Commissioning Support for London

Cardiovascular project

Co-dependencies framework

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Commissioning Support for London
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Contents

Executive summary

This framework has been developed as part of Commissioning Support for London's cardiovascular project.

The framework aims to describe the level of services required to provide a world-class cardiovascular service. It is intended to provide commissioners with a set of recommendations to inform the provision of services for a world-class cardiovascular service, and can also be used by commissioners and trusts as a benchmarking tool against current service provision.

There is currently no clinically agreed consensus on the essential services required for acute and complex cardiovascular services. However, there is evidence to suggest that the collocation of services can improve outcomes for patients undergoing acute and complex cardiovascular procedures.

The approach to the development of the co-dependencies framework is taken from the Department of Health report on interdependencies in specialised paediatric services, and was led by the cardiovascular project's three clinical expert panels.

The completed framework suggests a high level of dependency between acute and complex cardiovascular procedures, including cardiac surgery and complex vascular surgery. This is illustrated further in the completed framework. However, no recommendations are made as to the number of specialist cardiovascular centres or networks required as a result of the development of the framework.

1. Introduction

The purpose of the Commissioning Support for London cardiovascular project is to review cardiovascular services in London, develop a model of care and support the implementation of a world-class London wide service.

This document supports the case for change and model of care for acute and complex cardiovascular services. It outlines the methodology used to develop the co-dependencies framework, the service co-dependencies and recommendations for service collocation of the following specialties:

- vascular surgery
- cardiac surgery
- cardiology.

The purpose of the co-dependencies framework is to establish a clear, clinically agreed and robust statement of the relationships and dependencies for acute and complex cardiovascular services. In the context of this work, world-class refers to a focus on patient outcomes, equitable access and efficient use of resources. The framework recommends which services should be provided together, and at what level collocation is required, to achieve a world-class standard.

The framework is intended to assist commissioners in planning any future service reconfigurations.

In developing the framework we have been conscious that:

- This framework is not prescriptive of the service changes that may take place but aims to facilitate change by informing the potential planning, reconfiguration and distribution of services.
- This framework should be used as a planning tool by commissioners to inform change in sectors, trusts or local areas.
- Any application of the framework will require a process of engagement with stakeholders including patients, carers, clinicians and representatives.

2. Background

A report commissioned by the Department of Health in 2008

[1] to examine the critical interdependencies between specialised paediatric services produced a framework illustrating these relationships. A similar approach has been taken in developing this co-dependencies framework.

The definitions used differ from those used in the specialised paediatric services framework. The focus of the cardiovascular co-dependencies framework is on standards to provide a world-class service, whereas the paediatrics framework had a specific focus on safety.

Although each cardiovascular specialty – vascular surgery, cardiac surgery and cardiology – has demonstrable dependencies on other services, these services are not always located in the same hospital or, in some cases, in the same trust. There is currently no clinically agreed consensus on the essential services that should be collocated to provide a cardiovascular service. However, there is evidence to show that collocating services improves outcomes for patients undergoing acute and complex cardiovascular procedures.

The Vascular Society's 2009 report *The Provision of Services for Patients with Vascular Disease*[2] outlined the essential components of a vascular service and supports the view that additional specialty services improve the quality of emergency and elective vascular services for patients. Other studies have also suggested that collocating support services contributes to improved patient outcomes at high volume hospitals.[3] [4] [5]

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[1] Department of Health, *Commissioning Safe and Sustainable Specialised Paediatric Services,* August 2008.

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

[3] J. B. Dimick et al, 'The volume-outcome effect for abdominal aortic surgery', *Archives of Surgery*, 2002, 137: 828-832.

[4] D. R. Urbach & N. N. Baxter, 'Does it matter what a hospital is "high volume" for? Specificity of hospital volume-outcome associations for surgical procedures: analysis of administrative data', *Quality and Safety in Health Care*, 2004, 13: 379-383.

[5] R. D. Cebul et al, 'Indications, outcomes and provider volumes for carotid endarterectomy', *Journal for the American Medical Association*, 1998, 279 (16): 1282-1287.

3. The co-dependencies framework

The need to clarify the requirements of a world-class cardiovascular service has formed the basis of this work. Given the currently fragmented nature of cardiovascular services, and lack of agreement over which services are essential, it is hoped this framework will be used to inform service improvement and change.

The following recommendations are made:

- Commissioners should use the co-dependencies framework for acute and complex cardiovascular services to support decision making on future service reconfigurations, based on a set of clinically agreed service dependencies.
- The list of services identified as essential for collocation (purple relationships) should be considered as the minimum requirements to deliver a world-class cardiovascular service.
- Commissioners should be aware of the interdependencies between each cardiovascular service recommended as essential and key support services in the framework, to achieve a truly world-class service.
- To ensure the required key support services are provided, the formal and informal network arrangements outlined in the model of care would need to be in place, in addition to any robust protocols for emergency and elective referrals recommended by the framework.

4. The framework

4.1 How it was developed

The clinical leads for each speciality agreed the service listings and headings for the framework following a review of the available literature and extensive discussion. The final list of services chosen for inclusion in the framework is in appendix 1.

Additional services included in the framework are those services that:

- have been identified as essential for each specialty to enable world-class standards for cardiovascular services to be achieved
- are more likely to have critical interdependencies on other major specialties.

Each specialty has been categorised further. For example, cardiology has been broken down into three distinct areas:

- urgent/emergency/primary percutaneous coronary intervention (PCI)
- complex/interventional – transcatheter aortic valve implantation (TAVI)
- complex and intermediate electrophysiology.

For cardiology, urgent/emergency/primary PCI includes both heart attack centres and access to urgent primary PCI services at other hospitals.

Details of the inclusions and exclusions for each are found in appendix 2.

The blank framework

The blank framework is shown below.

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	VascularArterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary	Cardiology Complex/ interventional TAVI	Cardiology Complex and intermediate EP	Cardithoracic Specialist Intensive	Cardiothoracic Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology
Cardiac Surgery													
Thoracic Aortic Surgery													
VascularArterial: Complex & Emergency													
Cardiology Urgent/Emergency/Primary PCI													
Cardiology Complex/ interventional TAVI													
Cardiology Complex and intermediate EP													

Each specialty and their further categories are listed in the left hand column of the framework. For example, urgent/emergency/primary PCI and complex/intermediate electrophysiology are services specific to cardiology. The services listed in the top row include each specialty and all other additional support services.

Taking a service from the left hand column and reading across will show the level of dependency on other services, and the recommended level of collocation as per the colour coding system explained in section 4.2. The framework is only intended to be read in this way, and not from the opposite direction – right to left.

4.2 The definitions

The key issue addressed by the framework is the structure of co-dependent services including:

- level of service dependency
- recommended level of collocation
- services that demonstrate a dependency but where collocation is not essential.

The relationships and level of dependency between services in the framework are defined by the use of a simple colour coding system.

How these were developed

The focus of the definitions used for the co-dependencies framework is on the standards required to provide a world-class cardiovascular service. The clinical leads for each speciality discussed the definitions at length before agreeing those which are used in the framework.

Collocation

Where the definition of location in the framework states ‘in the same trust’ this is to ensure the collocated service benefits from shared managerial and clinical governance arrangements. Shared arrangements will mean the collocated service:

- can be accessed quickly – particularly important for urgent referrals and emergencies
- provides a standard of care which can be easily audited, even where procedure volumes are low
- is supported by teams who are able to provide follow-up visits where needed
- benefits from shared rotas and a wider pool of specialist expertise.

Collocation in an Academic Health Science Centre (AHSC) is accepted where the overarching managerial function and level of clinical governance can be demonstrated as being equivalent to that of a trust.

It is recognised that the collocation of services identified as essential by the framework may be challenging for providers to achieve immediately. Commissioners should review services to identify the changes required to meet the framework, and agree providers' planning to ensure that developments are consistent with the aspirations to a world class service laid out in the framework. Commissioners should then regularly review plans and progress towards the aspired collocation.

The definitions

The agreed definitions are contained in the table below.

Coding	Definition
PURPLE	Definition: Absolutely dependent service. Location: Collocation in the same hospital.
RED	Definition: Highly dependent service. Location: Ideally collocation in the same hospital, if not then must be located in the same trust.
AMBER	Definition: Moderately dependent service. Location: Ideally in the same trust, if not possible then robust protocols for emergency and elective referrals to be in place.
GREEN	Definition: Minimal dependency. Location: Robust protocols for urgent and emergency referrals to be in place.

4.3 Explaining the definitions

Purple

Purple relationships are those services where an absolute dependency has been agreed. Collocation is therefore recommended as essential. These services are the minimum required to deliver a world-class cardiovascular service.

For example, cardiac surgery has an absolute dependency on specialist anaesthesia.

Case study

Mr Udeh was admitted for a coronary artery bypass graft. Without the support of an on site specialist cardiac anaesthetist, the surgery could not be performed safely.

Red

Red relationships are those where a highly dependant service relationship has been identified but, unlike purple relationships, there is some flexibility in the level of collocation. For highly dependent relationships, while collocation in the same hospital is recommended, collocation in the same trust is acceptable. These services are those which have been identified as vital but do not necessarily require collocation in the same hospital.

For example, cardiology – urgent/emergency/primary PCI has a high dependency on a gastrointestinal bleeding service.

Case study

Mr Philips was admitted with a heart attack requiring urgent investigation and treatment. He was taken to the cardiac catheter laboratory where he underwent a coronary angioplasty procedure and had a stent inserted. He was prescribed standard drug therapy to reduce the risk of a blood clot forming.

As a consequence of this essential drug treatment, and with his past history of a stomach ulcer, Mr Philips suffered a severe bleed into his gut which required an urgent endoscopy. Had the gastrointestinal bleeding service not been immediately available Mr Philip's life would have been in danger and his stay in hospital prolonged.

Amber

Amber relationships have been defined as services on which there is a moderate dependency. They are recommended for collocation wherever opportunities exist, either in the same hospital or trust, but it is not essential. If collocation is not possible, it is essential that robust protocols for emergency and elective referrals are in place to ensure continuous high quality care.

For example, cardiac surgery has a moderate dependency on plastic surgery.

Case study

Mr Kapoor underwent a coronary artery bypass graft. The operation was unexpectedly long and complicated. During the postoperative period his sternal wound broke down. There was no plastic surgery on site and the nearest service was in a hospital, in another trust. He required a complex plastic reconstruction and the other trust was unable to provide a surgeon to operate for three weeks. If robust referral protocols had been in place between the two trusts, Mr Kapoor could have been seen earlier and been discharged sooner.

Green

Green relationships are defined as services on which there is a minimal dependency. Collocation is not essential but robust protocols for urgent and emergency procedures are recommended to ensure continuous high quality care. These services offer support to essential services and enable world-class standards to be achieved. For example, thoracic aortic surgery has a minimal dependency on maxillofacial surgery (including dentistry).

Case study

Maria underwent replacement of her thoracic aorta. In the postoperative period she developed an abscess on her tooth, which could have led to an infection. Advice was given by the on-call maxillofacial surgeon from the local hospital. The pain settled with antibiotics and pain relief.

Grey

The grey boxes in the framework are used to show either where services match or where it is recognised that there is no relationship at all between specific services.

For example, neither cardiac surgery nor complex and emergency arterial vascular surgery would ever require complex and interventional cardiology TAVI.

5. The completed framework

5.1 How was the framework completed?

Following agreement of the service listing and definitions for the framework, members of the project's three clinical expert panels were invited to submit completed frameworks using the definitions provided.

These panels were established to provide expert clinical knowledge and input to the project for each speciality, and also include patient representatives. When describing their view of services in the framework, panel members were asked to consider it as a 'blank sheet of paper' – as if services were to be set up independent of existing provider arrangements.

A meeting was held to discuss the results of the submitted frameworks. The panels were split into groups, and were asked to agree the dependencies for their area of the framework. The results from each group were then presented back for general discussion and debate, where a consensus on the entire framework was reached.

5.2 Results of the completed framework

The overall results of the framework are shown below (see appendix 4 for a full scale version).

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ interventional TAVI	Cardiology Complex and intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery		R	P	P		P	P	P	P	P	R	P	R	R	R	R	A	R	A	A	A
Thoracic Aortic Surgery	P		P	P	P	A	P	P	P	P	R	P	R	R	R	R	A	R	G	R	A
Vascular Arterial: Complex & Emergency	R			P		A	P	P	P	P	A	P	R	R	R	P	R	R	G	R	A
Cardiology Urgent/ Emergency/ Primary PCI	P	P	R			R	P	P	P	P	A	P	R	R	R	A	G	R	G	A	G
Cardiology Complex/ interventional TAVI	P	P	P	R		R	P	P	P	P	R	P	R	R	R	A	G	R	A	A	G
Cardiology Complex and intermediate EP	P	A	R	P			P	P	P	P	A	P	R	R	R	A	A	R	G	A	G

Framework examples

Using the completed framework enables users to identify the service dependencies and collocation recommendations for each cardiovascular specialty.

Cardiac surgery has:

- an absolute dependency on, and collocation is recommended as essential with:
  - vascular arterial – complex and emergency surgery
  - cardiology – urgent/emergency/primary PCI, complex and intermediate electrophysiology
  - specialist intensive care

  - specialist anaesthesia
  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility.
- a high dependency on, and collocation is strongly recommended with:
  - thoracic aortic surgery
  - thoracic medicine
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - diabetes service
  - general surgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - plastic surgery
  - maxillofacial surgery
  - neurology or neurosurgery
  - urology.

Determining the degrees of dependency will benefit those involved in the commissioning or delivery of cardiovascular services, and will assist in determining the provision and distribution of services in future reconfigurations.

A detailed explanation of the service relationships is contained in appendix 5.

6. Essential relationships (purple)

The primary focus of this report is to define the essential dependant service relationships – that is those, according to the framework, for which collocation is essential irrespective of whether they are mutually dependant. These services are the minimum required to deliver a world-class cardiovascular service and should therefore be collocated in the same hospital.

The context for collocation for the purposes of this framework is outlined in section 3.

To ensure the required range of clinical conditions and services are supported with no unnecessary duplication in a sector or geographical area, there may also be additional relationships with other specialities. This may, in turn, generate a cumulative effect.

It is acknowledged that there are some services not included in the framework that also require cardiovascular services, for example, major trauma centres. The requirements of a major trauma centre are as follows.

- cardiology
- vascular surgery
- cardiothoracic surgery
- anaesthetics
- radiology (plain film, ultrasound, MRI and CT)
- general surgery
- neurosurgery
- plastic surgery
- maxillofacial
- urology.

Decisions relating to the designation of major trauma centres have already been made. However, it should be noted that none of the services in either the above list or the framework have any dependency on major trauma centres.

6.1 Common requirements

During the development of the framework, a degree of commonality emerged with five of the six specialties sharing a common requirement (due to either a red or purple relationship) for each of the following services:

- cardiac surgery
- complex and emergency arterial vascular surgery

- cardiology – urgent/emergency/primary PCI.

This is illustrated further in the table below (see appendix 6 for a full scale version).

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ Interventional /AVI	Cardiology Complex and Intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery			P	P		P	P	P	P	P		P									
Thoracic Aortic Surgery	P		P	P	P		P	P	P	P		P									
Vascular Arterial: Complex &				P			P	P	P	P		P				P					
Cardiology Urgent/ Emergency/	P	P					P	P	P	P		P									
Cardiology Complex/ interventional	P	P	P				P	P	P	P		P									
Cardiology Complex and intermediate EP	P			P			P	P	P	P		P									

The remaining services have some flexibility in terms of their configuration but all six specialties have a common requirement for the following support services:

- specialist intensive care
- specialist anaesthesia
- interventional radiology
- a filtration/dialysis service.

6.2 Interrelationships

Where some service relationships are coded red, there are instances where the same service relationship with a different speciality is coded purple. This generates a cumulative effect as described below:

For example:

- cardiac surgery has an absolute dependency (purple relationship) with complex and emergency arterial vascular surgery but
- complex and emergency arterial vascular surgery only has a high dependency (red relationship) with cardiac surgery.

Although there is no mutual level of dependency between the two services, as there is an essential relationship between cardiac surgery and arterial vascular surgery, the collocation of both services in the same hospital is recommended as essential. This is demonstrated in this table (see appendix 5 for larger scale version).

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ Interventional /TAVI	Cardiology Complex and Intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery		R	P	P		P	P	P	P	P	R	P	R	R	R	R		R			
Thoracic Aortic Surgery	P		P	P	P		P	P	P	P	R	P	R	R	R	R	R	R		R	
Vascular Arterial: Complex &	R			P			P	P	P	P		P	R	R	R	P	R	R		R	
Cardiology Urgent/ Emergency/	P	P	R			R	P	P	P	P		P	R	R	R			R			
Cardiology Complex/ interventional	P	P	P	R		R	P	P	P	P	R	P	R	R	R			R			
Cardiology Complex and intermediate EP	P		R	P			P	P	P	P		P	R	R	R			R			

7. How should commissioners use this framework?

The framework on cardiovascular co-dependencies is intended to provide commissioners with a set of recommendations to inform the provision of essential services to provide a world class cardiovascular service. It aims to provide commissioners with a ‘direction of travel’ for the future commissioning of services. The framework can also be used by trusts and commissioners as a benchmarking tool to assess the current provision of services in the round.

When making decisions about the distribution of services using the framework, commissioners should be sensitive to the cumulative nature of red and purple service relationships. Commissioners are also asked to consider the links between moderately and minimally dependent relationships and the differing dependencies identified for each specialty.

No recommendations have been made as to the number of specialist cardiovascular centres or networks required as a result of the development of this model. However, it is possible for commissioners and trusts to use this framework as a benchmarking tool to implement a clinically agreed approach to the provision and configuration of specialised cardiovascular services.

8. Conclusion

This report presents a co-dependency framework, which is intended for use by commissioners to drive forward service change in implementing world-class standards for acute and complex cardiovascular procedures. Used as a benchmarking tool, the framework will also enable trusts to identify where opportunities exist to improve current service provision.

No recommendations are made as to the number of specialist cardiovascular centres or networks required as a result of the development of this model.

Appendices

Appendix 1: Services in included in the co-dependencies framework

Cardiac surgery

Thoracic aortic surgery

Vascular arterial – complex and emergency surgery

Cardiology – urgent/emergency/primary PCI

Cardiology – complex/interventional TAVI

Cardiology – complex and intermediate electrophysiology

Specialist intensive care

Specialist anaesthesia

Cardiothoracic specialist imaging

Interventional radiology

Thoracic medicine

Filtration/dialysis facility

Microbiology

Renal medicine

Gastronintestinal bleeding service

Diabetes service

Plastic surgery

General surgery

Maxillofacial surgery

Neurology or neurosurgery

Urology

Appendix 2: Inclusions and exclusions

Inclusions and exclusions for each speciality as described in section 4.

Service	Inclusions	Exclusions
Cardiac surgery (standard)	• All routine adult cardiac surgery e.g. CABG, valves, elective ascending aortic surgery.	• Surgery for grown-up congenital heart patients • Thoracic aortic surgery
Cardiovascular – thoracic aortic surgery	• Acute aortic dissection (types A and B). • Aneurysms of the arch and descending aorta.	• Elective ascending aneurysm surgery • Aortic surgery below the diaphragm
Vascular arterial surgery – complex and emergency (24/7 on-call for vascular trauma)	• Elective and emergency aortic surgery – open and endovascular – includes visceral arteries. • Carotid surgery and endovascular intervention. • Elective and emergency lower limb surgery and interventions.	• Elective lower limb PCI
Cardiology – urgent/emergency /primary PCI	• Primary PCI, PCI for higher risk NSTEMI.	• Elective PCI • Low risk NSTEMI
Cardiology – complex interventional (TAVI)	• TAVI, or future new (developmental) complex interventional procedures (e.g. left artial appendage occlusion).	• Existing interventions (e.g. persistent foramen ovale closure), which are already disseminated.
Cardiology – complex and intermediate electrophysiology	• Atrial fibrillation, atrial or ventricular tachycardia ablation. • Electrophysiology for grown-up congenital heart patients.	• Supraventricular tachycardia ablation (atrioventricular nodal reentry tachycardia or accessory pathway [not involving transeptal] • AV nodal ablation

	• Pacing lead extraction. • Implantable cardioverter defibrillator, cardiac resynchronisation therapy pacing.	• Atrial flutter ablation • Diagnostic electrophysiology study • Routine permanent pacing

Appendix 3: Clinical expert panels

Vascular services

- Nick Cheshire (Chair) – Clinical Lead, Vascular Surgeon, Imperial College NHS Trust
- Professor Matt Thompson – Consultant Vascular Surgeon & Project Clinical Director, St Georges Healthcare NHS Trust
- Peter Taylor – Vascular & Endovascular Surgery, Guy's & St Thomas' NHS Foundation Trust
- David Evans – Interventional Radiology, King's College Hospital NHS Trust
- Sophie Renton – Vascular Surgery, North West London Hospitals NHS Trust
- Ross Naylor – Vascular Professor, Leicester Royal Infirmary Vascular Surgery Group
- Peter Holt – Vascular Fellow, St Georges Healthcare NHS Trust
- George Hamilton – Vascular Surgery, Royal Free Hampstead NHS Trust

Cardiology

- Huon Gray (Chair) – Clinical Lead, Southampton General Hospital Trust
- Professor Matt Thompson – Consultant Vascular Surgeon & Project Clinical Director, St Georges Healthcare NHS Trust
- Charles Knight – Consultant Cardiologist, Barking Havering Redbridge NHS Trust & Barts & The London
- Andrew Archbold – Consultant Cardiologist, Bart's and The London (London Chest Hospital) & Newham University Hospital NHS Trust
- Richard Bogle – Cardiologist & Lead for Cardiology, Epsom & St Helier NHS Trust
- Michael Cooklin – Consultant Cardiologist (Cardiac Electrophysiologist), Guy's and St Thomas' NHS Foundation Trust
- Martyn Thomas – Clinical Director for Cardiovascular, Guys & St Thomas' NHS Trust
- Glain Jones – Head of Nursing/ Service Manager – Cardiac Division, King's College Hospital
- Kim Fox – Cardiology, Royal Brompton & Harefield NHS Foundation Trust

- Gerry Coghlan – Cardiology, Royal Free Hampstead NHS Trust
- Nick Bunce – Cardiologist – Lead for SW Cardiac Network, St Georges Healthcare NHS Trust
- John Deanfield – Consultant Cardiologist, The Heart Hospital - UCLH / Great Ormond Street
- Jamil Mayet – Chief-of-Service, Cardiovascular Medicine, Imperial College

Cardiac surgery

- Steve Livesey (Chair) – Clinical Lead, Consultant Cardiothoracic Surgeon, Southampton General Hospital
- Professor Matt Thompson – Consultant Vascular Surgeon & Project Clinical Director, St Georges Healthcare NHS Trust
- Rakesh Uppal – Cardiothoracic Surgery, Bart's and The London
- Carol McCoskery – Head of Nursing for Cardiovascular Services, Guy's & St Thomas' NHS Foundation Trust
- Christopher Young – Cardiothoracic Surgery, Guy's & St Thomas' NHS Foundation Trust
- Iqbal Malik – Cardiology, Imperial College Healthcare NHS Trust
- Olaf Wendler – Clinical Director for Cardiology and Cardiothoracic Surgery, Kings College Hospital
- Darryl Shore – Cardiac Surgery, Royal Brompton & Harefield NHS Foundation Trust
- Chris McGregor – Consultant Cardiothoracic Surgeon, The Heart Hospital – UCLH

Appendix 4: Service co-dependency framework

The framework below sets out the results of the work on co-dependencies.

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ interventional TAVI	Cardiology Complex and intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery		R	P	P		P	P	P	P	P	R	P	R	R	R	R	A	R	A	A	A
Thoracic Aortic Surgery	P		P	P	P	A	P	P	P	P	R	P	R	R	R	R	A	R	G	R	A
Vascular Arterial: Complex & Emergency	R			P		A	P	P	P	P	A	P	R	R	R	P	R	R	G	R	A
Cardiology Urgent/ Emergency/ Primary PCI	P	P	R			R	P	P	P	P	A	P	R	R	R	A	G	R	G	A	G
Cardiology Complex/ interventional TAVI	P	P	P	R		R	P	P	P	P	R	P	R	R	R	A	G	R	A	A	G
Cardiology Complex and intermediate EP	P	A	R	P			P	P	P	P	A	P	R	R	R	A	A	R	G	A	G

Appendix 5: Framework examples

Thoracic aortic surgery has:

- an absolute dependency on, and collocation is recommended as essential with:
  - cardiac surgery
  - vascular arterial – emergency complex
  - all cardiology – urgent/emergency/primary PCI, complex and intermediate electrophysiology and complex/interventional TAVI
  - specialist intensive care
  - specialist anaesthesia
  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility.
- a high dependency on, and collocation is strongly recommended with:
  - thoracic medicine
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - diabetes service
  - general surgery
  - neurology or neurosurgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - cardiology – complex and intermediate electrophysiology
  - plastic surgery
  - urology.
- has a minimal dependency on, and robust protocols for emergency referrals are recommended for:
  - maxillofacial surgery.

Vascular arterial – complex and emergency surgery

- Absolute dependency on, and collocation is recommended as essential with:
  - cardiology – urgent/emergency/primary PCI
  - specialist intensive care
  - specialist anaesthesia
  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility
  - a diabetes service.
- a high dependency on, and collocation is strongly recommended with:
  - cardiac surgery
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - plastic surgery
  - general surgery
  - neurology or neurosurgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - cardiology – complex and intermediate electrophysiology
  - thoracic medicine
  - urology.
- has a minimal dependency on, and robust protocols for emergency referrals are recommended for:
  - maxillofacial surgery.

Cardiology – urgent/emergency/primary PCI has:

- an absolute dependency on, and collocation is recommended as essential with:
  - cardiac surgery

  - thoracic aortic surgery
  - specialist intensive care
  - specialist anaesthesia
  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility.
- a high dependency on, and collocation is strongly recommended with:
  - vascular arterial – complex and emergency surgery
  - cardiology – complex and intermediate electrophysiology
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - general surgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - thoracic medicine
  - a diabetes service
  - neurology or neurosurgery.
- has a minimal dependency on, and robust protocols for emergency referrals are recommended for:
  - plastic surgery
  - maxillofacial surgery
  - urology.

Cardiology – complex/interventional TAVI:

- an absolute dependency on, and collocation is recommended as essential with:
  - cardiac surgery
  - thoracic aortic surgery
  - vascular arterial – complex and emergency surgery

  - specialist intensive care
  - specialist anaesthesia
  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility.
- a high dependency on, and collocation is strongly recommended with:
  - cardiology – urgent/emergency/primary PCI, complex and intermediate electrophysiology
  - thoracic medicine
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - general surgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - diabetes service
  - maxillofacial surgery
  - neurology or neurosurgery.
- has a minimal dependency on, and robust protocols for emergency referrals are recommended for:
  - plastic surgery
  - urology.

Cardiology – complex and intermediate electrophysiology has:

- an absolute dependency on, and collocation is recommended as essential with:
  - cardiac surgery
  - cardiology – urgent/emergency/primary PCI
  - specialist intensive care
  - specialist anaesthesia

  - cardiothoracic specialist imaging
  - interventional radiology
  - a filtration/dialysis facility.
- a high dependency on, and collocation is strongly recommended with:
  - vascular arterial: complex and emergency surgery
  - microbiology
  - renal medicine
  - gastrointestinal bleeding service
  - general surgery.
- a moderate dependency on, and collocation is recommended but not essential on site, with:
  - thoracic aortic surgery
  - thoracic medicine
  - diabetes service
  - plastic surgery
  - neurology or neurosurgery.
- has a minimal dependency on, and robust protocols for emergency referrals are recommended for:
  - maxillofacial surgery
  - urology.

Appendix 6: Essential (purple) relationships

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ interventional TAVI	Cardiology Complex and intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery			P	P		P	P	P	P	P		P									
Thoracic Aortic Surgery	P		P	P	P		P	P	P	P		P									
Vascular Arterial: Complex & Emergency				P			P	P	P	P		P				P					
Cardiology Urgent/ Emergency/ Primary PCI	P	P					P	P	P	P		P									
Cardiology Complex/ interventional TAVI	P	P	P				P	P	P	P		P									
Cardiology Complex and intermediate EP	P			P			P	P	P	P		P									

Appendix 7: Interrelationships

Service	Cardiac Surgery Standard	Thoracic Aortic Surgery	Vascular Arterial: Complex & Emergency	Cardiology Urgent/ Emergency/ Primary PCI	Cardiology Complex/ interventional TAVI	Cardiology Complex and intermediate EP	Specialist Intensive Care	Specialist Anaesthesia	Cardiothoracic Specialist Imaging	Interventional Radiology	Thoracic Medicine	Filtration /dialysis facility	Microbiology	Renal Medicine	GI Bleeding Service	Diabetes Service	Plastic Surgery	General Surgery	Maxillofacial Surgery (inc dentistry)	Neurology or Neurosurgery	Urology
Cardiac Surgery		R	P	P		P	P	P	P	P	R	P	R	R	R	R		R			
Thoracic Aortic Surgery	P		P	P	P		P	P	P	P	R	P	R	R	R	R		R		R	
Vascular Arterial: Complex & Emergency	R			P			P	P	P	P		P	R	R	R	P	R	R		R	
Cardiology Urgent/ Emergency/ Primary PCI	P	P	R			R	P	P	P	P		P	R	R	R			R			
Cardiology Complex/ interventional TAVI	P	P	P	R		R	P	P	P	P	R	P	R	R	R			R			
Cardiology Complex and intermediate EP	P		R	P			P	P	P	P		P	R	R	R			R			