Does reconfiguration improve hospital services?

An assessment of the evidence base for reconfiguration of maternity, paediatrics, stroke services, emergency medicine, trauma and emergency surgery services

1. Introduction and objectives

Reconfiguration of hospital services is not new – it has been an ever-present feature of the NHS since the Porritt Report and Hospital Plan of 1962 led to the building of District General Hospitals.

However, reconfiguration has become increasingly unpopular and controversial over the last decade, in particular in cases where it has involved closure either of A&Es or of maternity units. Since the 2010 general election, Andrew Lansley has pledged to end “the imposition of top-down reconfigurations in the NHS” and has stated that reconfigurations should “focus on improving patient outcomes” and “be based on sound clinical evidence”.

This document contains the initial findings of an analysis of the relationship between size of service, quality of service and financial efficiency, across all acute hospitals in England. This document covers maternity services, paediatrics, stroke services, emergency medicine, trauma and emergency surgery and is intended to serve three purposes:

1. To support decision-making on whether to reconfigure services by providing quantitative historical evidence that can supplement theoretical/model-based evidence;

2. To highlight areas where there is a need to capture more evidence on outcomes (e.g., maternity services), to enable judgments to be made as to whether reconfiguration improves outcomes;

3. To highlight the relative size of opportunities to improve quality and efficiency of care through reconfiguration compared to opportunities through other means.

2020 Delivery does not have an agenda as to whether reconfiguration and centralisation of hospital services is necessarily either a “good” or “bad” thing – merely a wish to help decision-making on reconfiguration proposals to be informed by the best available evidence.

Please note that the analyses presented in this document are based on a snapshot of quality performance and financial performance across the NHS in England from the period 2007 - 2009, and as such they should be seen as indicative rather than conclusive. The analysis does not at this stage include longitudinal analyses on the performance of individual services before, during and after centralisation.
2. Executive summary

Financial evidence:
There is strong evidence that larger units are more financially-efficient than smaller units, for almost all of the services reviewed in this document. The analysis indicates statistically significant improvements in financial efficiency from centralisation, but with those improvements being somewhat smaller than savings that have been claimed during some consultations on reconfiguration. This analysis indicates that a medium-scale nationwide programme of reconfiguration could have a value of hundreds of millions of pounds per annum for the NHS\(^1\), on top of savings that could be made through means other than reconfiguration.

Quality and outcomes evidence:
There are two possible ways in which centralisation can lead to better outcomes: firstly it can increase the number of procedures performed by each operator and therefore enable each operator to improve their skills ("practice makes perfect"); secondly it can make it possible for hospitals to be able to afford to comply with clinical guidelines and standards (these standards can involve process standards, such as time from presentation to scan for stroke patients, or can involve staffing requirements, such as number hours of dedicated consultant presence per week on obstetric wards).

Where reconfiguration of hospital services is proposed, the outcomes-based case for reconfiguration should be based on the answers to the following questions:

1. How strong is the evidence that outcomes are improved either through each operator performing more procedures, or through improved compliance with clinical guidelines?
2. How strong is the evidence that it is difficult for operators in small units to perform sufficient procedures/ difficult for small units to comply with clinical guidelines?
3. How strong is that evidence that larger units, or previous reconfigurations, have delivered better outcomes?

The evidence for stroke services on each of the three questions is as follows:

1. Stroke units that comply with clinical standards\(^2\) tend to have lower stroke mortality rates and hence have better clinical outcomes

2. However, there has not historically been a strong correlation between size of stroke unit and compliance with clinical standards (some small units comply well, some larger units have shown weaker compliance) – and, perhaps as a result, there has not historically been a clear link between size of unit and stroke mortality. There is strong evidence that it is very expensive for small stroke units to comply with clinical standards for stroke services. As a result, in a financially-constrained

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\(^1\) For instance, analysis indicates a potential annual value of £300m if reconfiguration were pursued at a scale to affect: 50% of stroke units; 35% of maternity units, paediatric units, trauma units and emergency surgery units; 20% of A&Es/ emergency medicine units.

\(^2\) Sentinel Stroke Audit; this evidence linking performance on the Sentinel Stroke Audit to improved performance on mortality is statistically significant at the 90% level
future it will be very difficult for health communities to sustain multiple small stroke units, each of which complies with clinical standards

3. There is emerging (but as yet unpublished and not yet statistically-reviewed) evidence from London that commissioning large hyper-acute stroke units, in combination with compliance with clinical standards, can lead to very substantial improvements in stroke mortality.

As a result, in the case of stroke services, it appears likely that reconfiguration of stroke services will lead to improved outcomes if reconfiguration of those services is combined with a programme to have the centralised “hyper acute stroke units” fully compliant with standards for stroke treatment.

In the case of other services, our analysis found gaps in the data which make the evidence for or against reconfiguration less definitive than it is for stroke services:

- For maternity services, clinical guidelines require minimum numbers of dedicated hours of consultant presence on obstetric wards each week. The evidence suggests that smaller units find it hard to meet these requirements, which would indicate a potential quality and outcomes benefit to be had from centralising to larger units. However, although some data on maternity outcomes is collected locally, there do not appear to be national data collections and hence there is not enough data to assess whether larger units do deliver better outcomes.

- For paediatrics, while there are datasets which measure process quality, we were unable to find appropriate datasets on outcomes to be able to measure whether large units have better outcomes than small units.

- For trauma services, the TARN database and the National Hip Fracture Database (together with data published by Dr Foster on standardised mortality for fractured neck of femur) provide many of the elements needed to assess the extent to which size of trauma unit is linked to outcomes. However, as yet the TARN database only has a completion rate of approximately 60%, and the initial findings from the first year of data in the National Hip Fracture Database have hospital names anonymised, so cannot be linked to size of unit. The TARN database, once fully populated, will provide outcomes-based evidence that can be plotted against size of trauma unit (analysis of the impact of centralising major trauma services in London will provide an additional opportunity to test whether the outcomes evidence supports centralisation of major trauma services).

- In the case of hip fracture, the initial findings of the National Hip Fracture Project indicate that compliance with clinical standards and recommended pathways, rather than scale, is likely to be the primary driver of outcomes for hip fracture patients. The findings also indicate that, currently, smaller hospitals often show better compliance with clinical standards than do tertiary centres (which in some cases have prioritised major trauma patients over hip fracture patients, to the detriment of hip fracture patients).

- Within emergency surgery, for a number of individual procedures (e.g., procedures for ruptured abdominal aortic aneurisms) there is some evidence of outcomes improving as unit size increases, but the magnitude of the improvement is not large enough to be statistically significant. When

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3 At least in urban areas where reconfiguration does not lead to long travel times to hyper acute centres

4 Safer Childbirth: Minimum Standards for the Organisation and Delivery of Care in Labour, 2007
emergency surgery was examined as a whole, our analysis did not find clear evidence of improvement in outcomes as scale increased.

If quality is assessed in terms of patient experience or process/workforce measures, this may lead to different conclusions from if quality is assessed in terms of outcomes. For instance, for maternity services, larger maternity units tended to score lower on the Healthcare Commission’s 2007 Maternity Services Review than did smaller maternity units. The reasons for this are not clear, but may be linked to patient preference for smaller units, or possibly to lower rates of staff turnover in smaller units.

The case for centralisation varies from service to service, with stroke services appearing to have the strongest case for centralisation. In the case of major trauma and hip fracture, the outcomes data is getting to a point where it should be possible to clearly quantify the potential outcomes benefits from centralisation within a couple of years. In the cases of emergency surgery, maternity and paediatrics there is further to go before outcomes data is available to make clear assessment of the likely outcomes benefits of reconfiguration possible.
3. Service-by-service summary of findings

3.1 Maternity services

There are four key findings for maternity:

(i) Larger maternity units tend to have lower reference costs, and hence be more financially efficient, than smaller units.

(ii) There is a lack of published data on outcomes delivered by maternity units, although some SHAs (e.g., South East Coast) have begun systematic collection of outcomes data. As a result, we have no evidence on the relationship between size of maternity unit and outcomes delivered. Further, there is no published evidence as to the magnitude of the impact of compliance/non-compliance with clinical guidelines on outcomes delivered.

(iii) Unpublished evidence from a number of SHAs indicates that smaller maternity units struggle to meet clinical guidelines for number of hours of dedicated consultant presence on obstetric wards each week. However, based on the indicators of patient experience and process that were used within the Healthcare Commission’s 2007 Maternity Services Review, larger maternity units tend to have slightly lower quality of care than smaller units.

(iv) Maternity units that score better on patient experience and process measures (as per the Healthcare Commission’s 2007 survey) tend to have higher reference costs than other maternity units. This indicates that complying with the measures in the Healthcare Commission’s survey is expensive.

The first three findings are detailed in Chart 1, below:

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5 Safer Childbirth: Minimum Standards for the Organisation and Delivery of Care in Labour, 2007

6 An increase in quality score of 1 point (on a scale of 1, lowest quality to 4, highest quality) is associated with an 18% increase in reference cost.
Chart 1: Relationship between reference cost index, size and quality for maternity units

**i. Size vs. reference costs**
- Significant economies of scale:

  ![Graph showing downward-sloping relationship between reference cost index and size of unit.](chart)

  **Gradient:** downward-sloping such that increase in size of a typical maternity unit from £5m to £10m would imply reduction in reference cost index of more than 15%
  
  **Statistical significance:** downward slope significant at 99% level
  
  **Scatter:** substantial scatter, size accounts for ~24% of variation of reference cost across units

**ii. Size vs. quality outcomes**
- Relationship is uncertain:

  ![Graph showing uncertain relationship between quality outcomes and size of unit.](chart)

  No robust outcome measures published, although some now being collected (e.g., NHS SouthEast Coast)

**iii. Size vs. process/patient experience quality measures**
- Relationship is weakly negative:

  ![Graph showing slight downward slope between quality outcomes and size of unit.](chart)

  **Gradient:** slight downward slope (quality reduces as size increases, but only by a small amount)
  
  **Statistical significance:** downward slope significant at 90% level but not at 95% level
  
  **Note:** this does not show outcomes, nor extent of compliance with RCOG’s “Safer Childbirth” guidelines

* On a scale of 1 (lowest quality) to 4 (highest quality)

The finding that reference cost index decreases (and hence financial efficiency increases) as size increases, and the slope of the trend-line, contribute to the arguments in favour of reconfiguration and centralisation of maternity services. There is substantial scatter, as shown on the attached chart (each point on the chart represents a hospital site that has a consultant-led obstetric unit), but the statistical significance of the downward trend is overwhelming. The scatter may be caused by differences in factors such quality of clinical teams and of management between Trusts – this is discussed further in section 4 of this document.

**Chart 2: Relationship between size of maternity unit and maternity reference cost index**

The trend line has a gradient of -3.5% per £m. This means that a reconfiguration from a £5m sized unit to a £10m sized unit would, on average, result in ~17% lower reference costs.

This trend-line of increasing financial efficiency with size is broadly consistent with theoretical models of financial efficiency that have been produced to support some consultations on reconfiguration proposals. These models tend to show that larger units can benefit from economies of scale in costs such as medical staffing and anaesthetists/ theatre costs. However, the magnitude of overall economies of scale is limited by the fact that there are not significant economies of scale in midwife costs (because of recommended midwife-to-mother ratios) nor in drug costs.

On the relationship between quality and size, the absence of robust published data on outcomes makes a key gap in the evidence. Some relevant data on outcomes is collected (for instance that shown below is collected monthly by South East Coast SHA for maternity units within its geography), but has not yet been published.
Relevant indicators to assess the extent of relationship between size and outcomes could include the following:

<table>
<thead>
<tr>
<th>Metric Description</th>
<th>Definition of measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective caesarean section rate</td>
<td>% of deliveries that are by elective caesarian</td>
</tr>
<tr>
<td>Emergency caesarean section rate</td>
<td>% of deliveries that are by emergency caesarian</td>
</tr>
<tr>
<td>Ventouse and forceps deliveries</td>
<td>% of deliveries that involve ventouse/forceps</td>
</tr>
<tr>
<td>Failed Instrumental Delivery</td>
<td>% of instrumental deliveries that fail</td>
</tr>
<tr>
<td>Intrapartum stillbirths</td>
<td>% of babies</td>
</tr>
<tr>
<td>Term neonatal deaths &lt; 7 days</td>
<td>% of babies</td>
</tr>
<tr>
<td>Shoulder dystocia</td>
<td>% of babies</td>
</tr>
<tr>
<td>Meconium aspiration</td>
<td>% of babies with meconium aspiration</td>
</tr>
<tr>
<td>Number of cases of hypoxic encephalopathy (Grades 2&amp;3)</td>
<td>% of babies</td>
</tr>
<tr>
<td>Unexpected admissions to SCBU/ NICU</td>
<td>% of babies unexpectedly admitted to SCBU/ NICU</td>
</tr>
<tr>
<td>Postpartum haemorrhage &gt;2L</td>
<td>% of mothers</td>
</tr>
<tr>
<td>3rd/4th degree tear</td>
<td>% of mothers</td>
</tr>
<tr>
<td>Post/Peri partum Hysterectomies</td>
<td>% of mothers</td>
</tr>
<tr>
<td>Weekly hours of dedicated consultant presence on labour ward</td>
<td>Hours per week</td>
</tr>
<tr>
<td>Woman/Midwife ratio</td>
<td>Births per WTE per annum</td>
</tr>
<tr>
<td>No of times midwifery led unit closed due to staff shortage</td>
<td># of occasions</td>
</tr>
<tr>
<td>Number of serious untoward incidents</td>
<td>Incidence</td>
</tr>
</tbody>
</table>

The relationship shown in the Healthcare Commission’s Maternity Services Survey (2007) is of patient experience and process quality reducing as size increases. This trend does not support centralisation of maternity services. This quality data is from a respected source (the Healthcare Commission) but should be treated with caution for three reasons:

1. The quality indicator used is from 2007, which makes the data older than that used for the other analyses (2008-09 data). Up-to-date data will be available from the Care Quality Commission by the end of 2010, as the Care Quality Commission re-runs the national maternity services survey.

2. The quality indicator is based on a series of process indicators and patient experience indicators—which are important but which do not include outcomes indicators. Furthermore, the indicators used do not include number of hours of dedicated consultant presence on the obstetric ward each week.

3. The trend is relatively weak and shows lots of scatter. Although the trend is downward, there are some examples of very large units which score well on quality.

In summary, while financial evidence strongly favours reconfiguration and centralisation of maternity services, the quality evidence is uncertain, and needs to be bolstered both by evidence on outcomes, and by more up-to-date evidence, before a definitive view can be taken on the evidence for or against reconfiguration and centralisation. The quality of the evidence, the magnitude of the trends, and the resulting implications are discussed further in Appendix 1.

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1 Ideally, this data on outcomes would be casemix adjusted
3.2 Paediatric services

This analysis indicates significant reductions in reference cost index, and hence significant improvements in financial efficiency, as the size of paediatrics units increase. This trend-line of increasing financial efficiency with size is broadly consistent with theoretical models of financial efficiency that have been produced for some consultations on reconfiguration proposals. These models tend to show that larger units can benefit from economies of scale in costs such as medical staffing, and may also benefit to some extent from economies of scale in ward-sizing, bed utilisation and nursing costs.

As with maternity services, we were not able to find robust and comparable data on outcomes delivered by paediatrics services.

The data within the Healthcare Commission’s Improvement Review of Services for Children in Hospital does not provide a clear trend of quality improving with size. However, the Improvement Review did raise a number

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*The analysis was performed for both specialist and non-specialist paediatric units. No statistically significant results were found for specialist paediatric units. We have defined specialist paediatric units as those units which qualified for specialist top-ups in 2008-09 and non-specialist units as those which did not qualify for specialist top-ups.
of concerns about very small paediatric units as follows: “We found that some paediatric inpatient units carried out less work with children than the minimum professional recommended level... The Royal College of Paediatrics and Child Health recommended that... small paediatric units admitting fewer than 1,800 children each year should not continue to exist unless they are geographically isolated.... Twenty nine hospitals providing inpatient care to children reported fewer than 1,800 admissions a year”. The document also said: “Some accident and emergency (A&E) departments treated only small numbers of children... this affects the ability of hospitals to deal safely with emergencies in young children.”

On the basis that some of the financial benefits of improved efficiency can be used to pay for increased quality, and on the basis of concerns raised by the Healthcare Commission and the Royal College of Paediatrics and Child Health about very small units, this analysis provides directional support for the centralisation of non-specialist paediatric services, in particular in the case of very small units – provided that access considerations and transitional costs of centralisation do not outweigh the benefits outlined above. However, this support for reconfiguration is weakened by the lack of evidence on outcomes.

Further detail of these analyses, including of the quality indicators used, is provided in Appendix 2.
3.3 Stroke services

There are four key findings from this work:

1. Stroke units that comply with clinical standards\(^9\) tend to have lower stroke mortality rates\(^{10}\) and hence have better clinical outcomes

2. **However,** there has not historically been a strong correlation between size of stroke unit and compliance with clinical standards (some small units comply well, some larger units have shown weaker compliance) – and, perhaps as a result, there has not *historically* been a clear link between size of unit and stroke mortality.

3. Larger stroke units tend to be significantly more financially efficient than small units. The data indicates that increasing the size of a typical stroke unit from £1.5m of inpatient activity per annum to £3.0m of inpatient activity is associated with an 11% reduction in unit costs. There is strong evidence that it is very expensive for small stroke units to comply with clinical standards for stroke services. As a result, in a financially-constrained future it will be very difficult for health communities to sustain multiple small stroke units, each of which complies with clinical standards.

4. There is emerging (but as yet unpublished and not yet statistically-reviewed) evidence from London that commissioning large hyper-acute stroke units, in combination with compliance with clinical standards, can lead to very substantial improvements in stroke mortality.

If the emerging evidence from London is substantiated, it would then provide the outcomes-basis for further centralisation of stroke services in other parts of the country, so long as access considerations, travel times and transitional costs associated with centralisation are appropriate.

Further detail on these analyses is provided in Appendix 3.

\(^9\) Sentinel Stroke Audit; this evidence linking performance on the Sentinel Stroke Audit to improved performance on mortality is statistically significant at the 90% level

\(^{10}\) This trend is statistically significant at the 90% confidence interval but not at the 95% level
### 3.4 Emergency medicine

Within emergency medicine, reconfiguration can take a number of forms:

- It is possible to reconfigure a part of the emergency medicine service (e.g., stroke services, heart attack services) but still leave all A&Es open. Reconfiguration of stroke services is examined in section 3.3 of this document. Reconfiguration of heart attack services is not currently examined explicitly in this document.

- It is possible to centralise emergency medicine for all conditions, which then involves closing A&Es: this is the type of centralisation that is examined within this section 3.4

Headline findings are as follows:

#### Chart 5: Relationship between reference cost index, size and quality for emergency medicine

**i. Size vs. reference costs**
- **Significant economies of scale:**
  - Reference cost index
  - Size
  - **Gradient:** downward-sloping such that an increase in size of a typical unit from £15m to £30m of inpatient emergency medicine income per annum would imply 5% reduction in reference cost index
  - **Statistical significance:** downward slope is significant at the 95% level
  - **Scatter:** very substantial scatter. Less than 10% of variation in reference costs across units is caused by size:

**ii. Size vs. Quality outcomes**
- **Trend is approximately flat**
  - Quality outcomes
  - Size
  - There trend between size of unit and quality outcomes (as measured by the Hospital Standardised Mortality Index for non-elective admissions, Dr Foster, 2008-09) appears to be approximately flat.

**iii. Quality vs. reference costs**
- **Relationship is significantly positive:**
  - Reference cost index
  - Quality
  - **Gradient:** upward-sloping such that increase improved quality of 1% (i.e., 1% reduction in HSMR for non-elective admissions) associated with 0.5% higher reference cost index
  - **Statistical significance:** upward slope is statistically significant at the 99% level
  - **Scatter:** very substantial scatter. Less than 10% of the change in reference cost is associated with change in quality

This analysis indicates significant reductions in reference cost index, and hence significant improvements in financial efficiency, as the size of units increases. It should be noted however that the gradient of the trend-line is relatively modest: a 5% improvement of efficiency is a smaller improvement in efficiency than would be indicated for centralisation of any of maternity services, paediatric services or stroke services.
On quality, if Dr Foster’s Hospital Standardised Mortality Index for non-elective admissions is used as the indicator of quality\textsuperscript{11}, there does not appear to be a material trend (up or down) between quality and mortality index. Other measures of quality are possible too (e.g., Care Quality Commission’s measure of “Overall quality of services” for each Trust\textsuperscript{12}; MINAP report data on treatment of myocardial infarction\textsuperscript{13}), although no single published measure directly measures service quality for Emergency Medicine as a whole.

On this basis, while there may be a quality-based argument for centralising parts of the emergency medicine service (e.g., stroke services, heart attack services), this data does not indicate a strong quality-based argument for the sorts of centralisation that leads to closure of A&Es.

\textsuperscript{11} As a caveat, this index will include mortality for trauma and emergency surgery patients as well as for emergency medicine patients

\textsuperscript{12} This measure covers quality of care across the whole portfolio of the hospital’s activity, not just emergency medicine

\textsuperscript{13} This measure indicates quality of care for treatment of myocardial infarction, which represents an important subset (but a small subset) of emergency medical care
3.5 Trauma

We examined trauma services as a whole, and fractured neck-of-femur services as a specific and important sub-set of trauma services. The data indicated five key conclusions:

(i) Financial efficiency improves as size of trauma unit increases (this trend is relatively weak for trauma services as whole, but very strong for fractured neck-of-femur services)

(ii) Increasingly good-quality outcomes data exists for trauma services. The TARN database indicates case mix adjusted relative mortality rates for trauma units (however, data completion and submission rates for the TARN database are currently only 60%, but improving), while Dr Foster publishes standardised mortality rates for fractured neck of femur patients. On the data available so far, we did not find any observable trend between mortality and size of unit, either for fractured neck of femur services or for trauma services as a whole. While there may be a link between trauma mortality and size of trauma unit for the most seriously injured trauma patients, the data does not indicate such a link for more “standard” trauma patients, who make up the vast majority of the trauma workload in England

(iii) Through initiatives such as the National Hip Fracture Project, it will increasingly become possible to quantify the impact of compliance with clinical standards on patient mortality – and to assess the extent to which it is possible for smaller units to comply with clinical standards for different patient groups

(iv) There is a very clear relationship between average length of stay and reference cost index: longer length of stay is associated with higher reference cost index

(v) We did not find any clear relationship between average length of stay and hospital standardised mortality index

The financial finding supports reconfiguration of trauma services into centralised units, provided that access considerations are appropriate. However, the quality data (i.e., the lack of evidence of mortality benefits with scale) does not support centralisation of routine trauma services.

Examining these findings in more detail, for trauma services as a whole, the relationship between reference cost index and size is only weakly negative. This may be because economies of scale within trauma services are

For major trauma, research performed by the National Audit Office (“Major trauma care in England”, February 2010) and others indicates that there would be a substantial quality benefit in terms of lives saved if major trauma services were arranged in networks, and with major trauma centres within those networks appropriately staffed and with appropriate pathways to accept major trauma patients. This research into major trauma does not investigate what would constitute appropriate service configurations for minor trauma/ more standard trauma

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small, or (very possibly), it may be because larger trauma units perform higher quantities of trauma work which qualifies for specialist top-ups.\(^{15}\) Chart 6 shows this relationship:

For Fractured Neck of Femur (FNOF), there is much more substantial evidence of financial efficiency improving as scale increases, as shown in Chart 7, below:

\(^{15}\) For trauma services in 2008-09, specialist top-ups were decided on a spell-by-spell basis, based on the patient’s diagnosis codes. We have not yet been able to test whether larger trauma units had a higher proportion of their trauma activity qualify for specialist top-ups.
These trend-lines of increasing financial efficiency with size are broadly consistent with theoretical models of financial efficiency that have been produced for some consultations on reconfiguration proposals. These models tend to show that larger units can benefit from economies of scale in costs such as medical staffing and theatre utilisation, and may also benefit to some extent from economies of scale in ward-sizing, bed utilisation and nursing costs.

When looking at the relationship between size and quality outcomes, we did not find any significant relationships. For instance, TARN data on trauma patient survival vs size of trauma unit is shown in Chart 8:
Chart 8: Relationship between size of trauma service and trauma survival as measured on the TARN database

The trend-line is virtually flat (i.e., the data* does not indicate any systematic change in trauma survival as the size of trauma unit increases)

* The TARN database has been growing in use across Acute Trusts over the last few years, but is still not systematically in use across all Trusts. As a result, the data shown represents data from about half of the hospitals in England that admit trauma patients.

Source: NHS Reference Costs 2008-09; Trauma audit and research network (www.tarn.ac.uk); 2020 Delivery analysis
Similarly, there is no significant trend for FNOF mortality to improve as the size of FNOF unit increases (see chart 9, below).

**Chart 9: Relationship between size of fractured neck of femur (FNOF) service and mortality index for FNOF**

![Chart 9: Relationship between size of fractured neck of femur (FNOF) service and mortality index for FNOF](image)

The trend-line for this chart is almost flat (i.e., no variation in HSMR for FNOF as the size of unit increases).

The National Hip Fracture Database’s Preliminary National Report (2009) gives some indication of why there may not currently be improvements in mortality amongst fractured-neck-of-femur patients as the scale of trauma units increases:

- “Early surgery (within 48 hours of arrival at Accident and Emergency) for hip fracture not only minimises avoidable discomfort and dependency but has been shown to improve rehabilitation prospects and hence diminish the length of stay.16 Extended delay is associated with preventable morbidity and mortality”
- “Pre-operative delay appears to vary with care setting. NHFD data shows that there is a significant difference between the percentage of patients treated in ‘district’ hospitals having their operation within 48hrs (71.6%) and those treated at a ‘tertiary’ hospital (60.1%, \( P < 0.0001 \))”
- “Hospitals that provide ‘tertiary’ orthopaedic care should ensure that such care is properly resourced and organised so that the high caseload associated with tertiary care does not detrimentally affect the care given to patients with fragility fractures.”

This indicates that the primary driver of a unit’s standardised mortality ratio for FNOF patients may be the way that pathways for that care are organised, including the length of time between patients presenting at A&E and being operated (% within 24 hours, % within 48 hours) and including use of pre-operative assessments by geriatricians.
The second national report of the National Hip Fracture Database is expected to be published later in 2010, and will enable further comparison of financial performance, scale, mortality, and compliance with key pathway metrics.

Further details of our findings for trauma and for fractured neck of femur are included in Appendix 5 to this document. These findings also include findings about the relationships between length of stay, quality, efficiency and mortality.
3.6 Emergency Surgery

The trend of reference costs reducing as size increases implies that there are economies of scale for emergency surgery\(^{16}\) – however, this trend is much weaker than the trends observed for the other services reviewed in this document, and is not steep enough (given the amount of scatter) for the downward slope to be statistically significant. We have not at this stage performed further analysis to understand why this trend would be weaker than that observed for other services.

On quality, two indicators were tested. The first looked at mortality rates for one specific type of procedure: operations performed on ruptured abdominal aortic aneurisms. For this measure, there is a very slight improvement in mortality as unit size increases, but the increase is so slight relative to the scatter that it is not statistically significant. Chart 11 shows details:

\(^{16}\) For the purposes of this analysis, we have defined emergency surgery as any non-elective admissions in the following specialties: general surgery; breast surgery; colorectal surgery; hepatobiliary and pancreatic surgery; upper gastrointestinal surgery; vascular surgery
The second indicator used was hospital standardised mortality for emergency admissions. This should be caveated because emergency admissions cover more conditions than just emergency surgery (e.g., they also cover emergency medicine). Chart 12 shows that this also showed a slight improvement in mortality as the size of emergency surgery unit increases:
There are alternative indicators (e.g., Care Quality Commission’s measure of “Overall quality of services” for each Trust\(^\text{17}\)), although no single published measure directly measures service quality for Emergency Surgery as a whole. Additional quality information will be available later in 2010 when NCEPOD publishes its study into “Elective and emergency surgery in the elderly”, which will examine the care of a cohort of elderly patients who died within 30 days of surgery.

Taken together, the trends of slight improvement in efficiency as size increases, and of slight improvement in mortality as size increases, provide some support to the reconfiguration and centralisation of emergency surgery services. However, the trends are sufficiently slight in each case that it may well be the case that greater benefits could be achieved through means other than reconfiguration.

\(^{17}\) This measure covers quality of care across the whole portfolio of the hospital’s activity, not just emergency medicine
4. Commentary on the causes of scatter, and the importance of scatter, within the data analysed

The conclusions suggest that while significant trends exist to relate financial efficiency to service size, (and in some cases to relate service quality to service size), there is also a considerable amount of scatter in the data and thus it is possible that units can be financially efficient across a range of sizes.

For a given service on a given hospital site, the financial efficiency of the service is a function of many factors, including service size, extent of compliance with clinical guidelines, quality of management and clinical teams, degree of specialisation, degree of rurality, socio-economic deprivation and other factors. This can be expressed as an equation:

\[
\text{Financial efficiency} = \text{Function (service size, extent of compliance with clinical guidelines, quality of management and clinical teams, degree of specialisation, rurality, socio-economic deprivation, other factors)}
\]

In addition, variation in accounting practice (for instance, how a trust allocates its overheads across HRGs and specialties) may be responsible for some of the scatter that we have observed in measurement of reference cost index at a service level.

Size is therefore only one of a number of factors that drives financial efficiency, and as a result charts of financial efficiency against size show significant scatter, as shown in Chart 2 earlier in this document.

However, it is important to note that although there is substantial scatter in the data, the number of data points in this analysis is sufficiently large that in the cases of each of maternity, paediatrics, stroke, emergency medicine and fractured neck of femur the trend of financial efficiency improving as service size increases can be demonstrated to be statistically significant.

Quality outcomes are also driven by many factors, of which service size is just one, as shown in the figure below:

\[
\text{Quality outcomes} = \text{Function (service size, extent of compliance with clinical guidelines, quality of management and clinical teams, expenditure decisions, degree of specialisation, rurality, socio-economic deprivation, other factors)}
\]
5. Potential shortcomings of the quality indicators used in this analysis

Our analysis used the following publicly available measures of quality:

- Maternity: Healthcare Commission’s 2007 “Maternity Services Scored Assessment”
- Paediatrics: Healthcare Commission’s “Improvement Review of Services for Children in Hospital”, 2007
- Stroke: 2009 Sentinel Stroke Audit Scores; 2008-09 hospital standardised mortality ratio for stroke patients (Dr Foster quality accounts)
- Emergency Medicine: 2008-09 hospital standardised mortality ratio for non-elective admissions (Dr Foster quality accounts)
- Trauma: 2008-09 hospital standardised mortality ratio for fractured neck of femur patients (Dr Foster quality accounts); TARN data
- Emergency Surgery: 2008-09 hospital standardised mortality ratio for non-elective admissions (Dr Foster quality accounts); data on mortality rates for ruptured abdominal aortic aneurisms

Note that in the case of paediatrics and maternity, the Healthcare Commission’s measures do not include any outcomes indicators. Note also that these indicators are from 2007 rather than from 2008-09. In order to draw a more robust conclusion of the relationship between reference costs, size and quality, we would wish to supplement these analyses with more up to date indicators of quality and with outcomes-based measures.¹⁸

¹⁸ The Care Quality Commission will be re-running the national maternity services survey during 2010, and updated results on quality by maternity unit should be available by end 2010
6. Next steps

The findings presented in this document are the results of an initial analysis. In order to improve the robustness of our findings, we will investigate opportunities to strengthen and deepen the analysis as follows:

- Where “imperfect” data sets have been used (e.g., some measures of quality did not include outcomes), supplement the analysis with additional data, where possible.

- Perform longitudinal (historic) analyses as a cross-check on our findings (e.g., for a health economy where centralisation of services has occurred, look to see what happened to reference costs and quality before, during and after that centralisation). Longitudinal analyses are likely to be particularly valuable where large-scale reconfigurations have taken place (for instance, the reconfigurations to stroke services, heart attack services and trauma services in London; the Manchester reconfigurations of stroke services, maternity/paediatrics services (part of the Making it Better programme) and emergency medicine/ emergency surgery services (part of the Healthy Futures programme).

- Where the data shows considerable variation in performance between trusts of a similar size, try to understand the drivers of variation with a view to build a picture of the elements of “best practice” in terms of quality and financial performance.

- Test for relationship between financial efficiency for a service and overall Trust size (as opposed to service size on a particular site). In this case we would expect only a weak relationship: large Trusts may have an advantage on ability to spread their overheads across larger services, but we would expect that the largest financial advantage comes due to size of service on a particular site, not due to size of Trust.
Appendices (included as separate document):

Appendix 1: Detailed findings for maternity
Appendix 2: Detailed findings for paediatrics
Appendix 3: Detailed findings for stroke services
Appendix 4: Detailed findings for emergency medicine
Appendix 5: Detailed findings for trauma
Appendix 6: Detailed findings for emergency surgery
Appendix 7: Methodology
Appendix 8: Measures of statistical significance
Appendix 9: Criteria used to assess quality in the Healthcare Commission Maternity Services Scored Assessment
Appendix 10: Criteria used to assess quality in the Healthcare Commission Improvement review of Children’s Services in Hospital
Appendix 11: Criteria used to assess quality in the Stroke Sentinel Audit