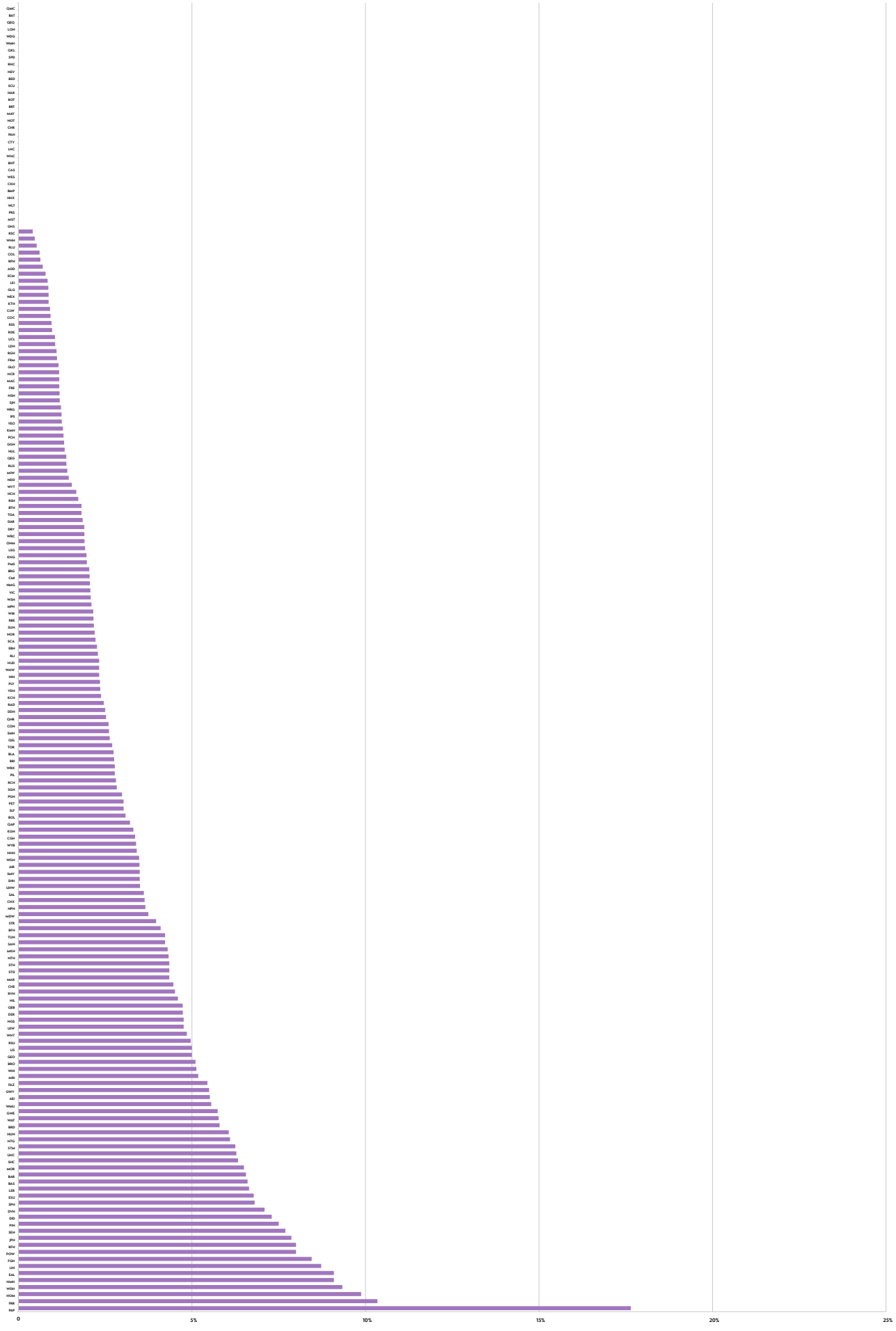

Figure 43 Proportion of included cases where neither time of decision to operate nor time of booking for theatre were entered by hospital. Black bars indicate hospitals submitting less than ten cases in the second year of data collection

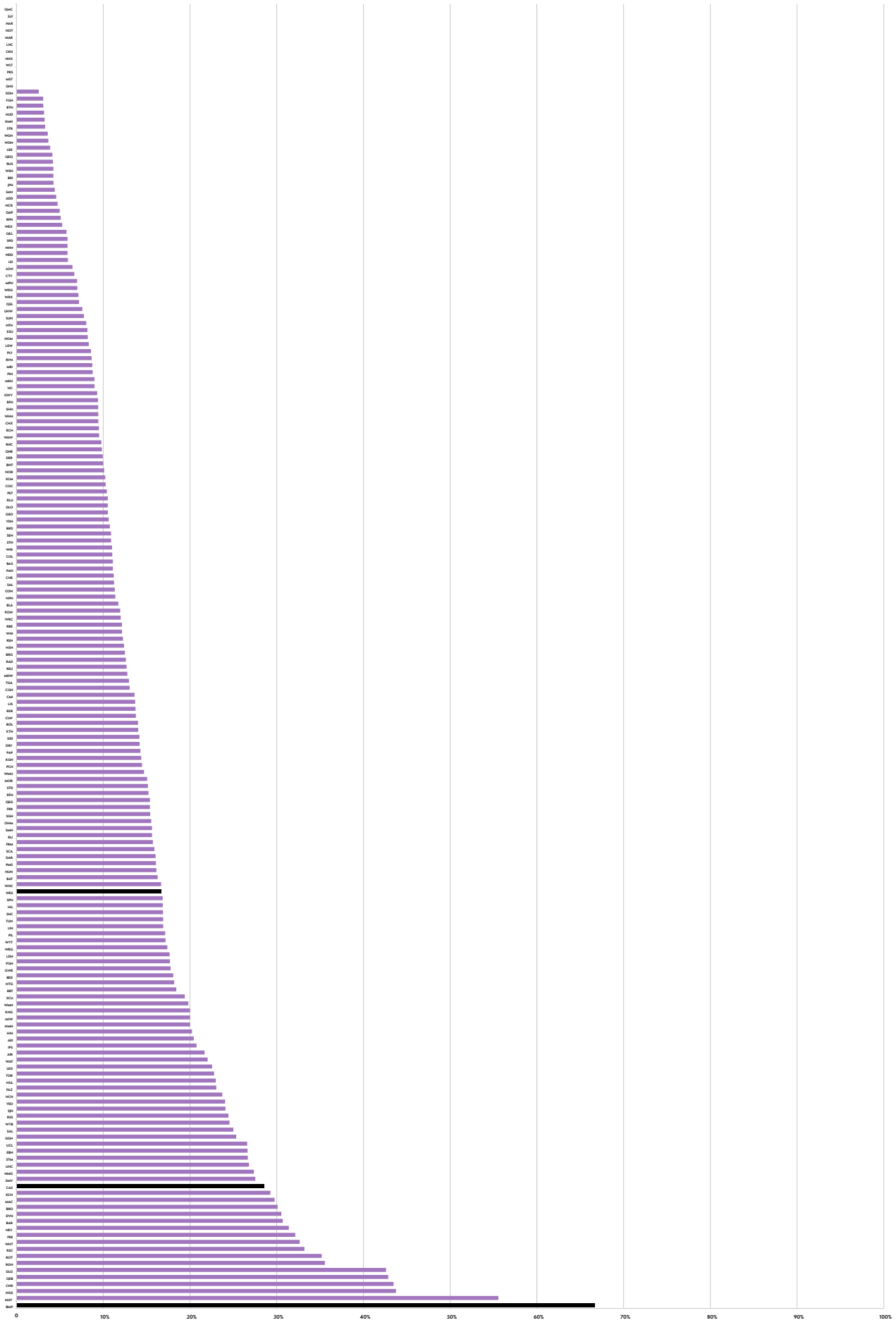

Figure 44 Proportion of included cases with missing preoperative and postoperative P-POSSUM fields by hospital. Black bars indicate hospitals submitting less than ten cases in the second year of patient data collection

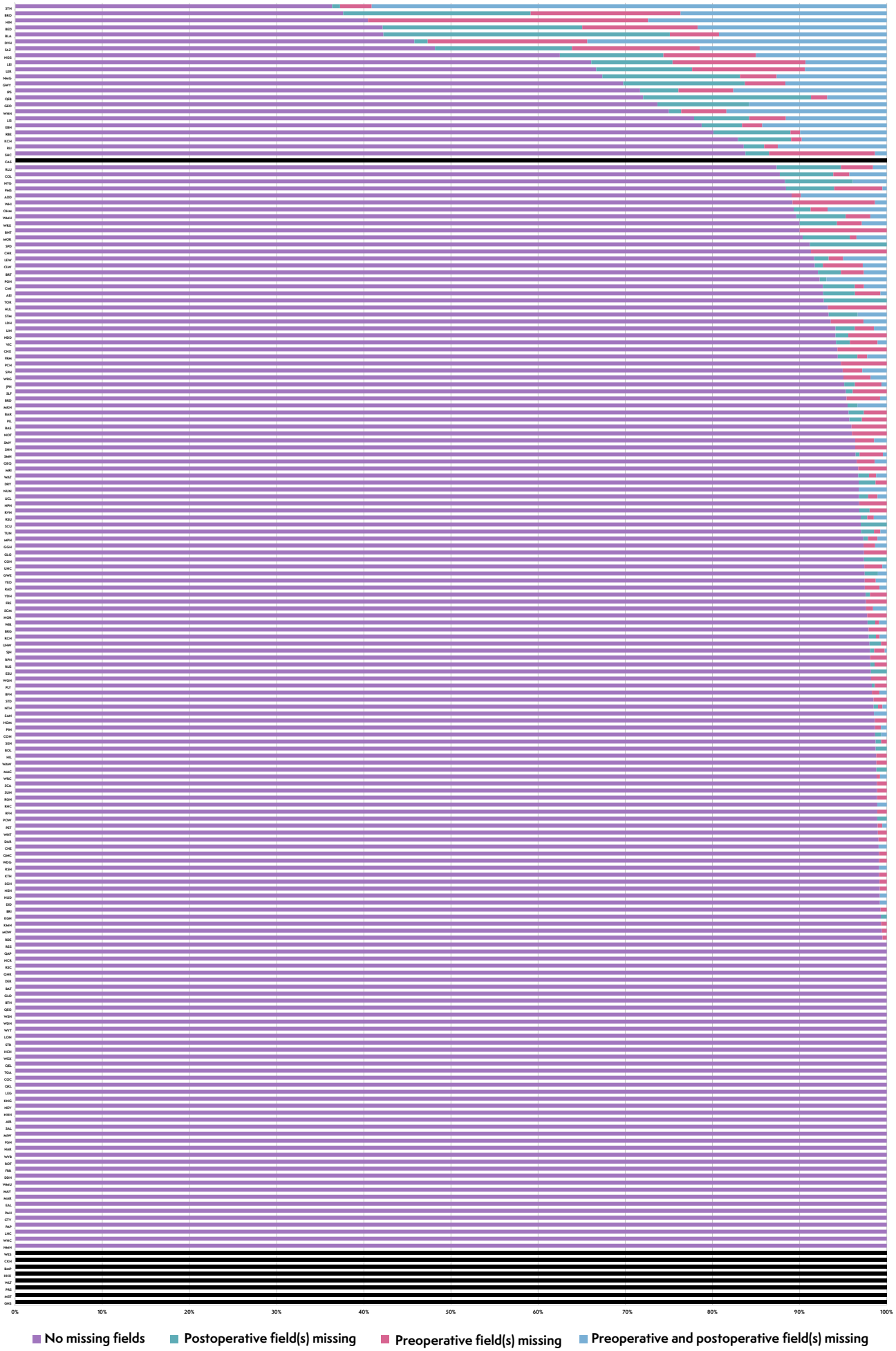

Figure 45 Achievement of key process measures in each hospital

London

Region	Hospital Code	Health Boards	Hospital Name	YEARS 1 & 2					YEAR 2													
				Total number of cases in years 1 and 2 datasets	Adjusted mortality rate- %	99.8% upper outlier limit	99.8% lower outlier limit		Total number of cases in year 2 cleaned dataset	Final Case Ascertainment	CT reported before surgery	Risk documented before surgery	Arrival in theatre in timescale appropriate to urgency	Preoperative review by a consultant surgeon and anaesthetist when risk of death ≥5%	Consultant surgeon and anaesthetist present in theatre when risk of death ≥5%	Consultant surgeon present in theatre when risk of death ≥5%	Consultant anaesthetist present in theatre when risk of death ≥5%	Admitted to critical care following surgery when risk of death >10%	Assessment by elderly medicine specialist in patients > 70 years	Median length of stay following surgery in patients surviving to hospital discharge (days)	Proportion of patients returning to theatre after emergency laparotomy	Proportion of patients with unplanned critical care admission from the ward < 7 days following surgery
LONDON																						
NORTH CENTRAL	BNT	Royal Free London NHS Foundation Trust	Barnet Hospital	87	13.9	23.7	1.6		10										9.4	10	0
	NMH	North Middlesex University Hospital NHS Trust	North Middlesex University Hospital	60	9.0	26.5	0.1		10										11.4	0	0
	RFH	Royal Free London NHS Foundation Trust	Royal Free Hospital	182	10.0	19.5	4.5		92										14.3	9.8	2.2
	UCL	University College London Hospitals NHS Foundation Trust	University College Hospital	158	12.0	20.1	4.0		94										11.8	13.8	7.6
	WHT	Whittington Health	Whittington Hospital	196	12.1	19.2	4.7		98										8.3	12.2	3.1
NORTH EAST	HOM	Homerton University Hospital NHS Foundation Trust	Homerton Hospital	151	7.4	20.4	3.8		73										9.6	2.7	4.2
	KNG	Barking Havering & Redbridge Univ Hosps NHS Trust	King George Hospital	193	13.4	19.2	4.7		100										11	8	6.6
	LON	Barts Health NHS Trust	The Royal London Hospital	262	12.1	18.0	5.5		124										15.5	19.4	5.7
	NWG	Barts Health NHS Trust	Newham University Hospital	6					0												
	QHR	Barking Havering & Redbridge Univ Hosps NHS Trust	Queen's Hospital - Romford	374	12.6	16.8	6.5		193										11.2	17.1	6.2
	WHC	Barts Health NHS Trust	Whipps Cross University Hospital	92	11.2	23.3	1.9		12										11.1	8.3	0
NORTH WEST	EAL	London North West Healthcare NHS Trust	Ealing Hospital	22	7.7	39.2	0.0		20										11.6	5	0
	HHX	Royal Brompton & Harefield NHS Foundation Trust	Harefield Hospital	7					2												
	HIL	The Hillingdon Hospitals NHS Foundation Trust	Hillingdon Hospital	126	11.4	21.3	3.2		83										11.4	2.4	2.4
	NPH	London North West Healthcare NHS Trust	Northwick Park/St Marks Hospital	272	11.9	17.9	5.7		158										10.5	11.4	6.5
	STM	Imperial College Healthcare NHS Trust	St Mary's Hospital	128	11.3	21.2	3.2		60										13.3	11.7	7
	WMU	Chelsea and Westminster Hosp NHS Foundation Trust	West Middlesex University Hospital	96	12.2	22.9	2.1		34										10.4	5.9	0
SOUTH EAST	BRO	King's College Hospital NHS Foundation Trust	The Princess Royal University Hospital	181	8.1	19.5	4.5		93										12.2	4.3	6.5
	KCH	King's College Hospital NHS Foundation Trust	King's College Hospital	219	15.0	18.7	5.1		82										14.6	13.4	1.3
	LEW	Lewisham and Greenwich NHS Trust	University Hospital Lewisham	123	9.9	21.5	3.1		60										10.6	13.3	5.1
	QEL	Lewisham and Greenwich NHS Trust	Queen Elizabeth Hospital (Lewisham and Greenwich NHS Trust)	186	12.4	19.4	4.5		111										12.5	10.8	6.4
	STH	Guy's and St Thomas' NHS Foundation Trust	St Thomas' Hospital	111	10.2	22.1	2.7		110										15.1	16.4	4.9

				YEARS 1 & 2					YEAR 2													
Region	Hospital Code	Health Boards	Hospital Name	Total number of cases in years 1 and 2 datasets	Adjusted mortality rate- %	99.8% upper outlier limit	99.8% lower outlier limit		Total number of cases in year 2 cleaned dataset	Final Case Ascertainment	CT reported before surgery	Risk documented before surgery	Arrival in theatre in timescale appropriate to urgency	Preoperative review by a consultant surgeon and anaesthetist when risk of death ≥5%	Consultant surgeon and anaesthetist present in theatre when risk of death ≥5%	Consultant surgeon present in theatre when risk of death ≥5%	Consultant anaesthetist present in theatre when risk of death ≥5%	Admitted to critical care following surgery when risk of death >10%	Assessment by elderly medicine specialist in patients > 70 years	Median length of stay following surgery in patients surviving to hospital discharge (days)	Proportion of patients returning to theatre after emergency laparotomy	Proportion of patients with unplanned critical care admission from the ward < 7 days following surgery
SOUTH WEST	BMP	Royal Brompton & Harefield NHS Foundation Trust	Royal Brompton Hospital	13	16.7	50.1	0.0		6													
	CHX	Imperial College Healthcare NHS Trust	Charing Cross	91	3.2	23.3	1.8		53											11.6	5.7	3.8
	GEO	St George's Healthcare NHS Trust	St George's Hospital	50	12.9	28.1	0.0		19											12.2	5.3	0
	KTH	Kingston Hospital NHS Trust	Kingston Hospital	241	16.3	18.3	5.3		114											11	4.4	4.5
	MAR	The Royal Marsden NHS Foundation Trust	Royal Marsden Hospital	46	6.1	29.2	0.0		22											18.4	9.1	0
	MAY	Croydon Health Services NHS Trust	Croydon University Hospital	121	12.3	21.5	3.0		27											8.8	7.4	3.8
	SHC	Epsom and St Helier University Hospitals NHS Trust	St Helier Hospital	305	13.4	17.5	6.0		148											11.6	6.8	2.8
	WES	Chelsea and Westminster Hosp NHS Foundation Trust	Chelsea and Westminster Hospital	54	6.8	27.5	0.0		6													

Central

				YEARS 1 & 2					YEAR 2													
Region	Hospital Code	Health Boards	Hospital Name	Total number of cases in years 1 and 2 datasets	Adjusted mortality rate - %	99.8% upper outlier limit	99.8% lower outlier limit		Total number of cases in year 2 cleaned dataset	Final Case Ascertainment	CT reported before surgery	Risk documented before surgery	Arrival in theatre in timescale appropriate to urgency	Preoperative review by a consultant surgeon and anaesthetist when risk of death ≥5%	Consultant surgeon and anaesthetist present in theatre when risk of death ≥5%	Consultant surgeon present in theatre when risk of death ≥5%	Consultant anaesthetist present in theatre when risk of death ≥5%	Admitted to critical care following surgery when risk of death >10%	Assessment by elderly medicine specialist in patients > 70 years	Median length of stay following surgery in patients surviving to hospital discharge (days)	Proportion of patients returning to theatre after emergency laparotomy	Proportion of patients with unplanned critical care admission from the ward < 7 days following surgery
CENTRAL																						
EAST MIDLANDS	CHE	Chesterfield Royal Hospital NHS Foundation Trust	Chesterfield Royal Hospital	168	15.0	19.9	4.2		107											13.3	6.5	3.8
	DER	Derby Hospitals NHS Foundation Trust	Royal Derby Hospital	338	9.0	17.2	6.2		181											9.6	7.2	2.2
	KGH	Kettering General Hospital NHS Foundation Trust	Kettering General Hospital	286	11.0	17.7	5.8		146											6.8	3.4	0
	KMH	Sherwood Forest Hospitals NHS Foundation Trust	Kings Mill Hospital	288	10.2	17.7	5.8		154											8.6	4.5	0.7
	LEI	University Hospitals of Leicester NHS Trust	Leicester General Hospital	168	5.7	19.9	4.2		118											9.6	1.7	2.6
	LER	University Hospitals of Leicester NHS Trust	Leicester Royal Infirmary	575	9.7	15.7	7.4		309											11.6	3.9	2.6
	LIN	United Lincolnshire Hospitals NHS Trust	Lincoln County Hospital	220	12.4	18.7	5.1		136											12.4	12.5	1.5
	NOT	Nottingham University Hospitals NHS Trust	Nottingham City Hospital	25	8.2	36.7	0.0		25											14.4	40	17.4
	NTH	Northampton General Hospital NHS Trust	Northampton General Hospital	380	10.6	16.8	6.5		199											9.3	5	4.6
	NUN	George Eliot Hospital NHS Trust	George Eliot Hospital	108	10.2	22.2	2.6		31											10	3.2	3.2
	PIL	United Lincolnshire Hospitals NHS Trust	Pilgrim Hospital	105	6.8	22.4	2.4		70											11.8	5.7	1.5
	QMC	Nottingham University Hospitals NHS Trust	Queens Medical Centre - Nottingham	689	10.7	15.3	7.7		338											10.6	16.6	4.1

				YEARS 1 & 2					YEAR 2														
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EAST OF ENGLAND	ADD	Cambridge University Hosps NHS Foundation Trust	Addenbrookes Hospital	525	8.7	15.9	7.2		284											10.9	10.2	3.2
	BAS	Basildon and Thurrock University Hospitals NHS Foundation Trust	Basildon University Hospital	191	7.4	19.3	4.6		99											11.1	9.1	6.1
	BED	Bedford Hospital NHS Trust	Bedford Hospital	174	12.9	19.7	4.3		83											10.4	4.8	1.2
	BFH	Mid Essex Hospital Services NHS Trust	Broomfield Hospital	197	15.8	19.1	4.7		117											9.5	6.8	6.8
	COL	Colchester Hospital University NHS Foundation Trust	Colchester General Hospital	326	11.5	17.3	6.1		163											9.85	12.3	3.2
	HIN	Hinchingbrooke Health Care NHS Trust	Hinchingbrooke Hospital	159	9.7	20.1	4.0		84											9.5	7.1	6
	IPS	Ipswich Hospital NHS Trust	Ipswich Hospital	283	8.2	17.7	5.8		159											10.4	14.5	4.5
	JPH	James Paget University Hosps NHS Foundation Trust	James Paget University Hospital	352	12.1	17.0	6.3		164											9.4	16.5	3.7
	LDH	Luton and Dunstable Hospital NHS Foundation Trust	Luton & Dunstable Hospital	331	12.9	17.2	6.2		187											10.2	8	3.9
	LIS	East and North Hertfordshire NHS Trust	Lister Hospital	202	14.9	19.0	4.8		95											8.8	5.3	6.7
	NOR	Norfolk and Norwich University Hospitals NHS Foundation Trust	Norfolk and Norwich University Hospital	316	8.9	17.4	6.1		89											10.4	6.7	2.3
	PAH	The Princess Alexandra Hospital NHS Trust	Princess Alexandra Hospital	64	20.7	26.0	0.2		18											10.1	11.1	5.6
	PAP	Papworth Hospital NHS Foundation Trust	Papworth Hospital	22	11.1	39.2	0.0		14											21.1	7.1	18.2
	PET	Peterborough & Stamford Hosps NHS Foundation Trust	Peterborough City Hospital	315	12.1	17.4	6.1		192											10.1	10.9	2.6
	QKL	The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust	The Queen Elizabeth Hospital - King's Lynn	215	11.1	18.8	5.0		104											10.1	7.7	1
	SEH	Southend University Hospital NHS Foundation Trust	Southend University Hospital	282	16.4	17.7	5.8		156											11.4	10.9	2.6
	WAT	West Hertfordshire Hospitals NHS Trust	Watford General Hospital	345	11.4	17.1	6.3		245											9.8	15.5	9.2
	WSH	West Suffolk NHS Foundation Trust	West Suffolk Hospital	256	8.7	18.1	5.5		141											9.4	10.6	2.9

Central (continued)

				YEARS 1 & 2					YEAR 2														
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WEST MIDLANDS	BRT	Burton Hospitals NHS Foundation Trust	Queen's Hospital - Burton	93	12.4	23.2	2.0		38											13.5	10.5	2.8
	CTY	Sandwell & West Birmingham Hospitals NHS Trust	City Hospital	35	13.7	32.2	0.0		15											26.2	13.3	6.7
	EBH	Heart of England NHS Foundation Trust	Birmingham Heartlands Hospital	385	9.0	16.8	6.5		259											8.5	10.8	2.4
	GHS	Heart of England NHS Foundation Trust	Good Hope Hospital	32	16.3	33.5	0.0		1													
	HCH	Wye Valley NHS Trust	Hereford County Hospital	217	14.3	18.7	5.0		118											9.6	11	7.9
	NCR	The Royal Wolverhampton Hospitals NHS Trust	New Cross Hospital	439	9.4	16.4	6.8		253											11.2	2.4	1.2
	PRS	The Shrewsbury and Telford Hospital NHS Trust	The Princess Royal Hospital	1					1													
	QEB	University Hosp Birmingham NHS Foundation Trust	Queen Elizabeth Hospital Birmingham	187	11.9	19.4	4.5		161											13.1	13	7.7
	RSH	University Hospitals of North Midlands NHS Trust	Royal Stoke University Hospital	396	14.3	16.7	6.6		114											11.6	5.3	6.1
	RSS	The Shrewsbury and Telford Hospital NHS Trust	Royal Shrewsbury Hospital	407	12.7	16.6	6.7		311											8.5	7.1	4
	RUS	The Dudley Group NHS Foundation Trust	Russells Hall Hospital	393	9.2	16.7	6.6		214											11.2	8.4	5.8
	SAN	Sandwell & West Birmingham Hospitals NHS Trust	Sandwell General Hospital	167	15.1	19.9	4.2		68											7.6	1.5	1.5
	UHC	University Hospitals Coventry & Warwickshire NHS Trust	University Hospital, Coventry	485	13.6	16.1	7.0		194											10.2	9.8	3.2
	WAW	South Warwickshire NHS Foundation Trust	Warwick Hospital	138	18.3	20.8	3.5		84											9	4.8	6
	WMH	Walsall Healthcare NHS Trust	Walsall Manor Hospital	209	11.5	18.9	4.9		106											12.6	13.2	2.9
	WRC	Worcestershire Acute Hospitals NHS Trust	Worcestershire Royal Hospital	415	13.5	16.6	6.7		258											11.3	8.1	7.2

				YEARS 1 & 2					YEAR 2														
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NORTH																							
NORTH EAST	DAR	County Durham & Darlington NHS Foundation Trust	Darlington Memorial Hospital	224	13.9	18.6	5.1		106											9.5	9.4	1
	DRY	County Durham & Darlington NHS Foundation Trust	University Hospital North Durham	304	9.9	17.5	6.0		155											9.4	9	5.3
	FRE	The Newcastle upon Tyne Hospitals NHS Foundation Trust	Freeman Hospital	155	9.7	20.3	3.9		84											17.5	11.9	3.6
	NSH	Northumbria Healthcare NHS Foundation Trust	Northumbria Specialist Emergency Care Hospital	464	15.9	16.3	6.9		250											9.5	2.4	3.3
	NTG	North Tees & Hartlepool NHS Foundation Trust	University Hospital of North Tees	112	10.0	22.0	2.8		77											10.6	11.7	6.5
	QEG	Gateshead Health NHS Foundation Trust	Queen Elizabeth Hospital - Gateshead	253	13.4	18.1	5.5		143											11.6	12.6	4.2
	RVN	The Newcastle upon Tyne Hospitals NHS Foundation Trust	Royal Victoria Infirmary	498	10.9	16.1	7.1		254											10.5	4.7	2.4
	SCM	South Tees Hospitals NHS Foundation Trust	The James Cook University Hospital	260	10.9	18.0	5.5		127											13.3	7.1	5.6
	STD	South Tyneside NHS Foundation Trust	South Tyneside District Hospital	135	10.9	21.0	3.4		66											10.6	6.1	3.1
	SUN	City Hospitals Sunderland NHS Foundation Trust	Sunderland Royal Hospital	372	13.8	16.9	6.5		180											12.2	22.8	5.6

				YEARS 1 & 2					YEAR 2													
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NORTH WEST	AEI	Wrightington, Wigan & Leigh NHS Foundation Trust	Royal Albert Edward Infirmary	250	13.3	18.2	5.4		137											10.1	10.9	2.2
	BLA	East Lancashire Hospitals NHS Trust	Royal Blackburn Hospital	431	13.2	16.5	6.8		213											12.3	5.6	4.8
	BOL	Bolton NHS Foundation Trust	Royal Bolton Hospital	225	10.3	18.6	5.1		157											12.2	12.7	7.7
	CHR	The Christie NHS Foundation Trust	The Christie	39	11.3	30.7	0.0		23											14.4	0	4.3
	CMI	North Cumbria University Hospitals NHS Trust	Cumberland Infirmary	310	13.2	17.4	6.0		191											8.5	11	3.2
	COC	Countess of Chester Hospital NHS Foundation Trust	Countess of Chester Hospital	211	9.5	18.9	4.9		107											8.6	6.5	1.9
	FAZ	Aintree University Hospitals NHS Foundation Trust	Aintree University Hospital	299	11.4	17.6	5.9		191											11.7	13.1	7.6
	FGH	University Hospitals of Morecambe Bay NHS Foundation Trust	Furness General Hospital	117	9.0	21.8	2.9		65											10.6	4.6	1.5
	LEG	Mid Cheshire Hospitals NHS Foundation Trust	Leighton Hospital	185	7.6	19.4	4.5		102											15	7.8	6.9
	LHC	Liverpool Heart & Chest Hospital NHS Foundation Trust	Liverpool Heart and Chest Hospital	19	13.9	41.5	0.0		14											25.2	14.3	0
	MAC	East Cheshire NHS Trust	Macclesfield District General Hospital	166	12.5	19.9	4.2		84											9.6	2.4	2.4
	MRI	Central Manchester University Hospitals NHS Foundation Trust	Manchester Royal Infirmary	325	8.4	17.3	6.1		183											14.6	14.8	1.1
	NMG	The Pennine Acute Hospitals NHS Trust	North Manchester General Hospital	117	9.3	21.8	2.9		95											10.4	2.1	3.2
	OHM	The Pennine Acute Hospitals NHS Trust	The Royal Oldham Hospital	217	10.4	18.7	5.0		103											14.5	6.8	6
	RLI	University Hospitals of Morecambe Bay NHS Foundation Trust	Royal Lancaster Infirmary	204	10.6	19.0	4.8		128											12.4	3.1	1.6
	RLU	Royal Liverpool and Broadgreen Univ Hospitals NHS Trust	Royal Liverpool University Hospital	371	10.1	16.9	6.5		190											14.4	6.3	3.2
	RPH	Lancashire Teaching Hospitals NHS Foundation Trust	Royal Preston Hospital	311	10.6	17.4	6.0		157											12.3	1.3	0
	SHH	Stockport NHS Foundation Trust	Stepping Hill Hospital	310	6.9	17.4	6.0		138											11.1	7.2	3
	SLF	Salford Royal NHS Foundation Trust	Salford Royal Hospital	275	11.0	17.8	5.7		128											12.3	7	2.3
	SPD	Southport & Ormskirk Hospital NHS Trust	Southport District General Hospital	195	10.4	19.2	4.7		102											11.5	7.8	5.1
	TGA	Tameside Hospital NHS Foundation Trust	Tameside General Hospital	210	13.7	18.9	4.9		108											11.1	11.1	8.6
	VIC	Blackpool Teaching Hospitals NHS Foundation Trust	Blackpool Victoria Hospital	382	15.5	16.8	6.5		189											11.5	5.8	1.7
	WDG	Warrington & Halton Hospitals NHS Foundation Trust	Warrington Hospital	231	12.6	18.5	5.2		114											13.2	11.4	1.8
	WHI	St Helens & Knowsley Teaching Hospitals NHS Trust	Whiston Hospital	131	13.0	21.1	3.3		74											11.1	12.2	4.3
	WIR	Wirral University Teaching Hospital NHS Foundation Trust	Arrowe Park Hospital	388	10.3	16.7	6.5		227											10.6	4	0.4
	WLT	The Walton Centre NHS Foundation Trust	The Walton Centre	4					1													
	WYT	University Hospital of South Manchester NHS Foundation Trust	Wythenshawe Hospital	271	6.8	17.9	5.6		128											8.6	0.8	0.8

				YEARS 1 & 2					YEAR 2													
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YORKSHIRE AND HUMBER	AIR	Airedale NHS Foundation Trust	Airedale General Hospital	143	15.8	20.7	3.6		83											10.1	20.5	42
	BAR	Barnsley Hospital NHS Foundation Trust	Barnsley Hospital	216	15.6	18.8	5.0		114											12.3	14	4.5
	BRD	Bradford Teaching Hospitals NHS Foundation Trust	Bradford Royal Infirmary	274	17.8	17.9	5.7		130											11.5	2.3	7.8
	CAL	Calderdale & Huddersfield NHS Foundation Trust	Calderdale Royal Hospital	0					0													
	CAS	Hull and East Yorkshire Hospitals NHS Trust	Castle Hill Hospital	61	8.2	26.3	0.1		7													
	DDH	The Mid Yorkshire Hospitals NHS Trust	Dewsbury and District Hospital	108	16.0	22.2	2.6		39											9.65	12.8	7.9
	DID	Doncaster and Bassetlaw Hosps NHS Foundation Trust	Doncaster Royal Infirmary	229	7.9	18.5	5.2		127											10.3	8.7	0
	FRR	South Tees Hospitals NHS Foundation Trust	Friarage Hospital	117	7.2	21.8	2.9		52											13	9.6	5.9
	GGH	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust	Diana Princess of Wales Hospital	197	13.6	19.1	4.7		75											13	5.3	0
	HAR	Harrogate and District NHS Foundation Trust	Harrogate District Hospital	134	11.5	21.0	3.4		61											13.1	3.3	1.7
	HUD	Calderdale & Huddersfield NHS Foundation Trust	Huddersfield Royal Infirmary	269	7.4	17.9	5.6		126											13	1.6	0.8
	HUL	Hull and East Yorkshire Hospitals NHS Trust	Hull Royal Infirmary	165	9.1	19.9	4.2		74											13.3	6.8	4.1
	LGI	Leeds Teaching Hospitals NHS Trust	Leeds General Infirmary	1					0													
	NGS	Sheffield Teaching Hospitals NHS Foundation Trust	Northern General Hospital	308	11.0	17.5	6.0		160											11.3	4.4	2.5
	PIN	The Mid Yorkshire Hospitals NHS Trust	Pinderfields Hospital	261	10.5	18.0	5.5		148											11.1	6.1	2.1
	ROT	The Rotherham NHS Foundation Trust	Rotherham Hospital	119	13.2	21.7	2.9		54											13.4	5.6	0
	SCA	York Teaching Hospital NHS Foundation Trust	Scarborough Hospital	145	12.5	20.6	3.7		88											9.9	8	3.5
	SCU	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust	Scunthorpe General Hospital	142	10.1	20.7	3.6		67											10.5	4.5	3
	SJH	The Leeds Teaching Hospitals NHS Trust	St James's University Hospital	681	10.2	15.4	7.7		415											10.2	8.4	4.4
	YDH	York Teaching Hospital NHS Foundation Trust	York Hospital	370	9.6	16.9	6.4		207											10.4	13	3.5

South of England

				YEARS 1 & 2					YEAR 2													
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SOUTH																						
SOUTH CENTRAL	CCH	Oxford University Hospitals NHS Trust	Churchill Hospital	8					0													
	MIW	Isle of Wight NHS Trust	St Mary's Hospital - IOW	131	15.2	21.1	3.3		70										10.7	12.9	4.3
	MKH	Milton Keynes Hospital NHS Foundation Trust	Milton Keynes Hospital	136	11.6	20.9	3.5		89										8.5	7.9	4.6
	NHH	Hampshire Hospitals NHS Foundation Trust	Basingstoke & North Hampshire Hospital	153	7.8	20.3	3.9		85										10	3.5	1.2
	QAP	Portsmouth Hospitals NHS Trust	Queen Alexandra Hospital	571	9.8	15.7	7.4		301										10.6	9	0.7
	RAD	Oxford University Hospitals NHS Trust	John Radcliffe Hospital	207	10.6	18.9	4.9		119										9.5	16	5
	RBE	Royal Berkshire NHS Foundation Trust	Royal Berkshire Hospital	337	12.5	17.2	6.2		181										7.4	14.4	4.5
	RHC	Hampshire Hospitals NHS Foundation Trust	Royal Hampshire County Hospital	181	8.3	19.5	4.5		92										8.4	10.9	2.2
	SGH	University Hospital Southampton NHS Foundation Trust	Southampton General Hospital	489	9.3	16.1	7.1		240										12	9.6	3.8
	SMV	Buckinghamshire Healthcare NHS Trust	Stoke Mandeville Hospital	205	10.0	19.0	4.9		138										8.6	15.2	1.6
	WEX	Frimley Health NHS Foundation Trust	Wexham Park Hospital	261	10.5	18.0	5.5		114										10.1	8.8	8
SOUTH EAST COAST	CKH	East Kent Hospitals University NHS Foundation Trust	Kent and Canterbury Hospital	9					6												
	CON	East Sussex Healthcare NHS Trust	Conquest Hospital	203	14.4	19.0	4.8		150										12.4	6	2.7
	DVH	Dartford & Gravesham NHS Trust	Darent Valley Hospital	246	11.3	18.2	5.4		131										12.1	13	6.3
	ESU	Surrey & Sussex Healthcare NHS Trust	East Surrey Hospital	291	9.4	17.7	5.9		110										9.8	10	2.8
	FRM	Frimley Health NHS Foundation Trust	Frimley Park Hospital	195	12.1	19.2	4.7		89										12.4	7.9	8.2
	MDW	Medway NHS Foundation Trust	Medway Maritime Hospital	335	14.4	17.2	6.2		180										10.4	14.4	2.8
	MST	Maidstone and Tunbridge Wells NHS Trust	Maidstone Hospital	2					1												
	QEQ	East Kent Hospitals University NHS Foundation Trust	Queen Elizabeth The Queen Mother Hospital	300	8.1	17.6	5.9		145										8.6	8.3	9.1
	RSC	Brighton and Sussex University Hospitals NHS Trust	Royal Sussex County Hospital	326	13.6	17.3	6.1		241										10.5	13.3	0.9
	RSU	Royal Surrey County Hospital NHS Foundation Trust	Royal Surrey County Hospital	222	8.1	18.7	5.1		134										11.1	7.5	3
	SPH	Ashford & St Peter's Hospital NHS Foundation Trust	St Peter's Hospital	349	11.3	17.1	6.3		178										11.3	14.6	7.5
	STR	Western Sussex Hospitals NHS Trust	St Richards Hospital	200	9.5	19.1	4.7		121										13.3	10.7	0
	TUN	Maidstone and Tunbridge Wells NHS Trust	Tunbridge Wells Hospital	233	7.2	18.4	5.2		136										11.5	8.8	0.7
	WHH	East Kent Hospitals University NHS Foundation Trust	William Harvey Hospital	378	12.7	16.8	6.5		212										11.4	9.4	2.9
	WRG	Western Sussex Hospitals NHS Trust	Worthing Hospital	172	10.7	19.7	4.3		161										11.6	6.8	1.3

				YEARS 1 & 2					YEAR 2													
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SOUTH WEST	BAT	Royal United Hospital Bath NHS Trust	Royal United Hospital	339	9.3	17.1	6.2		172											9.9	17.4	3.6
	BRI	University Hospitals of Bristol NHS Foundation Trust	Bristol Royal Infirmary	292	10.3	17.6	5.9		141											11.4	11.3	3.6
	BTH	The Royal Bournemouth and Christchurch Hosps NHS Foundation Trust	The Royal Bournemouth Hospital	346	9.6	17.1	6.3		162											9.7	9.9	4.4
	CGH	Gloucestershire Hospitals NHS Foundation Trust	Cheltenham Hospital	221	8.1	18.7	5.1		115											10.3	9.6	1.8
	GLO	Gloucestershire Hospitals NHS Foundation Trust	Gloucestershire Royal Hospital	343	8.6	17.1	6.3		171											9	6.4	4.2
	MPH	Taunton & Somerset NHS Foundation Trust	Musgrove Park Hospital	339	10.4	17.1	6.2		186											10.5	7	3.3
	NDD	Northern Devon Healthcare NHS Trust	North Devon District Hospital	133	9.6	21.0	3.3		68											9.4	10.3	1.5
	PGH	Poole Hospital NHS Foundation Trust	Poole Hospital	235	12.9	18.4	5.2		130											8	6.2	1.6
	PLY	Plymouth Hospitals NHS Trust	Derriford Hospital	537	11.5	15.9	7.3		291											10.6	15.8	4.6
	PMS	Great Western Hospitals NHS Foundation Trust	The Great Western Hospital	365	13.5	16.9	6.4		199											11.5	3	2
	RCH	Royal Cornwall Hospitals NHS Trust	Royal Cornwall Hospital	476	7.5	16.2	7.0		242											8.5	9.1	3.3
	RDE	Royal Devon & Exeter NHS Foundation Trust	Royal Devon & Exeter Hospital	396	10.5	16.7	6.6		204											10.3	6.9	2.5
	SAL	Salisbury NHS Foundation Trust	Salisbury District Hospital	132	12.0	21.1	3.3		80											9.4	1.3	2.5
	SMH	North Bristol NHS Trust	Southmead Hospital	322	6.6	17.3	6.1		224											9.2	16.1	2.7
	TOR	South Devon Healthcare NHS Foundation Trust	Torbay District General Hospital	303	14.4	17.5	6.0		180											9.8	7.2	6.4
	WDH	Dorset County Hospital	Dorset County Hospital	255	11.4	18.1	5.5		136											9.6	10.3	0
	WGH	Weston Area Health NHS Trust	Weston General Hospital	228	15.7	18.5	5.2		111											11.8	11.7	0.9
	YEO	Yeovil District Hospital NHS Foundation Trust	Yeovil District Hospital	164	9.7	20.0	4.1		79											10.4	12.7	5.1

Wales

				YEARS 1 & 2					YEAR 2														
Region	Hospital Code	Health Boards	Hospital Name	Total number of cases in years 1 and 2 datasets	Adjusted mortality rate - %	99.8% upper outlier limit	99.8% lower outlier limit		Total number of cases in year 2 cleaned dataset	Final Case Ascertainment	CT reported before surgery	Risk documented before surgery	Arrival in theatre in timescale appropriate to urgency	Preoperative review by a consultant surgeon and anaesthetist when risk of death ≥5%	Consultant surgeon and anaesthetist present in theatre when risk of death ≥5%	Consultant surgeon present in theatre when risk of death ≥5%	Consultant anaesthetist present in theatre when risk of death ≥5%	Admitted to critical care following surgery when risk of death >10%	Assessment by elderly medicine specialist in patients > 70 years	Median length of stay following surgery in patients surviving to hospital discharge (days)	Proportion of patients returning to theatre after emergency laparotomy	Proportion of patients with unplanned critical care admission from the ward < 7 days following surgery
WALES																							
WALES	BRG	Hywel Dda Health Board	Bronglais General Hospital	95	10.2	23.0	2.1		48											13.1	12.5	2.2
WALES	CLW	Betsi Cadwaladr University Health Board	Glan Clwyd District General Hospital	203	13.0	19.0	4.8		109											10.3	18.3	2.8
WALES	GLG	Hywel Dda Health Board	Glangwili General Hospital	212	14.1	18.8	4.9		115											14.4	20	6.1
WALES	GWE	Aneurin Bevan Health Board	Royal Gwent Hospital	408	14.7	16.6	6.7		197											11.2	7.6	5.1
WALES	GWY	Betsi Cadwaladr University Health Board	Ysbyty Gwynedd Hospital	158	10.5	20.1	4.0		86											14.2	9.3	6.2
WALES	MOR	Abertawe Bro Morgannwg University Health Board	Morriston Hospital	445	11.4	16.4	6.9		259											12	7.7	2
WALES	NEV	Aneurin Bevan Health Board	Nevill Hall Hospital	185	13.5	19.4	4.5		86											15.4	5.8	4.8
WALES	PCH	Cwm Taf Health Board	Prince Charles Hospital	157	18.0	20.2	4.0		76											10.4	9.2	8.3
WALES	POW	Abertawe Bro Morgannwg University Health Board	Princess of Wales Hospital	164	17.5	20.0	4.1		92											9.9	7.6	5.7
WALES	RGH	Cwm Taf Health Board	Royal Glamorgan	151	18.1	20.4	3.8		90											14	12.2	4.7
WALES	UHL	Cardiff and Vale University Health Board	University Hospital Llandough	1					0													
WALES	UHW	Cardiff and Vale University Health Board	University Hospital of Wales	567	13.3	15.8	7.4		303											11.1	8.9	3.4
WALES	WRX	Betsi Cadwaladr University Health Board	Wrexham Maelor Hospital	106	18.7	22.4	2.5		70											9.4	15.7	3
WALES	WYB	Hywel Dda Health Board	Withybush General Hospital	101	12.1	22.6	2.3		57											11.4	1.8	8.9

Key

Green ≥80% (EXCEPT case ascertainment where green ≥70%)

Amber 50–79% (EXCEPT case ascertainment where amber is 50-69%)

Red <50%

Grey Cells = not applicable/too few cases to report/data uncertain

Timeliness of arrival = excluding expedited cases (category 3)

Critical care admission when P-POSSUM mortality risk >10%: excludes patients that died in theatre and those noted to be for palliative care only post operatively

Hospitals in orange contributed no cases to year 2

Hospitals in blue contributed <10 cases to year 2

21.2 SUPPLEMENTARY SUMMARY TABLES

Table 37 Proportion of patients who were reviewed by a consultant surgeon within 14 hours of emergency admission to hospital. Data presented for patients admitted as an emergency and for whom the time of consultant review had been entered into the NELA web tool (Year 2 data)

	Total number of patients	Proportion of patients reviewed by consultant surgeon within 14 hours of admission (%)
Age (years)		
18–39	1,755	56
40–49	1,595	58
50–59	2,314	57
60–69	3,437	55
70–79	4,138	54
80–89	3,022	53
≥90	424	52
ASA		
1	1,778	64
2	5,890	56
3	5,894	52
4	2,834	53
5	289	54
Documented risk		
Lower	4,215	58
High	2,385	56
Highest	4,337	55
Not documented	5,748	52
Overall	**16,685**	**55%**

Table 38 Preoperative CT scanning and reporting by a consultant radiologist by time of day and day of week of emergency hospital admission (Year 2 data)

Time of emergency admission to hospital	Monday–Friday		Saturday–Sunday	
	CT scan before surgery (%)	CT scan reported by a consultant radiologist before surgery (%)	CT scan before surgery (%)	CT scan reported by a consultant radiologist before surgery (%)
0800–1159	81	72	85	73
1200–1759	83	72	83	72
1800–2359	84	71	84	72
0000–0759	81	72	85	74
Overall	**82%**	**72%**	**84%**	**73%**

Table 39 Preoperative CT scanning and reporting by patient characteristics (Year 2 data)

	Total number of patients	Proportion who had a CT scan before surgery (%)	Proportion who had a CT scan reported by a consultant radiologist before surgery (%)
Age (years)			
18–39	2,452	72	61
40–49	2,265	81	69
50–59	3,253	83	72
60–69	4,796	85	74
70–79	5,767	85	74
80–89	4,068	86	76
≥90	537	84	76
ASA			
1	2,381	78	67
2	7,990	83	73
3	8,161	85	74
4	4,141	83	71
5	465	74	60
Admission type			
Emergency	21,552	84	73
Elective	1,586	71	62
Documented risk			
Lower	5,504	83	74
High	3,196	87	78
Highest	6,105	84	73
Not documented	8,333	80	69
Overall	**23,138**	**83%**	**72%**

Table 40 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 (Year 2 data)

	Number of hours from admission to first antibiotics Median (IQR)	Number of hours from admission to arrival in theatre Median (IQR)	Number of hours from decision to operate to arrival in theatre Median (IQR)
Age (years)			
18–39	3.1 (1.7–6.3)	7.1 (4.5–12.5)	2.0 (1.1–3.1)
40–49	3.6 (1.7–6.8)	7.7 (4.5–12.0)	1.9 (1.1–3.0)
50–59	3.4 (1.5–6.3)	7.5 (4.8–12.4)	1.8 (1.1–3.0)
60–69	3.0 (1.2–7.0)	7.5 (4.5–12.0)	1.9 (1.1–3.0)
70–79	3.0 (1.3–6.3)	8.0 (5.0–14.3)	1.8 (1.2–2.8)
80–89	3.9 (1.5–7.2)	8.0 (5.2–13.5)	1.8 (1.1–3.0)
≥90	3.5 (1.4–7.9)	10.3 (7.1–16.4)	2.5 (1.8–3.6)
ASA			
1	3.3 (1.7–6.6)	7.6 (4.7–12.6)	2.0 (1.1–3.2)
2	3.8 (1.8–6.9)	7.6 (5.0–12.5)	1.8 (1.2–3.0)
3	3.7 (1.6–7.1)	8.5 (5.4–13.6)	2.0 (1.2–3.0)
4	2.9 (1.0–6.1)	7.5 (4.6–12.8)	1.7 (1.1–2.7)
5	2.0 (0.8–4.0)	6.5 (3.8–10.3)	1.2 (0.8–2.0)
Documented risk			
Lower	3.5 (2.0–6.6)	7.9 (5.0–12.7)	2.0 (1.2–3.2)
High	3.1 (1.4–6.3)	8.0 (4.5–11.9)	1.8 (1.1–3.0)
Highest	3.0 (1.1–6.2)	7.5 (4.8–12.3)	1.7 (1.1–2.8)
Not documented	3.7 (1.7–7.5)	8.1 (5.0–13.8)	2.0 (1.1–3.0)
Operative urgency			
<2 hours	2.8 (1.1–5.7)	6.5 (3.5–10.6)	1.5 (0.8–2.1)
2–6 hours	3.5 (1.7–6.9)	8.4 (5.3–13.5)	2.1 (1.3–3.3)
Overall	**3.3 (1.4–6.6)**	**7.7 (4.8–12.8)**	**1.9 (1.1–3.0)**

Table 41 Interval between admission and 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) (Year 2 data)

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	3.6 (1.7–6.3)	3.0 (1.3–6.5)
1200–1759	3.5 (1.5–6.8)	3.0 (1.0–5.4)
1800–2359	3.3 (1.3–6.7)	3.5 (1.7–9.0)
0000–0759	3.2 (1.3–6.5)	4.4 (1.9–9.0)
Overall	**3.3 (1.5–6.6)**	**3.3 (1.4–6.8)**

Table 42 Intervals between admission and arrival in theatre, and decision to operate and 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) (Year 2 data)

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	7.7 (5.2–10.8)	2.0 (1.1–3.0)	7.1 (4.7–9.2)	2.0 (1.0–3.1)
1200–1759	7.3 (4.9–11.0)	1.8 (1.2–2.9)	7.0 (5.0–10.0)	1.8 (1.0–2.8)
1800–2359	8.6 (4.2–15.5)	2.0 (1.1–3.0)	9.9 (5.2–16.3)	1.9 (1.2–3.0)
0000–0759	8.4 (5.0–12.7)	1.8 (1.2–3.0)	8.7 (5.5–12.3)	2.2 (1.2–3.3)
Overall	**7.7 (4.7–12.9)**	**1.8 (1.2–3.0)**	**7.6 (5.0–12.6)**	**1.9 (1.1–3.0)**

Table 43 Proportion of patients who arrived in theatre in a timescale appropriate to their operative urgency after the decision was made to perform surgery (or from time of booking if time of decision unavailable). Expedited surgery (category 3) has been excluded from this analysis (Year 2 data)

	Surgery required within 2 hours		Surgery required within 2–6 hours		Surgery required within 6–18 hours		All patients assessed	
	n=	%	n=	%	n=	%	n=	%
Age (years)								
18–39	263	74	791	87	645	82	1,699	83
40–49	241	72	813	88	607	82	1,661	83
50–59	391	69	1,111	87	840	82	2,342	82
60–69	553	71	1,631	87	1,264	81	3,448	82
70–79	698	73	1,923	85	1,543	80	4,164	81
80–89	457	67	1,441	84	1,121	81	3,019	81
≥90	29	62	184	86	167	84	380	84
ASA								
1	198	74	875	89	721	87	1,794	87
2	447	70	2,529	86	2,529	81	5,505	83
3	684	67	2,739	84	2,252	80	5,675	80
4	1,035	67	1,630	87	669	80	3,334	81
5	268	76	121	93	16	56	405	81
Admission type								
Emergency	2,288	70	7,301	86	5,917	81	15,506	82
Elective	344	79	593	90	270	84	1,207	86
Documented risk								
Lower	202	64	1,754	86	1,913	83	3,869	84
High	271	69	1,143	85	895	81	2,309	82
Highest	1,497	70	2,443	87	1,038	82	4,978	81
Not documented	662	74	2,554	85	2,341	80	5,557	82
Overall	**2,632**	**71%**	**7,894**	**86%**	**6,187**	**81%**	**16,713**	**82%**

Table 44 Proportion of patients who arrived in theatre in a timescale appropriate to their operative urgency category, by time of day and day of week of arrival in an operating theatre. Expedited surgery (category 3) has been excluded from this analysis (Year 2 data)

Time of arrival in operating theatre	Monday–Friday (%)			Saturday–Sunday (%)		
	Surgery required within 2 hours	Surgery required within 2–6 hours	Surgery required within 6–18 hours	Surgery required within 2 hours	Surgery required within 2–6 hours	Surgery required within 6–18 hours
0800–1159	76	80	73	69	84	75
1200–1759	66	86	80	60	88	80
1800–2359	66	87	91	73	86	90
0000–0759	77	88	96	76	90	93
Overall	**70%**	**86%**	**81%**	**70%**	**87%**	**81%**

Table 45 Proportions of patients receiving input before surgery by consultant surgeons and consultant anaesthetists by patient characteristics (Year 2 data)

	Total number of patients	Proportion of patients (%)			
		Decision to operate made in person by a consultant surgeon and patient reviewed preoperatively by a consultant anaesthetist	Decision to operate made in person by a consultant surgeon	Preoperative review by a consultant anaesthetist	Decision to operate not made in person by a consultant surgeon and patient not reviewed preoperatively by a consultant anaesthetist
Age (years)					
18–39	2,452	51	70	69	12
40–49	2,265	53	70	72	12
50–59	3,253	55	71	73	10
60–69	4,796	57	74	74	9
70–79	5,767	57	72	76	9
80–89	4,068	58	73	77	8
≥90	537	60	74	77	8
ASA					
1	2,381	48	68	67	14
2	7,990	54	73	70	10
3	8,161	58	74	75	9
4	4,141	60	69	82	8
5	465	58	63	86	8
Admission type					
Emergency	21,552	56	72	74	10
Elective	1,586	58	72	76	9
Overall	**23,138**	**56%**	**72%**	**74%**	**10%**

Table 46 Proportions of patients whose *care during surgery* was directly supervised by consultant surgeons and consultant anaesthetists by patient characteristics (Year 2 data)

	Total number of patients	Proportion of patients (%)			
		Both consultants present in theatre	Consultant surgeon present	Consultant anaesthetist present	Neither consultant present in theatre
Age (years)					
18–39	2,452	65	86	72	7
40–49	2,265	66	86	74	6
50–59	3,253	70	88	78	5
60–69	4,796	71	87	78	5
70–79	5,767	71	87	80	5
80–89	4,068	72	86	81	4
≥90	537	71	84	82	5
ASA					
1	2,381	59	82	68	9
2	7,990	66	85	75	6
3	8,161	71	87	80	4
4	4,141	79	90	86	3
5	465	87	93	94	1
Admission type					
Emergency	21,552	69	86	78	5
Elective	1,586	77	92	82	3
Overall	**23,138**	**70%**	**87%**	**78%**	**5%**

Table 47 Proportion of patients receiving input before surgery by consultant surgeons and consultant anaesthetists by time of day and day of week of arrival in theatre (Year 2 data)

Time of arrival in operating theatre	Monday–Friday (%)			Saturday–Sunday (%)		
	Both consultants	Consultant surgeon	Consultant anaesthetist	Both consultants	Consultant surgeon	Consultant anaesthetist
0800–1159	63	77	81	53	76	69
1200–1759	65	81	80	56	78	70
1800–2359	52	69	71	43	61	66
0000–0759	23	34	57	25	38	55
Overall	**58%**	**73%**	**76%**	**49%**	**69%**	**67%**

Table 48 Proportions of patients whose care during surgery was directly supervised by consultant surgeons and consultant anaesthetists by day of arrival in theatre (Year 2 data)

Day of arrival in operating theatre	Total number of patients	Proportion of patients (%)			
		Both consultants present in theatre	Consultant surgeon present	Consultant anaesthetist present	Neither consultant present in theatre
Monday	2,988	72	87	81	5
Tuesday	3,556	73	87	82	4
Wednesday	3,669	73	87	82	4
Thursday	3,694	73	87	82	4
Friday	3,537	70	85	80	5
Saturday	2,917	62	87	69	6
Sunday	2,777	62	86	69	7
Overall	**23,138**	**70%**	**87%**	**78%**	**5%**

Table 49 Proportions of patients receiving goal directed fluid therapy and method of provision by patient characteristics (Year 2 data)

	Total number of patients	Proportion of patients (%)		
		Cardiac output monitor	Other method	Overall
Age (years)				
18–39	2,452	31	13	44
40–49	2,265	34	13	47
50–59	3,253	38	14	52
60–69	4,796	42	15	57
70–79	5,767	41	16	57
80–89	4,068	43	16	59
≥90	537	39	15	54
ASA				
1	2,381	29	12	42
2	7,990	35	14	48
3	8,161	41	15	57
4	4,141	48	17	66
5	465	46	25	70
Admission type				
Emergency	21,552	39	15	54
Elective	1,586	39	16	55
Documented risk				
Lower	5,504	35	14	49
High	3,196	43	16	58
Highest	6,105	51	17	68
Not documented	8,333	32	14	46
Overall	**23,138**	**39%**	**15%**	**54%**

Table 50 Proportions of patients receiving goal directed fluid therapy and method of provision by documented urgency of surgery (Year 2 data)

Urgency of surgery	Total number of patients	Proportion of patients (%)		
		Cardiac output monitoring	Other method	Overall
<2 hours	2,943	45	19	64
2–6 hours	8,948	42	15	57
6–18 hours	7,273	36	14	50
18–24 hours	3,869	33	14	47
Overall	**23,033**	**39%**	**15%**	**54%**

Table 51 Proportion of patients admitted directly to a high dependency or intensive care bed after surgery by patient characteristics (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

	Total number of patients	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
Age (years)		
18–39	2,438	40
40–49	2,238	47
50–59	3,194	54
60–69	4,683	63
70–79	5,607	68
80–89	3,923	75
≥90	515	72
ASA		
1	2,375	31
2	7,931	45
3	8,001	69
4	3,906	91
5	385	99
Admission type		
Emergency	21,041	60
Elective	1,557	75
Overall	**22,598**	**61%**

Table 52 Proportion of patients admitted directly to a high dependency or intensive care bed after surgery by operative urgency (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Urgency of surgery	Total number of patients	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
<2 hours	2,773	87
2–6 hours	8,762	67
6–18 hours	7,177	51
18–24 hours	3,784	46
Overall	**22,496**	**61%**

Table 53 Proportion of *all patients* admitted directly to a high dependency or intensive care bed after surgery by time of day and day of week that surgery was commenced (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Time of arrival in operating theatre	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)	
	Monday–Friday (%)	Saturday–Sunday (%)
0800–1159	56	56
1200–1759	58	60
1800–2359	67	68
0000–0759	75	73
Overall	**64%**	**64%**

Table 54 Proportion of all patients admitted directly to a high dependency or intensive care bed after surgery by the day that surgery was commenced (excluding 69 patients who died intraoperatively and 471 patients with an active decision not to admit to critical care) (Year 2 data)

Day of arrival in operating theatre	Total number of patients	Frequency (%)	Proportion of patients admitted directly to a high dependency or intensive care bed after surgery (%)
Monday	2,923	13	62
Tuesday	3,471	15	61
Wednesday	3,584	16	60
Thursday	3,605	16	60
Friday	3,453	15	61
Saturday	2,850	13	62
Sunday	2,712	12	62
Overall	**22,598**	**100%**	**61%**

Table 55 Proportion of patients aged 70 years or over who were assessed after surgery by an Elderly Medicine specialist following emergency laparotomy by patient characteristics (Year 2 data)

	Total number of patients	Proportion of patients assessed after surgery by an Elderly Medicine specialist (%)
ASA		
1	249	4
2	2,784	8
3	4,570	11
4	2,544	12
5	225	6
Admission type		
Emergency	9,668	11
Elective	704	6
Documented risk		
Lower	1,581	8
High	1,652	11
Highest	3,825	12
Not documented	3,314	9
Overall	**10,372**	**10%**

Table 56 ONS 30-day and 90-day mortality by patient characteristics (Year 2 data)

	Number of patients (frequency (%))	ONS 30–day mortality (%)	ONS 90–day mortality (%)
Age (years)			
18–39	2,455 (11)	2.2	2.9
40–49	2,270 (10)	3.0	4.9
50–59	3,255 (14)	6.3	9.0
60–69	4,805 (21)	10.0	15.4
70–79	5,779 (25)	14.7	19.4
80–89	4,075 (17)	19.7	25.6
≥90	538 (2)	21.0	29.0
ASA			
1	2,385 (10)	0.9	1.5
2	8,008 (35)	2.9	4.7
3	8,170 (35)	9.6	15.2
4	4,149 (18)	30.3	37.1
5	465 (2)	60.4	64.5
Admission type			
Emergency	21,590 (93)	11.1	15.1
Elective	1,587 (7)	11.4	15.3
Documented risk			
Lower	5,511 (24)	1.7	4.1
High	3,198 (14)	7.1	11.7
Highest	6,108 (26)	26.9	33.1
Not documented	8,360 (36)	7.3	10.5
Return to theatre after initial operation			
No return to theatre	20,776 (91)	10.2	14.1
One or more returns	2,149 (9)	16.9	21.9
Overall	**23,177**	**11.1%**	**15.1%**

Table 57 ONS 30-day and 90-day mortality by operative urgency (Year 2 data)

Urgency of surgery	Number of patients (frequency (%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
<2 hours	2,958 (13)	26.8	29.9
2–6 hours	8,993 (39)	11.4	14.9
6–18 hours	7,281 (31)	6.7	10.7
18–24 hours	3,904 (17)	6.9	12.4
Overall	**23,136**	**11.1%**	**15.1%**

Table 58 ONS 30-day and 90-day mortality by indication for surgery (more than one can be selected) (Year 2 data)

Indication for surgery	Number of patients	Frequency (%)	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Intestinal obstruction	11,709	51	8.1	12.9
Perforation	5,429	23	14.6	18.6
Peritonitis	4,433	19	16.0	19.7
Ischaemia	2,116	9	26.0	29.3
Sepsis: other	1,554	7	19.0	22.9
Abdominal abscess	1,487	6	7.2	10.6
Colitis	827	4	7.6	9.3
Haemorrhage	817	4	12.5	16.1
Anastomotic leak	630	3	8.6	11.8
Intestinal fistula	362	2	7.5	11.9
Abdominal wound dehiscence	125	1	9.6	14.4
Abdominal compartment syndrome	39	<1	41.0	47.5
Planned relook	34	<1	23.5	25.5
Other	1,866	8	9.4	12.9

Table 59 ONS 30-day and 90-day mortality by operative findings (more than one can be selected) (Year 2 data)

Operative findings	Number of patients	Frequency (%)	ONS 30-day mortality (%)	ONS 90-day mortality (%)
Adhesions	6,319	27	7.4	10.8
Perforation: small bowel/colonic	4,300	19	15.7	20.3
Intestinal ischaemia	3,054	13	22.7	25.9
Malignancy: localised	2,878	12	8.9	13.5
Abscess	2,670	12	8.0	11.7
Malignancy: disseminated	1,767	8	18.0	37.0
Incarcerated hernia	1,402	6	10.1	12.3
Perforation: peptic ulcer	1,384	6	13.1	14.8
Diverticulitis	1,278	6	7.8	10.5
Volvulus	822	4	7.8	10.0
Crohn's disease	728	3	2.2	3.4
Colitis	723	3	8.7	10.7
Anastomotic leak	596	3	8.9	11.9
Haemorrhage: postoperative	337	2	5.6	8.3
Normal intra-abdominal findings	260	1	11.5	14.5
Haemorrhage: intestinal	240	1	12.5	16.4
Haemorrhage: peptic ulcer	183	1	20.2	24.6
Abdominal compartment syndrome	45	<1	40.0	47.8
Other	3,579	15	9.9	13.4

Table 60 ONS 30-day and 90-day mortality by age group (Year 1 and Year 2 data combined)

Age (years)	Number of patients (frequency (%))	ONS 30-day mortality (%)	ONS 90-day mortality (%)
18–39	4,661 (11)	2.3	3.2
40–49	4,227 (10)	3.1	5.0
50–59	5,994 (14)	6.2	9.3
60–69	9,045 (21)	9.9	14.2
70–79	10,916 (25)	15.1	20.1
80–89	7,650 (18)	20.2	26.7
90+	1,073 (2)	23.8	32.8
Overall	**43,566**	**11.4%**	**15.6%**

Table 61 Proportion of patients who returned to theatre following their initial emergency laparotomy by patient characteristics (Year 2 data)

	Total number of patients	Proportion patients who returned to theatre following initial emergency laparotomy (%)
Age (years)		
18–39	2,452	9
40–49	2,265	10
50–59	3,253	10
60–69	4,796	11
70–79	5,767	10
80–89	4,068	7
≥90	537	3
ASA		
1	2,381	5
2	7,990	7
3	8,161	10
4	4,141	14
5	465	19
Overall	**23,138**	**9%**

21.3 NELA RISK-ADJUSTMENT MODEL AND PERFORMANCE OF P-POSSUM

A risk model was developed to produce the risk-adjusted 30-day postoperative mortality results for hospitals performing emergency bowel surgery. The model was based on data submitted to NELA on patients who had their operations between 1 December 2013 and 30 November 2015 in an NHS hospital within England and Wales. We excluded patients:

- Whose age was outside the range of 18 years to 113 years.
- Who had an unknown mortality status at 30 days.
- Recorded as having a surgical procedure that was not eligible for inclusion in NELA.
- Who had a date of death that occurred before date of admission.

The risk model included 22 variables describing different aspects of the patient's admission. The variables included:

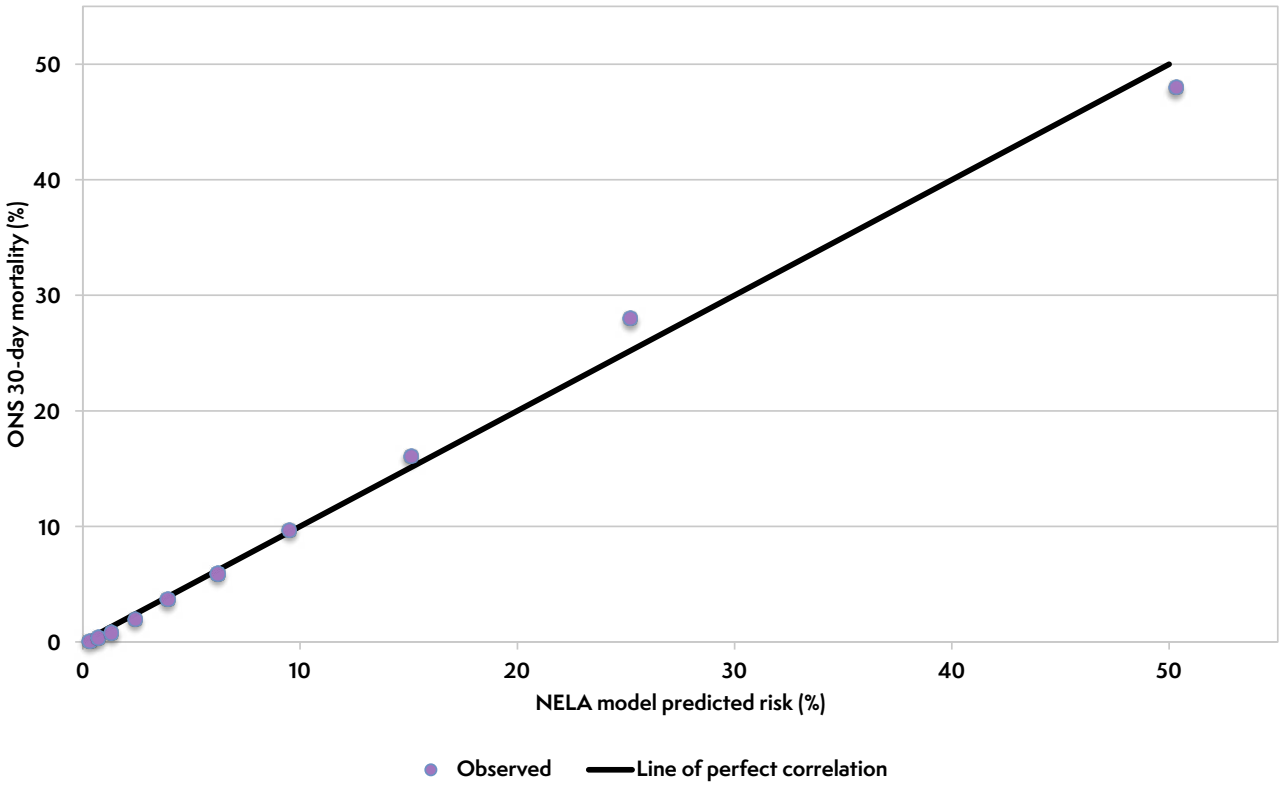
- Patient age and sex.
- Preoperative factors including ASA score, systolic blood pressure, urgency of surgery, and comorbid conditions.
- Preoperative physiological measurements (creatinine, sodium, potassium, urea, and white blood cell count).
- Perioperative factors (peritoneal soiling, intraoperative blood loss).

Patient status at 30 days after surgery was primarily determined using data from the ONS mortality dataset. In the minority of cases where there were 'no trace' observations within the ONS mortality dataset, we used the inpatient status at 30 days instead.

Logistic regression was used to assess the relationship between 30-day mortality and the individual patient and treatment characteristics. Variables were included in the model using the appropriate mathematical form. This was typically a linear relationship, but it was also necessary to include non-linear terms for some variables (eg, physiological measurements).

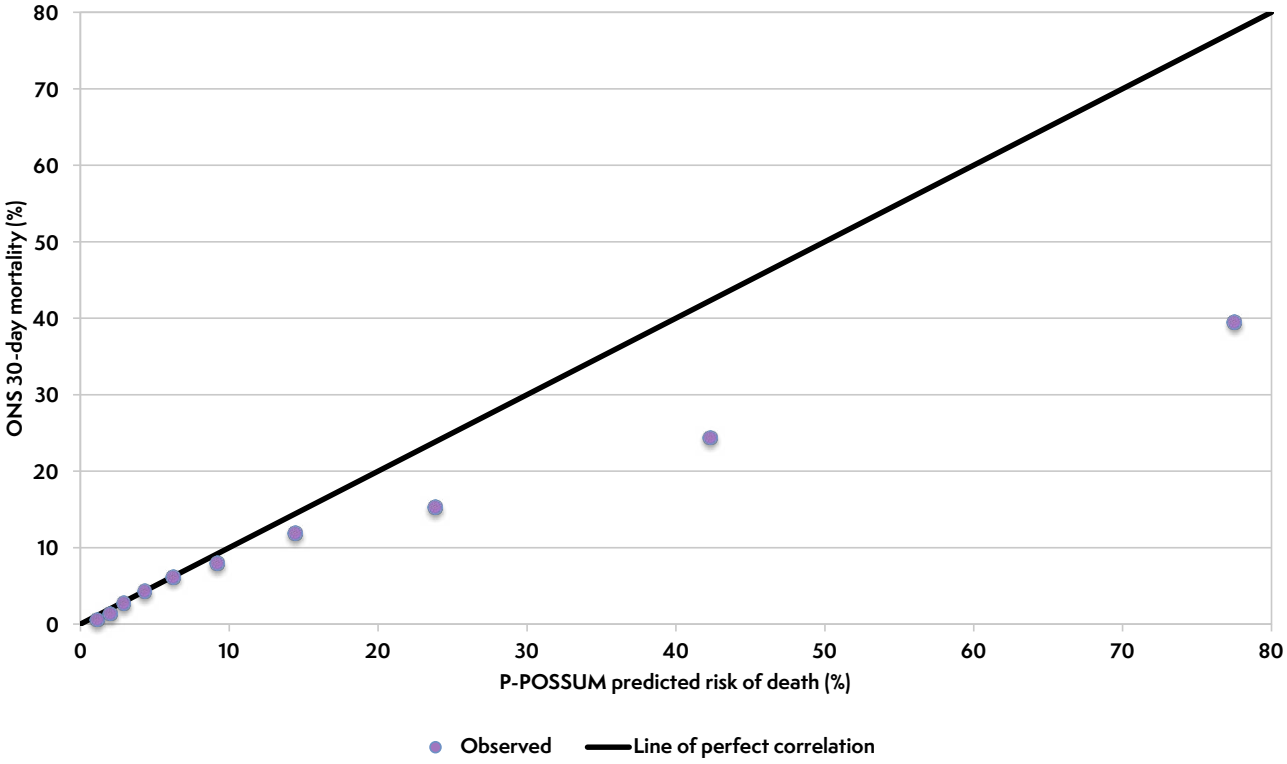
The risk model proved to have excellent discrimination, with a C-index of 0.863 (95% CI: 0.858, 0.868). The C-index ranges from 0.5 (no better than toss of coin) to 1 (perfect discrimination). The model also demonstrated good calibration (Figure 46). The calibration plot highlights the considerable heterogeneity in risk faced by patients undergoing emergency laparotomy. The average observed ONS 30-day mortality in the two groups with the highest risk are around 28% and 48%, respectively. Additional information about the risk prediction model is provided in the accompanying Technical Documents (www.nela.org.uk/reports).

Figure 46 Risk adjustment calibration plot comparing the observed ONS 30-day mortality against that predicted by the model in deciles of predicted risk (Year 1 and Year 2 data combined)



We also examined the performance of the P-POSSUM model on the NELA patients, using its original coefficients. The discrimination of the P-POSSUM was still reasonably high, with a C-index of 0.803 (95% CI: 0.797, 0.809). However, the calibration plot for the P-POSSUM model (Figure 50) reveals that it no longer provides an adequate prediction of surgical risk among the cohort of high-risk patients. It now overestimates a patient's risk of death. This may be due to differences between the NELA patients and those in the original cohort used to develop P-POSSUM. It may also be a reflection of the improvements in healthcare since the P-POSSUM model was first developed.

Figure 47 Calibration plot comparing the observed 30-day mortality against that predicted by P-POSSUM in deciles of predicted risk (Year 1 and Year 2 data combined)



21.4 STANDARDS OF CARE AND SUMMARY OF RECOMMENDATIONS

ASGBI EGS
Emergency General Surgery: The future, a consensus statement (*ASGBI*, 2007)

ASGBI PS
Patient safety: A consensus statement (*ASGBI*, 2009)

CQUIN
Guidance for 2015/2016. NHS England/contracting and incentives team (*CQUIN*, 2015)

NCEPOD Age
An age old problem: review of the care received by elderly patients undergoing surgery (*NCEPOD*, 2010)

NCEPOD EA
Emergency Admissions: A journey in the right direction (*NCEPOD*, 2007)

NCEPOD KTR
Knowing the risk: A review of the perioperative care of surgical patients (*NCEPOD*, 2011)

NHS 7 Day Services
Seven day services clinical standards (*NHS IQ*, 2016)

NICE CG50
Clinical Guideline 50: Acutely ill patients in hospital (*NICE*, 2007)

NICE MTG3
Medical Technologies Guidance: CardioQ-ODM (*NICE*, 2011)

NSF older people
The National Service Framework for Older People (*DH*, 2001)

RCS HR
The Higher Risk General Surgical Patient: towards improved care for a forgotten group (*RCSEng* and *DH*, 2011)

RCS USC
Emergency Surgery Standards for unscheduled surgical care (*RCSEng*, 2011)

NELA
National Emergency Laparotomy Audit

KEY STANDARDS AGAINST WHICH CARE IS REPORTED IN THIS REPORT

Chapter 8

Patients admitted as an emergency should be seen by a consultant at the earliest opportunity. Ideally this should be within 12 hours and should not be longer than 24 hours.
NCEPOD EA

All emergency admissions must be seen and have a thorough clinical assessment by a suitable consultant as soon as possible but at the latest within 14 hours from the time of arrival at hospital.
NHS 7 Day Services

Chapter 9

Hospitals which admit patients as emergencies must have access to both conventional radiology and CT scanning 24 hours per day, with immediate reporting.
NCEPOD EA

Consultant-directed diagnostic tests and completed reporting will be available seven days a week, within 1 hour for critical patients (i.e those for whom the test will alter their management at the time).
NHS 7 Day Services

The delivery of quality clinical care is dependent on access to supporting facilities. Rapid access to CT imaging, U/S [ultrasound] scanning and laboratory analyses are critical to the efficient diagnosis, resuscitation and prioritisation of these patients.
ASGBI EGS

Chapter 10

An assessment of mortality risk should be made explicit to the patient and recorded clearly on the consent form and in the medical record.
NCEPOD KTR

Patients must be actively involved in shared decision making and supported by clear information from healthcare professionals to make fully informed choices about treatment and ongoing care that reflect what is important to them. This should happen consistently, seven days a week.
NHS 7 Day Services

We recommend that objective risk assessment become a mandatory part of the preoperative checklist to be discussed between surgeon and anaesthetist for all patients. This must be more detailed than simply noting the ASA score.
RCS HR

Patients with a predicted mortality ≥5% should be managed as 'high risk'.

Chapter 11

Those with septic shock require immediate broad-spectrum antibiotics with fluid resuscitation and source control.
RCS HR

Providers are expected to screen for sepsis all those patients for whom sepsis screening is appropriate, and to rapidly initiate intravenous antibiotics, within 1 hour of presentation, for those patients who have suspected severe sepsis, Red Flag Sepsis or septic shock.
CQUIN 2015/2016

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.
RCS HR

Chapter 12

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.
RCS HR

The time from decision to operate to actual time of operation is recorded in patient notes and audited locally.
RCS USC

Delays in surgery for the elderly are associated with poor outcome. They should be subject to regular and rigorous audit and this should take place alongside identifiable agreed standards.
NCEPOD Age

Chapter 13

Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist.
RCS HR

A consultant surgeon (CCT holder) and consultant anaesthetist are present for all cases with predicted mortality ≥10% and for cases with predicted mortality >5% except in specific circumstances where adequate experience and manpower is otherwise assured.
RCS USC

Each higher risk case (predicted mortality ≥5%) should have the active input of consultant surgeon and consultant anaesthetist. Surgical procedures with a predicted mortality of ≥10% should be conducted under the direct supervision of a consultant surgeon and a consultant anaesthetist unless the responsible consultants have actively satisfied themselves that junior staff have adequate experience and manpower and are adequately free of competing responsibilities.
RCS HR

Chapter 14

There should be clear strategies for the management of intraoperative low blood pressure in the elderly to avoid cardiac and renal complications. Non-invasive measurement of cardiac output facilitates this during major surgery in the elderly.
NCEPOD Age

Chapter 15

Patients with a predicted mortality ≥5% should be managed as 'high risk'.

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.
RCS HR

Intensive care requirements are considered for all patients needing emergency surgery. There is close liaison and communication between the surgical, anaesthetic and intensive care teams perioperatively with the common goal of ensuring optimal safe care in the best interests of the patient.
RCS USC

The outcome of high-risk General Surgical patients could be improved by the adequate and effective use of critical care in addition to a better preoperative risk stratification protocol.
ASGBI PS

Chapter 16

Clear protocols for the postoperative management of elderly patients undergoing abdominal surgery should be developed which include, where appropriate, routine review by an MCOP [Medicine for Care of Older People] consultant and nutritional assessment.
NCEPOD Age

Comorbidity, disability and frailty need to be clearly recognised as independent markers of risk in the elderly. This requires skill and multidisciplinary input, including early involvement of Medicine for the Care of Older People.
NCEPOD Age

All emergency inpatients must have prompt assessment by a multi-professional team to identify complex or on- going needs, unless deemed unnecessary by the responsible consultant.
NHS 7 Day Services

SUMMARY OF RECOMMEDATIONS MADE IN THIS REPORT

Chapter 3 (High level recommendations)

Commissioners

Commissioners should review the Audit results for hospitals from which they commission services, to assure themselves of the quality of care provided to patients undergoing emergency laparotomy. Where hospitals fall short of standards, or where mortality is of concern, commissioners should ensure that there is adequate commissioning of:

- **Multidisciplinary input** across the whole of the patient pathway (Chapters 8, 9, 13, 15 and 16).
- **Capacity to deliver consultant-delivered care** and other services, such as CT scanning and reporting regardless of the time of the day or the day of the week (Chapters 8, 9 and 13).
- **Theatre capacity** to prevent delays for patients requiring emergency bowel surgery. Some hospitals may require the capacity for emergency and elective care to continue in parallel (Chapter 12).
- **Critical care capacity** to match high-risk caseload, such that all high-risk emergency laparotomy patients can be cared for on a critical care unit after surgery (Chapter 15).
- **Elderly Medicine services** to provide input for older patients (Chapter 16).

Providers (Chief Executives and Medical Directors)

In order to deliver high-quality care to high-risk emergency patients that meets standards, attention should be directed at organisational change in the following areas:

Patients undergoing emergency bowel surgery require **consultant involvement in their care** 24 hours per day, seven days per week. Rotas, job plans and staffing levels for surgeons and anaesthetists should reflect this. The workload may require an increase in the number of consultants available for emergency work. In some hospitals, this may require separation of elective and emergency care so that both services can continue in parallel without competing for resources. Delivery of high-quality care can be facilitated by reconfiguring services to locate acute surgical patients within a single area. (Chapters 8 and 13).

Policies should be developed and implemented which use **individual risk assessment to guide allocation of resources** (e.g. critical care) appropriate to the patient's needs (Chapters 10, 15 and 17). This can also help with capacity planning by defining a hospital's expected caseload and resource requirements.

Provision of **emergency theatre capacity** needs to be sufficient to enable patients to receive emergency surgical treatment without undue delay, and may require capacity to allow emergency and elective care to continue in parallel. Where capacity is limited, prioritisation of time-sensitive emergency surgery can be facilitated by policies to defer elective activity (Chapters 11 and 12).

National standards for **postoperative critical care admission** should be adhered to. This may require an increase in critical care capacity so that emergency and elective care can continue in parallel (Chapter 15).

Data collected from NELA has the potential to inform NHS trust boards of many different aspects of emergency care provision. Local NELA Leads and perioperative teams must have **adequate time and resources to support accurate data collection, review adverse patient outcomes**, and to feed this back to clinical teams and hospital management including NHS trust boards. Such resources include **access to individuals with audit and quality improvement skills** throughout the NHS trust, allocated (job-planned) time to support data collection and analysis, and protected time for presentation of data in departmental meetings. Effort should be invested in ensuring clinical coding is accurate (Chapters 5, 17 and 18).

Clinical Directors and Multidisciplinary Teams

Patients undergoing emergency bowel surgery will receive care from a variety of clinical specialties, including the emergency department or acute admissions unit, radiology, surgery, anaesthesia, operating theatres, critical care and elderly care. These recommendations apply across these areas, as in many cases the need for change is not confined to a single area or specialty.

In order to reduce variation in care and minimise delays, hospitals should implement appropriate pathways for the care of emergency General Surgical patients, starting at the time of admission to hospital or referral by another team. Where pathways of care do already exist, Multidisciplinary Teams (MDT) should examine these in the light of audit data to determine their efficacy, and identify why standards are still not met. Care pathways should ensure patients are admitted under the most appropriate specialty, aid communication within the MDT, prioritise emergency resources, and aim to ensure that all processes of care are provided for each patient. Standardised pathways of care also facilitate audit and thereby highlight key areas for improvement. **Pathways should cover the following areas:**

- Referral of patients for General Surgical review if they have been admitted under non-surgical specialties.
- Identification of patients with signs of sepsis and prompt prescription and administration of antibiotics.
- Identification and escalation of care of patients who would benefit from the opinion of a consultant surgeon before the next scheduled ward round.
- Rapid request, conduct, and reporting of CT scans.
- Routine documented assessment of the risk of complications and death from surgery.
- Presence of consultant surgeon and consultant anaesthetist for high-risk patients with a predicted mortality ≥5%.
- Admission to critical care for patients with a predicted mortality >10%.
- Identification of patients who would benefit from input from Elderly Medicine specialists in their perioperative care.

Multidisciplinary Teams should hold regular joint meetings to continuously review essential processes of care (for instance, using the NELA Quality Improvement Dashboard) and review perioperative morbidity (including unplanned returns to theatre and admissions to critical care) and mortality following emergency laparotomy. This should include formal collaboration with hospital mortality review panels in order to bring about greater understanding of where improvement is needed (Chapters 17 and 18).

Continuous quality improvement informed by local data should involve monitoring the impact of pathway and process changes with time-series data (run charts). The NELA web tool provides automated dashboards that can be used for this purpose. Multidisciplinary Teams should ensure that they include members with a good understanding of quality improvement principles, such as the Model for Improvement and good data feedback practices (Chapter 18).

NELA Leads

NELA Leads should review their local data to **ensure case-submission and data completeness**. Where data collection and entry is a problem, NELA Leads, supported by NHS trust resources, should work with clinical teams to improve this, to facilitate future audit and quality improvement (Chapter 5).

NELA Leads should actively promote **completion of P-POSSUM data fields** to ensure that risk estimation is accurate and avoid falsely elevated risk-adjusted hospital mortality rates (Chapter 5). This is in addition to the finding that standards of care were better met where risk assessment had been carried out.

Professional Stakeholder Organisations

Professional stakeholders, such as Royal Colleges and Specialist Societies, should collaborate to:

- Improve clarity and remove ambiguity in the wording of standards of care. This would be particularly welcome for standards for admission to critical care (Chapter 15).
- Bring together standards in a single, unified document.
- Highlight the issues to their members to ensure appropriate engagement.

Chapter 5 (Data quality and case ascertainment)

Local NELA Leads and perioperative teams must have adequate time and resources to support data collection, and to feed this back to clinical teams and hospital management including NHS trust boards. The time required should be reflected in job plans (Chief Executives, Medical and Clinical Directors).

NELA Leads should review their local data to ascertain case-submission and data completeness (NELA Leads).

NELA Leads should actively promote completion of P-POSSUM data fields to ensure that risk estimation is accurate (NELA Leads).

Where data completeness is a problem, NELA Leads should work with clinical teams to improve this, to facilitate future audit and quality improvement (NELA Leads, MDT).

Chapter 8 (Consultant surgeon review within 14 hours of admission)

Departments of surgery should use local NELA data to determine if the availability of duty consultant surgeons could be improved. Consultant surgeon rota patterns and job plans should be reviewed to ensure a consultant surgeon is always available to see patients within 14 hours of emergency admission, seven days per week This may involve a second scheduled ward round. This would be facilitated by locating acute surgical patients within a single ward as a priority (Medical and Clinical Directors).

Pathways for the identification and escalation of care of patients who would benefit from the opinion of a consultant surgeon before the next scheduled ward round should be implemented. In almost all units, this will require duty consultant surgeons to be freed from routine commitments such as clinics or elective operating lists. Forward thinking units manage this through a modern structure of Emergency General Surgery delivery featuring active ongoing senior input and a strong, well-functioning admission pathway (Medical and Clinical Directors).

Hospitals should review the quality of their clinical coding to ensure accuracy (Medical and Clinical Directors).

Hospitals who admit a high proportion of emergency laparotomy patients under specialties other than General Surgery should review their admission and referral pathways to ensure that patients requiring emergency laparotomy receive appropriate surgical input (Medical and Clinical Directors).

Chapter 9 (Preoperative imaging)

Pathways should be implemented to facilitate rapid request and conduct of CT scans for patients who may require emergency laparotomy. These pathways should also support contemporaneous reporting by consultant or senior radiologists with expertise in interpreting emergency abdominal CT scans, so as not to delay subsequent treatment (Medical and Clinical Directors, MDT).

Multidisciplinary pathways should be established to prevent inappropriate delays to a patient undergoing surgery, especially once a consultant decision has been made. This will require cross-disciplinary cooperation between surgeons, anaesthetists, radiological and laboratory services and theatre and critical care staff (MDT).

Chapter 10 (Preoperative documentation of risk)

Policies should be developed and implemented which use individual risk assessment to allocate resources (e.g. critical care) appropriate to the patient's need (Medical and Clinical Directors).

When surgery is contemplated, a formal assessment of the risk of death and complications should be undertaken by a clinician and documented in the patient record. This information should be communicated to all members of the MDT in order to prioritise care and allocate appropriate resources. If surgery is undertaken, this risk assessment should be documented on the patient consent form (MDT).

P-POSSUM should continue to be used to assess risk. However clinicians should be aware that it over-predicts above ~15% risk and should not rely solely on P-POSSUM assessments of risk when deciding on benefits of treatment (MDT).

Chapter 11 (Timliness of care for patient with peritonitis)

Any areas of the hospital that admit emergency General Surgical patients need to have robust mechanisms in place to identify patients with signs of sepsis and ensure prompt prescription and administration of antibiotics (Medical and Clinical Directors, MDT).

Medical and Clinical Directors should examine their emergency theatre provision in the context of their local Audit results, in order to determine whether sufficient resources are available to enable patients to receive emergency surgical treatment without undue delay (Medical and Clinical Directors).

Multidisciplinary Teams, including emergency departments and acute assessment units, should review their pathways of care for the administration of antibiotics in order to identify why delays occur (MDT).

Clinicians should regularly review Audit data on timing of administration of antibiotics and time to theatre in order to ensure that aims are being achieved (MDT).

Chapter 12 (Timliness of arrival in theatre)
Medical and Clinical Directors should examine their emergency theatre provision in the context of their local Audit results, in order to determine whether sufficient resources are available to enable patients to receive emergency surgical treatment without undue delay (Medical and Clinical Directors).

Multidisciplinary pathways should be established to prevent inappropriate delays in a patient undergoing surgery, especially once a consultant decision has been made. This will require cross-disciplinary cooperation between surgeons, anaesthetists, radiological and laboratory services, and theatre and critical care staff (MDT).

Theatre capacity should be sufficient to allow emergency and elective surgery to continue in parallel. Where capacity is limited, prioritisation of time-sensitive emergency surgery can be facilitated by policies to defer elective activity (Medical and Clinical Directors).

Commissioners should work with local providers to determine whether theatre capacity is sufficient to prevent potentially harmful delays to surgery in patients requiring emergency bowel operations. Some hospitals may require the capacity for emergency and elective care to continue in parallel (Commissioners and provider Chief Executives).

Chapter 13 (Consultant-delivered perioperative care)
Local protocols should be developed which ensure a consultant-delivered service for emergency laparotomy patients. Rotas, job plans and staffing levels for surgeons and anaesthetists should allow a consultant-delivered service 24 hours per day, seven days per week (Medical and Clinical Directors).

Consideration should be given to increasing the number of consultants available for emergency surgical work as required to facilitate a consultant-delivered anaesthetic service 24 hours per day, seven days per week. This may be of particular relevance to hospitals in which on-call anaesthetists also cover other emergency services such as trauma, maternity or critical care (Medical and Clinical Directors).

Chapter 15 (Postoperative admission to critical care)
Local audit data should be examined to determine if national standards for postoperative critical care admission are being met. Where compliance is poor, a change of local policies and reconfiguration of services should be considered to enable all high-risk emergency laparotomy patients to be cared for on a critical care unit after surgery (Commissioners and provider Chief Executives).

When surgery is contemplated, a formal assessment of the risk of death and complications should be undertaken by a clinician and documented in the patient record. This information should be communicated to all members of the MDT in order to prioritise care and allocate appropriate resources. If surgery is undertaken, this risk assessment should be documented on the patient consent form (MDT).

Professional stakeholders, such as Royal Colleges and Specialist Societies, should collaborate to improve clarity and remove ambiguity in the wording of standards of care for high-risk patients (Professional Stakeholder Organisations).

Chapter 16 (Postoperative assessment by an Elderly Medicine specialist)
Increased Elderly Medicine input may require specific commissioning for this service (Commissioners and provider Chief Executives).

Pathways should be implemented to ensure that all patients aged 70 years or over, who undergo an emergency laparotomy, receive an assessment of multimorbidity, frailty and cognition to guide further input from an Elderly Medicine specialist (MDT).

Chapter 17 (Outcomes)
Hospital teams should review the care received by patients who suffer adverse outcomes. This includes: (MDT)

- Those who died following surgery.
- Those who returned to theatre following their emergency laparotomy.
- Those who had an unplanned escalation of care in the postoperative period

The results of these reviews should be discussed at multidisciplinary meetings, and cascaded to those involved in the planning and delivery of care to drive improvements (MDT, Medical and Clinical Directors).

Hospitals should ensure they have policies in place for the allocation of critical care resources according to risk, and clear escalation protocols for patients who deteriorate on the ward (Medical and Clinical Directors).

Chapter 18 (Quality improvement)

NHS trusts should review their data in run charts using the NELA Quality Improvement Dashboard to monitor performance and inform them about the impact of organisational changes over time (Chief Executives, Medical and Clinical Directors, MDT).

Teams should endeavour to use quality improvement methodology such as the Model For Improvement when planning and executing changes to patient pathways or organisational processes (MDT, Medical and Clinical Directors).

Improvement teams should be multidisciplinary, and use good engagement and data feedback practices to implement changes. Patients' or carers' views and involvement should be sought at all stages of developing and making improvements (MDT, Medical and Clinical Directors)

21.5 GOVERNANCE AND ORGANISATIONAL ARRANGEMENTS FOR NELA

Project Board

The Project Board oversees the strategic direction and is responsible for monitoring all aspects of delivery of the project by the Project Team and sub-contractors, and is accountable to the stakeholder organisations.

Chair

Mr John Moorehead, President, Association of Surgeons of Great Britain and Ireland

Members

Mr John Abercrombie, Royal College of Surgeons of England

Dr Liam Brennan, Royal College of Anaesthetists representative

Dr David Cromwell, Clinical Effectiveness Unit, Royal College of Surgeons of England

Ms Tasneem Hoosain, Health Quality Improvement Partnership

Dr Jeremy Langton, Royal College of Anaesthetists representative

Ms Lauren Osborne, patient representative

Mr Tim Russell, Intensive Care National Audit & Research Centre

Dr Yvonne Silove, Health Quality Improvement Partnership

Ms Lynne Smith, patient representative

Miss Gillian Tierney, Association of Surgeons of Great Britain and Ireland

Project Team

The NELA Project Team is responsible for the ongoing delivery of the project.

Chair

Professor Mike Grocott, RCoA Council Member, Consultant in Anaesthesia and Critical Care Medicine, University Hospital Southampton

NELA National Clinical Lead

Dr Dave Murray, Consultant Anaesthetist, James Cook University Hospital, Middlesbrough

Members

Mr Iain Anderson, NELA Surgical Adviser, Association of Surgeons of Great Britain and Ireland
Dr Michael Bassett, Research Fellow, NIAA Health Services Research Centre
Mr Martin Cripps, Net Solving
Dr David Cromwell, NELA Methodologist, Clinical Effectiveness Unit, Royal College of Surgeons of England
Mrs Emma Davies, Surgical Research Fellow
Ms Sharon Drake, RCoA Director of Clinical Quality and Research
Ms Natalie Eugene, Statistician, Clinical Effectiveness Unit, Royal College of Surgeons of England
Mr James Goodwin, RCoA Research Manager
Dr Carolyn Johnston. NELA Quality Improvement Lead (St George's University Hospital)
Dr Angela Kuryba, Statistician, Clinical Effectiveness Unit, Royal College of Surgeons of England
Mr Jose Lourtie, RCoA Research Supervisor
Dr Ramani Moonesinghe, Director, NIAA Health Services Research Centre
Mr Dimitri Papadimitriou, NELA Research Team Administrator
Professor Carol Peden, NELA Quality Improvement Adviser

Dr Thomas Poulton, Research Fellow, NIAA Health Services Research Centre
Dr Kate Walker, Statistician, Clinical Effectiveness Unit, Royal College of Surgeons of England

Clinical Reference Group (CRG)

All relevant clinical professional and specialty stakeholders have direct input into the design and conduct of this Audit. The Clinical Reference Group consists of representatives from partner organisations as well as other stakeholders, including patients. The CRG acts in an advisory capacity to the Project Team, providing specialty-specific advice, and lay advice as appropriate. CRG meetings are chaired by Professor Mike Grocott and are attended by members of the Project Team.

List of organisations and members

Age Anaesthesia Association (AAA)
Dr Irwin Foo, Immediate Past President, Age Anaesthesia Association

The Association of Anaesthetists of Great Britain and Ireland (AAGBI)
Dr Richard Griffiths, Honorary Secretary AAGBI

The Association for Perioperative Practice (AfPP)
Ms Jenny Abraham, Perioperative Specialist Laparoscopic Nurse Practitioner

The Association of Surgeons of Great Britain and Ireland (ASGBI)
Mr Iain Anderson, Executive Board Member, ASGBI
Mr Nicholas Markham, Executive Board Member, ASGBI

British Geriatric Society (BGS)
Dr Jugdeep Dhesi, Chair of BGS Perioperative Care of Older People Undergoing Surgery, POPS

Emergency Laparotomy Network (ELN)
Dr Simon Varley, Chair, Emergency Laparotomy Network
Dr David Saunders, Secretary, Emergency Laparotomy Network

The Faculty of Intensive Care Medicine (FICM)
Dr Diane Monkhouse, Consultant in Anaesthesia and Critical Care

Intensive Care National Audit & Research Centre (ICNARC)
Mr Tim Russell, Technical Services Manager

The Intensive Care Society (ICS)
Dr Andy Rhodes, Council Member, The Intensive Care Society

Quality Observatories
Dr Gary Cook, Consultant Epidemiologist

The Royal College of Anaesthetists (RCoA)
Dr Liam Brennan, President, RCoA
Dr Jeremy Langton, Vice-President, RCoA
Dr Hywel Jones, Consultant Anaesthetist

The Royal College of Emergency Medicine (RCEM)
Dr Sally-Anne Wilson, Quality in Emergency Care Committee member, RCEM

The Royal College of Nursing (RCN)
Mr J P Nolan, Nurse Adviser in Acute, Emergency and Critical Care

The Royal College of Radiologists (RCR)
Dr Richard Wright, Radiology Audit Committee member

NELA
National Emergency Laparotomy Audit

The Royal College of Surgeons of England (RCS)

Mr John Abercrombie, Council Member, Royal College of Surgeons of England
Mr Mike Parker, Council Member, Royal College of Surgeons of England
Mr Nicholas Lees, Consultant General and Colorectal Surgeon
Dr David Cromwell, Clinical Effectiveness Unit, Royal College of Surgeons of England

UK Clinical Director Network

Dr Mike Nevin, National Lead UK Clinical Director Network

Commissioning representative

Dr Mark Spencer, Medical Director Quality and Service Design, NHS England

Patient representative – Elderly

Mrs Joyce Colston

Patient representative – Anaesthesia

Ms Lauren Osborne
Ms Lynne Smith

The National Emergency Laparotomy Audit
The Royal College of Anaesthetists
National Institute of Academic Anaesthesia
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