

Cardiovascular project

Proposed model of care

August 2010



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Executive summary

Commissioning Support for London's model of care for cardiovascular services aims to improve the treatment, care and health outcomes for Londoners with cardiovascular disease.

The development of the model has been clinically led with extensive patient input and addresses issues highlighted in an assessment of services in the capital. It should assist commissioners in considering how cardiovascular services can be arranged to provide better outcomes, improved patient experience and world-class care for all.

The model of care proposes improvements to the delivery of care and patient pathways for vascular services, cardiac surgery and cardiology.

Vascular services

The model of care proposes vascular services be provided as part of an effective, comprehensive network system. The clinical expert panels felt that five central units providing arterial vascular surgery each linked with several local units, would be the optimum number of units to deliver the best outcomes.

Central units would perform all elective and emergency arterial surgery. The units would be staffed by vascular specialists and would operate 24 hours a day, seven days a week. Performing all complex procedures at central units would ensure all patients have their surgery at a high volume hospital by an experienced vascular specialist, using the latest technology and techniques.

The role of local hospitals will be crucial to ensuring high quality, equitable vascular care. Local hospitals would continue to deliver the majority of vascular services including the full range of day surgery procedures, supported by outpatient and diagnostic facilities. These units would continue to deliver varicose vein surgery, amputations and selected limb interventions, which represent around 75% of all vascular services.

Cardiac surgery

The model proposes changes to the management of non-elective cardiac surgery patients to reduce transfer waiting times and reduce post-operative length of stay. It also advocates specialist treatment for major cardiothoracic aortic and mitral valve disease.

Patients waiting for non-elective cardiac surgery should follow a pathway based on pan-London referral, assessment and transfer protocols. Agreed clinical protocols should be used to diagnose all patients with suspected heart disease and establish their need for surgery. Those needing surgery would be risk assessed to determine priority for transfer and treatment, based on clinical need. Some low risk patients may be discharged home with a planned date for surgery.

Hospitals should have appropriate discharge plans in place to reduce patients' post-operative length of stay. They would work together in a cardiac surgery benchmarking group to compare performance and establish London-wide standards for the length of stay following cardiac surgery. Trusts should work



together to consider changes in working arrangements to reduce unnecessarily long post-operative stays.

All patients requiring emergency surgery for acute type A aortic dissection should only be operated on at units that have all the essential facilities on site including a comprehensive 24-hour cardiology, cardiac surgery, vascular surgery and interventional vascular radiology service. Elective surgery for the thoracic aorta would only take place at units with a cohesive vascular thoracic service and an active multidisciplinary team.

For mitral valve procedures, the model advocates that these patients must be treated by teams with appropriate expertise and specialism. Sub-specialisation of mitral valve surgery would ensure these complex procedures are delivered by specialists, which would improve patient outcomes and increase the use of mitral valve repair. Units should only refer patients to surgeons with appropriate mitral valve expertise. Those who are not initially referred to specialists would be subsequently transferred.

Cardiology

The proposed model of care would ensure better assessment and treatment of patients with non ST-elevation acute coronary syndromes (NSTEMACS) and advocates the creation of electrophysiology networks.

All high risk NSTEMACS patients should follow a pathway that guarantees treatment within 24 hours, as needed. Patients with suspected NSTEMACS would be diagnosed in an emergency department and risk assessed using pan-London clinical criteria and biomarkers. High risk patients would receive immediate, evidence-based medical therapy and then either be admitted to the local hospital, if it is capable of undertaking an angiogram and percutaneous coronary intervention (PCI) within 24 hours of initial assessment; or be transferred to a centre capable of doing so.

The new pathway would ensure direct admission or transfer to a unit capable of providing early access to an angiogram and PCI. This would improve equity of service across London and avoid two hospital admissions for many patients.

Units in London currently delivering electrophysiology procedures would become part of regional networks, comprising of central and local units. Central units would carry out most complex procedures including ablations, ICD procedures and CRT implantations, as well as providing emergency cover for acute electrophysiology problems. All units in the network would provide follow-up care and support.

Central and local units would work together to improve the identification, referral and treatment of patients needing complex electrophysiology procedures, which would help to increase uptake of these procedures.

The future of cardiovascular services

As well as clinical improvements, the model makes recommendations for non-clinical aspects of cardiovascular services including academia and research; workforce and training; and rolling out new technology.



Improvements in these areas will contribute to delivering a world-class cardiovascular service for patients in London.



Foreword

By Martin Saunders & Jeremy Gold - Co chairs of the cardiovascular patient panel

This project has improving outcomes for patients at its core. The cardiovascular model of care is designed to improve treatment, care and outcomes for all Londoners. It is about saving the lives of the many people in the capital who suffer from cardiovascular disease and meeting growing demand as the population ages.

The model has been developed following a comprehensive assessment of how services are currently provided in the capital, a robust review of clinical evidence and a review of national and international best practice.

Key to the work of the project was the work of the patient panel, which we jointly chaired. The group was comprised of people that have direct experience of being treated in London hospitals for varying types of cardiovascular disease. In this group we were able to shape the project recommendations and, in partnership with the clinical groups, ensure that the project recommendations were patient centred.

In addition to chairing the patient group, we also attended all of the clinical expert panel meetings. There were three multi-professional clinical expert panels each focusing on a specific area of work – vascular services, cardiac surgery and cardiology. This really meant that recommendations came out of partnership working between clinicians and patients.

We want this document to be used by London's commissioners to commission the world-class cardiovascular services all Londoners deserve. In practice, this means achieving better outcomes for patients including:

- saving more patients' lives
- increasing the speed and equity of services
- improving patient access
- reducing the length of time spent in hospital
- meeting unmet needs
- improving the use of new technology and research
- making the best use of NHS resources and saving public money.

We believe that the model of care addresses these issues and sets out a blueprint for providing the highest quality services for all Londoners.



1. Vascular services

The case for change assessment made a compelling case for changing the way vascular services in the capital are provided, in order to improve outcomes and equity of service for patients and make the best use of NHS resources. It found that:

- It is anticipated there will be an increased need for clinical quality and outcomes in arterial surgery following the roll out of the national aneurysm screening programme.
- The current distribution of arterial surgery across London is not appropriate. About 75% of surgery takes place in six hospitals and 25% is spread across the remaining hospitals.
- Patients achieve the best outcomes following arterial surgery if it is done at a high volume hospital, by a vascular specialist team including surgeons and interventional radiologists.
- Patients who have an endovascular stent to repair their elective or ruptured abdominal aortic aneurysm have better outcomes than those who have their aneurysm repaired using the open technique. Currently, the uptake of endovascular stenting in the UK is low compared to European comparators.
- The length of stay for patients following vascular surgery varies hugely across the capital and the UK has the longest length of stay in Europe for elective aneurysm surgery. The NHS in London can improve patient experience by performing vascular surgery at specialist centres and adopting better surgical technologies, which are proven to reduce lengths of stay.
- A quality vascular service has a defined range of co-dependent clinical services to achieve the best outcomes and resource utilisation.

To address these findings, this model recommends concentrating all elective and emergency arterial services at fewer centres, while continuing to deliver a high quality vascular service locally. Arterial services include abdominal aortic aneurysm repair, carotid endarterectomy surgery and lower extremity arterial bypass surgery. The model reflects the proposals in recent key reports by The Vascular Society^{1 2} and the National Confidential Enquiry into Patient Outcome and Death (NCEPOD)³.

¹ The Vascular Society of Great Britain & Ireland, *The provision of services for patients with vascular disease*, 2009.

² The Vascular Society of Great Britain & Ireland, *The provision of emergency vascular services*, 2007 <http://www.bsir.org/files/File/C_Provision_of_Emergency_Vascular_Services_Final_Doc.pdf>.

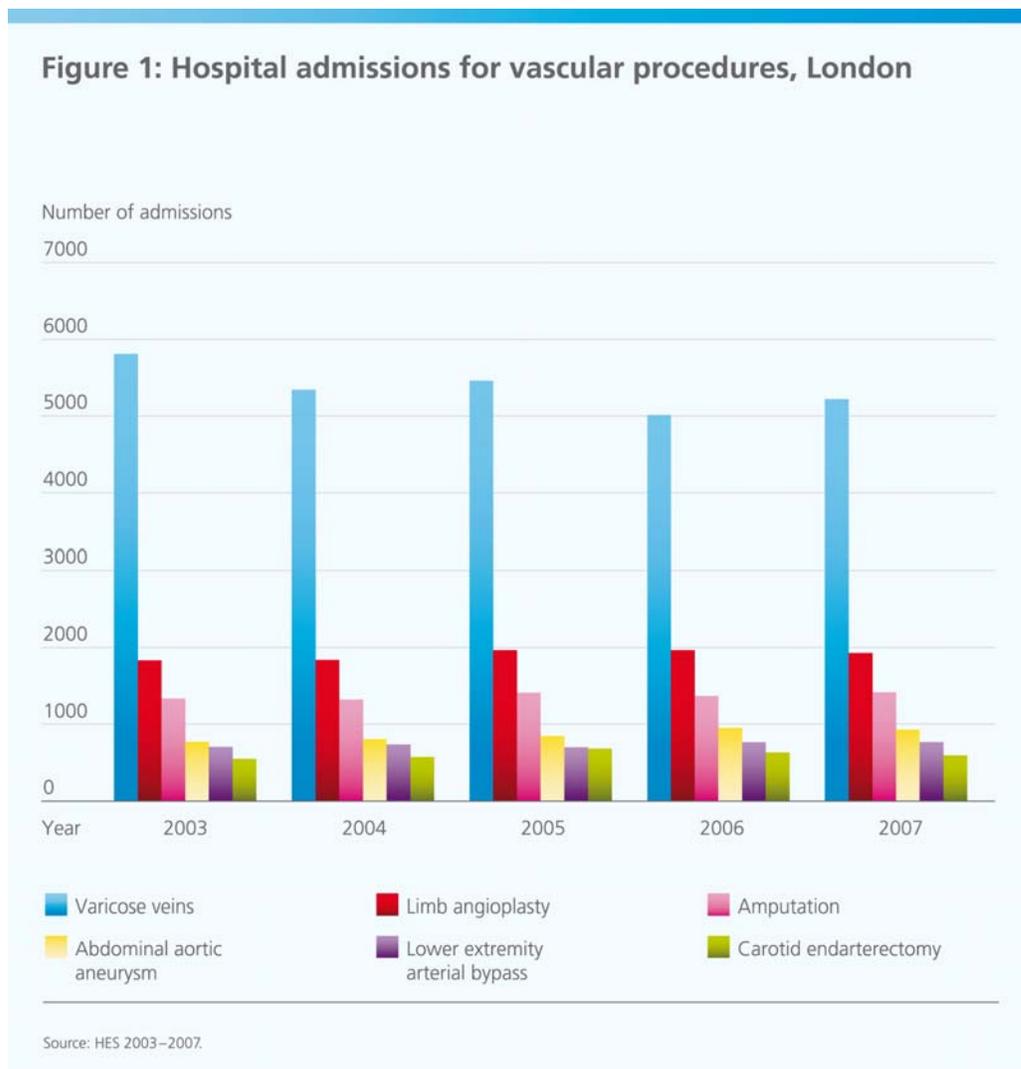
³ The National Confidential Enquiry into Patient Outcome and Death, *Abdominal Aortic Aneurysm: A Service in Need of Surgery?*, 2005.



1.1 Creating vascular networks

Arterial surgery is safer when done at hospitals performing high volumes of arterial procedures. Currently in London, there are a large number of hospitals performing relatively low volumes of procedures.

To improve patient outcomes and provide a world-class service, the model of care recommends centralising all elective and emergency arterial services at a few, high volume central vascular units. Most venous services, which represent around 75% of the total volume of vascular services (see figure 1), would continue to be provided at all hospitals currently performing them.



Given London's large population and the unstructured past development of hospitals, this model aligns with The Vascular Society's position that centralisation is 'more likely to be feasible in areas of relatively dense population where two or more hospitals are



relatively close. It is the preferred method of providing high standard vascular services⁴.

Centralising arterial services would enable vascular service providers to implement the Department of Health's *Stroke and TIA* initiative⁵ recommendation that patients should be able to access carotid endarterectomy services on an urgent basis.

In order to implement these recommended improvements to vascular services, including centralising all arterial services, some hospitals may not have capacity to accommodate all arterial surgery immediately. To overcome this issue, there should be a transition plan enabling designated central vascular units to perform abdominal aortic aneurysm repairs and carotid endarterectomies immediately. Lower extremity arterial bypass surgery should be moved to the central units over a planned, organised period of time, once capacity planning has been carried out and sufficient capacity has been identified.

Network structure

The proposed model will operate as an effective cohesive system, comprising of numerous central vascular units across London, each one linked with several local units. Central and local units should work in partnership to provide a comprehensive vascular service for a defined local population. The patient panel were particularly keen to stress the importance of a local service, and that were transfers between different sites were necessary (for both elective and non-elective care) that they were conducted in a smooth, efficient and organised way.

Central vascular units would be the clearly defined source of excellence for arterial intervention and would lead the network. Central units should all have a responsibility for ensuring that standards of clinical and non-clinical governance are robust and were all to a defined high standard across the region. As a result, vascular services would be delivered consistently across the capital so all Londoners receive the same high quality care and have equal access to services.

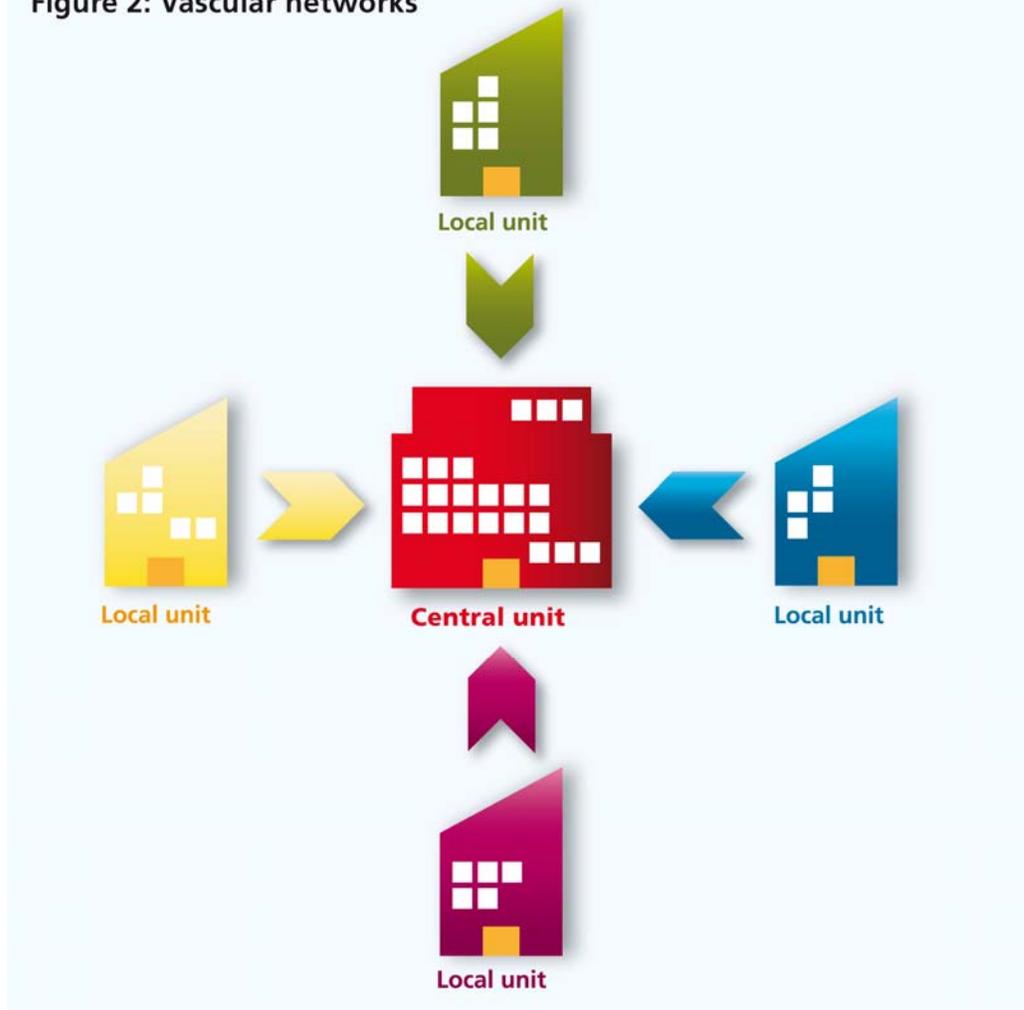
The model does not recommend a network structure in which a number of hospitals that perform low volumes of arterial procedures, pool surgeons to provide either elective or emergency arterial services at every site in the network. Arterial procedures should only take place at designated, high volume central vascular units.

⁴ The Vascular Society of Great Britain and Ireland, *The Provision of Services for Patients with Vascular Disease*, 2009.

⁵ Department of Health, *Improving stroke services: a guide for commissioners*, 2009, <http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_076287.pdf>.



Figure 2: Vascular networks



Number of central units

A number of factors were considered to determine the optimal number of central vascular units to provide all Londoners with a high quality, safe and equitable arterial service.

Factors considered were:

- current and future volumes of arterial procedures
- number of surgeons
- co-dependencies.

For a detailed analysis of the number of central vascular units needed in London see appendix 1.



Assessment of these factors by the clinical expert panel lead them to recommend that there should be five central vascular units, each staffed with at least eight surgeons, would be the optimum number of central units for London. The panel's clinical groups felt that five central units would ensure each unit achieves a critical mass of arterial procedures, particularly abdominal aortic aneurysm repairs, and have enough vascular surgeons to provide elective and 24-hour emergency care for unit's population.

1.2 The role of central units

The model proposes that all elective and emergency arterial surgery would be performed only at a central vascular unit. Arterial surgery includes abdominal aortic aneurysm repair, carotid endarterectomy surgery and lower extremity arterial bypass surgery. These procedures comprise around a quarter of all vascular surgery in London.

GPs would continue to refer all vascular patients to their local hospital in the same way as they do now.

Patients whose local hospital is also a central unit would continue to be referred to that hospital by their GP. The hospital would continue to act as their local hospital, meaning certain patients with venous, lymphatic and arterial disease would be referred directly to the central unit for treatment. On arrival, patients would have access to the usual range of vascular and support services including outpatient appointments, diagnostics and venous surgery.

Patients presenting at any other local hospital who need an elective arterial procedure would have most of their pre-surgery investigation at that local hospital before being transferred to a central unit for treatment. All patients would receive the same high quality standards of service regardless of whether they are transferred from a local hospital to the nearest central unit, or referred directly to the central unit by their GP.

Increased endovascular aneurysm repair

Currently the uptake of endovascular aneurysm repair procedures across London is variable. This is most likely due to a shortage of specialist equipment and compounded by a shortage of 24-hour emergency cover by vascular surgeons and interventional radiologists. Performing abdominal aortic aneurysm procedures at specialist, high volume units would increase the use of endovascular aneurysm techniques. An increased use of endovascular aneurysm repair would improve patient outcomes, enhance patient experience and make the best use of NHS resources.

Central vascular units would have access to vascular specialists and the most appropriate equipment and technology 24 hours a day, seven days a week. This would ensure the endovascular technique is used to repair the majority of abdominal aortic aneurysms. Patient outcomes would improve with the increased use of endovascular aneurysm repair as this technique is clearly associated with significantly lower mortality levels compared with open repair techniques⁶.

⁶ R.M. Greenhalgh et al, 'Comparison of endovascular aneurysm repair with open repair in patients with abdominal aortic aneurysm (EVAR trial 1), 30-day operative mortality results: randomised controlled trial', *The Lancet*, 2004, 364: 843-848.



Data also shows the average post-operative hospital length of stay in London is lower following endovascular aneurysm repairs compared with open repair techniques. The expected increase in endovascular aneurysm repair following the centralisation of arterial services would ensure the majority of abdominal aortic aneurysm patients have shorter lengths of stay, allowing patients to safely return home sooner. This would contribute to a better overall patient experience and ensure an equal service for abdominal aortic aneurysm patients.

Emergency services

The model proposes that emergency arterial services are provided on a 24-hour emergency basis at all central vascular units. This is supported by recommendations by The Vascular Society regarding the need to change current emergency arterial provision.

Key recommendations from The Vascular Society

- In 2004, the society highlighted the benefits of high volume sites, where outcomes are known to be better, and advocated the need to centralise emergency arterial services.
- In 2007, the society stated that: 'the way services are currently organised, there are not enough specialist vascular surgeons to provide full emergency rotas at every hospital site'.
- In their 2009 report, the society reiterated the need for centralising emergency arterial services.⁷

Transferring patients to central units for emergency services

Patients presenting with arterial emergencies at local hospitals without an emergency vascular service would be diagnosed and triaged in the emergency department. Patients would then be transferred immediately by the London Ambulance Service to a central unit for treatment, without being admitted to the local hospital first.

Local hospitals would have clear protocols for diagnosing and transferring patients with a ruptured abdominal aortic aneurysm.

NCEPOD⁸ demonstrated that patients treated for a ruptured abdominal aortic aneurysm by a vascular surgeon, rather than a general surgeon, have better outcomes. Patient mortality after a ruptured abdominal aortic aneurysm may be as

⁷ The Vascular Society of Great Britain and Ireland, *The provision of Services for Patients with Vascular Disease*, 2009.

⁸ The National Confidential Enquiry into Patient Outcome and Death, *Abdominal Aortic Aneurysm: A Service in Need of Surgery?*, 2005.



high as 95% if they stay in a hospital under the care of a non-vascular general surgeon, compared with 35% if they are transferred to a specialist vascular hospital.⁹

Transferring patients to a central unit for emergency arterial procedures would ensure optimal patient outcomes as they would have their procedure done in a high volume unit, with access to vascular specialist's current technology and techniques 24 hours a day, seven days a week.

On-call rotas for emergency cover

Central units would be covered by on-call specialist vascular surgeons¹⁰ on a rotational basis. Vascular surgeons from across each network would be expected to be available for emergency rota cover. To ensure sufficient 24-hour emergency cover on a rotational basis, an appropriate number of surgeons would be needed to staff each central unit. Standards for on-call rotas must be set and regularly audited to achieve this cover. See appendix 1 for recommended number of surgeons to cover each central unit.

Delivering emergency arterial cover on a rotational basis would ensure emergency vascular cover is provided 24 hours a day, seven days a week. In addition, all surgeons would gain exposure to a high volume unit and to emergency work, allowing them to maintain their expertise and specialist skills.

Supporting services and facilities

While also saving lives, centralising arterial surgery would have numerous other benefits for patients. Facilities would be improved as all central units would have ward(s) dedicated to vascular patients, better critical care facilities and dedicated operating theatres.

Ongoing interventional radiology cover would be available on site. This means these investigations would be available 24 hours a day, seven days a week and would be provided by specialists with experience in complex arterial cases. Patients would also have access to anaesthetists with experience in vascular surgery.

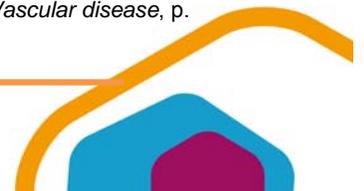
Emergency services would ensure the central unit has interventional radiologists, anaesthesia specialists and intensive care specialists available 24 hours a day, seven days a week. These specialists are all critical to the vascular emergency care team. Urgent vascular imaging would also be available 24 hours a day, seven days a week.

Facilities and support would be available so patients undergoing abdominal aortic aneurysm surgery are nursed in an intensive care unit or high dependency unit environment, in the immediate post operative period¹¹.

⁹ P.S. Basnyat et al, 'Mortality from ruptured abdominal aortic aneurysm in Wales', *British Journal of Surgery*, 1999, 86: 765-770.

¹⁰ The National Confidential Enquiry into Patient Outcome and Death, op cit.

¹¹ The Vascular Society of Great Britain and Ireland, *The provision of services for patients with Vascular disease*, p. 25, 2009.



These additional emergency services are vital to providing comprehensive elective and emergency vascular care. The availability of specialist facilities and support services would further help to improve surgical outcomes, standards of care and the overall patient experience.

The cardiovascular co-dependent services paper provides further information on the full range of services required at a central unit (see section 4).

1.3 The role of local vascular units

Local vascular units would continue to deliver the key components of a quality local vascular service. They would provide the full range of outpatient, diagnostic and day surgery for venous procedures, including:

- Varicose vein surgery.
- Amputations – patients would need local access to a limb-fitting service and while this would not necessarily be at the same unit, there should be close collaboration with prosthetics.¹²
- Selected limb angioplasty procedures where vascular cover is considered appropriate and safe. Limb angioplasty services would usually take place at units providing percutaneous coronary intervention (PCI) services.

Varicose vein surgery, limb angioplasty and amputations account for around 75% of all vascular surgery in London, so local hospitals would continue to provide the majority of vascular services.

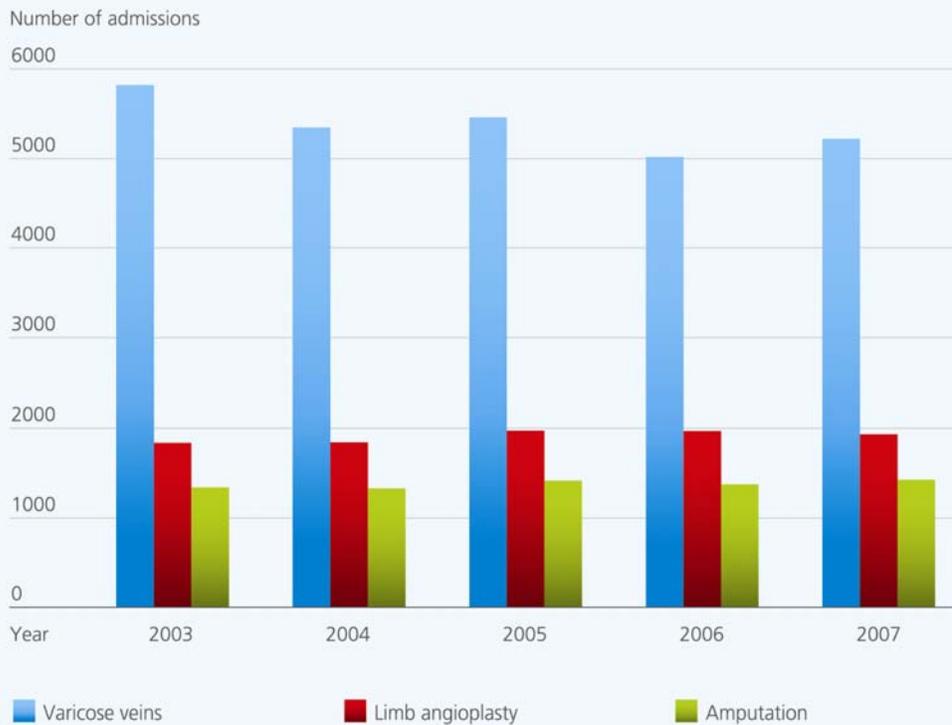
The average incidence of patients requiring venous surgery annually in London is:

- varicose veins – 5,366
- limb angioplasty – 1,906
- amputations – 1,374.

¹² The Vascular Society of Great Britain and Ireland, *The Provision of Services for Patients with Vascular Disease*, 2009.



Figure 3: Elective and non-elective hospital admissions for venous surgical procedures in London, 2003-2008



Source: HES 2003-2007.

GPs would continue to refer patients to their current local hospital in the same way as they do now. The role of local hospitals will be crucial to ensuring high quality, equitable care for all patients across the network.

Once referred, patients would be seen on an outpatient basis in the usual way for any venous surgery. Local units would be responsible for triaging and transferring elective arterial patients to a central unit, where appropriate.

As elective surgery forms the vast majority of the arterial surgical workload, it is envisaged that significant numbers of patients would have their diagnostic work and outpatient consultation locally, before being transferred to a central unit to have their arterial procedure.

Emergency departments at local hospitals would also be responsible for diagnosing and transferring emergency arterial patients to a central unit. Local hospitals would have clear protocols for diagnosing and transferring patients with a ruptured abdominal aortic aneurysm.



1.4 Network management and governance

Central units would have overall responsibility for coordinating all arterial surgery to take place at the unit, including referrals and transfers from local units. This would also involve coordinating surgeon rotas across the network so they can attend the unit for elective and emergency surgical lists.

Central units would have a managerial role over all linked local vascular units. It would be the responsibility of the central unit to monitor standards of all vascular services and units across the network, improving equity of service for all patients in London. These standards would include:

- Audit data collections and analysis.
- Standardisation of administrative and clinical practices across the network (for example, discharge protocols and intervention strategies).
- Results, analysis and submission of correctly coded data for the entire network to the Department of Health, NHS London (London's Strategic Health Authority) and National Vascular Database.
- Analysis of quality accounts returns to the Department of Health to ensure quality care is provided by all units in the network.

Central units would align productivity and quality – ensuring all NHS teams in the network work closely together to increase efficiency. This is in line with Vascular Society recommendations that surgeons should continuously audit the quality of their service and that records relating to emergency and urgent transfers, mortality, morbidity and other significant events should be kept¹³.

Central units would also monitor individual surgeons. As with the cardiac surgery community, surgeons should be encouraged to publish their own mortality data for public scrutiny and transparency. Central units would be responsible for ensuring each surgeon is carrying out sufficient volumes of surgery per year to maintain their skills and expertise.

The model recommends regular multidisciplinary meetings are held to discuss and review individual patients. To support this and wider network management and governance responsibilities, administrative support should be provided to facilitate clinical governance, appraisals, data collection and audits.

Each network would be managed by a network board, led by an appointed clinical director, to ensure adherence to network management and governance procedures. In addition, an overarching clinical director would be appointed to oversee all vascular networks across London.

1.5 Monitoring performance

¹³ The Vascular Society of Great Britain & Ireland, *The provision of emergency vascular services*, 2007 <http://www.bsir.org/files/File/C_Provision_of_Emergency_Vascular_Services_Final_Doc.pdf>



Performance of central and local units would be measured with data submitted to the National Vascular Database. The National Vascular Database is well established and has a number of data sets, which central units would be required to collect and report on.

The National Vascular Database collects information on the following clinical factors (please note this list is not exhaustive):

- Abdominal aortic aneurysm:
 - size of aneurysm
 - co-morbidities
 - medication used
 - method of treatment
 - outcomes
 - mortality
 - complications
 - grade of surgeon¹⁴.

- Amputation:
 - surgery used
 - gender of patient
 - mortality
 - age of patient
 - admission type
 - co-morbidities
 - complications¹⁵.

Regular data collection and submission to the National Vascular Database would be organised and planned to ensure collection is standardised. This would allow for better comparisons of outcomes in vascular surgery to be made – for units and individual surgeons. The information is also valuable as professional revalidation and key reading for external agencies, commissioners and patients.

¹⁴ The National Vascular Society of the Great Britain and Ireland, *The National Vascular Database 2009*, 2009.

¹⁵ The National Vascular Society of the Great Britain and Ireland, op cit.



Information held by the National Vascular Database would be analysed on an ongoing basis. Annual reports, which bring this information together, would highlight practice irregularities by identifying good practice and areas that need improving. It is recommended that commissioners review this to ensure performance is being maintained.

From 2010, NHS trusts will be required to submit 'Quality Accounts' to the Department of Health to provide the public with quality of care information and performance monitoring. These quality accounts can also be used to monitor performance.

All this information would also be available for use by the Litigation Authority, to investigate negligence claims in the NHS. This would help ensure procedures and services are being delivered at the appropriate locations.

1.6 Workforce and training

Vascular surgeons' time

It is proposed that vascular surgeons' time would be spent at both central and local units. Surgeons providing vascular outpatient clinics at local units would have regular access to lists for arterial surgery at a central unit. All surgeons would carry out emergency arterial surgery at a central unit on a rotational basis, regardless of whether they were based at the central or a local unit.

All surgeons would be expected to participate in the delivery of vascular services across the network to ensure they gain experience at a high volume unit and complex, emergency procedures. This would support surgeons to build and maintain individual expertise and specialist skills, which would contribute to improved patient outcomes.

Training

Central units would serve as training centres of excellence ensuring surgeons develop expertise and skills, which would lead to improved patient outcomes¹⁶. Trainees can develop skills under the guidance of vascular specialists and would have greater exposure to complex arterial surgery. Other advantages would include training in endovascular repair techniques and multidisciplinary working.

1.7 Academia and research

Central units would act as leading centres of research. There would be greater opportunities for surgeons and specialists who want to pursue a joint career in academia and surgery. It is hoped that ongoing research can help define future management and treatment strategies for vascular diseases.

¹⁶ The Vascular Society of Great Britain and Ireland, *The Provision of Services for Patients with Vascular Disease*, 2009.



2. Cardiac surgery

The cardiovascular case for change made a compelling case for improving the way cardiac surgery services are delivered, in order to provide a world-class service in London.

The following key messages from the case for change have informed the development of this model of care:

- Patient mortality following cardiac surgery in London is low. However, to achieve the best outcomes, expertise in some specialist procedures needs to be concentrated amongst fewer surgeons.
- In London, the death rate for patients suffering from an aortic dissection is around 20%. The current service provision means that patients are not always receiving the best care that this condition demands.
- To improve the quality of surgery and promote mitral valve repair over replacement in patients with degenerative mitral valve disease, mitral valve surgery in London should be performed by fewer, specialist surgeons.
- Patients in the capital are waiting too long in hospital for non-elective cardiac surgery procedures because efficient transfer and networking arrangements are not always in place.
- Length of stay in hospital following cardiac surgery in London is too long and varies considerably between hospitals. Units and commissioners need to understand how their length of stay compares with other hospitals and should seek to reduce this to optimise patient care.
- There are significant workforce issues in cardiac surgery following changes to medical training and the implementation of the European Working Time Directive. The role of non-medical staff in cardiac surgery needs to be developed to improve patient experience.
- Considerable improvements to patient experience and cost savings can be made if London's cardiac surgery centres work more closely together.
- While there is a significant amount of research activity in the London cardiac surgery community, its international profile would be improved if a more systematic, cohesive and collaborative approach was adopted.
- There is no organised plan for the roll out of new specialist surgical technologies, such as TAVI, leading to a fragmented implementation and slow development of expertise.

This model of care outlines how key changes to service provision, patient pathways and improvements to the way units work together to deliver cardiac surgery, could ensure better outcomes for patients. It recommends improvements to the patient pathway for non-elective cardiac surgery; to service provision to treat major cardiothoracic aortic disease; and to the delivery of mitral valve surgery.



The proposals in the model align with recommendations by NCEPOD¹⁷ and the *Sixth Blue Book*¹⁸, regarding the further specialisation of surgeons performing cardiac surgery and developing a multidisciplinary approach to patient assessment and treatment.

2.1 Proposed pathway for non-elective cardiac surgery patients

According to 2007/08 HES, up to 40% of patients currently undergo non-elective cardiac surgery in London's hospitals – this equates to up to 2,400 patients annually. These are predominantly patients undergoing coronary artery bypass grafting (CABG) and valve surgery.

Many patients requiring non-elective cardiac surgery have an unacceptably long overall pathway length and wait much longer than is appropriate for their condition, posing potential health risks such as hospital-acquired infection, venous thrombo-embolism and further cardiac events. This is often because of inadequate referral and transfer arrangements, and the lack of pan-London standards for treatment.

Non-elective cardiac surgery patients currently follow one of two pathways for treatment:

- Pathway 1: the decision to refer the patient for cardiac surgery is taken in a hospital that does not perform the surgery. The patient then has to be transferred to a hospital that does perform cardiac surgery. Evidence shows that the process of transferring patients between hospitals has the single biggest effect on increasing the overall pathway length.
- Pathway 2: the patient is admitted directly to a hospital that performs cardiac surgery. For these patients, reducing the length of time spent in hospital after the procedure will have the single biggest effect on reducing the overall pathway length.

The current system is inequitable and provides a sub-optimal standard of care for patients. It is also inefficient and unnecessarily overuses hospital beds. This model of care recommends the following changes to the current patient pathways to address these issues:

- Use of network-wide agreed clinical protocols to establish the need for surgery and referral.
- Use of a pan-London risk stratification system to determine priority for treatment.
- Mandatory use of existing electronic referral inter-hospital transfer systems to refer and transfer patients for urgent cardiac surgery.

¹⁷ National Confidential Enquiry into Patient Outcome and Death, *Death following a first time, isolated coronary artery bypass graft. The heart of the matter. A report of the National Confidential Enquiry into Patient Outcome and Death*, 2008 < http://www.ncepod.org.uk/2008report2/Downloads/CABG_report.pdf>.

¹⁸ B. Bridgewater & B. Keogh, *Sixth adult cardiac surgical database report 2008. Demonstrating quality*, Society for Cardiothoracic Surgery in Great Britain & Ireland, 2009.



Determining need for surgery with agreed clinical protocols

Patients admitted to any hospital with suspected heart disease should be investigated in line with network-wide agreed clinical protocols, to determine whether cardiac surgery is needed. Protocols would include an assessment based on clinical markers such as lung function tests and carotid Dopplers.

A EuroSCORE would be calculated based on this assessment, which would allow surgeons to assess operative risk objectively. Some sectors in London are currently using such an assessment to calculate a EuroSCORE.

The EuroSCORE is already built into the existing web-based electronic inter-hospital transfer systems, which would be used by all referring and receiving units.

For the system to run efficiently it is vital that the essential work-up of patients prior to surgery is conducted in the referring hospital. For patients being referred for coronary artery surgery, the following investigations are essential:

- a coronary angiogram
- assessment of left ventricular function
- basic assessment of lung function
- carotid Dopplers if:
 - there is history of transient ischaemic attacks
 - carotid bruit
 - left main stem stenosis
 - the patient is over 75 years old
 - any previous surgery for vascular disease
- agreed routine blood tests
- ECG
- chest X-ray
- MRSA screen
- EuroSCORE
- assessment of risk of adverse event using modified Rexius score (this is called risk of waiting score [ROW]).

Risk stratification for priority



Once the need for cardiac surgery has been established, a risk stratification system should be used to score and assess all identified patients. Patients would be assigned a risk category depending on their criteria score. For those patients assessed and risk stratified in a hospital that cannot perform the surgery, set protocols would be used to determine referral and transfer arrangements for patients in each risk category. See appendix 1 for further detail on the proposed risk stratification system and protocols.

The risk assessment would determine which cardiac surgery patients need urgent transfer for surgery and those patients who are at the lowest risk of an adverse cardiac event. Some patients categorised as low risk can be discharged home with an agreed date for planned surgery. It is envisaged the number of such patients would be small.

Risk stratifying patients would have two effects on those currently following pathway one. The overall number of patients on this pathway would decrease because some low risk patients could be sent home with a planned date for elective surgery. It would also ensure those patients at the highest risk of suffering a cardiac event are given priority for surgery.

Using a risk stratification system has shown to improve patient outcomes¹⁹ and would ensure priority for treatment and transfer is based on clinical need, rather than order of referral.

Reducing the number of patients following pathway one would free capacity and allow those who need surgery urgently to receive it promptly. Set standards for assessing and transferring cardiac surgery patients would provide a more equitable service for patients, reduce transfer waiting times and the total patient pathway length, thus improving the overall patient experience.

Electronic referral and transfer process

At present, the choice of which hospital or surgeon to refer a patient to is often based on historical referral patterns rather than surgical capacity. The model proposes all referring units and receiving cardiac surgery departments use a pan-London electronic referral system to refer and transfer patients for urgent surgery. Network-wide electronic referral systems are currently available but are used to a variable extent. The model proposes the mandatory use of the electronic inter-hospital transfer system for all patients needing to be transferred for urgent, non-elective cardiac surgery; with referrals unable to take place without using the system. To ensure that this happens, it is recommended commissioners link payments to evidence the inter-hospital transfer system is being used for referral

To ensure all referring units and receiving cardiac surgery departments' work together to deliver services, the inter-hospital transfer systems used by referring and receiving units must be compatible throughout the network. Currently all except one London network use the same system; however, the two individual systems are compatible.

¹⁹ W. K. Plompa et al, 'Death on the waiting list for cardiac surgery in the Netherlands in 1994 and 1995', *Heart*, 1999 81:593-597.



Referring units would continue to follow traditional referral processes but when patients face excessive waits, units would be able to identify cardiac surgery departments with surgical availability and to refer the patient to that unit. For information on the system to be accurate, receiving units would need to update the system at least once a day with their available capacity. Receiving cardiac surgery departments would be able to access patient referrals electronically and work together to deliver services.

This transfer system would ensure fast and equitable access for patients. It would also ensure security of patient information; with all relevant data is logged and loss of patient referrals avoided. It would mean the whole patient journey is mapped and both referring and receiving units would be able to track patient information and progress on the system.

Use of the electronic transfer system would facilitate standardised data reporting for patient transfers and their associated delays. This would allow for more accurate assessments and comparisons to be made so network performance can be monitored and improved.

In the majority of cases, non-elective referrals should be made to the cardiac surgery department at a hospital, rather than to specific consultants in the department. Although non-elective referrals may be made by physician to surgeon conversation, all relevant data must be entered onto the electronic system for the referral to be complete and accepted by the surgical department. It is envisaged that junior doctors and trained specialist nurses would perform the data entry. Referring units must use the inter-hospital transfer system to identify a cardiac unit with availability, in the timeframe set by the protocols.

Referrals would be completed by non-medical professionals or trained nurses. A central administrator should oversee the electronic system for London. The central administrator will be able to link with individual hospitals and identify cases that have been waiting longer than the protocols specify. A pan-London group of e-referral coordinators would help this flow. This has been demonstrated on a smaller scale by the Greater Manchester and Cheshire cardiac networks.

On receiving referrals, all cases should be managed by case managers and reviewed by the surgical team on the day of referral. Case managers should allocate patients to an appropriate operating list. Contentious referrals must be discussed at a surgeons' meeting so all consultants buy-in to the treatment plan.

All essential investigations would be performed by the referring hospital according to the agreed protocols – it should not be necessary to repeat investigations in the surgical unit.

Standards for waiting times

Currently patients wait an excessive amount of time for urgent cardiac surgery. To reduce these long waits, it is proposed that waits do not exceed the following specific standards unless clinical factors mean a delay is appropriate.



- The average total pathway length for patients needing urgent CABG should not exceed 21 days.
- The time between admission to the patient's local hospital and referral to a surgical unit should not exceed five days.
- The time between referral and transfer to the surgical centre should not exceed five days.
- The average length of stay at the surgical centre should be 11 days or less.

These waits are still excessive by international standards but represent a considerable improvement on the current situation. The audit standard should be that 90% of patients reach these targets.

Patient length of stay

Delays occur at all stages of the patient pathway and not just while waiting to be transferred for surgery. There are significant variations in post-operative lengths of stay between London trusts for all elective and non-elective cardiac surgery procedures. For example, the difference in the average length of stay in 2007/08 for aortic valve surgery between London trusts was nearly seven days – a difference of 40% between the best and worst performing trusts.

Discharge planning should be given a higher priority. Trusts and hospitals should have appropriate discharge plans to reduce hospital stays and allow patients to return to their normal lives as soon as they are clinically ready.

This model proposes that trusts work together to create a pan-London cardiac benchmarking group that establishes London-wide standards for average length of stay following cardiac surgery.

Trusts should organise quarterly meetings to compare average length of stay, as well as other elements of their performance. Together they should consider changes in working arrangements to reduce their average length of stay to that of the best performing trust.

To reduce length of stay, the whole patient pathway must be considered. This can be achieved by using the inter-hospital transfer system to log each stage of the process.

Pan-London standards and uniform measurement for length of stay would allow commissioners and units to assess their performance and benchmark against the best performing trust to improve services.

Reducing the average length of stay can improve the overall patient experience; reduce unnecessary bed days and help the system operate more efficiently. Additionally, hospital resources used in excess length of stay could be reallocated.

2.2 Service provision for major cardiothoracic aortic disease



The current service provision for treating aortic dissection is fragmented and does not achieve the best outcomes for London patients. Redesigning the service can improve the results of treating this difficult, life-threatening condition.

Patients suffering from emergency type A aortic dissection often go to the nearest centre rather than to a unit with particular thoracic aortic expertise. Consequently, operations for type A aortic dissection are invariably undertaken by the on-call surgeon of the day. This surgeon may not be a cardiac surgeon with a special interest and experience in aortic disease, or have a mixed cardiothoracic caseload. This means these high risk cases may be the only real aortic vascular procedure this surgeon undertakes in a year, making it difficult for any surgeon to build up significant expertise in this area.

To improve outcomes, patients need prompt assessment and appropriate treatment by a specialist surgeon. This model recommends patients are treated at specialist sites by surgeons with a particular interest and expertise in aortic dissection. Surgeons treating this condition must have the support of other specialties such as vascular services with experience of aortic stenting, which may be necessary to treat some of the complications of aortic dissection.

This model proposes that patients with aortic dissection are only treated in units that have all the essential facilities, as indicated in the separate *Cardiovascular services co-dependencies* paper. Such a unit would require cardiology, cardiac surgery, vascular surgery and interventional vascular radiology on site and provide a comprehensive 24-hour service.

In order to improve outcomes for all patients with aortic dissection, both patients with type A and type B dissections should be treated in these units.

Elective thoracic aortic surgery

The model also recommends that all elective surgery for the thoracic aorta should only take place at hospitals with a cohesive thoracic vascular service, which has an active multidisciplinary team structure. This would ensure all patients with these complex problems are treated in units able to provide a comprehensive service.

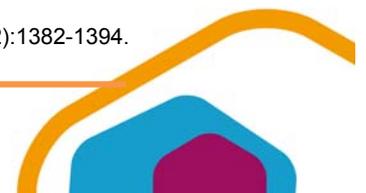
2.3 Mitral valve surgery

Overall, patients having mitral valve surgery have a greater risk of mortality than patients having other forms of cardiac surgery²⁰. The most frequent pathology requiring surgery is mitral regurgitation due to degenerative mitral valve disease.

Patients who undergo mitral valve repair for mitral regurgitation due to degenerative mitral valve disease have better outcomes compared with mitral valve replacement surgery²¹. Patients undergoing surgery for mitral regurgitation has doubled in the past seven years but access to surgeons skilled in mitral valve repair is variable. These

²⁰ B. Bridgewater & B. Keogh, *Sixth adult cardiac surgical database report 2008. Demonstrating quality*, Society for Cardiothoracic Surgery in Great Britain & Ireland, 2008.

²¹ M. Enriquez-Sarano, C.W. Akins & A. Vahanian, 'Mitral regurgitation', *Lancet*, 2009, 373(9672):1382-1394.



patients need to be referred to surgeons who have the appropriate level of expertise to determine and deliver the best treatment.

Currently, the uptake of mitral valve repair for degenerative mitral valve disease in London is 71%, but the rate varies across hospitals from 56% to 82%²². This model of care recommends an increased uptake of this procedure to 85-90%.

The American Heart Association has developed clear guidelines for the treatment of mitral regurgitation. They state: 'Mitral valve repair is recommended over mitral valve replacement in the majority of patients with severe chronic mitral regurgitation who require surgery, and patients should be referred to surgical centres experienced in mitral valve repair'²³. In addition, the *Sixth Blue Book* states: 'referral to regional [mitral valve] repair centres, where appropriate, should not only be possible but be a stated goal to improve access to the highest available level of care'. Units treating patients with mitral regurgitation should adhere to these guidelines.

Patients are more likely to have a mitral valve repair when treated by surgeons with a special interest in mitral valve disease. To improve uptake it is essential patients are referred to surgeons who have the appropriate expertise in this area so the best treatment options can be determined.

This model of care proposes greater sub-specialisation of surgeons performing mitral valve surgery. This proposal aligns with recent recommendations in the *Sixth Blue Book*, which advocates that mitral valve surgery is performed by fewer, specialist surgeons²⁴.

It is recognised that some surgeons have developed an expertise in mitral valve replacement but not in mitral valve repair. To incorporate their expertise, it is proposed that units develop teams of surgeons who treat patients with mitral valve disease. Units should identify such teams and refer all elective cases to them. The best treatment for such patients would be ideally determined following discussion by a multidisciplinary team.

If the unit does not have the appropriate expertise for this patient group, the patient must be transferred to an alternative hospital for treatment. This would enable the NHS in London to achieve the standards recommended by the American Heart Association and the *Blue Book*. Data on the treatment and outcomes of patients with mitral valve disease should routinely be made available to commissioners.

2.4 The role of the multidisciplinary team

With an increasing number of cardiac surgery patients having concurrent medical problems, appropriate patients should be discussed by a multidisciplinary team.

²² B. Bridgewater & B. Keogh, op cit.

²³ American Heart Association, '2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease', *Circulation*, 2008;118:e523-e661.

²⁴ B. Bridgewater & B. Keogh, *Sixth adult cardiac surgical database report 2008. Demonstrating quality*. Society for Cardiothoracic Surgery in Great Britain & Ireland, 2009.



The team should include both cardiac surgeons and cardiologists and where patients are being considered for surgery, members of the anaesthetic and intensive care teams.

The team must agree the most appropriate plan of care and revascularisation strategy in line with recent recommendations by NCEPOD.²⁵

There are some patients requiring revascularisation where both percutaneous coronary intervention (PCI) and CABG may be feasible and these patients should be discussed by the team. This would include patients with multi-vessel disease⁵, diabetes and those with left main stem stenosis, as well as those at high risk of morbidity or mortality following surgical intervention.

It is recognised that the process may have to be modified for urgent patients. There may not be time to wait for a routine multidisciplinary team meeting and a discussion between cardiologist and surgeon may suffice. However, there may be some patients, particularly those with complex pathologies or those at high risk of morbidity or mortality following surgery, where the multidisciplinary discussion is of such importance that the delay this imposes is acceptable for the patient to receive the best care. Cases that would benefit from multidisciplinary team discussion are:

- all mitral valve cases – to allow discussion of repair versus replacement
- all left main stem cases – in particular of PCI is being considered
- multi-vessel disease especially in patients with diabetes
- with Euroscore more than 10%.

2.5 Workforce and training

In August 2009 the NHS became fully compliant with the European Working Time Directive. The directive limits all employees to a maximum working week of 48 hours. This means there will not be enough hours in the week for trainees to be trained appropriately if they are to continue to perform their current service role²⁷.

To allow cardiac surgery trainees to focus their time on activities directly related to training rather than on service delivery, some tasks would need to be undertaken by permanent members of staff, who are trained in specific aspects of care.²⁸ This would reduce reliance on surgeons in training to deliver the essential service and is a major

²⁵ National Confidential Enquiry into Patient Outcome and Death, *Death following a first time, isolated coronary artery bypass graft. The heart of the matter. A report of the National Confidential Enquiry into Patient Outcome and Death*, 2008 <http://www.ncepod.org.uk/2008report2/Downloads/CABG_report.pdf>.

²⁶ A system such as the SYNTAX Score could be used to identify those patients where there should be discussion about the method of revascularisation (PCI or CABG).

²⁷ P. M. Lamont & D. J. A. Scott, 'The impact of shortened training times on the discipline of vascular surgery in the United Kingdom', *The American Journal of Surgery*, 2005, 190 (2): 269-272.

²⁸ S. A. Livesey & T. Bartley, *Staffing cardiothoracic units. Developing a workforce for the 21st century*, Society for Cardiothoracic Surgery, 2007.



change to how cardiothoracic units are run. Units would be staffed by trainees and trust doctors in a non-training position, as well as by specially trained nurse practitioners. Surgical trainees would in effect, be supernumerary in that the service could, for the most part, be delivered without them.

New roles in cardiac surgery will need to be developed. This will involve maximising the input of surgical nurse practitioners to patient care, as well as separating the service and training aspects of junior doctors' experience. A traditional model of surgery would involve a consultant, being assisted by a specialist registrar and a senior house officer. In future, it is likely the consultant would be assisted by surgical care practitioners for some operations. For others, a trainee consultant would be taught the technical aspects of the surgery, rather than just acting as an assistant. The role of surgical care practitioner is currently being developed and must include competencies relating to both surgical techniques, care on the ward and outpatient clinics.

It is vital that trusts work to develop a workforce that will deliver both high quality care and high quality training. Deaneries and trusts should develop plans to allow designated trainees (those with a national training number) to work in a supernumerary capacity. Trusts should train and employ more surgical care practitioners and surgeon assistants to deliver much of the post-operative care traditionally given by doctors. This would reduce the reliance on rotas staffed by overseas doctors in non-training roles.

It is recognised that doctors who are not in recognised training posts will still be needed in cardiac surgery units. To attract high quality individuals to these posts, it is essential that they also have a structured development programme which is developed and monitored locally.

2.6 New technology

As new specialist technologies and techniques continue to be developed for cardiac surgery, such as transcatheter aortic valve implantation (TAVI), organised implementation strategies need to be developed. This would ensure the right patients have timely access to the benefits research advances bring.

There is concern that currently an unlimited number of cardiac centres start to perform new types of procedures. TAVI is an example whereby numerous cardiac centres in London performing the procedure but only a few reach critical mass and sufficient experience to take part in controlled trials. This may prolong the learning curve and makes it challenging to analyse results of these new techniques.

A collaborative and structured approach to rolling out new technologies must be implemented across London to ensure all patients have appropriate access to, and benefit from, new available services. It would also ensure equal exposure to new techniques for cardiac surgeons and cardiologists to develop their expertise.

It is proposed that the roll out new technology would be concentrated in a few designated units with appropriate infrastructure and experience initially, to set the standards for the rest of London. Adopting this approach means the designated units



can assess the success of outcomes associated with the new technology and determine the suitability of roll out to more units.

2.7 Academia and research

Changes to the way cardiac surgery units collaborate and the way research is carried out should help London become a world centre of excellence for cardiac surgery research and training.

Research output is low compared to clinical activity in London with about 25% of national caseload performed in the capital. Investment in basic science, translational and clinically based research could have a high economic return.

The London Deanery and School of Surgery are encouraging research with new initiatives such as Clinical Academic Lectureships. The training is monitored by the Specialty Training Committee and leads to a longer period of overall training, with academic progress monitored by the School of Surgery Academic Committee.

The main aims are to:

- consolidate and integrate research activity and improve university collaboration
- increase research output and training, providing it nationally
- provide training for trainees out of programme
- increase numbers of research fellows aiming for higher research degrees
- increase the number of academic clinical lecturers and fellows, improving bids for these positions nationally
- ensure appropriate training and appointment of future academic staff in London
- maximise output to attract increased funding.

This model of care proposes identifying two new centres in London to enter into three to five year plans with their universities working closely with the School of Surgery to gain funding and personnel.

The two centres would represent north and south London training rotations, based on the London Deanery and the School of Surgery Academic Committee's recognition of training centres. Trainees would be appointed to north or south for their academic training but could rotate between all hospitals.

The number of lecturers would need to be increased. Academic clinical lecturers would be split evenly between clinical and research, while academic clinical fellows would be split 75-25% between clinical and research.



3. Cardiology

Following a review of the clinical evidence and assessment of the current situation in the case for change, a number of conclusions were drawn that informed the model of care:

- Patients get the best outcomes following their urgent or emergency PCI when their procedure is done by a high volume clinician, at a high volume hospital.
- Hospitals should adhere to best practice guidelines, as published by the British Cardiovascular Intervention Society, Heart Rhythm UK and British Cardiovascular Society. Other guidance, such as that from NICE and the Department of Health, should also be followed.
- Hospitals must participate in local and national audits and demonstrate that high quality care is being delivered.
- All patients requiring cardiac intervention should have timely access to their procedure. Those requiring emergency procedures, such as for STEMI, should be admitted to acute cardiac units that have skilled staff (with acceptable working conditions) available 24 hours a day, seven days a week.
- NSTEMACS patients should have access to early angiogram, and for those at high risk this should be in a centre where it can be undertaken within 24 hours.
- Patients should be taken directly to the most appropriate hospital to manage their condition wherever possible, reducing the need for inter-hospital transfers.
- Patients get the best outcomes following complex electrophysiology intervention when their procedure is done by an experienced physician in a high volume centre.
- The introduction of new technology should be undertaken in a planned and coordinated way, to ensure early experience is concentrated with fewer clinicians subsequently rolled out to others.
- Commissioners should be encouraged to commission for service quality taking into account the entire patient journey and standard of service, rather than focusing solely on procedural volumes. Good audit data must be collected so providers can demonstrate quality.

This model of care advocates pathway changes to the current management of high risk non ST-elevation acute coronary syndrome (NSTEMACS) patients. The model also proposes that complex electrophysiology procedures are organised in partnerships operating as regional networks.

3.1 Management of patients with non ST-elevation acute coronary syndromes (NSTEMACS)

An electrocardiogram (ECG) can determine whether a patient is suffering ST-elevation myocardial infarction (STEMI) heart attack.



These patients require emergency coronary intervention (primary percutaneous coronary intervention [PPCI]) and are currently taken directly to one of eight London heart attack centres, providing PPCI 24 hours a day, seven days a week. This model does not propose any pathway changes for these patients.

Diagnosis of non ST-elevation acute coronary syndromes (NSTEMACS) requires more than an ECG assessment. Patients suspected of having a NSTEMACS are currently taken to the nearest emergency department for medical assessment, and the diagnosis is often not confirmed until blood test (cardiac biomarker) results are available.

Once at the emergency department, patients may then follow one of a number of different pathways for treatment. These include:

- Pathway 1: patients have the diagnostic angiography in a first hospital, before being transferred to a second hospital for PCI (undertaken as a second invasive procedure).
- Pathway 2: patients are admitted to a first hospital, before being transferred to a second hospital for both angiography and PCI (undertaken as a single invasive procedure).
- Pathway 3: patients have both angiography and PCI (undertaken as a single invasive procedure) in the same hospital to which they are initially admitted.

Patients on pathway 1 are admitted to the first hospital, which can undertake an angiogram but not PCI so they undergo an angiogram in the first hospital, and are subsequently transferred (often with an unsatisfactory delay) to another hospital for PCI. This is not best practice and subjects patients to two invasive procedures where one would be possible. These pathways are set out in figure 4.

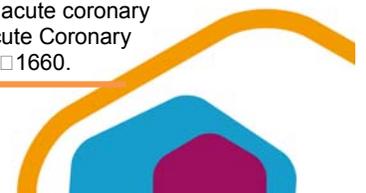
For some patients, the current process is inequitable, unnecessarily lengthy and inconvenient. Furthermore, recent evidence^{29 30} has demonstrated that outcomes for patients with NSTEMACS, particularly those at higher risk, can be improved by early (24-72 hours) angiogram and coronary revascularisation (PCI), where appropriate. The current management of NSTEMACS patients often makes this difficult to achieve.

The proposed model of care recommends improvements to streamline the current patient pathway.

Patients presenting with chest pain but without ST-elevation on their ECG will include many with NSTEMACS patients but a number will be subsequently diagnosed as having other causes of chest pain. Presentation with undifferentiated chest pain represents a diagnostic challenge, and is the subject of guidance from the National Institute of

²⁹ S.R. Mehta et al for the TIMACS Investigators, 'Early versus delayed intervention in acute coronary syndromes', *New England Journal of Medicine*, 2009, 360:2165-2175.

³⁰ J.P. Bassand et al, 'Guidelines for the diagnosis and treatment of non-ST-segment elevation acute coronary syndromes, The Task Force for the Diagnosis and Treatment of Non-ST-Segment Elevation Acute Coronary Syndromes of the European Society of Cardiology', *European Heart Journal*, 2007, 28(13):1598-1660.



Health and Clinical Excellence (NICE) published in March 2010. This guidance highlights the potential for improved practice and a better care pathway.

Based on the annual number of STEMI patients in London (circa 2,500) and information from various databases, such as the Myocardial Infarction National Audit Project (MINAP), British Cardiovascular Intervention Society and HES data, it is estimated that the average number of patients admitted to London hospitals with NSTEMI is about 7,500 per year ³¹.

Early diagnosis and risk stratification are central to the effective management of these patients. This model of care proposes that patients' condition should be managed according to their assessed risk level using a combination of clinical criteria and biomarkers. This aligns with the European Society of Cardiology recommendations that patients displaying a series of risk factors should be offered a coronary angiogram as soon as possible.

³¹ National data from the Myocardial Ischaemia National Audit Project (MINAP) suggests that there are roughly three times as many NSTEMI as STEMI admissions. This observation, together with additional data from British Cardiovascular Intervention Society, MINAP & HES informed the estimate of 7,500 NSTEMI admissions per year in London.

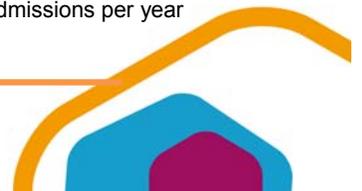
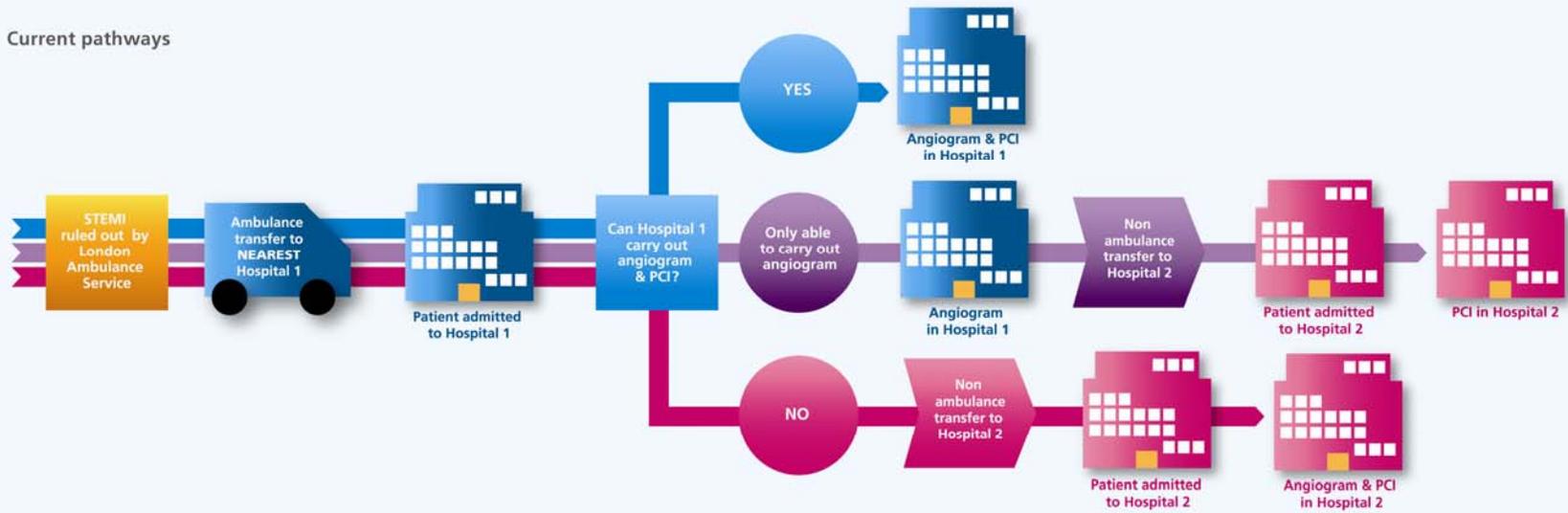
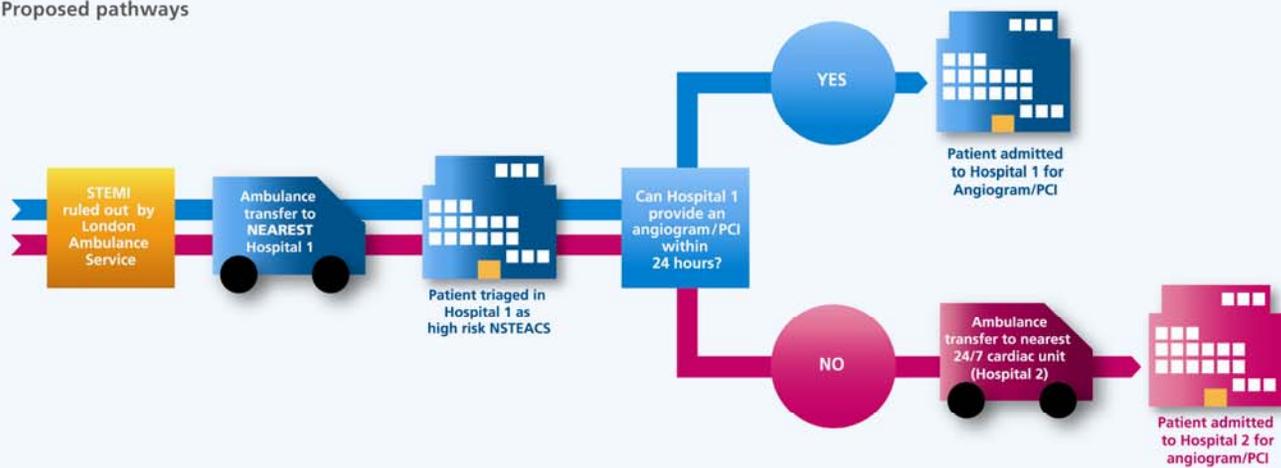


Figure 4: Current and proposed pathways for patients with NSTEMI/ACS

Current pathways



Proposed pathways



Early diagnosis and risk stratification

For patients without ECG criteria for STEMI but with suspected NSTEMI, this model proposes that early diagnosis and risk stratification takes place in the emergency departments of local hospitals. Patients in whom NSTEMI is excluded and who are therefore considered to be at lower risk of an adverse clinical event, may be suitable for discharge home, avoiding a hospital admission altogether. Recently published NICE guidance³² has extensively reviewed the management of patients presenting with chest pain. Its proposed triage may result in fewer patients with a low likelihood of an acute coronary syndrome being admitted to hospital for further investigation.

Patients diagnosed with a NSTEMI should be risk assessed in the emergency department using a combination of set clinical criteria and biomarkers³³.

Patients determined to be at higher risk would receive evidence-based medical therapy immediately and then follow one of two pathways:

- If the patient has been risk assessed in a hospital capable of undertaking angiogram and PCI within 24 hours of initial assessment, the patient should be admitted directly from the emergency department to that hospital for an angiogram and, where appropriate, a PCI as part of the same procedure.
- If the patient is risk assessed in a hospital not capable of undertaking angiogram and PCI within 24 hours of initial assessment, the patient should be immediately transferred by ambulance to a centre that can undertake an angiogram and PCI 24 hours a day, seven days a week.

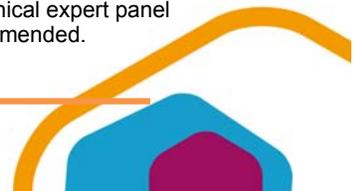
Two important points are stressed:

- Hospitals claiming to be able to undertake PCI within 24 hours of initial assessment should be audited and be able to demonstrate that such a service both exists, and is operational. As a minimum such a hospital should be able to demonstrate regular weekday catheter laboratory working.
- If a patient is risk assessed in the emergency department and is considered so unstable as to require an emergency angiogram, then the patient should be immediately transferred to a heart attack centre.

The recommended pathway changes would reduce a patient's length of stay in hospital and total pathway time, as they would not have to wait several days at the

³² National Institute of Health and Clinical Excellence, *Unstable Angina and NSTEMI: the early management of unstable angina and non-ST-segmentelevation myocardial infarction*, 2010, <<http://www.nice.org.uk/nicemedia/pdf/CG94FullGuidance.pdf>>, accessed on 30 March 2010.

³³ Risk stratification for patients with NSTEMI is considered in great detail in forthcoming NICE guidance. If the proposed model of care is accepted by commissioners additional work will be required by the clinical expert panel to determine at what level of risk (as defined by NICE) immediate inter-hospital transfer is recommended.



local hospital before being transferred to a PCI centre. This was considered highly important by patient representatives on the clinical expert panel.

A standardised system for diagnosing and managing suspected NSTEMI patients ensures that:

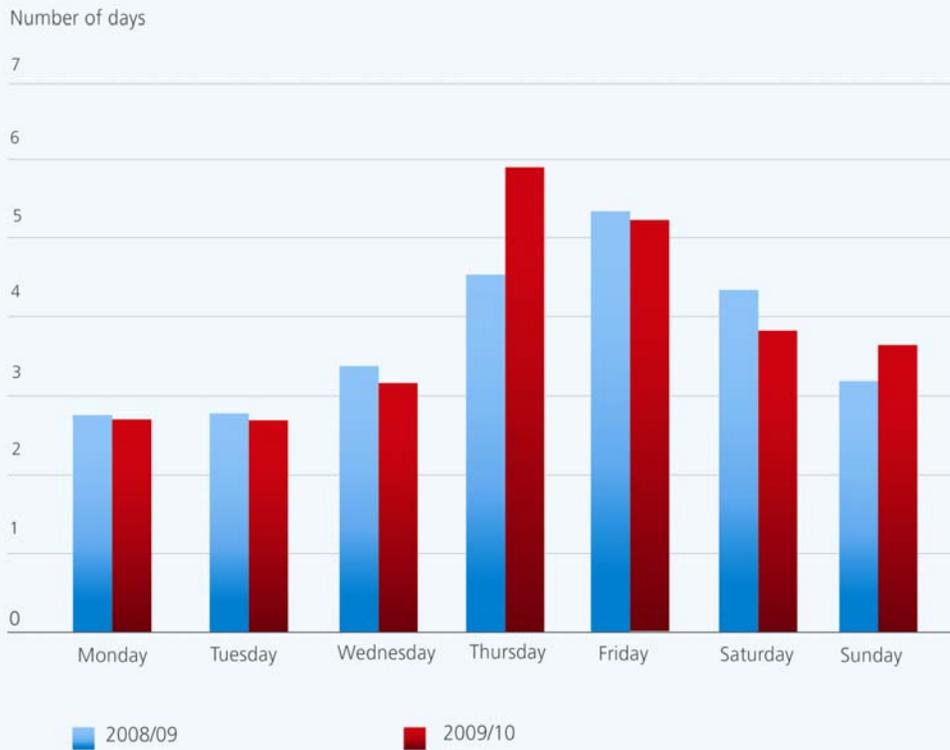
- all patients follow the same pathway, thus ensuring equity of care and access
- early access to angiogram and possible PCI is offered
- earlier access to specialist care is achieved
- best practice is encouraged
- patients at higher risk are managed in specialist centres early in their clinical episode.

The majority of patients with NSTEMI (about 70-80%) will require an angiogram and possible PCI. Patient panel representatives stressed that even those who are not at high risk should be offered access to an angiogram and possible PCI as soon as possible. This would reduce the stress of waiting for an intervention, and achieve earlier discharge from hospital. An audit of patients transferred for an angiogram (and possible PCI) undertaken in London's north central sector³⁴ has shown a marked difference in waiting times depending on the day of admission. Those admitted to the referring hospital on Thursdays through to Saturdays waited up to three days longer for transfer than those admitted on Sundays through to Wednesdays because of lack of regular catheter laboratory weekend working.

³⁴ Personal communication with Dr Gerry Coghlan. The receiving (PCI) centres were the Royal Free Hospital and the Heart Hospital, and the referring centres were Barnet General Hospital, Chase Farm Hospital, Whittington and North Middlesex Hospitals.



Figure 5: Number of days waiting for an inpatient angiogram transfer from admission to transfer, by day of admission



Source: HES 2003–2007.

Future triage by London Ambulance Service

Diagnosis and risk stratification may be possible by ambulance paramedics in future. At present, ambulance services are unable to carry out the required assessments to diagnose high risk NSTEMI patients due to lack of equipment and appropriate clinical training. If this was resolved many patients with NSTEMI could be admitted directly to the appropriate hospital first time, avoiding some inter-hospital transfers.

The clinical expert panel felt this was an important aspiration, on both clinical grounds and as a means of accelerating patient management, and reducing hospital lengths of stay. Further work is needed to determine the feasibility, cost and workforce implications of such a development, and to model its consequences on current service pathways. This model of care advocates that this work be undertaken.



Case study: North east London pilot

The proposed model was piloted in North East London between November 2007 and January 2008 to assess the feasibility of early transfer of high risk NSTEMI patients from an emergency department to a receiving PCI centre.

The pilot was undertaken at Newham University Hospital NHS Trust and Barts and The London NHS Trust (Royal London Hospital). Once risk stratified, patients diagnosed at these hospitals with high risk NSTEMI (based on locally pre-determined criteria) were transferred to the London Chest Hospital.

Over 800 patients with suspected acute myocardial cardiac ischaemia were assessed in the two emergency departments. Of these, 11% fulfilled all the criteria and were confirmed as high risk NSTEMI. These patients were treated on the pathway, which involved immediate medical therapy followed by ambulance transfer to the London Chest Hospital for possible PCI.

The north east London pilot data demonstrated that for those patients assessed as high risk NSTEMI, the mean time from entering the emergency department to transfer was 3.5 hours. This comprised 37 minutes to be seen at the emergency department, 88 minutes 'process' time, and 78 minutes waiting for the ambulance transfer.

Coronary angiogram was performed an average of 12 hours after presentation, with a revascularisation rate of 65% in transferred patients. This compares favourably with the rates of revascularisation in randomised controlled trials of early revascularisation in NSTEMI.

This pilot study demonstrates that earlier transfer of patients is feasible and that shorter treatment times can be achieved. Further work would need to be undertaken to determine the criteria to be used for assessing NSTEMI patients.

3.2 Electrophysiology services

The provision of a world-class electrophysiology service for London requires that some specific issues are addressed:

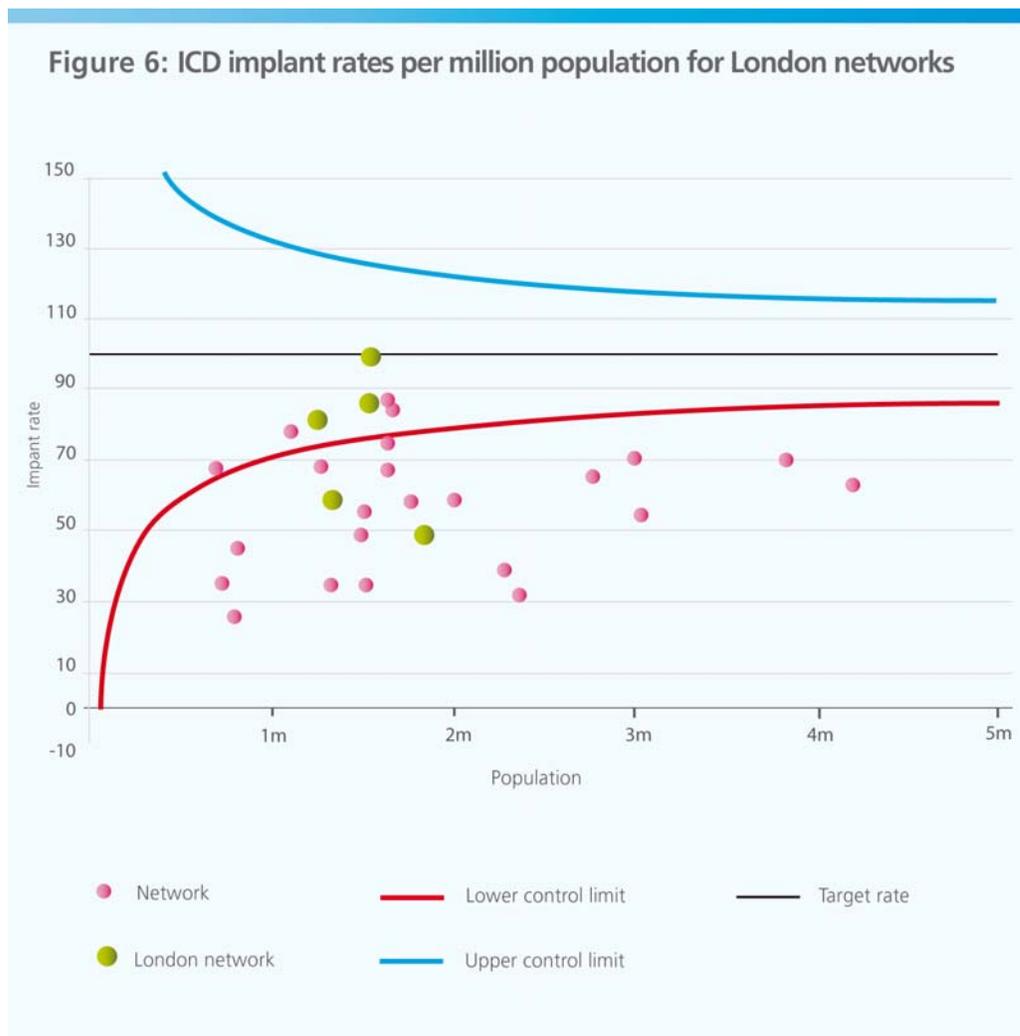
- Electrophysiological interventions in the UK are low compared to most other European countries.
- There is a wide variation in these intervention rates, inequity of care (see figures 6-8), and varying lengths of hospital stays. The service in London needs to ensure that the correct patients are identified, those who require treatment are managed by teams experienced in arrhythmia care, and access to services across London is equitable.
- Many electrophysiology interventions are highly technical and evidence shows that patient outcomes are improved when these procedures are



performed at high volume, specialist arrhythmia sites^{35 36}. Importantly, the follow-up of patients with devices also requires a high level of expertise.

- The detection and management of all arrhythmia patients could be enhanced by greater coordination of electrophysiology services between specialised and non-specialised hospitals. This would also encourage a more planned approach to the roll out of specialised services, where appropriate, in the future.

Figure 6 shows ICD implant rates for the five London cardiac networks (and the remaining cardiac and stroke networks in England and Wales) indicating that most networks are performing significantly below the national target.



³⁵ R. Cappato et al, 'Updated worldwide survey on the methods, efficacy, and safety of catheter ablation for human atrial fibrillation', *Circ Arrhythm Electrophysiology*, February 2010, 1;3(1):32-8.

³⁶ P. Jeptha et al, 'Association of physician certification and outcomes among patients receiving an implantable cardioverter-defibrillator', *The Journal of the American Medical Association*, 2009; 301:1661-70.

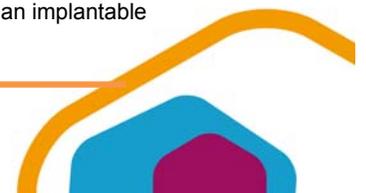


Figure 7 shows ICD implant rates for London PCTs over the last four years. These implant rates are corrected for demographic characteristics and show year on year growth but still indicate a marked variation.

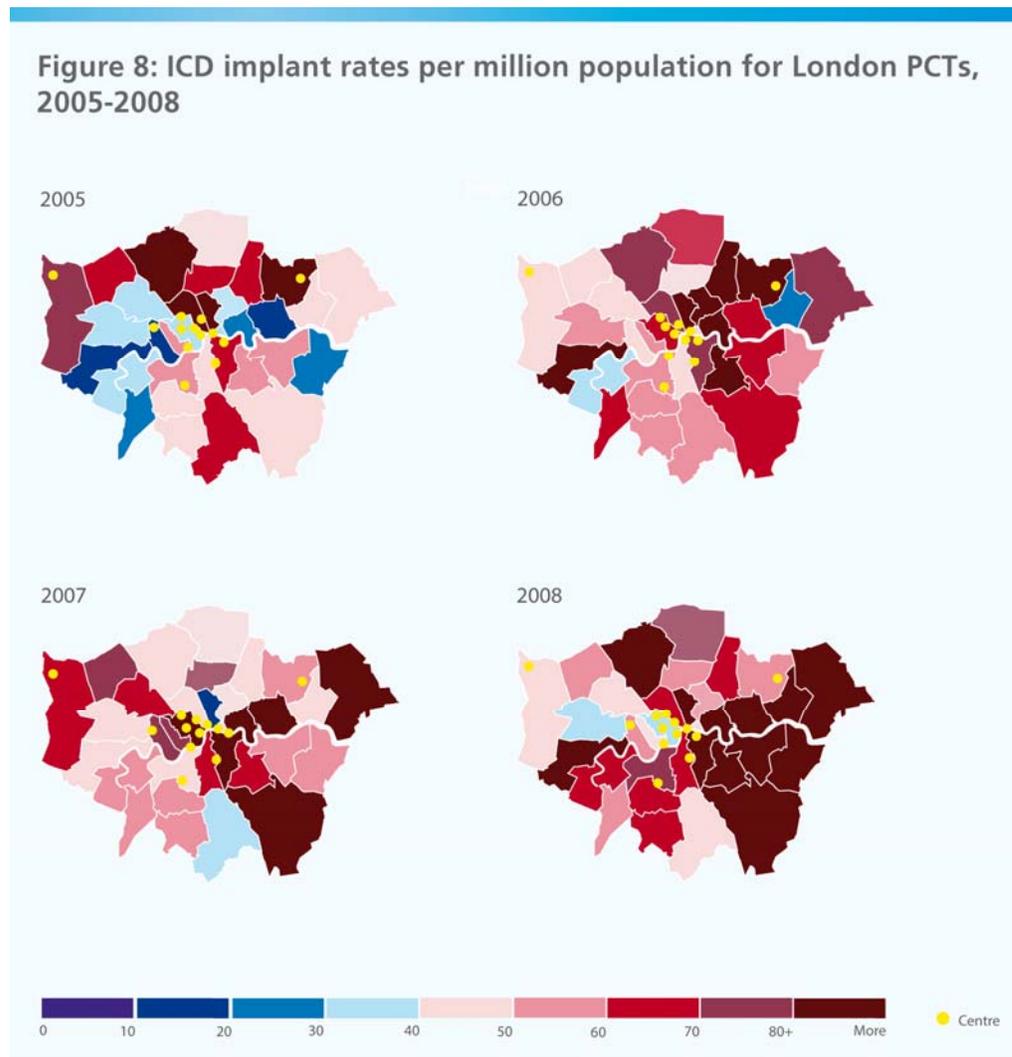
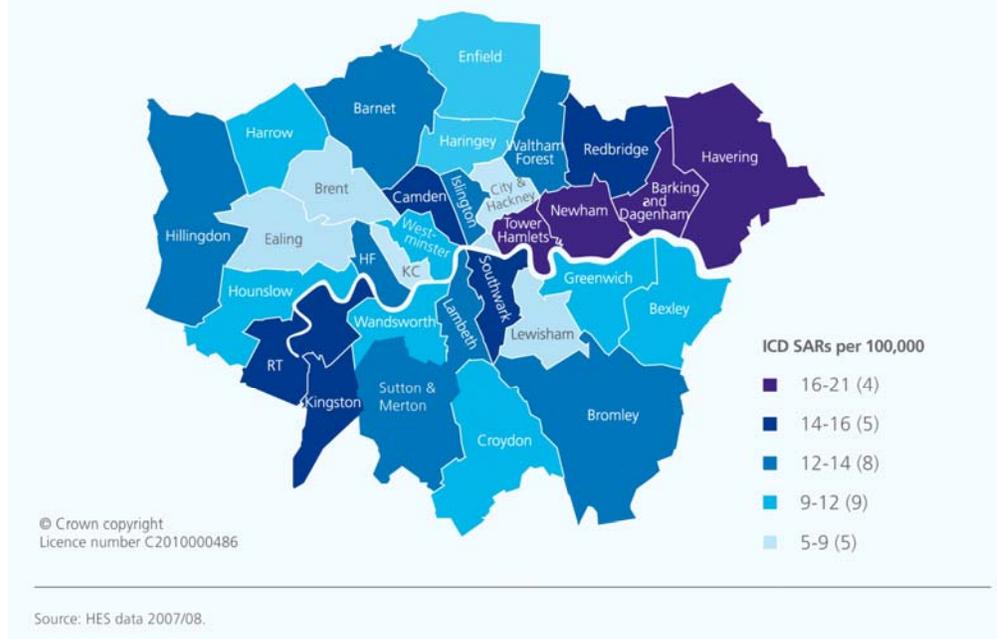


Figure 8 shows ICD implant rates for the London PCTs in 2007/08 highlighting a marked variation difficult to explain by factors other than inequitable access.



Figure 8: ICD implant rates for London PCTs, 2007/08



Creating electrophysiology networks

The main principles of the proposed model of care for electrophysiology services are:

- Hospitals should continue to work in existing cardiac networks to deliver electrophysiology services but work more closely together to provide a coordinated service, with more cross-unit working of staff.
- Complex electrophysiological procedures should be delivered at central units within networks.
- Clinical expertise in diagnosis and management of cardiac arrhythmias should be available across the whole network to ensure patients receive the highest levels of care. Care should be undertaken locally where possible and at a central unit where required in order to ensure the best quality of care.
- Audit of activity, performance and outcomes of arrhythmia services should be a mandatory part of patient care and should be benchmarked against national standards.

Enhancing existing cardiac networks



Expertise in the diagnosis and management of electrophysiology procedures in London is already concentrated in central units³⁷ and electrophysiology care is subject to varying degrees of cardiac network oversight. The model proposes that this will remain largely unchanged but should be enhanced. There are currently five cardiac networks across London delivering services in each sector. Some networks operate with more than one central unit.

Although the case for change addresses complex electrophysiological procedures, these are only required in a small minority of patients with cardiac rhythm problems. Identifying the correct management for all those with cardiac arrhythmias requires clinical arrhythmia expertise be available throughout the network and not just concentrated at central units. It is clear that among the factors responsible for the low rates of electrophysiological intervention in the UK is poor access to arrhythmia expertise. The network model provides the best platform for addressing this and delivering care widely.

Delivery of electrophysiology services

The model recommends that most ablation procedures (complex and non-complex), ICD procedures and CRT implantations take place at central units. The delivery of most pacemaker implantations will continue to take place across all current units. Centralising electrophysiological procedures in this way ensures that a critical mass of expertise will be concentrated in centres of excellence. There is evidence that high volume sites and operators are associated with higher success rates and better patient outcomes for some of these interventions^{38 39}.

The overriding objective in identifying certain centres as providing specialist electrophysiology services is to provide safe and equitable patient care with the best outcomes possible. With complex interventional procedures, such as most ablations, ICD/CRT implantation and pacemaker lead extraction, the clinical expertise and resource infrastructure required to provide a comprehensive and reliable service throughout the year inevitably calls for centralisation. It is for commissioners and cardiac networks to agree how the network model of care should work in their area but it is likely each network should have one or two central units and each will serve a number of referring hospitals.

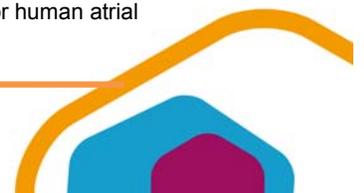
Central units should have a responsibility to provide specialist expertise to their referring hospitals. They should:

- provide clinical support 24 hours a day, seven days a week so urgent and emergency arrhythmia cases are managed promptly and appropriately by a specialist.

³⁷ The current specialist sites are St George's Hospital; Guys and St Thomas' and Kings Hospitals; Barts and The London Hospitals; the Heart Hospital; Imperial College; and the Royal Brompton Hospital.

³⁸ E. M. Aliot et al, 'EHRA/HRS Expert consensus on catheter ablation of ventricular arrhythmias', *Europace*, 2009, 11: 771-817.

³⁹ R. Capatto et al, 'Worldwide survey on the methods, efficacy and safety of catheter ablation for human atrial fibrillation', *Circulation*, 2005, 111: 110-1105.



- offer to undertake clinics in referring local units
- support optimum follow-up arrangements for patients.

The intention of this model of care is to encourage a more coordinated and consistent approach to the care of all arrhythmia patients, and it is anticipated that greater cross-unit working will be required. These arrangements ensure that expertise in the decision-making for arrhythmia care is disseminated as widely as possible; that all treatment options are available (for example, catheter ablation for ventricular tachycardia (VT) when appropriate, not just ICD implantation); and the highest quality of care for electrophysiology interventions is delivered. Commissioners and networks have an important part to play in ensuring that clinical governance remains as a top priority of service development.

These proposals align with recommended practice and recent publications such as The European Heart Rhythm Association and the United States' Heart Rhythm Society's consensus paper. These state that complex ablation procedures should be performed in adequately equipped units with a dedicated electrophysiology programme that offers appropriate patient assessment and selection; treatment strategies; and post-procedure follow-up. More details of the specific factors that constitute best practice are listed in these guidance documents^{40 41 42}.

The role of central units

Clinical services

All ablation procedures and atrial fibrillation ablation in particular, should take place in specialised units. The level of expertise for non-atrial fibrillation ablation should be considered comparable to that required for atrial fibrillation ablation. Although examples of both forms of ablation being performed in local hospitals exist in the UK, a preferable model is for experienced operators appointed to local hospital units to perform these procedures on their patients in the central arrhythmia units. Pooling volumes of procedures will give those operating at the unit, and their supporting staff, such as catheter laboratory staff, electrophysiology specialist nurses, cardiac physiologists, the opportunity to undertake optimum procedure volumes and more easily discuss cases with colleagues.

⁴⁰ A report of the Heart Rhythm Society (HRS) Task Force on Catheter and Surgical Ablation of

Atrial Fibrillation, 'HRS/EHRA/ECAS Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation: Recommendations for Personnel, Policy, Procedures and Follow-Up', *Europace*, 2007, 9: 335–379

⁴¹ A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, 'ACC/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities', *Journal of the American College of Cardiology*, 2008; 51:1-62.

⁴² Heart Rhythm Society/Pediatric and Congenital Electrophysiology Society Clinical Competency Statement, 'Training pathways for implantation of cardioverter-defibrillators and cardiac resynchronization therapy devices in pediatric and congenital heart patients', *Heart Rhythm Society*, 2004, 3:371-375.



ICD and CRT implantation and follow-up services require a high level of expertise at consultant and physiologist level. They also require close collaboration with other cardiology specialities (for example, coronary disease, heart failure, heart muscle disease, inherited cardiac conditions, grown-up congenital heart disease as required) for appropriate case selection.

A patient specific plan for the whole patient journey – from counselling, to implant and follow-up – should be clear before implantation is considered. Clear plans must be in place across the network for device troubleshooting out-of-hours, unusual complications, lead extraction and device deactivation when necessary.

Beyond improved outcomes, delivering these procedures at central units has a number of advantages for patients. These could include specialist facilities, such as dedicated wards for electrophysiology patients, access to physicians with expertise in managing cardiac arrhythmias, appropriately trained physiologists and specialist nurse support. Patients will have access to the complete range of associated support services for electrophysiological procedures.

These dedicated services and facilities will improve the standards of quality for patients.

Cardiac surgical expertise will be required at central units – occasionally with complex device extraction and infrequently with procedural complications. Surgical atrial fibrillation ablation, as well as epicardial cardiac resynchronisation device implants, are being undertaken in most units and requires close collaboration between cardiology and surgical teams.

It is not the intention of this model of care to downplay the importance of arrhythmia services in local, non-specialist units; quite the reverse. It is vital that arrhythmia services are coordinated in a network approach and local hospitals are as important in delivering a world-class service as the central unit, and should be regarded as such.

Emergency services

Emergency electrophysiology cases should take place at central units, which should all operate an emergency service 24 hours a day, seven days a week.

Patients who suffer from acute cardiac electrophysiological problems need access to rapid specialist care, for example those needing emergency temporary pacing, or management of life threatening arrhythmias, particularly those in whom ICDs are fitted where numerous shocks may be delivered over a short period of time (VT Storm).

Patients presenting as emergencies at a hospital without an emergency electrophysiology service should be transferred to a central unit. Standardised triage protocols will be needed so all patients requiring transfer can be identified.

Providing an emergency service 24 hours a day, seven days a week will allow for out-of-hours device troubleshooting for patients, such as sudden device malfunction, frequent shocks, or device deactivation.

Where feasible, patients should be triaged by ambulance services and taken directly to a central unit. It is proposed that a further piece of work should be



carried out to model the possibility of the London Ambulance Service triaging high risk arrhythmia patients in the ambulance and taking them directly to the central units.

The role of local units

Clinical services

Many patients with cardiac rhythm problems are seen initially at local hospitals. Local arrhythmia clinics must be established where the necessary expertise can be provided for correct investigation and management. Where appropriate this will lead to transfer to a central unit for all emergency and complex elective electrophysiological procedures.

Procedures that are regarded as complex when introduced may become more routine and undertaken more often over time. They may then appropriately become disseminated to local units. A good example of this is permanent pacemaker insertion. This technique was initially only undertaken in tertiary centres but many years ago became safely and appropriately devolved to secondary centres. It is likely that such devolution will occur in future, and to some extent this has happened already with some ICD implants. This model of care accepts that devolution will often be appropriate, but the clinical expert panel felt it to be of paramount importance that such devolution should be prospectively agreed in networks; planned for appropriately; and only undertaken in a framework of strong clinical governance. Devolution should not occur simply because an individual clinician or hospital wishes to introduce a new technique to their institution for professional or financial advantage.

Pacemaker implantation will continue to take place across the network. Currently, these procedures are performed in large volumes at many units without the need for patients to be referred to a central unit. However, local units must have established links with the central units to facilitate arrangements for dealing with complex arrhythmia procedures, and interventions such as pacemaker extraction and removal of device due to infection and lead fracture.

Follow-up care and support for complex devices (ICD and CRT) can also take place across the network, by appropriately trained staff. This must be supported by the central unit and by the network to provide continuous training, education and IT support for follow-up data collection.

Network management and governance

The proposed model of care recommends a more coordinated approach to the provision of arrhythmia services in a network. Commissioners and cardiac networks should ensure that clinical services are appropriately planned and adhere to high levels of clinical governance. The collection of audit data is vital if activity, outcomes, patient experience and benchmarking are to be available to those commissioning and providing these services.

Cardiology has a long history of data collection and many databases are housed in the Central Cardiac Audit Database (CCAD), funded by the Department of Health. However, many hospitals receive little or no support for data collection and this will have to be rectified if robust and complete data collection (especially that relating to outcomes data) and better accountability is to be



achieved. Detailed best practice guidelines are also available nationally and internationally and can be used to inform local developments.

Central unit(s) in each network should have overall responsibility for coordinating arrhythmia service delivery, for patients referred directly to the unit, and referrals and transfers from local units. This will require the coordination of cardiologists across the network to support elective and emergency services. Central units should be responsible for ensuring each cardiologist is carrying out sufficient volumes of procedures per year to deliver optimum outcomes.

Central units should also have a managerial role over the network. This means it is the responsibility of the central unit to set standards for all electrophysiology services across the network. It is envisaged that this will include responsibilities around collecting and running audits, standardising operative and surgical practices across all units (including discharge and transfer protocols), as well as intervention strategies. In addition, central units must ensure that all units across the network submit correctly coded data to CCAD.

Standardising the delivery of service across the network and having clear protocols in place should improve the equity of service to patients.

Monitoring performance

Low rates of interventions for arrhythmia in the UK suggest that there is a significant unmet need. To address this all networks must have pathways in place to ensure that patients with cardiac rhythm abnormalities or in need of arrhythmia treatment have access to the appropriate expertise

National audit data (for example, network device survey) have demonstrated the underperformance of arrhythmia care in the UK against approved clinical guidelines, as well as international comparators. Each network must develop a plan for measuring the unmet need and how the deficiency can be addressed.

Performance of central and local units should be measured through returns to the CCAD. The CCAD is well established and has a number of data sets that central units should be required to collect and report on annually.

From 2010 trusts will be required to submit quality accounts to the Department of Health providing the public with quality of care information and performance monitoring. This too can be used to monitor performance.

The CCAD collects information on the following (please note, this list is not exhaustive):

- treatment of heart attacks (both STEMI and NSTEMI)⁴³

⁴³ Data is published and presented annually by the British Cardiovascular Intervention Society (BCIS) and can be accessed via their web site www.bcis.org.uk/resources. The data is also reviewed annually by the Department of Health.



- national devices survey for implantation of electrophysiology devices, such as pacemakers and ICDs⁴⁴
- ablation and other electrophysiology data⁴⁵.

Regular data collection and submission to CCAD should be organised and planned to ensure it is collected in a standardised way. This should allow for better comparisons of outcomes (benchmarking) and patient experience to be made. This information is also valuable for professional revalidation and as key reading for external agencies, commissioners and patients.

Information held by the CCAD will continue to be analysed and plans are in place for this to be undertaken more comprehensively through the work of the National Institute for Clinical Outcomes Research, currently based at University College London.

Performance can only be properly monitored if data is collected, analysed and published. Cardiology has a good track record to date but this has been achieved with little hypothecated funding, so data collection has often been incomplete, particularly in those fields not included in national performance indicators by government.

Workforce and training

Creating electrophysiology networks should involve physicians, specialist nurses, and cardiac physiologists. Delivering expertise depends not only upon diagnosis but is also crucially dependent on expert follow-up care, where the role of arrhythmia nurses and physiologists is critical for patient support.

There should be an arrhythmia clinic in all local hospitals. Most local arrhythmia clinics are staffed by clinicians from the central unit but an alternative model is for clinics to be run by consultants appointed at local hospitals who have arrhythmia expertise. In future such appointments should be agreed, and be appointed, in the network and the central unit would be expected to offer sessions for the appointee to undertake complex procedures (for which he/she is adequately trained).

The model proposes that existing and new job plans for consultants with expertise in arrhythmias at central units should include delivering services in at least one local electrophysiology unit. Those consultants with arrhythmia expertise at local units should have sessions at the network central unit. Appointing future positions on a network basis, rather than to individual units, would provide a mechanism for distributing the available expertise as widely as possible.

More detailed work will be required to determine the workforce consequences of this proposed model of care but a few points can be highlighted in advance:

⁴⁴ See the National Devices Survey website <www.devicesurvey.com>.

⁴⁵ Collected by the specialist society Heart Rhythm UK, within CCAD.



- The provision of cardiac services in any hospital is crucially dependent on the input of cardiac physiologists (previously called cardiac technicians), and there is a significant shortage of them. They are particularly needed for electrophysiology services as they can undertake much of the specialist follow-up of devices and are a vital part of the catheter laboratory team for all electrophysiological procedures. It is likely that further investment will be needed to train and recruit more.
- There may be a need to appoint more cardiologists if a comprehensive electrophysiological service is to be developed as outlined, and hospitals providing urgent PCI are to offer greater weekend working. However, it is likely that sufficient cardiologists are already in training and the issue will be more one of the affordability of additional recruitment, which could obviously be phased.
- The London Ambulance Service may require additional investment if greater reliance is placed on their staff undertaking earlier triage of patients with arrhythmias or acute coronary syndromes requiring urgent specialist care.
- The cost of any workforce implications should be offset by potential savings made by reduction in hospital lengths of stay.

3.3 New technology

When new technology is introduced it inevitably involves a steep learning curve for those physicians and units undertaking the procedure. Devices are appropriately licensed for human use and cannot be introduced without such a licence, but the roll out of such technology to all patients who may benefit from it requires planned implementation. A good example of this is the recent introduction of TAVI – a prosthetic aortic valve that can be implanted without the need for open heart surgery and as such is attractive for those patients too sick or elderly to withstand conventional cardiac surgery.

The case for change recommended that the introduction of new technology/devices should be undertaken in a planned and coordinated way, to ensure early experience is limited to fewer operators subsequently rolled out to others in a planned way.

Commissioners and cardiac networks can play a key role in ensuring the appropriate development and roll out of new skills and technology. At a national level there has been strong collaboration between specialist societies (British Cardiovascular Intervention Society and the Society for Cardiothoracic Surgery), commissioners from the National Specialist Commissioning Group (NSCG), NICE and the Department of Health, with respect to the introduction of TAVI, through the establishment of a steering group, and the collection of outcome data. The NSCG have indicated that such collaboration is helpful in their decision-making and it is planned that this advisory group should continue to offer input to the commissioning of other new technologies (such as mitral valve repair devices).

The importance of establishing a more structured introduction and roll out of new technology is foremost to ensuring patient safety and optimum outcome from what are often high risk procedures. It does not just apply to London and is equally relevant elsewhere in the UK. Such an approach should not stifle innovation and development; it should encourage the introduction of new technology; the collection



of robust audit data, as available evidence is inevitably limited when new devices are introduced; and should contribute towards London's desire to provide a world-class service.

3.4 Academia and research

This model of care is not intended to address how research and academic cardiology is developed in future. However, there is a need to support academia if London wishes to be a truly world-class centre. It has already a number of world class institutions and eminent researchers but would benefit from greater integration between academic and clinical departments. The recommendations of this model of care that cardiac services are even more organised across networks in future, bringing greater collaboration between hospital units and cross-unit working, may allow academic objectives to be achieved more easily.



4. Co-dependencies

There is evidence to suggest that the collocation of certain services can improve outcomes for patients undergoing acute and complex cardiovascular procedures.

A framework has been developed as part of the cardiovascular project, which aims to describe the level of services required to provide a world-class cardiovascular service. It presents a clear, clinically agreed and robust statement of the relationships and dependencies between services required to provide acute and complex cardiovascular services.

The framework provides commissioners with a set of recommendations to inform the provision of cardiovascular services, and can also be used by commissioners and trusts as a benchmarking tool against current service provision. It suggests a high level of dependency between acute and complex cardiovascular procedures, including cardiac surgery and complex vascular surgery.

The framework recommends which services should be provided together, and at what level collocation is required, to achieve a world-class standard. It is intended for use by commissioners to support future decision-making on any potential service reconfiguration for acute and complex cardiovascular services, based on a set of clinically agreed service dependencies.

- The list of services identified by the framework as essential for collocation should be considered to be the minimum required to deliver a world-class cardiovascular service.
- When using the framework, commissioners should be aware of the interdependencies between those cardiovascular services recommended as essential and the key support services, in order to achieve a truly world-class service.
- To ensure the required key support services are provided at the level identified in the framework, it is recognised that the formal and informal network arrangements outlined in this model of care would need to be in place, in addition to any robust protocols for emergency and elective referrals also recommended by the framework.

With regard to service reconfiguration, the framework does not prescribe what changes should take place but should be used to inform the future planning, reconfiguration and distribution of services and is intended to assist commissioners in the planning of any future service reconfiguration in sectors, trusts or local areas.

Details of this work are set out in the separate *Cardiovascular services co-dependencies framework* paper.



5. Finance

The cost implications of providing cardiovascular services in the recommended model of care have been modelled and evaluated, taking into consideration the potential cost implications for both commissioners and providers.

The overall analysis of the project demonstrates that implementing the models will be cost neutral, with possible savings for both commissioners and providers.

| | Commissioner £'000 | Provider £'000 |
|---|-------------------------------|---------------------------|
| Vascular surgery | | |
| Market forces factor | (92) | |
| Increase uptake of endovascular aneurysm repair to 70% | (372) | 186 |
| Reduce length of stay following carotid endarterectomy surgery | | 150 |
| Reduce length of stay following lower extremity arterial bypass | | 430 |
| TOTAL – Vascular surgery | (464) | 766 |
| Cardiac surgery | | |
| Reduce cardiac valve excess bed days to that of the 25 th centile provider | 47 | |
| Reduce coronary bypass excess bed days to that of the 25 th centile provider | 285 | |
| Increase mitral valve repair | 290 | |
| Reduce pre-transfer length of stay for non-elective cardiac surgery (to maximum of five days) | | 2,800 |
| Reduce post-operative length of stay | | 2,300 |
| TOTAL – Cardiac surgery | 622 | 5,100 |
| Cardiology | | |
| Reduce double admission of high risk NSTEMI patients | 1,000-4,000 | |
| Reduce admission of low risk NSTEMI patients | 850-3,400 | |
| Increase electrophysiology uptake | (4,100)-(2,000) | |
| TOTAL – Cardiology | (2,250)-5,400 | |



A separate detailed analysis for each area of work – vascular services, cardiac surgery and cardiology – can be found in the separate *Cardiovascular services financial analysis* paper.



6. Conclusion

The cardiovascular case for change highlighted considerable scope for improving cardiovascular services in London. It found the NHS in London could improve outcomes, quality and equity of access, as well as enhancing patients' experience.

The model of care makes a number of recommendations to address the issues raised in the case for change and sets out a blueprint for the highest quality services possible to be available to the whole of London's population.

Key proposals include centralising services where this would improve outcomes; reducing hospital stays; improving patient pathways; greater sub-specialisation of surgeons delivering complex procedures and improvements in the way providers work together to deliver services.

The recommendations outlined in the model of care are designed to help and support commissioners in London to develop a world-class services for cardiovascular patients.

Some of the recommendations have already been taken forward and will be used by commissioners in developing their service intentions for 2010/11. The rest should be considered over the coming months.

Work currently being carried out by the project includes developing set performance metrics and quality standards, to be used by all providers of cardiovascular services during the implementation phase. These standards should allow for the measurement of providers' performance against the agreed standards. Quality standards are being designed to measure the specific recommendations for improvement in the model of care. It is envisaged that these outcome measures will be aligned to the Department of Health's *Quality Accounts* initiative.

The patient panel has also produced a paper covering issues, which are out of the project's scope but cover areas of major importance to improving the overall patient experience. The project board has committed to looking at how these can be used as metrics for performance measurement.

Full implementation should see a major improvement in the treatment, care and outcome of London's cardiovascular patients over the coming years, as well as reducing costs for the NHS. This is particularly important as the requirement for services grows, while NHS funding becomes tighter.

Ultimately, adopting the recommendations should result in a healthier population suffering fewer premature deaths from heart disease, while saving the NHS money.



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Patient panel

- Jeremy Gold (Co-Chair) – North Central London Cardiac Network Patient Panel
- Martin Saunders (Co-Chair) – Commissioning Support for London Patient and Public Advisory Group
- Christian Clark – North Central London Cardiac Network Patient Panel
- Iain Thomas – South West London Cardiac Network Patient Panel
- Sirkka Thomas – Patient Carer, South West London
- Lyn Wheeler – South East London Cardiac Network Patient Panel
- Barry Silverman – Commissioning Support for London Patient and Public Advisory Group
- Michael English – Commissioning Support for London Patient and Public Advisory Group



- Dilmohan Bhasin – Commissioning Support for London Patient and Public Advisory Group
- Susan Jackson, Commissioning Support for London Patient and Public Advisory Group



Appendices

Appendix 1: Analysis of the number of central vascular units needed in London

The model of care proposes the centralisation of all emergency and elective arterial surgery in London. The optimum number of central vascular units needed was determined based on the following assessment.

Volumes of arterial procedures

While the volumes of carotid endarterectomy and lower extremity arterial bypass procedures are expected to remain constant, the number of people undergoing abdominal arterial aneurysm repairs are expected to increase due to the national aneurysm screening programme for men over 65 and an ageing population.

Incidence levels suggest that eight in 100,000 Londoners will have an abdominal aneurysm procedure.

Figure 1: Total hospital admissions for all emergency and elective arterial procedures in London

| Procedure | Total procedures (2007/08)* | Patients from outside of London (2007/08)* | Predicted total procedures over the next five years |
|---------------------------------|-----------------------------|--|---|
| Abdominal aortic aneurysm | 927 | 334 (36%) | 1,072 |
| Carotid endarterectomy | 592 | 168 (28%) | 592 |
| Lower extremity arterial bypass | 765 | 166 (22%) | 765 |
| Total | 2284 | 668 (30%) | 2,429 |

*Source: HES inpatients 2007/08.

The volumes of arterial procedures per unit were calculated for different numbers of central vascular units:

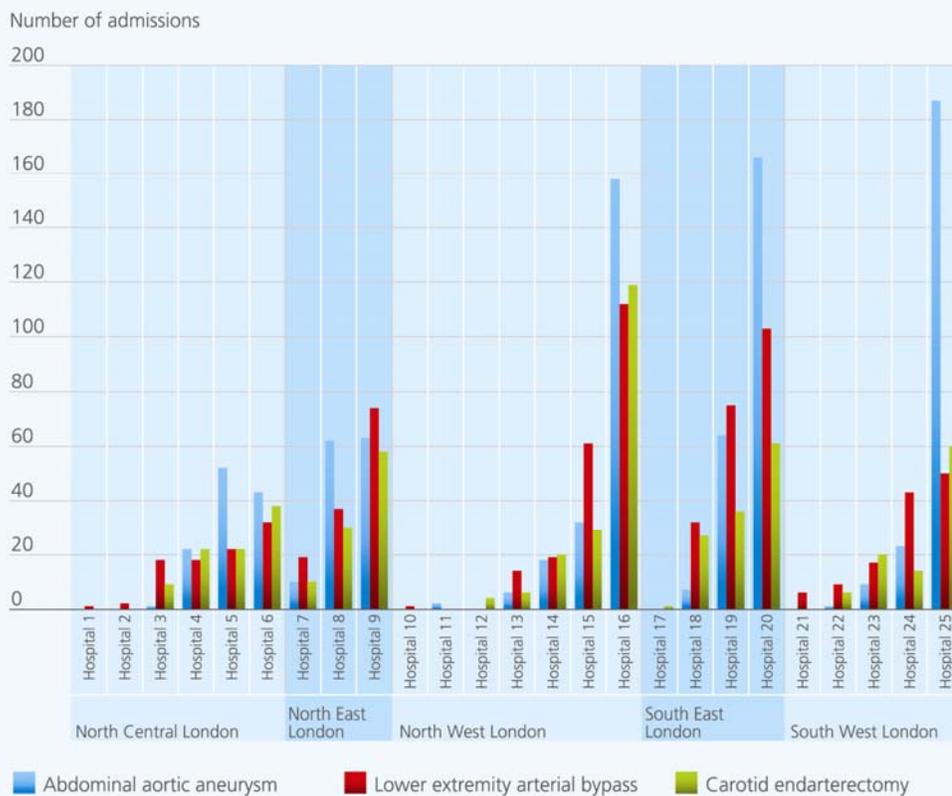
- seven central units = annual average of 347 admissions per unit
- six central units = annual average 405 admissions per unit
- five central units = average 486 admissions per unit
- four central units = annual average 607 admissions per unit.

The hospital currently performing the majority of arterial procedures undertakes around 200 abdominal aortic aneurysm repairs a year. It is recommended that all designated central vascular units achieve this standard. With the number of these procedures expected to be 1,072 in future, this standard would mean five central units would be the optimum number with each performing around 215 of these procedures each year.

There is already a level of centralisation of arterial surgery across London with most sectors having one hospital performing the bulk of procedures.



Admissions for abdominal aortic aneurysm, carotid endarterectomy and lower extremity arterial bypass by sector



Number of surgeons

The Vascular Society recommends hospitals that have vascular services require a minimum of one vascular surgical specialist per 150,000 people, and an equivalent number of interventional radiologists to provide emergency care.

Using this as a guide, each sector would require between eight and twelve surgeons depending on the size of the population.

| Sector | Population size | Approximate number of surgeons (WTE) |
|----------------------|-----------------|--------------------------------------|
| North east London | 1,610,819 | 11 |
| North central London | 1,248,911 | 8 |
| North west London | 1,846,474 | 12 |
| South east London | 1,582,076 | 10.5 |
| South west London | 1,340,019 | 9 |



These recommended figures do not take into account the increase in workload over recent years, and the reduced amount of time junior staff working on full shift rotas are available for service activity on the wards, in theatre and in outpatient clinics. These figures therefore represent a minimum estimate of the numbers of surgeons required.

The Vascular Society also recommends that services need to allow for reasonable elective activity alongside an acceptable consultant emergency on-call rota – ideally one to six, with no fewer than four surgeons.

As the number of surgeons recommended by the Vascular Society is an underestimate, it is likely that at least eight surgeons performing emergency and elective procedures will be needed to staff a 24-hour central vascular unit.

Co-dependencies

All designated major trauma centres must have an emergency vascular service on site providing 24-hour emergency care. It is recommended that emergency and elective aspects of a vascular service are not split. The co-dependencies matrix also recommends urgent cardiology and emergency primary PCI centres are collocated with an on site vascular service.

Therefore, specialist vascular services would need to be collocated with major trauma centres, which also have heart attack centres on site.

Recommendation

For these reasons, the recommended optimal number of central units for London is five, staffed with at least eight vascular surgeons.



Appendix 2 – Risk stratification process for non-elective cardiac surgery patients

Risk of waiting score

This model of care proposes the following criteria and associated points by which to assess patients waiting for non-elective cardiac surgery. The risk stratification system below has been adapted from Rexus et al recent publication⁴⁶.

| | Definition | Score |
|------------------------------------|--------------------------------|--|
| Acute coronary syndrome | Hospitalisation for chest pain | Trop positive = 3 Trop negative = 2 |
| Left main stenosis | >50% | 2 |
| Aortic valve disease | Needing surgery | 2 |
| Gender | | Male = 1 Female = 0 |
| Operative risk⁴⁷ | EuroSCORE | 0-3 = 0 4-6 = 1 >7 = 2 |
| Ejection fraction | Echo or LV gram | >50% = 0 35-50% = 1 <35% = 2 |

Patients will be assessed on the above factors and depending on which of factors they demonstrate, a total number of points will be allocated. The total number of points will determine which of three risk groups the patient belongs to. The risk groups proposed are:

- high risk = >6 points
- medium risk = 3-5 points
- lower risk = 0-2 points.

Based on this risk assessment, decisions can be made about the order in which patients are to be treated. Clear protocols for treating patients in the various risk groups are recommended below:

High risk – patient to be transferred to a cardiac surgery unit immediately and operated on as an in-patient within one week of admission (left main stem and acute coronary syndrome ideally within 48 hours).

Medium risk – patient to be operated on within two weeks of admission.

⁴⁶ H. G. Rexus et al, 'Simple Score to Assess Mortality Risk in Patients Waiting for Coronary Artery Bypass Grafting', *The Annals of Thoracic Surgery*, 2006, 81(2):577-582.

⁴⁷ T.L. Higgins et al, 'Stratification of morbidity and mortality outcome by preoperative risk factors in coronary artery bypass patients. A clinical severity score', *The Journal of the American Association*, 1992, 267:2344–2348. (The Cleveland Clinic Risk Score was used for peroperative mortality and morbidity risk stratification. This has been replaced by the Euroscore).

