

Cardiothoracic Surgery

GIRFT Programme National Specialty Report

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GIRFT Clinical Lead for Cardiothoracic Surgery

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Foreword from Professor Tim Briggs, GIRFT Programme Chair

I am delighted to recommend this 'Getting it Right First Time' review of cardiothoracic surgery by David Richens.

David's report brings the GIRFT approach to his own clinical specialty, combining a data-led view of outcomes and costs with real insight into what is and is not working. I firmly believe that, with the support of clinicians and managers, it can lead to the redesign of services to improve care and patient outcomes – as well as saving the NHS millions of pounds.

GIRFT and the other Carter programmes are already demonstrating that transforming provider services and investing to save can bring huge gains in stabilising trusts financially and improving care for patients.

The programme began following my review of orthopaedic surgery in 2012. That review was driven by a desire to ensure better care and outcomes for patients and to fix the issues faced by colleagues in my own specialty. With a small team, we visited over 200 sites, meeting more than 2,000 surgeons, clinicians, support staff and trust managers. Almost everybody acknowledged that the NHS must review all unwarranted variation in the quality and efficiency of the services we deliver.

Together we set out to understand the impact of that variation by reviewing data, discussing challenges, and debating solutions. At the end of the process we were able to make evidence-based recommendations and to share the good practice we found. Today, with the support of my fellow clinicians and the British Orthopaedic Association, those recommendations are helping to improve care and patient outcomes, as well as saving the NHS millions of pounds.

That support is crucial. GIRFT cannot succeed without the backing of clinicians, managers and all of us involved in delivering care. So I am most heartened to hear how supportive people have been as David has been carrying out his review.

My greatest hope is that GIRFT will provide further impetus for all those involved in the delivery of cardiothoracic surgery to work together, shoulder to shoulder, to create solutions and improvements that have appeared out of reach for too long.



GIRFT Programme Chair and National Director for Clinical Quality and Efficiency at NHS Improvement

Professor Tim Briggs is Consultant Orthopaedic Surgeon at the Royal National Orthopaedic Hospital NHS Trust, where he is also Director of Strategy and External Affairs. He led the first review of orthopaedic surgery that became the pilot for the GIRFT programme, which he now Chairs.

Professor Briggs is also National Director for Clinical Quality and Efficiency, at NHS Improvement.

Professor Tim Briggs

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National Institute for Cardiovascular Outcomes Research (NICOR) data

This report includes NICOR data, which is based on data collected by or on behalf of the Healthcare Quality Improvement Partnership, who have no responsibility or liability for the accuracy, currency, reliability and/or correctness of this report.

Introduction David Richens GIRFT National Clinical Lead for Cardiothoracic surgery

In carrying out this review, I am fortunate to have been able to visit every one of the 31 cardiothoracic units in England.

During my visits, I have been repeatedly struck by the passionate commitment of the clinical staff towards the NHS as a force for good in society. Time and again, I have found them expressing pride in their work, a sense of ownership of their unit, and a loyalty to the local communities they serve.

Overwhelmingly, clinical staff are striving to continue to do things better. They combine astonishing levels of energy and enthusiasm with intellectual rigour and a commitment to innovation – qualities that have characterised the development of cardiothoracic surgery as a distinct surgical specialty since the 1950s.

I am excited to put forward the recommendations in this report. I firmly believe they offer the potential to achieve significant improvements in patient care and to create significant financial opportunities.



David Richens FRCS

David Richens is a cardiac surgeon. He studied medicine at King's College Hospital, London. After postgraduate surgical training in the UK and at St Vincent's Hospital, Sydney, David took up his first NHS consultant post in Glasgow, where he was instrumental in setting up the Scottish Heart Transplant programme.

In 1995, he moved to the Nottingham University Hospitals, establishing the cardiac surgery programme before going on to take up roles as Head of Service, Clinical Director, and Director of Surgery.

He chaired the Joint Committee on Intercollegiate Examinations on behalf of the four UK Surgical Royal Colleges from 2014-17 and was Internal Professional Adviser to the Parliamentary and Health Service Ombudsman for 10 years.

David has been the GIRFT National Clinical Lead for cardiothoracic surgery since 2016. He retired from clinical practice in January 2017.

Statement of support

Society for Cardiothoracic Surgery in Great Britain and Ireland

The Society for Cardiothoracic Surgery (SCTS) welcomes the publication of this report and the broadly positive picture it paints of cardiothoracic surgery. We strongly endorse the GIRFT programme and the 20 recommendations made in the report.

SCTS has pioneered the collection and publication of clinical outcomes data. Since we started publishing survival rates for adult cardiac surgery, we have seen a progressive reduction in the number of hospitals and surgeons whose results are not as good as should be expected. Indeed, survival rates for adult cardiac and congenital cardiac surgery in the UK are now amongst the best in the world.

The GIRFT project has enabled the collection, analysis and publication of a far wider range of clinical and process measures than has been possible up to now. This report allows units to benchmark performance against the national average and will provide a powerful stimulus for improvements in services to patients. The report highlights some particular areas of good practice and we have explored these in further detail in our professional guidance on implementing GIRFT, available at www.scts.org

The report also highlights the need for certain conditions to be treated by surgeons who are specialists in that area; for conditions such as mitral valve and aortovascular disease, specialisation is important. Again, SCTS strongly supports this recommendation. With the push towards increasing specialisation, we would hope to see a reduction in the variation in survival for aortovascular operations and repair rate for degenerative mitral valve disease.

The benefits to patients of a minimally invasive lung resection are well described. Although half of all lung resections are now carried out by this method (a significant improvement compared to ten years ago), the variation shows that there is still potential for even more patients to benefit.

This report highlights some areas of excellent practice and some areas that can be improved. We have no doubt that clinical staff will respond with vigour and passion to improve, where they can, the services provided for patients.

Graham Cooper

President, Society for Cardiothoracic Surgery

Recommendations

In this report, we make the following 20 recommendations and identify owners and a timeline for each one.

Patient pathways and bed management

- 1 Make day of surgery admission routine practice.
- 2 Ring-fence beds on ward and ITU for elective cardiothoracic surgery.
- 3 Establish regional work-up protocols for non-elective referrals.
- 4 Pool non-elective cases ready for next available theatre session and next available appropriate surgeon.
- 5 Ensure that every patient is reviewed by a consultant pre- and post-operatively – and that this happens seven days a week.

The role of risk management in clinical outcomes

- 6 Establish a formal Standard Operating Procedure on cardiothoracic data validation, risk adjustment, outlier identification, escalation plans and reporting for GIRFT metrics.
- 7a Use uniform draping technique in theatre
- 7b Use chlorhexidine skin preparation
- 7c Ensure that individual cases of deep sternal wound infection (DSWI) are reviewed by a multidisciplinary team, led by a consultant microbiologist.
- 8a Establish a national formal policy for complex and very high-risk cases.
- 8b Establish collective responsibility for clinical outcomes.
- 9 Attribute outcomes for complex and very high-risk cases to units rather than to individuals.
- 10 Record blood product transfusion rates for cardiac surgery.

Cancer pathway

- 11a Centralise and reduce the number of lung cancer multidisciplinary teams (MDTs).
- 11b Ensure that a thoracic surgeon is present at every lung cancer MDT.
- 12 Ensure that patients being treated with surgery for Stage 1 lung cancer receive VATS or robotic-assisted lobectomy as the treatment of choice.

Other pathways and treatment

- 13a Ensure that patients who do not recover from medical treatment of empyema within 5-7 days are assessed by a thoracic surgeon.
- 13b When possible, routinely use VATS rather than open operation to manage empyema.

Aortovascular surgery

- 14 Ensure that acute aortic syndrome patients are only operated on by rotas of acute aortic syndrome specialist teams.

Mitral valve surgery

- 15 Ensure that patients with degenerative mitral valve disease are only operated on by specialist mitral valve surgeons.

Trauma

- 16** Ensure that major trauma centres are covered by published rotas for both thoracic and cardiac trauma. Providers should end of the practice of using full-time, cardiac-dedicated surgeons to provide emergency thoracic surgery cover.

Coding

- 17** Review the list of complications and comorbidities for cardiothoracic surgery, so that only codes that are genuinely relevant to the cost of treatment trigger a cc score in pricing, and that the HRG splits reflect an authentic variation in cost.
- 18** Increase collaboration between clinical cardiothoracic teams and coders by including coders in multidisciplinary team meetings (MDTMs) and morbidity and mortality meetings.

NICOR data quality

- 19** NICOR should work with providers to improve the quality of data submitted and stored, specifically for
- return to theatre
 - deep sternal wound infection
 - new CVA
 - post-operative renal replacement therapy.

Litigation

- 20** Implement GIRFT 5 point plan for reducing litigation costs.

Executive summary

Our GIRFT review of cardiothoracic surgery identifies significant opportunities to improve patient care and outcomes alongside a total notional financial opportunity of up to £52 million.

This report describes the variation we have found, examples of good practice, and our recommendations on how our specialty can realise the opportunities open to us.

We have found significant degrees of unwarranted variation in a number of key areas, including patient pathways and associated bed management, management of clinical risk and adverse clinical outcomes, lung cancer services, aortovascular surgery, mitral valve repair, and clinical coding.

Getting it Right First Time (GIRFT)

The GIRFT programme seeks to identify variation in NHS care, including practices, process and outcomes. It is one of several workstreams to improve operational efficiency in NHS hospitals. In particular, it is part of the response to Lord Carter's review of productivity and provides vital input to the Model Hospital project.

GIRFT is closely aligned with other programmes that seek to improve standards while delivering efficiencies, such as NHS RightCare, acute care collaborations (ACCs) and sustainability and transformation partnerships (STPs). It is funded by the Department of Health and is jointly overseen by NHS Improvement and the Royal National Orthopaedic Hospital NHS Trust.

Cardiothoracic surgery

Cardiothoracic surgery is the surgical treatment of diseases of the organs contained within the chest, including the heart, major blood vessels and the lungs. It involves major, technically demanding operations on patients who have life-threatening disease. Surgery is relatively low-volume and high-cost, and carries a measurable mortality rate.

Seven million people in England have cardiovascular disease and it accounts for 27% of all deaths. Lung cancer is the most common cause of cancer-related death.

Cardiothoracic centres in England

Relatively few centres across the UK practice cardiothoracic surgery and it falls under specialised commissioning. There are associated national service specifications for both thoracic and adult cardiac surgery.

There is no standard configuration for a cardiothoracic surgical unit in England. Of the 31 units, 25 provide both cardiac and thoracic surgery. Some are specialised stand-alone cardiothoracic centres, some have a major trauma centre on campus, and some have an A&E department on campus. Unit configuration is among the factors we have considered in our report.

About our analysis

We carried out our analysis following the established GIRFT model.

First we consolidated and analysed the relevant existing NHS data to provide a detailed national picture of cardiothoracic surgery. We also conducted our own supplementary data collection through an extensive questionnaire to providers. We benchmarked providers on key measures and identified where there is variation in care decisions, patient outcomes, costs and other factors.

After our team of experienced clinicians and analysts had reviewed the data, we provided every provider with data for their unit. We visited each provider to discuss the findings at length with clinicians, senior provider management and all those involved in delivering cardiothoracic services. During these discussions, we focused on areas where the provider's approach differed from the national norm, where they outperform their peers, and where they underperform.

We also discussed our findings with the Society for Cardiothoracic Surgery.

What we found

We found meaningful variation in clinical practice and clinical outcomes across the 31 cardiothoracic units.

For most of the metrics we analysed, our review found that most units perform within the average range. All units are good in some areas, whilst each one has at least a few areas that would benefit from further development.

Some units are outstanding in nearly all of the metrics, achieving excellent clinical outcomes with highly cost-effective processes. These outstanding units are all characterised by the quality of their clinical leadership and teamwork, a sense of unit identity, an understanding of how they are performing, and close working relationships between clinical staff and senior trust management.

Key findings

Patient flow

An overwhelming majority of units cited the lack of availability of staffed ITU and ward beds as the single greatest pressure point in the clinical service.

We found units routinely discharging patients home from critical care, with those patients having spent their entire post-operative stay in a level 3 bed because of the lack of a ward bed.

The national service specifications for cardiac surgery state that post-operative care of cardiac surgery patients should be delivered in a dedicated area, with core staff dedicated to the delivery of post-operative care of patients recovering from open-heart surgery. We found that 11 units ring-fence ITU beds and 13 units ring-fence ward beds.

We found a wide variation in the rate of cancellations on the day of surgery (ranging from 2.6% to 18.2% of elective cases), with a clear link between cancellation rates and the absence of ring-fenced beds.

Day of surgery admission (DOSA) is the norm in thoracic surgery in England, but this is not the case in cardiac surgery. Only one unit practised DOSA to a significant degree in cardiac surgery (60% of their elective cardiac cases). The majority of cardiac units do not practise this at all.

There was wide variation in the weekend discharge rate – from 15.3% to 34.1%. The consultant ward round is a powerful determinant of weekend discharges. Similarly, a lack of seven-day pharmacy services means that patients who improve throughout a weekend and become fit for discharge may be held on wards until the following Monday.

It is clear that ring-fencing is the key enabler for improving patient flow, reducing cancellation rates, increasing day of surgery admission and increasing weekend discharges.

Clinical outcomes and risk management

We report on clinical outcome measures after surgery at unit level. We looked at stroke, unplanned take-back to theatre, deep sternal wound infection (DSWI), renal replacement therapy, blood transfusion and unplanned readmission to hospital.

Variations in risk management are resulting in significant variations in outcomes and care. For example, measures to prevent infections can reduce DSWI rates, which vary between 0.1% and 2.1%. Patients with DSWI carry a mortality rate of 7.5% versus 2.1% for those who do not. Mean length of stay in DSWI is 38.5 days versus 9.5 days for other patients.

Lung cancer

For non-small-cell lung cancer (NSCLC) patients, resection is the main intervention to offer a chance of cure. We found unacceptable variation in resection rates for NSCLC – 48.9 percentage points between the lowest and highest rate.

The national service specifications for thoracic surgery state that ‘consultant thoracic surgeons are core members of lung cancer multidisciplinary teams (MDTs)’. We found that it is becoming increasingly difficult for many thoracic surgery centres to provide the level of multidisciplinary team meeting (MDTM) attendance required by lung cancer commissioners across the large number of peripheral MDTMs.

Video-assisted thoracoscopic surgery (VATS)

We found variation between providers in the rate of video-assisted thoracoscopic surgery (VATS) procedures for lung resection – from 84% down to 10.3%.

This is concerning when many reports confirm the advantages of VATS lobectomy in particular patient groups. There is a very wide variation in the use of VATS to manage empyema between providers, mirroring the variation in the use of VATS lobectomy for cancer.

Aortovascular surgery

We found a wide variation in survival following surgery for acute aortic syndromes between units. The data strongly suggests that high volume is associated with better outcome, with a four-fold variation in 30-day mortality.

Mitral valve repair

We found wide variation in the rate of repair versus replacement for patients suffering from degenerative mitral valve disease (42% to 95%) despite the strong evidence base supporting repair.

Repair rates were not influenced by unit-nominated mitral surgeons or by the presence of a mitral valve MDT, indicating that the definition of mitral specialist should be better defined.

Cardiothoracic surgery today

Cardiothoracic surgery is the surgical treatment of diseases of the organs contained within the chest, including the heart, major blood vessels and the lungs.

Diseases of these organs and systems are common. All told, seven million people in England have cardiovascular disease and it accounts for 27% of all deaths.¹ Lung cancer is the most common cause of cancer-related death, with survival rates the second lowest amongst the 20 most common cancers in England².

Skills and expertise

Cardiothoracic surgery involves major, technically demanding operations on patients who have life-threatening disease. Surgery is relatively low-volume and high-cost, and carries a measurable mortality rate.

Relatively few centres across the UK practice cardiothoracic surgery and much of it involves specialised commissioning.

National service specifications

The service specifications include the relevant evidence base and applicable national standards for cardiothoracic surgery.

Cardiac surgery

www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/01/a10-spec-adlt-cardiac-surgry.pdf

Thoracic surgery

www.england.nhs.uk/wp-content/uploads/2017/07/thoracic-surgery-service-specification.pdf

Successful outcomes depend on the skills and expertise of highly specialised multidisciplinary teams. These teams combine surgery, anaesthesia, intensive care, specialised nursing, and a wide number of allied professionals, such as perfusionists and physiotherapists. Surgery is also supported by many other clinical disciplines such as cardiology, respiratory medicine and oncology.

Data collection and outcomes

Amongst surgical specialties, cardiothoracic surgery has long been in the vanguard of data collection and measuring outcomes.

Data on unit and surgeon specific mortality rates for cardiac surgery is already in the public domain and involves sophisticated risk adjustment methods. Recently, unit specific chest surgery data has also been published.

Attention has long been focused on mortality figures, but there is a growing awareness for the need to monitor other clinical outcome measures. This is coupled with an understanding that it is vital that the cardiothoracic specialty continues to improve efficiency and reduce unwarranted variation whilst maintaining clinical quality.

Challenges in patient demographics

Patient demographics have altered significantly over the last 20 years.

Advances in interventional cardiology have enabled many patients who were previously suitable for cardiac surgery to have less-invasive treatments. This means, today's cardiac surgeon treats an ageing population that has often undergone previous interventions and often has critical multisystem dysfunction.

Likewise, thoracic surgeons operate on increasingly infirm and elderly early stage lung cancer patients, meaning a greater proportion can benefit from potentially curative surgery.

Despite all of these challenges, outcomes for cardiothoracic surgery in the UK have shown incremental improvement and remain amongst the best in the world.

¹ Public Health England (September 2016) Action on Cardiovascular Disease.

² Healthcare Quality Improvement Partnership (HQIP) National Lung Cancer Audit annual report 2016 (published January 2017).

About our analysis

We carried out our analysis following the established GIRFT model.

[For more on the GIRFT programme, see the separate section in this report.]

First we assembled all of the relevant existing NHS data on cardiothoracic surgery and conducted our own supplementary data collection through an extensive questionnaire to providers.

We benchmarked providers on key measures and identified where there is variation in both performance and outcomes. We also identified significant correlations between practice and outcomes.

We provided every unit with a data pack and then visited them to discuss the data in depth. During these deep dive visits, we looked closely at the reasons why providers outperform their peers and where they underperform too. We discussed this detail at length with clinicians, senior provider management and all those involved in delivering cardiothoracic services. We also discussed our findings with the Society for Cardiothoracic Surgery.

Cardiothoracic centres in England

Our review found there is no standard configuration for a cardiothoracic surgical unit in England.

31 NHS cardiothoracic centres

25 provide both cardiac and thoracic surgery

12 of these have at least one cardiothoracic surgeon (performing both subspecialised disciplines)

3 provide cardiac only

3 provide thoracic surgery only

Performing **28,250** cardiac surgery operations per year
and **69,000** thoracic surgery operations per year

3 are specialised stand-alone cardiothoracic centres

7 also perform paediatric cardiac surgery

8 also perform paediatric thoracic surgery

6 perform transplants

11 have a major trauma centre on campus

19 have an A&E department on campus

Source data: GIRFT Provider questionnaire responses, 2016 and HES data 2015/16

Cardiothoracic surgeons in England

27 cardiothoracic surgeons

182 cardiac-dedicated surgeons

92 thoracic-dedicated surgeons

Source data: GIRFT Provider questionnaire responses, 2016

Table 1: Headline data for the 31 cardiothoracic centres in England

Metric	Total/average	Provider range	
		Lower	Upper
Spells for cardiac procedures ¹ (pro-rata to 12 months)	28,250 operations per year	518	2,029
Cardiac surgery in hospital survival (risk adjusted) ²	98.01%	96.44%	98.98%
Average age of adult cardiac patient ¹	66.6 (versus 54.3 for all surgical patients)	61.7	69.6
Average deprivation index* of adult cardiac patient ¹	20.5 (versus 22.4 for all surgical patients)	12.8	28.4
Average Charlson score** of adult cardiac surgery patient ¹	2.1 (versus 1.7 for all surgical patients)	1.7	2.3
Spells for thoracic procedures ³	69,000 total spells per year	922	6,574
Average age of adult thoracic surgery patient ³	62.1 (versus 54.3 for all surgical patients)	52	64.3
Average deprivation index* of adult thoracic surgery patient ³	22.6 (versus 22.4 for all surgical patients)	13.25	31.1
Average Charlson score** of adult thoracic surgery patient ³	3.1 (versus 1.7 for all surgical patients)	2.1	3.6

* Average deprivation is based on IMD2015 (Index of multiple deprivation) and is assigned to patients at GP practice level. The higher the number, the greater the deprivation.

** Charlson score is a measure of co-morbidities linked to expected mortality. A higher-than-average score indicates patients recorded as having more co-morbidities and a higher expected mortality.

Data sources:

¹Hospital Episode Statistics (HES), Apr 2015 – Dec 2016

²National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

³Hospital Episode Statistics (HES), 2016

This report considers NHS adult cardiothoracic surgery in England. It excludes operations on patients under 18 years of age, transplantation and procedures where artificial hearts are implanted.

Explanation of tables and figures used in this report

Variation tables

These show the variation in the data for each key aspect of cardiothoracic surgery.

We would expect to see some level of warranted variation between providers for each aspect.

This report focuses on the unwarranted variation we have found.

Example

Table 3: Variation in cancellation rates for cardiothoracic surgery

Average	Range		Best quartile
	Lowest	Highest	
7.5%	2.6%	18.2%	5.4%

The mean average in the data. In this case, the average percentage of surgeries that providers cancel.

The lowest and highest levels in the data.

In this case, the provider with the fewest cancellations sees only 2.6% of surgeries cancelled. The provider with the highest level sees 18.2% of their surgeries cancelled.

Providers doing better than this figure are in the top 25% of the providers we looked at.

In this case, any provider seeing fewer than 5.4% of surgeries cancelled is in the top 25%.

Improvement and opportunity tables

These show the opportunities available if all providers were to match the average or the best performance.

Example

Table 4: Activity and notional financial opportunities of reducing cancellations – where patient discharged without their planned procedure taking place

Improvement	Estimated spells saved	Notional financial opportunity
All units at least match the average	545	£420k to £4m
All units at least match the current best quartile	1,070	£825k to £7.8m

What happens if the improvement were to be achieved. In this case, the spells that would be saved.

The opportunities available if all providers currently below the average were to raise performance to the current average.

The opportunities available if all providers currently below the best quartile were to raise performance to the current best quartile.

The gross notional financial opportunity puts an estimated value on the resources that could be saved or reduced. These notional financial opportunities are not always cash-releasing efficiency savings.

For example, if a provider reduces length of stay, it may create an opportunity for bed resources to be used more efficiently, but it may not necessarily release cash (unless sufficient days are saved to close beds).

Findings and recommendations

What we found

We found meaningful variation in clinical practice and clinical outcomes across the 31 cardiothoracic units.

For most of the metrics we have analysed, our review has found that most units perform within the average range. All units are good in some areas, whilst each one has at least a few areas that would benefit from further development.

Some units are outstanding in nearly all of the metrics, achieving excellent clinical outcomes with highly cost-effective processes. These outstanding units are all characterised by the quality of their clinical leadership and teamwork, a sense of unit identity, an understanding of how they are performing, and close working relationships between clinical staff and senior trust management.

We have also found significant degrees of unwarranted variation in a number of key areas, including patient pathways and associated bed management, management of clinical risk and adverse clinical outcomes, lung cancer services, aortovascular surgery, mitral valve repair, and clinical coding.

Good practice

Where we have found best practice, we have briefly highlighted the good work that is being done and how it is affecting outcomes.

In appendix 2, we highlight how two providers have been able to put in place a range of processes, practices and measures that have led to positive patient outcomes matched with greater cost efficiencies.

Patient pathways and bed management

Enhanced Recovery After Surgery (ERAS)

In line with most surgical specialties, cardiothoracic surgery has adopted a range of clinical management strategies for the individual patient that fall under the umbrella of Enhanced Recovery After Surgery (ERAS). These strategies focus on planning and preparation before admission, reducing the physical stress of the operation, a structured approach to perioperative management, and early mobilisation.

In this report, we address the wider systematic themes that influence patient flow and bed management for cardiothoracic units. We found that the principles of ERAS, as applied to individual patients, are already in place wherever clinically possible.

Availability of staffed beds

An overwhelming majority of units cited the lack of availability of staffed ward and ITU beds as the single greatest pressure point in the clinical service.

Table 2: Bed occupancy on cardiothoracic general wards

Ward	Occupancy rate
General cardiothoracic	91%
ITU	83%
HDU	96%

Source data: GIRFT Provider questionnaire responses, 2016

The impact of cancellations

Cancellations in cardiothoracic surgery have a deep and lasting impact on both patients and units that go far beyond any financial implications.

For patients and their families, any cancellation causes distress and disruption. Patients have life-threatening conditions and any delay in treatment could have serious consequences. They must prepare themselves for an operation that carries a risk of death, so it's unsurprising that almost every patient is apprehensive when they're admitted. To be told on the morning of their operation that it is to be cancelled can be devastating. Some patients find themselves going through this upheaval on multiple occasions.

Units also feel the impact of cancellations. If a unit has to cancel some of the day's operations, they will usually elect to operate on patients with the highest clinical priority. Over time, this means more high-risk patients are treated than low-risk, leading to more long-stay patients on ITU. In turn, this reduces the availability of ITU beds, further fuelling the need to cancel operations. It's a downward spiral that saps staff morale. Pressures on the recruitment and retention of highly trained specialist staff lead to further pressure on bed availability: activity falls, cost per case rises, and clinical outcomes worsen.

Cancellation rates

All cardiac surgery and many thoracic surgery patients initially recover on an Intensive Treatment Unit (ITU) after their operation.

Our review found that a lack of staffed ITU beds is a major cause of cardiothoracic surgery cancellations. This may in turn be due to a lack of general ward beds preventing or delaying timely transfer of recovering patients from the ITU.

Table 3 shows the percentage of spells where patients are discharged after admission without their planned procedure taking place, for all possible reasons (medical, patient, unspecified or other). These figures are merely the tip of an iceberg since they do not include occasions where patients are cancelled prior to admission, or where a procedure is cancelled on a particular day, the patient kept in hospital and the operation subsequently takes place at a later date within the same admission.

Table 3: Variation in cancellation rates for cardiothoracic surgery – where patient discharged without their planned procedure taking place

Average	Range		Best quartile
	Lowest	Highest	
7.5%	2.6%	18.2%	5.4%

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Good practice case study

Reducing cancellations through ring-fenced beds

Basildon and Thurrock University Hospital

Despite very high rates of bed occupancy and limited number of available beds, the Essex Cardiothoracic Centre achieves fewer cancellations than average.

General beds are ring-fenced for cardiothoracic surgery patients, enabling effective bed management. This detailed understanding of their available beds means the Centre is able to accommodate their patients and manage their lists further in advance.

The Centre has also developed a highly effective urgent patient pathway and achieves good lengths of stay across the board.

Good practice case study

Managing patients effectively with a consultant of the week

Barts Health

Barts has a very low cancellation rate compared with the national average and good overall length of stay.

The Centre's consultant of the week has sole responsibility for managing every patient on the ward and providing a central point of communication for the unit. They manage patient flow, assess patients, refer them appropriately, and stratify and pool urgent patients across the collective surgical teams.

They also conduct a robust analysis of any cancellations, which is then discussed at a weekly theatre operations meeting to help prevent avoidable cancellations in the future.

Notional financial opportunity

When we looked at the notional financial opportunity, we established two figures for both levels of improvement.

The lower value (£825k on best quartile) is based on the reported average cost of admitting and discharging patients for spells where no planned procedure takes place.

However, this lower figure is likely to be a material underestimation of the true opportunity cost of a cancellation. For example, cancellations on the day of surgery due to lack of beds leave fully staffed operating theatres lying fallow and consultant surgeons and associated teams with a whole day of wasted allocated operating time. The upper valuation (£7.8m on best quartile) attempts to capture this, and is based on the average cost of a cardiac surgery procedure.

In reality, the true cost is likely to lie somewhere between these two figures and will depend largely on the reasons for the cancellations. For example, if an elective case were to be cancelled because the theatre was being used for an urgent emergency case, there would be no wasted operating time.

Table 4: Activity and notional financial opportunities of reducing cancellations – where patient discharged without their planned procedure taking place

Improvement	Estimated spells saved	Notional financial opportunity
All units at least match the average	545	£420k to £4m
All units at least match the current best quartile	1,070	£825k to £7.8m

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Ring-fencing beds to reduce cancellations

The national service specification for cardiac surgery states that post-operative care of cardiac surgery patients:

...will be delivered in a dedicated area with core staff dedicated to the delivery of post-operative care of patients recovering from open-heart surgery. Such staff would be fully trained in the post-operative care of surgical patients, including their resuscitation. Similarly there should be dedicated intensivists who have experience and training in the management of the ill post-operative patient following open-heart surgery.

This encompasses level 3, 2, and 1 beds. Ring-fencing implies a degree of bed protection from patients from other specialties - this level of protection may be either full or partial.

Cardiac surgery is a unique case in that all patients who undergo an operation spend their initial recovery in critical care. Without access to beds on the critical care unit there can be no cardiac surgery. Similarly, without access to general ward beds, patients cannot be discharged from their critical care bed once they have recovered, meaning their critical care bed cannot be released for the next case.

We found that 11 of the 28 units performing cardiac surgery fully ring-fence critical care beds. This includes units in general hospitals with accident and emergency departments. 13 of the 28 units ring-fence general ward beds.

There is a clear link between cancellation rates and ring-fencing beds – particularly when those are ITU and HDU beds. When we look at the 10 providers with the lowest cancellation rates, 8 ring-fence either critical care beds or ward beds or both. Reinforcing this link, 7 of the providers with the highest cancellation rates do not ring-fence beds or only partially ring-fence beds.

Only one of the units that ring-fences ITU beds and ward beds has a higher than average cancellation rate.

Figure 1: Ring-fenced ITU/HDU beds and post-admission cancellations of elective spells in cardiothoracic specialty

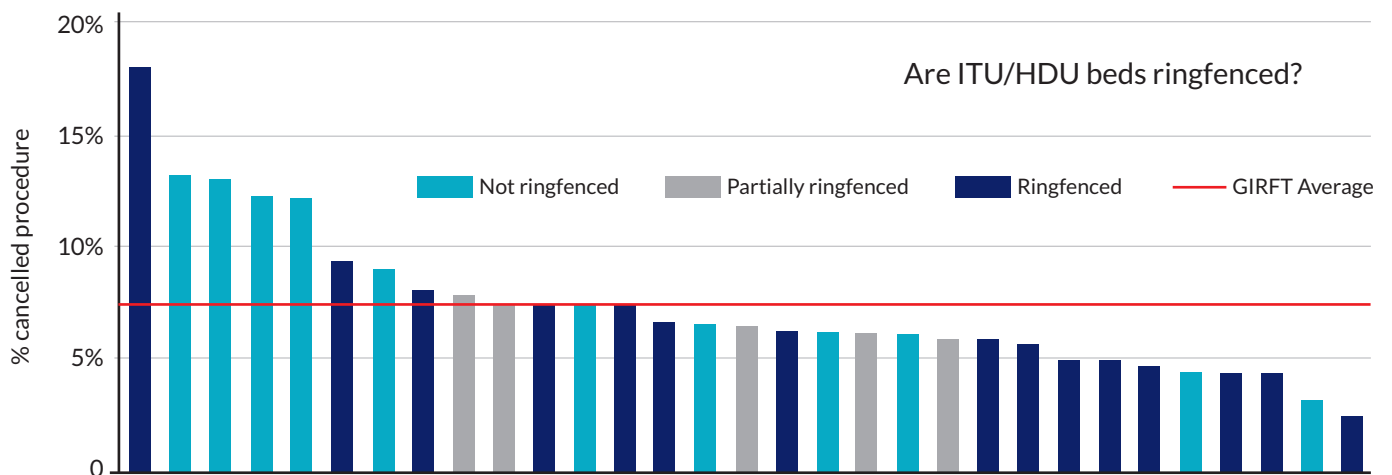


Figure 2: Ring-fenced ward beds and post-admission cancellations of elective spells in cardiothoracic specialty

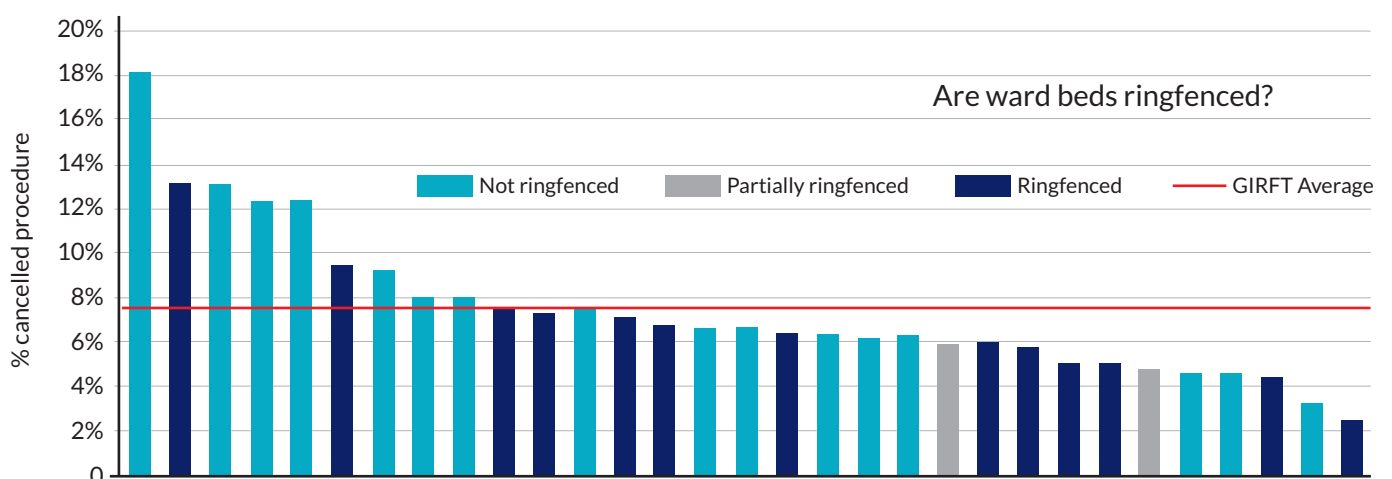
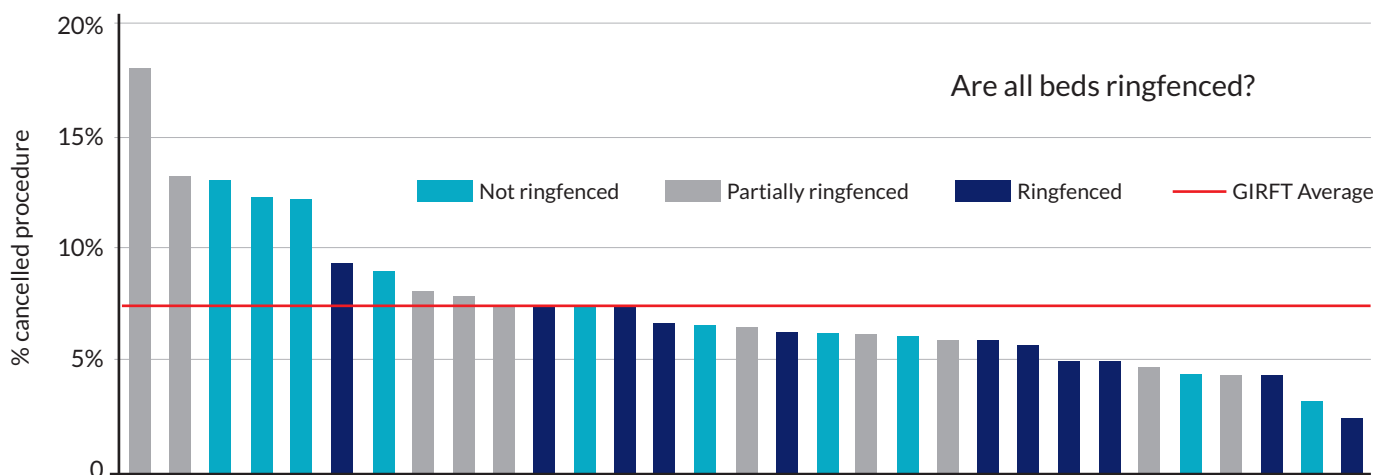


Figure 3: Ring-fenced ITU/HDU and ward beds and post-admission cancellations of elective spells in cardiothoracic specialty



Good practice case study

Zero tolerance cancellation culture

University Hospital Southampton Cardiology unit

Southampton has a culture of zero tolerance of cancellations.

Issues with the typical approach

A cardiac operation typically occupies a half-day in the anaesthetic room and operating theatre combined, allowing most units to perform two procedures per theatre per day. Induction of anaesthesia can only start once the operating team have been assured there will be a bed available on the ITU after surgery, around 4 hours later.

In many units, decisions about whether to proceed or cancel surgery on the basis of ITU and ward bed availability are taken at the beginning of the day – before there's been an opportunity to make a full assessment of the current ITU and ward patients.

The first patients on the list need to be transferred to theatre by 8am. Yet it's not reasonably possible to optimise all patients on the ITU and ward, and to complete discharge to home processes, such as medication, social services and transport, by then.

This means that ITU beds may become available during the day that cannot be foreseen or guaranteed at the beginning of the day.

Continual assessment of bed availability

Southampton have a multidisciplinary team, including intensive care staff, case managers, ward managers and consultants, who plan and reassess patients on ITU and the ward throughout the day.

The team liaises with the theatre team to review and manage lists, and decisions about the second case are not made right up until the scheduled induction time.

This approach avoids the majority of cancellations.

Annualised job planning

Southampton also use annualised job planning within the surgical team as a way of ensuring that every theatre session available each day is utilised. Patients are pooled across surgeons and anaesthetists, creating flexibility for operating on patients throughout the week.

This means that patients necessarily cancelled on one day are rarely sent home, but instead receive surgery under a different team in a vacant session later in the week.

Weekend discharges

There are wide variations in the rate of weekend discharge, both between providers and when comparing rates for cardiac patients with thoracic patients.

During our deep dive visits, we found three key factors affecting weekend discharges:

- absence of consultant ward rounds at weekends
- lack of pharmacy services
- bed 'holding'.

Note: if service delivery was uniform across the entire week, weekend discharges would be 28.6%.

Figure 4: Weekend discharge rates for cardiac surgery and thoracic surgery

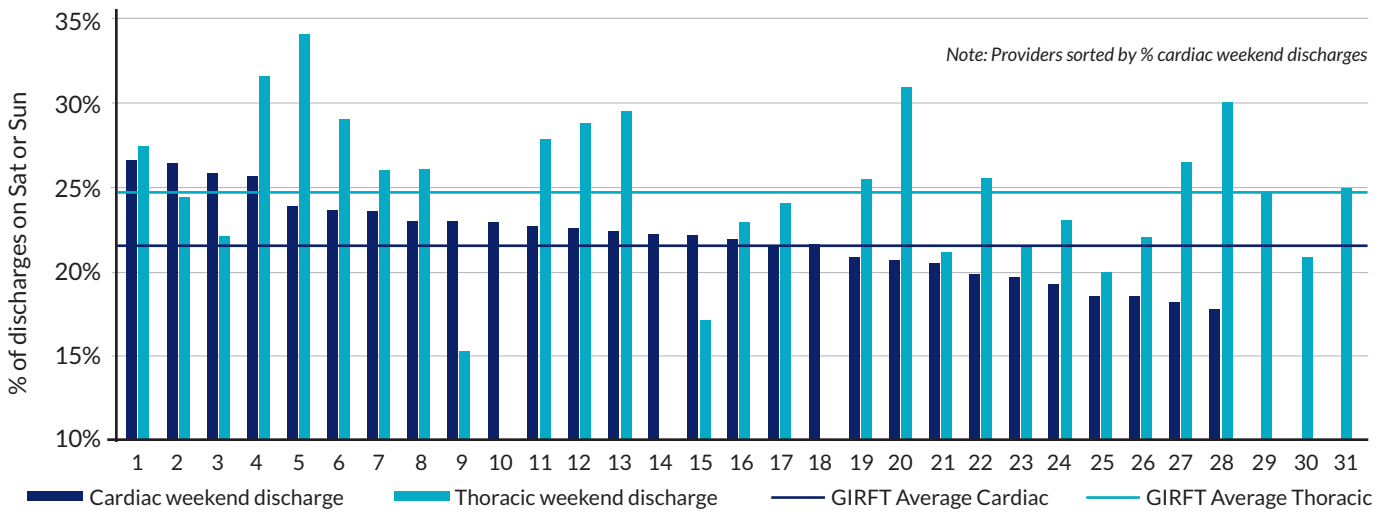


Table 5: Variation in weekend discharge rates

Specialism	Average	Range		Best quartile
		Lowest	Highest	
Cardiac surgery	21.6%	17.7%	26.6%	23.2%
Thoracic surgery	24.7%	15.3%	34.1%	28.1%

Figure 5: Cardiac surgery – relationship between post-operative average length of stay for elective surgery and weekend discharges

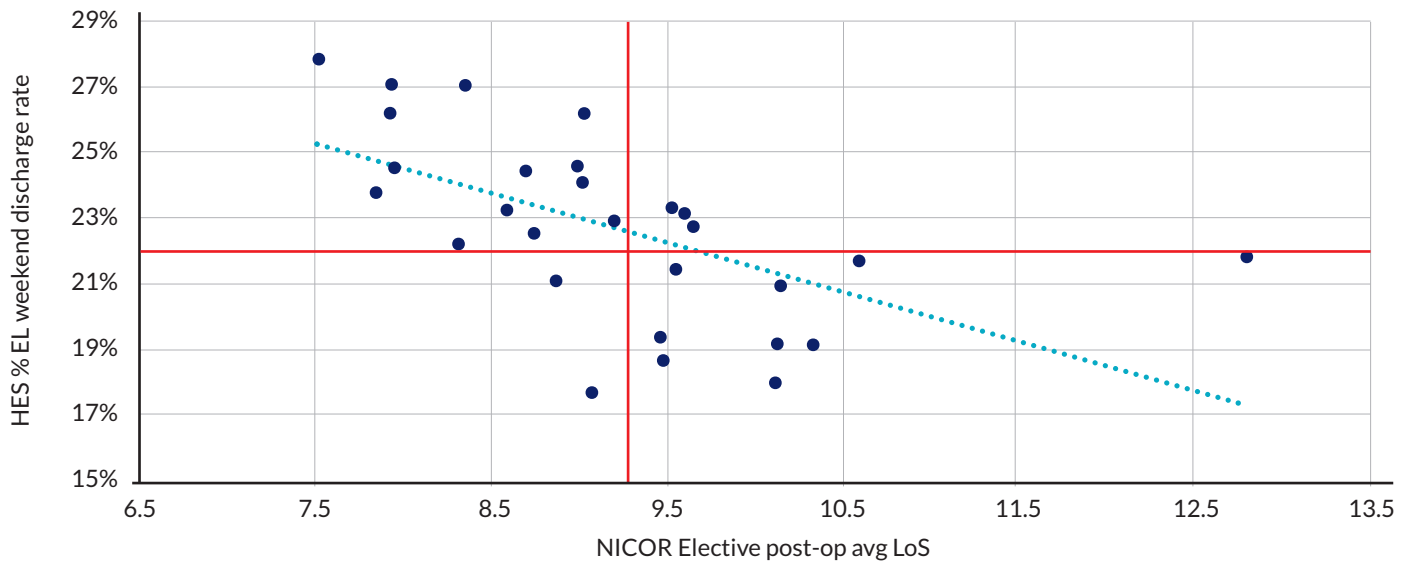


Figure 5 shows the positive impact that higher rates of weekend discharges could have on overall post-operative average length of stay within cardiac surgery.

Table 6: Estimated opportunity for additional weekend discharges

Specialism	Potential additional discharges	
	All units at least match the average	All units at least match the current best quartile
Cardiac surgery	290	565
Thoracic surgery	200	570

Source data for cardiac surgery: Hospital Episode Statistics (HES), Apr 2015 – Dec 2016

Source data for thoracic surgery: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Consultant ward round seven days per week

We found that the consultant ward round is a powerful determinant of weekend discharges. Non-consultant staff are less likely than consultant surgeons to make difficult judgements about fitness to discharge in-patients who have been unstable or unwell.

In the units with relatively high rates of weekend discharges, a consultant of the day makes a ward round of all in-patients (not just patients on critical care areas). This consultant has authority to make decisions about patients across the entire surgical team – not just their own.

Pharmacy services

A lack of seven-day pharmacy services means that medicines to take out (TTOs) and transport arrangements have to be prepared on a Friday for weekend discharges. Patients who improve throughout a weekend and become fit for discharge may be held on wards until the following Monday.

'Bed holding'

We found that units without ring-fenced ward beds may deliberately keep patients in hospital over the weekend, despite the patients' fitness for discharge, in order to 'hold' the bed for the following week's admissions.

Units reasonably argued that these beds would otherwise be taken by acute medical outliers, leading to a cancellation of Monday's scheduled cardiac elective case.

Ring-fencing ward beds to avoid the need for 'bed holding' would facilitate Friday discharges. And when combined with day of surgery admission (DOSA) for elective cases, this would reduce demand for ward beds by up to three days for a patient fit for discharge on a Friday.

We look at this in more detail in the following section.

Day of surgery admission (DOSA) for elective cardiac surgery

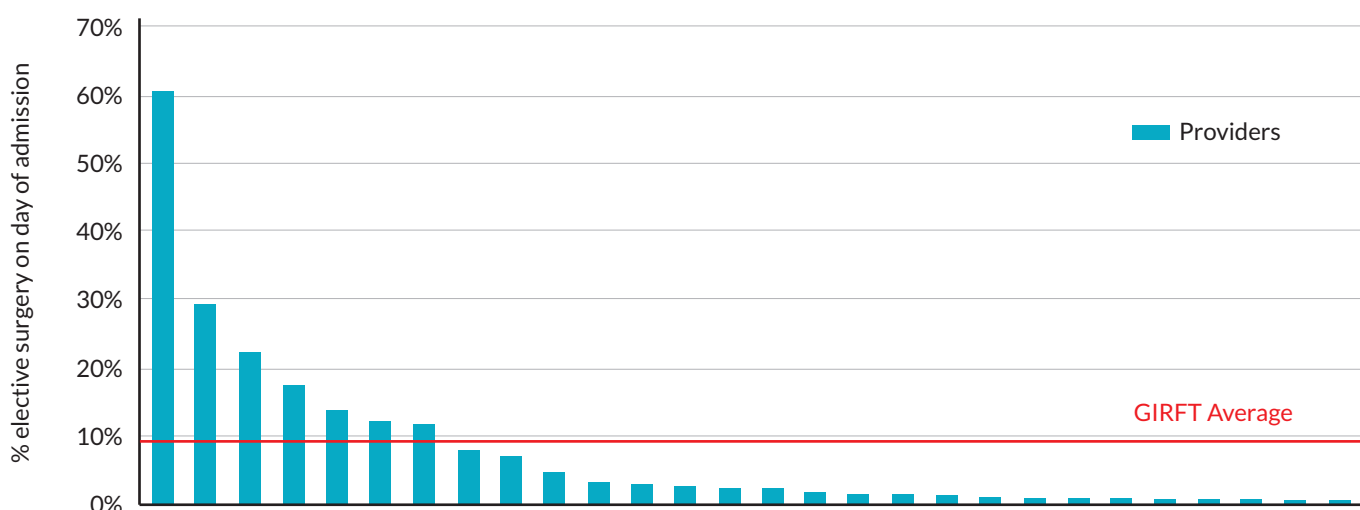
Day of surgery admission (DOSA) is standard practice in major thoracic surgery in England. However, the reverse is the case in cardiac surgery, where very few units practise it – indeed 9 of the 28 providers report rates of below 1%.

Table 7: Variation in DOSA rates for elective cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
9%	0.3%	60.9%	9.8%

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Figure 6: DOSA for elective cardiac surgery by provider



One provider, Blackpool Teaching Hospitals, achieves a rate of 60.9% at the same time as maintaining one of the lowest average rates for post-operative length of stay, an average re-admission rate, and below average complication rate. Taken together, these figures suggest their high rate of day of surgery admission is not causing issues later in the patient spell.

Table 8: Activity and notional financial opportunities of increasing DOSA rates for elective cardiac surgery

Improvement	Estimated days saved @ 1 day per spell	Notional financial opportunity @ 1 day per spell
All units at least match the average	865	£315k
All units at least match the current best quartile	975	£355k
All units at least achieve 50% DOSA	7,285	£2,665k

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Setting a target for day of surgery admission

Given that one provider is able to achieve such a high rate of day of surgery admission, we believe a target of 50% should be achievable for all providers – a rate that’s significantly higher than the current best quartile.

Providers commonly run both a morning and afternoon surgery list, often with only one patient per list. These providers could achieve the target rate of 50% just by altering the pathway for the afternoon patients.

The need to ring-fence ITU and ward beds

Day of surgery admissions can only work if the post-operative ITU and ward beds are ring-fenced.

During our deep dive visits, we found that executive level hospital management in several units would be willing to allow ring-fencing of ward beds provided that clinicians agreed to switch to day of surgery admission.

Good practice case study

Clinical commitment to day of surgery admission

Blackpool Teaching Hospitals

Surgeons at Blackpool Teaching Hospitals started a programme to facilitate day of surgery admission in 2005. Today, the unit admits over 60% of their elective cardiac surgery patients on the day.

Pre-operative clinic patients are seen by anaesthetists (who pool pre-operative care across the entire service) and consultant surgeons. When necessary, the unit assists getting patients to the hospital, such as through taxi services.

Day of surgery admission goes hand in hand with improved length of stay and reduced cancellations, all combining to reduce costs.

The most important factor in the success of the programme has been the clinical team’s commitment – with consultant surgeons and anaesthetists working to make it happen.

Post-operative length of stay for elective cardiac surgery

We found a wide variation of between 7.5 and 12.8 days in the average post-operative length of stay following elective cardiac surgery.

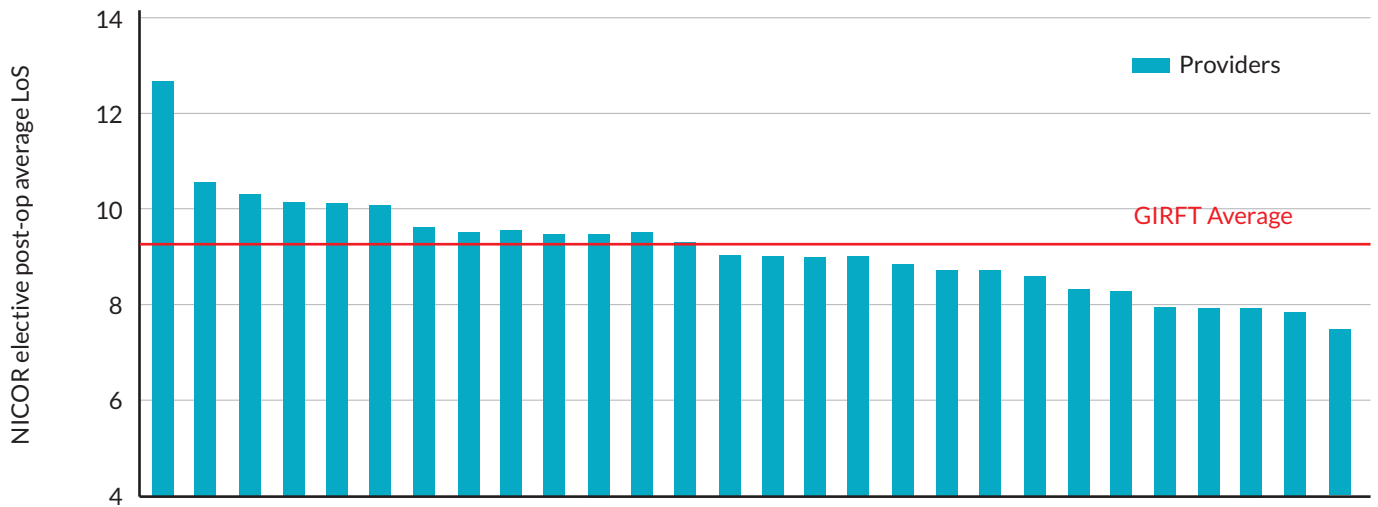
We did not specifically consider the impact of enhanced recovery programmes because they are broadly useful across surgical specialties rather than being specifically relevant to cardiac surgery.

Table 9: Variation in post-operative length of stay for elective cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
9.2 days	7.5 days	12.8 days	8.5 days

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Figure 7: Post-operative length of stay for elective cardiac surgery by provider



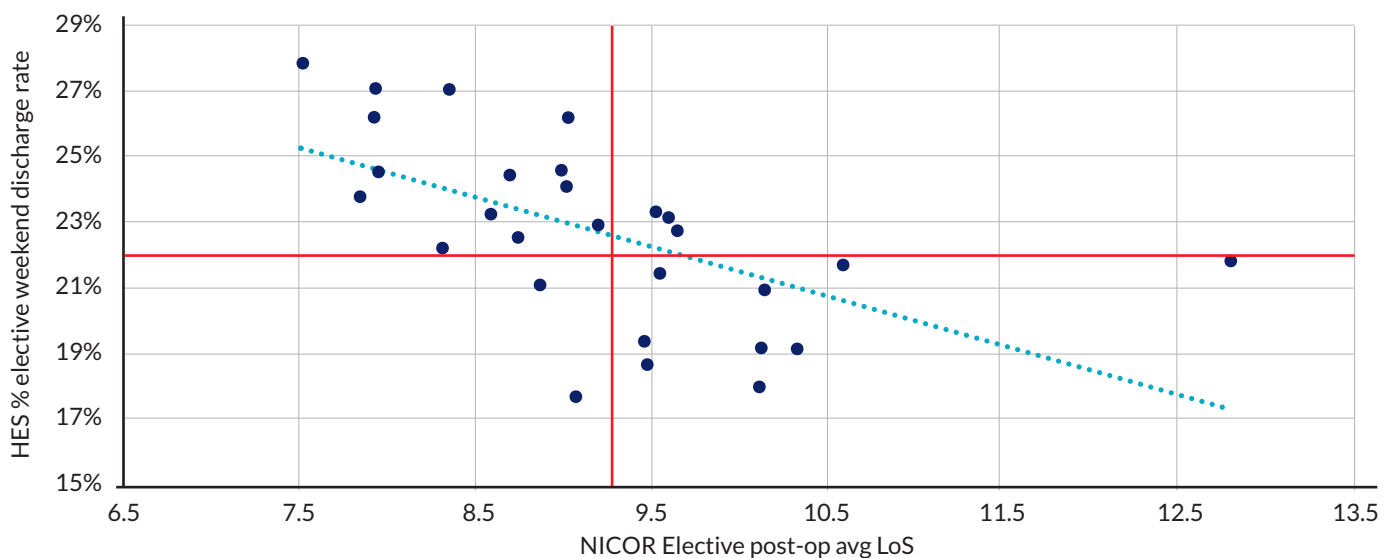
Post-operative length of stay and weekend discharge rates

See also: *Weekend discharges.*

We found a strong link between lower post-operative length of stay and higher rates of weekend discharge.

13 of the 15 providers with a below-average post-operative length of stay also reported above-average rates of weekend discharge.

Figure 8: Relationship between post-operative length of stay and weekend discharge for elective cardiac surgery



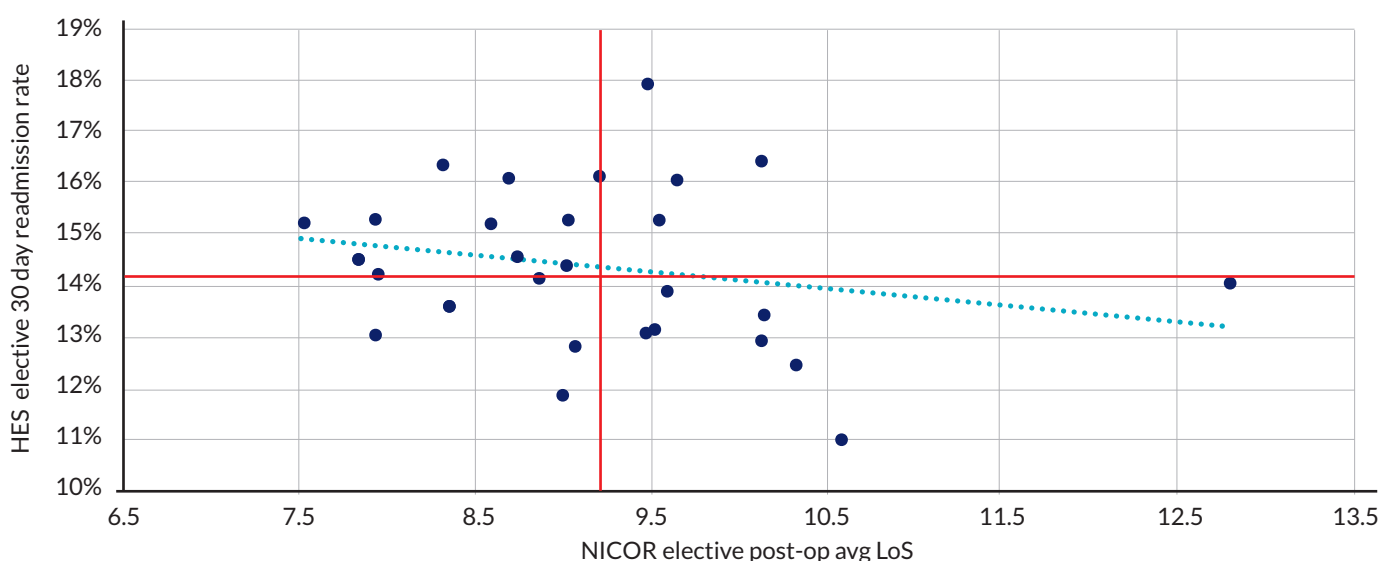
Those units that practice a consultant of the day/week with senior level review for every in-patient had the shortest post-operative lengths of stay.

Some of this effect is related to higher rates of weekend discharges, but quicker identification and management of post-operative complications and shared decision-making across teams based on protocols of care also contribute.

Post-operative length of stay and readmission

Any link between post-operative length of stay and 30-day readmission rates is relatively weak. Indeed, some providers achieve both below-average post-operative lengths of stay and low readmission rates.

Figure 9: Relationship between post-operative average length of stay and 30-day readmission for elective cardiac surgery



Post-operative length of stay and complications

The link with rates of complications is also weak, with the variation in length of stay not fully explained by complication rates.

Table 10: Activity and notional financial opportunities of potential length of stay reduction - elective cardiac surgery

Improvement	Estimated days saved	Notional financial opportunity
All units at least match the average	6,600 days	£2.4m
All units at least match the current best quartile	14,625 days	£5.35m

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 - Mar 2016

Post-operative length of stay for urgent cardiac surgery

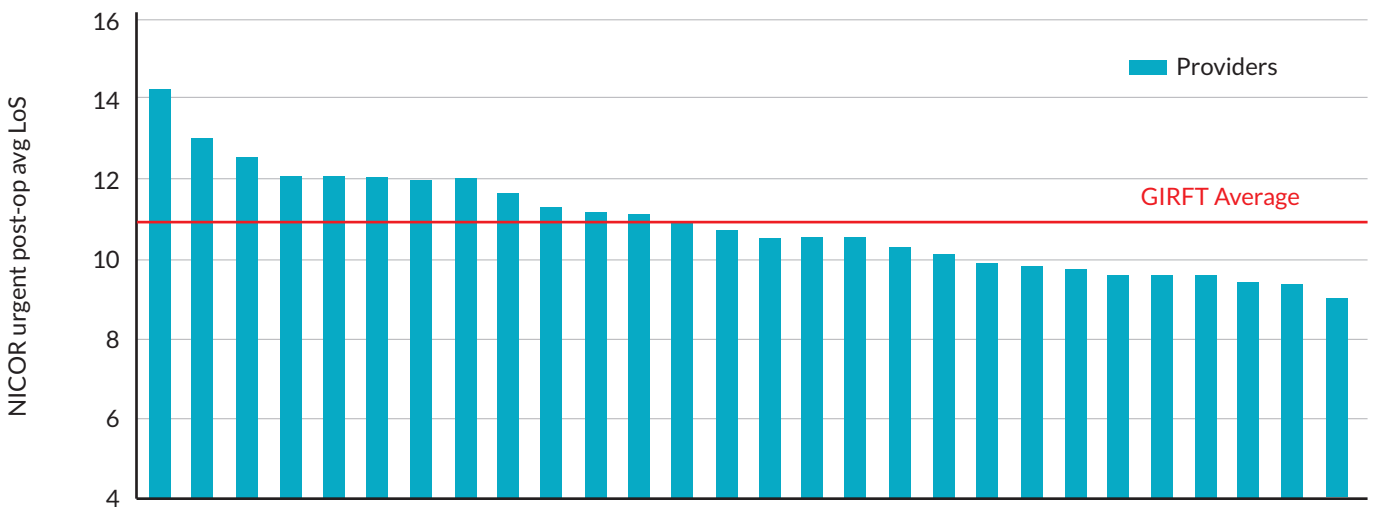
Providers show a wide variation of between 9 and 14.3 days in the average post-operative length of stay following urgent cardiac surgery, with an overall average of 10.9 days.

Table 11: Variation in post-operative length of stay for urgent cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
10.9 days	9 days	14.3 days	9.8 days

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

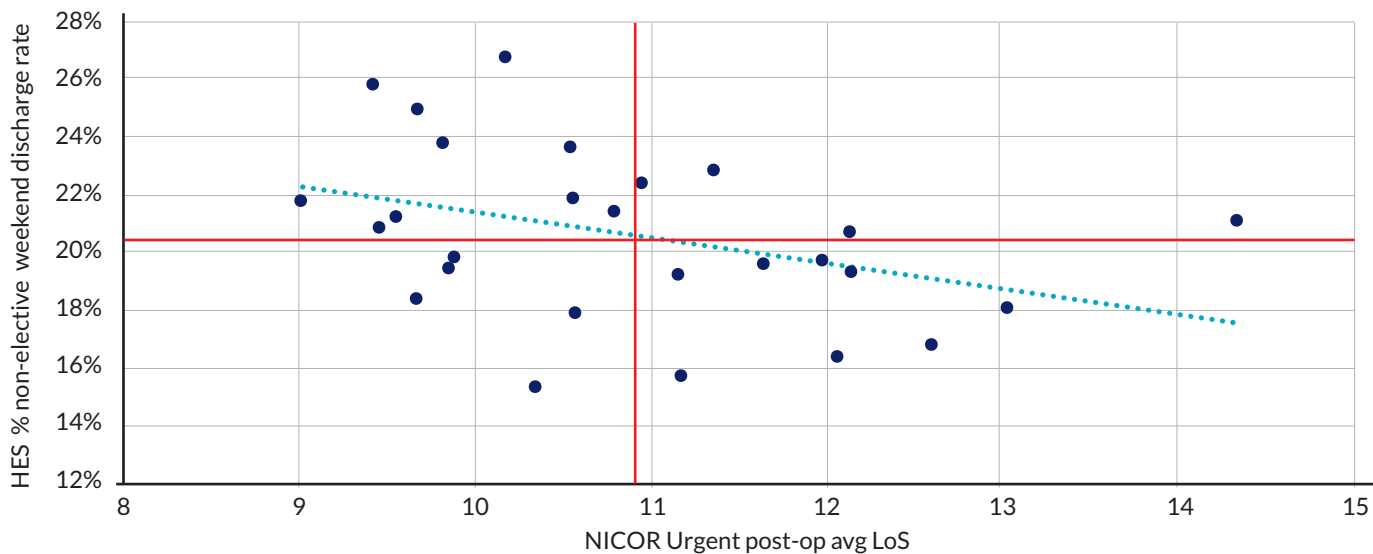
Figure 10: Post-operative average length of stay for urgent cardiac surgery by provider



Post-operative length of stay and weekend discharge rates for urgent cardiac surgery

There appears to be some correlation between post-operative length of stay and weekend discharge rates. (As discussed elsewhere in this report, weekend discharge rates could be improved with changes to discharge procedures.)

Figure 11: Relationship between post-operative average length of stay and weekend discharge for urgent cardiac surgery



Post-operative length of stay and average age of patients for urgent cardiac surgery

There is no correlation between post-operative length of stay and average age.

Post-operative length of stay and 30-day re-admission rates for urgent cardiac surgery

With 9 of the 10 providers that reported the lowest average length of stay also reporting above average readmission rates, there's a possible relationship between the two.

Given this, we recommend that providers monitor readmission rates when taking measures to reduce length of stay to ensure there is no adverse impact.

Figure 12: Relationship between post-operative average length of stay and 30-day readmission rate for urgent cardiac surgery

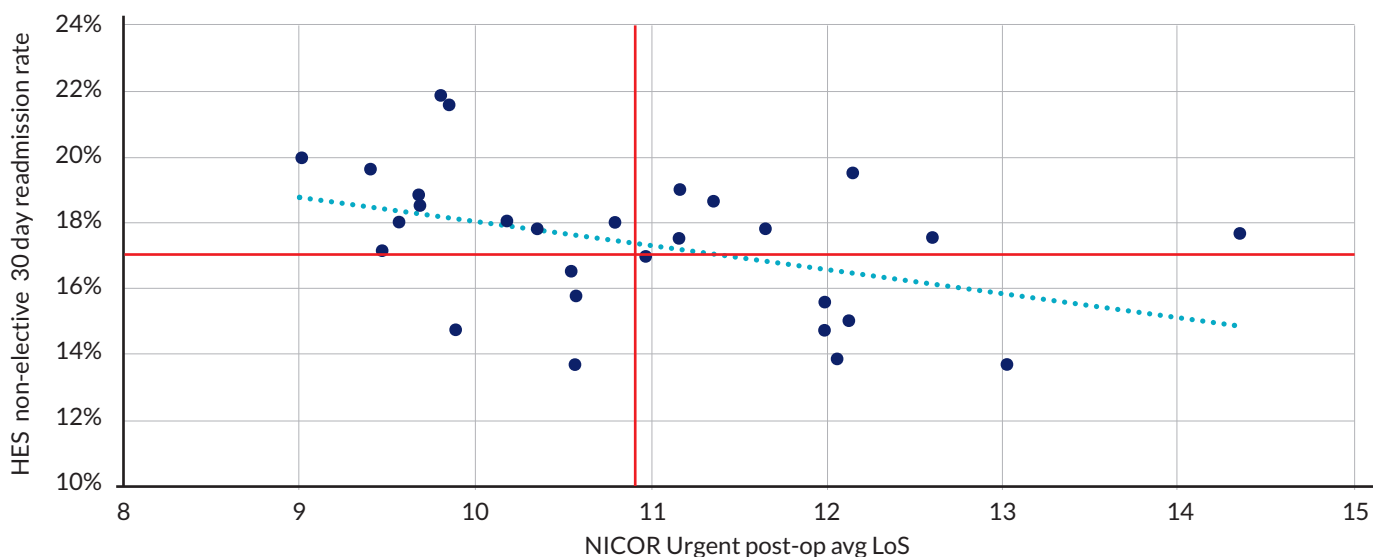


Table 12: Activity and notional financial opportunities of reducing post-operative length of stay for urgent cardiac surgery

Improvement	Estimated days saved	Notional financial opportunity
All units at least match the average	4,655 days	£1.7m
All units at least match the current best quartile	10,670 days	£3.9m

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Pre-operative length of stay for urgent cardiac surgery

There is a wide variation in the average length of pre-operative stay for urgent patients once they have arrived at the cardiac centre – ranging from 2.2 days to 13.4 days, with an average of 7.2 days.

Table 13: Variation in pre-operative length of stay for urgent cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
7.2 days	2.2 days	13.4 days	5.3 days

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Profile of urgent cardiac cases

Urgent cases account for 32.8% of adult cardiac surgery. This figure is made up of:

- cases admitted via the tertiary unit’s own A&E (18.7% of urgent cardiac surgery cases).
- cases admitted via referring unit’s A&E and/or elective cardiology admissions that have been deemed too unwell to discharge home before undergoing surgery owing to the risk of death (81.3% of urgent cardiac surgery cases). Patients transferred from a cardiology unit are known as ‘in-house transfers’.

Patients transferred from other units will have spent time undergoing diagnosis and treatment prior to transfer and surgery. For the purposes of this report, we don’t have access to ‘super spell’ data. However, we do know that patients referred for surgery can wait for a considerable time for a transfer to the cardiac surgical unit after diagnosis and work-up. Transfer is delayed waiting for beds and theatre availability in the tertiary unit, which causes blocked beds in the peripheral units. Most cardiac units leave spaces on each week’s operating schedule for such cases.

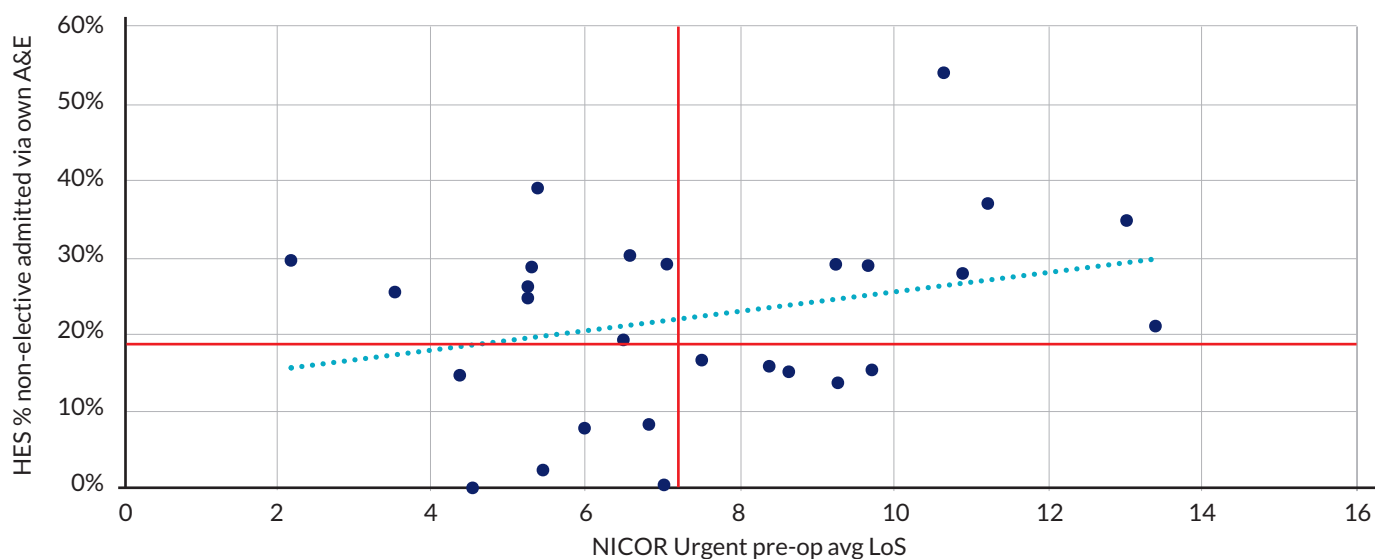
We believe the total patient pathway for these patients – taking account of days spent in other hospitals before patients are admitted to a specialist cardiothoracic centre – should be explored further.

Key causes of delay within the cardiac surgery unit

Key causes of delays after admission to the cardiac surgery centre include:

- insufficient work-up at the referring centre, which leads to repeat investigations, such as echocardiography, additional investigation, and case management
- referral to and acceptance by a specific surgeon despite that surgeon not having available operating slots
- lack of available ITU bed.

Figure 13: Relationship between pre-operative average length of stay for urgent cardiac surgery and number of non-elective patients admitted via provider's A&E department



Reducing delays for urgent patients within the cardiac surgery unit

During our deep dive visits, we found several providers adopting a mix of the following strategies to reduce delays within the cardiac surgery unit:

- pooling urgent cases across the entire surgical team, which eases the issue of vacant operating slots not being uniform across the surgical team
- agreeing regional protocols for investigation and work-up by referring centres
- only transferring patients to the tertiary centre when the work-up is complete and when there is a confirmed operation date
- holding virtual multidisciplinary team (MDT) meetings between peripheral cardiologists, tertiary centre cardiologists and surgeons – with remote telelinks so that each team member can see the investigations
- allocating appropriate numbers of vacant slots to the operating schedule each week
- moving patients between surgeons to fill any empty slots.

Table 14: Activity and notional financial opportunities of reducing pre-operative length of stay for urgent cardiac surgery

Improvement	Estimated days saved	Notional financial opportunity
All units at least match the average	9,230 days	£3.4m
All units at least match the current best quartile	18,645 days	£6.8m

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Good practice case study

Urgent referral system

Royal Papworth Hospital

Papworth have reduced delays for patients by revising their urgent cardiac surgery referral system and improving coordination.

Daily MDT team meetings

An MDT discusses all urgent referrals every Monday to Friday at 12pm.

The team includes a nominated, rotating surgical firm (usually at least two surgeons), an imaging cardiologist, the interventionalist/cardiologist of the week, admin support and the pathway coordinator. All decisions are minuted.

Standardised referral form

To ensure that all the required information is available, the referring cardiology team completes a standard referral form for every patient. Cases are also only discussed once appropriate imaging is available.

Patients already in Papworth, under the care of the local cardiologists, are presented by the cardiology team. Patients at other hospitals are presented by their referring team at the MDT meeting via conference call.

Same day decision

For the majority of cases, a decision is made on the day. The patient is assigned a surgical plan, date for surgery and operator – usually the next available operating list with a vacant operating slot. Occasionally a specific operator with particular skills and experience is needed.

If the assigned surgeon was not present at the meeting, they are notified of the case.

Patient management

Patients already in Papworth are managed by the cardiology team until the operating day.

Patients outside Papworth stay in their referring hospital and are transferred the day before the planned operation day. If there are doubts about a patient's candidacy for surgery, the patient may be called to Papworth for a surgical assessment on the day-ward. This is carried out on a transfer and return basis.

Flexible slot allocation

Typically, there are 15 operating slots a week assigned for in-house urgent cardiac surgery.

The cardiac surgeons accept that approximately 30% of their cardiac surgery caseload will be urgent. At times of longer waits (over one week), more in-house urgent slots are added at the expense of elective surgery. If there are fewer in-house urgent patients waiting, some slots are switched to elective patients at two to three days' notice.

Length of stay in intensive care following cardiac surgery

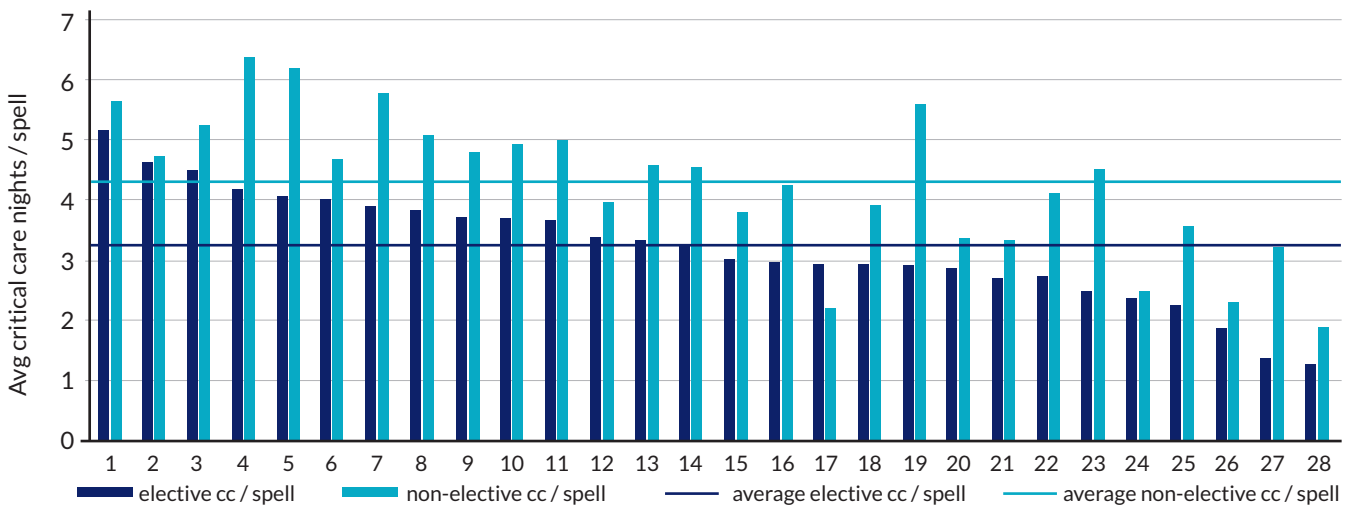
We found a wide variation between providers in the average number of nights spent in critical care per cardiac surgery spell. This applies to both elective surgery and non-elective surgery.

There is a strong correlation between critical care length of stay for elective surgery and critical care length of stay for non-elective surgery, i.e. a provider with an above average rate of critical care nights for elective patients is also likely to have an above average rate for non-elective patients.

Table 15: Variation in length of stay in critical care following cardiac surgery

	Average	Range		Best quartile
		Lowest	Highest	
Elective surgery	3.2 nights per spell	1.2 nights per spell	5.2 nights per spell	2.7 nights per spell
Non-elective surgery	4.3 nights per spell	1.9 nights per spell	6.4 nights per spell	3.5 nights per spell

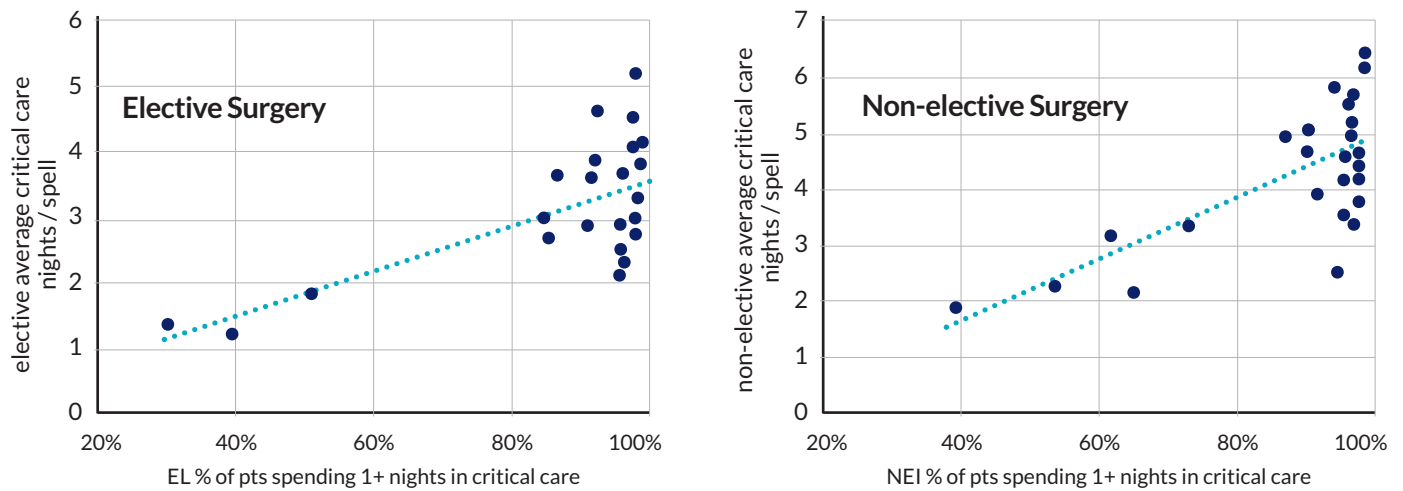
Figure 14: Average critical care nights per spell following cardiac surgery by provider



When we look at the providers achieving the lowest average critical care nights per spell – particularly in elective care – we can see they have only a small percentage of patients spending more than one night in critical care. One provider had only 39% of patients spending at least one night in critical care. And those patients then only stayed an average of 3.2 nights (giving an overall rate of 1.2 days across all cardiac surgery spells).

At the other end of the scale, the provider with the highest average number of critical nights per elective spell (5.2 nights) saw 98.6% of all patients spending at least one night in critical care. This provider cited pressure on ward beds (which are not ring-fenced and are subject to use by emergency medical outliers) as the main cause of delayed transfer from ITU to ward.

Figure 15: Relationship between average critical care nights per spell following cardiac surgery and patients spending at least one night in critical care



Patient age and nights in critical care

The variation in critical care nights is not explained by the average age of patients. For example:

- two of the providers with the lowest average critical care nights per elective spell have patients of average age or slightly above
- the provider with the highest elective average critical care nights per spell has the lowest average age patients.

On this basis, the data suggests that age would not be a limiting factor in reducing critical care nights per spell.

Availability of ward beds and nights in critical care

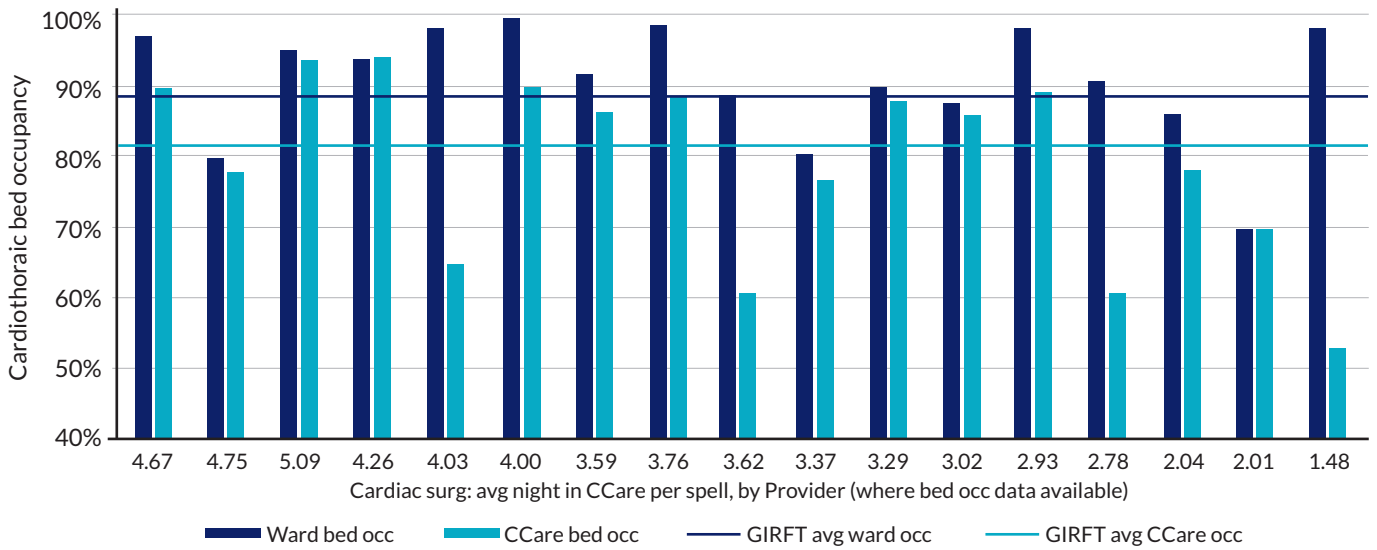
Many providers with above average rates of critical care nights told us this is because a lack of availability of ward beds delays their ability to discharge patients from ITU.

We gathered data on ward bed numbers, critical bed numbers and occupancy rates. Unfortunately, the data is only available for combined cardiothoracic services rather than for cardiac surgery alone. Also, not every provider submitted robust data for occupancy rates.

However, from the data we do have available to us, we can see that seven of the eight providers with the highest rates of critical care nights also had above average occupancy rates in ward beds.

Any work to achieve a material reduction in the average rate of critical care nights per spell will require a wider review of ward and critical bed configuration and availability. Therefore, we feel it's unlikely that large changes can be made quickly in this area.

Figure 16: Average critical care nights per cardiac surgery spell and cardiothoracic bed occupancy by provider



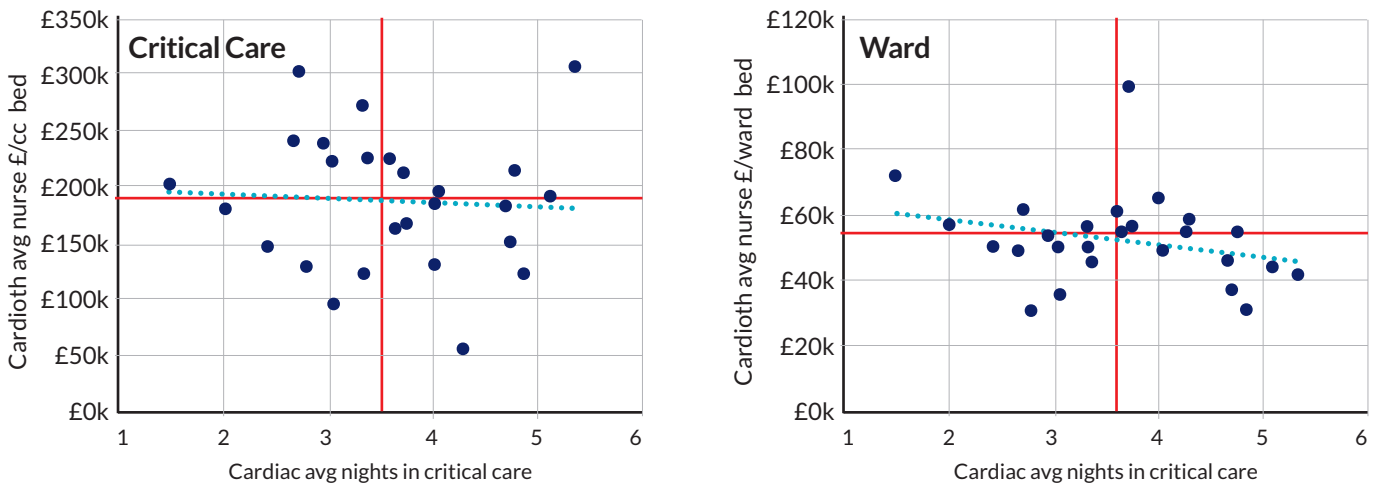
Average nursing costs and nights in critical care

We looked at whether units with low critical care rates have higher critical care costs, which might suggest that patient needs are addressed more intensively during their time there.

We also looked at whether units with low critical care rates have higher ward costs, which might suggest that wards are caring for patients that may be candidates for critical care.

The data does not indicate any material link between these two factors.

Figure 17: Relationship between average critical care nights per cardiac surgery spell and average nursing cost



Key factors affecting length of stay in critical care

From our discussions with providers and the evidence in the data, we believe the key factors affecting length of stay in critical care are:

- bed availability on the general ward
- case complexity – with sicker patients requiring longer stays
- individual clinical preferences – some centres reported a reluctance to transfer patients to the general ward until they were very low dependency.

During our visits, we discovered that a number of units were routinely finding themselves discharging patients home directly from critical care. These patients are fully ambulant and self-caring, yet they have spent their entire post-operative stay on critical care wards because there is insufficient availability of beds on the general wards.

This not only means that some of the most expensive beds in the hospital are being used unnecessarily, but also that patients are on wards without the facilities (patient toilets, day room, dining rooms) they would expect to find on a general ward.

Notional financial opportunity

Table 16: Activity and notional financial opportunities of reducing length of stay in intensive care following Elective cardiac surgery

Improvement Elective cardiac surgery	Estimated nights saved	Notional financial opportunity
All units at least match the average	6,720 nights	£6m
All units at least match the current best quartile	12,625 nights	£11.3m

Improvement Non-elective cardiac surgery	Estimated nights saved	Notional financial opportunity
All units at least match the average	4,605 nights	£4.1m
All units at least match the current best quartile	9,130 nights	£8.2m

Source data: Hospital Episode Statistics (HES), Apr 2015 – Dec 2016

Variations in bed management in thoracic surgery

We selected lung resections as the bellwether for our detailed review of thoracic surgery pathways.

There were around 7,500 lung resections in 2016, accounting for around 32% of the total thoracic surgery activity, with the majority being elective procedures.

Individual provider activity ranged from 100 procedures to 629.

Day of surgery admission (DOSA) for lung resection

Overall, day of surgery admission (DOSA) is achieved for 47.3% of lung resections. However, there is a wide variation between providers – while six providers achieve rates of over 90%, another six see rates sitting below 10%.

Table 17: Average rate of day of surgery admission for lung resection

Average	Range		Best quartile
	Lowest	Highest	
47.3%	3%	97.8%	75.3%

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Figure 18: Day of surgery admission rate for lung resection

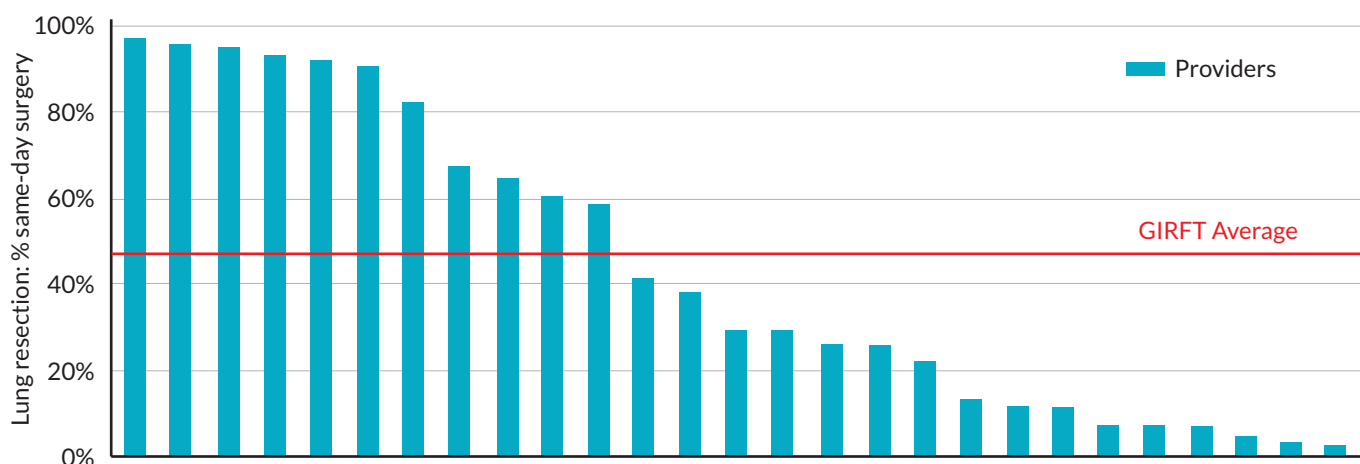


Table 18: Activity and notional financial opportunities of increasing day of surgery admission

Improvement	Estimated days saved	Notional financial opportunity
All units at least match the average	1,170 days	£430k
All units at least match the current best quartile	2,445 days	£895k

Source data: Hospital Episode Statistics (HES), Apr 2015 – Dec 2016

Average post-operative length of stay for lung resections

Average post-operative length of stay for lung resection varies from 5.2 days to 8.5 days, with an average of 6.4 days.

Table 19: Variation in post-operative length of stay for lung resection

Average	Range		Best quartile
	Lowest	Highest	
6.6 days	5.2 days	8.5 days	6.4 days

Source data: Hospital Episode Statistics (HES), Jan 2016 - Dec 2016

Figure 19: Average post-operative length of stay for lung resection by provider

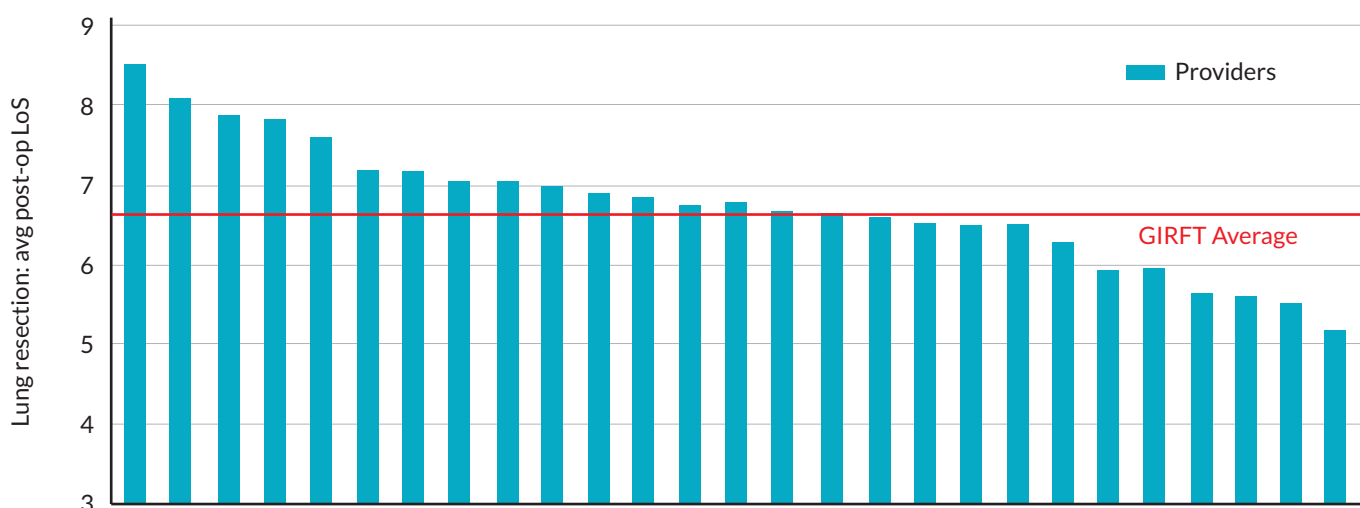


Table 20: Activity and notional financial opportunities of reducing post-operative length of stay for lung resections

Improvement	Estimated days saved	Notional financial opportunity
All units at least match the average	1,840 days	£670k
All units at least match the current best quartile	2,925 days	£1.1m

Source data: Hospital Episode Statistics (HES), Jan 2016 - Dec 2016

Post-operative length of stay and patient age

There is only a slight correlation between length of stay and average age, with around half of providers with below-average length of stay having an above-average patient age.

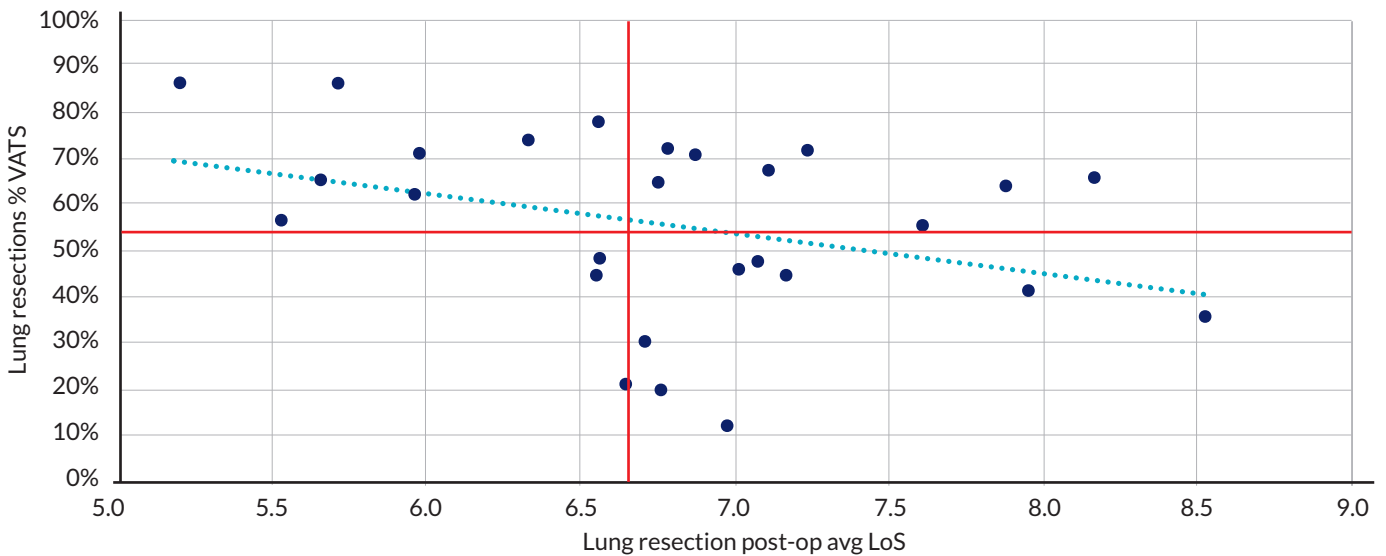
Post-operative length of stay and weekend discharge

The link between length of stay and weekend discharge rate is not as strong in lung resections as it is in cardiac surgery. Indeed, the weekend discharge rate does not appear to be a material factor in average post-operative length of stay in lung resections. This is possibly because the total length of stay is shorter for this group of patients or because the average rate for weekend discharges is already higher for thoracic surgery than for cardiac surgery.

Post-operative length of stay and video-assisted thoracoscopic surgery (VATS)

There's a strong link between the use of VATS for lobectomy (rather than open surgery) and reduced length of stay. HES data for 2016 shows that average lengths of stay are 1.9 days shorter for E543 Lobectomy of lung procedures undertaken with VATS than those without (8.7 days following open surgery versus 6.8 days following VATS).

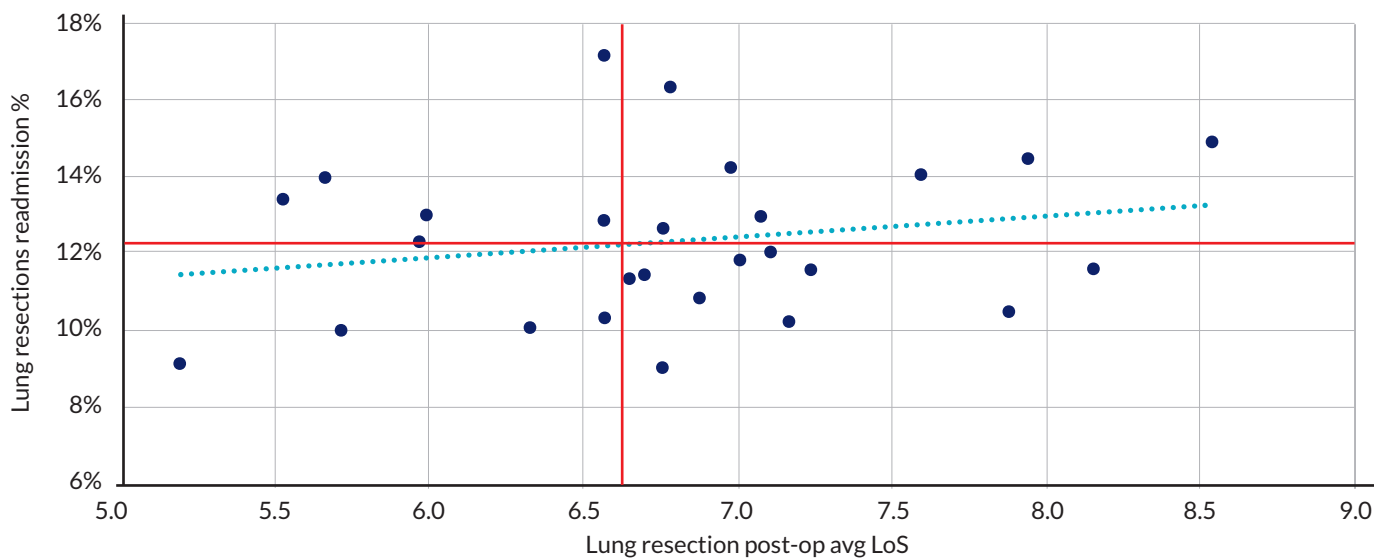
Figure 20: Relationship between post-operative length of stay and video-assisted thoracoscopic surgery (VATS)



Post-operative length of stay and readmission

There's no relationship between shorter average length of stay and increased readmission rates. In fact, the data shows the opposite, with readmission rates increasing slightly as the average length of stay increases.

Figure 21: Relationship between post-operative length of stay and readmissions



Critical care nights following lung resection

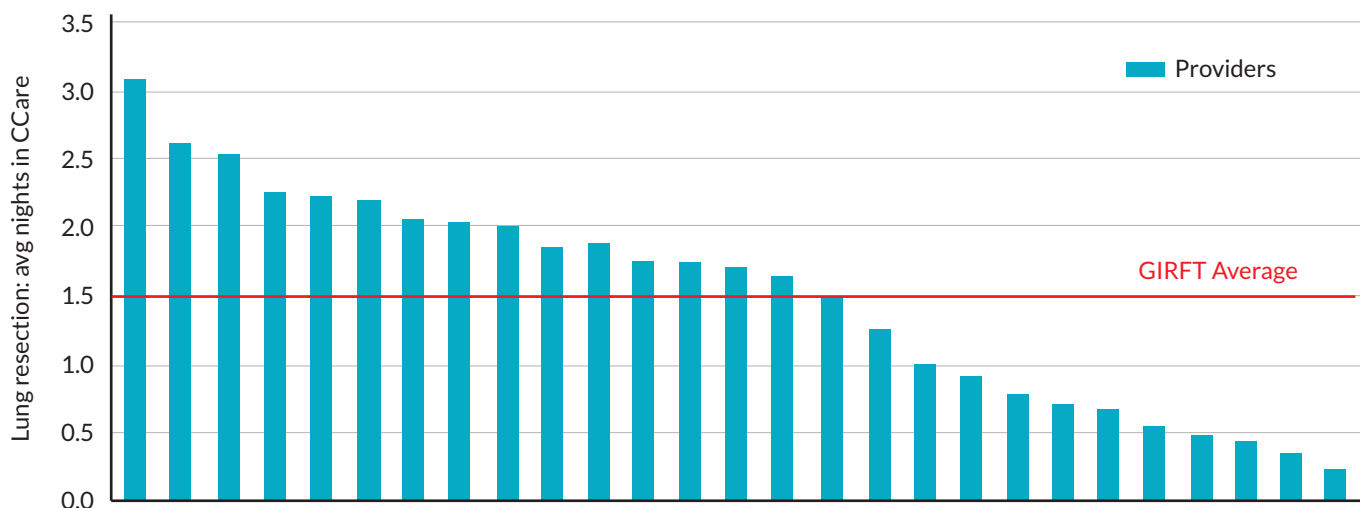
With 10 providers reporting an average of less than one critical care night per lung resection and 8 providers reporting more than two nights, we looked at why there should be such a marked variation.

Table 21: Variation in critical care nights following lung resection

Average	Range		Best quartile
	Lowest	Highest	
1.5 nights per spell	0.2 nights per spell	3.1 night per spell	0.74 nights per spell

Source data: Hospital Episode Statistics (HES), Jan 2016 - Dec 2016

Figure 22: Average nights in critical care for lung resection by provider



Critical care in the treatment pathway

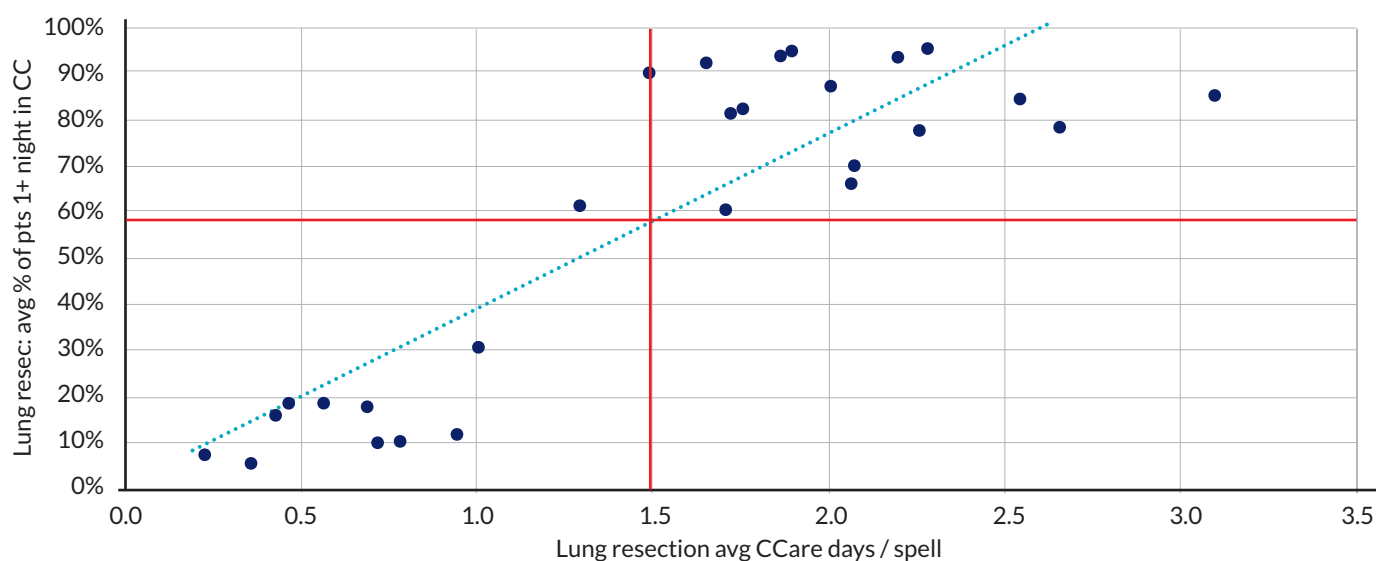
Unlike following cardiac surgery, critical care is not necessarily an essential component of early post-operative thoracic care.

Following major lung surgery, many units send the majority of their patients to theatre recovery, from where patients are transferred to the general ward rather than ITU. Other units routinely send all patients to ITU, from where they're transferred to the ward the next day.

Those units that only send patients to ITU electively do so when patients have significant co-morbidities. Since the complicated nature of these cases mean patients tend to require a longer stay in ITU, these units report higher average length of stay rates.

There is a very strong link between the average length of stay in critical care and the proportion of patients that spend 1+ nights in critical care – 9 providers report fewer than 20% of patients spending 1+ night in critical care, whilst at the other extreme, 11 providers report more than 80%.

Figure 23: Relationship between average post-operative length of stay for lung resection and number of patients spending 1+ nights in critical care



Relationship between critical nights and average age of patients and surgical complications within 30 days

The data shows no clear link between nights in critical care and either the average age of patients or surgical complications within 30 days of the procedure.

Cost of critical care versus cost of ward care – cardiothoracic surgery

There is a significant cost difference between the reported cost of caring for a patient in critical care compared to in a ward setting:

- The average cost of a thoracic surgery critical care bed day in 2015/16 was £1,260.
- The cost of an excess general ward bed day in cardiothoracic specialty was £366. (2015/16 Reference Costs)
- The average cost of nursing care for a cardiothoracic critical care bed is £188k per annum.
- The average cost of nursing care for a ward bed is £58k. (GIRFT questionnaire)

Table 22: Activity and notional financial opportunities of reducing critical care nights following lung resection

Improvement	Estimated nights saved	Notional financial opportunity (assuming cost at ward day instead of critical care day)
All units at least match the average	2,225 nights	£2m
All units at least match the current best quartile	6,030 nights	£5.6m

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Recommendations

Recommendation	Actions and owners	Timeline
<p>1 Make day of surgery admission routine practice.</p>	<p>Providers</p>	<p>50% of admissions within 6 months</p>
<p>2 Ring-fence beds on ward and ITU for elective cardiothoracic surgery.</p>	<p>2a Discuss established successful methods of ring fencing in similarly configured providers that have cardiothoracic units. GIRFT Implementation teams and providers.</p> <p>2b Develop tools for providers to use to estimate the impact on bed capacity. Develop ring-fencing case studies to ensure best practice is shared. GIRFT Implementation teams.</p>	<p>9 months</p>
<p>3 Establish regional work-up protocols for non-elective referrals.</p> <p>The protocol should be included in service specifications, and should specify that patients should only be transferred to the tertiary centre once an operation date has been confirmed and pre-operative work-up has been completed.</p>	<p>Guidance to be developed by SCTS</p>	<p>6 months</p>
<p>4 Pool non-elective cases ready for next available theatre session and next appropriate available surgeon.</p>	<p>Providers</p>	<p>6 months</p>
<p>5 Ensure that every patient is reviewed by a consultant pre- and post-operatively – and that this happens seven days a week.</p>	<p>Providers</p>	<p>6 months</p>

Relationship between management of risk and clinical outcomes

We found variation across providers for a number of the clinical outcomes measured for cardiothoracic surgery.

Some of this variation can be explained by case mix and operation complexity: it's clear that sicker patients and more complex operations require higher post-operative support and carry increased risk of complications and death.

This section takes a detailed look at the variation we found.

Measuring clinical outcomes

The mechanisms for public reporting of cardiac surgery outcomes have been subject to considerable scrutiny from many directions, including: patients and the public; lay media; surgeons, trainees and specialty associations; employers, NHS arms-length bodies and the regulator (General Medical Council).

Surgeon-specific cardiac outcome data and unit-specific cardiothoracic outcome data have been publicly available for many years. These data have focused on in-hospital risk-adjusted survival rates published by the National Institute for Cardiovascular Outcomes Research (NICOR), using unit data that have been validated and risk adjusted.

When clinical outcomes are measured, it is important to define the acceptable levels of performance and a mechanism of responding to adverse outcomes if discovered. These measures are already in place for cardiac surgery mortality data.

Society for Cardiothoracic Surgery (SCTS) on clinical outcomes

The Society for Cardiothoracic Surgery (SCTS) monitors and publishes the outcomes of cardiothoracic surgery.

Here is how the Society describes the role it takes:

SCTS has 2 responsibilities in this process:

To provide advice on understanding and explaining any lower than expected survival

To provide support for members and units

Any surgeon or unit that triggers an alert or alarm has a duty to explain the divergence of their results.

Divergence is a cause for looking at the data in more detail and is not a sufficient reason in itself for restricting a surgeon's practice unless there are clear concerns about the safety of patients. It is important that all investigations are reasonable and proportionate.

By the time any data is published it should have gone through a robust analysis to ensure that it accurate (with respect to the activity, mortality and risk factor data). SCTS then recommends:

Analysis of the caseload to ensure that the risk stratification mechanism accurately reflects expected outcomes (e.g. is there any subspecialist practice which is not adjusted for by the risk prediction model).

Analysis of institutional factors that may contribute to the divergence in clinical outcomes such as referral practices, the provision of intensive care, or other post-operative services.

More detailed analysis of the surgeon's performance.

It is important to look for trends in mortality over time to ascertain at what stage survival rates started to decline, and whether it is possible to identify any precipitants.

The SCTS believes that all intra-operative or post-operative cardiac surgical mortalities should be reviewed in detail, and that both the hospital and the individual have a responsibility here.

The hospital should be reviewing cases of mortality as part of their routine clinical governance meetings, to learn and feed back to improve practice.

The surgeon should be reviewing all mortality through the process of reflective practice, and documenting this for their appraisal portfolio.

In addition to reviewing overall mortality rates and each death in detail, SCTS would recommend a wider benchmarking of additional process and outcomes data.

All benchmarking of outcomes should be conducted in the full knowledge of the case mix and risk profiles. It may in this context be appropriate to benchmark complete practice and/or outcomes for specific operative groups.

It is important that there is organisational engagement with these investigations to support the process. SCTS would suggest that this is supported by clear action plans with defined timescales and personal responsibilities.

scts.org/outcomes/advice-for-surgeons/

Funnel plots

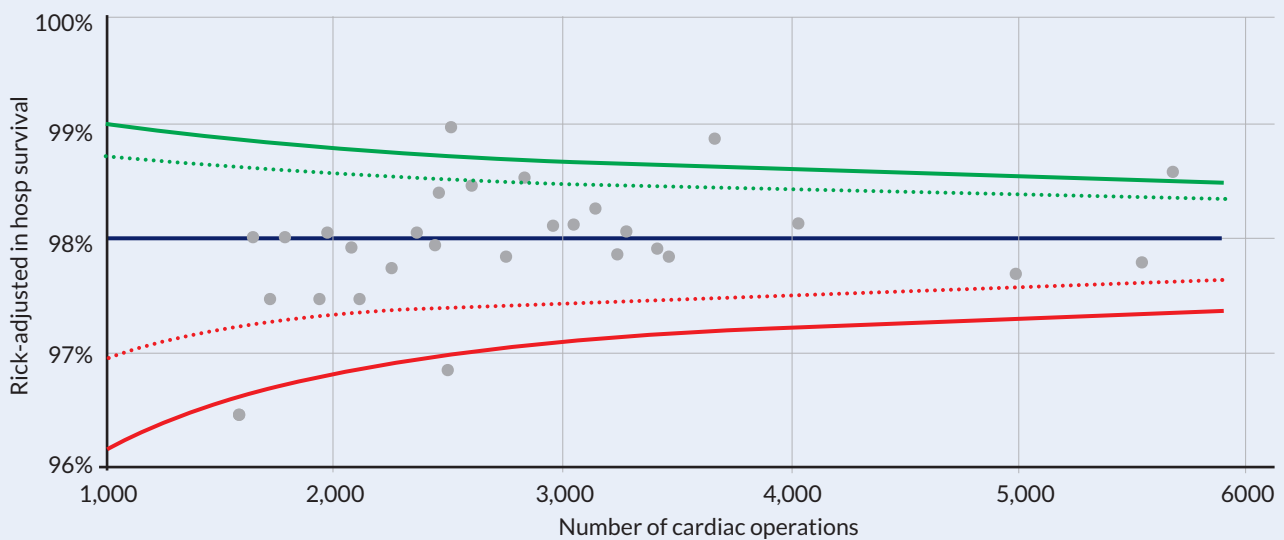
Funnel plots are a good way to identify and show variation.

For example, **Figure 24** shows the variation in in-hospital risk-adjusted survival rates for providers.

The x-axis plots the volume metric (number of cardiac operations) and the y-axis plots the outcome metric (survival rates).

The average value (mean) for the population is shown by the blue line (in this case, 98%).

Figure 24: Cardiac surgery risk-adjusted in-hospital survival rate



Variation due to chance

The curves on either side show the likelihood that an outcome might vary from the average due to chance alone:

- The inner curves show 2 standard deviations from the mean. 5% of values are likely to be beyond these curves due to chance.
- The outer curves show 3 standard deviations from the mean. 0.3% of values are likely to be beyond these curves due to chance.

Providers that sit outside these curves are the outliers. In **Figure 24**, three providers have higher than expected survival rates and two providers have lower than expected survival rates.

Accuracy and volume

When there is less volume (x-axis), the accuracy of calculating the variation due to chance is poorer, so the funnel curves are further from the average.

When there is greater volume, the accuracy of calculating the variation due to chance is better, so the funnel curves are closer to the average.

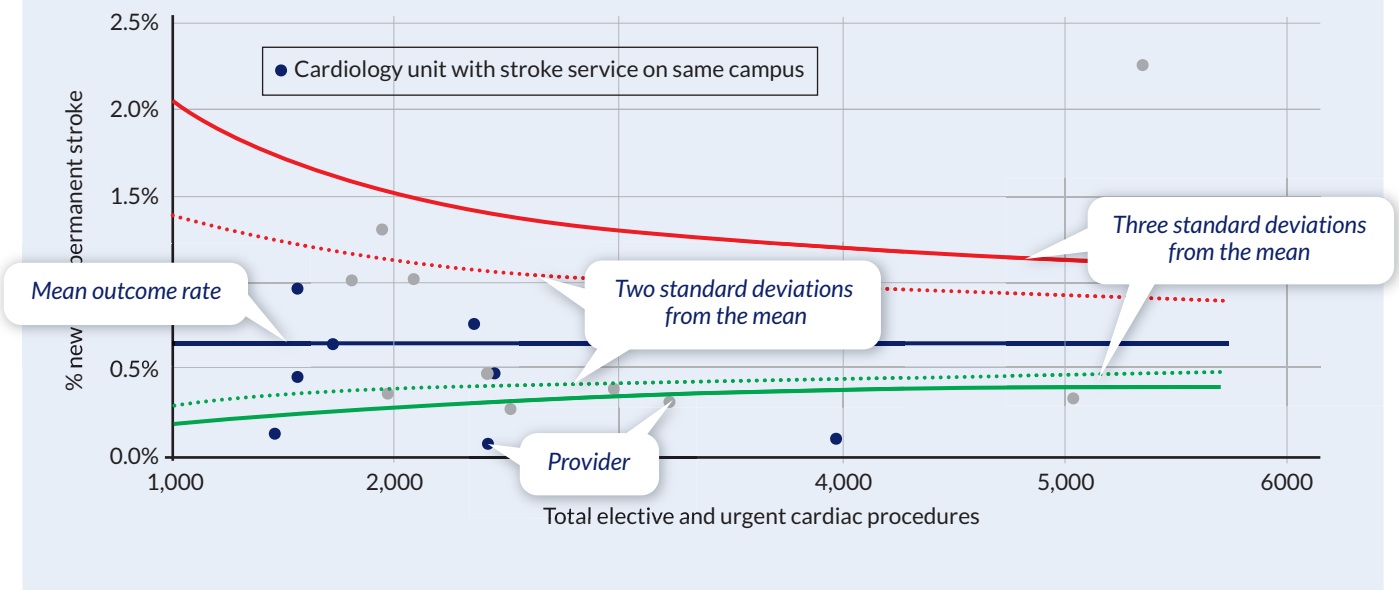
Variation caused by other factors

'All things being equal', funnel plots accurately show the variation from the average.

With **Figure 24**, it's relatively easy to measure mortality, so we can be reasonably confident that the funnel plot shows the outcome accurately.

However, **Figure 26** looks at new Cerebrovascular Accident (CVA). Here more providers than might be expected have outcome values below the lower funnel. This is called 'over-dispersion' and indicates that all things are not necessarily equal – other factors may be influencing the data. In this example, it could be that some providers are achieving low new CVA rates as a result of good clinical practice, or it could be because they are not good at recording stroke, or because there is not a clear definition of when to record a stroke.

Figure 26: Elective and urgent cardiac surgery – new Cerebrovascular Accident (CVA), permanent stroke only



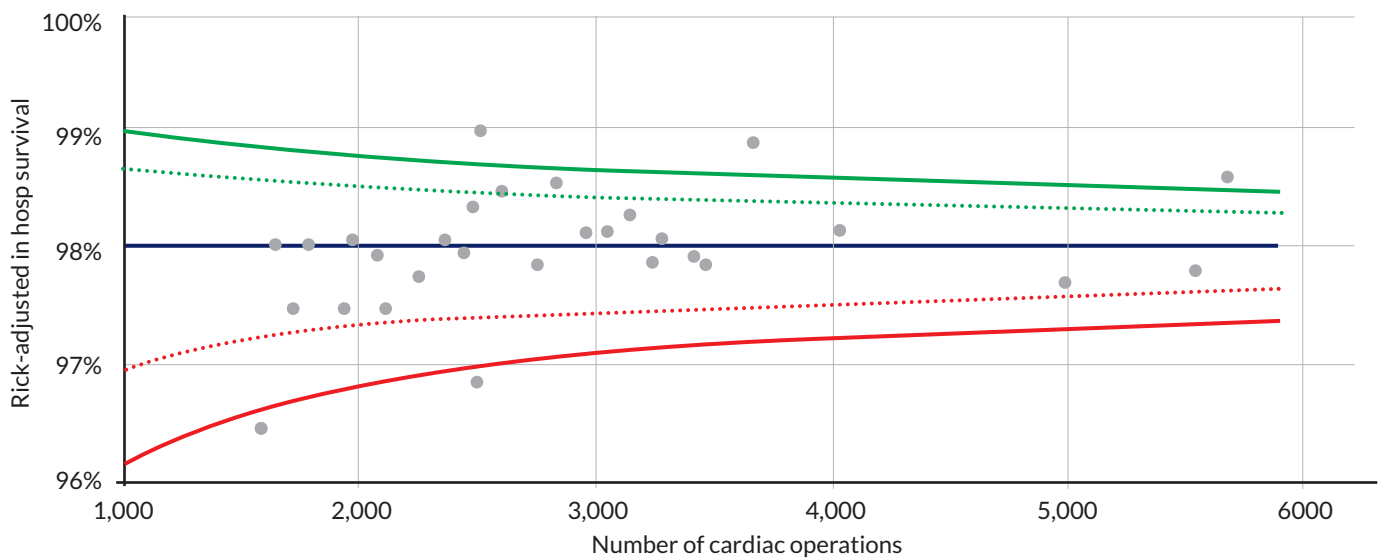
Cardiac surgery: In-hospital risk-adjusted survival rates

Table 23: Variation in cardiac surgery in-hospital risk-adjusted survival rates

Average	Range		Best quartile
	Lowest	Highest	
98.01%	96.44%	98.98%	98.13%

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Figure 24: Cardiac surgery in-hospital risk-adjusted survival rates by provider



Cardiac surgery: Return to theatre for bleeding rates

Table 24: Variation in cardiac surgery return to theatre for bleeding rates

Average	Range		Best quartile
	Lowest	Highest	
3.75%	1.70%	6.89%	2.78%

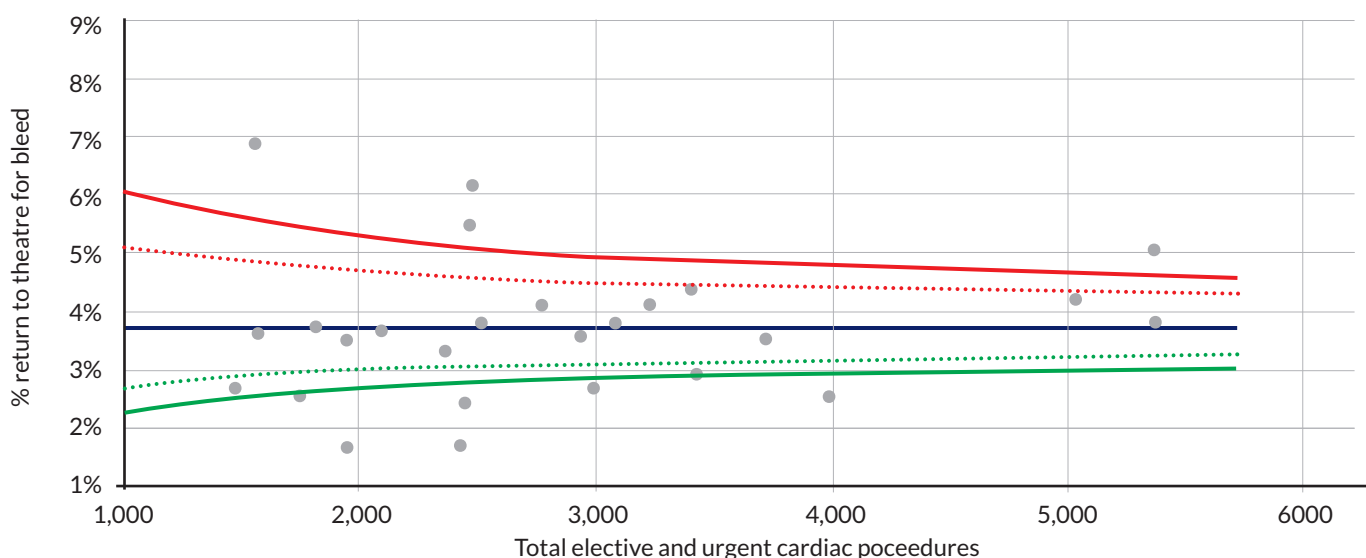
Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Table 25: Activity and notional financial opportunities of reducing return to theatre for bleeding

Improvement	Estimated reduction in return to theatre	Notional financial opportunity Length of stay (based on 2.3 days/pt)	
		Days	Cost
All units at least match the average	95 returns	215 days	£80k LoS + theatre costs
All units at least match the current best quartile	260 returns	835 days	£305k LoS + theatre costs

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Figure 25: Cardiac surgery – elective and urgent return to theatre for bleed or tamponade



NICOR data for a three-year period indicates that patients returning to theatre for a bleed or tamponade report an average post-operative length of stay that's 2.28 days longer than patients who don't return to theatre.

We have used this figure to estimate the financial cost of the variation. However, our estimate will not represent the full cost because it does not include the cost of additional theatre time needed to treat these patients. (Data on theatre time or costs was not available to us.)

Cardiac surgery: New permanent stroke

Permanent stroke has a life-changing impact on patients.

There is wide variation in reported rate of permanent stroke between providers.

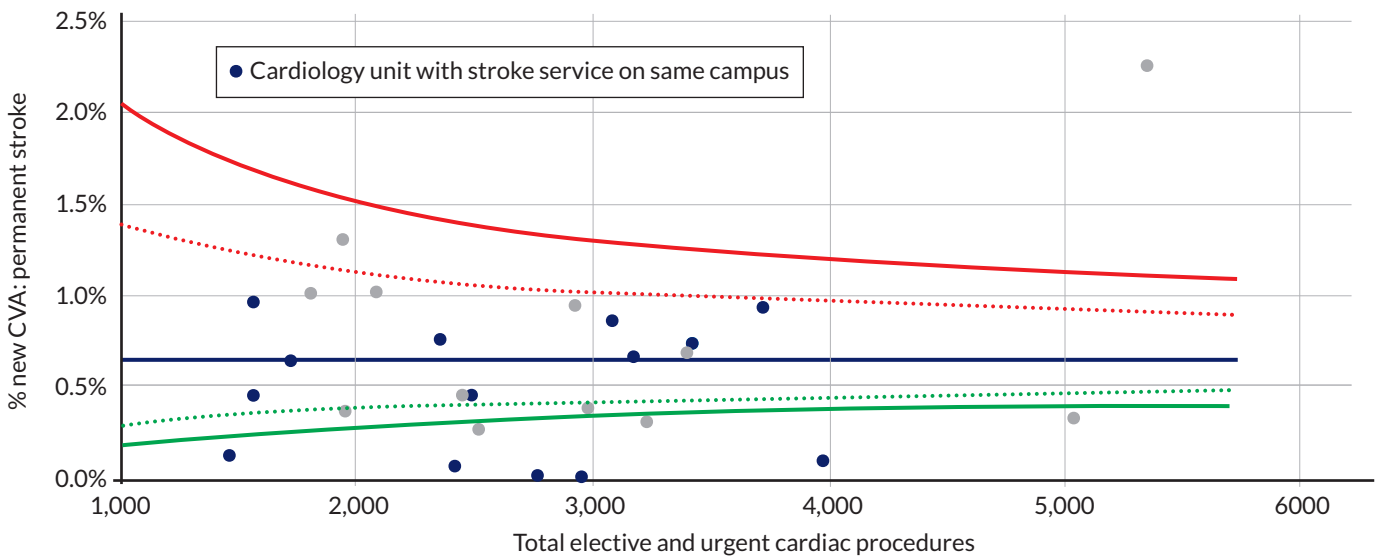
One provider reported a particularly high rate of 2.23%, with the next highest rate being 1.29%. Many are reporting very low levels, with only one or two patients in the three-year period.

Table 26: Variation in rates of new permanent stroke related to cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
0.66%	0.03%	2.23%	0.32%

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Figure 26: Elective and urgent cardiac surgery – new Cerebrovascular Accident (CVA), permanent stroke only



Note that the quality of some of the NICOR data used in this figure is suboptimal, reporting unachievably low rates of around zero despite high volumes of surgery.

See the section on *Coding in NICOR datasets* for an exploration of this issue.

Stroke units on the same campus

The data does not indicate a strong association between stroke rates and the presence of a stroke unit on the same campus.

Aortic arch surgery

Surgery on the aortic arch (a subspecialised and highly technical discipline) is associated with an increased risk of stroke.

The CVA rate following aortovascular surgery (other than on the aortic arch) is 1.03%, whereas the rate following surgery on the aortic arch is 4.03%.

Mortality rate

NICOR data for the three-year period shows a mortality rate of around 19% for patients with a new permanent stroke, compared to 1.9% for those with no new CVA or a transient stroke. Note: these figures are not risk-adjusted.

Potential effect on cost

New CVA or transient stroke extends post-operative length of stay. NICOR data for the three-year period shows an average length of stay of 27.3 days per patient with new CVA or transient stroke, compared to 9.6 days for patients without.

We have used this difference in length of stay to estimate the financial cost associated with new CVA or transient stroke. However, the full cost would almost certainly be higher than the figures shown. This is because our calculations are not able to take account of the costs associated with the ongoing support and care that many stroke patients need.

Table 27: Activity and notional financial opportunities of reducing rates of new permanent strokes related to cardiac surgery

Improvement	Estimated reduction in new strokes	Notional financial opportunity (based on 17.7 days/pt)	
		Days	Cost
All units at least match the average	50 new strokes	885 days	£325k
All units at least match the current best quartile	95 new strokes	1,680 days	£615k

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Cardiac surgery: Deep sternal wound infection (DSWI)

We found variation in the deep sternal wound infection rates between units.

Table 28: Variation in DSWI following cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
0.69%	0.10%	2.11%	0.39%

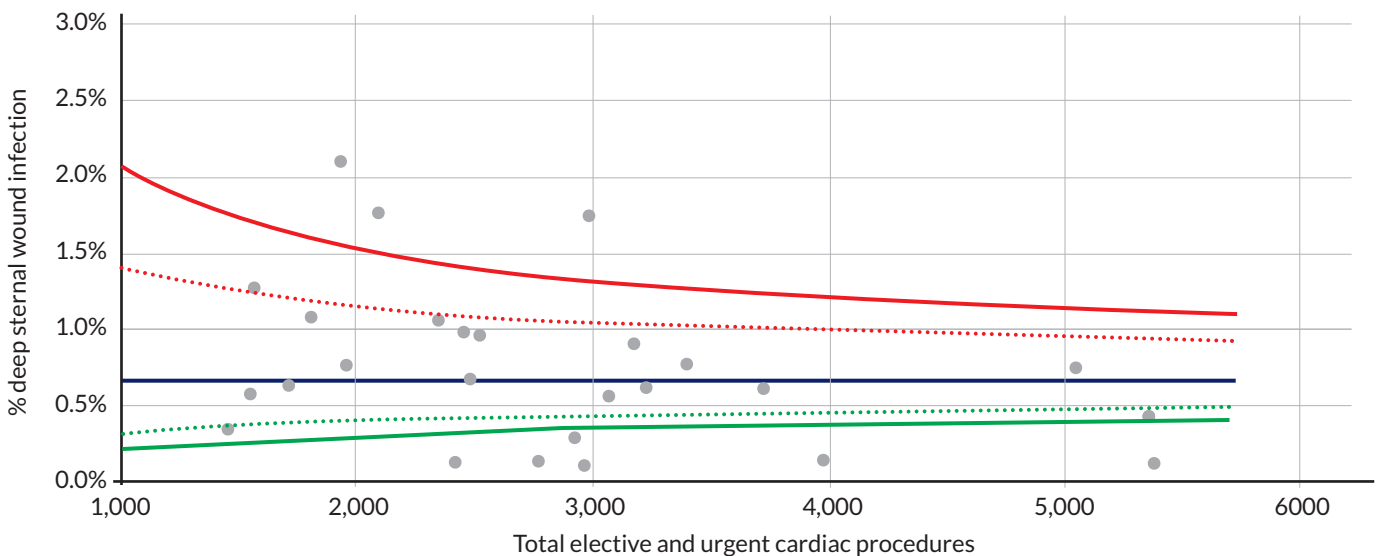
Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Deep sternal wound infection (DSWI) is a major surgical site infection that may follow cardiac surgery and can lead to mediastinitis. The resulting treatment and care requirements are extensive. Patients typically present with swinging fever around day five or six after surgery and go on to develop sternal instability, wound inflammation, pain and purulent discharge. Common causative organisms are staphylococci.

Treatment involves wound debridement with removal of sternal wires. Wounds may be left open for the long term, with resulting respiratory compromise. The patient’s heart and aorta is exposed to the environment, covered only with dressings, often for many weeks.

Current treatment modalities include antibiotics, long-term use of vacuum assisted negative pressure devices (Vacump), repeated wound debridement and revision. Once the infection is eradicated, the sternum must be rewired and chest wall defects will require plastic surgical repair.

Figure 27: Elective and urgent cardiac surgery and urgent deep sternal wound infection (DSWI)



Mortality rate

NICOR data for the three-year period shows a mortality rate of around 7.5% for patients with a deep sternal wound infection, compared to 2.1% for those without this serious complication. Note: these figures are not risk-adjusted.

Potential reduction in deep sternal infection

Deep sternal wound infection (DSWI) significantly extends post-operative length of stay. NICOR data for the three-year period shows an average length of stay of 38.5 days per patient with DSWI, compared to 9.5 days for patients without. Indeed, of the 532 reported cases of DSWI, 32 required a post-operative length of stay of more than 100 days.

We've used the difference in length of stay to estimate the financial cost associated with DSWI. However, the full cost would almost certainly be higher than the figures shown. This is because our calculations are not able to take account of the costs associated with the higher level of care, including additional days in critical care, needed by patients with DSWI.

The calculations use the average cost of a ward bed day.

Table 29: Activity and notional financial opportunities of reducing rates of DSWI

Improvement	Estimated reduction in DSWI	Notional financial opportunity (based on 29 bed days/pt)	
		Days	Cost
All units at least match the average	50 DSWIs	1,450 days	£530k
All units at least match the current best quartile	95 DSWIs	2,755 days	£1m

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Best practice case study

Dramatically reducing DSWI rates

Guy's and St Thomas'

Guy's and St Thomas' Hospitals have lowered their deep sternal wound infection rates to 0.27% after introducing a number of measures to prevent infections.

Measures include:

- carrying out a consultant microbiologist-led, formal multidisciplinary team review of every case of infection – with every meeting minuted
- using uniform patient draping in theatre (same drapes, same draping technique)
- establishing and following unit-wide protocols for antimicrobial prophylaxis
- using chlorhexidine skin prep rather than iodine-based solutions.

Cardiac surgery: Post-operative new renal filtration/dialysis

Many cardiac surgery patients have chronic renal dysfunction at the time of surgery. The ability to offer ultrafiltration has been a significant advance in the critical care and support of patients recovering from surgery. It is frequently instituted, implemented and managed by cardiac surgical teams without input from renal physicians.

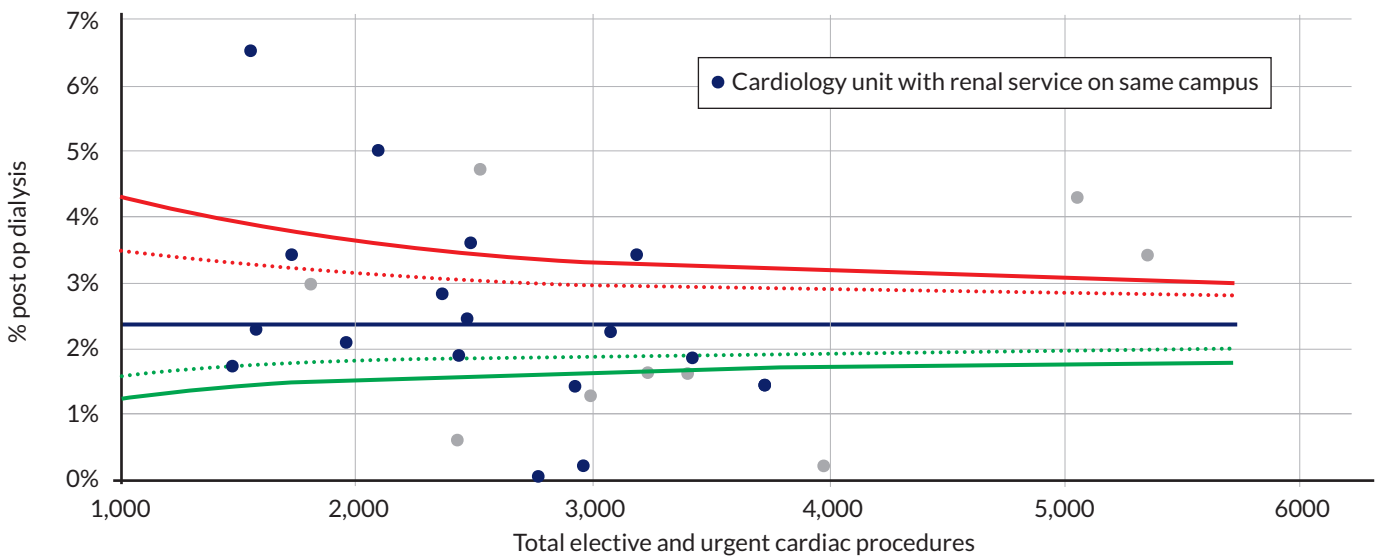
A significant minority of surgeons and intensivists consider early filtration to be beneficial even when patients have not gone into established acute renal failure. This practice consumes resources and exposes patients to risk.

Table 30: Variation in post-operative new renal filtration/dialysis related to cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
2.35%	0.04%	6.44%	1.56%

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 – Mar 2016

Figure 28: Elective and urgent cardiac surgery – post-operative dialysis



We have not found any significant correlation between post-operative dialysis and the presence of same-campus renal services.

Mortality rate

NICOR data for the three-year period shows a mortality rate of around 31.9% for patients who receive post-operative filtration, compared to 1.3% for those who don't. Note: these figures are not risk-adjusted.

Potential number of renal filtrations that could be reduced

Renal filtration has a significant impact on post-operative length of stay. NICOR data for the three-year period shows an average post-operative length of stay of 25.5 days per patient, compared to just 9.4 days for patients not given post-operative filtration.

We've used the difference in length of stay to estimate the financial cost associated with providing filtration. However, this is likely to under-represent the full cost, as it does not include the cost of the filtration itself.

Table 31: Activity and notional financial opportunities of reducing rates of post-operative new renal filtration/dialysis related to cardiac surgery

Improvement	Estimated reduction in filtration	Notional financial opportunity (based on 16.2 bed days/pt)	
		Days	Cost
All units at least match the average	150 patients	2,425 days	£885k
All units at least match the current best quartile	265 patients	4,290 days	£1.6m

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 - Mar 2016

Cardiac surgery: 30-day emergency readmission

We found variation in patients requiring re-admission (to any hospital) following discharge after cardiac surgery.

Table 32: Variation in 30-day emergency readmission rates following cardiac surgery

Average	Range		Best quartile
	Lowest	Highest	
15.05%	12.51%	17.9%	14.06%

Source data: Hospital Episode Statistics (HES), Oct 2013 – Sept 2016

Figure 29: Cardiac surgery – emergency readmission within 30 days (to any provider)

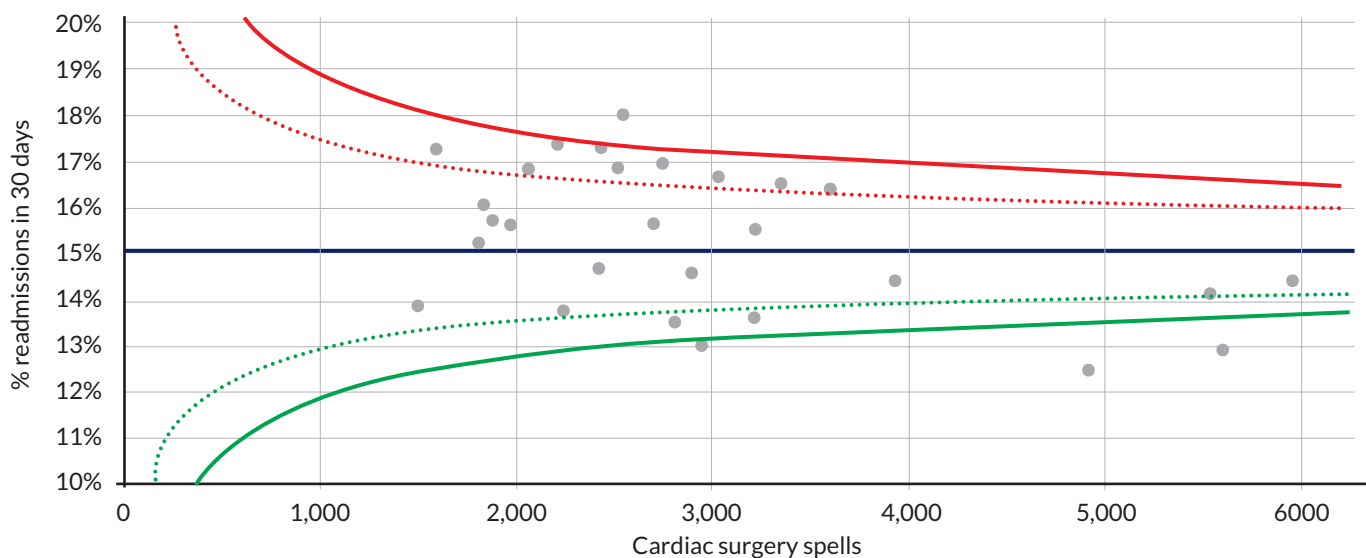


Table 33: Activity and notional financial opportunities of reducing 30-day emergency readmission rates following cardiac surgery

Improvement	Estimated reduction in emergency readmission spells	Notional financial opportunity
All units at least match the average	190 spells	£515k
All units at least match the current best quartile	345 spells	£935k

Source data: Hospital Episode Statistics (HES), Oct 2013 – Sept 2016

Percutaneous coronary intervention (PCI) within one year of coronary artery bypass graft (CABG)

Over the last decade, the number of patients requiring coronary artery bypass graft (CABG) has diminished as percutaneous catheter-based technology has advanced. Percutaneous coronary intervention (PCI) offers clinicians more treatment options and interventional therapy is ideally tailored to patient-specific disease and anatomic configuration using evidence-based decision making.

However, coronary artery bypass graft (CABG) remains the most common procedure in adult cardiac surgery. In patients with advanced three-vessel disease and impaired left ventricular function, CABG continues to be the gold standard treatment, offering reduced rates of reintervention over PCI and reduced medication requirements.

The need for further intervention in the form of PCI within 12 months offers a measure of the success of CABG surgery.

One high-volume unit is electively performing hybrid off-pump CABG and PCI on patients with multivessel coronary artery disease. This makes them an outlier, sitting outside of 3 standard deviations from the mean. This practice sits outside of current, recognised international evidence-based guidelines and there is no NICE interventional procedures guidance (IPG) for the procedure.

Table 34: Variation in rates of PCI within one year of CABG

Average	Range		Best quartile
	Lowest	Highest	
1.37%	0.15%	4.56%	1.1%

Source data: Hospital Episode Statistics (HES), Apr 2013 – Sept 2015

Figure 30: CABG with PCI within 12 months of discharge

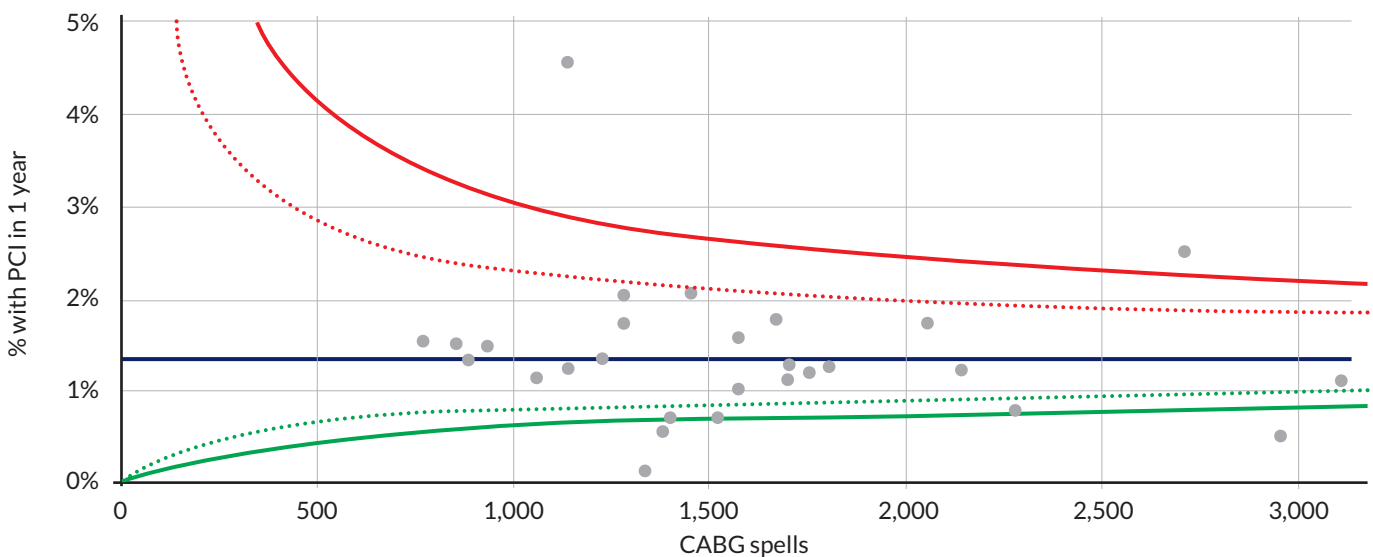


Table 35: Activity and notional financial opportunities of reducing rates of PCI within one year of CABG

Improvement	Estimated PCIs avoided	Notional financial opportunity
All units at least match the average	75 spells	£280k
All units at least match the current best quartile	200 spells	£745k

Source data: Hospital Episode Statistics (HES), Apr 2013 – Sept 2015

Cardiac surgery: Blood transfusion

Blood transfusion rates offer a useful bellwether for how a unit functions.

Low rates are associated with positive practices, including:

- protocolised care across the entire unit
- referring cardiologists and surgeons following a uniform policy on antiplatelet cessation
- agreed transfusion triggers
- standardised management policies for pre-operative anaemia, including use of IV Iron.

As well as the expensive cost of blood products, there is some evidence that transfusion is associated with adverse outcomes. However, it's self-evident that cardiac surgery comes with the risk of major haemorrhage and that without rapid blood transfusion death would result.

Table 36: Variation in cardiac surgery blood transfusion rates

Average	Range		Best quartile
	Lowest	Highest	
46%	23%	85%	37%

Source data: GIRFT questionnaires, 2015/16

Disappointingly, only 17 units provided data on the percentage of patients receiving blood transfusions. However, within the responses we received, there is a wide variation, with rates ranging from 23% to 85%.

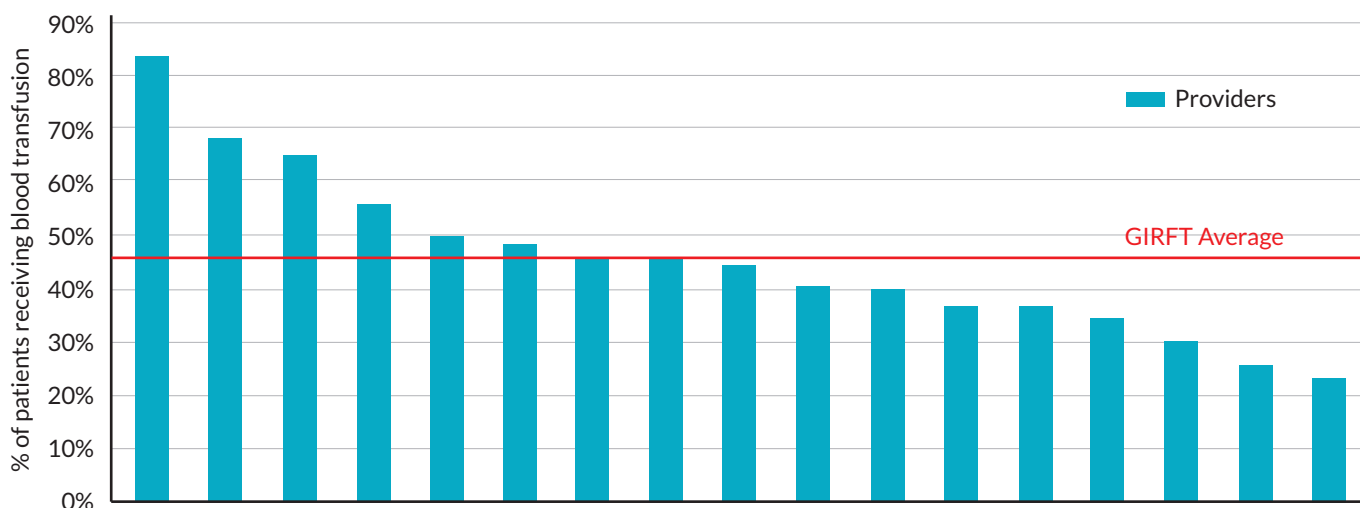
Spend on blood products

17 units provided data on their cardiothoracic spend on blood products.

In 2015/16, total spend across all 17 units was £14.9m.

Individual provider spend ranged from £41k to £1.9m.

Figure 31: Cardiac surgery – blood transfusion rates



Source data: GIRFT questionnaires, 2015/16

Best practice case study

Attention to detail the key to low rates of blood transfusion

Plymouth Hospitals

SWCC has the lowest reported transfusion rate for blood products after surgery in England, with a rate of just 23%. They put this down to surgical attention to detail and highlight the following key practices:

- stressing the importance of their blood transfusion practices to surgical trainees (28% of their cases are operated on by trainees as primary surgeon – the fourth highest in England)
- stopping pre-operative dual antiplatelet therapy
- observing a strict transfusion trigger (Hb of 8g/100ml)
- ensuring that surgical care practitioners carry out off-site patient assessments, accompany surgeons to outlying MDTs, and review in-house transfers
- using IV Iron in anaemic patients pre-operatively.

Thoracic surgery outcomes

We found variation between units in clinical outcomes after thoracic surgery. We looked at the 90-day survival after lung cancer surgery, the in-hospital mortality after lung resection, the 30-day emergency readmission after lung resection and the 30-day complication rate after lung resection.

Table 37: Variation in thoracic lung cancer surgery, 90-day post-operative survival rates

Average	Range		Best quartile
	Lowest	Highest	
96.3%	94.3%	98.7%	96.7%

Source data: Lung Cancer Clinical Outcomes Publications, 2016 (2014 data)

Figure 32: Lung Cancer surgery – 90-day post-operative survival

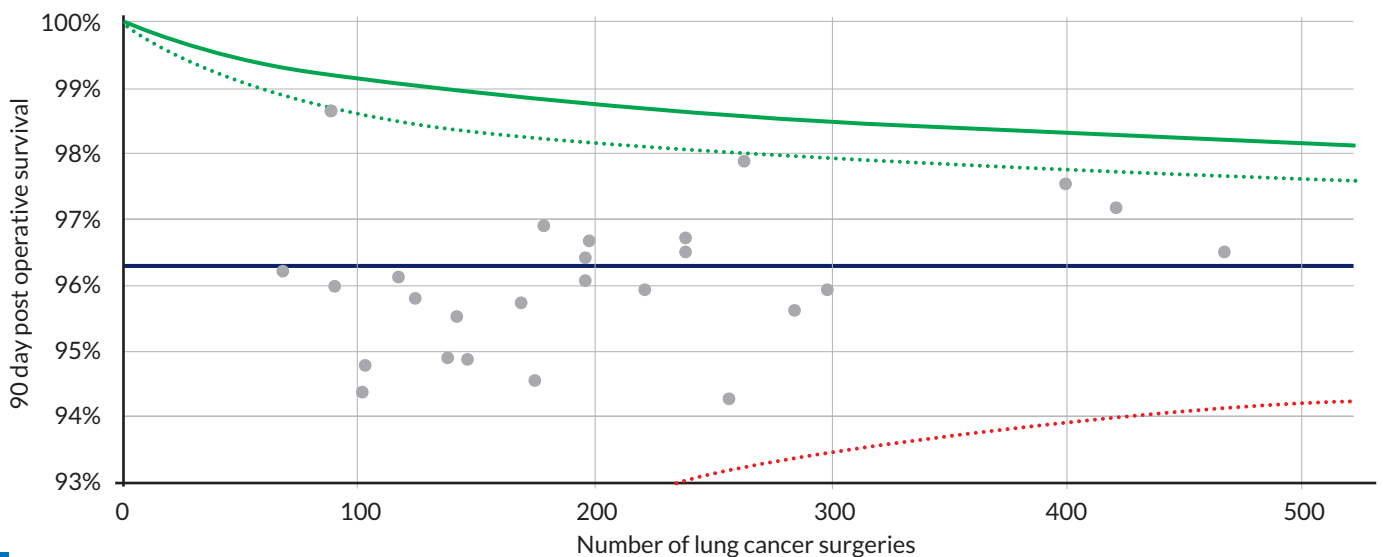


Table 38: Variation in rates of in-hospital mortality related to lung resection

Average	Range		Best quartile
	Lowest	Highest	
1.31%	0%	3.38%	0.88%

Source data: Hospital Episode Statistics (HES), Jan 2014 - Dec 2016

Figure 33: Lung resections - in-hospital mortality

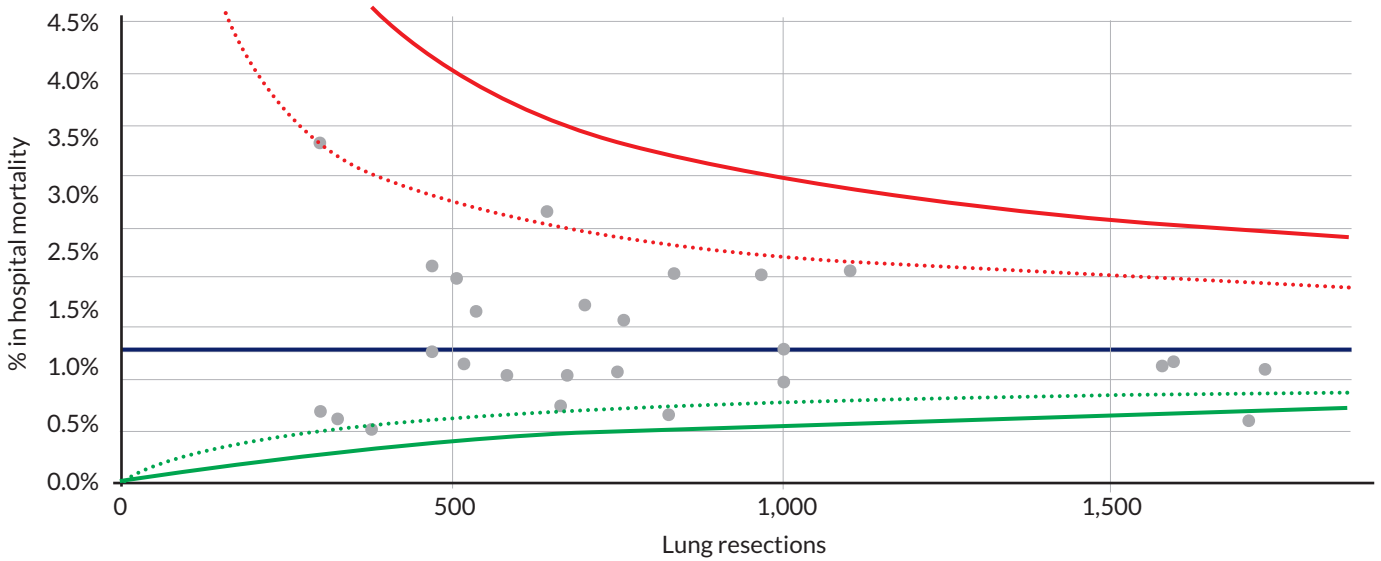


Table 39: Variation in rates of 30-day emergency readmission following a lung resection

Average	Range		Best quartile
	Lowest	Highest	
12.1%	9%	17.1%	10.7%

Source data: Hospital Episode Statistics (HES), Oct 2013 - Sept 2016

Figure 34: Lung resection – 30-day emergency readmission (to any provider and any specialty)

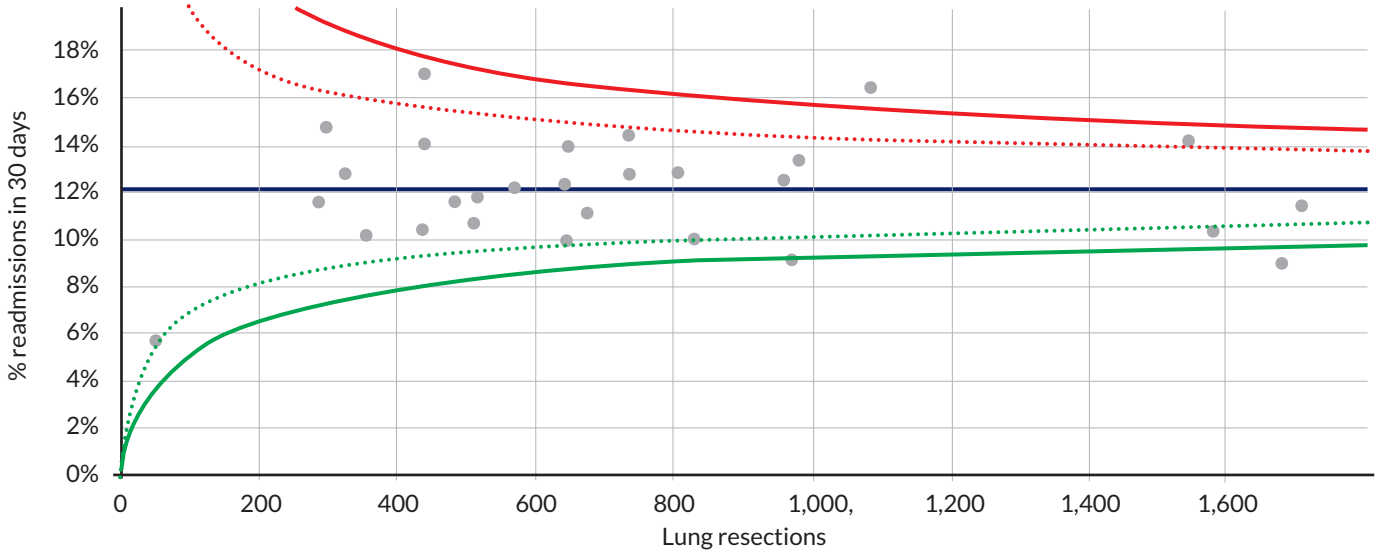
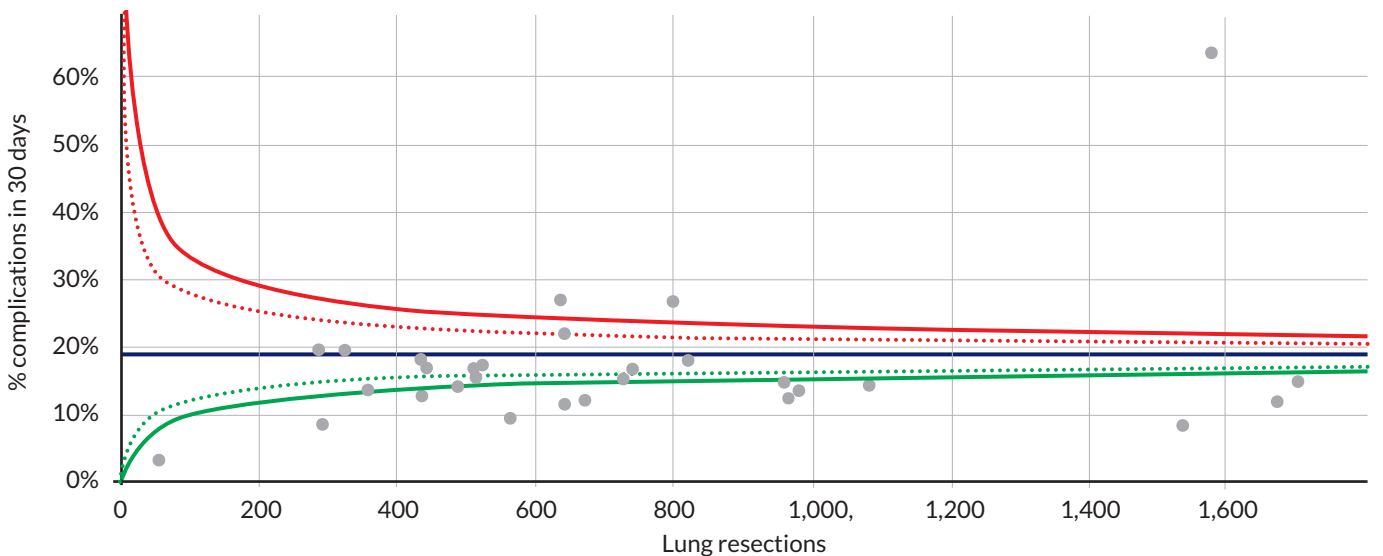


Table 40: Activity and notional financial opportunities of reducing rates of 30-day emergency readmission following a lung resection

Improvement	Estimated reduction in readmissions	Notional financial opportunity
All units at least match the average	60 readmissions	£160k
All units at least match the current best quartile	120 readmissions	£320k

Source data: Hospital Episode Statistics (HES), Apr 2013 – Sept 2015

Figure 35: Lung resections – 30-day surgery complications



One provider is a clear outlier in 30-day complications after lung resection, reporting 68.31% of lung resections as having complications associated with surgery. We understand that this could be related to coding within this provider rather than a genuine issue with complication rates.

See the section below 'Example of variation in casemix of HRG DZ02 Complex Thoracic Procedures 19 years and over' for more details.

However, even without this provider, there is still a material variation of 8.37% to 27.4% between providers.

Table 41: Variation in 30-day surgery complications after lung resection

Average	Range		Best quartile
	Lowest	Highest	
18.97%	8.37%	27.41%	13.19%

Source data: Hospital Episode Statistics (HES), Apr 2013 - Sept 2015

Table 42: Activity and notional financial opportunities of reducing the rates of 30-day surgery complication after lung resection

Improvement	Estimated reduction in patients with complications
All units at least match the average	285 patients
All units at least match the current best quartile	447 patients

Responsibility for outcomes

For NICOR national audit purposes, outcomes are currently attributed to a single operator. This creates attribution issues when units wish to take collective responsibility for complex cases.

Ideally, it should be possible for outcomes to be reported under the collective unit rather than under an individual surgeon.

Good practice case study

Establishing collective responsibility for very high-risk and complex cases

Royal Papworth Hospital

Papworth has established a category of 'joint care' for very high-risk elective cardiac surgical cases. For these selected cases, the consultant body as a group (rather than an individual surgeon) oversees planning.

Patient cohort

The very high-risk patient cohort includes the following:

- patients referred to the unit for cardiac surgery after having been turned down by one or more other centres
- patients referred for transplantation, for whom a conventional operation is being considered
- patients with a logistic euroSCORE over 25
- when a surgeon feels, for whatever reason, that the patient would benefit.

Practices in planning and surgery

The group discusses very high-risk cases at a regular dedicated meeting, which is held fortnightly. At this meeting, the group makes and documents their pre-operative decision to treat the patient as very high-risk.

They then decide whether to offer the patient an operation and which consultants should perform it. If the patient wishes to go ahead and gives consent, they're admitted under the care of the lead consultant.

The chosen consultants carry out the operation in the name of the entire group and unit. More than one consultant surgeon will routinely be scrubbed and contribute at the operation.

One consultant is nominated as the lead and is the first call for post-operative care.

Outcomes and data collection

The team takes corporate responsibility for the outcome, and the unit is listed as 'operator' for internal audit purposes.

Operations in these cases are subject to the same data collection, quality monitoring, and local and national data publication as all other operations.

Remedial action to address poor performance

NICOR outcomes

This is the first review to report NICOR outcomes (other than mortality outcomes) to units.

Apart from mortality data, the data used in this report is raw, unadjusted, un-validated and, in certain metrics, incomplete.

Action plans to tackle poor performance

Where we found outcome data that was greater than three standard deviations from the mean, we discussed this at our deep dive visits. We agreed action plans with the units that included:

- validating the data
- investigating the cause of any poor performance revealed by the data
- feeding back on progress to the GIRFT team.

We found a very small number of units where the GIRFT metrics built up a holistic picture of poor performance. In each case, we were reassured to find that the national mechanisms for oversight of clinical outcomes – through NICOR and the SCTS – had already identified the issues and triggered alerts. Each unit had put proportionate actions plans into place, including independent review by the Royal College of Surgeons England (RCS) and Care Quality Commission (CQC) special reporting measures.

We asked members of the senior executive and clinical teams from these providers to detail their quality improvement plans and demonstrate the resulting contemporary performance indicators. In each case, we were satisfied that the units had appropriate remedial plans (with internal and external oversight), were making meaningful improvements, and were committed to ongoing quality improvement.

Recommendations

Recommendation	Actions and owners	Timeline
6 Establish a formal Standard Operating Procedure on cardiothoracic data validation, risk adjustment, outlier identification, escalation plans and reporting for GIRFT metrics.	GIRFT, NHSE, NICOR, providers, SCTS, HQIP and NHS Digital	12 months
7a Use uniform draping technique in theatre.	Providers	3 months
7b Use chlorhexidene skin preparation	Providers	3 months
7c Ensure that individual cases of deep sternal wound infection (DSWI) are reviewed by a multidisciplinary team, led by a consultant microbiologist.	Providers	3 months
8a Establish a national formal policy for complex and very high-risk cases.	NHSE, CRG and SCTS	6 months
8b Establish collective responsibility for clinical outcomes.	SCTS and providers	
9 Attribute outcomes for complex and very high-risk cases, as defined in 8a, to units rather than to individuals.	NICOR	6 months
10 Record blood product transfusion rates for cardiac surgery.	Providers	12 months

Cancer pathway

Non-small-cell lung cancer (NSCLC) stage I/II Surgical resection

We found considerable variation in resection rates for NSCLC – 48.9 percentage points between the lowest and highest rate. This variation is unacceptable.

For non-small-cell lung cancer (NSCLC) patients, resection is the main intervention to offer a chance of cure, so it is crucial that as many patients as possible receive surgery.

The entire lung cancer team must be responsible for ensuring that a thoracic surgeon personally assesses the suitability for surgery of all patients with early stage lung cancer. To this end, cancer teams must ensure that a thoracic surgeon attends every lung cancer multidisciplinary team meeting (MDTM).

Table 43: Variation in rates of NSCLC stage I/II – surgical resection

Average	Range		Best quartile
	Lowest	Highest	
54.9%	37.5%	86.4%	64.7%

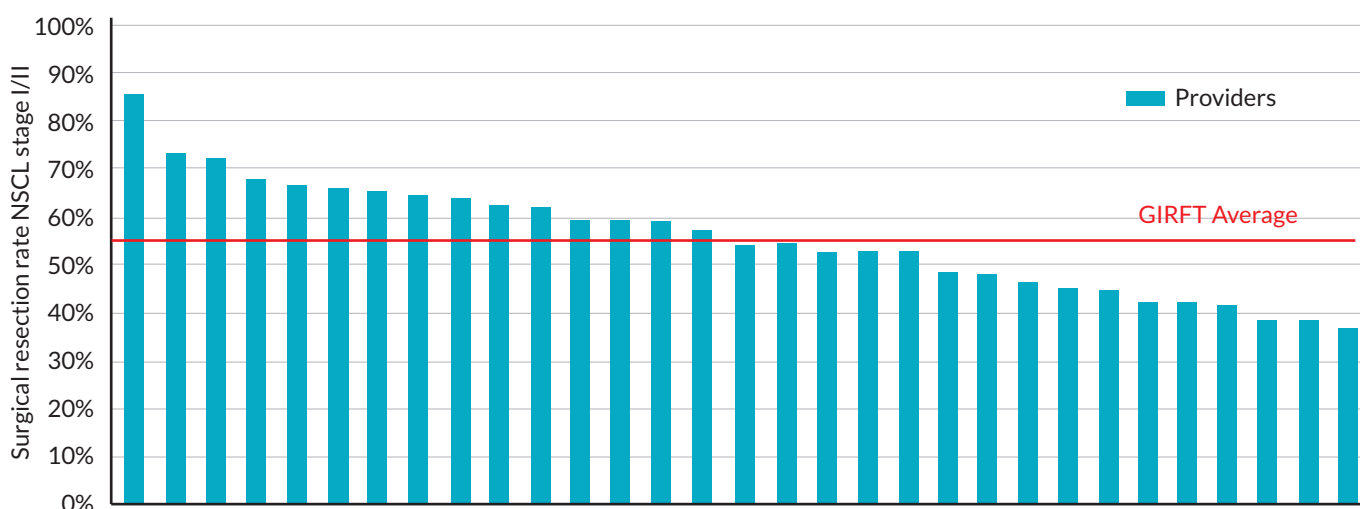
Source data: National Lung Cancer Audit, 2015*

Table 44: Notional additional resections

Improvement	Additional resections
All units at least match the average	60
All units at least match the current best quartile	145

Source data: National Lung Cancer Audit, 2015*

Figure 36: NSCLC stage I/II – surgical resection by provider



*The National Lung Cancer Audit team identified some caveats for interpreting the results of their 2015 audit, but noted that 'the results are as representative as a large national audit can be.' rcplondon.ac.uk/nlca2016.

Using multidisciplinary team meetings effectively

The national service specifications for thoracic surgery state that ‘consultant thoracic surgeons are core members of lung cancer multidisciplinary teams (MDTs)’. The specifications go on to detail the need for thoracic surgical units to allow time for attendance (‘preferably in person’), travel to meetings, and named and/or competent cover during leave. So it’s clear that multidisciplinary team meetings (MDTMs) place significant demands on surgeons’ time.

Since their introduction, MDTMs have dramatically improved the quality of care for patients with suspected or proven thoracic malignancy – particularly primary lung cancer. They have also led to the expansion and development of the speciality of thoracic surgery over the last 20 years.

However, we share the Society for Cardiothoracic Surgery’s (SCTS) concern that MDTMs are often being used as proxy chest medicine and radiology opinion meetings – particularly in smaller hospitals. It is becoming increasingly difficult for many thoracic surgery centres to provide the level of MDTM attendance required by lung cancer commissioners across the large number of small peripheral MDTMs.

This practice can have negative impact on the MDTM’s true function and leaves complex cases that require true multidisciplinary input at a disadvantage.

Lung resection Lobectomy

There is now limited place for pneumonectomy as a treatment for lung cancer. While it was once the principal operation, operations for lung resection are now more diverse. The rates of these different types of operation vary between units.

Table 45: Variation in rates of lung resection lobectomy

Average	Range		Quartile Lowest	Best quartile Highest
	Lowest	Highest		
60.7%	2.9%	79.8%	56%	66%

Source data: Hospital Episode Statistics (HES), Jan 2016 - Dec 2016

Figure 37: Lung resections by primary procedure (all GIRFT providers)

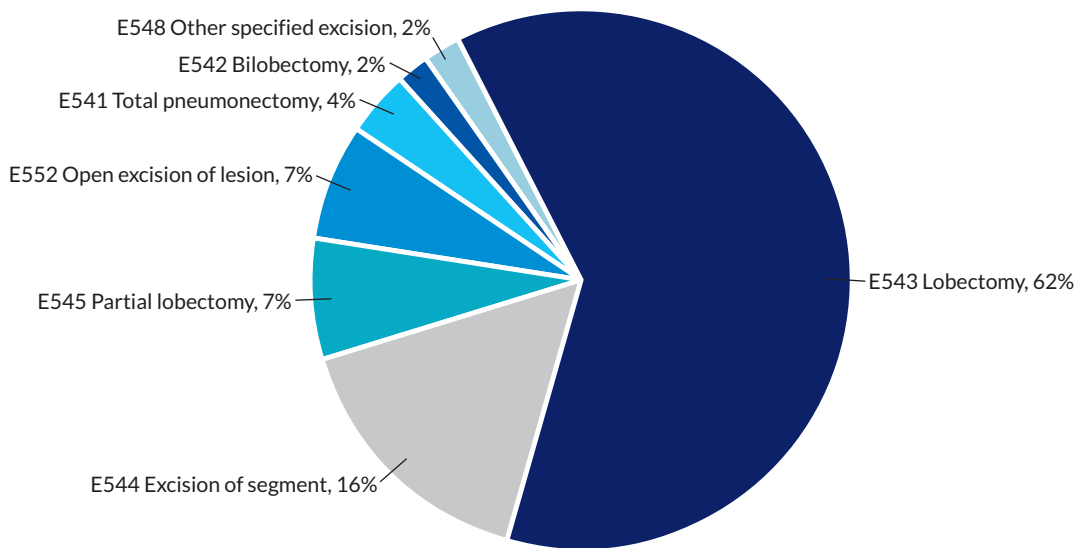
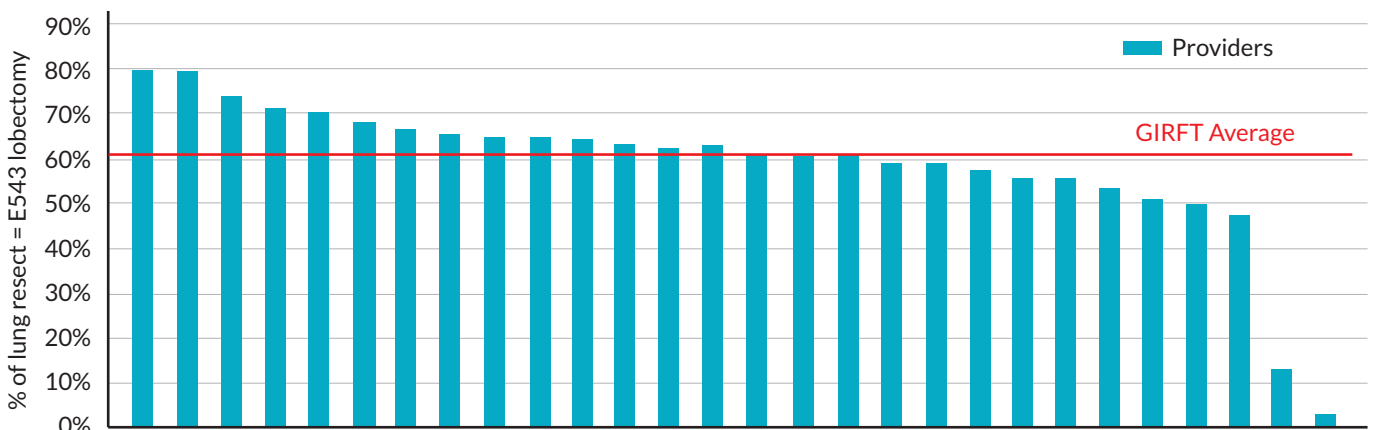


Figure 38: Lung resections with E543 lobectomy as primary procedure



Thoracic procedure

E543 lobectomy – video-assisted thoracoscopic surgery (VATS)

There is an unacceptable variation between providers in the rate of video-assisted thoracoscopic surgery (VATS) procedures for E543 lobectomy – from as high as 84% down to 10.3%.

This is concerning when many reports confirm the advantages of VATS lobectomy in particular patient groups. As well as facilitating adjuvant chemotherapy, these advantages include:

- reduced post-operative pain
- reduced complication rates
- reduced length of hospital stay – HES data for 2016 reports average lengths of stay that are 1.9 days shorter for E543 procedures undertaken with VATS (6.8 days) than those without (8.7 days).

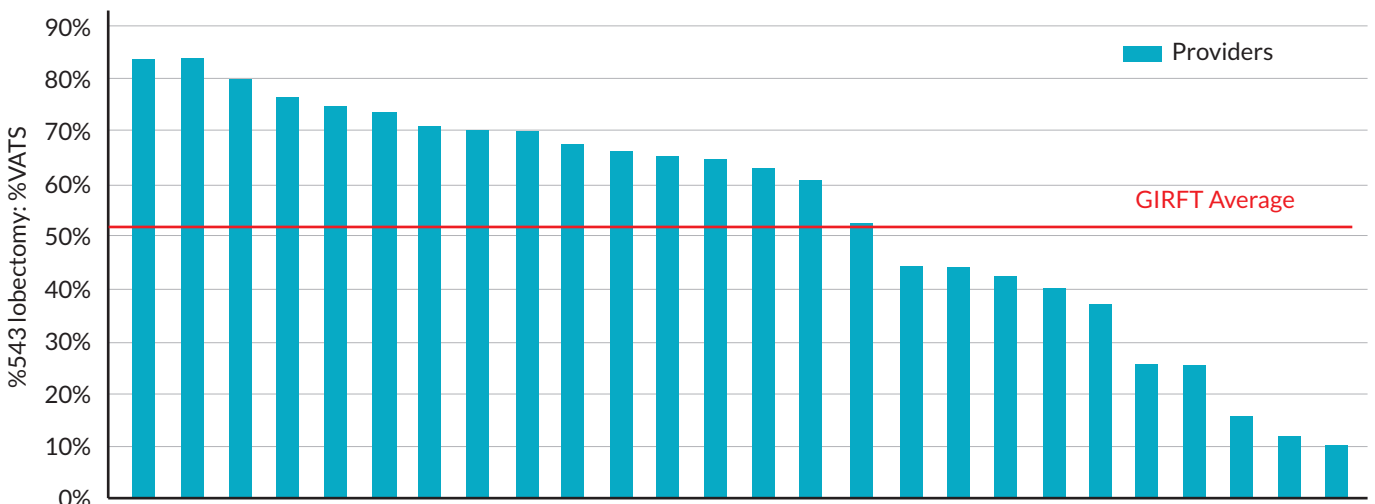
There is no change in the commissioning costs for VATS as it is grouped within the same HRG: while the technique changes, the primary procedure is the same.

Table 46: Variation in VATs rates for E543 lobectomy

Average	Range		Best quartile
	Lowest	Highest	
51.6%	10.3%	84%	71%

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Figure 39: E543 lobectomy – VATS procedures, by provider



Estimated bed days that could be saved by increasing VATs rates

Table 47: Activity and notional financial opportunities of increasing rates of E543 lobectomy – VATS

Improvement	Estimated additional E543 lobectomy – VATs	Notional financial opportunity (based on 1.9 bed days/pt saved)	
		Days	£
All units at least match the average	525 procedures	1,005 days	£365k
All units at least match the current best quartile	1,050 procedures	2,010 days	£735k

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Good practice case study

Achieving lung cancer resection rates

Oxford University Hospitals

Oxford has the highest resection rate for early lung cancer in the country.

Their approach includes:

- discussing all patients at a cancer MDTM
- ensuring that all patients default to seeing a surgeon
- considering all patients with anatomically resectable disease as surgical until proven otherwise – includes providing a second opinion service for patients turned down for surgery elsewhere.

Also, before turning patients down on the basis of poor pulmonary function, Oxford will place patients on a pre-operative pulmonary rehabilitation plan under two band 7 physiologists and nurse specialists to improve physiological function.

Cancer pathway

Recommendations

Recommendation	Actions and owners	Timeline
11a Centralise and reduce the number of lung cancer multidisciplinary teams (MDTs).	NHSE, Cancer Clinical Reference Group, Cancer Alliances, Providers	12 months
11b Ensure that a thoracic surgeon is present at every lung cancer MDT.	Cancer Alliances	12 months
12 Ensure that patients being treated with surgery for Stage 1 lung cancer receive VATS or robotic-assisted lobectomy as the treatment of choice.	Providers	12 months

Thoracic surgery – other pathways and treatment

Empyema Decortication

The choice of empyema management depends on the maturity of the case at the time of the referral.

Early referral facilitates the use of therapeutic measures such as drainage and washout under video-assisted thoracic surgery (VATS), which is associated with a shorter post-operative length of stay. Chronic forms require more extensive decortication through open operation.

There is a very wide variation in the use of VATS to manage empyema between providers, mirroring the variation in the use of VATS lobectomy for cancer.

Table 48: Variation in rates of empyema decortication as primary procedure

Average	Range		Best quartile
	Lowest	Highest	
41.3%	4.9%	78%	28.3%

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Figure 40: NEI empyema spells with decortication by provider

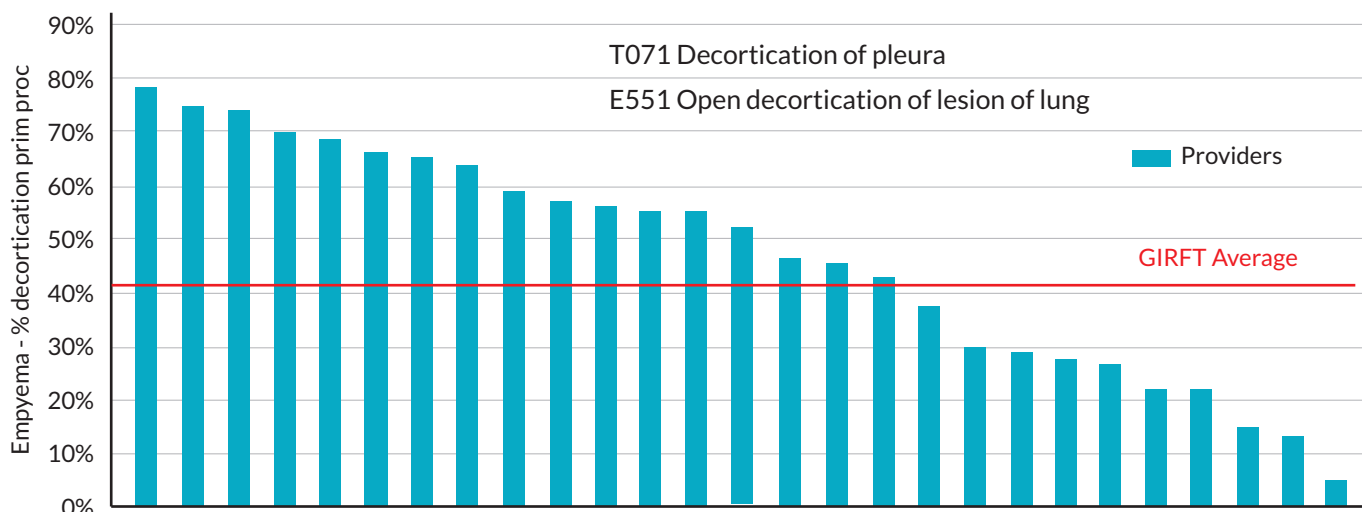
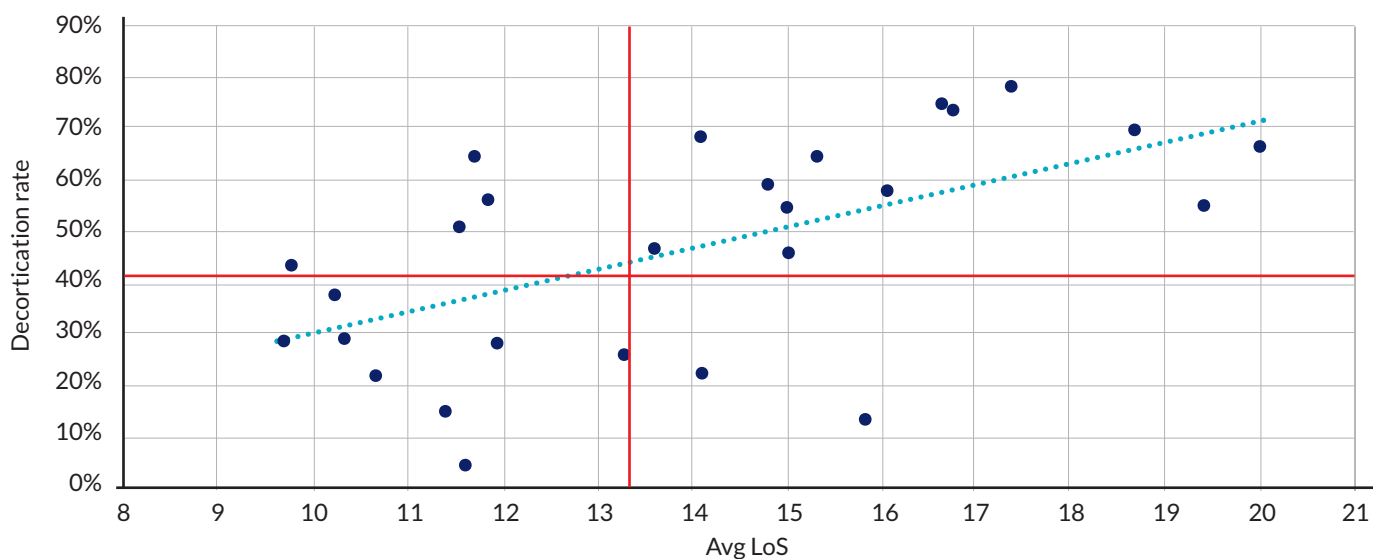


Figure 41: Non-elective empyema spells – relationship between decortication and post-operative length of stay



Notional financial opportunity

Table 49: Activity and notional financial opportunities of increasing rates of empyema decortication as primary procedure

Improvement	Estimated additional decortications	Notional financial opportunity (based on 2 bed days/pt)	
		Days	£
All units at least match the average	245	480 days	£175k
All units at least match the current best quartile	425	830 days	£305k

Source data: Hospital Episode Statistics (HES), Jan 2016 – Dec 2016

Effect of on-site A&E

During our deep-dive visits we were told that patients who were received from external referring centres had more advanced empyema than those arising 'in-house'. This would imply that centres without on-site A&E departments tend to receive later referrals.

Recommendations

Recommendation	Actions and owners	Timeline
13a Ensure that patients who do not recover from medical empyema treatment within 5-7 days are assessed by a thoracic surgeon.	British Thoracic Society to produce guideline	3 months
13b When possible, routinely use VATS rather than open operation to manage empyema.	Providers	6 months

Sub-specialties

Aortovascular surgery

Aortovascular surgery is relatively low-volume, highly specialised surgery.

Emergencies fall into the overall category of acute aortic syndromes. Most common of these is acute aortic dissection (AAD) – a life-threatening emergency that occurs spontaneously when the layers of the wall of the aorta tear.

AAD is rapidly fatal if the aorta ruptures. In 50% of cases, death occurs within 20-30 minutes of the dissection happening. For the remainder of cases, emergency cardiac surgery is required and the mortality rate without surgery for these patients is equivalent to 1% per hour.

Incidence and mortality

Incidence of AAD in the UK is estimated at 2 to 3 cases per 100,000 population per year.³

The average 30-day mortality in England amongst patients surviving to go forward for surgery is approximately 12%.

Surgery and the need to act quickly

Surgery is needed when the aortic dissection involves the portion of the aorta as it arises from the heart (Type A Dissection). Special investigations are required to confirm the diagnosis:

- a contrast enhanced CT scan is currently the gold-standard diagnostic imaging modality, offering a sensitivity and specificity over 90%
- transthoracic echocardiography and transoesophageal echocardiography may also give useful additional information.

The availability of all three investigations varies considerably across the NHS in England – particularly out of hours.

The risk of mortality with a Type A dissection (1% per hour) means that it is vital that patients move as quickly as possible from initial presentation to the operating theatre at a cardiac centre. It's essential to avoid any hold ups, especially with:

- delays establishing the diagnosis, for example due to issues with access to CT scanning
- poor co-ordination within providers (such as confirmation of intensive care bed availability).

Variation in provision of acute aortic dissection (AAD)

There is evidence of variation in the provision of surgical expertise in AAD across England. With current staffing arrangements, the receiving surgeon in a cardiac surgical centre is unlikely to be a subspecialist in thoracic aortic surgery.

The national service specification states:

The majority of [AAD] are dealt with by the on-call surgeon. It will be part of the remit of the Aortic Vascular Group to advise on how this area of acute surgery should be taken forward.

It is anticipated that there should be networks of surgeons crossing traditional geographical boundaries so that patients presenting with difficult or unusual problems could be discussed and, if need be, moved to a unit or surgeon with a particular expertise.

Aortovascular surgery volumes

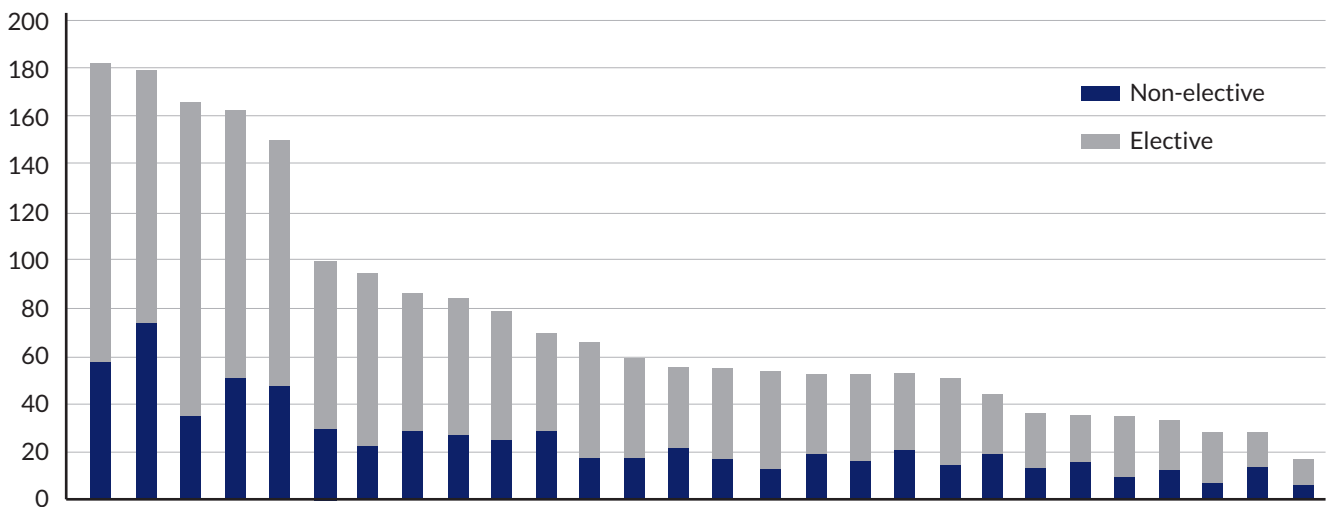
A total of 2,100 procedures were carried out in 2016, of which 700 were emergencies.

In terms of both elective and emergency aortovascular activity, only five providers undertake more than 100 procedures per year, with eight undertaking fewer than 50 – in other words, not even one a week.

When we look at emergencies, only four providers undertake 50 or more procedures a year, while 13 do fewer than 20.

³ National service specification for cardiac surgery.

Figure 42: Aortovascular surgery volumes by provider



Source data: Hospital Episode Statistics (HES), Jan 2014 - Dec 2016

Table 50: Variation in mortality rate for non-elective aortovascular surgery

Average	Range		Best quartile
	Lowest	Highest	
12.33%	0%	22.73%	10.18%

Source data: Hospital Episode Statistics (HES), Jan 2014 - Dec 2016

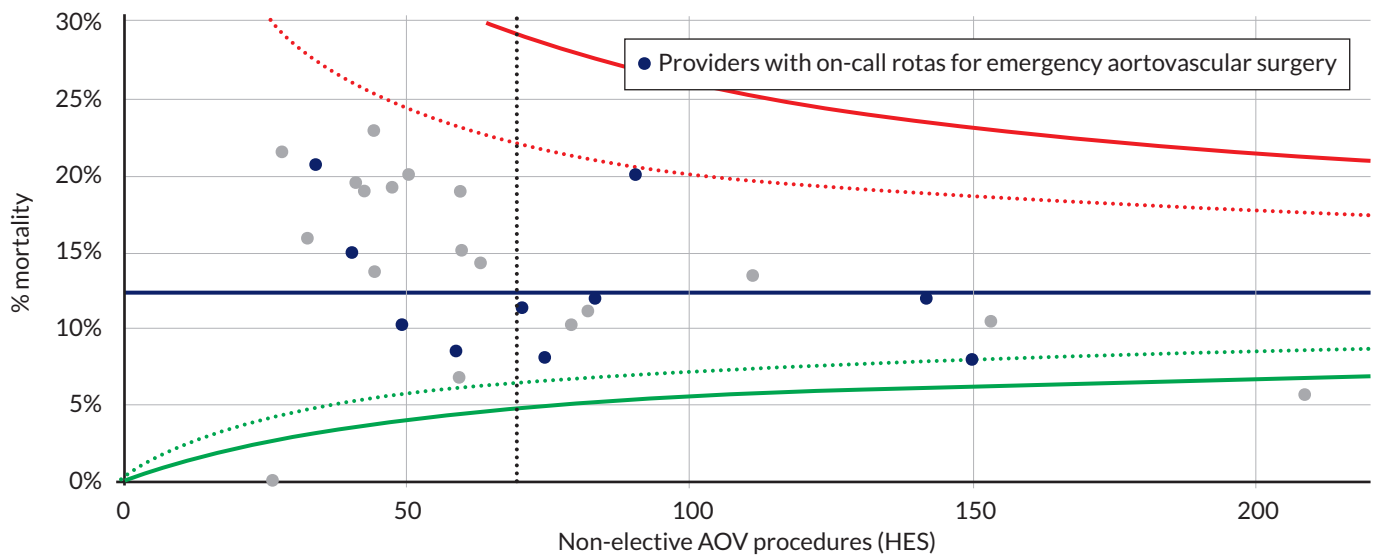
Relationship between activity levels and mortality

Data for a three-year period, comparing non-elective activity with mortality (not-risk adjusted), indicates that higher rates of mortality are associated with lower volumes of activity:

- 9 of the 11 providers with 70 or more aortovascular procedures in 3 years, report below average mortality;
- 13 of the 17 providers with less than 70 aortovascular procedures in 3 years report above average mortality.

The data strongly suggests that high volume is associated with better outcome, with a four-fold variation in 30-day mortality.

Figure 43: Non-elective aortovascular surgery – mortality rates by provider



Source data: Hospital Episode Statistics (HES), Jan 2014 – Dec 2016

Relationship between on-call rotas and mortality

7 of the 10 providers that operate on-call rotas for aortovascular emergencies report mortality rates that are on or below the national average.

Good practice case study

Aortovascular surgery

Guy's and St Thomas' Hospital and King's College Hospital

Since Guys' and King's merged their aortovascular on-call service, they have seen one-year survival rates for AAD rise from 51.8% to 74.6%.

Specialist aortic surgeons – those performing more than 10 aortic procedures annually – are now on a 24-hour on-call rota, with a dedicated referral pathway for AAD.

Key improvements

A comparison of 141 cases pre-dating the start of the rota with 125 since it has been in place found the following improvements:

- CT scan to operation time fell from 650 minutes to 390 minutes.
- In-hospital mortality fell from 25% to 14%.
- Median length of stay fell from 18 days to 12 days.
- Increased comprehensiveness of aortic repair.
- Blood product transfusion decreased.
- Composite complication outcome endpoint fell from 23% to 18% (included acute kidney injury, stroke, paraplegia, ITU stay of over one week.)

Aortovascular surgery

Recommendations

Recommendation	Actions	Owners	Timeline
<p>14 Ensure that acute aortic syndrome patients are only operated on by rotas of acute aortic syndrome specialist teams.</p>	<p>14a Create rotas of specialist surgeons allied to networks of referring hospitals to cover geographic areas.</p>	Providers	12 months
	<p>14b Ensure that all surgeons on the rotas meet minimum activity thresholds as defined by 14c.</p>	Providers	
	<p>14c Define minimum activity thresholds for the surgeons.</p>	NHSE Thoracic Aorta (ascending aorta – visceral segment) Working Group	
	<p>14d Establish formal agreements between referring hospitals, receiving specialist units and ambulance services for transfer of AAD patients to the relevant specialist centre. The arrangements should include a dedicated phone number for referrals and service co-ordination.</p>	Ambulance services and providers.	

Mitral valve surgery

Mitral valve disease is common in the UK. It occurs in 25% of the population and prevalence increases with age. It has a variety of causes, but the commonest is degenerative disease, which causes mitral valve prolapse.

Repair versus replacement

It is thought that 10% of patients with degenerative mitral valve disease will go on to develop regurgitation (leaking) that is severe enough to warrant surgical intervention. There are two options: mitral valve replacement or mitral valve repair.

In such patients, there is strong evidence that mitral valve repair has better outcomes than mitral valve replacement. This evidence applies to all patient categories and includes rates for early mortality, stroke after surgery, long-term survival and freedom from reoperation.

Patients receiving surgery for repair have a much lower mortality rate (1.8%) than those having replacement surgery (7.7%). This variation is not fully explained by risk factors in the NICOR risk adjustment (not complete for all data shared with GIRFT).

Difference in mortality rate

Table 51: Mitral valve surgery volumes, deaths, actual mortality rate and expected mortality - England, Apr 2013 to March 2016

	Repair	Replace	Total
All procedures			
Total procedures	4,116	1,319	5,435
Total deaths	76	101	177
Actual mortality rate	1.8%	7.7%	3.3%
Procedures with a euroSCORE in the dataset			
Total procedures	1,950	703	2,653
Deaths	38	57	95
Actual mortality rate	1.9%	8.1%	3.6%
Expected mortality on euroSCORE	6.3%	10.5%	7.4%
Ratio: actual mortality rate to expected on euroSCORE	0.31	0.77	0.48

Source data: National Institute for Cardiovascular Outcomes Research (NICOR), Apr 2013 - Mar 2016

Differences in length of stay

Length of stay comparisons also differ, with the average for a repair being 12.4 days, compared to 18.7 days for a replacement.

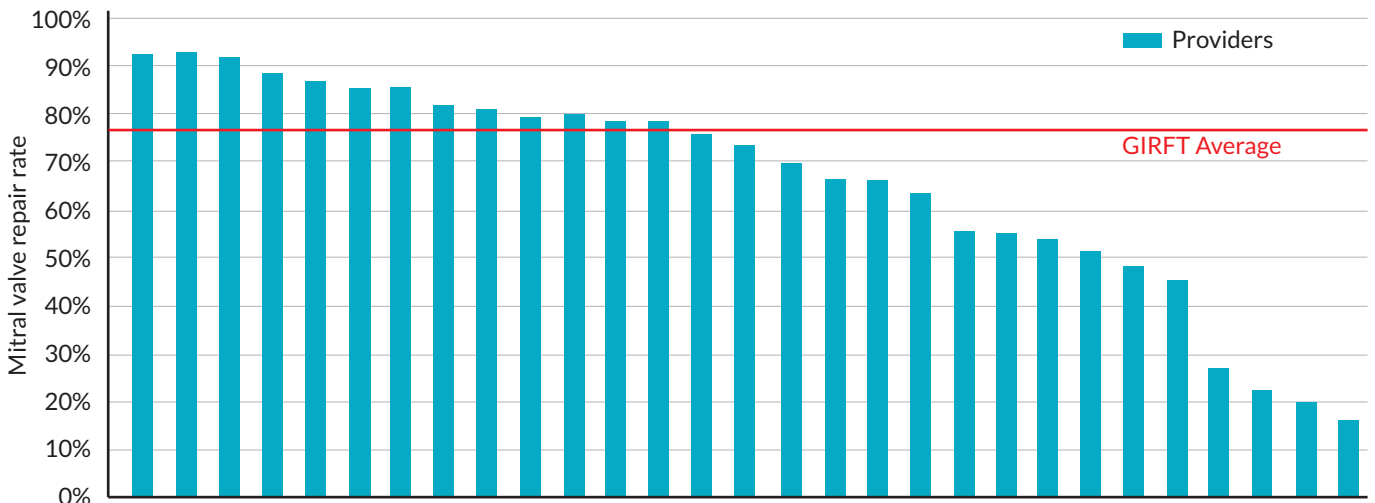
In England, there is evidence of unexplained variation in the mitral valve repair rate in patients undergoing surgery for degenerative mitral valve disease.

Table 52: Variation in degenerative mitral valve repair rates

Average	Range		Best quartile
	Lowest	Highest	
77%	42%	95%	88%

Source data: GIRFT questionnaire, 2015/16 (Note: we have used NICOR 2013–2016 data for three providers as they did not provide this information.)

Figure 44: Degenerative mitral valve repair rates by provider



Variation in repair rates

There is a wide variation in repair rates – from 42% to 95%.

In terms of service provision:

- all but two providers have dedicated surgeons for mitral valve surgery
- 19 providers report that all mitral valve surgery is referred to their dedicated surgeons
- 19 reported having regular, minuted, sub-specialty MDTs for mitral valve disease.

However, these factors do not seem to have any bearing on repair rates: some of the providers with the highest repair rates do not refer all surgery to dedicated surgeons, and do not hold regular MDTs.

Notional financial opportunity

Table 53: Activity and notional financial opportunities of increasing rates of mitral valve repair

Improvement	Estimated repairs	Notional financial opportunity (based on 6.3 bed days/spell)	
		Days	£
All units at least match the average	110 repairs	695 days	£255k
All units at least match the current best quartile	220 repairs	1,390 days	£510k

Source data: GIRFT questionnaire, 2015/16 (Note: we have used NICOR 2013–2016 data for three providers as they did not provide this information.)

Relationship between outcomes and volume of repair procedures

Mitral valve repair can be technically challenging and requires high levels of surgical experience and judgment. There is strong evidence, both in the UK and USA, that success rates for degenerative mitral valve repair depend on the volume of procedures performed by units and by individual surgeons.

Given this, repair rates for degenerative mitral valves by an institution or individual surgeon should be 90% or more.

Mitral valve repair and severity of regurgitation

Recent international, evidence-based guidelines have lowered the severity of regurgitation at which patients are recommended for mitral valve repair. In these cases of less severe degenerative mitral valve disease, outcomes for conservative treatment are exceeded by mitral valve repair – but not by mitral valve replacement. As such, the guidelines recommend that surgery in these cases should only take place when the valve is to be repaired rather than replaced.

Mitral valve multidisciplinary team meetings (MDTMs)

It is accepted best practice that patients with degenerative mitral valve disease should be referred to a properly constituted valve MDTM at the specialist centre. The MDTM should have decision-making responsibility

Unified patient pathway

A unified patient pathway reduces variation in the referral process, reduces the number of investigations patients must undergo, establishes standards of care and introduces a single point of contact at the tertiary centre for referrals.

Mitral valve surgery

Recommendations

Recommendation	Actions	Owners	Timeline
<p>15 Ensure that patients with degenerative mitral valve disease are only operated on by specialist mitral valve surgeons.</p>	<p>15a Activity threshold to be developed by the specialty association and then included in the NHS England service specification.</p>	SCTS and CRG	12 months
	<p>15b Minimum acceptable repair rate for mitral valve repair in degenerative disease to be set by the specialty association and then included in the NHS England service specification.</p>	SCTS and CRG	
	<p>15c Discuss all elective mitral valve cases at a properly constituted, dedicated mitral valve MDT team meeting.</p>	Providers	

Trauma services

The national service specification for thoracic surgery states:

24/7 emergency cover should be provided by general thoracic surgical consultants with or without mixed-practice cardiothoracic surgical colleagues. This should be appropriate to the service requirements. The surgeons on the rota should be able to deal with the full range of thoracic surgical emergencies. Cross cover of rotas from consultants with a purely cardiac practice or from consultants from other specialties is unacceptable.

Cardiac surgery cover is provided at every major trauma centre. However, we found that:

- there are a number of major trauma centres where there is no thoracic surgical cover
- six major trauma centres carry out thoracic surgery on a different campus to their A&E services
- emergency thoracic cover is provided by full-time cardiac surgeons at the trauma centres at Central Manchester University Hospitals, University Hospitals Birmingham, and King's College Hospital.

Trauma

Recommendations

Recommendation	Owners	Timeline
16 Ensure that major trauma centres are covered by published rotas for both thoracic and cardiac trauma. Providers should end the practice of using full-time, cardiac-dedicated surgeons to provide emergency thoracic surgery cover.	Providers	12 months

Coding, reference costs, and National Tariff Payment System (NTPS)

Variations in reference costs

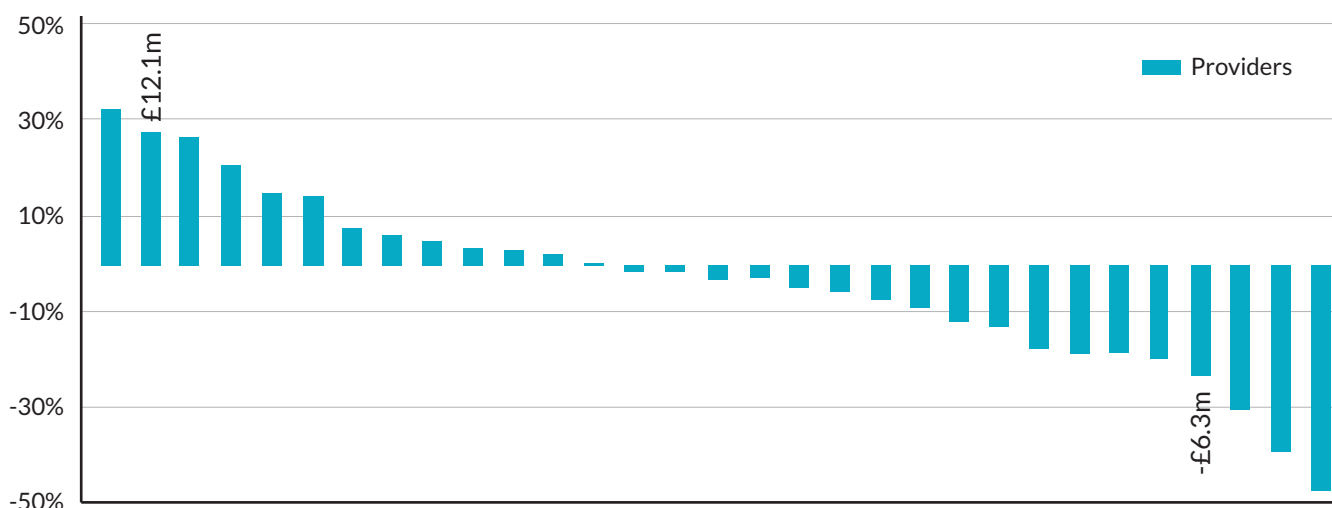
All providers are required to produce reference costs, which are reconciled to their annual accounts. Reference costs are used in the construction of the individual prices for National Tariff Payment System (NTPS), which underpins the commissioning of most acute care. Reference costs and the NTPS use Healthcare Resource Groups (HRGs). HRGs group together activities that should consume a similar amount of resources and are based on a clinically endorsed view of acute healthcare activities undertaken within the English NHS.

We have used reference costs to summarise actual total costs reported in cardiothoracic specialties, and to compare these to 'expected' total costs for each provider (based on the national average cost at HRG level, adjusted for market forces factor).

Variation between total actual cost and total expected cost by provider

The variation between total actual cost and total expected cost by provider varies from +32% to -47%, with the largest financial variations being +£12.1m above expected costs and -£6.3m below expected costs.

Figure 45: Cardiothoracic reference costs – variation between actual costs and expected costs by provider



Source data: Reference costs, 2015/16

The information currently collected within reference costs allows a breakdown of this figure by point-of-delivery (elective or non-elective) and by HRG. However, it does not facilitate further analysis to help understand cost variations, for example by theatre costs, ward costs, estates costs etc. The proposed Patient Level Information and Costing Systems (PLICS) would support this level of drill-down.

Impact of coding on casemix (HRG v4+)

Grouping admitted patient care activity to HRGs includes the following key steps⁴:

- 1 Activity is allocated to a HRG Root, for example HRG ED28 Standard Coronary Artery Bypass Graft.

The dominant procedure is selected from all of procedures that have taken place during the Finished Consultant Episodes (FCEs) that form part of the patient spell. If there are no procedures that are considered relevant to grouping, then the HRG Root will be determined by diagnosis information, for example HRG Root EB05 Cardiac Arrest.

- 2 The HRG Root is split to reflect the casemix of activity within the HRG Root.

This split may be based on a number of factors, including specified comorbidities and complications (cc).

For example, Root ED28 Standard CABG is split into three HRGs, each with a different price under the NTPS. This process looks at all diagnosis codes associated with the spell, and scores these using a different scoring mechanism for the sub-chapter, ED Open Cardiac Procedures for Acquired Conditions.

This second step is influenced by the depth and quality of clinical recording/coding at each provider, as well as any underlying casemix variations or treatment complications.

We look at the potential impact of casemix in the following two examples.

The examples use 2015/16 Reference Cost spells priced at 2017/18 NTPS tariff (adjusted by the weighted-average MFF across all GIRFT cardiothoracic providers reporting activity against these HRGs).

Healthcare Resource Groups (HRGs)

You can find more details on HRGs and grouping on the NHS Digital website:
<https://digital.nhs.uk/National-Casemix-Office>

⁴ Clinical coders do not group activity; this is completed by the HRG grouper using ICD-10 diagnosis and OPCS procedure codes to group FCEs within a spell to derive the HRG spell.

Example of variation in cardiac surgery casemix

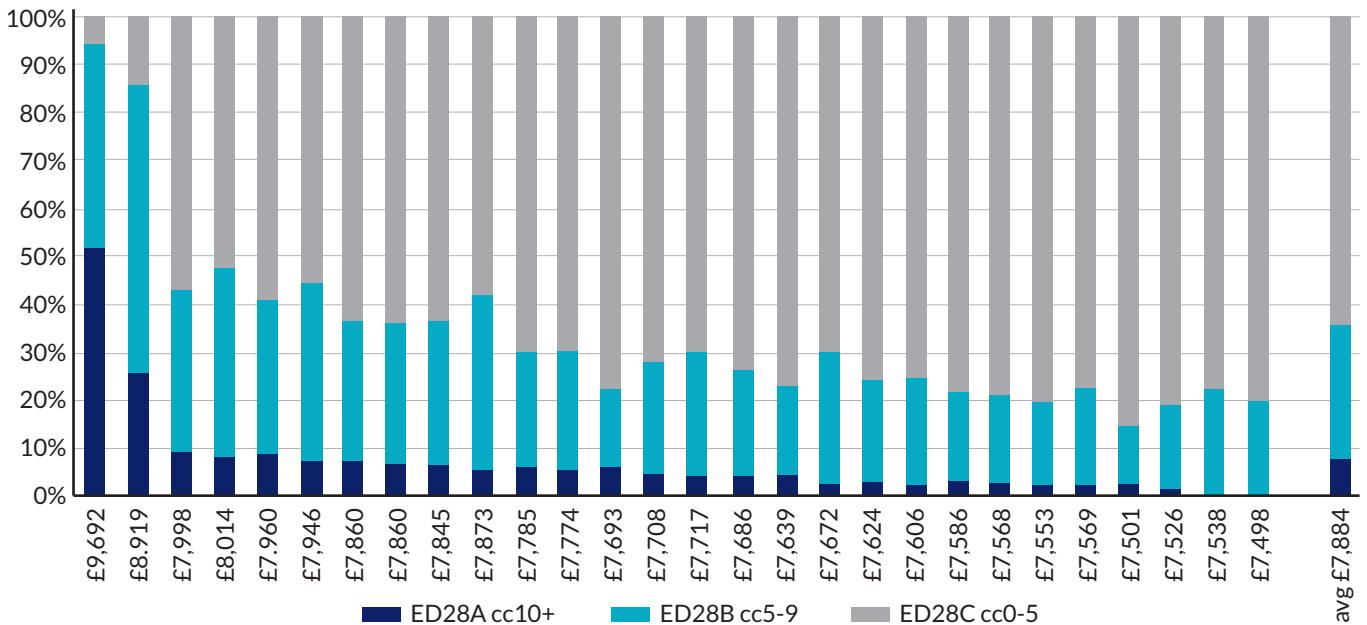
HRG Root ED28 Standard Coronary Artery Bypass Graft, elect

Within this HRG Root, the 2017/18 NTPS price by provider (adjusted for average MFF across all GIRFT cardiothoracic providers) varies from £9,692 to £7,498, with an average of £7,884.

The 2017/18 price for the provider reporting the most complex casemix is £1,808 above the average (+23%), and would result in additional income of around £410k on their activity for this one root HRG Root (subject to adjustment to the provider's MFF).

This provider reported 52% of their cases having complications/comorbidity scores of 10 or more in the 15/16 reference cost data. This compares to just 8% of the national activity, with most providers reporting less than 10% in this category.

Figure 46: HRG Root ED28, Standard CABG, elective, variation in casemix reported by providers



Coding detail

We investigated coding for the two providers with the highest average prices in more detail.

Table 54 summarises some of the codes that are being used extensively at these two providers in comparison to other providers. For example, the highest-priced provider reported R11X nausea and vomiting in 54.1% of their cases, compared to only 1.5% of cases in other providers.

Table 54: HRG Root ED28, Standard CABG, elective – examples of significant variation in diagnosis coding

ICD10 code	% of cases with this code		
	Highest cost provider	2nd highest cost provider	Other Providers (excluding 2 highest avg costs)
R11X Nausea and vomiting	54.1%	17.9%	1.5%
J90X Pleural effusion, not elsewhere classified	40.7%	58.1%	11.2%
J981 Pulmonary collapse	33.2%	51.9%	7.6%
I959 Hypotension, unspecified	27.3%	24.5%	3.0%
I088 Other multiple valve diseases	18.8%	3.2%	0.2%
I081 Disorders of both mitral and tricuspid valves	18.0%	2.2%	1.7%
E669 Obesity, unspecified	3.4%	46.1%	9.9%
R000 Tachycardia, unspecified	12.7%	23.4%	0.9%
I489 Atrial fibrillation and atrial flutter, unspecified	22.2%	34.1%	13.8%

Nausea, pleural effusion, pulmonary collapse, hypotension and unspecified tachycardia are all part of the normal post-operative phase following major heart surgery. Every patient will have these to a certain degree – in insignificant amounts in the majority of cases. On this basis, variation in clinical recording of these diagnoses at each provider is likely to be a significant driver of the variation in reported casemix.

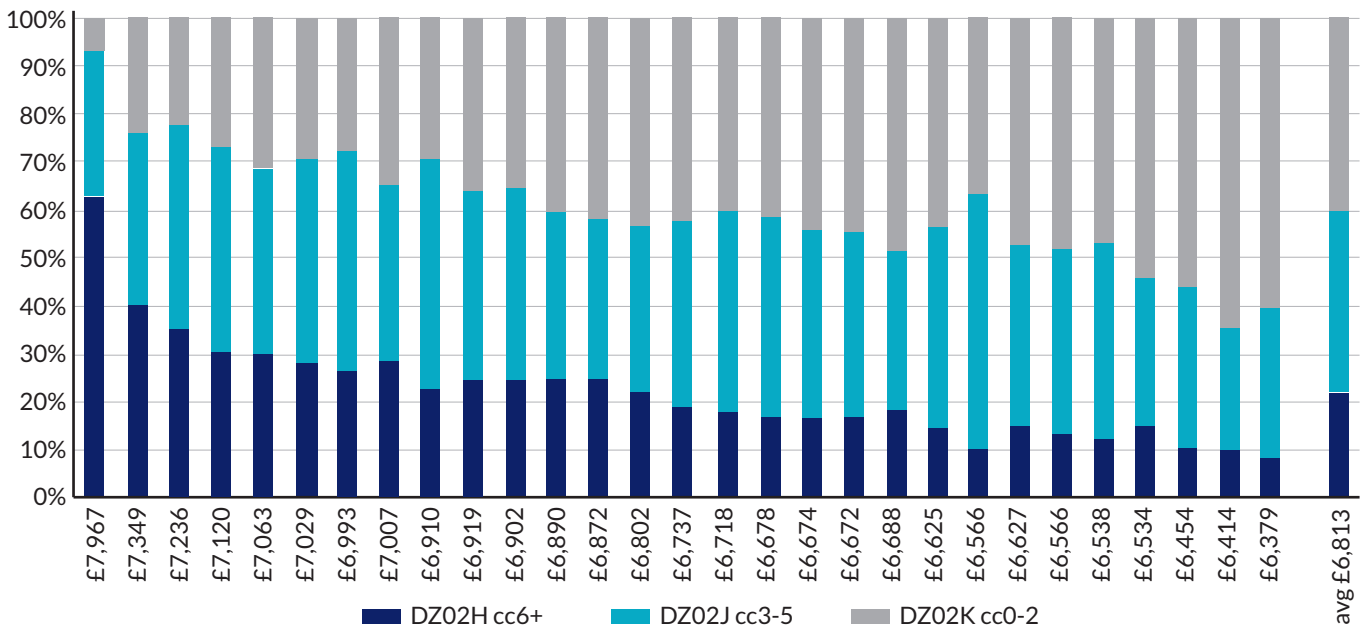
Example of variation in thoracic surgery casemix

HRG Root DZ02 Complex Thoracic Procedures 19 years and over

The overall picture is similar for this thoracic HRG Root. The 2017/18 NTPS price by provider (adjusted for average MFF across all GIRFT cardiothoracic providers) varies from £6,379 to £7,967.

The provider with the most complex casemix has a price that is £1,154 above average (+17%) – equating to around £570k additional income on their activity for this HRG Root (subject to adjustment to the providers MFF). This provider reports 64% of spells as being in the most complex category (cc score of 6+), compared to 22% across all providers.

Figure 47: HRG Root DZ02 Complex thoracic procedures, 19 years and over, elective -variation in casemix reported by providers



Implication of high-coding on HES complication rates

The two providers in cardiac surgery and the one in thoracic surgery that we identified as having above-average casemix and depth of diagnosis coding, appear as outliers in the HES 30-day complication rates.

We suggest that this is due to coding variation in clinical recording and/or coding of co-morbidities and complications rather than any real variation in the actual complication rates experienced by patients at these providers.

What is clear is the impact that coding can have on comparisons of clinical variation as well as on income.

We believe the variation in clinical recording/coding practice described is creating a significant income differential between providers that does not reflect an actual differential in the cost of treating these patients.

Figure 48a: HES 30-day complications by provider - Cardiac surgery

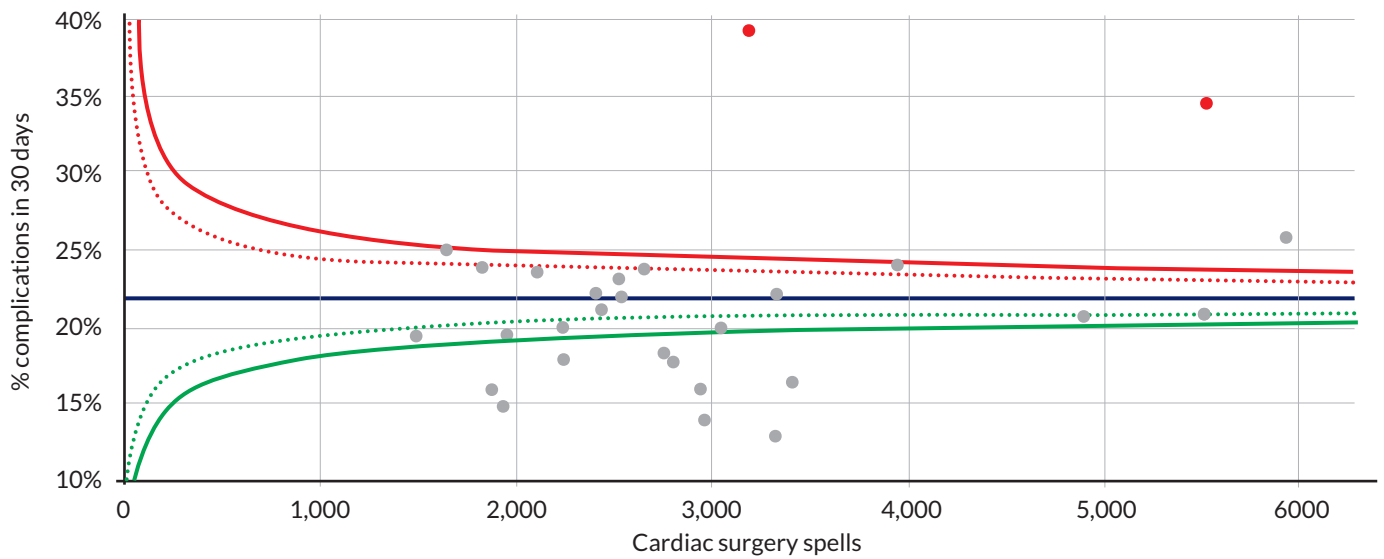
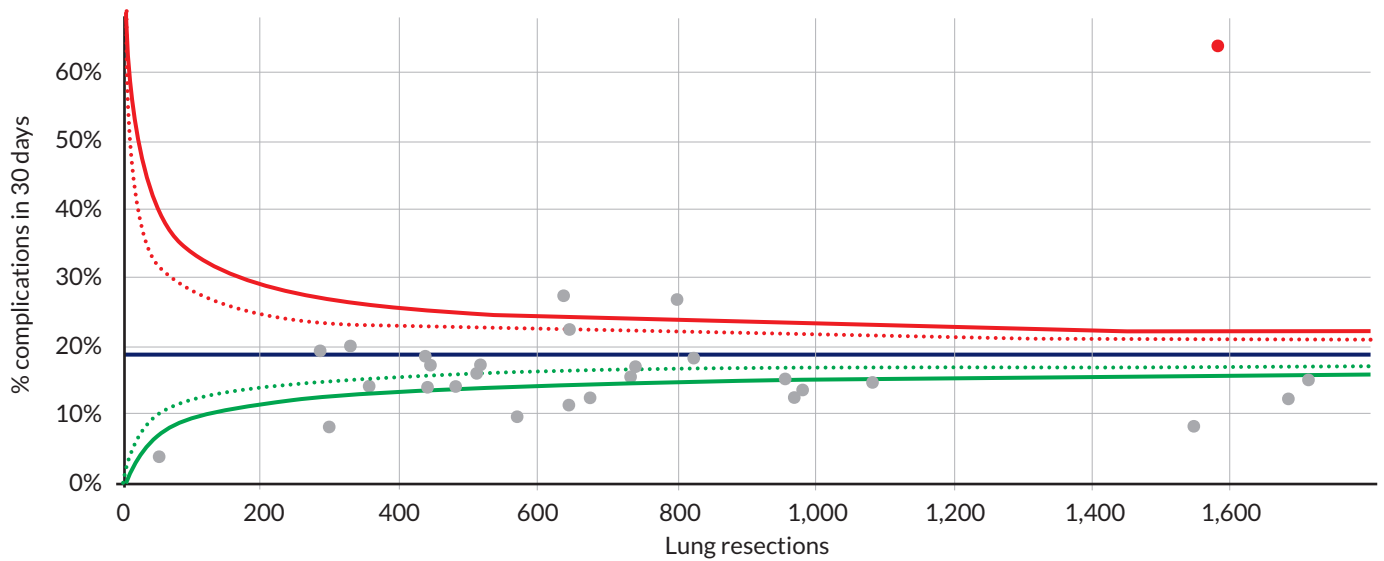


Figure 48b: HES 30-day complications by provider - Lung resections



Coding Recommendations

Recommendation	Actions	Timeline
17 Review the list of complications and comorbidities for cardiothoracic surgery, so that only codes that are genuinely relevant to the cost of treatment trigger a cc score in pricing, and that the HRG splits reflect an authentic variation in cost.	NHS Digital	In preparation for next National Tariff
18 Increase collaboration between clinical cardiothoracic teams and coders by including coders in multidisciplinary team meetings (MDTMs) and morbidity and mortality meetings.	Providers	6 months

Coding within National Institute for Cardiovascular Outcomes Research (NICOR) datasets

The NICOR database contains a depth of information, not available in any other source, that is essential to understanding the quality and outcomes of the cardiac surgery service.

We have used this dataset extensively. However, some of our analysis has been limited due to variable data quality. Table 55 lists examples of key fields where we found data to be incomplete. We've adjusted for these in our analysis as appropriate and removed some providers, or elements of data, where we were not confident in the accuracy of the data.

Coding within National Institute for Cardiovascular Outcomes Research (NICOR) datasets

Table 55: Examples of NICOR data fields that are not complete

Data field	Not complete %
Admission date	0.47%
Discharge date	0.78%
Operative urgency	0.94%
First operator grade	2.46%
Return to theatre	9.64%
Discharge destination	6.24%
Deep sternal wound infection	26.17%
New CVA	16.56%
Post-op dialysis	11.96%

NICOR data quality Recommendations

Recommendation	Actions	Timeline
<p>19 NICOR should work with providers to improve the quality of data submitted and stored – specifically for:</p> <ul style="list-style-type: none">• Deep sternal wound infection• New permanent stroke• Return to theatre• Post-operative renal replacement therapy.	NICORI	12 Months

Procurement spend

Purchase Price Index and Benchmarking (PPIB) review and validation

In early 2018, the GIRFT team will be working with trusts to review total procurement spend for high-cost cardiothoracic items and understand any variations. As part of this exercise, we will provide a curated PPIB data-pack to Heads of Procurement at trusts and ask for validation and feedback before drawing conclusions and making recommendations.

GIRFT will work closely with NHSI, NHSE and the Department of Health to review the potential impact of new procurement or payment initiatives, such as Category Towers, NHS Supply Chain, and the high-cost tariff excluded devices programme. In order to ensure best value, we believe it will be essential that procurement of high-cost cardiothoracic items be clinically led.

Early observations on variation in procurement spend

As part of our review of cardiothoracic surgery, we collected information on two key areas of procurement spend: heart valves and annuloplasty rings.

The following observations are based on the information we collected and our discussions with providers. We've included them to provide an initial picture of potential variations in procurement costs until the GIRFT review of PPIB data is available.

Heart valve procurement

Around 10,750 heart valves were procured in 2015/16 at a total cost of £16m. The average price paid per provider ranged from £1,064 to £2,161, with an average of £1,496 across all providers.

Note: We received data from 27 of the 28 providers.

Table 56: Variation in average price of heart valves

Average	Range		Best quartile
	Lowest	Highest	
£1,496	£1,064	£2,161	£1,344

Source data: GIRFT questionnaire, 2015/16 spend

Figure 49: Heart valve – average price by provider

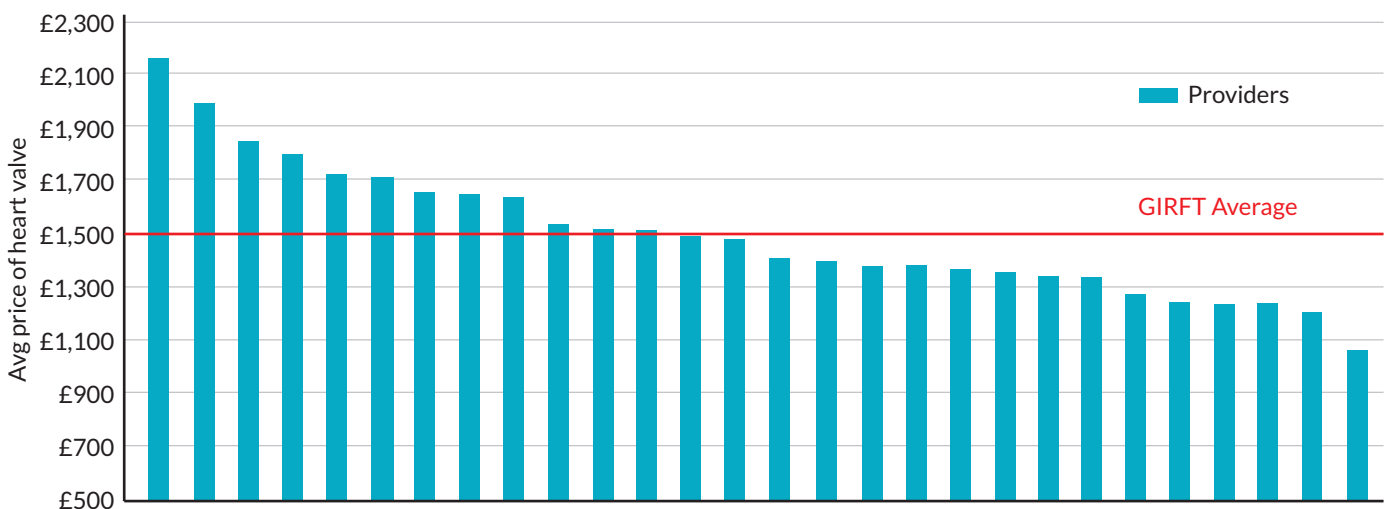


Table 57: Heart valve – estimated savings

Improvement	Estimated saving
All units at least match the average	£1m
All units at least match the current best quartile	£2m

Source data: GIRFT questionnaire, 2015/16 spend

Annuloplasty rings

Around 3,300 annuloplasty rings were bought in 2015/16 at a total cost of £3.17m. The average price paid per provider ranged from £676 to £1,313, with an average of £968 across all providers.

Note: We received data from 27 of the 28 providers.

Table 58 Variation in average price of annuloplasty rings

Average	Range		Best quartile
	Lowest	Highest	
£968	£676	£1,313	£845

Source data: GIRFT questionnaire, 2015/16 spend

Figure 50: Annuloplasty rings – average price by provider

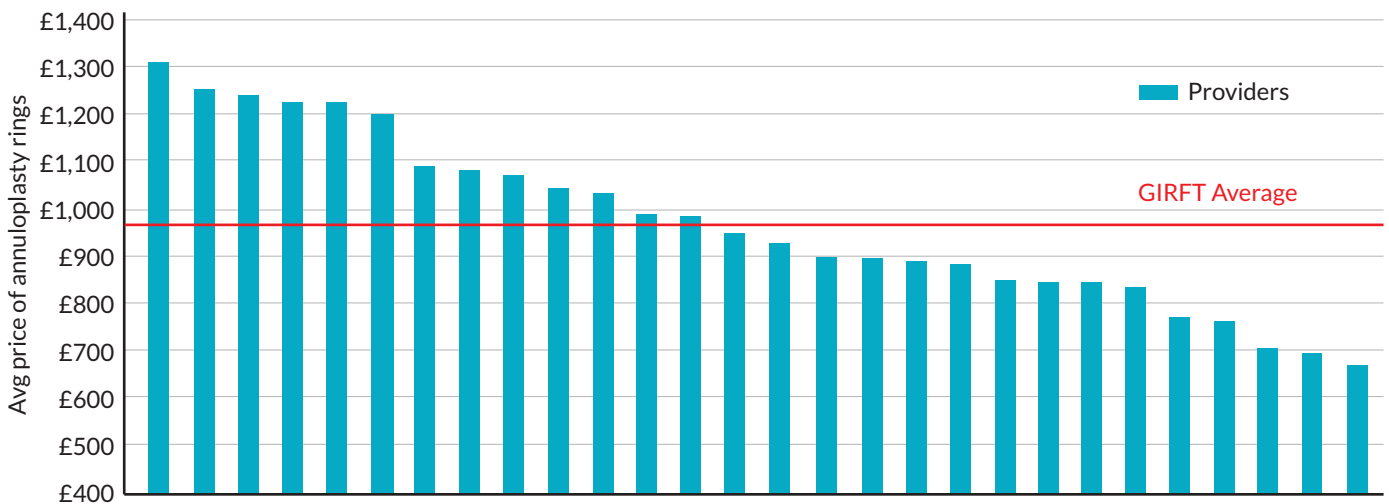


Table 59: Annuloplasty rings – estimated savings

Improvement	Estimated saving
All units at least match the average	£255k
All units at least match the current best quartile	£490k

Source data: GIRFT questionnaire, 2015/16 spend

Litigation

Every effort must be made to learn from litigation claims, complaints, severe untoward incidents (SUIs) and inquests. Avoiding past mistakes will improve patient care, reduce litigation costs, and remove the cost of managing complications resulting from incidents.

We found that many providers had little knowledge of the litigation claims against them. This included providers with high litigation costs per admission as well as those at the low end. As a consequence, very few lessons to inform future practice have been learnt.

Providing clinical staff with information on claims is essential and our review of the impact and causes of litigation in cardiothoracic surgery is intended to start supporting learning across providers. Further work is needed, at both a local and national level, to analyse claims to maximise opportunities to improve patient care.

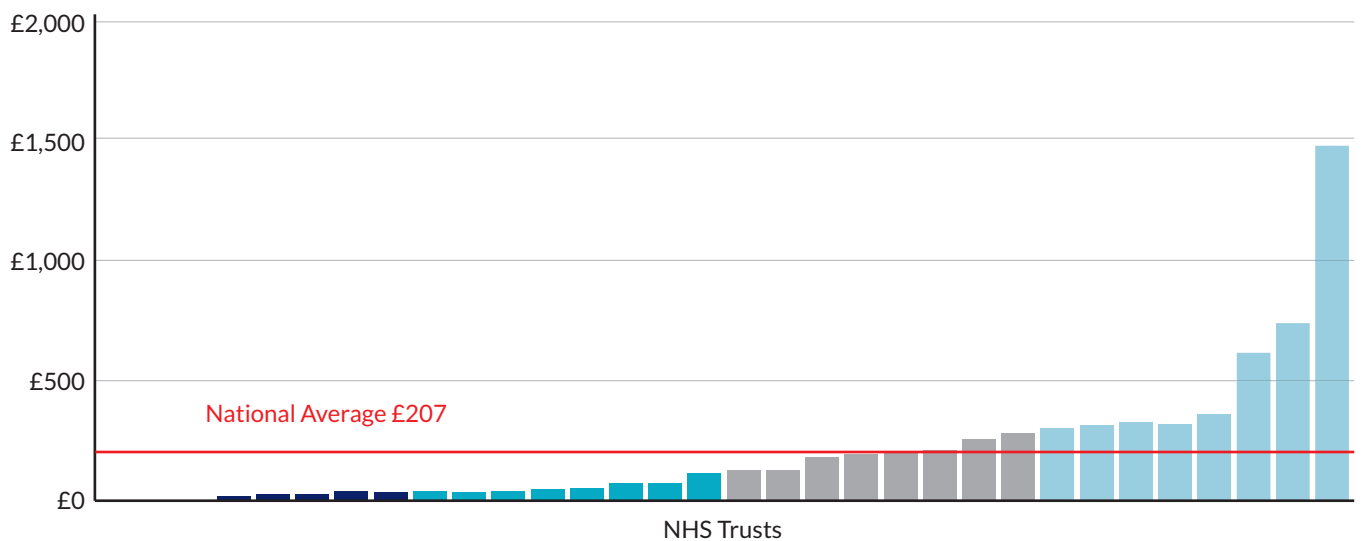
Variation in negligence costs for adult surgery

The average cost of litigation per adult cardiothoracic surgical admission is £207.

Variation between providers

There is a big difference in the cost of litigation between cardiothoracic service providers. The best performing provider is estimated to cost £0 per adult admission, while at the other end of the scale, claims against another provider are expected to cost an average of more than £1,480 per admission.

Figure 51: Estimated litigation costs for adult cardiothoracic surgery by provider



Includes day-case, elective and emergency admission under cardiac surgery and/or thoracic surgery specialties. Excludes transplantation. Patients aged 19 and over

Litigation

Recommendations

Recommendation	Actions and owner	Timeline
20 Implement GIRFT 5 point plan for reducing litigation costs.	Providers	See separate plan below

GIRFT Five-point plan for reducing litigation costs

	Action	Owner	Timeline
1	Assess and review position of estimated litigation cost per activity benchmarked against the national average. This information is in the GIRFT 'Litigation in surgical specialties data pack', December 2017. Updated details to come in Spring 2018 for vascular surgery (including variation charts for both arterial and venous surgery), and specialist vascular surgery with varicose vein surgery.	Clinicians and trust management	Immediately
2	Review claims submitted to NHS Resolution (included in the data set) to confirm correct specialty coding. Inform NHS Resolution of any claims that are not coded to the appropriate specialty correctly: CNST.Helpline@resolution.nhs.uk	Clinicians, trust management, legal department/claims management	On completing 1
3	Review claims in detail, including expert witness statements, panel firm reports, counsel advice, and medical records. Identify where patient care or documentation could be improved.	Clinicians, trust management, legal department/claims management <i>If the legal department or claims handler needs additional assistance with this, your trust's panel firm should be able to provide support.</i>	On completing 2
4	Triangulate claims with learning themes from complaints, inquests and serious untoward incidents (SUIs). <i>We recommend that all claims are reviewed as SUI to ensure no opportunity for learning is missed.</i>		On completing 3
5	Trusts outside the top quartile for litigation costs (for a GIRFT activity): Take steps to learn from claims, including learning from examples of good practice at other trusts	Clinicians, trust management, legal department/claims management Support will be provided by GIRFT national clinical leads and regional hub directors	Ongoing

Activity and notional financial opportunities

- The gross notional financial opportunities put an estimated value on the resource associated with variation, based on all providers achieving at least the average or best quartile performance.

The opportunities are not cash-releasing efficiency savings. For example, if a provider reduces length of stay, it may create an opportunity for bed resources to be used more efficiently, but it may not necessarily release cash by reducing bed numbers.

- Calculations are based on bed day savings* costed at the average 2015/16 Reference Cost bed day cost for cardiac and thoracic surgery. They assume that all providers can achieve average or best quartile, and do not take account of warranted variation.
*Except where shown in the table.
- The summary includes only those issues highlighted in our review. Individual providers may have other opportunities that are not included here.

Improvement	National mean average or better			Top quartile* or better		
	Target	Activity opportunity	Gross notional financial opportunity	Target	Activity opportunity	Gross notional financial opportunity
Cancellation rate – planned procedure not carried out – cardiothoracic specialty Note: Costs shown as reported costs of cancellations in reference costs. However, the financial impact of these in terms of missed opportunities is likely to be much larger – up to £4m for average and £7.8m for top quartile. Source: HES Jan 2016 – Dec 2016	7.5% or below	545 spells	£420k	5.4% or below	1070 spells	£825k
Cardiac surgery – percentage of day of surgery admission, elective surgery Assumes saving of 1 bed day per spell. Note: One provider achieves same-day rate of 60%. A target rate of 50% has been used to replace the top quartile percentage. Source: NICOR Apr 13 – Mar 16	9% or above	865 days	£315k	50% or above	7285 days	£2,665k
Cardiac surgery, elective post-operative length of stay Source: NICOR Apr 13 – Mar 16	9.2 days or below	6600 days	£2,415k	8.5 days or below	14625 days	£5,345k
Cardiac surgery, urgent post-operative length of stay Source: NICOR Apr 13 – Mar 16	10.9 days or below	4655 days	£1,700k	9.8 days or below	10670 days	£3,900k
Cardiac surgery, pre-operative length of stay for urgent patients Source: NICOR Apr 13 – Mar 16	7.2 days or below	9230 days	£3,375k	5.3 days or below	18645 days	£6,815k

Improvement	National mean average or better			Top quartile* or better		
	Target	Activity opportunity	Gross notional financial opportunity	Target	Activity opportunity	Gross notional financial opportunity
Cardiac surgery elective patients – average nights in critical care Gross notional financial opportunity estimated as difference between cardiac surgery critical care bed day and excess bed day in cardiothoracic surgery (from 15/16 reference costs). <i>Source: HES Apr 15 - Dec 16</i>	3.2 days or below	6720 days	£6,005k	2.7 days or below	12625 days	£11,285k
Cardiac surgery non-elective patients – average nights in critical care Gross notional financial opportunity estimated as difference between cardiac surgery critical care bed day and excess bed day in cardiothoracic surgery (from 15/16 reference costs). <i>Source: HES Apr 15 - Dec 16</i>	4.3 days or below	4,605 days	£4,115k	3.5 days or below	9,130 days	£8,160k
Lung resections – day of surgery admission Assumes saving of 1 bed day per spell <i>Source: HES Jan 16 - Dec 16</i>	47.3% or above	1,170 days	£430k	75.3% or above	2,445 days	£895k
Lung resections – post-operative average length of stay <i>Source: HES Jan 16 - Dec 16</i>	6.6 days or below	1,840 days	£670k	6.4 days or below	2,925 days	£1,070k
Lung resections – average nights in critical care Gross notional financial opportunity estimated as difference between thoracic surgery critical care bed day and excess bed day in cardiothoracic surgery (from 15/16 reference costs). <i>Source: HES Jan 16 - Dec 16</i>	1.5 days or below	2,225 days	£2,055k	0.7 days or below	6,030 days	£5,570k
Cardiac surgery emergency readmission within 30 days Gross notional financial opportunity based on the average NTPS cost of the readmission spells. <i>Source: HES Oct 2013 - Sept 2016</i>	15% or below	190 spells	£515k	14.1% or below	345 spells	£935k
Cardiac PCI within 1 year of coronary artery bypass graft (CABG) Gross notional financial opportunity based on the average NTPS cost of the readmission spells. <i>Source: HES April 2013 - Sept 2015</i>	1.37% or below	75 spells	£280k	1.1% or below	200 spells	£745k

Improvement	National mean average or better			Top quartile* or better		
	Target	Activity opportunity	Gross notional financial opportunity	Target	Activity opportunity	Gross notional financial opportunity
Lung resection emergency readmission within 30 days Gross notional financial opportunity based on the average NTPS cost of the readmission spells. <i>Source: HES Oct 2013 - Sept 2016</i>	12.1% or below	60 spells	£160k	10.7% or below	120 spells	£320k
Thoracic procedure E543 lobectomy – VATS <i>(video-assisted thoracoscopic surgery)</i> Opportunity based on 1.9 days per spell (length of stay variation in lobectomy procedures with VATs compared to those without VATs) <i>Source: HES Jan 16 - Dec 16</i>	51.6% or above	1,005 days	£365k	71%	2,010 days or above	£735k
Empyema – decortication rates Opportunity based on 2 days per spell (length of stay variation between empyema patients with decortication procedure compared to those with other procedures). <i>Source: HES Jan 16 - Dec 16</i>	41.3% or below	480 days	£175k	28.3% or below	830 days	£305k
Heart valves, average price Gross financial opportunity based on average provider prices collected via GIRFT questionnaires. <i>Source: GIRFT Questionnaires, 2015/16 spend</i>	£1,496 or below	n/a	£1,010k	£1,344 or below	n/a	£1,950k
Annuloplasty rings, average price Gross financial opportunity based on average provider prices collected via GIRFT questionnaires. <i>Source: GIRFT Questionnaires, 2015/16 spend</i>	£968 or below	n/a	£255k	£845 or below	n/a	£490k
Total			£24,260k			£52,010k

* Calculations for Cardiac surgery, percentage of elective surgery undertaken on day of admission, use the top quartile rather than target level.

Note: Length of stay reductions from cardiac quality metrics (return to theatre, new permanent stroke and deep sternal wound infection, mitral valve repair) are not included as they are likely to form part of the overall variation in post-operative length of stay.

About the GIRFT programme

Getting It Right First Time (GIRFT) is a national programme designed to improve medical care within the NHS. Funded by the Department of Health and jointly overseen by NHS Improvement and the Royal National Orthopaedic Hospital NHS Trust, it combines wide-ranging data analysis with the input and professional knowledge of senior clinicians to examine how things are currently being done and how they could be improved.

Working to the principle that a patient should expect to receive equally timely and effective investigations, treatment and outcomes wherever care is delivered, irrespective of who delivers that care, GIRFT aims to identify approaches from across the NHS that improve outcomes and patient experience, without the need for radical change or additional investment. While the gains for each patient or procedure may appear marginal they can, when multiplied across an entire trust – and even more so across the NHS as a whole – deliver substantial cumulative benefits.

The programme was first conceived and developed by Professor Tim Briggs to review elective orthopaedic surgery to address a range of observed and undesirable variations in orthopaedics. In the 12 months after the pilot programme, it delivered an estimated £30m-£50m savings in orthopaedic care – predominantly through changes that reduced average length of stay and improved procurement.

The same model is now being applied in 35 different areas of clinical practice. It consists of four key strands:

- a broad data gathering and analysis exercise, performed by health data analysts, which generates a detailed picture of current national practice, outcomes and other related factors;
- a series of discussions between clinical specialists and individual hospital trusts, which are based on the data – providing an unprecedented opportunity to examine individual trust behaviour and performance in the relevant area of practice, in the context of the national picture. This then enables the trust to understand where it is performing well and what it could do better – drawing on the input of senior clinicians;
- a national report, that draws on both the data analysis and the discussions with the hospital trusts to identify opportunities for NHS-wide improvement; and
- an implementation phase where the GIRFT team supports providers to deliver the improvements recommended.

GIRFT and other improvement initiatives

GIRFT is part of an aligned set of work streams within the Operational Productivity Directorate of NHS Improvement. It is the delivery vehicle for one of several recommendations made by Lord Carter in his February 2016 review of operational efficiency in acute trusts across England. As well as support from the Department of Health and Social Care and NHS Improvement, it has the backing of the Royal Colleges and professional associations.

GIRFT has a significant and growing presence on the Model Hospital portal, with its data-rich approach providing the evidence for hospitals to benchmark against expected standards of service and efficiency. The programme also works with a number of wider NHS programmes and initiatives which are seeking to improve standards while delivering savings and efficiencies, such as NHS RightCare, acute care collaborations (ACCs), and sustainability and transformation partnerships (STPs).

Implementation

GIRFT has developed a comprehensive implementation programme designed to help trusts and their local partners to address the issues raised in trust data packs and the national specialty reports to improve quality. GIRFT regional hubs provide support at a local level with clinical and project delivery leads able to visit trusts and local stakeholders in each region on a regular basis. They advise on how to reflect the national recommendations into local practice and support efforts to deliver any trust-specific recommendations emerging from the GIRFT visits. These teams also help to disseminate best practice across the country, matching up trusts who might benefit from collaborating in selected areas of clinical practice.

Through all its efforts, local or national, the GIRFT programme strives to embody the ‘shoulder to shoulder’ ethos which has become GIRFT’s hallmark, supporting clinicians nationwide to deliver continuous quality improvement for the benefit of their patients.

Glossary

Acute aortic dissection (AAD)

A potentially fatal condition in which the inner layer of the aorta (the large blood vessel from the heart) tears causing the inner and middle layers to separate (dissect).

Annuloplasty rings

An implant device used to re-establish mitral valve function.

Aortic arch

The section of the aorta in the chest between the ascending and descending aorta. The blood supply to the brain arises from this section

Aortovascular

Collective term for the main artery (aorta) and blood vessels, arteries and veins (vascular).

Cardiology

The branch of medicine (as opposed to surgery) concerned with disorders of the heart and parts of the circulatory system.

Charlson score

A score on the Charlson comorbidity index, which predicts one-year mortality for a patient with a range of comorbid conditions.

Chlorhexidene

Disinfectant and antiseptic used to disinfect skin and sterilise surgical instruments.

Clinical Commissioning Group (CCG)

Clinically-led statutory NHS bodies responsible for planning and commissioning health care services for their local area. There are 207 CCGs in England.

Commissioning

The process of identifying local health needs, and purchasing and reviewing services to meet those needs.

Comorbidity

Presence of one or more additional diseases or disorders co-occurring with a primary disease or disorder.

Coronary artery bypass graft (CABG)

A surgical procedure to restore normal blood flow to an obstructed artery to the heart.

Day of surgery admission

Admission to hospital on the same day that surgery takes place.

Decortication

Surgical removal of the surface layer, membrane, or fibrous cover of an organ.

Deep sternal wound infection (DSWI)

An infection of the sternum, mediastinum, or the muscle, fascia and soft tissue that cover the sternum. Infrequent, though severe, infection related to cardiac surgery.

Deprivation index

A UK government qualitative study of deprived areas in English local councils.

Dual antiplatelet therapy

The use of two types of drugs to inhibit blood clotting. Used for patients with coronary artery disease

Echocardiogram (echocardiography)

An ultrasound heart scan.

Elective surgery

Surgery that is scheduled (planned) rather than an emergency.

Empyema

Pus in the pleural cavity caused by microorganisms, usually bacteria. Often related to pneumonia.

EuroSCORE (European System for Cardiac Operative Risk Evaluation)

An internationally recognised model for calculating the risk of death after a heart operation.

Healthcare Resource Group (HRG)

Standard groupings of clinically-similar treatments that use common levels of healthcare resource. HRGs help organisations to understand their activity in terms of the types of patients they care for and the treatments they undertake.

Hospital Episode Statistics (HES)

Data collected by NHS Digital for each episode of admitted patient care in England.

Length of stay

The number of days that a patient is in hospital as an in-patient. Can be pre-operative, post-operative, or the sum of both.

Lobectomy

Surgical removal of a lobe.

Mediastinitis

Inflammation of the tissues in the mid-chest, or mediastinum. This includes the heart, great blood vessels and surrounding tissues. Considered a very serious condition.

Medicines to take out (TTOs)

Medicine prescribed to a patient when the patient is discharged.

Mitral valve

The valve that lets blood flow from the left atrium of the heart to the left ventricle.

Multidisciplinary team (MDT)

A team of healthcare professionals from different disciplines.

NHS Improvement (NHSI)

The body responsible for overseeing foundation trusts and NHS trusts, as well as independent providers that provide NHS-funded care.

Supports these providers in providing patients with consistently safe, high-quality, compassionate care within local health systems that are financially sustainable.

NHSE

NHS England

NICOR (National Institute for Cardiovascular Outcomes Research)

An independent body that collects and analyses data related to cardiovascular treatment to provide health professionals and patients with information to help them to review the quality and outcomes of care against national standards and guidance.

Non-elective surgery

Emergency surgery – surgery that is not pre-scheduled.

Oncology

The branch of medicine concerned with the prevention, diagnosis, and treatment of cancer.

Pathway

An agreed set of evidence-based practices and interventions for a specific patient group.

Patient Level Information and Costing Systems (PLICS)

A system of collecting and deriving costs at the patient level.

Payment by Results (PbR)

The payment system in England used by healthcare commissioners to pay healthcare providers for each patient seen or treated. The system takes account of the complexity of the patient's healthcare needs.

Percutaneous coronary intervention (PCI)

A non-surgical procedure to treat narrowing of the arteries. It involves inflating balloons across narrow portions of the arteries and may involve placement of stents at these sites.

Perfusionist

The clinician that operates the cardiopulmonary bypass machine (heart–lung machine) during cardiac surgery.

Purchase Price Index and Benchmarking (PPIB)

A system to collect procurement data from NHS trusts that enables trusts to compare and benchmark data.

Reference costs

Reference costs are the average unit cost to the NHS of providing defined services to NHS patients in England in a given financial year. They show how NHS providers spend money to provide healthcare to patients. NHS providers submit reference costs annually.

Regurgitation

A leak backwards through a heart valve.

Renal filtration/dialysis

A process for removing excess water, solutes and toxins from the blood in patients whose kidneys cannot perform effectively.

Resection

Surgical removal of all or part of an organ, tissue, or structure.

Respiratory medicine

The branch of medicine (as opposed to surgery) concerned with disorders of the respiratory (breathing) system, i.e. the nose, throat, larynx, the windpipe, the lungs and the diaphragm.

Society for Cardiothoracic Surgery (SCTS)

The independent, self-funded, representative body for cardiothoracic surgery in Great Britain & Ireland.

Spell

A period of healthcare, for example a period in hospital.

Tamponade

A build up of fluid in the pericardium (the sac around the heart) that compresses the heart. This is a potentially fatal condition.

Tertiary unit

A hospital that provides specialised consultative health care (as opposed to a primary or secondary healthcare provider).

Video-assisted thoracic surgery (VATS)

Thoracic surgery performed using a video camera inserted into the patient's chest via small incisions.

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GIRFT is the brainchild of Professor Tim Briggs. I am grateful to him and to Rachel Yates for giving me the opportunity to do this work and for their support during the process.

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Finally, all my love and thanks go to my wife Kim and our children, Imogen and William, who have put up with a lot during this process.

David Richens

FRCS

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- Hospital Episode Statistics (HES)©, 2017 – re-used with the permission of NHS Digital. All rights reserved.
- National Institute for Cardiovascular Outcome Research (NICOR) data, managed by the Healthcare Quality Improvement Partnership (HQIP) – this publication is based on data collected by or on behalf of HQIP, who have no responsibility or liability for the accuracy, currency, reliability and/or correctness of this publication.
- Public Health England (PHE), who administer the National Lung Cancer Audit (LUCADA) – data based on information collected and quality assured by the PHE National Cancer Registration and Analysis Service (NCRAS). Access to the data was facilitated by the PHE Office for Data Release.
- Data made freely available by other organisations.

Appendix 1: Providers that took part in this report

Provider code	Provider
R1H	Barts Health NHS Trust
RDD	Basildon and Thurrock University Hospital
RXL	Blackpool Teaching Hospitals NHS Foundation Trust
RXH	Brighton and Sussex University Hospitals NHS Trust, <i>Cardiac only</i>
RW3	Central Manchester University Hospitals NHS Foundation Trust, <i>Cardiac only</i>
RJ1	Guy's and St Thomas' NHS Foundation Trust
RR1	Heart of England NHS Foundation Trust, <i>Thoracic only</i>
RWA	Hull and East Yorkshire Hospitals NHS Trust
RYJ	Imperial College Healthcare NHS Trust
RJZ	King's College Hospital NHS Foundation Trust
RR8	Leeds Teaching Hospitals NHS Trust
RBQ	Liverpool Heart and Chest NHS Foundation Trust
RM1	Norfolk and Norwich University Hospitals NHS Foundation Trust, <i>Thoracic only</i>
RX1	Nottingham University Hospitals NHS Trust
RTH	Oxford University Hospitals NHS Trust
RGM	Royal Papworth Hospital NHS Foundation Trust
RK9	Plymouth Hospitals NHS Trust
RT3	Royal Brompton and Harefield NHS Foundation Trust
RHQ	Sheffield Teaching Hospitals NHS Foundation Trust
RTR	South Tees Hospitals NHS Foundation Trust
RJ7	St George's Healthcare NHS Foundation Trust
RTD	The Newcastle Upon Tyne Hospitals NHS Foundation Trust
RL4	The Royal Wolverhampton Hospitals NHS Trust
RRV	University College London Hospitals NHS Foundation Trust, <i>Thoracic only</i>
RJE	University Hospital of North Midlands NHS Trust
RM2	University Hospital of South Manchester NHS Foundation Trust
RHM	University Hospital Southampton NHS Foundation Trust
RRK	University Hospitals Birmingham NHS Foundation Trust, <i>Cardiac only</i>
RA7	University Hospitals Bristol NHS Foundation Trust
RKB	University Hospitals Coventry and Warwickshire NHS Trust
RWE	University Hospitals of Leicester NHS Trust

Appendix 2: Achieving greater cost efficiency through good practice

The following snapshots for two example units show how high-quality surgery with good outcomes leads to greater cost efficiency.

University Hospital Southampton

Southampton is a high-volume cardiothoracic unit housed in a busy general hospital with an A&E on site. The unit also provides paediatric cardiac surgery.

Figure 52: Cardiac surgery – risk-adjusted in-hospital survival rate

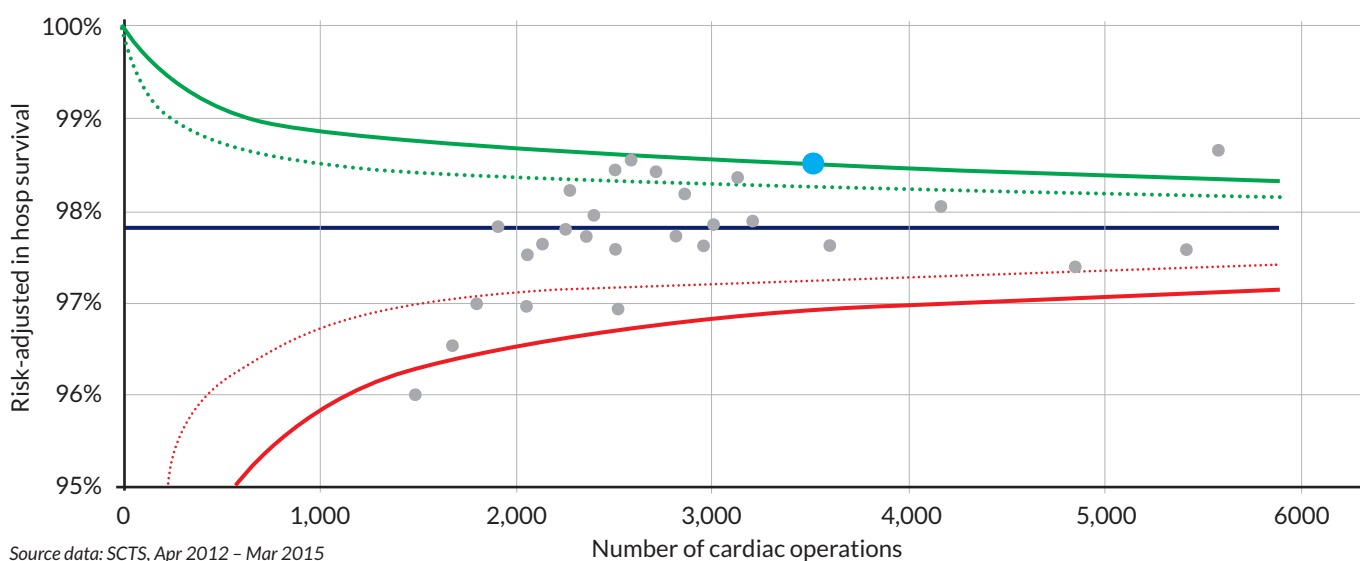


Figure 53: Lung cancer surgery – 90-day post-operative survival

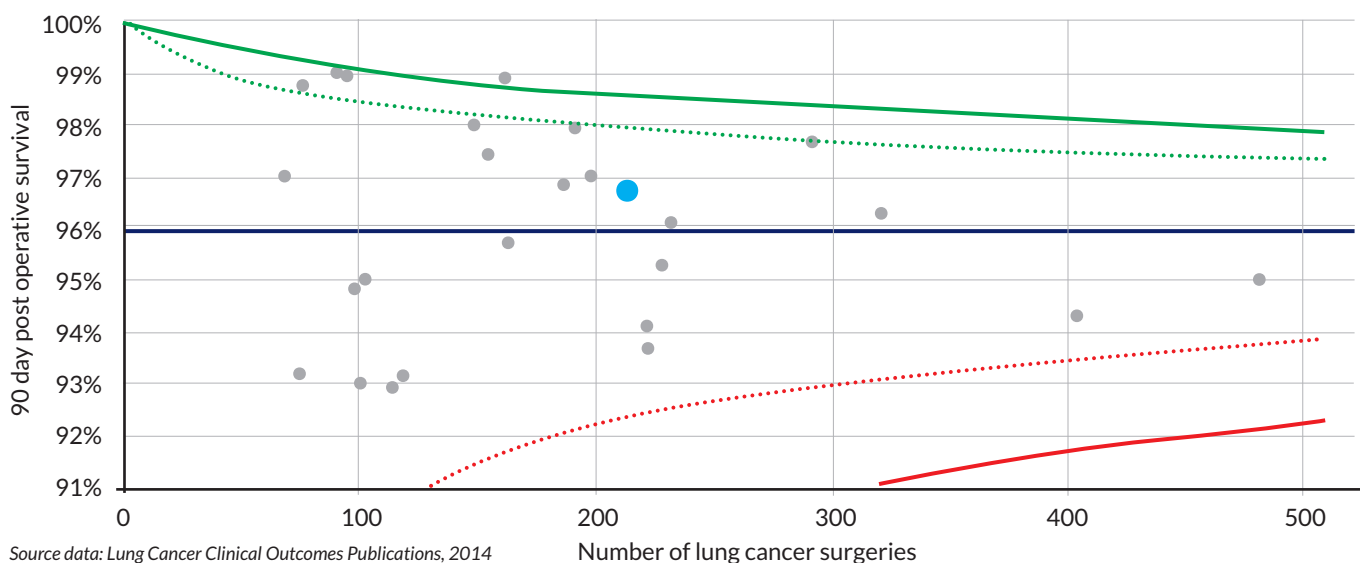


Figure 54: Elective spells in cardiothoracic specialty cancelled (after admission)

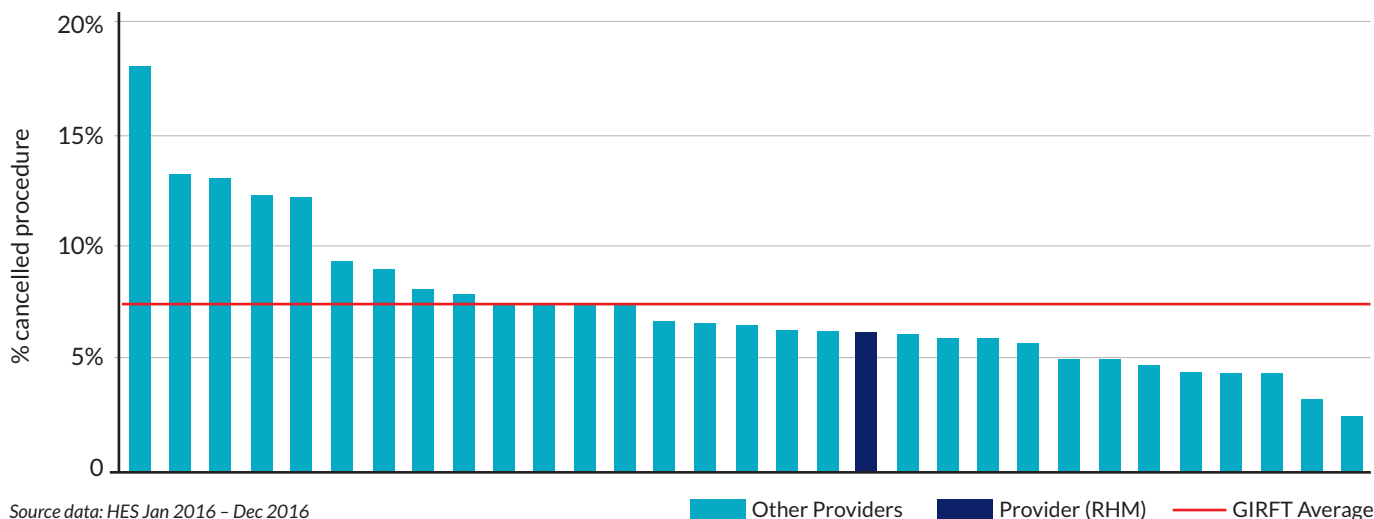


Figure 55: Elective and urgent cardiac surgery – deep sternal wound infection (DSWI)

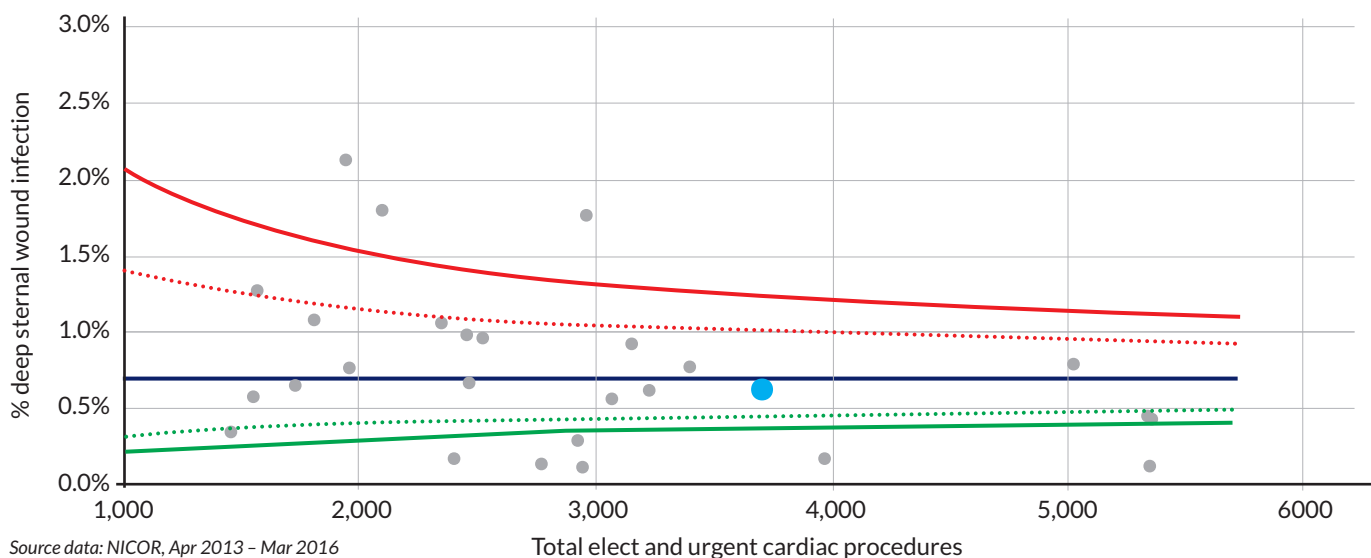


Figure 56: Elective and urgent cardiac surgery – post-operative dialysis

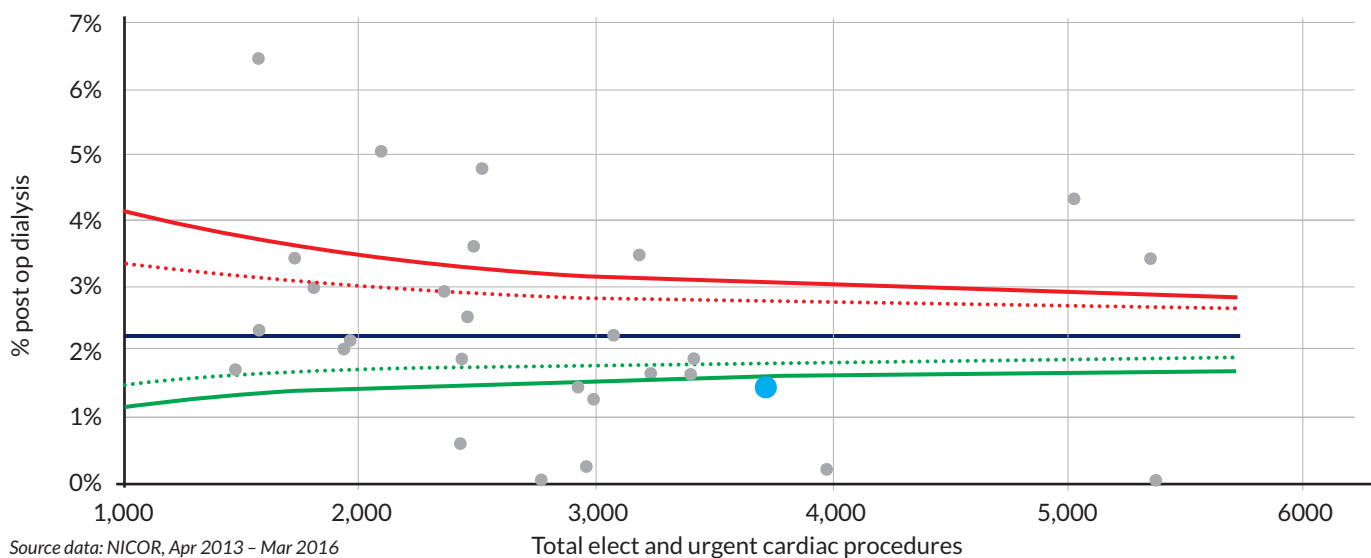


Figure 57: Cardiac surgery – emergency readmission within 30 days

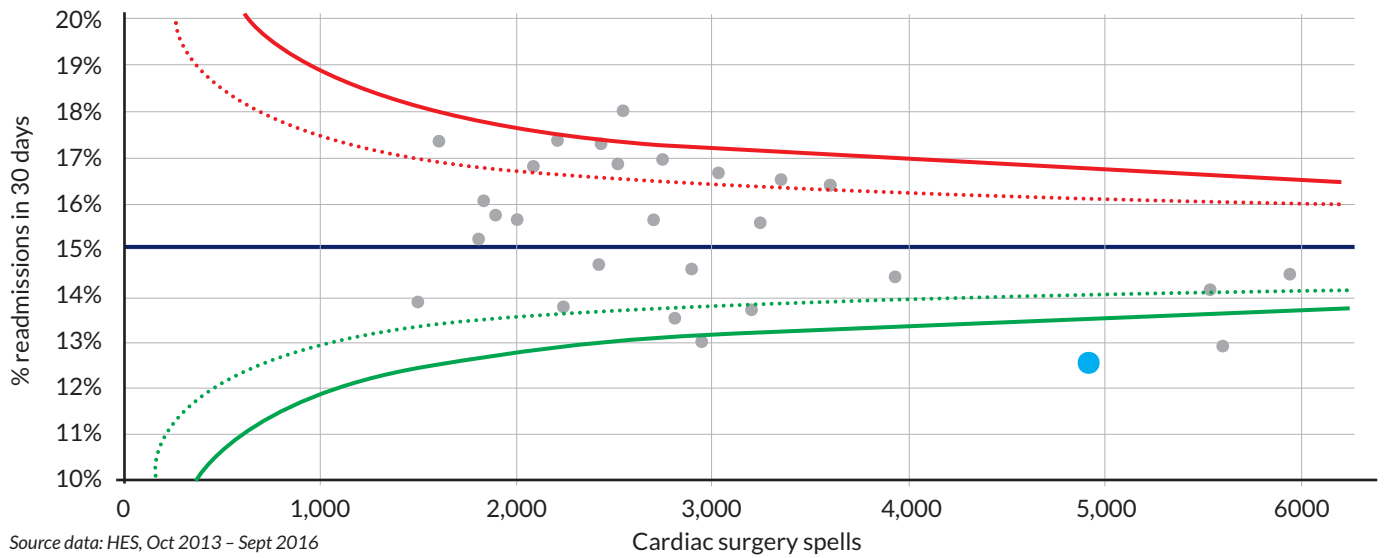


Figure 58: Cardiac surgery – complications within 30 days

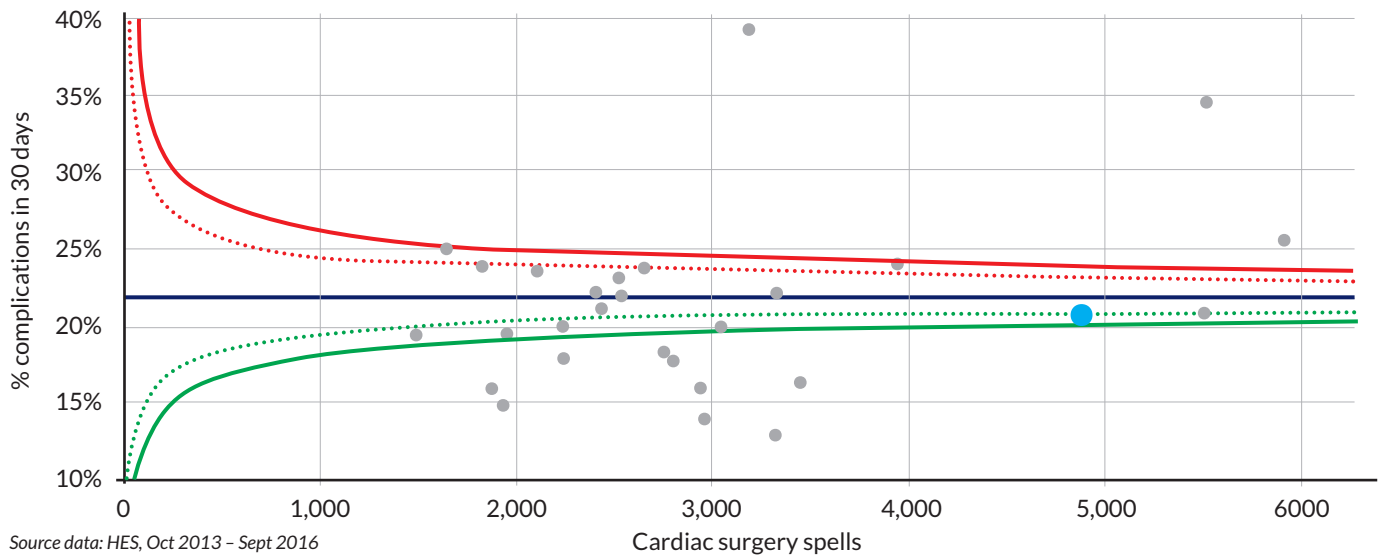


Figure 59: CABG with PCI within 12 months of discharge

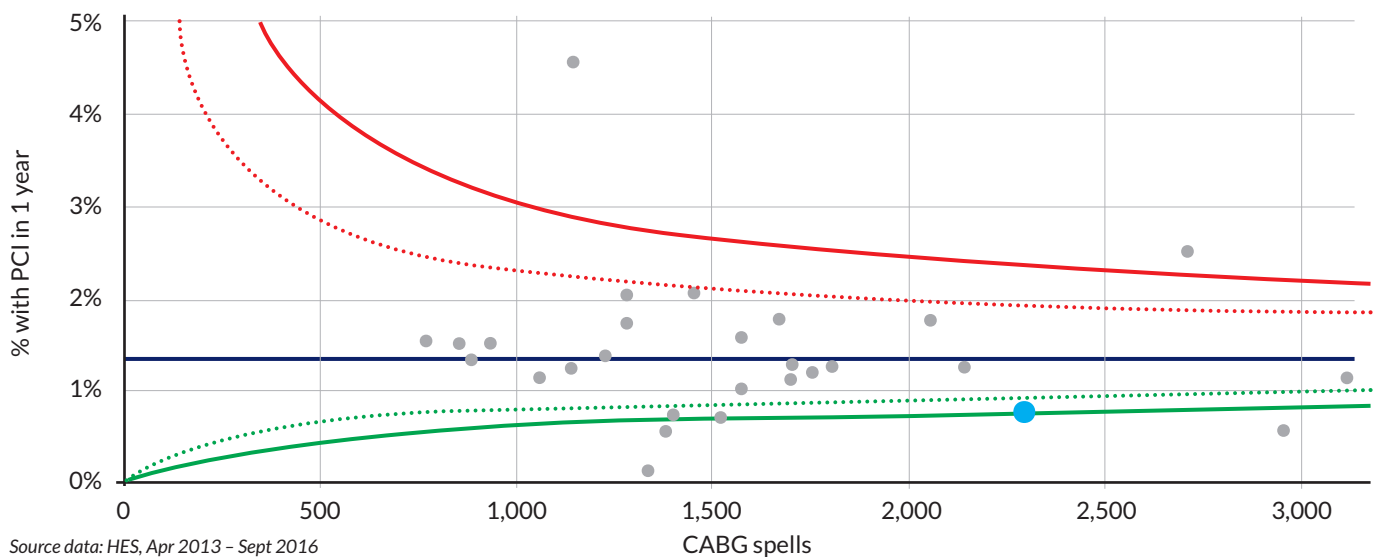


Figure 60: Elective aortovascular surgery - mortality (not risk-adjusted)

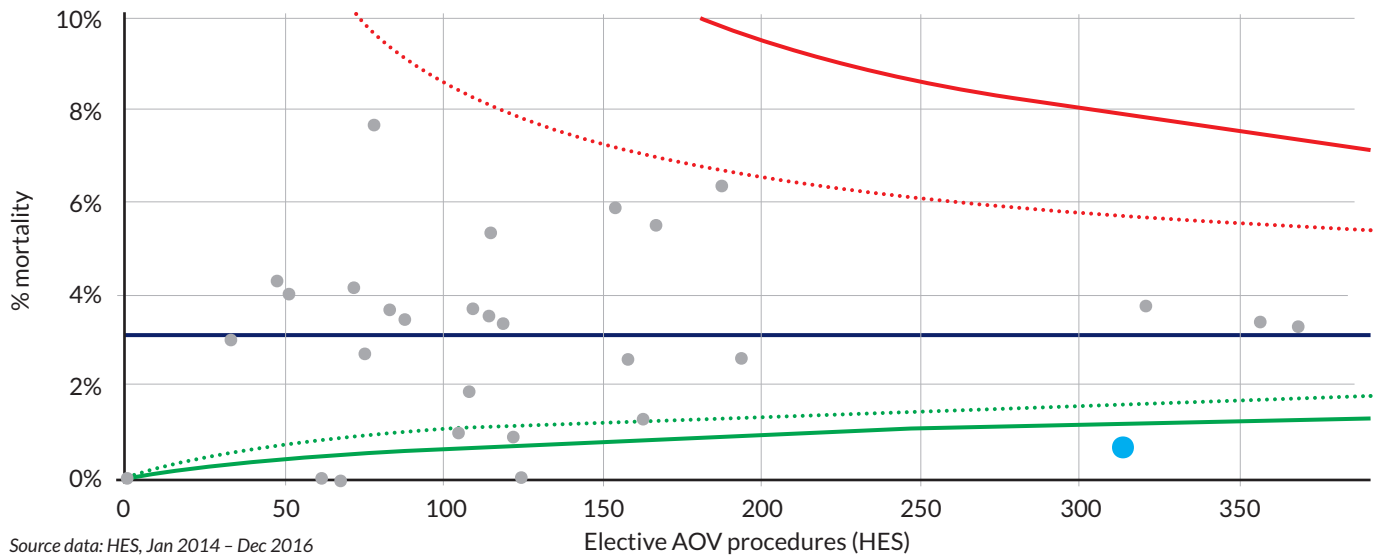


Figure 61: Non-elective aortovascular surgery - mortality (not risk-adjusted)

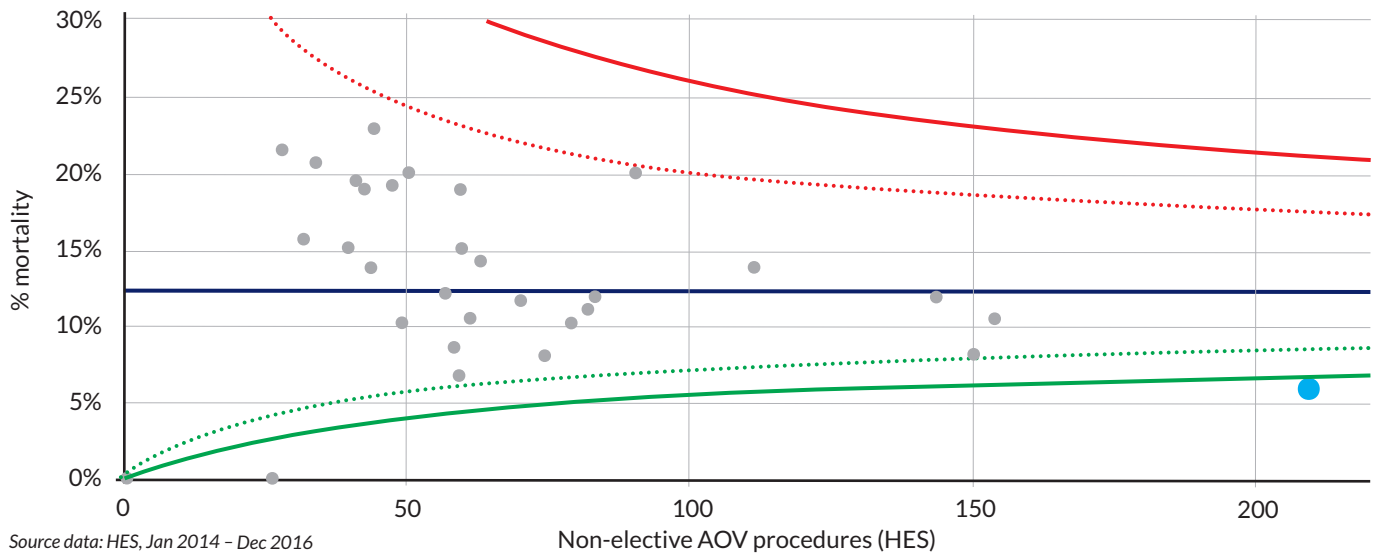


Figure 62: Urgent aortic valve procedure for patients with stenosis - pre-operative days

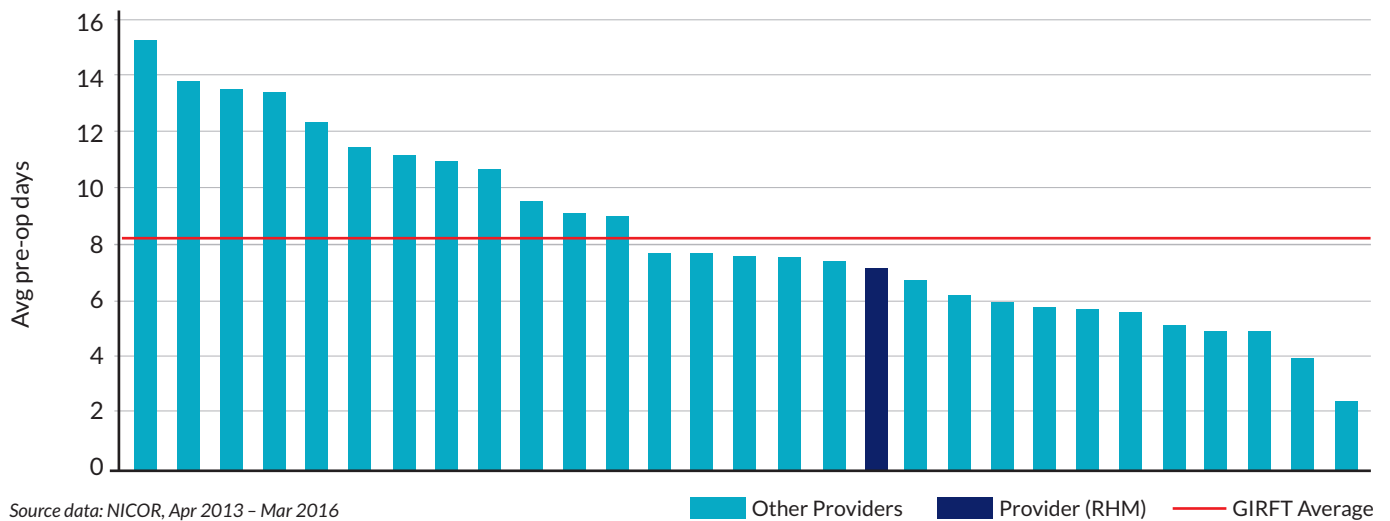
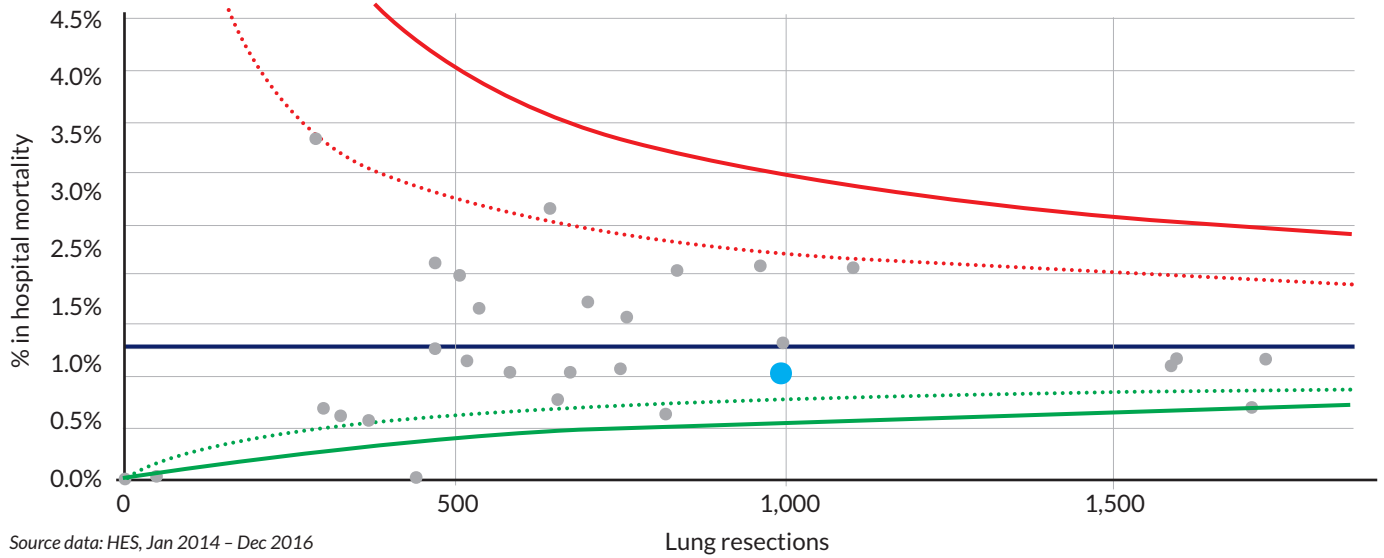
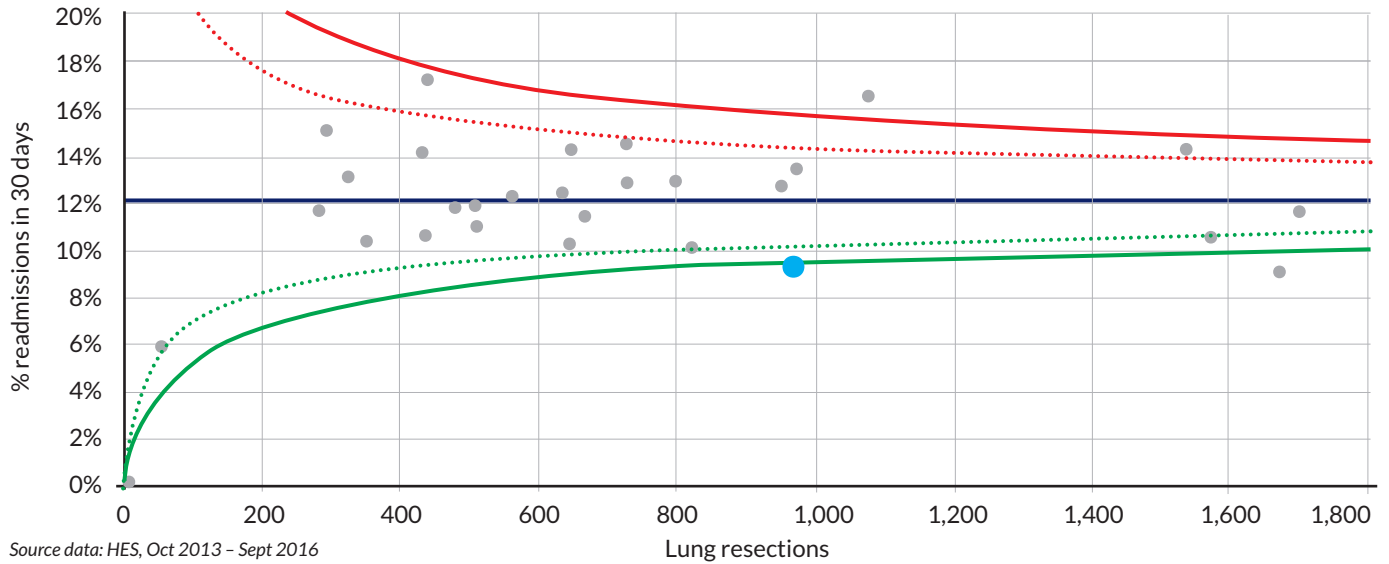


Figure 63: Lung resection – in-hospital mortality (not risk-adjusted)



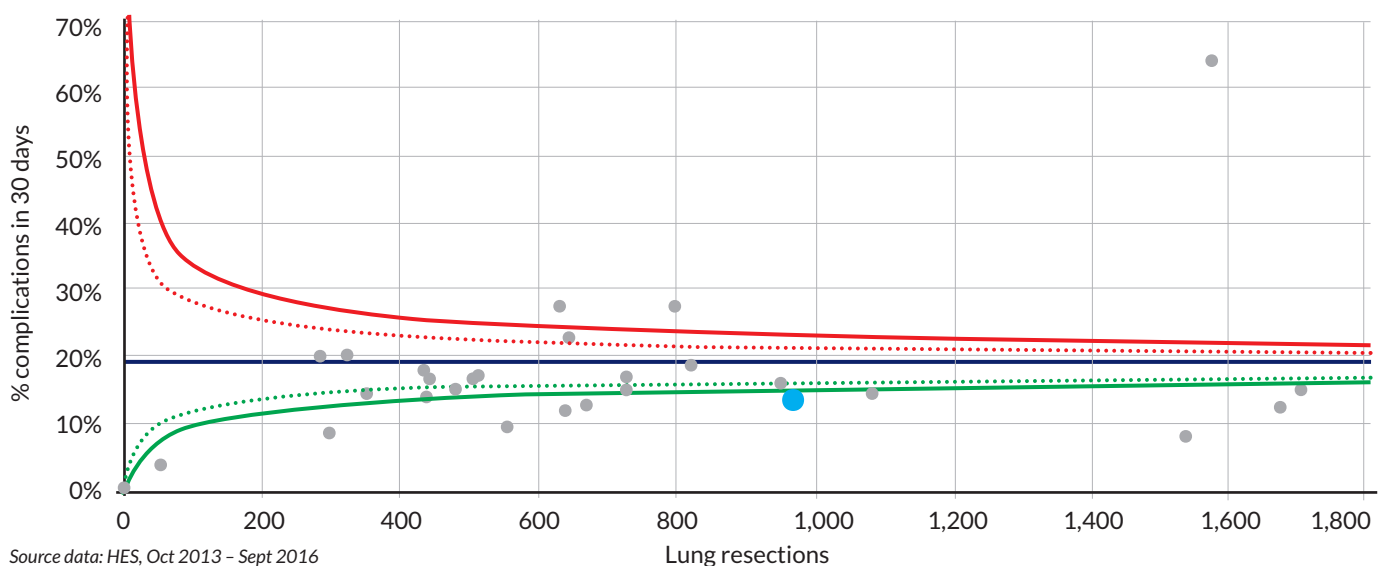
Source data: HES, Jan 2014 – Dec 2016

Figure 64: Lung resection – emergency readmission within 30 days



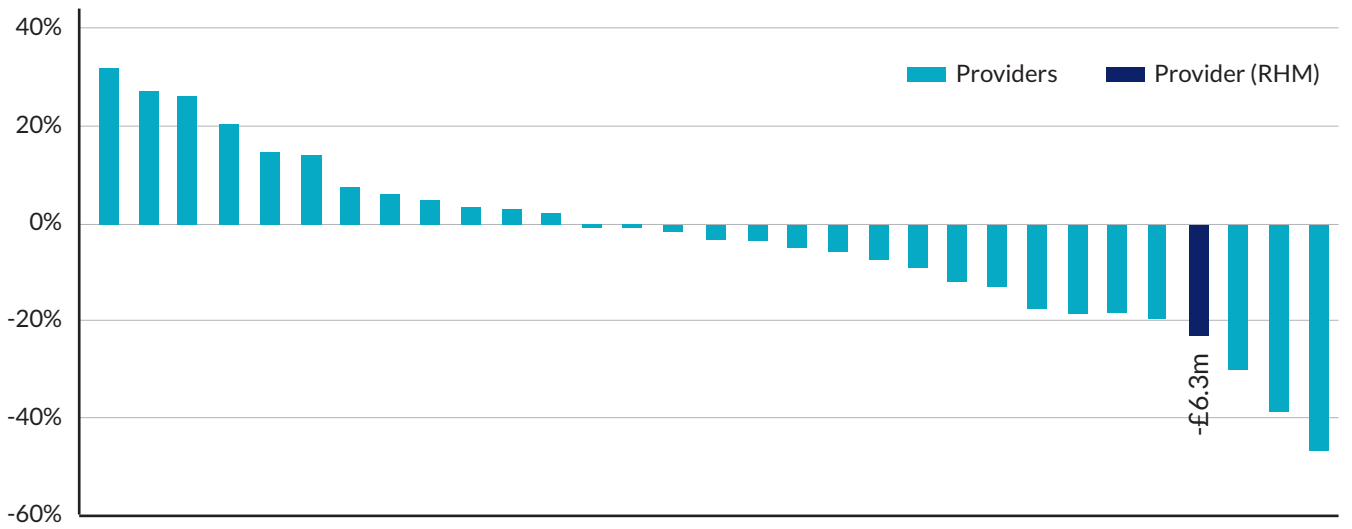
Source data: HES, Oct 2013 – Sept 2016

Figure 65: Lung resection – complications of surgery within 30 days



Source data: HES, Oct 2013 – Sept 2016

Figure 66: Total actual costs and expected costs for all cardiothoracic surgery – variation compared to other units



Source data: Reference Costs, 2015/16

University Hospitals Bristol

Bristol is a high-volume cardiothoracic unit housed in a busy general hospital with an A&E on site. The unit also provides paediatric cardiac surgery.

Figure 67: Cardiac surgery – risk-adjusted in-hospital survival rate

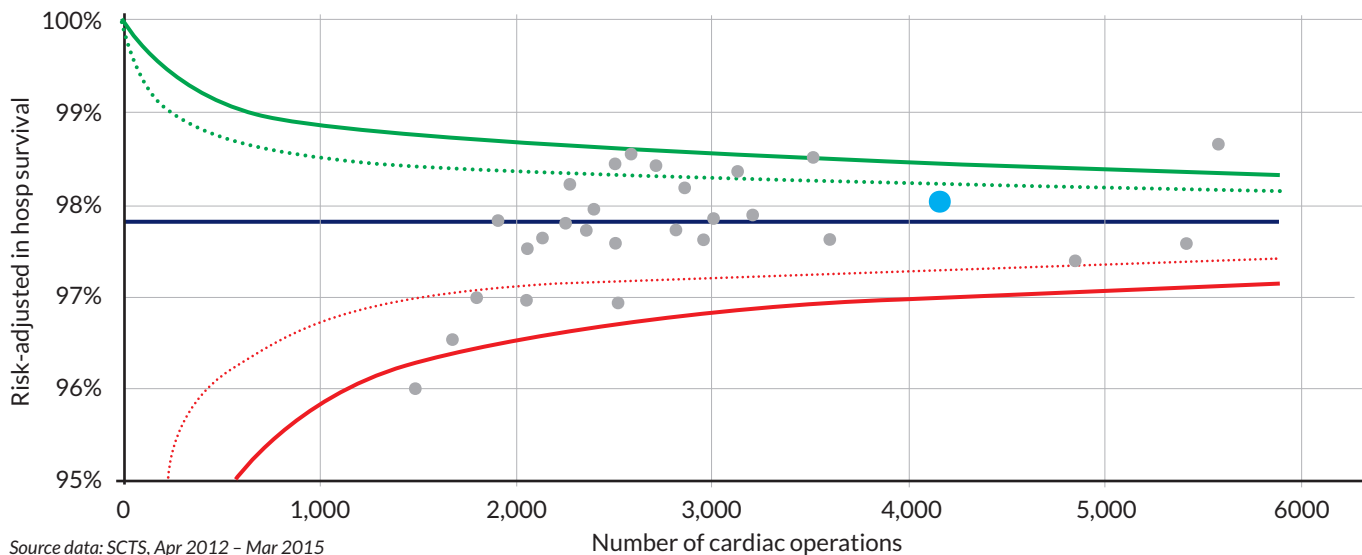


Figure 68: Lung cancer surgery – 90-day post-operative survival

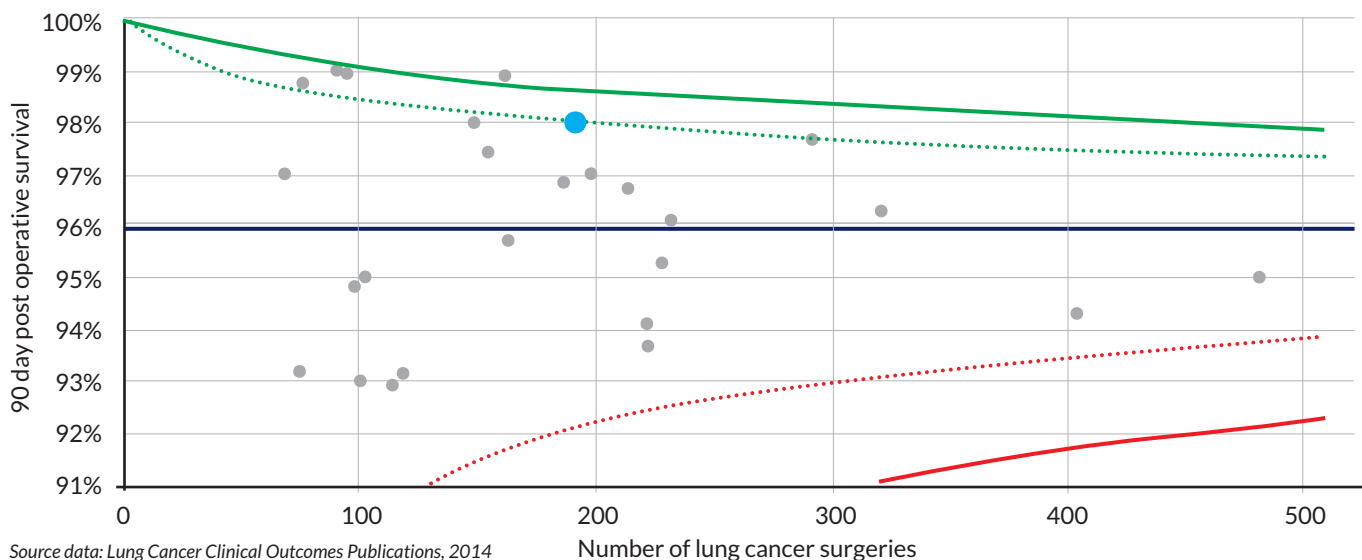


Figure 69: Elective spells in cardiothoracic specialty cancelled (after admission)

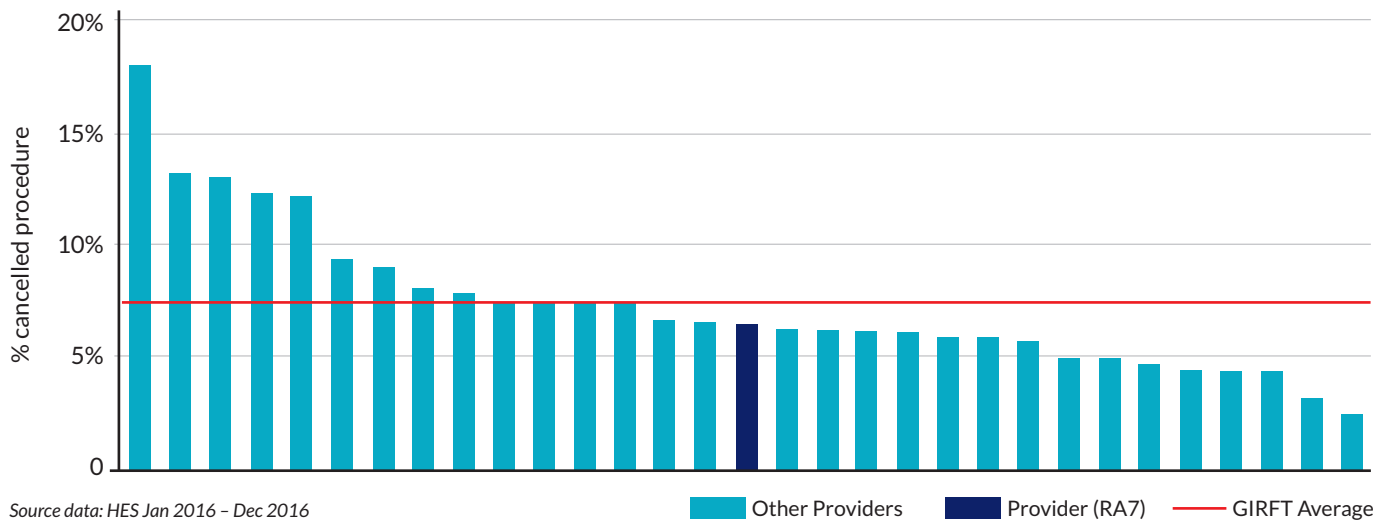


Figure 70: Elective and urgent cardiac surgery – return to theatre for bleed or tamponade

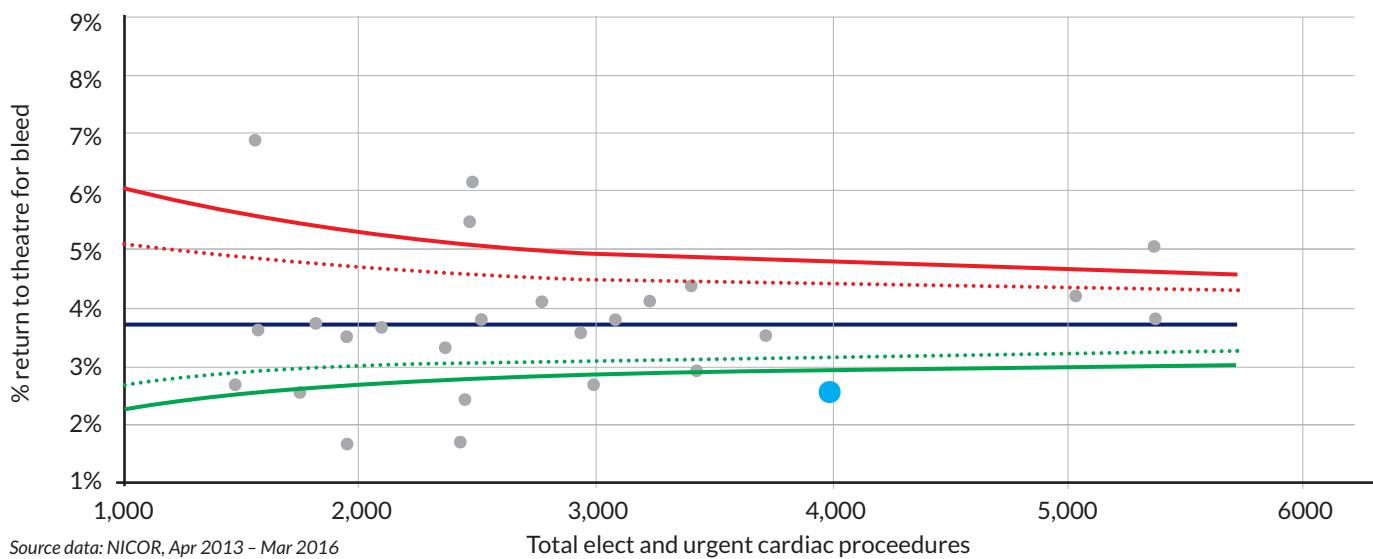


Figure 71: Repair of degenerative mitral valve disease

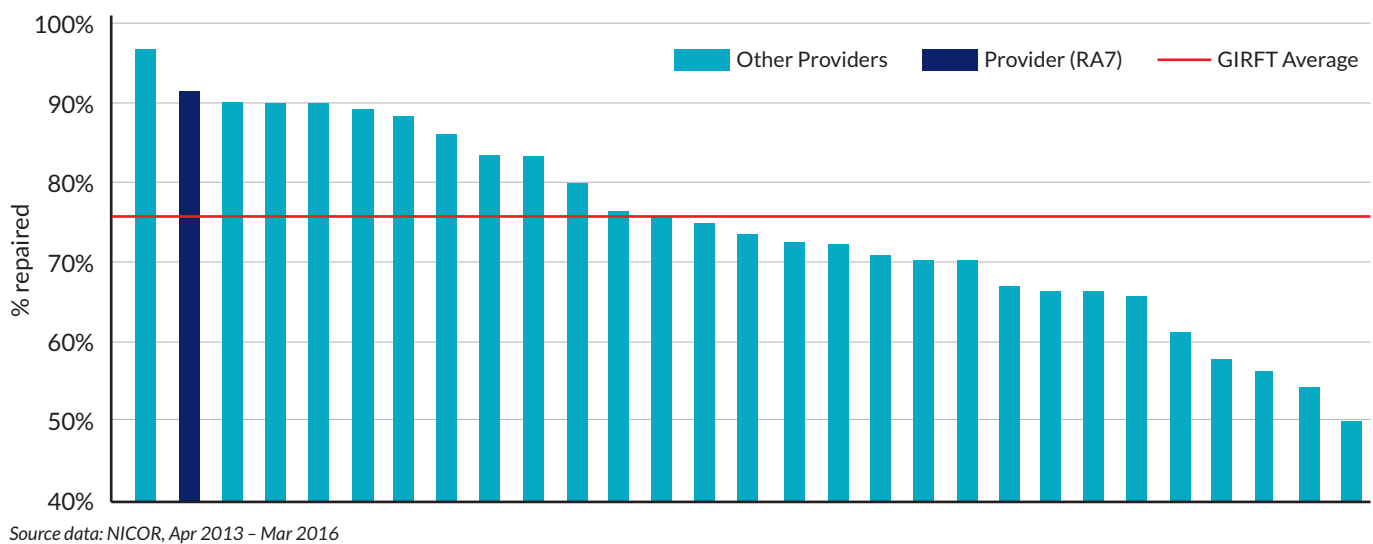
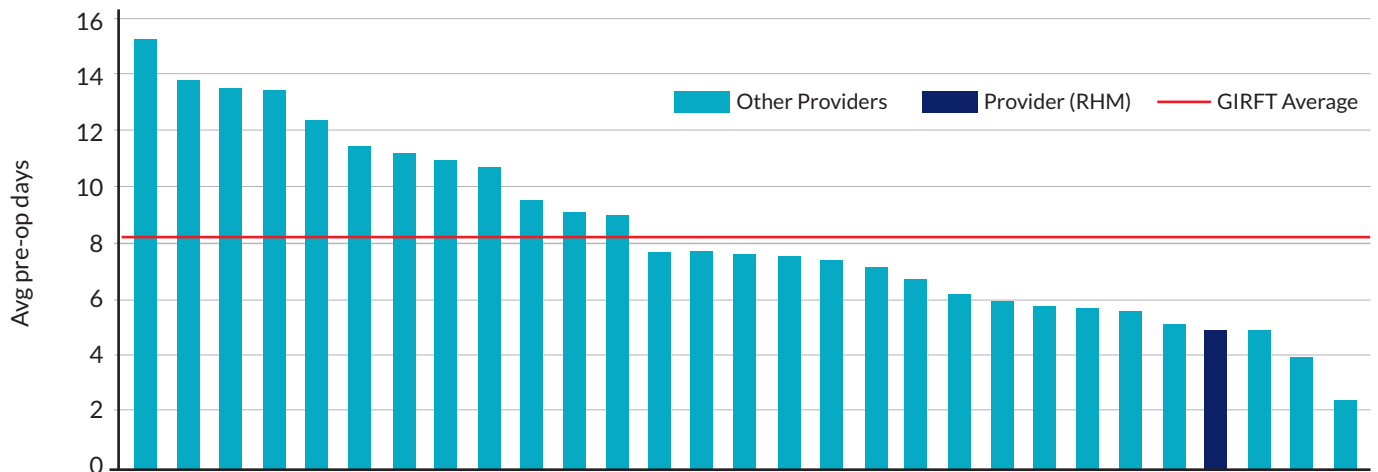
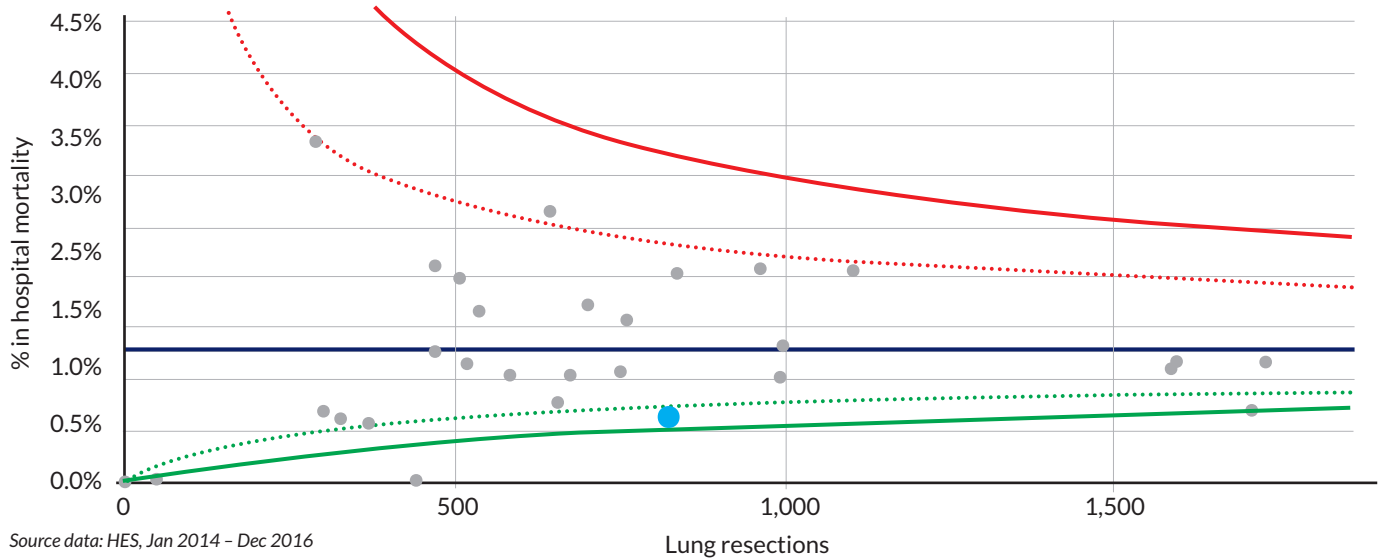


Figure 72: Urgent aortic valve procedure for patients with stenosis – pre-operative days



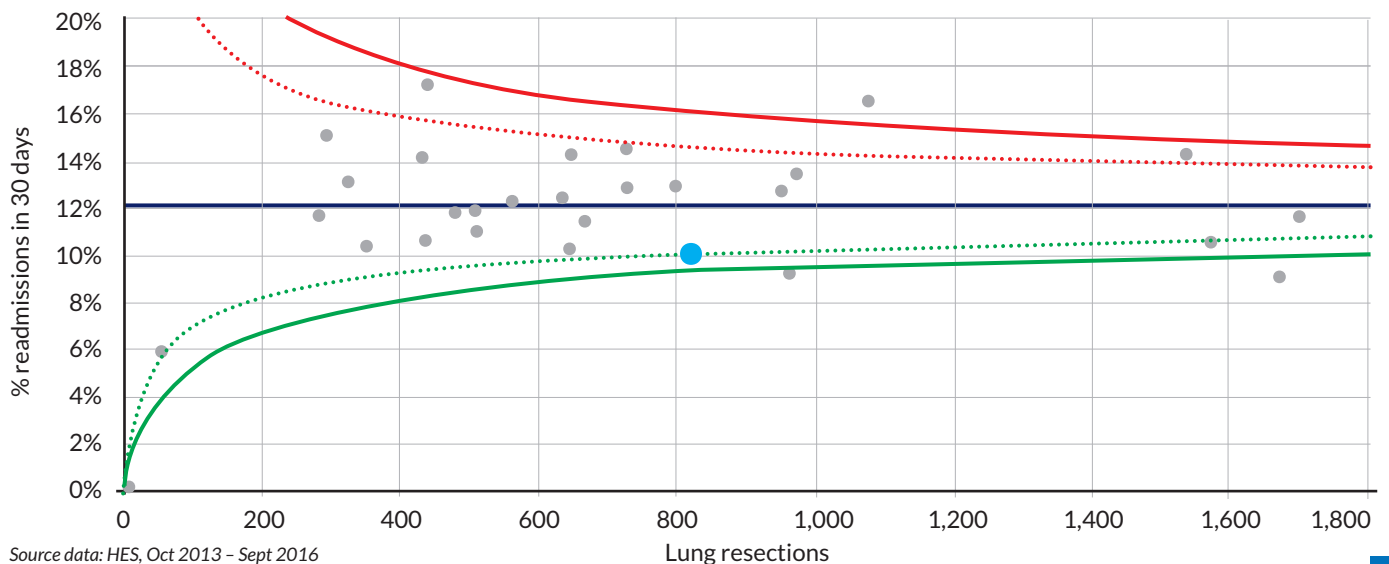
Source data: NICOR, Apr 2013 – Mar 2016

Figure 73: Lung resection – in-hospital mortality (not risk-adjusted)



Source data: HES, Jan 2014 – Dec 2016

Figure 74: Lung resection – emergency readmission within 30 days



Source data: HES, Oct 2013 – Sept 2016

Figure 75: E543 Lobectomy primary procedure – VATS rates

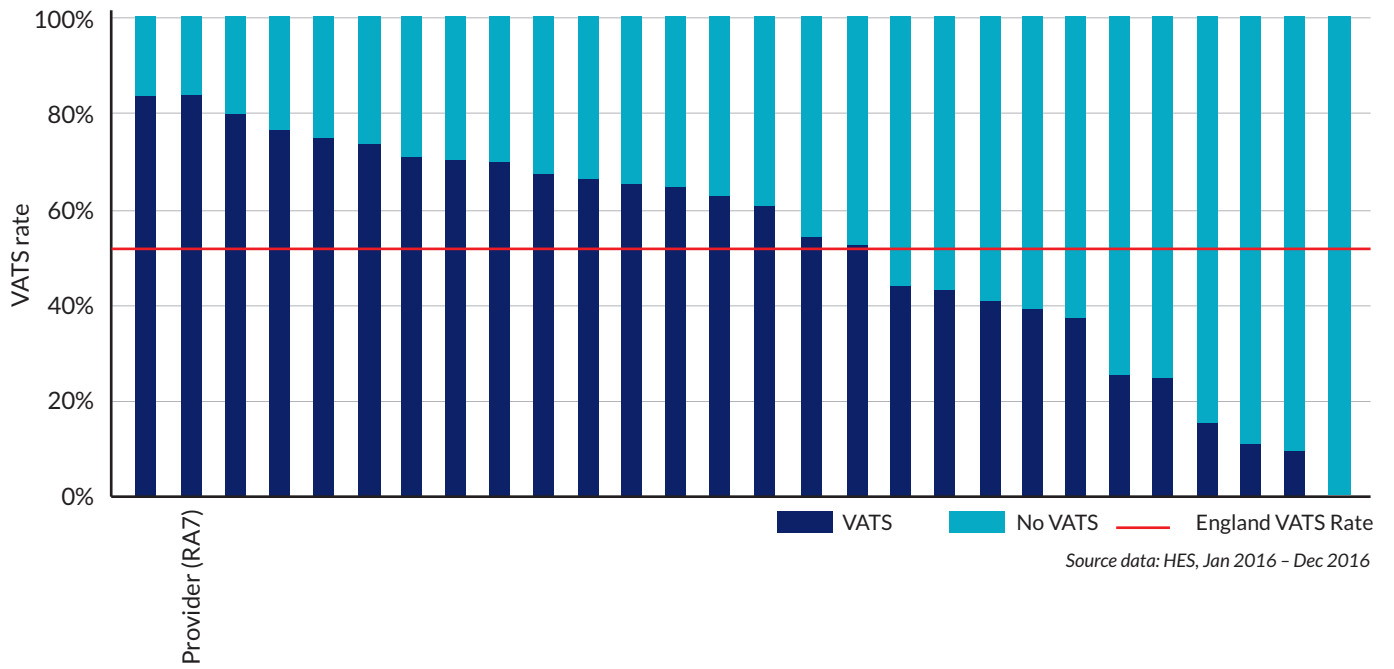
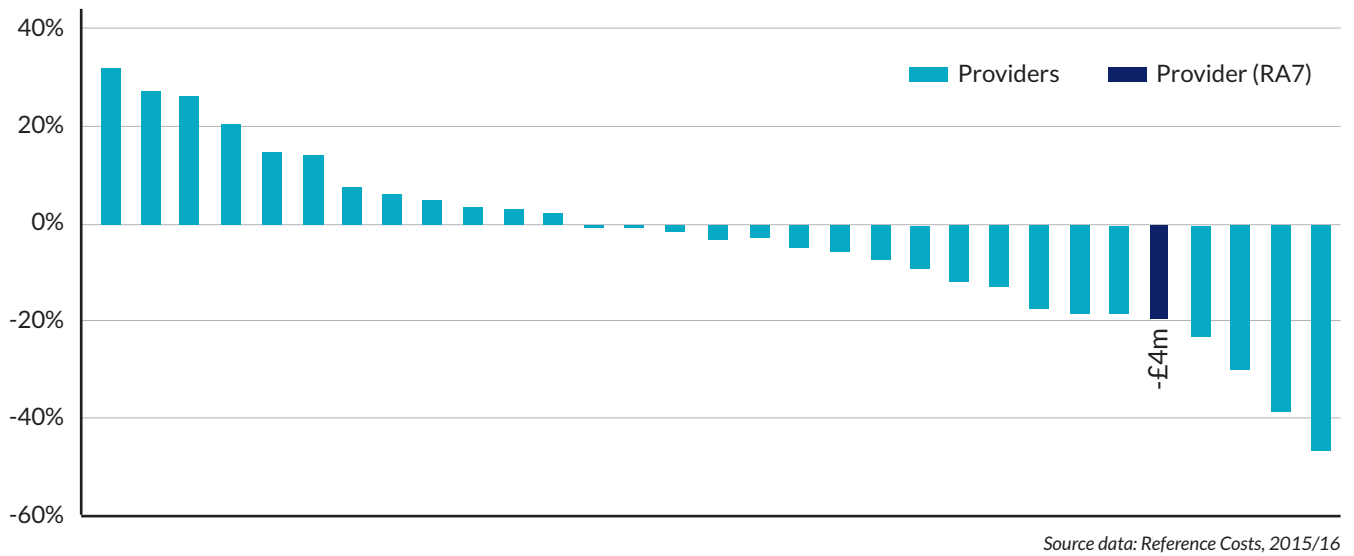


Figure 76: Total actual costs and expected costs for all cardiothoracic surgery – variation compared to other units





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