Centre for
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Summary

This document examines the feasibility of conducting, by September 2011, an economic evaluation of the new stroke service in London.

The key findings are:

- It is feasible to conduct an economic evaluation of the new stroke service in London but, because the evaluation will need to report by September 2011, observations relating to the new service will be restricted to just six months worth of patients followed up for a further three months.
- It is recommended that the new London system is compared to the previous London service (with due consideration for any counterfactual trend improvement) rather than comparing London to another part of the country.
- It is recommended that the evaluation focus on attempting to directly measure differences in health outcomes for the new London system compared to the counterfactual system. However, observation of the differences in process parameters between the two systems and/or using these to simulate patient outcomes should help to corroborate (or otherwise) any directly measured differences in health outcomes and should be attempted.
- Due to the short time horizon over which it will be possible to observe outcomes and the coverage of the data available, it is likely that the main evaluation's findings will be sensitive to assumptions used to extrapolate observations in one part of London to the rest of the capital and to extrapolate from short-term to lifetime QALY gains.
- The success of the evaluation will, at least in part, be influenced by the co-operation and support of those involved in collecting and supplying data on stroke services.

Table of contents

1. Context

In December 2007 the Department of Health published its National Stroke Strategy which sets out a framework of quality markers to raise the quality of stroke prevention, treatment, care and support over the following decade.

In November 2008 Healthcare for London published its own Stroke Strategy for London which set out proposals for a new centralised, multiple hub and spoke model for acute stroke care with the aim of achieving enhanced standards of care. The centralised model spans the 5 stroke networks in London, serves a population of around 8 million and consists of:

- Eight hyper-acute stroke units (HASUs) strategically located across London, that provide an immediate response to stroke where the patient receives primary intervention (including faster access to thrombolysis where appropriate) and is stabilised. A patient typically spends no longer than 72 hours at a HASU.
- 24 stroke units (SUs) that provide multi-therapy rehabilitation and ongoing medical supervision following a patient's hyper-acute stabilisation. Length of stay varies and will last until the patient is well enough for discharge from an acute inpatient setting.

The additional running costs of the new acute model of care are financed through an enhanced tariff with the enhanced funding agreed until the end of the 2011/12 financial year. The business case estimates that the enhanced tariff will provide additional funding of around £21m per year to the acute part of the London stroke pathway.

The new model of acute care was implemented over the period October 2009 to July 2010 with the new system now fully operational.

The new centralised hub and spoke system spanning the 5 stroke networks in London, is considerably different to the previous London system and many stroke services currently in operation in other regions of the UK which operate on a more local and less centralised basis and without an enhanced tariff.

2. Purpose of this paper

No formal plans were put in place to evaluate the cost-effectiveness of the new London stroke system. As such, NHS London have commissioned the Centre for Health Service Economics and Organisation (CHSEO) to explore the feasibility of conducting a cost-effectiveness evaluation that may be used to determine the sustainability of London's stroke service in its new configuration and at current levels of funding.

The London Stroke Strategy covers the whole patient pathway (i.e. prevention, acute and rehabilitation), however, almost all of the reforms have focussed on changes to the acute part of the pathway. Therefore, it is appropriate for a cost-effectiveness evaluation, at this stage, to focus on the changes to the acute part of the patient pathway.

The aim of this paper is to establish, as far as possible, what might be feasible in terms of a cost-effectiveness evaluation. However, since some issues do not surface until the work itself is embarked upon, it is not possible to fully determine what is

feasible at this stage. Rather, this paper seeks to explore what is likely to be feasible and sets out some options for potential evaluations.

3. Defining the counterfactual system

We understand that decisions regarding the future configuration and funding of London's stroke service will be made around September 2011. Decision-makers will want to understand what the additional funding (estimated at £21m per year) has paid for by way of improvements to the effectiveness of London's stroke service - i.e. they will want to be able to compare the cost-effectiveness of the new London system to that of a system that represents what London might have been *today* without the additional funding and perhaps under a different configuration (i.e. the "counterfactual" system). This would allow the incremental cost-effectiveness of the new London system as compared to the counterfactual system to be considered.

It is therefore important to attempt to clarify, for the purposes of a cost-effectiveness evaluation, what the relevant counterfactual system is. This involves considering which aspects of the new London system might be subject to political debate and therefore the configuration and funding regime that London might have been encouraged to adopt. As already discussed, the new London system is distinctive on two counts:

- The acute part of the patient pathway is financed using an enhanced tariff (as opposed to the standard national tariff)
- It is run as a centralised, multiple hub and spoke system across London's 5 stroke networks and a population of around 8 million

If it is solely the enhanced tariff that is the subject of political debate then the appropriate counterfactual is a centralised hub and spoke system financed using the standard tariff. However, if it is both the enhanced tariff and the centralised nature of the system that is subject to political debate then the appropriate counterfactual is a more local and less centralised system financed using the standard national tariff. For the purpose of this paper and based upon our discussions with stakeholders, we assume the latter.

4. Timing of an evaluation

In order to inform decisions regarding the future funding and configuration of London's stroke service around September 2011, an evaluation would need to be completed by August or September 2011. Allowing for time to analyse data and to write up an evaluation, this implies that data available up until June 2011 can be used for the evaluation.

5. Review of potential data sources and existing models

In order to scope the feasibility of conducting a cost-effectiveness evaluation we spoke to a number of people with knowledge of various data sources and existing relevant models. Annex A lists the individuals that we spoke to and their areas of knowledge or expertise. However, it should be noted that the recommendations in this paper regarding what is feasible represent our own views. We do not attribute any of the material in this paper to any of the individuals we have made contact with.

Annexes B1 to B6 each provide an overview of the key data sources that we investigated and are referred to as appropriate in subsequent sections of this paper.

6. Potential broad approaches for a cost-effectiveness evaluation

We have considered two broad approaches for the cost-effectiveness evaluation. These are discussed below:

6.1. Measuring health outcomes directly

A potential approach would be to measure health outcomes (morbidity and mortality) directly, observing outcomes for as long a period as feasibly possible for the new London and counterfactual system alongside measuring costs associated with each system.

It may then be feasible to estimate the incremental cost per QALY gain obtained by the new London system as compared to the counterfactual system by comparing differences in morbidity and mortality levels and costs associated with each system.

6.2. Measuring process parameters and simulating health outcomes

An alternative approach would be to measure stroke service process parameters (as far as possible) for the new London system and the counterfactual system. It may then be possible to translate these process parameters into simulated health outcomes, for both systems, based upon existing research.

Annex C4 sets out the process parameters that could be measured for the new and previous London systems. It should be noted however, that more detailed process data has only been collected centrally in London (and nationally) in more recent years which may somewhat limit the comparisons that can be made between the new system and previous London system.

We considered the feasibility of using an existing discrete-event-simulation model developed on behalf of the National Audit Office which was designed to estimate the cost-effectiveness of various stroke service configurations at a national level. The model covers the whole of the stroke patient pathway and allows the user to specify certain characteristics for each stroke service system being simulated (such as the proportion of patients treated at a stroke unit, proportion receiving early supported discharge and proportion of patients receiving thrombolysis) and essentially allows the cost-effectiveness (measured in terms of cost per QALY) for each system to be simulated and explored.

Making use of the model would involve adjusting parameters within the model, for the acute part of the patient pathway, so that it represents the new London system and counterfactual system as far as possible. However, the model, in its current form, may only be manipulated so far in order to represent a specific local system, i.e. it may not be possible to sufficiently represent the configuration of the new London system with the detail required (for example the intensity of the acute nursing) and further investigation in this area is required.

6.3. Our recommended approach

We recommend, as the primary approach, to measure health outcomes directly (as described in section 6.1) since this direct measurement approach, data permitting, would provide a truer, less speculative measure of the health gains of the new London system compared to the counterfactual system.

However, we do also recommend measuring differences in process parameters between the two systems since this should provide a clear picture of how the two systems differ. We also recommend attempting to translate these differences in process parameters into simulated health outcomes (as described in section 6.2). While we do not recommend this as the primary approach (since it is somewhat more speculative, as it involves simulation rather than direct measurement) results obtained here should be used to corroborate (or otherwise) those obtained via direct measurement of health outcomes.

7. A proposed framework for the cost-effectiveness evaluation

This section expands upon our recommended approach, as described in section 6.1, to measure health outcomes and costs directly.

7.1. Identifying a proxy for the counterfactual system

In order to construct a cost-effectiveness calculation it is necessary to identify a measurable system that could act as a proxy for the counterfactual system.

As described in section 3, for the purpose of this paper, we assume that the counterfactual system is a more local and less centralised system financed using the standard national tariff. The obvious candidate proxy system would therefore be the previous London system which operated on a more localised basis and without an enhanced tariff. However, the previous London system, which was last fully operational in October 2009, is not ideal since it does not represent how London might have operated *today* under a more localised system and without an enhanced tariff. Rather, it would only represent how the London system was operating pre-October 2009 - i.e. even without the additional funding, the London system would likely have made some improvements in terms of health gains due to the general improvement in stroke services over time. Therefore, a cost-effectiveness analysis that uses the previous London system (i.e. pre-October 2009) as a proxy for the counterfactual system could somewhat overstate the incremental cost-effectiveness attributable to the additional funding through the enhanced tariff. Section 7.2.5 discusses a potential approach, using general trends in improvement over time to attempt to make an adjustment to account for this.

We also considered the feasibility of using the *current* stroke service of another large urban region that operates without an enhanced tariff and on a more local basis as a proxy for the counterfactual. Studying a current system would eliminate the issue associated with using an older system as a proxy for the counterfactual, discussed above. West Midlands and West Yorkshire are potentially suitable regions, since geographically they might be considered relatively similar to London and operate without an enhanced tariff and on a more local basis.

However we have seen data that indicates that London's effectiveness (as measured by process parameters) has previously been ahead of these regions, therefore, a cost-effectiveness evaluation using one of these geographical regions as a proxy for the counterfactual system is likely to considerably overestimate the impact of the London Stroke Strategy/ the additional £21 million per year funding.

A study that considers the absolute cost-effectiveness of the current system of another geographical region as compared to the absolute cost-effectiveness of the current London system could provide insight (i.e. in terms of comparing generally how the two systems are operating) but it would not directly produce a measure of the incremental cost-effectiveness applicable to the additional £21 million per year funding.

We therefore do not recommend using another geographical region as a proxy for the counterfactual system and do recommend using the previous London system as a proxy (with the option of exploring whether it is possible to make an adjustment for the improvements that this system may have made over time in the absence of an enhanced tariff).

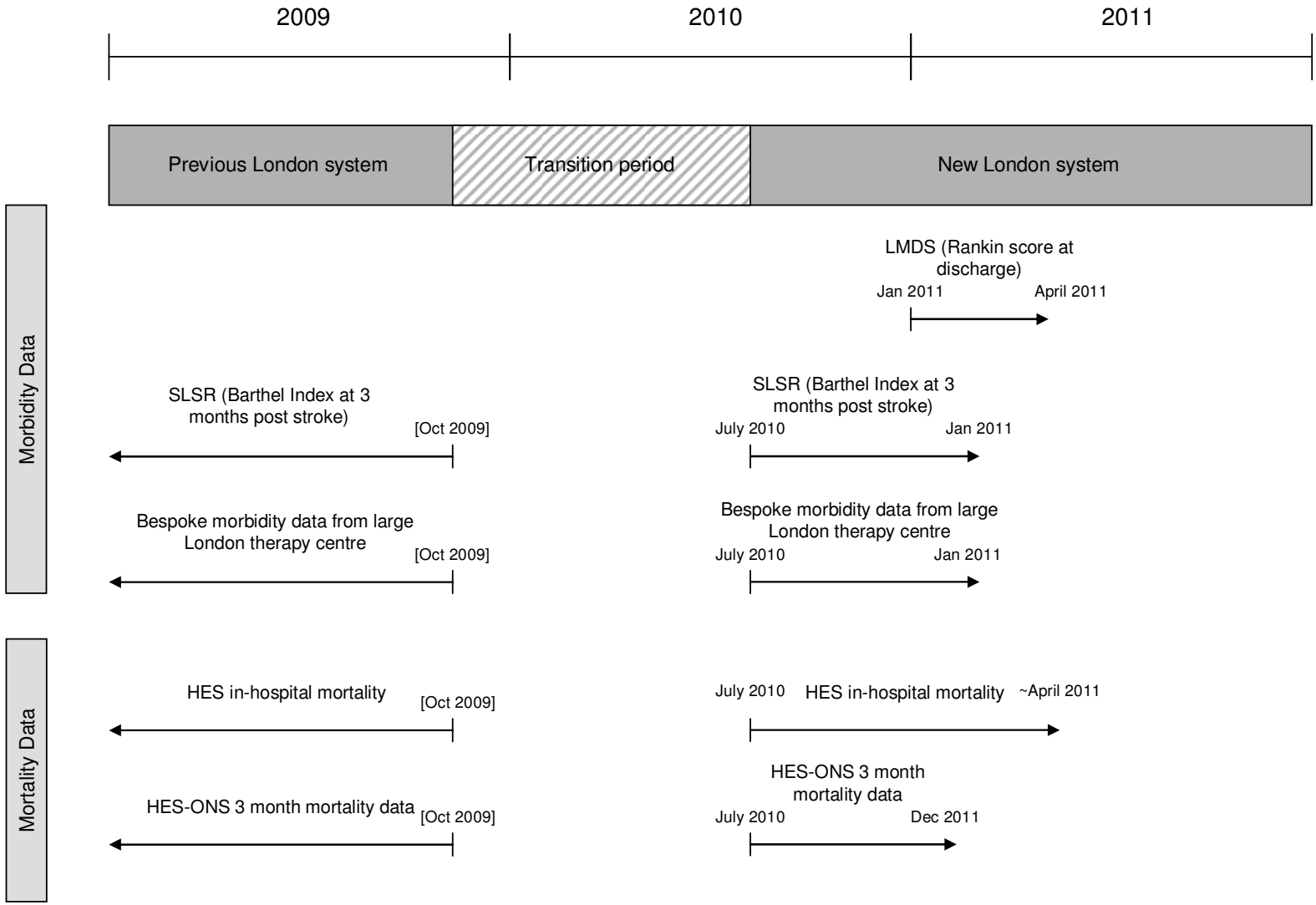
7.2. Measuring incremental health gains

Incremental health gains attributable to the additional funding can be estimated by measuring the morbidity and mortality of patients treated by the new London system as compared to the previous London system (leaving aside for the moment the issue of potentially needing to adjust health gains associated with the previous London system to account for improvements that may have been made over time in the absence of the additional funding).

In theory, the best approach would involve measuring morbidity and mortality by following-up patients for as long as feasibly possible. However, in practice, as discussed in section 4 the project will be constrained by the requirements of the timing of a potential evaluation and therefore it will only be possible to use patient outcome data up to around June 2011.

Figure 1, overleaf provides an overview of what may be feasible to measure in terms of health outcomes for the new London system and the previous London system and this is discussed further below.

Figure 1 – overview of health outcomes that may be feasibly measured by June 2011 for the new and previous London stroke systems (dates relate to patient onset of stroke)



7.2.1. Measuring differences in morbidity

Annex C1 sets out those data items that could potentially be used to measure morbidity for the new London and counterfactual system. This is discussed further below.

Data collected as part of the London Minimum Data Set (LMDS) (see Annex B2 for an overview) on patients' independence in activities of daily living (ADL) at discharge from acute care (as measured by the Rankin score) should be available. However, the LMDS was launched on 1st January 2011 and as such would only provide data relating to the new London system. It would, therefore, not be possible to obtain data from the LMDS for the previous London system. In any case, measuring morbidity at discharge is not particularly useful in measuring health outcomes since time of discharge can vary significantly by stroke unit and therefore does not represent a consistent point in time for patients post-stroke. It is necessary, therefore, to measure patient morbidity at a fixed point in time, post-stroke.

The South London Stroke Register (SLSR) (see Annex B3 for an overview) provides data on functional recovery of stroke patients, measured using the Barthel Index, at 3 months post-stroke and annually thereafter. The SLSR data collection began in 1995 and is ongoing and therefore should allow for data to be collected that relates to both the new and previous London systems. However, the SLSR covers a multi-ethnic population of around 230,000 in South London and as such may not be representative, in terms of patient characteristics, of the London population as a whole. Therefore, when extrapolating the results to the rest of London it might be necessary to control results in order to account for variations in ethnic mix and other socio-demographic characteristics. There is an approximate two month lag between patients being assessed at three months post-stroke and the register data becoming available for use. Therefore, by June 2011 it should be feasible to access three month post stroke morbidity data from the SLSR for patients treated by the new London system with onset of stroke from July 2010 to January 2011.

There may be issues associated with using data that relates solely to a particular region of London (i.e. data from the SLSR relates just to South London) because different regions of London have been at different stages of development at various points in time. Ideally, whatever data sources are used to measure morbidity for both the previous and new systems, the data should represent London as an aggregate whole. For example, we understand that South London may have been more advanced in terms of its stroke services than other regions, therefore in using the SLSR to measure morbidity for the previous London system it may be desirable to calibrate the point in time (pre-October 2009) that morbidity levels are measured using the SLSR such that the South London stroke service best represents London's position as an aggregate whole just before October 2009. It may be that the Sentinel Stroke Audits (SSA) that have been conducted could assist with this.

There is a one-off charge to access data from the SLSR which starts at around £1,000 - £2,000 up to around £10,000 depending upon how much modelling of the raw data is required.

It may also be feasible to collect bespoke data relating to functional recovery of stroke patients from a large London stroke therapy centre such at that at UCLH, at a certain number of months post stroke, for the new and previous London systems. This data could complement that obtained through the SLSR.

We have also investigated whether use could be made of bespoke patient outcome data collected at St Georges Hospital. Unfortunately, the data will not be available until autumn 2011 and therefore will not be suitable for the purposes of the main evaluation.

An approach to convert Barthel Index data into Health Related Quality of Life (HRQoL) measures (required to determine QALY gains) already exists. There is also a potential approach to convert Rankin score data into HRQoL measures but further investigation is required to understand how robust this methodology is.

There are other measures (as opposed to those that directly measure ADL or functional recovery at a fixed point in time post-stroke) that could act as proxies for patient morbidity (for example, institutionalisation at discharge, general hospital readmission rates and stroke recurrence rates). Such measures would not be directly convertible to HRQoL measures (and hence QALY gains), but could be used to help understand any differences in morbidity detected between the two systems.

7.2.2. Measuring differences in mortality

Annex C2 sets out those data items that could potentially be used to measure mortality for the new London and counterfactual system. This is discussed further below.

HES data will provide in-hospital mortality for all stroke patients treated by the new and previous London systems. However, the length of patients' in-hospital stay varies and, as with morbidity, it is more appropriate, for the purposes of a cost-effectiveness evaluation, to measure morbidity at a fixed point in time.

HES data linked to ONS death records (see Annex B6 for an overview) will provide mortality data at three month post-stroke. However, the delays associated with linking HES data with ONS records means that for the new London system, by June 2011 three month mortality data will only be available for patients treated up until around January 2011. For the previous London system it is feasible to obtain three month mortality data for all stroke patients.

The delays associated with linking HES and ONS records mean that it would not be possible to measure mortality for the new London system (and hence the previous London system) beyond three months post-stroke.

The South London Stroke Register (SLSR) would also provide three month mortality data for South London stroke patients, however, this does not provide advantage over HES-ONS data which covers all areas of London.

7.2.3. Powering samples

As described previously, the project is constrained by the timing of the evaluation and the data sources available. It is therefore not feasible to specify a certain sample size required in order to have a certain confidence in detecting differences in morbidity and mortality. However, given that a good idea of the sample size should be known (i.e. from the SLSR and HES data) it should be possible to specify the magnitude of difference in morbidity and mortality that the sample size will allow the evaluation to detect.

7.2.4. Controlling for variation in non-acute part of pathway

Since the project aims to measure the incremental health gains attributable to the additional funding associated with the *acute* part of the patient pathway and since it aims to measure health outcomes at three months post-stroke (i.e. beyond just the acute part of the pathway) it may be necessary to control for variation in the non-acute parts of the pathway up until three months post-stroke. Rehabilitation services will vary over time and regionally and further investigation of this and how it can be controlled for in an evaluation is required.

7.2.5. Adjusting previous London system for improvement over time

As described in section 7.1, use of the previous London system which was last fully operational in October 2009, as a proxy for the counterfactual system, is not ideal since it does not represent how London might have operated *today* without the additional funding and under a more local and less centralised system, rather it would only represent how such a system was operating pre-October 2009. It may be possible to adjust for this by considering the scale of health gains between October 2009 and today observed for another geographical region that has operated using the standard national tariff (i.e. not subject to additional funding). In theory, this improvement would be subtracted from any improvement observed in London over this period in order to leave those health gains attributable to the additional funding. However, this approach could be particularly "data hungry" since it would involve measuring health gains for another geographical control region as well as those measured for London. It also assumes that the rate of improvement over this period in the control region is the same as that which London would have experienced without the additional funding.

7.2.6. Potential seasonality of stroke incidence

We understand that there is evidence to indicate that there may be a seasonal variation in the incidence of stroke. Therefore, as well as the constraints as to when it is possible to observe patient outcomes (i.e. relating to data availability and when the previous and new systems were operational) it will be desirable to design an evaluation such that health outcomes for the previous and new London systems are measured at approximately similar times of the year.

7.2.7. Converting differences in HRQoL measures and mortality into lifetime QALY gains

Since health gains (i.e. differences in morbidity converted into HRQoL measures and mortality) at three months post stroke can be observed, it will be necessary to extrapolate or simulate forward the health gains in order to estimate lifetime QALY gains. There will be different ways to do this and further thinking in this area will be required. It will also be necessary to perform sensitivity analysis around any assumptions made as part of this process.

It may be that long-term follow-up data from the South London Stroke Register (SLSR) used to model the general profile of morbidity and mortality for the stroke population can be used for this process and in the most simple scenario it may be assumed that any incremental health gains observed at three months are maintained up until the point of death.

7.3. Measuring incremental direct costs or cost savings

The business case estimates that the enhanced tariff will provide additional funding of around £21m per year to the acute part of the new London system's patient pathway. This was estimated by considering the additional costs associated with achieving the higher quality of acute care (mainly due to more intensive nursing, greater levels of imaging and thrombolysis) offset by a cost reduction due to an assumed average reduction in patient length of stay of two days (due to an assumption that patients will be medically fitter, faster). The enhanced tariff was constructed around these assumptions.

In order to estimate the true incremental cost-effectiveness of the additional funding it is necessary to consider the true cost to providers of providing the new and previous systems as opposed to considering tariff costs. This can be achieved by considering stroke providers' reference costs. There is anecdotal evidence to indicate that, in some cases, reference costs may be somewhat different to tariff costs, which highlights the potential importance of using reference costs in a cost-effectiveness evaluation. Initial investigations indicate that reference costs relating to the new London system (i.e. covering the financial year 2010/11) will not be available until January 2012. It may be possible to gain early access to reference costs on a provisional basis, however, further investigation as to whether this is feasible is necessary. Accessing reference costs for the previous London system should be feasible but will require some adjustment to adjust them to represent 2010/11 prices.

The incremental cost of the new London system as compared to the counterfactual system can be calculated by comparing costs for the previous and new London systems.

If it is not possible to gain early access to reference costs for the new London system by around June 2011, the evaluation would need to be conducted using tariff costs as a proxy for the true costs (including a length of stay adjustment to reflect any disparity in the efficiency savings assumed as part of the tariff calculation and the savings actually observed in the form of reduced bed-days).

7.4. Constructing a cost per QALY metric

Costs and QALY gains can be combined to produce an incremental cost per QALY metric attributable to the additional funding. It will likely be necessary to provide confidence intervals and sensitivity analysis around any estimate to account for uncertainty in some of the measurements.

8. Areas of study supplementary to a cost-effectiveness evaluation

The following sections describe areas of study that could supplement a cost-effectiveness evaluation.

8.1. Measuring incremental wider costs, cost savings and benefits

The reconfiguration of the acute part of London's stroke service will result in a change in the morbidity and mortality profile of patients on discharge from acute care.

These changes are likely to create knock-on costs, cost-savings and benefits in a number of areas. The table below sets out the key knock-on impacts, who bears the costs, cost savings or benefits and how these knock-on impacts may be estimated.

Description of knock-on cost, cost saving or benefit	**Bearer of the cost, cost saving or benefit**	**How the impact might be measured**
Rehabilitation and community care	PCTs	To be further investigated but will depend upon assumptions made about the lifetime morbidity/ mortality profile.
Nursing home, carer, longer-term care	Individuals, LAs and carers	
London Ambulance Service	Non-stroke patients	Response times for non-stroke patients as a result of ambulances being forced out of area to respond to a stroke.
Return to work costs	Employers, employees	Studies that relate morbidity at 3 months with return to work.

8.2. Equality

The cost-effectiveness evaluation that has been described will not, on its own, measure equality. It should be possible, as a distinct study, to measure equality aspects of the new London system and the counterfactual system. For example, equality of access to stroke services can be considered using HES data to consider various patient characteristics (such as deprivation and ethnicity) against the quality and speed of admission. For the new London system it might be assumed that services have been (relatively speaking) standardised at least for the first 72 hours. However, it would be necessary to check, using HES data, that all or most stroke patients are being admitted properly to the new system. For the previous, more local system, a proxy for the quality of service admitted to could be obtained via the Sentinel Stroke Audit (SSA).

It may also be possible to consider equality of outcomes for stroke patients for the two systems. However, further investigation in this area is required.

8.3. Patient experience

It may be possible to supplement the cost-effectiveness analysis with a qualitative evaluation of patient experience associated with the two systems based upon available data. It has been suggested that the Stroke Association may be able to help in gathering some qualitative assessments of the new service.

8.4. Implementation costs

The cost-effectiveness evaluation described above would not consider costs associated with implementation of the new London system, i.e. the approach takes into account the additional running costs of the new system but considers the implementation costs to be sunk costs. This may be an appropriate approach when considering the future funding of the London system. However, it may be beneficial to understand the scale of the implementation costs in order to set the cost-effectiveness evaluation in context. Understanding of the implementation costs alongside a cost-effectiveness evaluation may be beneficial for another region considering implementing a similar system.

We understand that the investment required to meet the London Stroke Strategy varied significantly across trusts, therefore understanding implementation costs would likely require liaising with finance officers within each trust.

8.5. Centralised v localised systems

It could be argued that, for specialist care, the benefits of a centralised system build up over time (for example, through enabling specialist clinicians to hone their skills through treating greater volumes of patients and having the ability to more quickly and easily introduce high-tech equipment through economies of scale). Similarly, it might be argued that the benefits associated with a more localised system (i.e. the ability to allow competition to drive quality) also comes with time. The proposed cost-effectiveness evaluation (which would measure the effectiveness of the new London system soon after it was implemented) would not tackle these issues. Therefore, there may be scope to supplement the cost-effectiveness evaluation with a study of when centralised and localised systems have been shown to be beneficial (in other areas of health care) in terms of patient outcomes.

Annex A. List of individuals consulted with as part of the feasibility study

Individual	Area of knowledge or expertise
Marisa Rose *Network Project Lead* *NEL Cardiac and Stroke Network*	London stroke data generally
Hilary Walker *Director, NW and NC London Cardiac and Stroke Networks*	London stroke data generally
James Campbell *SINAP manager*	SINAP data source
Uta Henssge *SSA manager*	SSA data source
Gemma Snell *Service Improvement Project Manager & Information Analyst* *NW London Cardiac & Stroke Network*	LMDS data source
Gurkamal Virdi *Assistant Head of Clinical Audit and Research* *London Ambulance Service*	LAS data source
Omer Saka *Consultant*	NAO discrete-event-simulation model
Dr Barry Moynihan *Consultant in Stroke Medicine,* *St. George's Healthcare NHS Trust*	Patient outcome data collected at St Georges
Professor Charles Wolfe *Professor of Public Health* *Head Division of Health and Social Care* *Director of R&D Guy's and St Thomas' NHS Trust*	SLSR data source
Professor Alistair McGuire *Chair in Health Economics, LSE*	Health Economics

Annex B1. Data Source Description: SINAP

Data source:	**Stroke Improvement National Audit Programme (SINAP)**
Description:	A new national audit to enable a more detailed understanding of stroke services in the hyper-acute section of the stroke pathway. Focuses more on care standards than patient outcomes.
Period over which data is collected:	4th May 2010 onwards (Went live on 4th May 2010 and will run until 31st March 2011 - funding is being sought to continue beyond this.)
Part of stroke pathway covered:	First 72 hours
Inclusion criteria:	All patients that elicit a response from a stroke team
Data items particularly relevant:	Patient outcome measures: • In-hospital mortality (first 72 hours) • Morbidity at 3 months (Rankin score). (But unlikely to be completed since is not a mandatory field.) • Relative change in patient condition (worse, same or better than at presentation) during each 24 hour period within the first 72 hours Intermediate measures: • A number of measures relating to the first 72 hours of care (e.g. timings of care in relation to onset of stroke, thrombolysis, compliance with care standards etc.)
What will be available by June 2011?	**In theory – all activity from July 2010 – April 2011.** However, in practice, data coverage is unclear at present.

Annex B2. Data Source Description: LMDS

Data source:	**London Minimum Data Set (LMDS)**
Description:	A new minimum dataset for London stroke services to enable reporting against key national and local priorities (e.g. NICE, Accelerating Stroke Improvement and the 'Healthcare for London' acute stroke commissioning tariff standards of performance)
Period over which data is collected:	1st January 2011 onwards (Went live on 1st January 2011 and is on-going. There was a small pilot carried out in Nov 2010 which collected a very small number of records (~ 80 records))
Part of stroke pathway covered:	HASU care to discharge from SU
Inclusion criteria:	All London providers of stroke care
Data items particularly relevant:	Patient outcome measures: • Morbidity at admission to acute care (HASU) (Rankin score) • Morbidity at discharge from acute care (Rankin score) • In-hospital mortality • Final discharge destination Intermediate measures: • A number of measures relating to SU hospital care (i.e. post first 72 hours) (e.g. physiotherapy, occupational therapy, speech and language assessments etc)
What will be available by June 2011?	**In theory – all activity from January 2011 – April 2011** However, in practice compliance with data collection may vary by service and it is too early to get an indication of compliance with data collection.

Annex B3. Data Source Description: SLSR

Data source:	**South London Stroke Register (SLSR)**
Description:	A prospective stroke register covering a multi-ethnic population of around 240,000 in South London.
Period over which data is collected:	Ongoing
Part of stroke pathway covered:	From onset of stroke onwards
Inclusion criteria:	All stroke patients in South London
Data items particularly relevant:	Patient outcome measures: • Patient outcomes at 3 months (ADL (Barthel Score), mortality, secondary prevention indicator) • Annual follow-up
What will be available by June 2011?	**Patient outcomes relating to patients with stroke onset from July 2010 – Jan 2011**

Annex B4. Data Source Description: SSA

Data source:	**Sentinel Stroke Audit (SSA) – Clinical Audit**
Description:	An ongoing national audit that takes place every two years used to monitor stroke care against national standards.
Period over which data is collected:	Latest audit: 1st April – 30th June 2010 Previous audit: 1st April – 30th June 2008
Part of stroke pathway covered:	Stroke onset to discharge from acute care
Inclusion criteria:	All providers of stroke care First 60 consecutive cases (for each hospital)
Data items particularly relevant:	Patient outcome measures: • Morbidity at discharge (Barthel score) • Whether newly institutionalised at discharge Intermediate measures: • A number of measures relating to care from onset to discharge
What will be available by June 2011?	Data from both audits (2008 and 2010).

Annex B5. Data Source Description: LAS

Data source:	**London Ambulance Service (LAS) data**
Description:	Operational data relating to the LAS
Period over which data is collected:	Ongoing. May 2010 onwards detailed data available. Pre- Feb 2010 less detailed data available (unclear whether can separate out stroke patients from the 'stroke plus neurological conditions' group). (Feb 2010 to May 2010 was a transition period for LAS data collection.)
Part of stroke pathway covered:	Ambulance response rates
Inclusion criteria:	All stroke patients that elicit a response from the LAS.
Data items particularly relevant:	Ambulance response times, e.g. • Time for ambulance to reach scene • Time spent at scene • Time from scene to acute care
What will be available by June 2011?	Data relating to patients with onset of stroke from May 2010 to around April 2011 Less detailed data relating to patients with onset of stroke Pre-Feb 2010. However, is unclear whether it will be possible to access patient level data or aggregate level data.

Annex B6. Data Source Description: HES-ONS

Data source:	**HES – ONS linked mortality data**
Description:	HES – ONS linked mortality data
Period over which data is collected:	Ongoing.
Part of stroke pathway covered:	Mortality
Inclusion criteria:	All relevant patients recorded on HES
Data items particularly relevant:	• Mortality at 3 months post stroke
What will be available by June 2011?	By **July** 2011 it should be possible to have 3 month mortality data for patients treated during the period July 2010 – Dec 2010.

Annex C1. Morbidity data items for new London system and potential proxies for the counterfactual system

Measurable parameter	New London system	Proxies for the counterfactual	
		Previous London system	System in other geographical location
Morbidity at discharge from acute care	***LMDS*** • Rankin score		***Other local geographical dataset similar to LMDS?*** • Rankin score / Barthel Index (?)
Morbidity at 3 months	***SLSR*** • Barthel Index	***SLSR*** • Barthel Index	
Morbidity at annual follow-up	***SLSR*** • Barthel Index	***SLSR*** • Barthel Index	
Morbidity at x months	***Locally collected data from therapy centre (e.g. UCLH)?*** • Rankin score / Bartel Index?	***Locally collected data from therapy centre (e.g. UCLH)?*** • Rankin score / Bartel Index?	
Proxies for morbidity	***HES*** • Discharge destination • Readmission rates • Recurrence rates • Any medical procedures that could act as proxies for morbidity?	***HES*** • Discharge destination • Readmission rates • Recurrence rates • Any medical procedures that could act as proxies for morbidity?	***HES*** • Discharge destination • Readmission rates • Recurrence rates • Any medical procedures that could act as proxies for morbidity?

	LMDS • Discharge destination ***SINAP*** • Relative change in patient condition in each 24-hour period during first 72 hours (worse, same or better than at presentation)		***Other local geographical dataset similar to LMDS?*** • Discharge destination?

Annex C2. Mortality data items for new London system and potential proxies for the counterfactual system

Measurable parameter	New London system	Proxies for the counterfactual	
		Previous London system	System in other geographical location
In-hospital mortality	***SINAP*** • Within first 72 hours ***LMDS?*** • [If died during post first 72 hours acute stay ?] ***HES*** • In-hospital mortality	***HES*** • In-hospital mortality	***SINAP*** • Within first 72 hours ***HES*** • In-hospital mortality
Mortality at 3 months	***HES-ONS data*** • Mortality at 3 months	***HES-ONS data*** • Mortality at 3 months	***HES-ONS data*** • Mortality at 3 months

Annex C3. Control parameters relating to new London system and potential proxies for the counterfactual system

Measurable parameter	New London system	Proxies for the counterfactual	
		Previous London system	System in other geographical location
Patient demographics	***HES*** • Age • Sex • Ethnicity • Deprivation index • Various area -level data ***SINAP/LMDS*** • Age • Sex • Area of residence (?)	***HES*** • Age • Sex • Ethnicity • Deprivation index • Various area-level data	***HES*** • Age • Sex • Ethnicity • Deprivation index • Various area-level data ***Other local geographical dataset similar to SINAP/LMDS?***
Morbidity at admission to hyper-acute care	***LAS*** • FAST details ***LMDS*** • Rankin score ***SLSR (?)*** • Bartel Index (?)	***SLSR (?)*** • Bartel Index (?)	***Other geographical regions ambulance service data?*** • FAST details(?)

Annex C4. Intermediate measures/ process measures relating to new London system and potential proxies for the counterfactual system

Measurable parameter	New London system	Proxies for the counterfactual	
		Previous London system	System in other geographical location
Ambulance response rates	***LAS*** • Time for ambulance to reach scene • Time spent at scene • Time from scene to acute care	***LAS*** • Time for ambulance to reach scene • Time spent at scene • Time from scene to acute care	***Other geographical regions ambulance service data (?)*** • Time for ambulance to reach scene • Time spent at scene • Time from scene to acute care
Intermediate measures/ process measures during acute care	***SINAP*** (up to first 72 hours of acute care) • Timings of treatment in relation to onset of stroke • Thrombolysis rates • Time spent on various ward types (GMW, SU etc) • Standards achieved (e.g. assessments by nurses, occupational therapists, physiotherapists, speech and language etc)		***SINAP*** (up to first 72 hours of acute care) • Timings of treatment in relation to onset of stroke • Thrombolysis rates • Time spent on various ward types (GMW, SU etc) • Standards achieved (e.g. assessments by nurses, occupational therapists, physiotherapists, speech and language etc) (Or data from local database or dataset if have good local data but region not submitting good data to SINAP.)

	LMDS (acute care) • Ward type (GMWs/ SU) • Standards achieved (e.g. assessments by nurses, occupational therapists, physiotherapists, speech and language etc) ***SLSR*** • Some process data relating to acute care ***Length of stay (LOS) data*** • Locally collected	***SLSR*** • Some process data relating to acute care ***Length of stay (LOS) data*** • Locally collected (?) ***SSA 2010*** • A number of data items such as the % of patients spending most of their time in a dedicated stroke unit (as at April- June 2010)	***Other local geographical dataset/ database similar to LMDS?*** ***Length of stay (LOS) data*** • Locally collected ***SSA 2010*** • A number of data items such as the % of patients spending most of their time in a dedicated stroke unit (as at April- June 2010)

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