Lower Limb Amputation: Working Together

A review of the care received by patients who underwent major lower limb amputation due to vascular disease or diabetes

A report by the National Confidential Enquiry into Patient Outcome and Death (2014)

Compiled by:
MJ Gough ChM FRCS – Clinical Co-ordinator
Health Education Yorkshire and the Humber

M Juniper FRCP – Clinical Co-ordinator
Great Western Hospitals NHS Foundation Trust

H Freeth BSc (Hons) MSc RGN MSc – Clinical Researcher

A Butt BSc (Hons) – Research Assistant

M Mason PhD – Chief Executive

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Gavin Barlow, Consultant in Infectious Diseases
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Martin Fox, Vascular Specialist Podiatrist
Jane Greaves, Senior Lecturer/ Critical Care Nurse
Jai Kulkarni, Consultant in Rehabilitation Medicine
Jeremy Langton, Consultant Vascular Anaesthetist
David Mitchell, Consultant Vascular Surgeon
Gerry Rayman, Consultant Physician (Diabetes and Endocrinology)
Julian Scott, Consultant Vascular Surgeon

The Advisors who peer reviewed the cases:
Chandrasiri Abrew, Consultant Vascular & Endovascular Surgeon
Beas Bhattacharya, Consultant in Diabetes & Endocrinology
Gary Colleary, Consultant Orthopaedic Surgeon
Umesh Dashora, Consultant in Endocrinology and Diabetes
Julia Earle, Clinical Specialist Physiotherapist in Amputee Rehabilitation
Frances Game, Consultant Diabetologist
Jaclyn Glazebrook, Advanced Podiatrist
Amanda Hancock, Clinical Manager Physiotherapy Inpatients
Darren Hird, Surgical Nurse Practitioner and Vascular Nurse Specialist
Ian Hunter, Consultant Vascular & Endovascular Surgeon
Tariq Husain, Consultant in Anaesthesia and Intensive Care
Ajantha Jayatunga, Consultant Vascular Surgeon
Keith Jones, Consultant Vascular Surgeon
Ann Knowles, Diabetes Specialist Foot Care Nurse
John Mackinnon, Consultant Anaesthetist
Tapan Mehta, Consultant Vascular Surgeon
Jay Menon, Consultant Vascular & General Surgeon
Mohamed Mohamed, Consultant Vascular Surgeon
John Mosley, Consultant General & Vascular Surgeon
Maria Mousley, AHP Consultant Podiatrist
Taohid Oshodi, Consultant Vascular Surgeon
Arun Pherwani, Consultant Vascular Surgeon
Woolagasen Pillay, Consultant Endovascular Surgeon
Alag Raajkumar, Consultant Anaesthetist
Vino Ramachandra, Consultant Anaesthetist
Hisham Rashid, Consultant Vascular and Endovascular Surgeon
Deborah Ruff, Vascular Nurse Specialist
Bhaskar Saha, Consultant Vascular Anaesthetist
Srinivasan Shyamundar, Consultant Orthopaedic Surgeon
Elizabeth Uchegbu, Consultant Diabetologist and Endocrinologist
Neil Walton, Consultant Orthopaedic Surgeon
Lasantha Wijesinghe, Consultant Vascular Surgeon
Teun Wilmink, Consultant Vascular Surgeon
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Foreword

Nobody wants to have their leg cut off if they can avoid it. Bearing this in mind we should not be surprised to find that the commonest reason for pre-operative delay before amputation is a refusal to consent. Yet the procedure may be highly necessary, sometimes life-saving and if it be done, it had better be done well.

The operation seems to be as old as medicine itself although, alarmingly to our ear, it seems to have been called dismemberment until the sixteenth century. There is widespread evidence that it was practiced in Neolithic times, probably for ritual or punitive as well as therapeutic purposes. Certainly it was long established by the time of Hippocrates (BC 460-370). Hans van Gersdorff's graphic woodcut demonstrating the finer points of the procedure was published in 1517.

"Hans von Gersdorff: Feldbuch der Wundarznei"

One reader may have been Amboise Paré (1510-1590) who is famous for having avoided the added trauma of being cauterized with a red hot iron by tying off the bleeding vessels - a novel technique that had been meticulously described by Celsus 1,500 years earlier.

If the essence of the procedure has not changed very much, the surrounding techniques and the patients certainly have. Paré is also remembered for having ended his operative notes with pious modesty "I closed his wound, God healed him", where today he would hand over to a brigade of physicians, nurses and physiotherapists, who work with diabetologists and infection control specialists; then may follow the prosthetics team, the occupational therapists and psychologists, all working to restore the patient to as much of their pre-operative life as possible.

Paré's patient was a victim of the battlefield, and those otherwise fit young warriors have also been with us since the Rig Veda described Queen Vishpala returning to the battle with a prosthesis of some sort over 3,000 years ago. However, trauma is not the subject of our study. We wanted to look at the much larger number of mostly elderly people who now come to amputation as a result of vascular insufficiency. Their rising numbers are due to increased longevity and the current pandemic of diabetes, which all too often is associated with small vessel disease beyond the reach of the vascular surgeon. They are often extremely ill, and the objective may be palliative: other reports suggest that between 38% and 48% will die within the year, many of them within 30 days. These patients need well organised, highly skilled multi-disciplinary care if we are to deliver this age-old remedy successfully, often in an emergency to patients who are mostly unfit, ASA III or IV in anaesthetic parlance. This makes it an admirable subject for an NCEPOD study.

The time is also right. The fact that NHS England has predicted an epidemic of diabetic foot disease in the next 10 years means that the topic is recognised as increasing in importance by the NHS. The Vascular Society of Great Britain and Ireland (VSGBI) published a Quality Improvement Framework (QIF) for major amputation in 2010 and invited us to find out how far it is applied in practice. Our cohort is drawn from the 1900 patients treated over 6 months in 2012-2013 and so we could reasonably hope to see how those lessons are being applied and suggest touches to the tiller where necessary.

In a nutshell it seems we are not doing well enough, as the VSGBI suspected. Our Advisors found room for improvement in every aspect of both the organisation and the clinical delivery of care. There is insufficient thought going into the planning of these patients' treatment. Many of the findings will be wearily familiar to readers of previous NCEPOD studies. For example in 2007 we suggested that the realities of modern clinical training demand that every acute admission needed to be seen by a consultant within 12 hours; since then the call has been endorsed by the Royal College of Physicians and by NHS England, although on the way the interval has been reasonably modified to 14 hours. It still is not happening consistently in this group of what are often major emergencies and when the consultant does first review the patient it is not reliably documented as a significant event. There are also other problems generic to all acute operations, such as the issues surrounding consent and to that extent here are lessons for those treating many other acute surgical emergencies.

There are also proposals specific to candidates for this procedure. Overall there is no doubt in my mind that the vital lesson is the First Recommendation: The QIF needs to be supported by a best practice clinical care pathway specific to this group of patients. This should include a set of protocols covering every aspect of their care. I know that it sometimes seems as if we have more protocols than anyone could possibly read, let alone apply, that they often seem to be as long as the textbooks they have replaced and not much easier to keep up to date; but the reality of modern medicine is that if it is not in a protocol, it often does not happen. 60 years ago the doctor could be expected to pick up and apply information from articles and textbooks: in *Crawford v Charing Cross Hospital (Times Law Report 8.12.1953)*, the anaesthetist was lucky to escape liability for causing a brachial plexus palsy when the Court of Appeal forgave his failure to read one article in *The Lancet* six months earlier warning of the danger of keeping the unconscious patient's arm out at 80º. Lord Denning accepted that nobody could read all the articles published in the medical journals.

Today the plethora is such that nobody can read more than a tiny proportion of what is published, even in their own area. They rely on review articles to sift new findings and protocols to organise and apply the lessons of the reviews. Partly this is because many of the proposals call for the expenditure of resources, decisions that may be difficult for individual doctors to take on a case by case basis. And many others have to be acted upon by people who are not doctors, but members of different professions who have their own journals. But mostly it is because there is just too much information for the individual to absorb and apply. Furthermore, increased staff turnover means that there is much more likely to be a new recruit who has to learn the ways of the team. All contribute to the reality that if it is not in the protocol, it does not happen, at least not consistently.

Our authors and Advisors think it is especially important in this case because in almost half the centres we found there is no protocol at all, identifying both a need and an opportunity for the profession to step in, with the help of the Medical Directors. Furthermore, the needs of this group may be disparate but they share common themes. As usual we found that some things are done superbly well in many places: indeed we have revealed an enormous amount for the NHS to be proud of. But the room for improvement is also widespread and we need a coherent response that recognises that people

having their legs amputated share many common needs and common issues that must be considered in each case. If the requirements of this group of patients are recognised and described in one set of protocols or clinical care pathways then they will be more likely to be applied by the whole team. This is a major piece of work for the VSGBI and I hope they will find the other recommendations of assistance.

As with our recent study of tracheostomy, NCEPOD was responding to the request of enthusiasts within the profession who believe that it is possible to do better for their patients. They were already determined to raise the game and suspected that we would find the implementation of a number of areas of the QIF has been patchy and inconsistent. We think it is a useful role for NCEPOD to act as a megaphone for the concerns of the profession.

NCEPOD is dedicated to the proposition that the NHS can be improved and we must fight to make it better, but when we say there is much room for improvement, we mean no more as well as no less than that. Less than 43% of these patients got good care, that is what the Advisors would accept from their own teams, and where they could identify no room for improvement. That is something that needs to be addressed, but we should also acknowledge that under 4% got care that was less than satisfactory: at a time when NHS resources are under fire as never before, this is a cogent reminder of what we have to lose. One of the lessons here is that when the profession comes together as NCEPOD to continue the endless quest to improve what they and their colleagues are doing, they rightly aspire to achieve high standards. As regular readers expect, our vignettes illustrate how badly things can be done and the tragedy that can be caused by getting it wrong; but they also show how hard it can be to get it right. Helping the NHS to improve should not, and here does not, involve attacking people who are doing their best to help their patients.

As usual I pay tribute to all those who have made it happen. The enthusiasts from the vascular community who proposed the study because they wanted to see their routine work scrutinised in this way; the Steering Group and HQIP Independent Advisory Group who accepted the proposal; the Expert Group who devised the detail of the study; the Local Reporters and Ambassadors who got us the clinical questionnaires and case notes (high percentages of both, reflecting the enthusiasm to make this work); and the Advisors who did the immense work of reading and criticially reviewing the cases. All of these people give their time unpaid because they believe passionately that it is worthwhile. Finally there are our authors who have extracted the important truths from the data.

Thank you all, on behalf of the Trustees.

Bertie Leigh
NCEPOD Chair

Principal recommendations

A 'best practice' clinical care pathway, supporting the aims of the Vascular Society's Quality Improvement Framework for Major Amputation Surgery, and covering all aspects of the management of patients requiring amputation should be developed. This should include protocols for transfer, the development of a dedicated multidisciplinary team (MDT) for care planning of amputees and access to other medical specialists and health professionals both pre- and post operatively to reflect the standards of the Vascular Society of Great Britain and Ireland, the British Association of Chartered Physiotherapists in Amputee Rehabilitation and the British Society of Rehabilitation Medicine. It should promote greater use of dedicated vascular lists for surgery and the use of multidisciplinary records. *(Vascular Society of Great Britain & Ireland (development), Medical Directors (implementation)*

All patients with diabetes undergoing lower limb amputation should be reviewed both pre- and post operatively by the specialist diabetes team to optimise control of diabetes and management of co-morbidities. The pre-operative review should not delay the operation in patients requiring emergency surgery. *(Consultant Diabetologists)*

When patients are admitted to hospital as an emergency with limb-threatening ischaemia, including acute diabetic foot problems, they should be assessed by a relevant consultant within 12 hours of the decision to admit or a maximum of 14 hours from the time of arrival at the hospital, in line with current guidance. If this is not a consultant vascular surgeon then one should be asked to review the patient within 24 hours of admission. *(Medical Directors)*

For patients undergoing major limb amputation, planning for rehabilitation and subsequent discharge should commence as soon as the requirement for amputation is identified. All patients should have access to a suitably qualified amputation/discharge co-ordinator. *(Medical Directors)*

As recommended in the Quality Improvement Framework for Major Amputation Surgery (VSGBI), amputations should be done on a planned operating list during normal working hours and within 48 hours of the decision to operate. Any case waiting longer than this should be the subject of local case review to identify reasons for delay and improve subsequent organisation of care. *(Medical Directors)*

Introduction

Incidence

Peripheral arterial disease (PAD), the result of narrowing or blockage of the arteries, affects approximately 20% of adults older than 55 years in Europe and North America, most often in the lower limbs.[1] The Fontaine Classification describes four stages of PAD: stage I asymptomatic disease; stage II intermittent claudication; stage III rest pain/nocturnal pain; stage IV necrosis/gangrene (with or without rest pain).[2] Both stages III and IV are the result of advanced PAD[3], and may result in limb loss or death if limb revascularisation is either not performed or not technically possible.[4] In the UK, 500-1000 patients per million population have clinically significant PAD of whom 1-2% will eventually require a lower limb amputation (LLA). The incidence of LLA is 8-15 times higher in diabetics[5,6] with up to 70% dying within 5 years of surgery.[6]

Hospital inpatient data for 2009/10 showed that there were 5,498 Finished Consultant Episodes (FCEs) for LLA[7-9] with 530 deaths in England alone. These rates have remained relatively constant over the last decade although the proportion undergoing above knee amputation has decreased.[10] Previous reports[11-15] indicate that the mortality for major lower limb amputation is high in all health economies both within 30-days of surgery (12.4-22%) and at 1 year (38-48%), reflecting the age and co-morbidities of these patients. This and the global epidemic of type II diabetes mellitus (increased from 1.4 $x10^6$ to 2.9 $x10^6$ in the UK since 1996[6] and likely to reach 5 $x10^6$ by 2025) highlight the potential social and economic impact of critical limb ischaemia on the population, the latter including the costs of hospital care, rehabilitation and ongoing community support. These factors will have significant implications for vascular services.

There is a wide variation in the number of amputations carried out in hospitals across the UK[16] with fewer performed in vascular units that adopt an aggressive approach to limb salvage. Similarly, these centres perform a higher proportion of below knee amputations with better prospects of independent mobility (50% versus 25% for above knee amputation[16]).

Peri-operative cardiac complications are the leading cause of morbidity and mortality following surgery[17] and it is therefore important to identify patients with co-morbdities that could be optimised prior to surgery[17] and to ensure that appropriate specialist medical support is available post operatively.

In 2010, the Vascular Society of Great Britain & Ireland published a Quality Improvement Framework for Major Amputation Surgery[18] that aimed to reduce the mortality following surgery to <5% by 2015. The format of this study included collection of data that was designed to determine whether some key indicators within the QIF are being met, such as pre-operative assessment by a specialist multidisciplinary team, access to a named discharge co-ordinator, optimal medical management and appropriate rehabilitation facilities.

Similarly, implementation of guidance published by other organisations[19-21] on the care of this vulnerable population has been assessed. In particular a detailed review of the management of patients with diabetes has been undertaken.

As a result of this review a series of recommendations have been made in relation to the care of patients undergoing LLA.

1 – Method and Data returns

Method

Expert group

A multidisciplinary group of experts comprising clinicians from vascular surgery, vascular anaesthesia, orthopaedic surgery, rehabilitation medicine, diabetology, nursing, prosthetics, infectious diseases and podiatry contributed to the design of the study and reviewed the findings.

Aim

The aim of the study was:

- To explore remediable factors in the process of care of patients undergoing major lower limb amputation.

Objectives

The expert group identified a number of areas of surgical and medical care to be explored in more detail. These included:

Pre-operative care

- Access to multidisciplinary teams (MDT) (vascular, diabetes, radiology, anaesthesia) and a multiprofessional pathway of care
- Pain management
- Clinical assessment, decision making, grades and specialty of the clinicians providing care, discharge planning and record keeping
- Optimisation of co-morbidities, including diabetic control

Peri-operative care

- The scheduling of surgery, including priority and cancellations
- Seniority of clinicians (surgery and anaesthesia)
- Operation undertaken
- Antibiotic prophylaxis, venous thromboembolism (VTE) prophylaxis
- Diabetes control
- Anaesthetic care

Post operative care

- Access to critical care
- Diabetes control
- Pain management
- Wound care
- Rehabilitation

Organisational factors

- Hub and spoke arrangements
- Management of diabetic foot sepsis including multidisciplinary care & specialties involved
- Access to surgery
- Availability of rehabilitation and prosthetic services
- Submission of data to the National Vascular Database (now National Vascular Registry)

Hospital participation

Organisational data were collected from all hospitals where major lower limb amputation was undertaken, and also where rehabilitation was offered post operatively, in England, Wales, Northern Ireland, the Channel Islands and the Isle of Man. Clinical data were collected from all hospitals where major lower limb amputation was undertaken. Data were collected from both the National Health Service (NHS) and the Independent sector where applicable.

Within each hospital, a named contact, referred to as the NCEPOD Local Reporter, acted as a link between NCEPOD and hospital staff, facilitating case identification, dissemination of questionnaires and data collection.

Study population

All patients aged 16 and over who underwent major lower limb amputation for vascular insufficiency or the complications of diabetes between 1st October 2012 and 31st March 2013, were included in the study. The following codes were identified for inclusion in the study. Inclusion was based on having one code from each column.

OPCS codes for operation	ICD10 codes for disease
X09 – Amputation of leg	***Diseases of the circulatory system***
X09.1 – Hindquarter amputation	I70 – Atherosclerosis
X09.2 – Disarticulation of hip	I70.0 – Atherosclerosis of aorta
X09.3 – Amputation of leg above-knee	I70.2 – Atherosclerosis of arteries of extremities
X09.4 – Amputation of leg through knee	I70.8 – Atherosclerosis of other arteries
X09.5 – Amputation of leg below-knee	I70.9 – Generalised and unspecified atherosclerosis
X09.8 – Other specified	I73 – Other peripheral vascular disease
X09.9 – Unspecified	I73.0 – Raynaud's syndrome
X12 – Operations on amputation stump	I73.1 – Thromboangiitis obliterans
X12.1 – Re-amputation at higher level	I73.8 – Other specified peripheral vascular diseases
X12.8 – Other specified	I73.9 – Peripheral vascular disease, unspecified
X12.9 – Unspecified	I74 – Arterial embolism and thrombosis
	I74.0 – Embolism and thrombosis of abdominal aorta
	I74.1 – Embolism and thrombosis of other and unspecified parts of aorta
	I74.3 – Embolism and thrombosis of arteries of lower extremities
	I74.4 – Embolism and thrombosis of arteries of extremities, unspecified
	I74.5 – Embolism and thrombosis of iliac artery
	I74.8 – Embolism and thrombosis of other arteries
	I74.9 – Embolism and thrombosis of unspecified artery
	I77 – Other disorders of arteries and arterioles
	I77.1 – Stricture of artery
	I77.2 – Rupture of artery
	I77.3 – Arterial fibromuscular dysplasia
	I77.6 – Arteritis
	I77.8 – Other specified disorders of arteries and arterioles
	I77.9 – Disorder of arteries and arterioles, unspecified
	Endocrine, nutritional and metabolic diseases
	E10 – Type 1 diabetes (Insulin dependent diabetes mellitus)
	E11 – Type 2 diabetes (Non insulin dependent diabetes mellitus)
	E13 – Other specified diabetes mellitus
	E14 – Unspecified diabetes mellitus

Exclusions

Patients who underwent limb amputation as a result of trauma or malignancy were not included in the study.

Case identification and sampling

The NCEPOD Local Reporter in every hospital was asked to complete a spreadsheet listing all patients who met the relevant criteria for the study. Patient identifiers including the hospital and NHS number were collected alongside the details of the operating clinician. Once the spreadsheets were imported into the study database, cases were randomly sampled to identify seven per hospital and a maximum of three per clinician, to whom a questionnaire was sent for each patient.

Questionnaires and case notes

Organisational questionnaire
At the beginning of the study this was sent to all hospitals where lower limb amputation was reported to be undertaken, and also hospitals where rehabilitation was offered post operatively. This questionnaire collected data about staffing and facilities, inpatient care and also post-amputation care.

Clinical questionnaires
A questionnaire was sent to the consultant surgeon who was responsible for the patient's care at the time of the procedure. This collected data around the admission process, pre-operative care and preparation (including consent), the operation undertaken, post operative care and pain management, and the discharge process. Where relevant, data were also collected about diabetes management.

Case notes
The following case notes extracts were requested, for the duration of the patient's admission:

- Medical notes from admission to discharge
- Notes from multidisciplinary team meetings
- Imaging reports
- Consent forms
- Pre-anaesthetic assessment records
- Operation notes
- Anaesthetic charts
- Recovery room records
- Integrated care pathways
- Nursing notes
- Assessment and treatment reports by physiotherapy, occupational therapy and other rehabilitation services
- DNACPR documentation
- Autopsy report (where applicable)
- Drug charts
- Fluid balance charts
- Haematology and biochemistry results including data on peri-operative glucose control
- Critical care charts
- End of life care pathway

Advisor group

A multidisciplinary group of Advisors was recruited to undertake peer review of a sample of the case notes and the associated questionnaire. This group of Advisors comprised clinicians from a number of specialties including vascular surgery and vascular anaesthesia, general anaesthesia, orthopaedic surgery, diabetes, general medicine, rehabilitation medicine, physiotherapy and occupational therapy, nursing (diabetes nurse specialists and vascular nurse specialists) and podiatry.

All patient identifiers were removed from the case notes and questionnaires prior to review. Neither the Clinical Co-ordinators at NCEPOD, nor the Advisors, had access to patient identifiable information.

After being anonymised, each case was reviewed by at least one Advisor within a multidisciplinary group. At regular intervals throughout the meeting, the Chair (an NCEPOD Clinical Co-ordinator) allowed a period of discussion for each Advisor to summarise their cases and ask for opinions from other specialties or raise aspects of care for discussion.

Advisors reviewed each case using a semi-structured assessment form. Data were entered into a database comprising quantitative tick-boxes and qualitative free text. Where the Advisor stated that there was insufficient information available in the case note extracts to make a decision, there was the option to select 'unable to answer'.

The grading system shown in Figure 1.1 was used by the Advisors to grade the overall care that each patient received.

Good practice: a standard of care you would expect from yourself, your trainees, and your institution
Room for improvement: aspects of **clinical** care that could have been better
Room for improvement: aspects of **organisational** care that could have been better
Room for improvement: aspects of **clinical and organisational** care that could have been better
Less than satisfactory: several aspects of **clinical and/or organisational** care that were well below a standard you would expect from yourself, your trainees and institution
Insufficient data: Insufficient information submitted to NCEPOD to assess the quality of care

Figure 1.1 NCEPOD assessment of overall quality of care

Quality and confidentiality

Each case was given a unique NCEPOD number. The data from all questionnaires received were electronically scanned into a preset database. Prior to any analysis taking place, the data were cleaned to ensure that there were no duplicate records, and that erroneous data had not been entered during scanning. Any fields that contained data that could not be validated were removed. Section 251 approval had been gained to collect these data.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries were produced.

The qualitative data collected from the Advisors' opinions and free text answers in the clinician questionnaire were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD Clinical Co-ordinators, a Clinical Researcher, and a Researcher, to identify the nature and frequency of recurring themes.

All data were analysed using Microsoft Access and Excel by the research staff at NCEPOD.

The findings of the report were reviewed by the Expert Group, Advisors, and the NCEPOD Steering Group prior to publication.

Case studies have been used throughout this report to illustrate particular themes.

Data returns

During the six-month period (1st October 2012 – 31st March 2013) details on 1986 cases were returned to NCEPOD. From this group 103 patients were excluded as they did not meet the study criteria (i.e. the amputation was not undertaken as a result of vascular disease or diabetes), or were identified as duplicate cases. A further 760 cases were randomly sampled to be included in the study (maximum of seven per hospital, and up to three per clinician). In total 642 clinical questionnaires (84%) and 628 (83%) sets of case notes were returned. In terms of complete data sets (case notes and the clinical questionnaire) 596/760 were returned (78%) (Figure 1.2).

A number of questionnaires were returned blank or NCEPOD was notified of problems in terms of questionnaire completion. The most common reason for this was that the consultant who undertook the operation was no longer at the hospital. Further to this, in some cases the case notes that were returned were too incomplete or were returned after the deadline and so could not be included in the Advisor assessment.

Study sample denominator by chapter

Within this study the denominator will change for each chapter and occasionally within each chapter. This is because data have been taken from different sources depending on the analysis required. For example, in some cases the data presented will be a total from a question taken from the clinical questionnaire only, whereas some analysis may have required data from the clinical questionnaire and data from the Advisor assessment form.

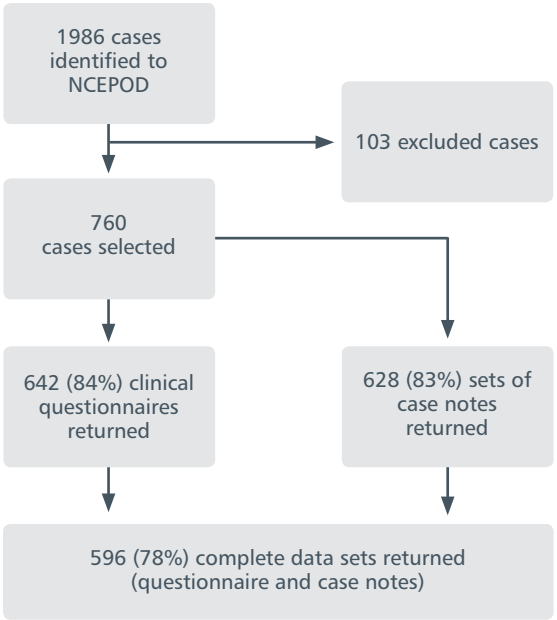

Figure 1.2 Data returns

2 – The organisation of care

At the start of the study, 278 hospitals were identified where either major lower limb amputation was undertaken or where rehabilitation was offered following major amputation. Of these hospitals, 246 (88.4%) returned an organisational questionnaire. In total 143 hospitals were identified as undertaking major lower limb amputation for vascular disease or diabetes, and 229 hospitals were identified as offering post operative rehabilitation (Table 2.1). One hundred and twenty five hospitals offered both surgery and rehabilitation.

The majority of hospitals that were classified as 'other' were community hospitals.

The organisational questionnaire was divided into two sections to allow review of those hospitals where amputation surgery was performed and those where either amputation was performed or rehabilitation was offered.

Data relating only to hospitals where amputation surgery is performed

Emergency department

An emergency department was present in 137/142 (96.5%) hospitals and this was open 24 hours a day, 7 days a week (24/7) in 136/137.

Vascular unit on-site

The presence of a vascular unit on-site, providing 24/7 access to vascular surgeons and/or interventional radiologists, was most commonly present in University Teaching Hospitals (Table 2.2).

Table 2.1 Service offered (amputation/rehabilitation) by hospital type

	Amputation		Rehabilitation	
	Yes	No	Yes	No
District General Hospital ≤500 beds	51	36	77	10
District General Hospital >500 beds	45	3	46	2
University Teaching Hospital	45	5	45	5
Other	2	59	61	0
Total	**143**	**103**	**229**	**17**

Table 2.2 Vascular unit on-site by hospital type

	Vascular unit on-site (24/7)				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	12	39	**51**	0	**51**
District General Hospital >500 beds	24	20	**44**	1	**45**
University Teaching Hospital	32	13	**45**	0	**45**
Other	0	2	**2**	0	**2**
Total	**68**	**74**	**142**	**1**	**143**

Table 2.3 Access to vascular surgeons 24/7 by hospital type

	Vascular unit on-site that had a combined rota with vascular surgeons from other hospitals to provide 24/7 access to vascular surgeons and/or interventional radiologists				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	25	14	**39**	0	**39**
District General Hospital >500 beds	14	5	**19**	1	**20**
University Teaching Hospital	10	2	**12**	1	**13**
Other	0	2	**2**	0	**2**
Total	**49**	**23**	**72**	**2**	**74**

Where such a unit was present, 56/67 routinely provided hub services for other hospitals that do not have a vascular unit on-site; 54/56 were part of formal network; and 47/55 hospitals had written protocols and/or pathways of care for the transfer of patients.

If the hospital did not have 24/7 access to vascular surgeons and/or interventional radiologists, the questionnaire asked whether there was a combined rota with vascular surgeons from different hospitals to provide 24/7 access to vascular surgeons and interventional radiologists (Table 2.3).

Where such a service was in place, 45/49 hospitals had a published rota which indicated to which hospital emergency or urgent patients should be referred.

In total 117/143 (81.8%) hospitals, where amputation was undertaken, provided 24/7 access (either on-site or via a combined rota with a different hospital) to vascular surgeons and/or interventional radiologists.

The presence of written protocols and/or pathways of care for the transfer of patients between hospitals was assessed. These were available in 102/123 (82.9%) hospitals. The Vascular Society of Great Britain and Ireland has stated *"As services are consolidated into fewer sites, the VSGBI recommends that all vascular surgeons and interventionalists working in high volume centres should be available to provide high quality care to those hospitals without arterial services who contribute to their network, and this relies on the use of formal arrangements and protocols"*.[16] It is important that where hub-spoke arrangements are in place there should be robust pathways that everyone should adhere to. In developing such protocols, the experience of similar repatriation protocols developed for Major Trauma Centres should be considered.

Vascular services

The number of consultant vascular surgeons ranged between 0 – 10, the number of consultant vascular anaesthetists between 0 – 11, and the number of interventional radiologists between 0 – 11. University Teaching Hospitals (which accounted for the largest group of hospitals with a vascular unit on-site) employed a larger number of vascular surgeons per hospital (Figure 2.1).

The number of operating sessions allocated to the vascular unit ranged between 0 – 23, with an average of seven. These data are also displayed by hospital type in Figure 2.2.

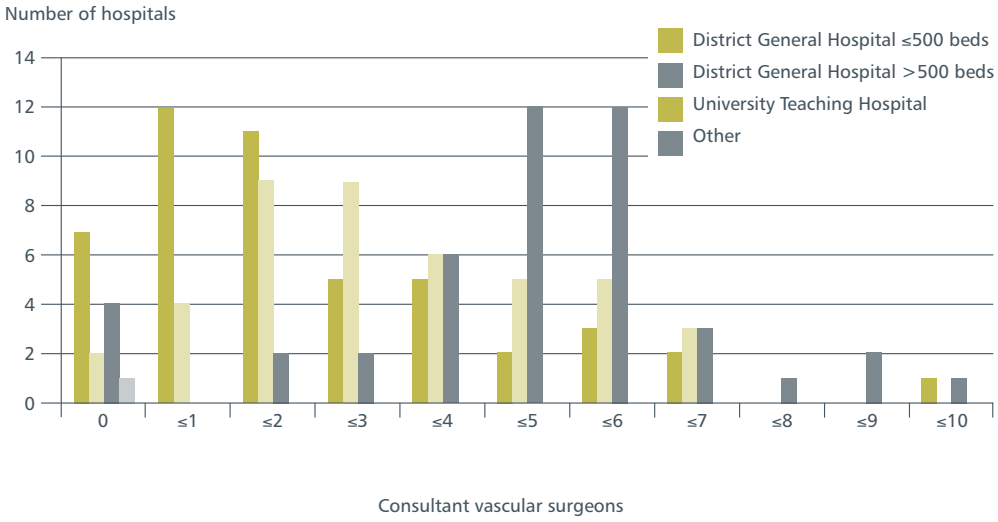

Figure 2.1 Number of consultant vascular surgeons employed by hospital type

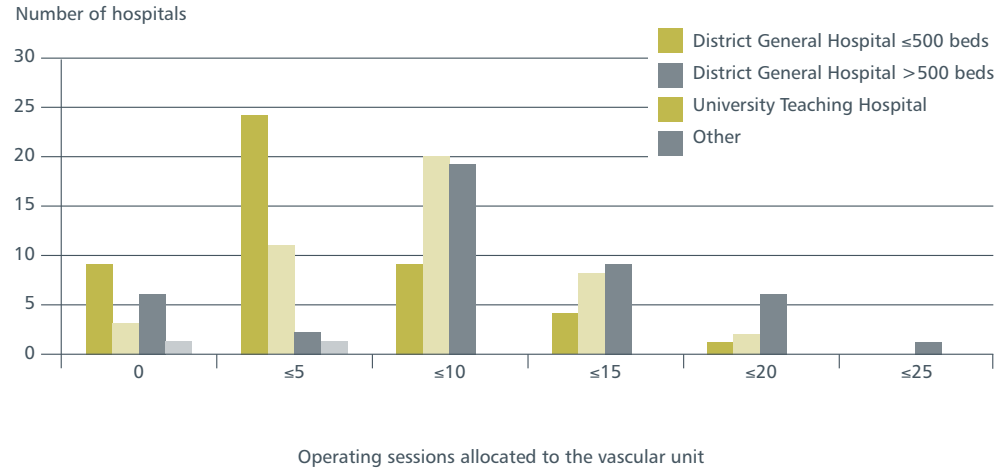

Figure 2.2 Number of operating sessions by hospital type

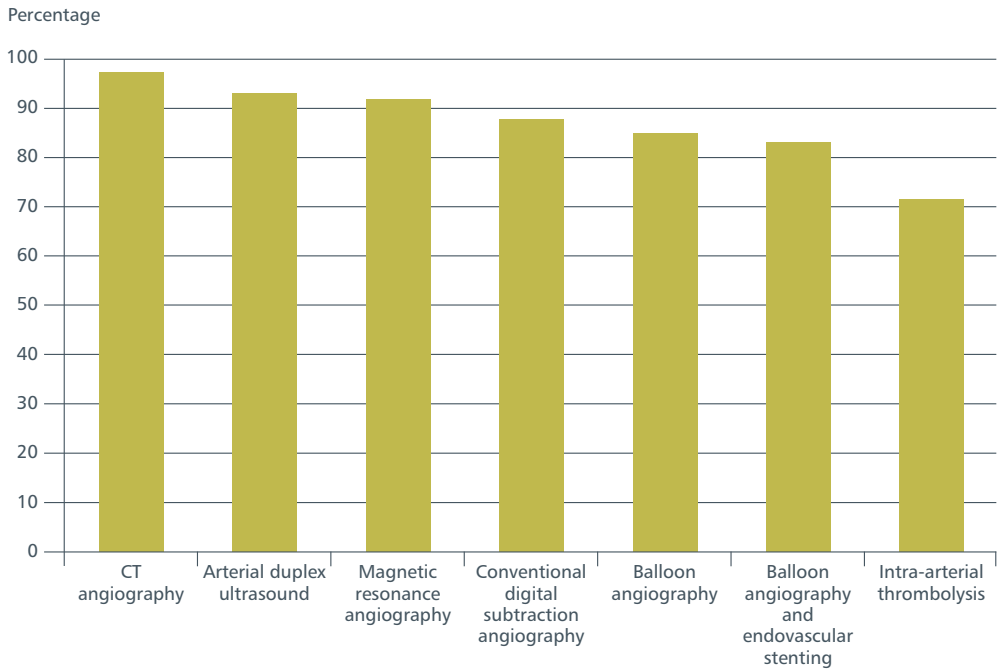

Figure 2.3 Investigations and therapies available in the hospital

Of the 140 hospitals who provided an answer, 136/140 had access to CT angiography, whilst only 100/140 hospitals had access to intra-arterial thrombolysis (Figure 2.3). Seventy-three hospitals (51.4%) had dedicated vascular inpatient beds (Table 2.4).

Table 2.4. Dedicated vascular inpatient beds

Number of amputations undertaken	Dedicated vascular inpatient beds				
	Yes	No	**Subtotal**	Not answered	**Total**
0 - 10	1	28	**29**	0	**29**
11 - 20	4	9	**13**	0	**13**
21 - 30	6	10	**16**	0	**16**
31 - 40	10	2	**12**	1	**13**
41 - 50	11	1	**12**	0	**12**
51 - 60	7	0	**7**	0	**7**
61 - 70	8	0	**8**	0	**8**
71 - 80	4	0	**4**	0	**4**
81 - 90	4	0	**4**	0	**4**
>90	4	0	**4**	0	**4**
Subtotal	**59**	**50**	**109**	**1**	**110**
Not answered	14	19	**33**	0	**33**
Total	**73**	**69**	**142**	**1**	**143**

Where such beds were available the numbers ranged from 8 to 50 with an average of 23 per hospital. These data were examined in more detail in relation to the number of procedures undertaken annually, and unsurprisingly, hospitals where a smaller number of operations were undertaken were less likely to have specific vascular inpatient beds.

In 39/140 (27.9%) hospitals there was a separate ward for vascular surgery that did not routinely admit general surgical emergencies.

Specialist diabetes physicians were present in 140/143 hospitals that offered amputation. Where specialist diabetes physicians were present the number of whole time equivalents ranged between 1 – 24 with an average of three per hospital.

Clinical/diabetes nurse specialists (CNS/DNS) who provide input on the management of patients with diabetes, as recommended by NHS Diabetes[22] were present in 140/143 hospitals, however where present they only reviewed patients under the care of the vascular unit routinely in 73/132 (55.3%) (Table 2.5).

Diabetic foot clinics were present in 130/143 (90.9%) hospitals. These clinics were most frequently staffed by diabetes physicians and/or podiatrists. Vascular surgeons were always available at 53 hospitals, and on request at a further 61 hospitals (Table 2.6).

Table 2.5 Routine review of patients under the vascular unit by CNS/DNS by hospital type

Hospital type	CNS/DNS routinely reviews patients under the care of the vascular unit, where CNS/DNS provides input for management of patients with diabetes				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	25	22	**47**	4	**51**
District General Hospital >500 beds	23	18	**41**	3	**44**
University Teaching Hospital	25	19	**44**	1	**45**
Total	**73**	**59**	**132**	**8**	**140**

Table 2.6 Routine staffing of the diabetes foot clinic

	Always	On request	**Subtotal**	Not answered
Diabetes physician	106	19	**125**	5
Vascular surgeon	53	61	**114**	16
Foot and ankle surgeon (orthopaedic)	21	83	**104**	26
Clinical/Diabetes nurse specialist	57	49	**106**	24
Podiatrist	112	10	**122**	8
Physiotherapist	9	71	**80**	50
Occupational therapist	4	72	**76**	54
Orthotist	38	62	**100**	30
Infection specialist	13	82	**95**	35
Other	14	10	**24**	106

In only 41/124 hospitals did the diabetes foot service provide 24/7 access for the management of acute foot lesions. Of the 83 hospitals that did not provide access 24/7, 62 provided access to the service within 24 hours as recommended by NICE,[23] and only 62/114 hospitals indicated the presence of an emergency 'hot line' telephone number for patients, carers and other health professionals to make contact with the diabetes foot service.

An outpatient parenteral intravenous (IV) antibiotic therapy service that accepted diabetic foot patients for treatment was available in 89/131 (67.9%) hospitals.

The number of amputations undertaken

The Vascular Society of Great Britain and Ireland (VSGBI) recommend that all amputations should be recorded on the National Vascular Database (NVD). Within this study, 116/136 (85.3%) hospitals stated that their vascular unit submitted data to the NVD. In comparison, only 68/116 hospitals reported that they submitted data to the British Society for Interventional Radiology (BSIR) database.

The Advisors commented on the fact that such a large number of hospitals reported submitting data to the NVD. To assess this further the NVD were asked how many hospitals had submitted any data during the same study period. Overall, fewer hospitals seem to have reported data to the NVD than were reported in the NCEPOD Organisational Questionnaire. This may reflect interpretation of the question, but hospitals should be aware of which national databases they are contributing to. This will ensure that these large databases can be used with confidence.

Hospitals were asked to indicate the number of lower limb amputations undertaken in the last year for which full reliable data were available (Table 2.7). These data were assessed by hospital type (Table 2.8) with the majority of operations performed in University Teaching Hospitals.

Table 2.7 Number of amputations undertaken across participating hospitals

	Total	Range	Average
Above-knee	**1926**	0 - 70	17
Below-knee	**1760**	0 - 66	16
Through knee	**173**	0 - 16	2
Hip disarticulation	**14**	0 - 2	<1

Table 2.8 Number of amputations by hospital type

Hospital type	**Number of patients that underwent a lower limb amputation**				
	Above-knee	Below-knee	Through knee	Hip disarticulation	**Total**
District General Hospital ≤500 beds	340	357	22	2	**721**
District General Hospital >500 beds	578	523	39	2	**1142**
University Teaching Hospital	1008	879	112	10	**2109**
Other	0	1	0	0	**1**
Total	**1926**	**1760**	**173**	**14**	**3873**

Of these amputations the majority were performed under the care of a vascular surgeon (Table 2.9).

Table 2.9 Surgical specialty under which amputation was performed

	Total	Range	Average
Vascular surgeons	**3414**	0 - 114	32
Foot and ankle surgeons	**171**	0 - 31	2
General surgeons	**123**	0 - 23	1

Length of stay

The length of stay for these patients ranged from 7 to 67 days with an average of 32 days. There was no major difference in the length of stay of the patient in terms of the type of hospital admitted to; (DGH ≤500 beds, average = 31 days, DGH >500 beds, average = 34 days; University Teaching Hospital, average = 30 days). The care pathway for these patients often involves transfer to a different facility for ongoing rehabilitation. The overall length of stay before discharge home is likely to be longer. The prolonged length of stay is a measure of the significant resources required for the care of these patients.

Care planning

The questionnaire asked whether there was a policy for patients requiring a major lower limb amputation to be routinely transferred to a bed on the vascular ward either before or immediately after surgery. This was the case in 81/136 (59.6%) hospitals (Table 2.10).

Table 2.10 Policy for patients to be routinely transferred to a bed on the vascular ward either before or immediately after surgery

	n	%
Yes	81	59.6
No	55	40.4
Subtotal	**136**	
Not answered	7	
Total	**143**	

Although the VSGBI recommends early planning for discharge home, or to an appropriate facility[16] only 49/135 (36.3%) hospitals had a discharge co-ordinator in the vascular unit/ward with a responsibility for amputees. In just over half of University Teaching Hospitals (where the majority of operations were undertaken) there was no discharge co-ordinator with responsibility for amputees (Table 2.11).

Table 2.11 Presence of a discharge co-ordinator by hospital type

Hospital type	Discharge co-ordinator responsible for amputees				
	Yes	No	Subtotal	Not answered	Total
District General Hospital ≤500 beds	13	32	**45**	6	**51**
District General Hospital >500 beds	14	30	**44**	1	**45**
University Teaching Hospital	21	23	**44**	1	**45**
Other	1	1	**2**	0	**2**
Total	**49**	**86**	**135**	**8**	**143**

Combined diabetes/vascular surgery clinics

Overall the number of hospitals where combined clinics and/or ward rounds took place was low despite the opinions expressed in previous publications particularly relating to the diabetic foot[24] Only 31/137 (22.6%) hospitals indicated there was a joint ward round with vascular surgeons for inpatients with diabetes, and only 26/137 (19%) hospitals indicated there was a joint ward round between the diabetes unit and a vascular surgeon for vascular inpatients (Table 2.12). Only eight hospitals provided all of the listed services, one of which was a District General Hospital ≤500 beds; two were District General Hospitals with >500 beds and five were University Teaching Hospitals.

In the majority of hospitals (121/133) vascular surgery was the principal speciality that provided amputation services for the diabetes unit.

A multidisciplinary team (MDT) responsible for the care of patients undergoing lower limb amputation in the hospital was available in 82/140 (58.6%) of hospitals and was no more likely in the University Teaching Hospitals than in large DGHs (Table 2.13). Where the MDT was in place this most commonly functioned five days per week (51/82).

Hospitals where amputations were undertaken were asked to indicate who would normally be present at a multidisciplinary team meeting discussing patients for whom lower limb amputation is being considered (Table 2.14).

Table 2.12 Types of shared care undertaken by the diabetes unit

	Yes	No	**Subtotal**	Not answered
A joint outpatient clinic with a vascular surgeon	62	76	**138**	5
A joint ward round with a vascular surgeon for inpatients with diabetes	31	106	**137**	6
A joint ward round with a vascular surgeon for vascular inpatients	26	111	**137**	6
A joint outpatient clinic with a foot and ankle surgeon (orthopaedic)	24	113	**137**	6

Table 2.13 Multidisciplinary team responsible for the care of amputees by hospital type

	Hospital had MDT that was responsible for the care of amputation patients				
Hospital type	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	25	25	**50**	1	**51**
District General Hospital >500 beds	28	16	**44**	1	**45**
University Teaching Hospital	28	16	**44**	1	**45**
Other	1	1	**2**	0	**2**
Total	**82**	**58**	**140**	**3**	**143**

Table 2.14 Staff present at a multidisciplinary team meeting when discussing patients for amputation

	Patients without diabetes	Patients with diabetes
Vascular surgeon	101	96
Foot and ankle surgeon (orthopaedic)	11	21
Interventional radiologist	79	71
Anaesthetist	29	27
Diabetologist	12	51
Medicine for the elderly physician	6	4
Consultant in rehabilitation medicine	9	11
Podiatrist	17	36
Trainees in vascular or general surgery	82	74
Vascular clinical nurse specialist	62	56
Diabetes nurse specialist	5	24
Vascular ward nurse	36	34
Physiotherapist	46	42
Occupational therapist	34	31
Representative from prosthetic service	7	12
Representative for intermediate care	3	3
Other	8	11
Subtotal	**106**	**107**
Not answered	37	36
Total	**143**	**143**

**Answers may be multiple*

The term 'MDT meeting' can refer to different arrangements for multi-professional review of patients. This includes meetings where decisions about vascular intervention takes place and also ward meetings designed to enhance rehabilitation and discharge processes. Respondents may have been considering both types of meeting when answering this question. In the majority of hospitals from which a response was received, a vascular surgeon was involved in the MDT. However, the low attendance of some specialists stands out. For example diabetology involvement was low (51/107 hospitals) even for patients with diabetes. Similarly a consultant in rehabilitation medicine was involved in <10% of patients both with and without diabetes. British Association of Chartered Physiotherapists in Amputee Rehabilitation (BACPAR) guidelines[20] highlight a number of roles for physiotherapy within the MDT including advice on the level of amputation, assessment of rehabilitation potential pre-operatively and the prediction of prosthetic use. Within this study, physiotherapists were involved in MDT meetings in only 46/106 hospitals for patients without diabetes, and 42/107 hospitals for patients with diabetes.

Table 2.15 Specialist review prior to surgery

	Yes	No	**Subtotal**	Not answered
Consultant in rehabilitation medicine	14	113	**127**	16
Rehabilitation physiotherapist	87	46	**133**	10
Occupational therapist	74	58	**132**	11
Podiatrist (care of the contralateral limb)	48	79	**127**	16
Representative from prosthetics service	24	103	**127**	16
Other	16	18	**34**	109

Respondents were also asked whether patients undergoing major amputation were reviewed by any of the following specialists prior to amputation (Table 2.15).

VSGBI guidelines state that discharge planning and rehabilitation should be considered pre-operatively and review by a rehabilitation team should be encouraged.[16] The involvement of the specialties listed in Table 2.15 was low and despite BACPAR guidelines rehabilitation physiotherapists did not review patients prior to surgery at many hospitals (46/133; 34.6%). Data from the case note review, also highlight low levels of pre-operative review, where Advisors found that physiotherapy was commenced pre-operatively in one third of patients.

In elective cases the occupational therapist is responsible for assessments such as pre-operative access visits to the home. Early involvement is therefore key to reducing delayed discharges, particularly when adaptations need to be made or rehousing may be required.

Policies and protocols

Hospitals were asked to indicate whether they had written protocols or guidelines for the implementation of NICE CG119: Inpatient management of diabetic foot problems.[23] Written protocols or guidelines were available in 82/131 (62.6%) hospitals where the question was answered.

Similarly, only 60/134 hospitals had a policy or protocol for the care of patients undergoing major amputation (Table 2.16). Although better, such a protocol was absent in a large proportion of University Teaching Hospitals where the vast majority of operations were undertaken.

Table 2.16 Presence of a protocol for the care of patients undergoing major amputation by hospital type

Hospital Type	**Hospital policy/protocol in place for the care for patients undergoing amputation**				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	18	28	**46**	5	**51**
District General Hospital >500 beds	17	26	**43**	2	**45**
University Teaching Hospital	24	19	**43**	2	**45**
Other	1	1	**2**	0	**2**
Total	**60**	**74**	**134**	**9**	**143**

Table 2.17 Policies and protocols for antibiotic therapy

	Yes	No	Subtotal	Not answered	Total
A policy or protocol for surgical antibiotic prophylaxis for patients undergoing lower limb amputation?	61	73	**134**	9	**143**
A policy or protocol for antibiotic prescription in patients with diabetes with foot sepsis?	131	6	**137**	6	**143**

A policy or protocol for antibiotic prescription in patients with diabetes with foot sepsis was available in 131/137 hospitals. Policies or protocols for surgical antibiotic prophylaxis for patients undergoing lower limb amputation were available in 61/134 hospitals (Table 2.17).

Recommended screening

All elective patients should undergo MRSA screen prior to admission and all emergency admissions should be tested with 24 hours.[24] Almost all (135/141) hospitals undertook this; of the six where this was not routinely undertaken, four were District General Hospitals with >500 beds and two were District General Hospitals ≤500 beds. The British Infection Association states *"clear guidance should be made available to all staff"* and *"Trusts should identify and screen patients in high risk specialties"* (vascular surgery is defined as a high risk specialty).[25]

In contrast only 73/135 hospitals screened for Methicillin-Sensitive Staphylococcus aureus (MSSA) prior to amputation surgery. Of the 62 hospitals who did not undertake MSSA screening, 26 were District General Hospitals ≤500 beds, 19 were District General Hospitals >500 beds, and 17 were University Teaching Hospitals.

Data relating to hospitals providing amputation surgery and rehabilitation services

Post amputation care

Two hundred and forty-six hospitals provided either an amputation service or offered post operative rehabilitation. The majority of hospitals had medicine for the elderly beds (Table 2.18). Of these 157/229 hospitals where the question had been answered indicated that they accept amputees for rehabilitation and of these 48/157 hospitals had specific beds for this.

Table 2.18 Medicine for the elderly beds

	n	%
Yes	233	95.9
No	10	4.1
Subtotal	**243**	
Not answered	3	
Total	**246**	

Specialist consultants in rehabilitation medicine were available in 136 hospitals (Table 2.19) and 62/132 hospitals routinely transferred amputees from the vascular unit to an inpatient rehabilitation bed. Only 52/118 sites had rehabilitation specialists who managed major amputation patients following discharge from hospital. Furthermore, only 26/101 hospitals had policies dictating which referrals are seen. Where no rehabilitation consultants were available on-site, the distance to the nearest service ranged from <1 to 150 miles (average 23 miles).

Table 2.19 Consultants in rehabilitation medicine available

Hospital type	Specialist consultants in rehabilitation medicine				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	44	37	**81**	6	**87**
District General Hospital >500 beds	30	15	**45**	3	**48**
University Teaching Hospital	32	18	**50**	0	**50**
Other	30	30	**60**	1	**61**
Total	**136**	**100**	**236**	**10**	**246**

Table 2.20 Availability of prosthetic services

Hospital type	Prosthetic services available in hospital				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	14	71	**85**	2	**87**
District General Hospital >500 beds	18	30	**48**	0	**48**
University Teaching Hospital	17	33	**50**	0	**50**
Other	3	58	**61**	0	**61**
Total	**52**	**192**	**244**	**2**	**246**

Prosthetic services were available in 52/244 hospitals (Table 2.20).

Where prosthetic services were not available on-site, the distance to the nearest such service ranged between <1 to 100 miles (average of 21 miles). Where prosthetic services were not available on-site, referrals were usually made by physiotherapists and/or medical staff (Table 2.21).

Where prosthetic services were not available on-site, these were provided at another hospital within the same Trust in 31/179 hospitals, and by another Trust in 137/179 hospitals. As recommended by the VSGBI,[18] 124/169 hospitals had formal arrangements for referral to prosthetic services; 36/169 hospitals made informal arrangements; 9/169 hospitals had no arrangement and for 23 hospitals this question was not answered; these data are presented by hospital type (Table 2.22).

Table 2.21 Process of referral to the prosthetic centre

	n
By medical staff	124
By physiotherapists	136
By occupational therapists	72
By ward nurses	69
Subtotal	**184**
Not answered	8
Total	**192**

**Answers may be multiple*

However, it is important to highlight that although these data indicate a large number of hospitals have formal arrangements in place, data presented later in the report highlight a decision regarding prosthesis is not always made prior to the patients' discharge.

Table 2.22 Arrangements for access to prosthetic services by hospital type

Hospital type	Access to prosthetic services, if not available in hospital					
	Formal arrangement	Informal arrangement	No arrangement	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	48	10	8	**66**	5	**71**
District General Hospital >500 beds	23	4	0	**27**	3	**30**
University Teaching Hospital	25	3	0	**28**	5	**33**
Other	28	19	1	**48**	10	**58**
Total	**124**	**36**	**9**	**169**	23	**192**

Table 2.23 Repatriation following amputation surgery

Hospital type	Repatriated to referring hospital following surgery				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	30	27	**57**	30	**87**
District General Hospital >500 beds	18	18	**36**	12	**48**
University Teaching Hospital	35	10	**45**	5	**50**
Other	25	18	**43**	18	**61**
Total	**108**	**73**	**181**	**65**	**246**

Respondents were asked to indicate whether patients transferred from another hospital for amputation, were subsequently repatriated to the referring hospital following surgery. This was the case in 108/181 hospitals, (Table 2.23).

However, in only 36/106 hospitals where this was undertaken, was there a formal written policy for this.

The organisational questionnaire asked whether there was local provision of intermediate care in the community that accepted amputees for further care, therefore expediting discharge. This was present in 153/224 hospitals (Table 2.24) and included care in the community beds in 112/141 hospitals.

Table 2.24 Provision of intermediate care in the community that accepts amputees for further care

	n	**%**
Yes	153	68
No	71	32
Subtotal	**224**	
Not answered	22	
Total	**246**	

Since, BACPAR guidelines recommend that a physiotherapist specialised in amputee rehabilitation should be responsible for the management of these patients[20] it is important that any community provision should have the specialist staff available to deliver care accordingly.

Hospitals were asked to indicate who was normally responsible for making the decision that a patient is safe for discharge or onward referral following a major amputation (Table 2.25).

In a large number of hospitals this decision was usually made by either a physiotherapist, occupational therapist, and/or vascular surgeon. Access to NHS podiatry and outpatient services was reasonably good but it was evident that there was much less availability for both domiciliary physiotherapy and domiciliary occupational therapy (Table 2.26).

Table 2.25 Personnel responsible for making the decision that a patient is safe for discharge

	n	%
Physiotherapist	177	75.3
Occupational therapist	162	68.9
Vascular surgeon	162	68.9
Medicine for the elderly physician	77	32.8
Vascular ward nurse	74	31.5
Trainees in vascular or general surgery	55	23.4
Vascular clinical nurse specialist	45	19.1
Other	43	18.3
Diabetologist	43	18.3
Consultant in rehabilitation medicine	42	17.9
Representative for intermediate care	36	15.3
Foot and ankle surgeon (orthopaedic)	25	10.6
Podiatrist	20	8.5
Diabetes nurse specialist	11	4.7
Subtotal	**235**	
Not answered	11	
Total	**246**	

**Answers may be multiple*

Table 2.26 Access to physiotherapy, occupational therapy and podiatry

	Yes	No	**Subtotal**	Not answered
Specialist OUTPATIENT physiotherapy services for amputees	184	42	**226**	20
Specialist DOMICILIARY physiotherapy services for amputees	81	134	**215**	31
Specialist OUTPATIENT occupational therapy services for amputees	135	88	**223**	23
Specialist DOMICILIARY occupational therapy services for amputees	90	124	**214**	32
NHS Podiatry service (care of the contralateral foot)	206	19	**225**	21

Table 2.27 Routine collection of post operative surgical site infection data

Hospital type	Hospital collects post operative surveillance data for surgical site infection in patients undergoing amputation				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	30	48	**78**	9	**87**
District General Hospital >500 beds	17	27	**44**	4	**48**
University Teaching Hospital	25	23	**48**	2	**50**
Other	13	43	**56**	5	**61**
Total	**85**	**141**	**226**	**20**	**246**

Written advice or a care pathway was routinely provided to those responsible for an amputee's management following discharge in only 111/230 hospitals: half of University Teaching Hospitals (22/48) and large District General Hospitals (24/44), and approximately one third of smaller District General Hospitals (30/82).

Where this was provided, this included advice on the management of diabetes on 76/105 occasions; the management of the contralateral limb in 70/100 and risk factors for cardiovascular disease in 75/102.

Amputees with diabetes were routinely followed up in the diabetic foot clinic in 144/201 (71.6%) hospitals. Twenty-six hospitals indicated that they did not have a diabetic foot clinic, and the question was not answered by a further 19 hospitals.

Data on post operative surgical site infection in patients undergoing lower limb amputation was routinely collected in only 85/226 hospitals (Table 2.27).

Pain team

The VSGBI recommends there should be a formal pain management protocol, and access to an acute pain team for amputees.[16] Only 158/181 (87.3%) of District General Hospitals and University Teaching Hospitals reported having an acute pain management team (Table 2.28). Whilst there is no national service specification which describes the exact make up of an acute pain service, the Royal College of Anaesthetists has recently updated detailed standards documents on acute pain services.[26] In relation to vascular anaesthesia services, it is stated, *"patients undergoing major vascular surgery should have access to a multidisciplinary, acute pain management service"*.

Table 2.28 Availability of an acute pain team by hospital type

Hospital type	Acute pain management team				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	64	21	**85**	2	**87**
District General Hospital >500 beds	46	1	**47**	1	**48**
University Teaching Hospitals	48	1	**49**	1	**50**
Other	13	48	**61**	0	**61**
Total	**171**	**71**	**242**	**4**	**246**

Table 2.29 Regular M&M meetings by hospital type

Hospital type	Hospital in which amputations are performed undertake regular M&M meetings				
	Yes	No	**Subtotal**	Not answered	**Total**
District General Hospital ≤500 beds	40	5	**45**	6	**51**
District General Hospital >500 beds	39	3	**42**	3	**45**
University Teaching Hospitals	0	2	**2**	0	**2**
Other	40	2	**42**	3	**45**
Total	**119**	**12**	**131**	**12**	**143**

**NB. These data are only presented for hospitals where amputation is undertaken*

Where an acute pain team was available, they were reported as routinely seeing amputees prior to surgery in only 31.1% (50/161) of hospitals.

Morbidity and mortality meetings

Regular morbidity and mortality (M&M) meetings were held in 119/131 hospitals. Where these were held, they were most frequently undertaken on a monthly basis (75/118) (Table 2.29).

Vascular surgeons (113/115) and surgical trainees (104/115) were present at the majority of hospitals' meetings (Table 2.30). The absence of other specialties undoubtedly diminished the thoroughness of these meetings.

Table 2.30 Attendance at M&M meetings

	n	**%**
Vascular surgeons	113	98.3
Surgical trainees	104	90.4
Specialist nurses	57	49.6
Ward nurses	48	41.7
Interventional radiologist	40	34.8
Anaesthetist	28	24.3
Other	15	13.0
Physiotherapists	5	4.3
Podiatrists	2	1.7
Subtotal	**115**	
Not answered	4	
Total	**119**	

**Answers may be multiple*

Key findings

1. 102/123 (82.9%) hospitals had written protocols and/or pathways of care for the transfer of patients between hospitals involved in a shared vascular rota.

2. 116/136 (85.3%) hospitals stated that their vascular unit submits data to the NVD. Only 68/116 (58.6%) hospitals submitted data to the British Society for Interventional Radiology (BSIR) database.

3. Only 49/135 (36.3%) hospitals had a discharge co-ordinator responsible for amputees.

4. 82/140 (58.6%) hospitals had a multidisciplinary team responsible for the care of patients undergoing lower limb amputation in the hospital.

5. Review by rehabilitation specialists prior to surgery was low; (consultant in rehabilitation medicine = 14/127; occupational therapist = 74/132; podiatrist = 48/127; prosthetics = 24/127). The number of hospitals where rehabilitation physiotherapists reviewed patients prior to surgery was also low, (87/133; 65.4%).

6. 60/134 (44.8%) hospitals had a policy or protocol for the care of patients undergoing major amputation.

7. Consultants in rehabilitation medicine were present in 136/236 (57.6%) hospitals where amputation was undertaken or rehabilitation was offered.

8. Prosthetic services were available on-site in 52/244 (21.3%) hospitals; where they were not available the nearest service was on average 21 miles away.

9. The VSGBI states that there should be a formal process for referrals to a specialist amputee rehabilitation team (prosthetics); this was the case in 124/169 (73.4%) hospitals. 36/169 (21.3%) hospitals had informal arrangements; 9/169 (5.3%) hospitals had no arrangement.

10. Specialist domiciliary physiotherapy services were available to patients from 81/215 (37.7%) hospitals; domiciliary occupational therapy services were available to patients from 90/214 (42.1%) hospitals.

11. Only 111/230 (48.3%) hospitals routinely provided written advice or a care pathway to those responsible for an amputee's management following discharge from hospital.

12. 158/181 (87.3%) District General Hospitals and University Teaching Hospitals reported having an acute pain management team. Where an acute pain team was available, they were reported as routinely seeing amputees prior to surgery in only 50/161 (31.3%) of hospitals.

3 – Admission to hospital

Patients who undergo lower limb amputation present to hospital in a variety of ways. This may be acutely with obvious limb threatening ischaemia due to vascular impairment or with more insidious problems such as trophic changes (ulceration, gangrene) and infection. Co-morbidities including diabetes are important factors that increase the risk of these events. There is no single pathway for admission of these patients. Some will be admitted electively or urgently from the vascular clinic, and some as emergencies. When limb viability is threatened, the primary intent is usually to salvage the limb rather than proceed directly to amputation. The need for amputation is not always clear on admission. This section will describe the admission pathway, the process of admission to hospital and the co-morbidities present in this group of patients.

Of the 628 patients where a clinical questionnaire was returned, 405/624 (64.9%) were male and 219/624 (35.1%) female. Age ranged from 16 - 95 years. Males were slightly older with an average age of 70 compared to females who had an average age of 68 (Figure 3.1).

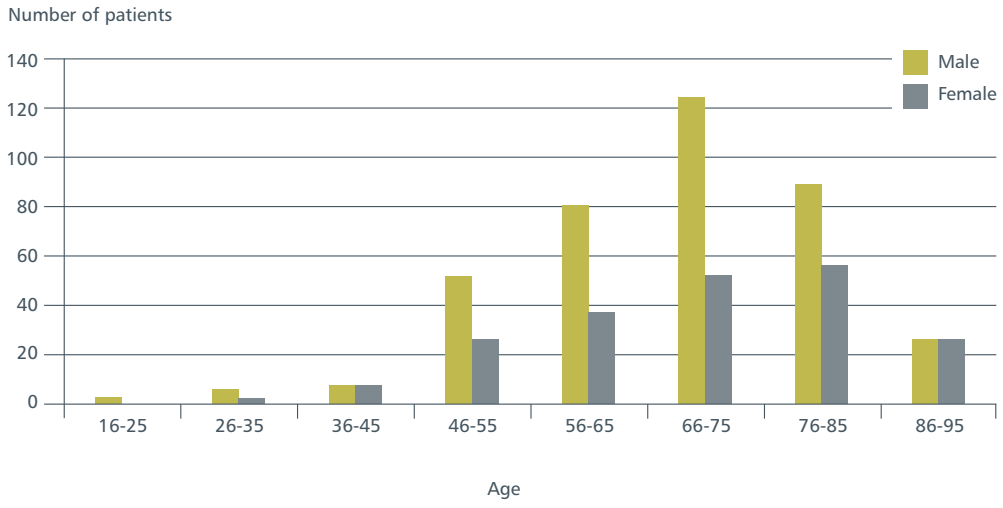

Figure 3.1 Age by gender *(Clinical questionnaire data)*

Table 3.1 Reason for admission *(Advisors' opinion)*

	n	%
Ischaemic rest pain	113	23.9
Ischaemic rest pain with ulceration and/or gangrene	236	50.0
Neuropathy	12	2.5
Neuropathy with ulceration and/or gangrene	66	14.0
Other (including additional details about infection/ ulceration)	183	38.8
Subtotal	**472**	
Not answered	57	
Total	**529**	

**Answers may be multiple*

The most common reason for admission as assessed by Advisors was ischaemic rest pain, with or without trophic changes (Table 3.1). It is important to note that pain was a feature in approximately three quarters of the patients included and this is discussed in chapter 7. In three cases, poor diabetes control was the primary reason for admission but poor diabetes control associated with infection was commonly present on admission.

The most common diagnoses on admission as reported in the clinical questionnaire were ischaemia and sepsis (Table 3.2).

Just over a quarter of the patients (30.6%) were admitted as an elective or planned admission, and the remainder were admitted as an emergency (Table 3.3).

Table 3.2 Diagnosis on admission *(Clinical questionnaire data)*

	n	%
Ischaemia	311	51.2
Sepsis	110	18.1
Gangrene	45	7.4
Other	35	5.8
Ulceration	34	5.6
Osteomyelitis	22	3.6
Complication of previous AK/ BK amputation	20	3.3
Complication of previous vascular surgery	13	2.1
Complication of previous distal amputation	11	1.8
Neuropathic complication	7	1.2
Subtotal	**608**	
Not answered	20	
Total	**628**	

Table 3.3 Admission category *(Clinical questionnaire data)*

	n	%
Elective	118	18.9
Planned	73	11.7
Emergency	432	69.3
Subtotal	**623**	
Not answered	5	
Total	**628**	

Admission was distributed through the week with lower numbers of patients admitted at weekends, reflecting the admission of elective and planned patients mainly Monday to Friday and also the pattern of all emergency admissions to hospitals (Figure 3.2).

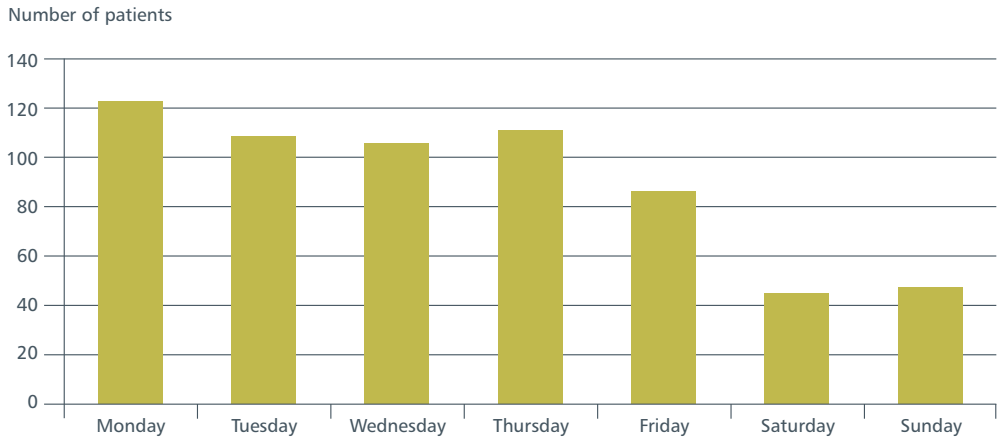

Figure 3.2 Day of admission *(Clinical questionnaire data)*

Table 3.4 Pathway of admission *(Clinical questionnaire data)*

	n	%
Elective admission from waiting list	43	6.9
Unplanned admission	76	12.2
Planned urgent admission following a previous vascular surgery outpatient appointment	97	15.5
Unplanned admission following vascular surgery outpatient appointment	66	10.6
Inpatient referral (unplanned admission)	33	5.3
Seen in another specialty's clinic (unplanned admission)	25	4.0
Emergency department (unplanned admission)	224	35.8
Transfer as an inpatient from another hospital	61	9.8
Subtotal	**625**	
Not answered	3	
Total	**628**	

Table 3.4 describes the route of admission in more detail. Just over a third of patients (224/625; 35.8%) were admitted via the emergency department and just under a third (206/625; 32.9%), were admitted either electively from the vascular waiting list or following review in vascular surgical outpatients.

Where the patient was referred via another specialty, referral was from the General Practitioner or community services in just under a third of cases (193/597; 32.3%) and via medical specialties in more than one in five cases (121/597; 20.3%).

Transfers

Almost a quarter of patients (152/628) were transferred from another hospital for their amputation. The reasons for transfer are shown in Table 3.5 overleaf.

The majority of patients required transfer (83/103 where reason was known) because vascular surgery was not available at the referring hospital. Given the current drive to centralise vascular services in the UK the proportion of patients requiring transfer to a vascular hub is likely to increase. Suitable protocols to facilitate this should be in place for all networks.

Table 3.5 Reasons why patients were transferred to another hospital *(Clinical questionnaire data)*

	n	%
Vascular surgery not available at referring hospital	83	80.6
Need for other specialist services	9	8.7
Receiving hospital was closer to patients home	2	1.9
Other	9	8.7
Subtotal	**103**	
Not answered	49	
Total	**152**	

**Answers may be multiple*

Patients were transferred on an elective, planned (urgent) and emergency basis and the proportion of each is shown in Table 3.6.

Table 3.6 Urgency of admission following transfer to another hospital *(Clinical questionnaire data)*

	n	%
Elective	14	9.3
Planned (Urgent)	30	20.0
Emergency	106	70.7
Subtotal	**150**	
Not answered	2	
Total	**152**	

Of the patients who were transferred to a second hospital the clinical questionnaire reported that this was delayed in 21/145 patients (unknown in 7) and affected 15/106 (14.2%) emergency transfers (Table 3.7) where the information was available.

The reasons for these delays are summarised in Table 3.8.

Table 3.7 Admission category for patients experiencing a delay in transfer to a vascular unit *(Clinical questionnaire data)*

	n
Elective	1
Planned (Urgent)	5
Emergency	15
Total	**21**

Table 3.8 Reason for delay in transfer to a vascular unit *(Clinical questionnaire data)*

Reason for delay	**n**
Delay in recognition of ischaemia	5
Delay in referral	2
Delay in vascular surgery review	2
No beds	4
Other	8
Total	**21**

Table 3.9 Admitting ward *(Clinical questionnaire data)*

	n	%
General ward	154	25.5
Specialist vascular ward	219	36.2
Assessment ward	120	19.8
Level 2 (HDU)	6	1.0
Diabetic/Endocrine ward	20	3.3
Renal ward	15	2.5
Level 3 (ICU)	8	1.3
Other	63	10.4
Subtotal	**605**	
Not answered	23	
Total	**628**	

The majority of patients (493/605; 81.5%) were initially admitted to general, vascular or assessment wards (Table 3.9). Only a small minority required high dependency or intensive care on admission. Initial assessment was by a consultant in 115/572 (20.1%) cases and by foundation trainees (Senior specialist trainee) in 127/572 (22.2%). Overall the initial assessment was made by a junior trainee (Basic grade) in 196/572 (34.3%) patients.

The admitting doctor was from a surgical specialty in 81% (447/554) of cases. This was usually vascular or general surgery, with a small number of patients admitted by an orthopaedic surgeon.

In 107/554 (19%) cases the patient was admitted by a doctor from a medical specialty. Despite 349/628 patients having underlying diabetes, and poor diabetes control occurring frequently on admission, patients were rarely admitted under the care of the diabetes specialist team.

First consultant review

Guidelines from various sources[27-30] recommend consultant review within 12-14 hours for emergency admissions and high risk surgical patients. Early senior review is recommended in order to ensure an accurate diagnosis and appropriate management plan for acutely ill patients. Despite the availability of this guidance, the time of first consultant review was frequently not documented (268/529 cases, 50.7%) in the cases assessed by the Advisors. Where it was documented this mainly (222/261; 85.1%) took place between the hours of 08:00 – 17:59.

Where both the time of admission and time of first consultant review were available, a similar proportion of cases (184/219; 84%) were seen by a consultant within the first 48 hours of admission. Despite the guidance referred to above, which recommends early review by

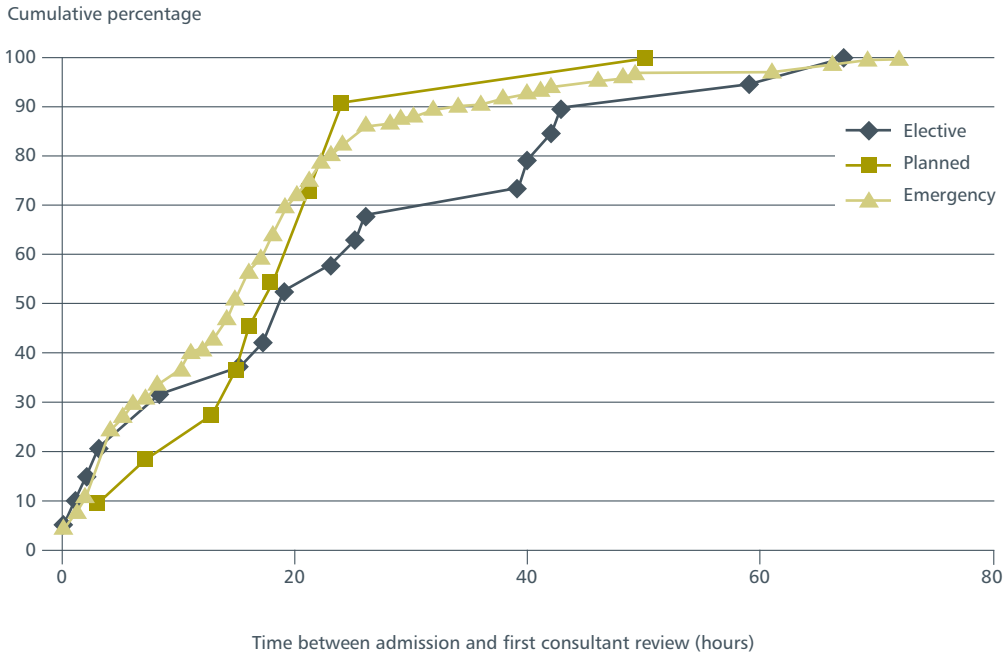

Figure 3.3 Time (hours) from admission to first consultant review vs. urgency of admission *(Clinical questionnaire data and Advisors' opinion)*

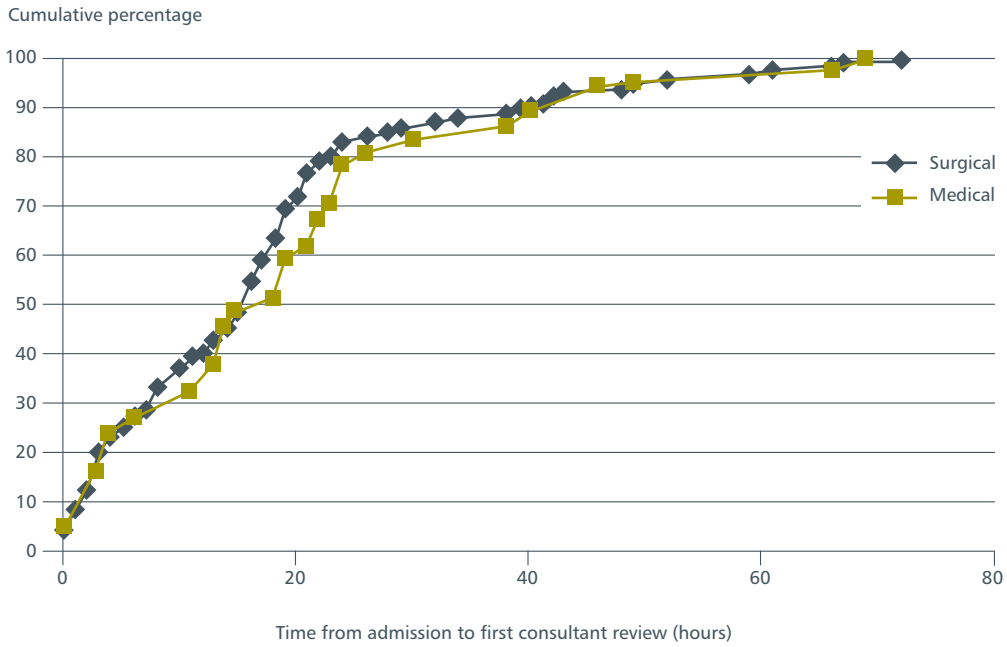

Figure 3.4 Time (hours) from admission to first consultant review by surgical/medical team
(Clinical questionnaire data and Advisors' opinion)

consultants, it is remarkable to note that only 42.4% (73/172) of patients admitted as an emergency were seen within 14 hours of admission (Figure 3.3) and that the time of review (or admission) was not documented in 297/506 (58.7%) of cases.

Table 3.10 Appropriateness of the timing of the first consultant review *(Advisors' opinion)*

	n	%
Yes	392	86.2
No	63	13.8
Subtotal	**455**	
Unable to answer	70	
Not answered	4	
Total	**529**	

Where data were available, 17/37 patients admitted under medical teams were seen by a consultant within 14 hours. For patients admitted under surgery, 60/156 were seen within 14 hours (Figure 3.4).

Advisors considered that the time of the first consultant review was appropriate in the majority of cases. There were 63 cases (13.8%) where the timing was not thought to be appropriate (Table 3.10). This was due to the clinical urgency assessed by the Advisors, not simply that the delay in consultant review was longer than recommended by current guidance.

Initial management

Following admission, a clear management plan was documented in the majority of patients (91%, 453/498) and was considered to be appropriate by the Advisors in 421/453 (92.9%) The initial management plan was either unclear and/or was thought inappropriate in 60/498 (12%) cases.

Management of medical co-morbidities

For patients admitted electively, pre-assessment clinics present an opportunity to consider co-morbidities prior to surgery. Of the patients admitted electively, 43% (47/109) were seen in a pre-assessment clinic (Table 3.11). There is an opportunity to improve pre-operative preparation by increasing the number of elective patients attending for pre-assessment.

The clinical questionnaire showed that the following co-morbidities were common in the patients included in this study. More than half of the patients (349/628; 55.6%) had diabetes and a quarter had chronic kidney disease (156/628; 24.8%). One in five had respiratory disease (124/628; 19.7%) or a history of myocardial infarction (128/628; 20.4%). Overall, 78.5% (493/628) of patients had at least one of diabetes, cardiovascular disease (myocardial infarction, cardiac failure or stroke), renal failure, or respiratory disease. 134/628 (21.3%) patients had sepsis on admission. Only seven patients in total had none of the co-morbidities listed in Figure 3.5.

Table 3.11 Patient was assessed in a pre-assessment clinic *(Clinical questionnaire data)*

	Elective	Planned (urgent)	Emergency	**Subtotal**	Not answered	**Total**
Yes	47	3	5	55	0	55
No	62	68	403	533	4	537
Subtotal	**109**	**71**	**408**	**588**	**4**	**592**
Unknown	9	0	10	19	1	20
Not answered	0	2	14	16	0	16
Total	**118**	**73**	**432**	**623**	**5**	**628**

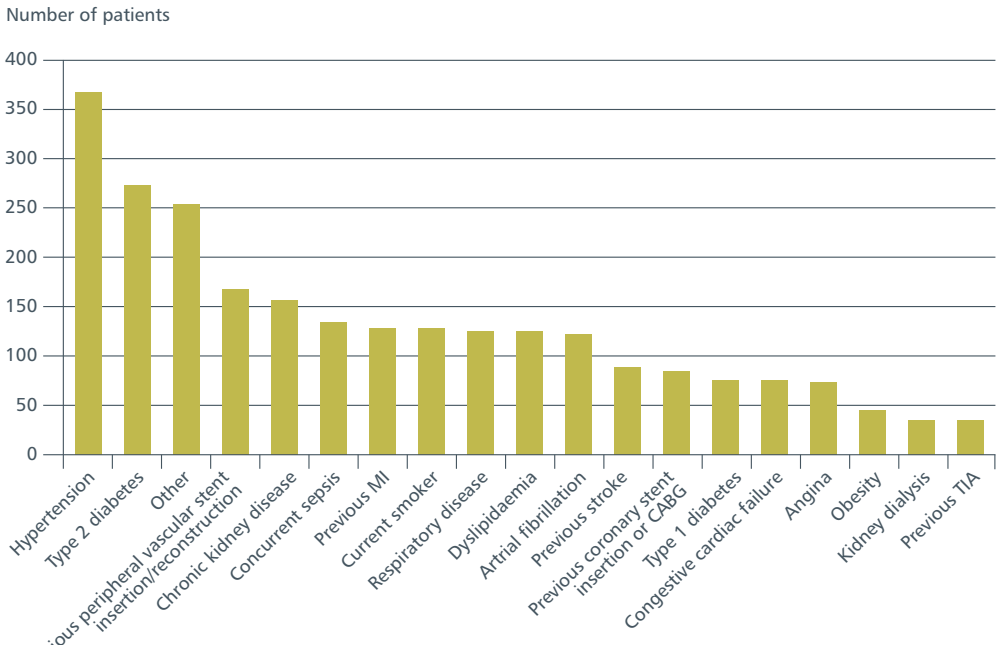

Figure 3.5 Co-morbidities on initial assessment
(Clinical questionnaire data)

When co-morbidities were analysed according to the presence or absence of diabetes, there were important differences between the two groups (Table 3.12).

Table 3.12 Differences in co-morbidities diabetes vs. no diabetes *(Clinical questionnaire data)*

	Diabetes		No diabetes	
	n	%	n	%
Type 1 diabetes	75	21.5	NA	NA
Type 2 diabetes	274	78.5	NA	NA
Respiratory disease	56	16.0	68	24.4
Chronic kidney disease	119	34.1	37	13.3
Kidney dialysis	28	8.0	6	2.2
Hypertension	227	65.0	140	50.2
Previous TIA	17	4.9	17	6.1
Previous stroke	56	16.0	31	11.1
Atrial fibrillation	64	18.3	58	20.8
Angina	40	11.5	32	11.5
Previous MI	80	22.9	48	17.2
Congestive cardiac failure	51	14.6	23	8.2
Previous coronary stent insertion or CABG	54	15.5	30	10.8
Obesity	32	9.2	13	4.7
Previous peripheral vascular stent insertion/reconstruction	73	20.9	91	32.6
Concurrent sepsis	87	24.9	47	16.8
Current smoker	52	14.9	76	27.2
Dyslipidaemia	86	24.6	37	13.3
Other	117	33.5	137	49.1
No co-morbidities	0		7	
Total	**349**		**279**	

**Answers may be multiple*

Table 3.13 Smoking history by diabetes *(Advisors' opinion)*

	Diabetes		No diabetes	
	n	%	n	%
Current smoker	62	37.8	74	47.1
Ex-smoker	65	39.6	60	38.2
Never smoked	37	22.6	23	14.6
Subtotal	**164**		**157**	
Not documented	82		57	
Unable to answer	20		22	
Not answered	13		14	
Total	**279**		**250**	

Case study 1

An elderly patient with diabetes and fast atrial fibrillation was admitted with critical ischaemia of the foot. Two attempts at angioplasty failed to revascularise the critically ischaemic limb and the patient required amputation. No advice was requested on diabetes management, which was rated as poor by the Advisors. Advice on rate control for atrial fibrillation was given by the medical registrar over the telephone. The first review by the medical team occurred on transfer to the rehabilitation ward a week post operatively.

The Advisors felt that medical review early in the admission would have improved the management of the patient's co-morbidities.

A greater proportion of the patients with diabetes had chronic kidney disease (34.1% vs. 13.3%), cardiac failure (14.6% vs. 8.2%), sepsis (24.9% vs. 16.8%) or a history of myocardial infarction (22.9% vs. 17.2%) compared to patients without diabetes. In contrast, patients without diabetes had a higher incidence of respiratory disease (24.4% vs. 16%) and a greater proportion were current smokers (27.2% vs. 14.9%). In cases assessed by the Advisors, a greater proportion of patients with diabetes had never smoked (22.6% vs. 14.6%) (Table 3.13). A lack of association between smoking and the need for amputation in patients with diabetes has previously been reported.[31]

In the general population however, smoking is a major risk factor for the development of peripheral vascular disease and the need for amputation. In the cases assessed by the Advisors almost half (42.4%; 136/321) were current smokers and the majority (261/321; 81.3%) were current or ex-smokers. The frequency of current smoking was more than double the current rate (20%) of smoking in the general population,[32] emphasising the importance of smoking as a risk factor. In this context it is disappointing to note that there were 139 cases reviewed by Advisors in whom the smoking history had not been documented. No data were gathered on smoking cessation advice or treatment in this study but the high prevalence of smoking in this population means that there is an opportunity to offer advice in a relatively high proportion of cases.

In the cases reviewed by the Advisors they found evidence of the same co-morbidities in 521/529 cases. In 147/457 (32.2%) cases they were of the opinion that there was the potential to improve or control these co-morbidities (Table 3.14). In the majority of these cases (123/138), an adequate attempt was made to control the co-morbidities present but they felt that a better attempt to do so should have been possible in 15/138 cases (Table 3.15).

Table 3.14 Potential to improve or control any of the co-morbidities present *(Advisors' opinion)*

	n	%
Yes	147	32.2
No	310	67.8
Subtotal	**457**	
Unable to answer	54	
Not answered	18	
Total	**529**	

Table 3.15 An adequate attempt was made to control the co-morbidities present *(Advisors' opinion)*

	n	%
Yes	123	89.1
No	15	10.9
Subtotal	**138**	
Unable to answer	8	
Not answered	1	
Total	**147**	

Table 3.16 Pre-operative review by specialists other than admitting consultant or vascular surgeon *(Advisors' opinion)*

	Yes - appropriately	No - should have been reviewed	**Subtotal**	Not applicable	Unknown	Not answered
Diabetology	100	57	**157**	153	19	200
Renal medicine	43	14	**57**	223	15	234
Care of the elderly	22	38	**60**	202	15	252
Cardiology	34	27	**61**	201	22	245
Anaesthesia	282	21	**303**	42	19	165
Respiratory	10	14	**24**	226	9	270
Other	75	6	**81**	52	6	390

The clinician responsible for the care of the patient were asked whether there was the potential to improve or control co-morbidities. Where data were available from both sources (Advisors and clinicians), they agreed in almost two thirds of cases (173/281; 61.6%). However, there were similar numbers of cases where only the Advisors (50/281; 17.8%) or only the responsible clinician (34/281; 12.1%) thought that this was the case.

As the majority of patients were admitted under the care of surgical specialties and the co-morbidities present were medical problems usually cared for by physicians, there was the potential for medical review pre-operatively to improve the care received. In the cases reviewed by the Advisors, review by at least one medical specialist other than an anaesthetist occurred in a total of 210/529 patients (368 cases if review by anaesthesia is included). Review was most frequently by a diabetologist.

There were 120/529 (22.7%) cases where the Advisors were of the opinion that a pre-operative review by a medical specialist should have taken place (Table 3.16). This means that in the total cohort of patients assessed, 330/529(62.4%) cases were either reviewed or the Advisors thought they should have been reviewed by a medical specialist other than an anaesthetist.

Case study 2

A young patient with diabetes was admitted with critical foot ischaemia, sepsis and a low blood pressure. They had an acute kidney injury on admission and blood sugar was poorly controlled. Amputation was deferred until the medical complications had been stabilised. The first review by a physician was by the medical registrar seven days after admission following a medical emergency call when the patient developed signs of severe sepsis.

Advisors commented that the pre-operative care was poorly organised. Earlier review by a medical team could have optimised management of diabetes, sepsis and renal function and both prevented deterioration and allowed earlier surgery.

Poor nutrition is associated with worse outcomes in hospital patients. Patients with multiple co-morbidities often have problems with nutrition and inadequate nutrition results in poor wound healing. In 2006, NICE recommended nutritional assessment of all patients on admission to hospital.[33] Where the Advisors were able to comment, only 55.1% (210/381) of cases reviewed had

a nutritional assessment within 48 hours of admission (Table 3.17). A similar percentage of cases where the clinician provided the information (280/460; 60.9%) had a pre-operative nutrition score calculated (Table 3.18). This suggests there is room for improvement in implementation of this NICE recommendation.

Whilst this chapter has concentrated on the medical aspects of pre-operative care, those relating to surgical care and attempts at re-vascularisation are covered in chapter 4.

The benefits of early medical review and optimisation of patients with similar co-morbidities to those presented here have been recognised in the context of elderly patients admitted to hospital with a fractured neck of femur.[34] In these patients, optimisation of co-morbidities as soon as possible following admission results in better outcomes including lower mortality and shorter length of stay. As a result, pathways have been developed to provide medical care for this group of patients. The data presented here suggests that patients requiring amputation would benefit from a similar pathway of care to the orthogeriatric model in order to optimise medical problems prior to amputation surgery.

Table 3.17 Nutritional status was assessed within 48 hours of admission to hospital *(Advisors' opinion)*

	n	%
Yes	210	55.1
No	171	44.9
Subtotal	**381**	
Unknown	125	
Not answered	23	
Total	**529**	

Table 3.18 Pre-operative calculation of a nutrition score *(Clinical questionnaire data)*

	n	%
Yes	280	60.9
No	180	39.1
Subtotal	**460**	
Unknown	164	
Not answered	4	
Total	**628**	

Key findings

1. Delays in the transfer of patients to vascular units occurred in 21/145 (14.5%) patients and affected 15/105 (14.2%) emergency transfers.

2. 493/605 (81.5%) patients were initially admitted to general, vascular or assessment wards and in 447/554 (81%) cases the admitting doctor was from a surgical speciality.

3. 73/172 (42.4%) emergency admissions were reviewed by a consultant within 14 hours of admission although the time of first consultant review was not documented in 268/529 (50.6%) cases.

4. The initial management plan was either not clear or was inappropriate in 60/498 (12%) cases.

5. 47/109 (43.1%) patients admitted electively were seen in a pre-assessment clinic.

6. Major co-morbidity was often present. 493/628 (78.5%) of patients had at least one of diabetes, cardiovascular disease, renal failure, or respiratory disease. In cases reviewed by Advisors, there was potential to improve co-morbidities pre-operatively in just under a third (147/457; 32.2%).

7. 210/529 (39.7%) patients underwent pre-operative review by a specialist physician (not including anaesthetics), and Advisors thought that review was indicated in a further 120/529 (22.7%) cases. In total, medical review either took place or was indicated in 330/529 (62.4%) cases.

8. Only 280/460 (60.9%) patients had a pre-operative nutrition score calculated.

4 – Peri-operative care

That fact that the majority of patients were admitted as an emergency reflects the typical workload of vascular surgical units where around two-thirds of patients who ultimately require surgery are admitted by this route.

Although 118 patients were deemed elective admissions only 69/616 patients were placed on a waiting list for surgery, of which 10 were actually planned or emergency admissions. The remainder (59) were "elective" patients. Whilst it might be expected that most patients who were on a waiting list for admission required surgery for deformity or another neuropathic complication of diabetes rather than critical ischaemia, Table 4.1 shows that this was not the case, with ischaemic rest pain (± ulceration and/or gangrene) being a common diagnosis in waiting list patients.

Table 4.1 Diagnosis for patients placed on a waiting list for amputation *(Clinical questionnaire data)*

	On waiting list for amputation					
	Yes	No	**Subtotal**	Unknown	Not answered	**Total**
Ischaemic rest pain	2	54	**56**	1	1	**58**
Ischaemic rest pain with ulceration and/or gangrene	32	256	**288**	3	1	**292**
Neuropathy	1	0	**1**	0	0	**1**
Neuropathy with ulceration and/or gangrene	7	37	**44**	0	1	**45**
Sepsis	4	77	**81**	0	1	**82**
Severe deformity	4	2	**6**	0	0	**6**
Other	8	48	**56**	1	0	**57**
Subtotal	**58**	**474**	**532**	**5**	**4**	**541**
Multiple answers given	11	71	**82**	1	2	**85**
Not answered	0	2	**2**	0	0	**2**
Total	**69**	**547**	**616**	**6**	**6**	**628**

Time from admission to first review by a vascular surgeon

Where the question was answered, most patients 294/498 (59%) were admitted under the care of a vascular surgeon. As commented upon earlier, it is surprising that few received their initial care from diabetologists (5/498; 1%).

Regardless of the admitting specialty most patients were reviewed by a consultant vascular surgeon prior to amputation (Table 4.2).

Although two-thirds (65.7%; 318/484) of patients were reviewed within the first 24 hours, 8.3% (40/484) were not seen for 10 days or more. Unfortunately the questionnaire was not designed to determine whether the referral was delayed or there was a delay between referral and review by the vascular surgeon.

Table 4.2 Reviewed by a consultant vascular surgeon prior to amputation *(Clinical questionnaire data)*

	n	%
Yes	576	93.4
No	41	6.6
Subtotal	**617**	
Unknown	11	
Total	**628**	

When the time to vascular consultant review was analysed by specialty of admission the findings are somewhat different. Figure 4.1 compares the time to review for patients admitted under a vascular surgeon with that for patients admitted to all other specialties. Nineteen percent of patients who were admitted to a vascular unit were not reviewed by a vascular consultant within 24 hours compared to 52.5% of patients admitted under another specialty. It is therefore important for non-vascular specialties to be aware of the importance of early vascular assessment for critical ischaemia and acute diabetic foot sepsis.

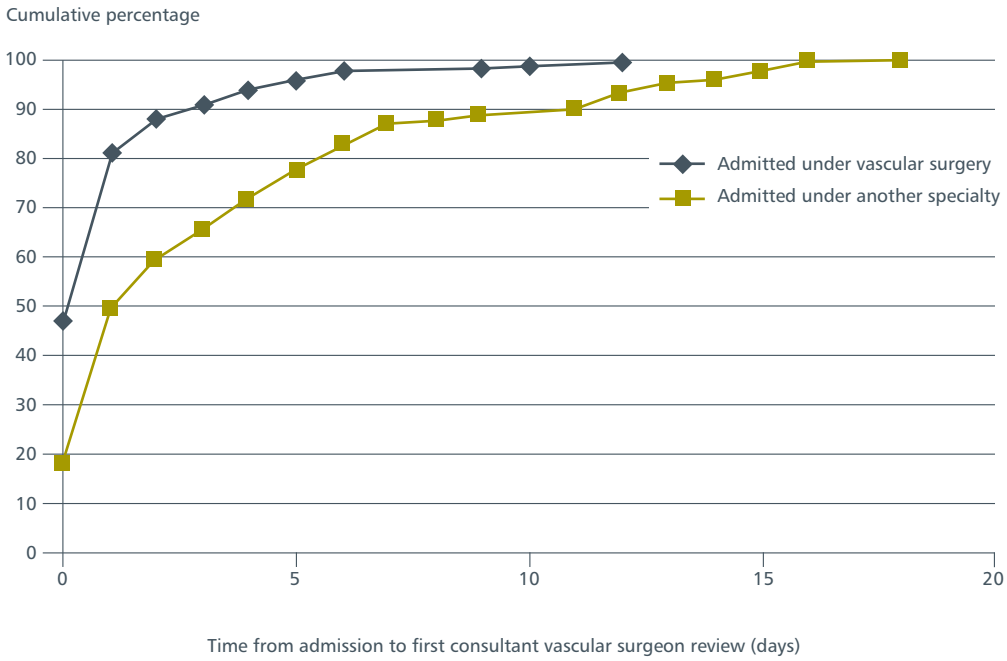

Figure 4.1 Time from admission to first consultant vascular surgeon review
(Clinical questionnaire data and Advisors' opinion)

For patients admitted under other specialties the Advisors were asked whether review by a consultant vascular surgeon at the time of admission might have had the potential to alter the outcome. They considered that this was the case in 16/148 patients in whom they were able to give an opinion (Table 4.3). It therefore seems that hospitals should adopt a policy that dictates that all patients who are admitted with limb-threatening ischaemia, including acute diabetic foot problems, are reviewed by the on-call vascular surgeon within 24 hours of admission.

Table 4.3 Vascular review on admission would have altered patient outcome (In patients not admitted under vascular surgery) *(Advisors' opinion)*

	n	%
Yes	16	10.8
No	132	89.2
Subtotal	**148**	
Unable to answer	23	
Not applicable	6	
Not answered	27	
Total	**204**	

The data also showed that patients who were admitted as an emergency often waited the longest for their first vascular consultant review, with 23.9% (86/360) patients not reviewed within 72 hours of admission.

Indications for surgery

Table 4.4 shows the principal indication for amputation in the study as a whole whilst Table 4.5 separates the data for patients with and without diabetes.

Table 4.4 Main indication for amputation in all patients *(Clinical questionnaire data)*

	n	%
Ischaemic rest pain	58	10.7
Ischaemic rest pain with ulceration and/or gangrene	292	54.0
Neuropathy	1	<1
Neuropathy with ulceration and/or gangrene	45	8.3
Sepsis	82	15.2
Severe deformity	6	1.1
Other	57	10.5
Subtotal	**541**	
Multiple answers	85	
Not answered	2	
Total	**628**	

Table 4.5 Main indication for surgery in patients with and without diabetes *(Clinical questionnaire data)*

	Diabetes		No diabetes	
	n	%	n	%
Ischaemic rest pain	17	5.9	41	16.9
Ischaemic rest pain with ulceration and/or gangrene	135	46.6	157	64.6
Neuropathy	1	<1	0	<1
Neuropathy with ulceration and/or gangrene	38	13.1	7	2.9
Sepsis	71	24.5	11	4.5
Severe deformity	5	1.7	1	<1
Other	23	7.9	26	10.7
Subtotal	**290**		**243**	
Multiple answers	59		26	
Not answered	0		2	
Total	**349**		**271**	

The majority of patients without diabetes required amputation for ischaemic rest pain with or without trophic changes, whilst complications associated with neuropathy and sepsis were more common indications in patients with diabetes requiring surgery.

Assessment of limb perfusion

The clinical questionnaire asked about the methods used to assess limb viability prior to surgery. The responses are shown in Table 4.6. It is apparent that a high proportion of patients underwent either Duplex ultrasound or angiography (conventional, MRA, CTA) to assess the circulation in the limb prior to amputation. For some this will have been performed to assess the options for limb salvage (radiological or surgical) or to enhance healing of a more distal amputation. In others it may have been to guide the level of amputation.

Table 4.6 Method of assessment of the circulation in the ipsilateral limb prior to amputation *(Clinical questionnaire data)*

	n	%
Clinical assessment	458	73.6
Angiography	300	48.2
Duplex ultrasound	167	26.8
Ankle-brachial pressure index	90	14.5
Previous major amputation	27	4.3
NA - bilateral amputation	14	2.3
No assessment	12	1.9
Unknown	5	<1
Subtotal	**622**	
Not answered	6	
Total	**628**	

**Answers may be multiple*

Table 4.7 indicates the proportion of patients who underwent a definitive assessment of their circulation using angiography or Duplex ultrasound. It is evident that no formal vascular imaging was performed in 244/622 (39.2%) patients.

Table 4.7 Use of angiography and Duplex ultrasound *(Clinical questionnaire data)*

	n
Angiography	211
Duplex ultrasound	78
Angiography and duplex ultrasound	89
Total undergoing formal vascular assessment	**378**
No vascular imaging	244
Total	**622**

The Advisors confirmed that assessment of the ipsilateral limb was satisfactory in 444/481 (92.3%) patients but inadequate in 37/481 (7.7%) cases. The reasons for the latter are shown in Table 4.8. The Advisors were unable to make a decision about the assessment in 48 patients.

Table 4.8 Reasons why the Advisors considered that vascular assessment of the limb for amputation was inadequate *(Advisors' opinion)*

Reason	n
Should have had angiography	15
Assessment delayed, limb deteriorated	2
No assessment at all (not even pulses)	4
No documentation of how assessed	3
Other	4
Subtotal	**28**
No reason given	9
Total	**37**

The Advisors were also asked whether assessment of the circulation in the contralateral limb was satisfactory. Their views are summarised in Table 4.9.

Table 4.9 Assessment of the circulation in the contralateral limb was satisfactory *(Advisors' opinion)*

	n	%
Yes	387	88.2
No	52	11.8
Subtotal	**439**	
Unable to answer	53	
Not answered	37	
Total	**529**	

Furthermore, the Advisors were asked if the interval between assessment and operation was appropriate. Whilst this was the case in most patients they felt that surgery was delayed in 55/477 patients (Table 4.10).

Table 4.10 The interval between assessment and operation was appropriate *(Advisors' opinion)*

	n	%
Yes	422	88.5
No	55	11.5
Subtotal	**477**	
Unable to answer	43	
Not answered	9	
Total	**529**	

The main reasons why the Advisors considered that there was a delay between assessment and operation was for non clinical reasons (23/54 cases). In one case no reason was given.

Limb salvage

Over a third of patients (174/515; 33.8%) underwent an attempt at limb salvage prior to the decision to undertake an amputation. The Advisors felt that this would have been appropriate in a further 22 patients. These data are summarised in Tables 4.11 and 4.12.

Table 4.11 Limb salvage surgery attempted prior to amputation *(Advisors' opinion)*

	n	%
Yes	174	33.8
No	341	66.2
Subtotal	**515**	
Unable to answer	10	
Not answered	4	
Total	**529**	

Table 4.12 Attempted limb salvage would have been appropriate *(Advisors' opinion)*

	n	%
Yes	22	7.7
No	264	92.3
Subtotal	**286**	
Unable to answer	52	
Not answered	3	
Total	**341**	

Selecting patients for attempted revascularisation rather than primary amputation is complex and may be influenced by issues other than the anatomical suitability of the arteries for surgery or radiological intervention. Nevertheless it is of concern that the Advisors felt, where they were able to make a judgment, that amputation might have been avoided in 22/286 (7.7%) patients, had limb salvage been attempted and proved successful. Further analysis of the data did not show any relationship between the time from admission to review by a consultant vascular surgeon and whether limb salvage surgery was attempted.

Multidisciplinary team meeting (MDT)

Vascular surgery multidisciplinary team meetings are primarily focused on patients in whom a definitive decision is required about options for revascularisation or interventional radiology and do not generally include the planning of care for amputees. These MDT meetings are attended by vascular surgeons, interventional radiologists, vascular anaesthetists, trainees, vascular nurse specialists and other members of the clinical team.

Table 4.13 indicates the proportion of patients in this study who were discussed at an MDT and also looks at the urgency of admission, as this may influence whether patients requiring amputation are discussed at a pre-operative MDT. Although Table 4.13 indicates that a greater proportion of elective admissions were discussed almost half were not, and only a minority of planned admissions were considered by this group.

In hospitals where an on-site vascular MDT was held it was marginally more likely (43% vs. 37%) that patients were discussed prior to amputation (Table 4.14).

Table 4.13 Patient discussed at an MDT by urgency of surgery *(Clinical questionnaire data)*

	Elective	Planned	Emergency	**Subtotal**	Not answered	**Total**
Yes	55	20	140	**215**	1	**216**
No	46	44	235	**325**	4	**329**
Subtotal	**101**	**64**	**375**	**540**	**5**	**545**
Unknown	16	9	50	**75**	0	**75**
Not answered	1	0	7	**8**	0	**8**
Total	**118**	**73**	**432**	**623**	**5**	**628**

Table 4.14 An on-site MDT increased the number of amputees who were discussed pre-operatively *(Clinical and organisational questionnaire data)*

Patient was discussed at an MDT meeting	**On-site vascular MDT team responsible for the care of amputees**						
	Yes		No		**Subtotal**	Not answered	**Grand total**
	n	**%**	**n**	**%**	**n**	**n**	**n**
Yes	138	42.5	63	37.3	**201**	1	**202**
No	187	57.5	106	62.7	**293**	8	**301**
Subtotal	**325**		**169**		**494**	**9**	**503**
Unknown	43		27		**70**	3	**73**
Not answered	4		3		**7**	0	**7**
Grand total	**372**		**199**		**571**	**12**	**583**

Given the typical format of a vascular MDT (described previously) this may not be surprising. Nevertheless, the lack of a formal discussion about patients requiring a major amputation demonstrates an important deficit in the clinical care pathway for these patients. It seems logical to suggest that the management of potential amputees should be discussed by a group that are responsible for pre- and post operative physiotherapy, occupational therapy, psychological support, discharge planning, social services, post operative rehabilitation, limb fitting services and the management of medical co-morbidities (including diabetes).

One of the difficulties of arranging an 'amputation' MDT is the relatively small number of patients who are likely to require discussion each week in an individual centre. Nevertheless optimum care is more likely to be delivered if patient management is appropriately co-ordinated and adheres to a well-designed clinical care pathway. Once vascular centralisation is completed there will be fewer than 50 vascular centres in England undertaking more than 5,000 major amputations each year. This equates to 2-3 new amputees per week so an MDT specifically designed to discuss the management of these patients and the progress of inpatients who have already undergone surgery is easily justified.

The need for such an MDT is confirmed by the variable involvement of important support services in the pre-operative management of amputees included in this study. This is summarised in Table 4.15.

Table 4.15 Pre-operative support services accessed by patients *(Clinical questionnaire data)*

	Psychologist	Amputee co-ordinator	Physiotherapist	Podiatrist	Vascular nurse specialist	Diabetes nurse specialist (n=349)
Seen pre-operatively	21	67	346	123	225	163
Not usual practice	259	142	47	182	94	41
No service provided within the Trust or hospital	185	210	4	17	96	2
Service provided at another hospital within the hospital	8	24	3	11	8	6
Service provided but support worker not available	2	6	14	4	11	5
Insufficient time for clinical/surgical reasons	58	79	105	72	65	39
Unknown	55	60	59	77	53	54
Other	17	23	12	44	19	14

**Answers may be multiple*

Provided that there was sufficient time, 346/531 patients were reviewed by a physiotherapist pre-operatively. Although it was considered that there was insufficient time for such a review in 105 patients, 68/531 patients were not seen for reasons that might be considered to represent a poor level of care. Similar data shows that almost one fifth (54/270) of patients with diabetes were not seen by a diabetes nurse specialist and an even greater proportion (209/518) were not reviewed by a vascular nurse specialist because it was not normal practice or the service was either not provided or was unavailable at the time.

These data are even worse when considering the absence of an assessment by an amputee co-ordinator (382/551; 67.3%) or a psychologist (454/550). For the latter it also seems that even when psychology services were available it was not considered normal practice to refer patients for assessment.

These data are of concern when the potential impact of these deficiencies on the post operative recovery, rehabilitation and timely discharge of amputees is considered.

Table 4.16 Pre-operative discussion of discharge planning and rehabilitation *(Advisors' opinion)*

	n	%
Yes	164	31.5
No	356	68.5
Subtotal	**520**	
Not answered	9	
Total	**529**	

To further assess the efficacy of the pre-operative management of amputees the Advisors were asked to comment upon the plans for discharge and rehabilitation services that were initiated prior to surgery. Delays in organising this might prolong the inpatient stay. Table 4.16 details the proportion of patients in whom there was evidence from the case notes that these issues were discussed before the operation.

Whether or not a discussion occurred depended to some extent on the urgency of admission (Table 4.17). However, even in elective admissions, planning did not commence pre-operatively in more than half of the patients.

Table 4.17 Discharge planning was discussed by urgency of surgery *(Advisors' opinion and clinical questionnaire data)*

	Discharge planning discussed						
	Yes		No		Total	Not answered	Grand total
	n	%	n	%			
Elective	36	39.1	56	60.9	**92**	1	**93**
Planned	19	35.2	35	64.8	**54**	1	**55**
Emergency	98	28.2	250	71.8	**348**	6	**354**
Subtotal	**153**		**341**		494	**8**	**502**
Not answered	1		3		**4**	0	**4**
Total	**154**		**344**		498	**8**	**506**

Although it might be considered that a lack of discussion reflected the urgency of surgery only 27/323 patients underwent immediate amputation and therefore this process should have been commenced in most patients.

Advisors also examined the case notes to try and identify if there was a named person who had responsibility for co-ordinating discharge planning and rehabilitation needs. This was only evident in a minority of patients (Table 4.18).

Based on the evidence that was available to them, the Advisors were asked to provide a global assessment of the quality of pre-operative care of these patients (Figure 4.2).

Table 4.18 A named individual was responsible for co-ordinating discharge planning and rehabilitation *(Advisors' opinion)*

	n	%
Yes	64	12.4
No	452	87.6
Subtotal	**516**	
Not answered	13	
Total	**529**	

It is of note that the quality was considered poor or unacceptable in 72/499 (14.4%) cases where the Advisors were able to provide an opinion. The reasons for this are difficult to analyse but included the issues described in Table 4.19 overleaf. In some instances there was more than one reason for this assessment.

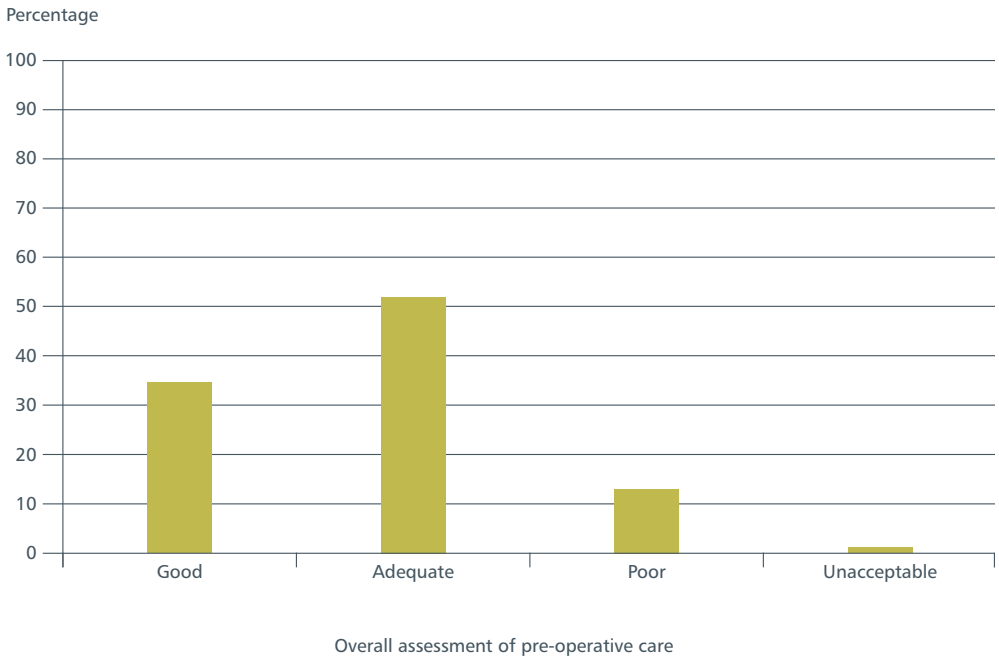

Figure 4.2 Overall assessment of the quality of pre-operative care *(Advisors' opinion)*

Table 4.19 Reasons for poor or unacceptable quality of pre-operative care

Delayed vascular review	Delayed referral to vascular team
Delays in other stages of the clinical care pathway	Failure to assess the potential for limb salvage
Failure to perform revascularisation	Delayed investigation of acute limb ischaemia
Poor decision making, including inappropriate amputation when palliative care required	Poor pain management
Inappropriate surgery by orthopaedic team	

Case study 3

A patient was admitted to a medical ward with a heel ulcer and systemic signs of sepsis. Gangrenous changes subsequently developed. A vascular opinion was requested after 9 days and when reviewed 2 days later gangrene of the left foot and a fixed flexion deformity of the knee were documented. Amputation was delayed for a further 6 days and was cancelled on one occasion.

The Advisors considered that care of this patient was poor due to delays in referral, vascular review, and surgery.

Consent

Information on the grade of clinician who took consent for amputation was obtained from both the clinical and Advisor questionnaires. Data from the clinical questionnaire is shown in Table 4.20.

Table 4.20 Grade of clinician taking consent *(Clinical questionnaire data)*

	n	%
Consultant	226	38.0
Staff grade/Associate specialist	51	8.6
Trainee with CCT	25	4.2
Senior specialist trainee	206	34.6
Junior specialist trainee	67	11.3
Basic grade	14	2.4
Nursing	5	<1
Other	1	<1
Subtotal	**595**	
Not answered	33	
Total	**628**	

Consent was taken by an inexperienced trainee or nurse in almost 15% of patients, suggesting that appropriate guidelines were not followed. Basic grade (Foundation) trainees should only take consent when observed by the doctor undertaking the procedure and if it is part of a structured training opportunity. When this is the case it seems logical that the supervising surgeon should countersign the consent form. For junior specialist (Core) trainees they should either be capable of performing the procedure themselves, or have received specialist training in advising patients about the procedure. The Advisors did not think the seniority of the person taking consent was appropriate in 53/452 (11.7%) patients (Table 4.21).

Table 4.21 The seniority of the person taking consent was appropriate *(Advisors' opinion)*

	n	%
Yes	399	88.3
No	53	11.7
Subtotal	**452**	
Insufficient data	57	
Not answered	20	
Total	**529**	

However, the Advisors also found that even when a more senior doctor completed the consent form that the risks and benefits of surgery were not adequately documented in a third of cases (Table 4.22) and risk of death was only included on the consent form in 105/479 (21.9%) of patients. This was most likely to be included when a consultant signed the consent form (35/129) and least likely when a junior specialist (8/52) or basic grade (2/21) trainee undertook this task.

Similarly, the benefits of amputation were not included on the consent form in almost a quarter of patients (40/165, 24.2%) in whom therapy specialists (physiotherapy, occupational therapy) undertook further peer review.

To overcome these omissions the development of specific guidelines for consenting patients for amputation or a standard consent form should be considered.

Table 4.22 The risks and benefits of surgery were fully recorded on the consent form *(Advisors' opinion)*

	n	%
Yes	310	68.3
No	144	31.7
Subtotal	**454**	
Unable to answer	66	
Not answered	9	
Total	**529**	

The issues around consent are further highlighted by the Advisors' views about the quality of information on the consent form (Figure 4.3). They considered it to be poor or unacceptable in more than a quarter of patients.

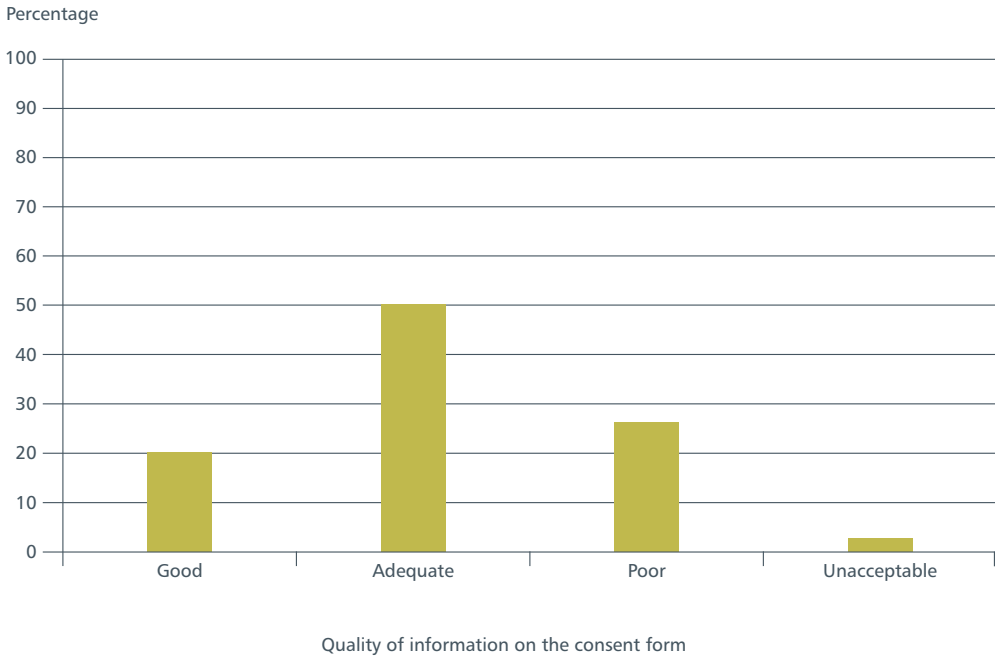

Figure 4.3 Quality of information on the consent form *(Advisors' opinion)*

Table 4.23 Grade of doctor taking consent where Advisors considered the information on the consent form to be poor or unacceptable *(Advisors' opinion)*

	Number consented	Poor or unacceptable
	n	n
Consultant	149	41
Staff Grade or Associate Specialist	27	5
Trainee with CCT	10	3
Senior specialist trainee	198	45
Junior specialist trainee	55	14
Basic grade	26	11
Nursing	2	0
Physiotherapy	2	0
Subtotal	**469**	**119**
Unable to answer	60	10
Total	**529**	**129**

The data in Table 4.23 indicates that the proportion of consent forms in which the information was considered poor or unacceptable was similarly distributed between all grades except for Basic grade trainees where nearly half were assessed at this level.

Pre-operative preparation

Despite the co-morbidities identified in patients requiring amputation and the significant risk of mortality, the pre-operative assessment of patients included in this study was largely limited to routine haematological and biochemical investigations.

Tests of physiological reserve were performed infrequently (Figure 4.4). This may reflect the relative urgency of the surgery in most instances, the lack of other treatment options for these patients, and the minimal haemodynamic impact of amputation. Although there are some patients in whom palliative care may be more appropriate than amputation it is likely that such decisions were made on clinical grounds rather on the basis of these investigations.

Overall, the Advisors were of the opinion that the pre-operative risk assessment was adequate in the majority of cases (Table 4.24).

Case study 4

A patient with disseminated malignancy and systemic sepsis presented with irreversible acute limb ischaemia. A consultant took consent and performed amputation with no risks documented on the consent form. The following day the contralateral limb became ischaemic and mottled and non-operative management was then followed. The patient subsequently died.

The Advisors considered that conservative treatment should have been adopted from the outset and that counseling for the amputation was poor. Furthermore, considering the consultant took consent the risk of death should have been recorded on the consent form.

Table 4.24: Pre-operative risk assessment adequate *(Advisors' opinion)*

	n	%
Yes	477	92.6
No	38	7.4
Subtotal	**515**	
Not answered	14	
Total	**529**	

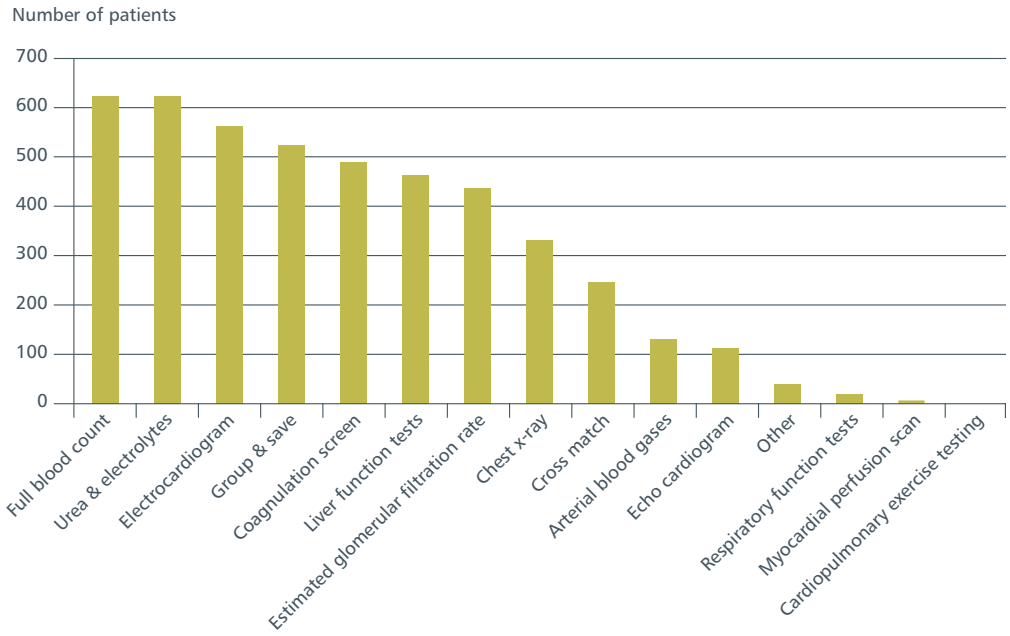

Figure 4.4 Pre-operative investigations for risk assessment *(Clinical questionnaire data)*

Venous thromboembolism (VTE) prophylaxis

Table 4.25 Prophylaxis prescribed against VTE *(Clinical questionnaire data)*

	n	%
Low molecular weight heparin	530	85.2
Compression stockings	15	2.4
Pneumatic compression	6	1.0
None	23	3.7
Unknown	9	1.4
Other	57	9.2
Subtotal	**622**	
Not answered	6	
Total	**628**	

**Answers may be multiple*

Previous studies have shown that VTE occurs in up to 13% of patients undergoing major lower limb amputation[35,36] and it is generally agreed that they should receive appropriate prophylaxis. Data from the clinical questionnaire confirms that this was provided for the majority of patients. It is also important to note that the use of compression stockings and pneumatic compression is contraindicated in patients with peripheral vascular disease, which explains the lower numbers for these categories in Table 4.25.

Antibiotic prophylaxis

Infection following major lower limb amputation is common and a recent study has reported that a third of patients developed a wound infection of which half were superficial and half were deep surgical site infections.[37] Furthermore, sepsis was significantly more likely in below-knee than above-knee amputations. Interestingly, these authors showed that rates of infection were not influenced by the prescription of antibiotics. In contrast a separate review of previous publications,[38] involving a much larger number of patients concluded that antibiotic prophylaxis significantly reduced the risk of wound infection and possibly the need for re-amputation. Another, relatively small study[39] showed that a 5-day course of antibiotic prophylaxis reduced stump infection rates leading to shorter in-hospital stay.

In this study antibiotics were administered pre-operatively, on induction of anaesthesia or during the operation to 580/601 (96.5%) patients. However, it is recommended that these should be given 1-60 minutes before the first incision. When the Advisors assessed this they found that a quarter of patients did not receive them at an appropriate time (Table 4.26).

Table 4.26 Prophylactic antibiotics were administered at an appropriate time *(Advisors' opinion)*

	n	%
Yes	191	72.1
No	74	28.3
Subtotal	**265**	
Not answered	264	
Total	**529**	

The number of patients in whom the Advisors could not answer this question was high and the reasons given for this included the failure to record either the time of administration or the time at which the first incision was made. This highlights deficiencies in note keeping and documentation on the anaesthetic chart. The poor quality of all parts of the case notes was a recurrent theme throughout this study.

Prophylaxis was continued for a median of 4 days although it did not continue beyond the first post operative day in 104/365 (28.4%) of patients.

MRSA screening

The NHS operating framework states that "all planned or unplanned adult admissions to hospital (with a few exceptions) should be screened for MRSA either prior to or within 24 hours of admission to hospital".[40] This did not occur in 88/579 (15.2%) patients (Table 4.27) but cannot be explained by the urgency of surgery since only 27 patients required immediate amputation following admission.

Table 4.27 Pre-operative screening for MRSA was undertaken *(Clinical questionnaire data)*

	n	%
Yes	491	84.8
No	88	15.2
Subtotal	**579**	
Unknown	47	
Not answered	2	
Total	**628**	

Screening for MRSA aims to reduce dissemination of the organism within an institution and to reduce the rate of clinically significant infection. That positive cultures have been obtained in up to 45% of patients requiring lower limb amputation[41] would justify a screening programme regardless of the NHS guidelines. This same study also found that pre-operative MRSA infection increased the risk of MRSA stump infection, the need for re-amputation, and increased the length of hospital stay. Two other studies have described similar findings with a reduction in stump primary healing rates and a higher mortality.[42,43] These data suggest that full compliance with MRSA screening is required.

It is evident that MRSA screening occurred less often in patients admitted as an emergency (Table 4.28). This is likely to reflect inadequacies in the processes of care rather than the urgency of admission given that immediate amputation was only performed in a small minority of patients as discussed earlier.

Table 4.28 MRSA screening by urgency of admission *(Clinical questionnaire data)*

	Yes	No	**Subtotal**	Unknown	Not answered	**Total**
Elective	108	6	**114**	4	0	**118**
Planned	59	7	**66**	7	0	**73**
Emergency	321	74	**395**	35	2	**432**
Subtotal	**488**	**87**	**575**	**46**	**2**	**623**
Not answered	3	1	**4**	1	0	**5**
Total	**491**	**88**	**579**	**47**	**2**	**628**

Previous procedures on the limb requiring amputation

Two-thirds of patients (401/608, 66%) included in this study had undergone 1-4 previous procedures (surgical or radiological) on the ipsilateral limb prior to the index amputation. Information about these is shown in Table 4.29.

Table 4.29: Previous interventions on the limb for amputation *(Clinical questionnaire data)*

	First	Second	Third	Fourth
Aorto-iliac reconstruction	15	3	0	0
Angioplasty ± stent	82	28	11	4
Infra-inguinal reconstruction	66	38	10	3
Graft Revision	NA	9	5	1
Chemical sympathectomy	3	4	0	0
Amputation or debridement toe/foot	64	30	22	6
Below-knee amputation	5	4	4	3
Above-knee amputation	3	2	2	1
Other	9	10	3	1

Urgency of surgery

Information from the clinical questionnaire also indicated the urgency of the amputation. This is shown in Table 4.30.

Table 4.30 Urgency of surgery *(Clinical questionnaire data)*

	n	%
Immediate	27	4.3
Urgent	278	44.6
Expedited	269	43.2
Elective	49	7.9
Subtotal	**623**	
Not answered	5	
Total	**628**	

Table 4.31 Urgency of surgery by type of operating theatre where surgery was performed *(Clinical questionnaire data)*

	Immediate	Urgent	Expedited	Elective	**Subtotal**	Not answered	**Total**
Emergency theatre	27	168	132	6	**333**	0	**333**
Elective operating list	0	85	123	43	**251**	1	**252**
Other	0	14	0	0	**14**	0	**14**
Subtotal	**27**	**267**	**255**	**49**	**598**	**1**	**599**
Unknown	0	7	8	0	**15**	1	**16**
Not answered	0	4	6	0	**10**	3	**13**
Total	**27**	**278**	**269**	**49**	**623**	**5**	**628**

The questionnaire also identified where the operation was performed. In the majority of patients this occurred in an emergency theatre (Table 4.31).

The use of the emergency theatre for these operations is clearly justified when surgery is required immediately. That this was not always the case is confirmed by the data in Table 4.31. One hundred and thirty-eight patients (138/598, 23.1%) who were classified in the clinical questionnaire as requiring expedited or elective amputation underwent surgery in the emergency theatre. This is inappropriate. Further, it might be questioned whether a proportion of the group requiring urgent surgery (acute onset or a deterioration in condition that threatened life, limb or organ survival) were correctly allocated to this group.

Data about the day of operation was recorded in both the Advisor and clinical questionnaires and it is apparent that a significant proportion of amputations were performed at the weekend (Table 4.32). At least 135 patients underwent 'out-of-hours' surgery. Given that only 27 patients required immediate amputation this seems difficult to explain. Further, it is widely recognised that when semi-elective surgery (such as amputation) is booked for the emergency theatre, particularly out-of-hours, it may be subject to postponement if more urgent cases require surgery. At best this makes the timing of the operation unpredictable and at worst leads to postponement and delays for the patient. Surgery was booked and cancelled at least once in 48/553 patients where the information was available.

Table 4.32 The day of the week on which the operation was performed *(Clinical questionnaire data)*

	n	**%**
Monday	94	15.1
Tuesday	97	15.6
Wednesday	107	17.2
Thursday	120	19.3
Friday	112	18.0
Saturday	47	7.6
Sunday	44	7.1
Subtotal	**621**	
Not answered	7	
Total	**628**	

Following out-of-hours surgery the level of nursing and medical care in the ward environment may be compromised and this should be considered when performing this type of surgery at these times. When surgery was performed out-of-hours or at weekends the proportion of cases performed by a consultant surgeon was no less frequent than in the study as a whole (50% vs. 45.7%) (Table 4.33).

The Advisors were also asked if there was evidence in the case notes to suggest that the operation was not given adequate priority. They confirmed that this was the case in 45/482 (9.3%) patients where they were able to give an opinion. Furthermore, performing surgery out-of-hours was considered inappropriate in 28/76 patients in whom a decision could be made (Table 4.34).

Table 4.33 Grade of surgeon performing amputation out-of-hours and at weekends *(Clinical questionnaire data)*

	n	%
Consultant	67	50
Staff grade or Associate specialist	9	6.7
Trainee with CCT	6	4.5
Senior specialist trainee	44	32.8
Junior specialist trainee	7	5.2
Basic grade	1	<1
Subtotal	**134**	
Not answered	1	
Total	**135**	

Table 4.34 Advisors' opinions on performing amputation out-of-hours and the priority given to surgery.

Out-of-hours appropriate	Adequate priority not given					
	Yes	No	**Subtotal**	Unable to answer	Not answered	**Total**
Yes	3	45	**48**	4	0	**52**
No	8	20	**28**	8	0	**36**
Subtotal	**11**	**65**	**76**	**12**	**0**	**88**
Unable to answer	9	71	**80**	7	1	**88**
Total	**20**	**136**	**156**	**19**	**1**	**176**

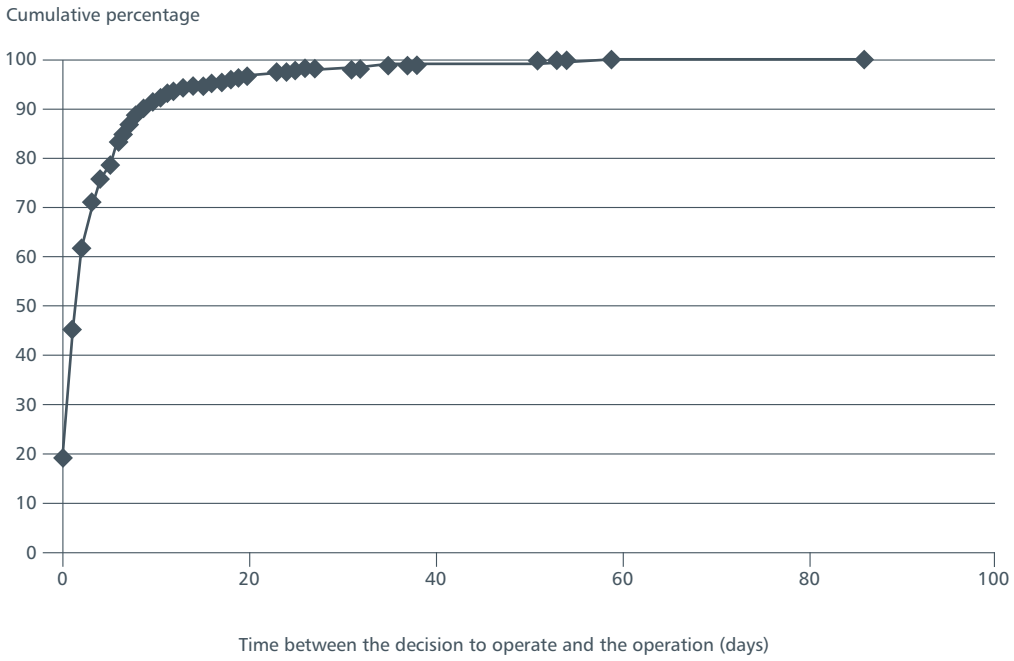

Figure 4.5 Time between the decision to operate and the operation (days)

Delays

Figure 4.5 shows the interval between the decision to operate and surgery and it is apparent that 11.6% of patients waited >7 days for their surgery.

Both the Advisor and clinical questionnaires asked if there were significant or unnecessary delays in performing surgery. The responses are shown in Tables 4.35 and 4.36, and are very similar.

The Advisors were also asked to comment upon the possibility that the time spent waiting for surgery affected the outcome. Their opinion is shown in Table 4.37 and indicates that they considered that this was the case in 20/479, 4.2% of all cases, and in more than a quarter (14/64) of those in whom they believed that there was an unnecessary delay.

Table 4.35 An unnecessary delay between the decision to operate and surgery *(Advisors' opinion)*

	n	%
Yes	76	15.1
No	428	84.9
Subtotal	**504**	
Unable to answer	20	
Not answered	5	
Total	**529**	

Table 4.36 A significant delay between the decision to operate and the procedure *(Clinical questionnaire data)*

	n	%
Yes	118	19.1
No	499	80.9
Subtotal	**617**	
Unknown	11	
Total	**628**	

Table 4.37 Delays in surgery affected outcome *(Advisors' opinion)*

	n	%
Yes	20	4.2
No	459	95.8
Subtotal	**479**	
Unable to answer	30	
Not answered	20	
Total	**529**	

Unnecessary delays and cancellations may have an adverse impact upon the management of diabetes and compromise nutrition and hydration. Further, it is also important to reflect upon the psychological impact of these delays on both the patient and their relatives. The ways in which the Advisors felt that delays affected outcome are summarised in Table 4.38.

Table 4.38 Impact of delayed surgery upon outcome *(Advisors' opinion)*

Deterioration in general condition	4
Stump breakdown	2
Led to major rather than minor amputation	2
Post operative infection	4
Death	3
Could/should have been revascularised	3
No details	2
Total	**20**

In the 118/617 patients identified by the clinical questionnaire as suffering a delay in undergoing surgery the length of the delay is shown in Figure 4.6. Almost half had their surgery delayed for five or more days.

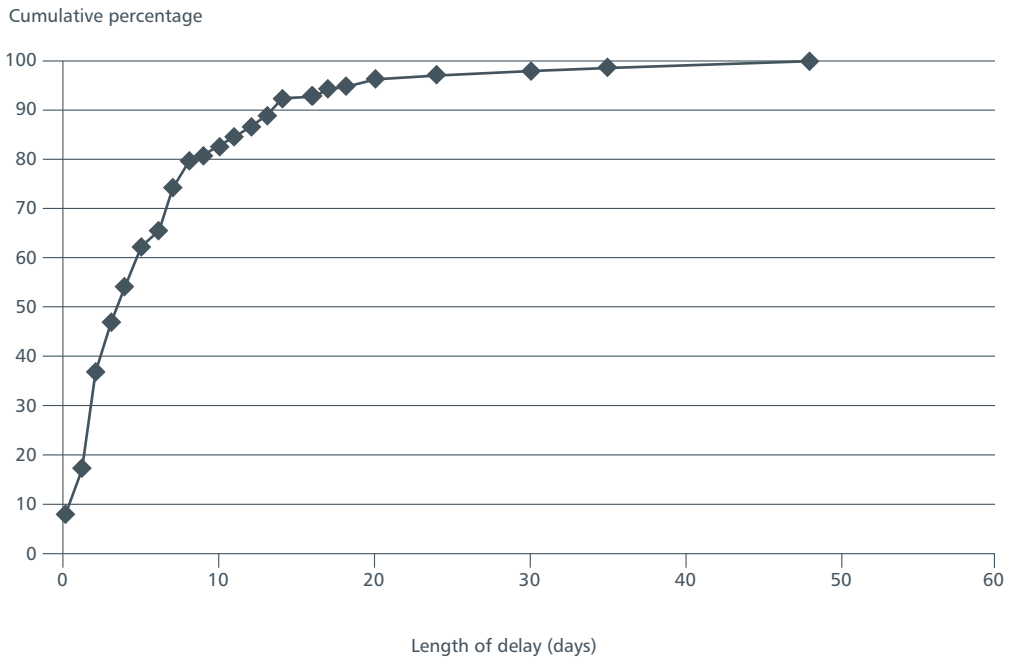

Figure 4.6 Duration of the delay in performing amputation *(Clinical questionnaire data)*

The clinical questionnaire also asked for the reasons for these delays. These are summarised in Table 4.39.

The most common reasons for a delay were that the patient initially refused amputation, or the patient required additional pre-operative treatment/optimisation/resuscitation. On the face of it this does not reflect any deficiency in patient care. However, it might be suggested that the inability to provide appropriate pre-operative counselling for the majority of patients included in this study may have been a factor in this.

These data show that on 64 occasions, factors beyond the control of the vascular surgeons contributed to the delay. However, in 52 cases the delay was related to organisational issues and the decision to perform surgery in the emergency theatre.

When considering the delays that patients suffered and the performance of a significant proportion of the amputations in an emergency theatre outside of normal hours, it should be remembered that these patients were generally considered to be high risk for surgery as indicated by their ASA status (Figure 4.7). These high-risk patients should receive optimum care.

Table 4.39 Reasons for delays in performing amputation
(Clinical questionnaire data)

	n
Patient required additional pre-operative treatment/optimisation/resuscitation	41
Patient choice (initially refused amputation)/waiting for discussion with relatives	37
Non availability of theatre/awaiting appropriate operating list	26
Superceded by other cases on emergency list	22
Delayed awaiting reversal of anticoagulants/antiplatelet therapy	8
Delays relating to transfer, weekends, critical care bed availability	6
Non availability of anaesthetist	4
Non availability of surgeon	2
Non availability of theatre staff	1
Other	3
Subtotal	**116**
Not answered	2
Total	**118**

**Answers may be multiple*

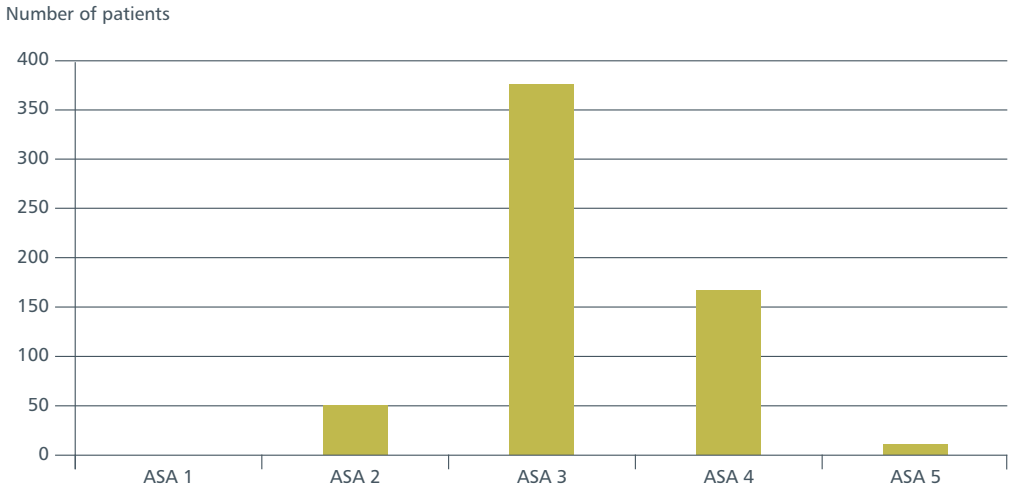

Figure 4.7 ASA status prior to surgery *(Clinical questionnaire data)*

The data presented in this section raises a number of concerns about the management of patients requiring amputation. The performance of surgery in elderly patients with multiple co-morbidities in the emergency theatre, often out-of-hours and following previous delays, with a sub-consultant grade undertaking the procedure in around half of cases does not seem to represent an optimum level of care. This should be addressed in an appropriate clinical care pathway.

Anaesthesia

The Advisors were asked to determine if an adequate pre-operative risk assessment depended on patients being reviewed by an anaesthetist on the ward before surgery. These data are shown in Table 4.40.

When the anaesthetist did not see the patient the risk assessment was considered satisfactory in 51/61 patients and this was similar to the proportion of adequate assessments in those who were visited (312/327).

In the main a consultant or senior trainee performed the initial anaesthetic review (Table 4.41) and in the majority of cases these grades were also the most senior anaesthetist present in the operating theatre (Table 4.42).

Table 4.40 A ward-based anaesthetic review influenced pre-operative risk assessment *(Advisors' opinion)*

	Pre-assessed on the ward					
Adequately risk assessed	Yes	No	**Subtotal**	Unable to answer	Not answered	**Total**
Yes	312	51	**363**	101	13	**477**
No	15	10	**25**	11	2	**38**
Subtotal	**327**	**61**	**388**	**112**	**15**	**515**
Not answered	6	0	**6**	6	2	**14**
Total	**333**	**61**	**394**	**118**	**17**	**529**

Table 4.41 Grade of anaesthetist reviewing patient pre-operatively *(Clinical questionnaire data)*

	n	%
Consultant	281	59.8
Staff grade/Associate specialist	29	6.2
Trainee with CCT	13	2.8
Senior specialist trainee	86	18.3
Junior specialist trainee	55	11.7
Basic grade	6	1.3
Subtotal	**470**	
Not answered	158	
Total	**628**	

Table 4.42 Grade of most senior anaesthetist present in the operating theatre *(Clinical questionnaire data)*

	n	%
Consultant	402	84.5
Staff grade/Associate specialist	26	5.5
Trainee with CCT	9	1.9
Senior specialist trainee	35	7.4
Junior specialist trainee	4	0.8
Subtotal	**476**	
Not answered	152	
Total	**628**	

The data in both of these tables includes a high proportion of cases where the person completing the questionnaire was unable to identify the grade of the anaesthetist involved in the case. This is contrary to guidelines from the Royal College of Anaesthetists[44] that state that both name and grade should be clearly written on the anaesthetic chart.

The Advisors felt that there were aspects of anaesthetic care that could have been improved in 55/506 (10.9%) patients and the reasons for this are shown in Table 4.43.

The most common reason for this view was the failure of the anaesthetist to document their assessment in the case notes followed by the failure to undertake a pre-operative visit and adequately assess risk. In one instance the pre-operative visit was delegated to a Foundation Year 1 doctor.

Table 4.43 Aspects of anaesthetic care that could have been improved *(Advisors' opinion)*

	n
Failure of documentation	20
Failure to undertake pre-op assessment	11
Seniority of clinician	3
Other	17
Subtotal	**51**
Not answered	4
Total	**55**

Table 4.44 shows the type of anaesthetic that was administered to patients undergoing amputation.

Table 4.44 Method of anaesthesia for amputation *(Clinical questionnaire data)*

	n	%
General anaesthetic	364	61.0
Spinal anaesthetic	229	38.4
Epidural	65	10.9
Intravenous sedation	41	6.9
Other	53	8.9
Subtotal	**597**	
Not answered	31	
Total	**628**	

**Answers may be multiple*

It is evident that the majority of patients received a general anaesthetic. Although some may believe that regional anaesthesia is associated with a better outcome for this type of surgery a recent systematic review[45] only showed a reduction in the risk of a chest infection with this technique. Interestingly, this was the most common complication in patients included in this study. The authors also concluded that there was insufficient data to allow an opinion as to the risk of mortality and myocardial infarction with different anaesthetic techniques. More recently, the Hip Fracture Anaesthetic Sprint Audit[34] has shown that spinal anaesthesia is associated with a lower incidence of hypotension than general anaesthesia in elderly patients. Although it is tempting to suggest that a similar benefit may occur in amputees, spinal anaesthesia is inappropriate in patients who are anticoagulated and some patients may not wish to be awake during surgery.

Whilst it has been suggested that epidural or spinal anaesthesia reduces the risk of phantom pain in the post operative period there is no evidence to support this concept.[46]

Key findings

1. For patients admitted under other specialties the Advisors considered that earlier review by a consultant vascular surgeon might have altered the outcome in 16/148 (10.8%) patients in whom they were able to give an opinion.

2. Deficiencies in note keeping are a recurrent theme throughout this study.

3. 244/622 (39.2%) patients had no formal vascular imaging performed, and the Advisors considered that assessment was inadequate in 37/481 (7.7%) cases.

4. In 76/504 (15.1%) patients the Advisors considered that surgery was unnecessarily delayed.

5. The Advisors felt that amputation might have been avoided in 22/286 (7.7%) patients, in whom they were able to make a judgment, had limb salvage been attempted.

6. The proportion of amputees who underwent pre-operative review by a physiotherapist, a diabetes nurse specialist and a vascular nurse specialist were poor. The data were worse when considering assessment by an amputee co-ordinator or a psychologist.

7. In 356/520 (68.5%) patients there was no pre-operative discussion of discharge planning and rehabilitation.

8. 452/516 (87.6%) patients did not have a named individual responsible for co-ordinating discharge planning and rehabilitation.

9. In 72/499 (14.4%) patients the Advisors considered that the quality of the pre-operative care was poor or unacceptable.

10. The Advisors did not think the seniority of the person taking consent was appropriate in 53/452 (11.7%) patients and found that the risks and benefits of surgery were not adequately documented in a third of cases, (144/454; 31.7%). The risk of death following the procedure was only included on the consent form in 105/479 (21.9%) of patients.

11. 88/579 (15.2%) patients did not undergo MRSA screening despite national guidelines.

12. 138/304 (45.4%) patients who were classified as requiring expedited or elective amputation underwent surgery in the emergency theatre. Further, it is likely that a proportion of those said to require urgent surgery should have had their operation on a planned list.

13. When surgery was delayed this was thought to affect outcome in (14/64) patients. Two-thirds of all delays would have been avoided if surgery had been performed on a planned operating list.

14. The level of anaesthetic support for patients undergoing amputation was generally good. However, deficiencies in record keeping were noted in respect of pre-operative assessment, administration of peri-operative antibiotics, and recording the grade of anaesthetist.

5 – The operation

Type of surgery

Table 5.1 details the type of amputation performed in the patients included in this study and whether or not they had diabetes. Initially it appears that a large number of above-knee amputations were performed. However, this does not seem to be the case when patients are divided into those with diabetes and those without where it is expected that a greater proportion of below-knee amputations should be undertaken in patients with diabetes (Table 5.1).

Table 5.1 Type of amputation performed in patients with diabetes and patients without *(Clinical questionnaire data)*

	Diabetes		No diabetes		Total
	n	%	n	%	
Disarticulation of hip	2	<1	0	0	**2**
Amputation of leg above-knee	128	36.8	157	56.7	**285**
Amputation of leg through knee	9	2.6	6	2.2	**15**
Amputation of leg below-knee	181	52.0	93	33.6	**274**
Re-amputation at a higher level	12	3.4	3	1.1	**15**
Other specified	1	<1	1	<1	**2**
Guillotine/Staged amputation	4	1.1	2	<1	**6**
Multiple answers	11	3.2	15	5.4	**27**
Subtotal	**348**		**277**		
Not answered	1		2		
Total	**349**		**279**		

Table 5.2 Grade of primary surgeon performing amputation and most senior surgeon in the theatre *(Clinical questionnaire data)*

	Operating surgeon		Surgeon in theatre	
	n	%	n	%
Consultant	284	45.7	405	67.2
Staff grade/Associate specialist	60	9.7	55	9.1
Trainee with CCT	34	5.5	21	3.5
Senior specialist trainee	213	34.3	116	19.2
Junior specialist trainee	29	4.7	6	1.0
Basic grade	1	<1	0	0
Subtotal	**621**		**603**	
Not answered	7		25	
Total	**628**		**628**	

Tables 5.2 indicates the grade of the primary surgeon who performed the amputation and the grade of the most senior surgeon who was in the operating theatre.

These data show that a consultant surgeon performed just under half of all amputations and that they were in the operating theatre for two-thirds of cases. Conversely, unsupervised non-consultant grades and trainees performed just under a third of amputations (198/603; 32.9%). The experience of these surgeons is unknown but in 20% (122/603) of all cases the most senior surgeon was a specialist registrar (ST3 and above) without a CCT or a core surgical trainee. These data, together with the greater proportion of procedures taking place in the emergency theatre require careful consideration in the planning of amputation services.

Data relating to the proportion of above- and below-knee amputations performed by consultant or post-CCT trainees compared to other grades of surgeon, when the latter were the most senior surgeon in the operating theatre, were explored. As expected the former performed a higher proportion of below-knee, through knee, Guillotine and redo procedures. This would be expected and is likely to represent appropriate case selection.

The Advisors were also asked if they believed that the procedure performed was the most appropriate for that patient and in particular if amputation was definitely indicated. Their opinions are shown in Tables 5.3, 5.4 and 5.5.

Table 5.3 Appropriate procedure undertaken *(Advisors' opinion)*

	n	%
Yes	478	91.2
No	46	8.8
Subtotal	**524**	
Not answered	5	
Total	**529**	

Table 5.4 The amputation was appropriate *(Advisors' opinion)*

	n	%
Yes	444	92.7
No	35	7.3
Subtotal	**479**	
Unable to answer	45	
Not answered	5	
Total	**529**	

In 10 cases the Advisors considered that palliative care would have been a more compassionate and appropriate management. This view was generally expressed on the basis that patients were considered unfit for surgery.

Table 5.5 Reason for inappropriate surgery *(Advisors' opinion)*

	n
Should have had or been considered for revascularisation	5
Should have had palliative care	10
Should have had above knee amputation (not below knee)	9
Other	6
Subtotal	**30**
Not answered	5
Total	**35**

The decision to manage patients conservatively is difficult when this will inevitably result in death, but exemplifies the need to discuss all potential amputees at an appropriate MDT and follow Good Medical Practice[47] which suggests consulting with appropriate colleagues.

Intra-operative monitoring

The clinical questionnaire requested information about both intra- and post operative monitoring. The data for this is shown in Figure 5.1.

The Advisor group believed that the monitoring was satisfactory given that amputation is not usually associated with major blood loss. However, more than a quarter of patients required a blood transfusion (see overleaf) and of the 42/512 (8.2%) patients in whom an immediate post operative complication occurred, a quarter of each were due to haemorrhage or cardiac event, and a further six patients became hypotensive. These patients would have benefited from intra-arterial pressure monitoring.

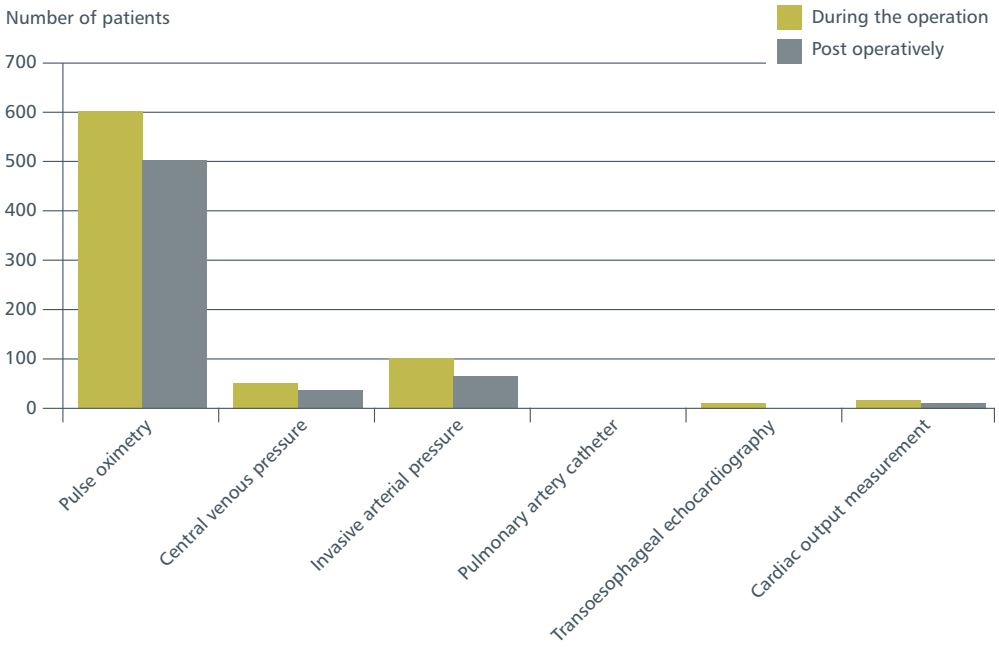

Figure 5.1 Intra- and post operative monitoring *(Clinical questionnaire data)*

Blood transfusion

There is some evidence that this is associated with an increased incidence of adverse post operative events (mortality, cardiac arrhythmia, acute renal failure and pneumonia) and prolonged hospital stay.[48]

From the clinical questionnaire it was evident that 154/565 (27.3%) patients required a blood transfusion. In 63 patients this could not be determined.

Key findings

1. Unsupervised non-consultant grades and trainees performed just under a third of amputations (175/603; 29%). In 122/603 (20.2%) the most senior surgeon present in the operating theatre was a non CCT specialist registrar (ST3 and above) or a core surgical trainee.

2. The Advisors considered that amputation was inappropriate in 35/479 (7.3%) of cases. In 15 of these patients either revascularisation or conservative management were considered more appropriate, highlighting the need for a dedicated MDT.

6 – Post operative care

Table 6.1 compares the immediate post operative destination for patients and their subsequent outcomes. Post operatively 348/617 (56.4%) patients were admitted to a specialist vascular ward and 407/622 were discharged within 30 days of surgery.

Table 6.1 Post operative destination and outcome *(Clinical questionnaire data)*

	Discharged alive (≤=30 days of surgery)	Still in hospital (≥=30 days after surgery)	Died (≤=30 days of surgery)	**Subtotal**	Not answered	**Total**
Specialist vascular ward	248	71	29	**348**	4	**352**
Level 3 (ICU)	13	8	22	**43**	1	**44**
Level 2 (HDU)	30	15	7	**52**	0	**52**
Non vascular ward	104	40	13	**157**	0	**157**
Mortuary	0	0	3	**3**	0	**3**
Other	10	3	1	**14**	0	**14**
Subtotal	**405**	**137**	**75**	**617**	**5**	**622**
Not answered	2	1	2	**5**	1	**6**
Total	**407**	**138**	**77**	**622**	**6**	**628**

When a higher level of care was required post operatively discharge rates within 30 days were lower and mortality higher.

Escalation of care

Both the clinical and Advisor questionnaires collected information about patients requiring an escalation in their level of care during the post operative period. These data are summarised in tables 6.2 and 6.3. In addition information about the type of escalation was collected in the clinical questionnaire (Table 6.4).

Table 6.2 Escalation of care was required post operatively *(Clinical questionnaire data)*

	n	%
Yes	27	4.4
No	583	95.6
Subtotal	**610**	
Unknown	8	
Not answered	14	
Total	**628**	

In contrast to the clinicians completing the questionnaire, the Advisors identified 103 patients in whom transfer to a higher level of care was necessary. In 93 of these patients the transfer occurred at an appropriate time. Two patients were transferred after a delay and five did not receive the required transfer. As in response to other questions in this study the Advisors were more astute at identifying patient events than those completing the clinical questionnaire, highlighting the benefit of peer review.

Table 6.3 The patient required an escalation in care post operatively *(Advisors' opinion)*

	n	%
Yes	103	20.3
No	405	79.7
Subtotal	**508**	
Not answered	21	
Total	**529**	

Table 6.4 shows the destination of patients who were identified from the clinical questionnaire as requiring escalation of care.

That a coronary care unit was the most frequent destination reflects the underlying co-morbidities that are present in patients requiring amputation and perhaps re-enforces the need for more aggressive intra-operative monitoring.

Table 6.4 Destination of patients requiring an escalation in care *(Clinical questionnaire data)*

	n
Specialist vascular unit	1
Level 3 (ICU)	7
Coronary care unit	12
Other	6
Subtotal	**26**
Not answered	1
Total	**27**

The clinicians were also asked if they were at any time unable to transfer patients to a higher level of care. This occurred in two of the 27 patients where an escalation of care was required.

Figure 6.1 uses data from the Advisor questionnaire to show the number of patients in each outcome category depending on whether or not they required a post operative escalation in care.

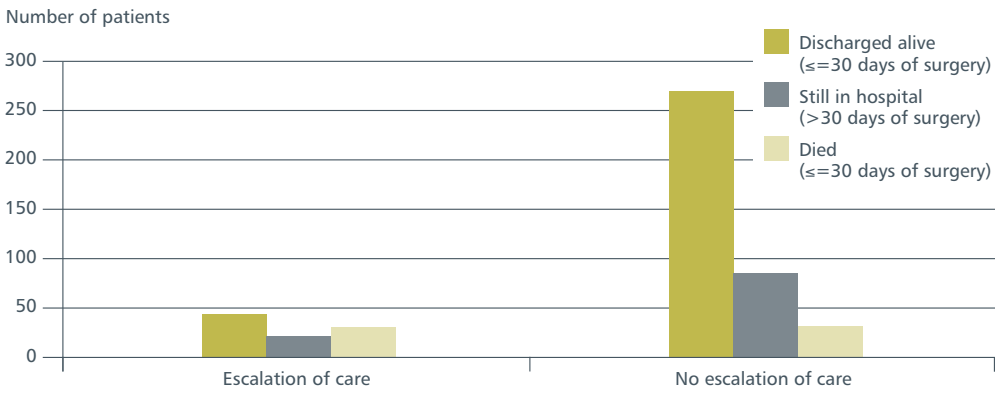

Figure 6.1 Patient outcome depending upon the need for a post operative escalation in care *(Advisors' opinion)*

The relative proportion of patients who were discharged within 30 days was lower with a greater proportion of deaths when an escalation of care was required.

The Advisors also collected information about the type of organ support that was required in critical care. This is shown in Table 6.5.

Table 6.5 Post operative organ support *(Advisors' opinion)*

	n
Ventilation	39
Cardiovascular	35
Renal	26
Other	7
Subtotal	**62**
Not answered/Not applicable	41
Total	**103**

**Answers may be multiple*

Stump complications

These include haematoma, infection, tissue necrosis (ischaemia), stump oedema, osteomyelitis, dehiscence, chronic pain and scar adhesion. Furthermore, amputation surgery is a leading cause of surgical site infection and the development of stump-related complications is associated with delays in discharge, the need for revisional surgery and delayed rehabilitation which is inevitably associated with poorer functional outcomes.

The literature confirms that healing rates for below- and above-knee amputation vary considerably and are higher for the latter (90% heal, 70% primarily). In comparison primary healing rates for below-knee amputation vary between 30-90% with a re-fashioning rate of up to 30%.[49] The stump complications in this study are shown in Table 6.6.

Table 6.6 Stump complications *(Advisors' opinion)*

	Yes		No	**Subtotal**	Unable to answer	Not answered	**Total**
	n	**%**	**n**	**n**	**n**	**n**	**n**
Stump cellulitis	66	15.1	371	**437**	11	81	**529**
Stump breakdown	89	20.4	348	**437**	8	84	**529**
Stump contracture	9	2.2	396	**405**	21	103	**529**

Table 6.7 Stump complications according to indication for surgery *(Clinical questionnaire data)*

	Stump cellulitis	Stump breakdown	Stump contracture	**Total**
	Yes	Yes	Yes	n
Ischaemic rest pain with or without ulceration and/or gangrene	28	50	1	350
Neuropathy with or without ulceration and/or gangrene	2	6	1	46
Sepsis	17	10	0	82
Severe deformity	2	0	0	6
Other	5	7	1	57
Multiple answered	11	0	0	85
Subtotal	**65**	**73**	**3**	**626**
Not answered	0	0	0	2
Total	**65**	**73**	**3**	**628**

The prevalence of stump complications was also reviewed in respect of the indication for surgery. The data from the clinical questionnaire are shown in Table 6.7.

These data show that wound infection (cellulitis) was more common when sepsis was the primary indication for amputation and lowest when operation was for complications of neuropathy. Conversely stump breakdown, to which both infection and poor vascularity may contribute, occurred with a similar frequency regardless of the indication for surgery.

A decision on whether the circulation is sufficient to allow healing of a below-knee amputation is often difficult and poor judgment increases the risk of stump breakdown.

Another factor that may influence the risk of stump complications is the grade of surgeon performing the amputation. The data from this study is summarised in Table 6.8.

Table 6.8 Frequency of stump complications by grade of primary surgeon *(Advisors' opinion and clinical questionnaire data)*

	Stump breakdown		**Total**
	Yes	%	n
Consultant/Trainee with CCT	38	14.5	262
Trainee grade	47	19.7	239
Subtotal	**85**		**501**
Not answered	1		5
Total	**86**		**506**

These data show that the frequency of stump breakdown was higher when a trainee performed the amputation, (19.7% vs. 14.5%).

Stump breakdown also occurred twice as often in patients undergoing below-knee as opposed to above-knee amputation (44/166, 26.5% vs. 27/201, 13.4%).

This difference is not unexpected but is greater than that reported by earlier work,[36] where superficial or deep infection and wound dehiscence occurred in only 261/2309 (11.3%) of below-knee amputations.

General complications

A wide range of complications occurred in patients following amputation. As is common in surgical patients, complications generally related to their underlying co-morbidities. As discussed in chapter 3 medical co-morbidity was common in this group of patients, with significant cardiovascular, respiratory, renal disease or diabetes occurring in 78.5% of cases.

The Advisors recorded complications in 249/529 (47.1%) patients. These data were also collected in the clinical questionnaire, which recorded adverse events in 290/628 (46.2%) amputees (Table 6.9). Although some patients experienced more than one complication 338 patients had none.

The most common complication was chest infection and 41/628 (6.5%) of the group also developed respiratory failure. These occurred with equal frequency regardless of the method of anaesthesia (general anaesthesia 54/271; 19.9%; regional anaesthesia 37/176; 21.0%; other anaesthesia 23/150; 15.3%; type of anaesthesia used not answered in 31 cases).

In addition to the above, death within 30 days of surgery was recorded in 77/622 (12.4%) and 67/528 (12.7%) patients by the Clinical and Advisor questionnaires. In a previous study[50] the combined mortality for above and below-knee amputations was 9.6%. The aim of the VSGBI is to reduce mortality rates to 5%.

Table 6.9 Complications recorded in clinical questionnaire

	n	%
Chest infection	102	16.2
Wound infection	78	12.4
Respiratory failure	41	6.5
Post operative delirium	35	5.6
Urinary tract infection	34	5.4
Significant deterioration in renal function	33	5.3
Cardiac failure	31	4.9
Pressure sores - other site	23	3.7
Myocardial infarction	18	2.9
Bloodstream infection	18	2.9
Retention of urine	16	2.5
Pressure sores - contralateral limb	14	2.2
Stroke	11	1.8
Clostridium difficile infection	10	1.6
Acute renal failure requiring RRT	10	1.6
Cardiac arrhythmia	7	1.1
Post operative bleeding	4	<1
Pulmonary embolus	3	<1
Deep vein thrombosis	1	<1
None	338	
Total	**628**	

The Advisors stated that complications were well managed on 194/209 (92.8%) occasions.

When complications were analysed by the grade of surgeon (consultant or trainee with CCT vs. all other grades) no important differences were identified, except for stump complications, as discussed earlier.

Post operative physician review

In a patient group with a high rate of medical co-morbidity and frequent post operative complications, review by specialists other than vascular surgeons would be expected in order to optimise their medical care. Major cardiovascular complications occurred in 9.9% of cases. Respiratory complications occurred in 18.8% and renal failure in 6.2%.

Advisors frequently found it difficult to identify whether medical review had taken place, as it was often impossible to identify the specialty or grade of medical staff reviewing patients due to poor note keeping. Where it could be identified, physician review occurred fairly frequently (Table 6.10). A total of 313/529 (59.2%) patients were reviewed by at least one of the medical specialists listed in Table 6.10. Additionally, 117 patients were also reviewed by a microbiologist.

Table 6.10 Post operative involvement of medical specialists *(Advisors' opinion)*

	Yes		No	**Subtotal**	Not answered	**Total**
	n	%	n	**n**	n	**n**
Diabetes	147	46.1	172	**319**	210	**529**
Renal medicine	58	21.5	212	**270**	259	**529**
Care of the elderly	55	20.8	209	**264**	265	**529**
Cardiology	45	17.6	210	**255**	274	**529**
Microbiology	117	41.5	165	**282**	247	**529**
Other	118	60.2	78	**196**	333	**529**

The presence or absence of a complication did have some impact on the frequency with which medical review took place (Table 6.11).

Table 6.11 Involvement of medical specialists vs. presence or absence of a complication *(Advisors' opinion)*

	Complication				**No complication**			
	Yes	No	**Subtotal**	Not answered	Yes	No	**Subtotal**	Not answered
Diabetes	61	82	**143**	106	86	90	**176**	104
Renal medicine	29	94	**123**	126	29	118	**147**	133
Care of the elderly	38	89	**127**	122	17	120	**137**	143
Cardiology	29	91	**120**	129	16	119	**135**	145
Microbiology	74	65	**139**	110	43	100	**143**	137
Other	79	30	**109**	140	39	48	**87**	193

Table 6.12 Review by medical specialist vs. grouped 'cardiovascular complications' *(Advisors' opinion)*

	Cardiovascular complication			
	Yes	No	**Subtotal**	Not answered
Diabetes	16	19	**35**	19
Renal medicine	7	22	**29**	25
Care of the elderly	8	21	**29**	25
Cardiology	16	16	**32**	22
Microbiology	17	14	**31**	23
Other	18	5	**23**	31

Table 6.13 Review by medical specialist vs. grouped 'renal complications' *(Advisors' opinion)*

	Renal complication			
	Yes	No	**Subtotal**	Not answered
Diabetes	13	9	**22**	18
Renal medicine	13	11	**24**	16
Care of the elderly	11	13	**24**	16
Cardiology	7	14	**21**	19
Microbiology	15	9	**24**	16
Other	18	4	**22**	18

When complications were grouped together, review by cardiologists was not more frequent in patients with cardiovascular complications (Table 6.12). Similarly, review by a nephrologist did not appear to be more frequent in patients with renal complications (Table 6.13).

This raises questions about the organisation of post operative care for patients following amputation. Medical specialist involvement occurs frequently and needs to be provided routinely where it is needed. The issues are the same as those discussed in chapter 3 in relation to admission to hospital and pre-operative care. A model similar to the orthogeriatric service frequently provided to patients with a fractured neck of femur would ensure optimal medical input was provided.

The recently published report by the Future Hospital Commission[51] stated that: "The ageing demographic profile of patients on surgical wards means that their age and co-morbidity profiles are similar to those of medical inpatients. The majority of clinical problems arising in these patients post operatively are medical rather than surgical. Each consultant physician-led team should be linked with a designated surgical ward or wards." This patient group provides a good example of why this type of arrangement is needed.

Case study 5

An elderly patient with a background of bronchiectasis underwent an urgent below-knee amputation for critical ischaemia. Post operatively the patient was admitted to a surgical ward and developed pneumonia. Treatment was delivered by the foundation trainees on the surgical team. The patient was referred for assessment by the medical team two weeks post amputation and changes to their treatment resulted in improvement of their respiratory problems. The patient spent six weeks in hospital post operatively.

The Advisors felt that earlier referral to the medical team would have improved the care the patient received and resulted in a shorter length of stay.

Key findings

1. Following amputation, stump-related complications were common; cellulitis 66/437 (15.1%); breakdown 89/437 (20.4%); and contracture 9/405 (2.2%); and were higher, particularly for stump breakdown when trainees performed the surgery. (38/262; 14.5% vs. 47/239; 19.7% consultant/trainee with CCT vs. trainee grade).

2. Stump breakdown occurred twice as often in patients undergoing below-knee amputation (44/166 (26.5%) vs. 27/201 (13.4%) above-knee amputation). The frequency of stump complications in this study was higher than in a contemporary study from the USA.

3. 249/529 (47.1%) patients experienced other complications of which chest infection was the most common (102/628; 16.2%). The frequency of medical complications suggests that regular, routine medical review of amputees would be beneficial.

4. 313/529 (59.2%) patients required post operative review by a physician.

5. The 30-day mortality for major limb amputation in this study was 12.4% (77/622).

7 – Pain management

In this study 350/626 patients presented with ischaemic rest pain, with or without trophic changes. Therefore, patients required pre-operative analgesia. Data derived from the clinical questionnaire revealed that in patients where the answer was given, 522/595 patients required pre-operative pain control. The method of providing this is summarised in Figure 7.1 and Table 7.1 provides examples of drugs included in each pharmacological group.

Optimum pain relief is generally achieved when patients are reviewed by an acute pain team. The organisational data indicated that such a team was present in 171/242 hospitals although they stated that routine review of amputees only occurred in a third of institutions. Of the patients included in this study a pain team saw 112/350 (32%) patients pre-operatively (Table 7.2) although 395/462 (85.5%) patients required pain relief. In contrast, the pain team reviewed 253/430 (58.8%) patients post operatively in whom data were available.

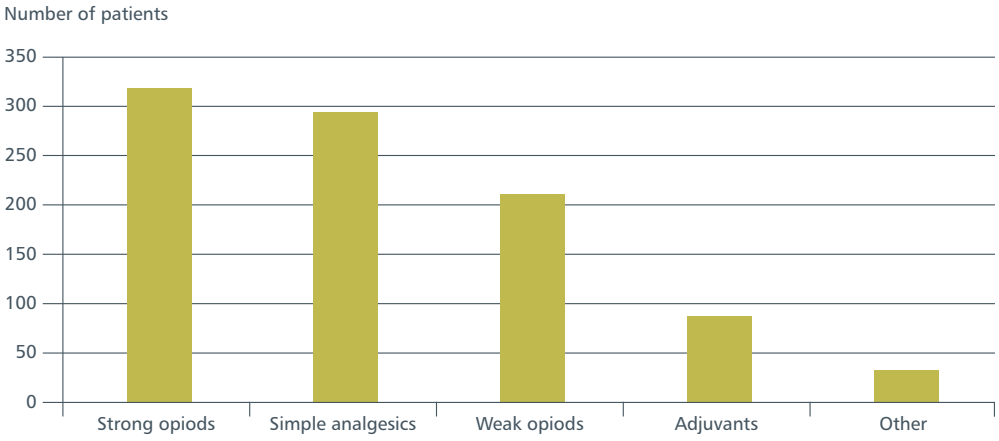

Figure 7.1 Methods of pre-operative analgesia

Table 7.1 Description of pharmacological groups

Analgesic Group	Examples
Simple analgesics	Paracetamol, NSAIDs
Weak opioids	Tramadol, Codeine
Strong opioids	Morphine, Fentanyl, Oxycodone, Pethidine
Adjuvants	Antidepressants, anticonvulsants

Table 7.2 The patient was seen by the inpatient acute pain team pre-operatively *(Advisors' opinion)*

	n	%
Yes	112	32.0
No	238	68.0
Subtotal	**350**	
Unable to answer	42	
Not answered	3	
Total	**395**	

The Advisors considered that review by the acute pain team would have been appropriate in half of those patients who were not seen pre-operatively (Table 7.3).

Table 7.3 Patients who were not reviewed by the acute pain team pre-operatively would have benefited from this *(Advisors' opinion)*

	n	%
Yes	93	50.3
No	92	49.7
Subtotal	**185**	
Unable to answer	52	
Not answered	1	
Total	**238**	

The Advisors were also asked to assess the quality of pre-operative pain control. The data, shown in Figure 7.2, indicates that this was only considered good in a fifth of patients.

When the acute pain team saw patients post operatively the Advisors generally considered that pain control was better. In only 19/464 patients was pain control considered poor. Their rating of post operative pain management is shown in Figure 7.3.

The management of pain, particularly prior to amputation could have been better and routine review of these patients by the acute pain team is required. This should be included in the clinical care pathway for amputees.

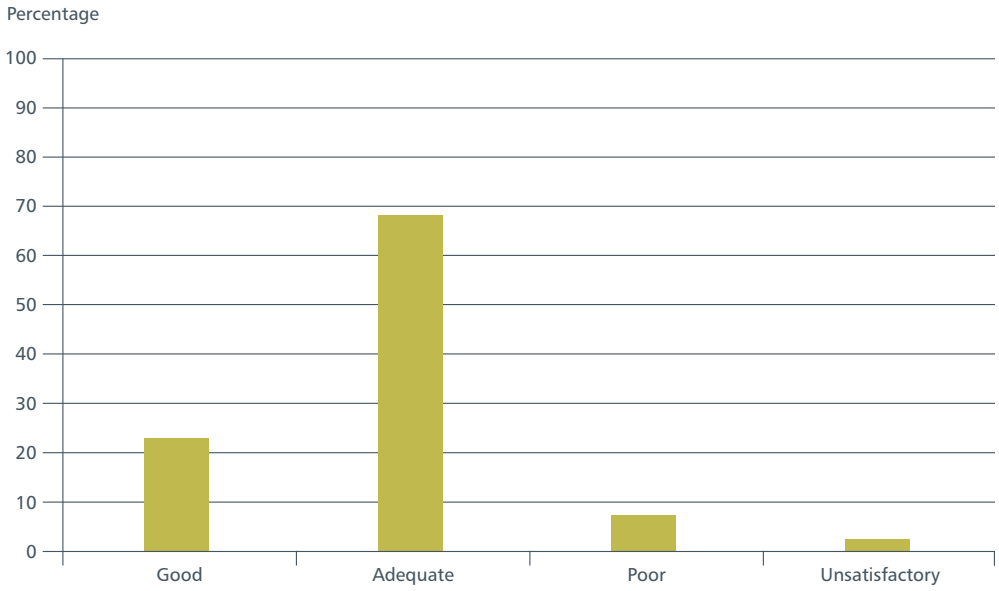

Figure 7.2 Advisors rating of pre-operative pain control

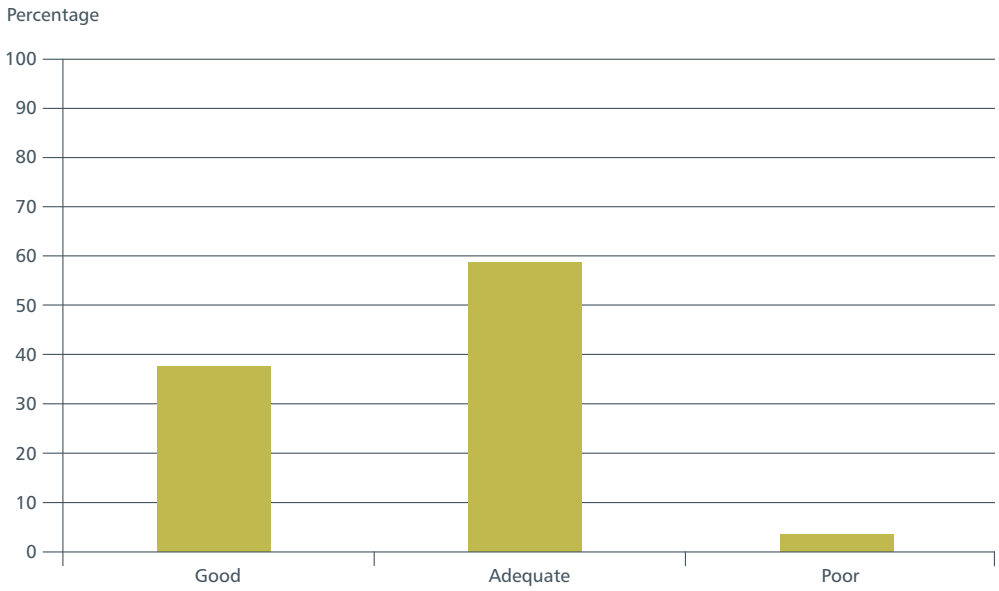

Figure 7.3 Rating of post operative pain control *(Advisors' opinion)*

Key findings

1. Pre-operative pain control was only considered as ‘good’ by the Advisors in 100/438 (22.8%) patients. Review by the acute pain team would have been appropriate in 93/185 (50.3%) patients who were not seen pre-operatively.

2. Post operative pain control was better but was only assessed as ‘good’ in 174/464 (37.5%) patients.

8 – Falls, rehabilitation and discharge

Falls

Amputees are at increased risk of falling due to the nature of their medical problems. Assessing the risk of falls is a key stage in ensuring that measures are put in place to reduce both the risk of falling and the consequences of a fall if it happens. At least 72/411 (17.5%) patients in this study did not have a falls assessment and it was not known whether one was undertaken in 202/628 cases (Table 8.1).

Table 8.1 Falls assessment undertaken in the view of the clinician and the Advisor

	Clinician		Advisor	
	n	%	n	%
Pre-operatively	224	54.5	205	53.4
Post operatively	248	60.3	179	46.6
Not undertaken	72	17.5	112	29.2
Subtotal	**411**		**384**	
Unknown	202		119	
Not answered	15		26	
Total	**628**		**529**	

**Answers may be multiple*

In the peer reviewed cases, there was no evidence of a falls assessment in 112/384 (29.2%). The therapy assessment considered the adequacy of the falls assessment that was made post operatively, and in nearly a third of cases (48/153; 31.4%) this was not felt to be adequate (Table 8.2).

Table 8.2 An adequate falls assessment was made post operatively (evidence of either a falls risk assessment or identification or falls risk factors) *(Advisors' opinion)*

	n	%
Yes	105	68.6
No	48	31.4
Subtotal	**153**	
Unable to answer	7	
Not answered	2	
Total	**162**	

Clinicians identified that a fall occurred in 50/576 (8.7%) cases post operatively. Despite Advisors reviewing only 529/628 (84%) of the cases included in the study, they identified evidence of falls in 66 (12.8%) cases (Table 8.3). This illustrates the value of peer review of case notes in identifying critical events more effectively than internal review.

Table 8.3 The patient experienced a fall post operatively

	Clinician		Advisor	
	n	%	n	%
Yes	50	8.7	66	12.8
No	526	91.3	449	87.2
Subtotal	**576**		**515**	
Unknown	38		14	
Not answered	14		0	
Total	**628**		**529**	

Table 8.4 An adverse consequence of the fall

	Clinician	Advisor
	n	n
Yes	10	18
No	31	38
Subtotal	**41**	**56**
Unable to answer	3	4
Not answered	6	6
Total	**50**	**66**

Adverse consequences of the fall were identified in 18 cases by the peer review process. Ten were identified on the clinical questionnaire (Table 8.4). Of the adverse consequences identified there was one fracture and eleven stump complications (stump cellulitis, breakdown or bleeding). Three patients required further surgery to the amputation stump.

Rehabilitation

Therapy referrals/input

Following lower limb amputation, patients require considerable input from non-medical professionals. As would be expected almost all patients received input from the physiotherapy team (Table 8.5). There were a number of patients where additional input would have been appropriate (Table 8.6). Clinical psychology or specialist amputee rehabilitation were the main areas identified where care could have been improved.

Table 8.5 Post operative review by non-medical professions *(Advisors' opinion)*

	Yes	No	Subtotal	Unable to answer	Not applicable	Not answered	Total
Physiotherapy	446	20	**466**	22	7	34	**529**
Occupational therapy	391	39	**430**	37	12	50	**529**
Social services	157	90	**247**	96	33	153	**529**
Foot care team	55	134	**189**	54	93	193	**529**
Specialist amputation rehabilitation service	169	110	**279**	73	32	145	**529**
Clinical psychology	30	201	**231**	54	49	195	**529**
Palliative care	17	140	**157**	22	144	206	**529**

Table 8.6 Non medical professional review should have occurred *(Advisors' opinion)*

	Yes	No	Subtotal	Not applicable	Not answered	Total
Physiotherapy	6	5	**11**	1	8	**20**
Occupational therapy	5	9	**14**	4	21	**39**
Social services	10	19	**29**	13	48	**90**
Foot care team	21	24	**45**	13	76	**134**
Specialist amputation rehabilitation service	33	12	**45**	13	52	**110**
Clinical psychology	38	37	**75**	18	108	**201**
Palliative care	6	29	**35**	21	84	**140**

Overall, additional non medical professional review of some description would have been appropriate in just under a quarter of cases (91/409; 22.2%) (Table 8.7).

Table 8.7 Any specialist review that was not obtained would have been appropriate *(Advisors' opinion)*

	n	%
Yes	91	22.2
No	318	77.8
Subtotal	**409**	
Not answered	120	
Total	**529**	

Additional information specifically detailing the physiotherapy received by patients was assessed using a separate questionnaire. Cases were assessed against standards set in the guidelines for pre and post operative physiotherapy management of adults with lower limb amputation.[20] Early input from the physiotherapy team is advantageous as assessment of the patient's needs and rehabilitation potential can have an influence on the level of amputation performed. Planning for post operative care and for discharge from an early stage also has the potential to improve outcomes and shorten length of stay.

The Advisors commented that in many cases it was difficult to assess the notes as medical, nursing and therapy records were kept separately. Advisors also commented that multidisciplinary record keeping generally resulted in a better quality of case notes and enhanced continuity of the clinical narrative.

Data presented in chapter 4 from the clinical questionnaire suggests that the majority of patients were assessed pre-operatively by a physiotherapist. When case notes were assessed by the therapy Advisors, there was no evidence that physiotherapy commenced pre-operatively in 103/160 (64.4%) of the cases reviewed (Table 8.8).

Table 8.8 Evidence that physiotherapy commenced pre-operatively *(Advisors' opinion)*

	n	%
Yes	57	35.6
No	103	64.4
Subtotal	**160**	
Unable to answer	12	
Not applicable	28	
Total	**200**	

Where physiotherapy did commence pre-operatively, this generally did include rehabilitation (Table 8.9).

Table 8.9 When therapy occurred it included rehabilitation *(Advisors' opinion)*

	n
Yes	40
No	10
Subtotal	**50**
Unable to answer	5
Not answered	2
Total	**57**

Where it is possible to choose the level of amputation, guidelines recommend that the physiotherapist should be included in the decision making process. Physiotherapists however were almost never included in the decision making process about the level of amputation (Table 8.10).

Table 8.10 Evidence that a physiotherapist was involved in the decision making process regarding the level of amputation *(Advisors' opinion)*

	n	%
Yes	8	4.3
No	179	95.7
Subtotal	**187**	
Unable to answer	11	
Not answered	2	
Total	**200**	

In 68/151 (45%) of the cases assessed by the therapists, physiotherapy did not commence on the first post operative day (Table 8.11), as recommended by BACPAR guidelines.[20]

Table 8.11 Evidence that physiotherapy started on the first day post surgery *(Advisors' opinion)*

	n	%
Yes	83	55.0
No	68	45.0
Subtotal	**151**	
Unable to answer	11	
Not applicable - patient died	38	
Total	**200**	

The ability to deliver effective therapy was often influenced by other aspects of the patient's medical condition including the use of sedative drugs or inadequate analgesia (Table 8.12). This again emphasises the complex needs of this group of patients and the need for co-ordination of multidisciplinary care in order to deliver the best outcomes.

Table 8.12 Factors that influenced the success of therapy input in this patient e.g. sedative drugs, inadequate analgaesia *(Advisors' opinion)*

	n	%
Yes	73	47.1
No	82	52.9
Subtotal	**155**	
Unable to answer	7	
Total	**162**	

As already noted, physiotherapists were almost universally involved in care of the patients in this study. Oedema control measures were found to be appropriate and timely in a majority of cases although in 24/120 (20%) patients this was not the case (Table 8.13). A similar proportion of patients (31/149; 20.8%) did not have an appropriate wheelchair (and stump board) provided (Table 8.14).

Table 8.13 Appropriate and timely oedema control measures used (such as support bands and compression socks) *(Advisors' opinion)*

	n	%
Yes	96	80
No	24	20
Subtotal	**120**	
Unable to answer	40	
Not answered	2	
Total	**162**	

Table 8.14 An appropriate wheelchair (and stump board) was provided post operatively *(Advisors' opinion)*

	n	%
Yes	118	79.2
No	31	20.8
Subtotal	**149**	
Not answered	13	
Total	**162**	

The majority of patients (78/125; 62.4%) were not suitable for early walking aids (Table 8.15). Where they were suitable however, there were 36 cases where their use was delayed inappropriately.

Table 8.15 Documented reasons why early walking aids were not clinically indicated *(Advisors' opinion)*

	n
Wound not compatible with EWA use	9
Previously immobile	14
Not for prosthetic rehabilitation	34
Other	21
Total	**78**

There also appeared to be a lack of decision making about the suitability of patients for a limb prosthesis prior to discharge. In 60/143 (42%) of cases there was no evidence in the notes that this had been considered (Table 8.16).

Table 8.16 Evidence of a decision being made regarding suitability for a prosthesis prior to discharge *(Advisors' opinion)*

	n	%
Yes	83	58.0
No	60	42.0
Subtotal	**143**	
Unable to answer	18	
Not answered	1	
Total	**162**	

In the cases assessed, physiotherapists contributed to the discharge planning process in 113/140 (80.7%) cases (Table 8.17).

Table 8.17 Evidence that a physiotherapist contributed to the discharge planning process following amputation *(Advisors' opinion)*

	n	%
Yes	113	80.7
No	27	19.3
Subtotal	**140**	
Unable to answer	21	
Not answered	1	
Total	**162**	

Finally, the therapy specialists assessed the overall standard of rehabilitation that was provided. This is summarised in Figure 8.1. It is of note that there was room for improvement in clinical rehabilitation care in 39% (51/131) of cases.

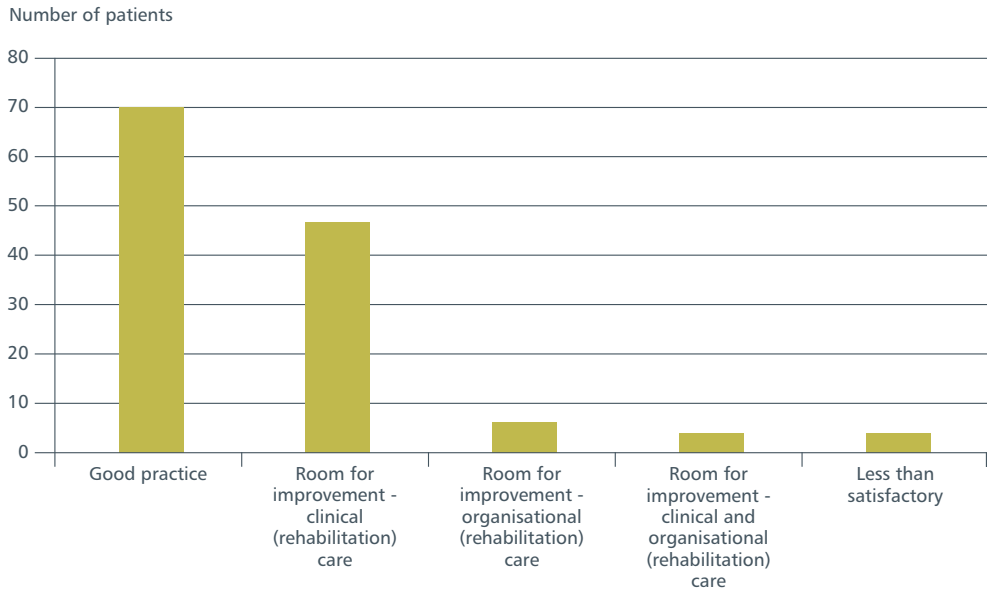

Figure 8.1 The overall quality of rehabilitation care *(Advisors' opinion)*

Case study 6

An elderly patient with extensive cardiac and peripheral vascular disease was admitted with a gangrenous leg. Angiography was performed on the day of admission and the patient was discussed at an MDT meeting. A decision was made to amputate and the operation was done the next day. The physiotherapy team saw the patient pre-operatively and daily thereafter. The patient was discharged 9 days after admission with plans for ongoing rehabilitation in the community.

Advisors thought that this patient had received an excellent standard of care. They commented particularly on the impact of good multidisciplinary care in reducing length of stay and providing a good patient experience.

Discharge

Delays in discharge

The needs of amputees following discharge from hospital vary considerably. Patients may be wheelchair dependent or mobilising on a new prosthetic limb and there is generally an ongoing need for rehabilitation. Adaptations to the home environment are often required and for patients discharged to care facilities, the same issues will occur and may subsequently influence the availability of a bed in the community.

All of these issues have the potential to delay discharge from hospital leading to an unnecessary increase in the use of acute beds. Planning and co-ordination of the discharge process from the earliest possible stage has the potential to prevent such delays.

For patients admitted electively, an important function of the pre-assessment visit might reasonably be the initiation of subsequent discharge planning. Disappointingly, in the patients who did attend a pre-assessment clinic, discharge planning was frequently not discussed (Table 8.18).

Table 8.18 A discharge plan was discussed if patients attended a pre-assessment clinic *(Clinical questionnaire data)*

	n
Yes	23
No	19
Subtotal	**42**
Unknown	12
Not answered	1
Total	**55**

Table 8.19 Delays in the patient's discharge *(Advisors' opinion)*

	n	%
Yes	149	31.4
No	326	68.6
Subtotal	**475**	
Unknown	36	
Not answered	18	
Total	**529**	

Table 8.20 Cause of delays when present *(Advisors' opinion)*

	n
Delays in recovery	82
Waiting for home alterations	13
Delay in social services assessment	12
Waiting for re-housing	11
Delay in access to secondary/tertiary care bed	10
Delays in occupational therapy assessment	7
Delay in wheelchair provision	6
Other (includes 17 for clinical reasons and 16 for non clinical reasons)	39
Subtotal	**143**
Not answered	6
Total	**149**

**Answers may be multiple*

Advisors identified 149/475 instances where delay occurred (Table 8.19). Although delay in recovery was an important factor, the Advisors also found that there was often limited planning or co-ordination of discharge arrangements. Delayed discharge due to non-medical reasons is costly as it "blocks" hospital beds and may contribute to a higher incidence of hospital acquired complications. There were 75 cases of delay for non-medical reasons (including 16 listed under the 'other' reasons) identified through case note review (Table 8.20).

Documentation during the post operative recovery or rehabilitation phase was often poor, making it difficult to identify when patients were fit for discharge. As a result, the delays identified are likely to be an underestimate of this problem.

Case study 7

An elderly patient with diabetes, ischaemic heart disease, and chronic kidney disease was admitted with gangrene of the foot. Peri-operative care was well co-ordinated with early vascular consultant review and input from the medical team. An above-knee amputation was performed 48 hours after admission. The patient required rehabilitation which commenced on the first post operative day. Prior to discharge, they waited 15 days for a wheelchair and discharge was further delayed while modifications were put in place in the patient's home.

Advisors commented that the standard of care received by this patient was excellent. Poor co-ordination of their non-medical care however, resulted in a markedly increased length of stay.

Discharge destination

Over half (57.3%) of the patients were discharged to their own home and almost a third (30.3%) were discharged to some form of community care facility (Table 8.21).

Figure 8.2 shows the number of days between admission and discharge.

Table 8.21 Destination on discharge for survivors *(Clinical questionnaire data)*

	n	%
Home	231	57.3
Another secondary care facility	50	12.4
Community care facility with rehabilitation services	102	25.3
Community care - other	20	5.0
Subtotal	**403**	
Not answered	4	
Total	**407**	

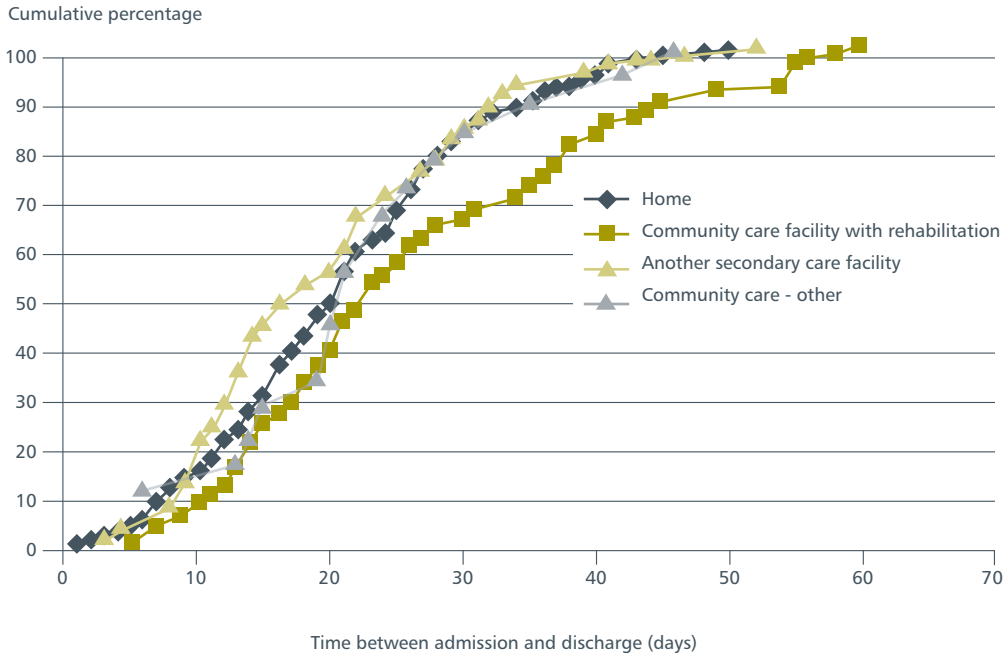

Figure 8.2 Length of stay and discharge destination *(Clinical questionnaire data)*

Key findings

1. Falls occurred in 66/515 (12.8%) of the cases assessed by Advisors. In 112/384 (29.2%) cases, Advisors found no evidence of a falls assessment.

2. In 91/409 (22.2%) cases assessed by Advisors, additional non-medical professional review would have been appropriate. Most commonly this related to psychologists (38/75) or specialist amputee rehabilitation services (33/45).

3. In 103/160 (64.4%) cases assessed by the therapy Advisors, there was no evidence that physiotherapy commenced pre-operatively. In 68/151 (45%), physiotherapy did not commence on the first post operative day.

4. Documentation of therapy input was much easier to assess when multidisciplinary records were used.

5. In 60/143 (42%) cases there was no evidence in the case notes of a decision being made regarding the suitability of the patient for limb prosthesis prior to discharge.

6. There were 75/143 (52.4%) cases of delayed discharge for non-medical reasons identified by the Advisors.

9 – Diabetes care

Diabetes is a major risk factor for the development of peripheral vascular disease and 349/628 (55.6%) of the patients in this study had diabetes.

Hospital inpatients with diabetes are on average older, sicker and have a longer length of stay than the general population. Around 15% of hospital beds are occupied by people with diabetes.[22] High quality diabetes care has the potential to improve outcomes and shorten length of stay. It is important not only in this patient group but in all hospital patients. This section will explore the process and quality of care as well as outcomes in patients with diabetes.

In the general population, approximately 10% of people with diabetes are affected by type 1 diabetes.[6] In this study, 21.5% (75/349) of patients with diabetes had type 1 diabetes. The higher incidence of type 1 diabetes illustrates its importance as a risk factor for the development of vascular disease. In addition to type 1 diabetes, treatment with insulin also identifies a group of patients with a higher risk of complications.[19]

In the overall population of inpatients with diabetes, 40% are on treatment with insulin. In the patients included in this study, 183/313 patients (58.5%) were receiving insulin therapy. This is therefore a patient group with more complex diabetes than the general population and therefore a high risk of complications. Table 9.1 summarises the treatment regimens for people with diabetes in this study.

Table 9.1 Diabetes treatment on admission *(Clinical questionnaire data)*

	n	%
Insulin	183	58.5
Sulphonylureas	64	20.4
Metformin	133	42.5
Thiazolidinediones	8	2.6
Dipeptidylpeptidase-4 inhibitors	12	3.8
GLP-1 agonists	2	0.6
Other	21	6.7
Subtotal	**313**	
Not answered	36	
Total	**349**	

**Answers may be multiple*

Referral to the specialist diabetes team has the potential to optimise diabetes control and to improve management of co-morbidities. Early referral to the specialist diabetes team is recommended in higher risk patients and patients undergoing emergency surgery.[19] In the National Diabetes Inpatient Audit just over half of the general inpatients with diabetes were reviewed by a diabetes specialist.[22]

In this study, 58.4% (160/274 where the answer was known) of patients were reviewed by a diabetes nurse specialist during the pre-operative period. In cases assessed by the Advisors, 123/217 (56.7%) had received advice from the diabetes team about pre-operative diabetes control (data not shown). As already noted in chapter 2 (Organisation of care), routine review by a diabetes nurse specialist only occurred in 73/132 (55.3%) hospitals performing amputations.

Table 9.2 Patients with diabetes reviewed by DNS and insulin treatment *(Clinical questionnaire data)*

Pre-operative review by DNS	Insulin		No insulin		**Subtotal**	Not answered	**Total**
	n	**%**	**n**	**%**	**n**	**n**	**n**
Yes	102	55.7	51	39.2	**153**	10	**163**
No	81	44.3	79	60.8	**160**	26	**186**
Total	**183**		**130**		**313**	**36**	**349**

It is worth noting that a similar percentage of patients were on insulin treatment as were seen by the diabetes nurse specialist (DNS). This might be taken to imply that patients on insulin were seen by a DNS. Table 9.2 shows that although a greater proportion of patients on insulin were seen by a DNS (55.7% vs. 39.2%), there were 81 patients (44.3%) on insulin who were not seen.

In the Advisors' view all patients with diabetes should have been reviewed pre-operatively by a diabetes nurse specialist. They also considered that there was the potential to improve care if patients were reviewed by a consultant diabetologist to advise on optimal management of co-morbidities and complications of diabetes.

It has been noted earlier that only 27 patients required immediate surgery. In the patients with diabetes, there were 31 cases (9%) in whom surgery occurred on the day of admission and 105 (30.6%) who had surgery within 48 hours of admission. This suggests that in the majority of cases it should be possible to make arrangements for a review of diabetes care prior to the operation.

Case study 8

An elderly patient with diabetes was admitted under the general surgical team with cellulitis and an ischaemic toe. The patient was dehydrated with an acute kidney injury and high blood sugar. A below-knee amputation was undertaken 48 hours after admission. The post operative course was complicated by stump breakdown but the patient improved slowly and was discharged.

The Advisors felt that management by a diabetes specialist had the potential to improve pre and peri-operative glycaemic control as well as optimise the management of the acute kidney injury.

The majority (62.2%; 173/278) of patients with diabetes received intravenous insulin during their admission.

In this group, the incidence of hypoglycaemia reported by the clinician who had responsibility for the patient was 10% (Table 9.3).

Table 9.3 Hypoglycaemia (glucose <4mmol/l) occurred while on the insulin infusion *(Clinical questionnaire data)*

	n	%
Yes	15	10.0
No	135	90.0
Subtotal	**150**	
Unknown	21	
Not answered	2	
Total	**173**	

While this appears at the lower end of the reported 10-20% incidence of hypoglycaemia,[22] in cases assessed by the Advisors, hypoglycaemia occurred in 22/97 (22.7%) cases where they were able to comment (Table 9.4). It is worth noting that the number of cases where the Advisors were able to identify hypoglycaemia was greater than the number identified by the clinicians.

Table 9.4 Hypoglycaemia occurred whilst on the insulin infusion (glucose <4mmol/l) *(Advisors' opinion)*

	n
Yes	22
No	75
Subtotal	**97**
Unable to answer	22
Not answered	11
Total	**130**

In cases reviewed by the Advisors, 130/255 (51%) patients received an intravenous insulin infusion. This continued for one or two days in 70/102 patients. Blood sugar monitoring is recommended at least hourly during surgery and in the immediate post operative period.[19] In 14/112 cases, blood sugar measurements were made less frequently than two hourly while patients were receiving intravenous insulin (Table 9.5).

Table 9.5 Glucose measurements were taken at least two hourly while on the infusion *(Advisors' opinion)*

	n	%
Yes	98	87.5
No	14	12.5
Subtotal	**112**	
Not applicable	6	
Not answered	12	
Total	**130**	

In order to maintain glycaemic control, usual diabetes treatment should be re-started before stopping an insulin infusion. When the insulin infusion was stopped, there were 12/64 cases where the usual diabetes treatment was not re-started before stopping this (Table 9.6).

Table 9.6 The usual diabetes treatment was re-started before the intravenous infusion was stopped *(Advisors' opinion)*

	n
Yes	52
No	12
Subtotal	**64**
Unable to answer	58
Not answered	8
Total	**130**

There were also 13/95 cases where Advisors thought that hyperglycaemia was not adequately managed or avoided during intravenous insulin treatment (Table 9.7).

Table 9.7 Hyperglycaemia was adequately managed/ avoided during the insulin infusion *(Advisors' opinion)*

	n
Yes	82
No	13
Subtotal	**95**
Unable to answer	24
Not answered	11
Total	**130**

In the majority of cases, the clinician responsible for the patient thought that peri-operative control of diabetes was satisfactory (Table 9.8). In contrast, the Advisors considered that it was either poor or unacceptable in 40/230 (17.4%) of cases (Figure 9.1).

Table 9.8 Was there satisfactory diabetes control in peri-operative period *(Clinical questionnaire data)*

	n	%
Yes	246	94.3
No	15	5.7
Subtotal	**261**	
Unknown	24	
Not answered	64	
Total	**349**	

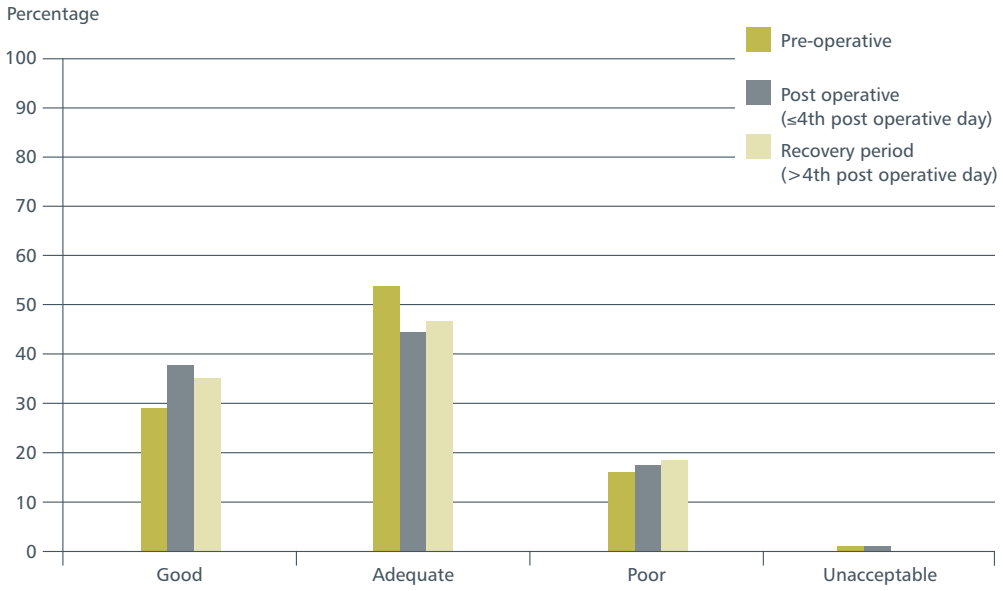

Figure 9.1 Overall rating of glycaemic control *(Advisors' opinion)*

Of 40 cases where glycaemic control was assessed as poor or unacceptable, in 9 cases, there was no clear effort made to address this prior to surgery (Table 9.9).

Table 9.9 Evidence that an effort was made to address pre-operative diabetes control prior to surgery *(Advisors' opinion)*

	n
Yes	24
No	9
Subtotal	**33**
Unable to answer	4
Not answered	3
Grand Total	**40**

Of the 24 patients with a corresponding clinical questionnaire, Advisors were able to identify review by a DNS in 9/19 cases where they were able to comment. In the 54 cases where adequate attempts were made to control blood sugar and Advisors were able to comment, 40 patients had been seen by a DNS. Review by a DNS was therefore more likely to be associated with better control of diabetes.

Good diabetes control, defined as no more than one reading of >11 mmol/l and none <4 mmol/l in a 24 hour period was achieved in 74/197 cases (37.6%) in the immediate post operative period. Glycaemic control in this period was poor or unacceptable in 36/197 (18.3%) of cases (Figure 9.1).

In the recovery period beyond the fourth post operative day, good control was achieved in a similar percentage of patients (63/181; 34.8%) (Figure 9.1). There is therefore potential to improve blood sugar control of amputation patients with diabetes at all stages of the surgical pathway.

Diabetes prescribing

Where drug charts were available for review in patients with diabetes, information on prescribing was recorded. The results of this assessment are presented in the two tables (Table 9.10 and Table 9.11).

Table 9.10 Oral Hypoglycaemic Agent (OHA) prescribing *(Advisors' opinion)*

	Did occur	Did not occur	Unable to answer	Not answered
OHA was written up	79	9	48	40
Prescription was signed by prescriber	85	8	35	47
OHA was signed as given	78	6	40	51
Dose was reduced following hypoglycaemia	17	16	93	49
Dose was changed when persistent BG>11mmol/l	20	22	83	50
Inappropriate omission of dose after hypoglycaemia	2	38	82	53

Table 9.11 Insulin prescribing *(Advisors' opinion)*

	Did occur	Did not occur	Unable to answer	Not answered
Insulin was written up	112	11	23	29
Name of insulin correct	111	8	21	35
Number (dose) clear	110	11	19	35
Unit abbreviated to 'u' or written unclearly	45	76	18	36
Insulin prescription was signed by prescriber	113	8	18	36
Insulin was signed as given	106	12	20	37
Insulin was increased when persistent BG>11 mmol/L	49	25	57	44
Insulin was reduced if unexplained BG <4mmol/L	47	12	72	44
Inappropriate omission of insulin after episode of hypoglycaemia	7	56	64	48

Basic prescribing errors were common including failure to sign prescriptions or lack of clarity of the dose required. Of the 175 cases where drug charts were available for review, 85 (48.6%) had at least one prescribing error. For insulin prescribing, this lack of clarity and specifically the abbreviation of units to the letter "u" was identified as a safety issue by the National Patient Safety Agency in 2010[52] as it has the potential to result in a ten-fold overdose risk if not written clearly (u interpreted as 0). The National Inpatient Diabetes Audit[22] has shown a progressive improvement in this safety issue from 6.3% in 2010 to 1.9% in 2013. In this study, this failure to prescribe the insulin dose was the most frequent error occurring in 45/279 (16.1%) of all patients with diabetes. The frequency with which this issue was found in patients undergoing amputation is worrying and suggests that this group of patients is more at risk from the consequences of this type of prescribing error than the general inpatient population with diabetes.

The response to both hypoglycaemia and hyperglycaemia was also examined. There was an inconsistent response in terms of prescribing both for insulin and for oral hypoglycaemic agents with no clear or logical prescription changes in response to abnormal glucose levels. This suggests that either local guidance is required to ensure an appropriate response to poor blood sugar control or the specialist diabetes team needs to be more involved in the management of these patients. Both the use of guidelines and involvement of the specialist diabetes team have been recommended in previous guidance.[19] In addition, implementation of electronic prescribing systems has the potential to reduce or eliminate the prescribing errors identified.

Complications in patients with diabetes

Patients with diabetes have a higher incidence of complications than those without diabetes.[19] This might be expected for infections, cardiovascular complications and development of renal failure, as diabetes is a risk factor for all of these in the general population.

Table 9.12 Complications in diabetes vs. no diabetes *(Clinical questionnaire data)*

	Diabetes		No diabetes		Total
	n	%	n	%	
Complication	160	45.8	130	46.6	**290**
No complication	189	54.2	149	53.4	**338**
Total	**349**		**279**		

In this study, the overall rate of complications was similar for patients with and without diabetes (Table 9.12). At least one complication occurred in 45.8% of the patients with diabetes and 46.6% of patients without diabetes.

When individual complications (listed in Table 9.13) were examined, there was no clear difference between the groups. Similarly, when they were grouped into infections or cardiovascular complications there was no clear difference. It is important to note this as it may reflect the severity of the co-morbidities other than diabetes that lead to vascular disease and the need for amputation. As discussed in the section on pre-operative co-morbidities, this would support the concept that all patients undergoing amputation, not just those with diabetes, require a service organised to deliver optimal care of their non-surgical problems.

Table 9.13 The presence of complication by diabetes *(Clinical questionnaire data)*

	Diabetes		No diabetes	
	n	%	n	%
Post operative bleeding	0	0	4	1.4
Wound infection	41	11.5	37	13.2
Chest infection	57	15.9	45	16.0
Retention of urine	10	2.8	6	2.1
Urinary tract infection	20	5.6	14	5.0
Respiratory failure	25	7.0	16	5.7
Cardiac failure	16	4.5	15	5.3
Cardiac arrhythmia	3	<1	4	1.4
Myocardial infarction	13	3.6	5	1.8
Stroke	6	1.7	5	1.8
Post operative delirium	21	5.9	14	5.0
Bloodstream infection	14	3.9	4	1.4
Clostridium difficile infection	5	1.4	5	1.8
Significant deterioration in renal function	23	6.4	10	3.6
Deep vein thrombosis	0	0	1	<1
Acute renal failure requiring RRT	5	1.4	5	1.8
Pulmonary embolus	1	<1	2	<1
Pressure sores - contralateral limb	4	1.1	10	3.6
Subtotal	**160**		**130**	
None	189		149	
Total	**349**		**279**	

Case study 9

A young patient with type 1 diabetes and peripheral neuropathy was admitted with an infected foot and poor glycaemic control. Below-knee amputation was delayed for five days while attempting to improve blood sugar. Peri- and post operative glycaemic control remained poor. The diabetes specialist team were not involved until the fifth post operative day.

Advisors thought that the specialist diabetes team should have been involved immediately on admission and that this would have provided better co-ordination of medical care and a more logical approach to blood sugar management.

Length of stay

Previous studies have shown that patients with diabetes have an increased length of stay compared with the general population of hospital inpatients.[22] In this study, there was no difference in length of stay between the patients with diabetes and without diabetes (Figure 9.2). This was not due to early mortality in patients with diabetes as there was no increase in 30 day mortality either. Again this might suggest that the complexity and co-morbidities of the cohort of patients without diabetes undergoing amputation has a similar effect to diabetes on outcomes.

It has been suggested that patients with diabetes may have a shorter length of stay if managed by the diabetes specialist team.[22] As already noted, there was considerable room for improvement in the diabetes care received. There did not however appear to be a

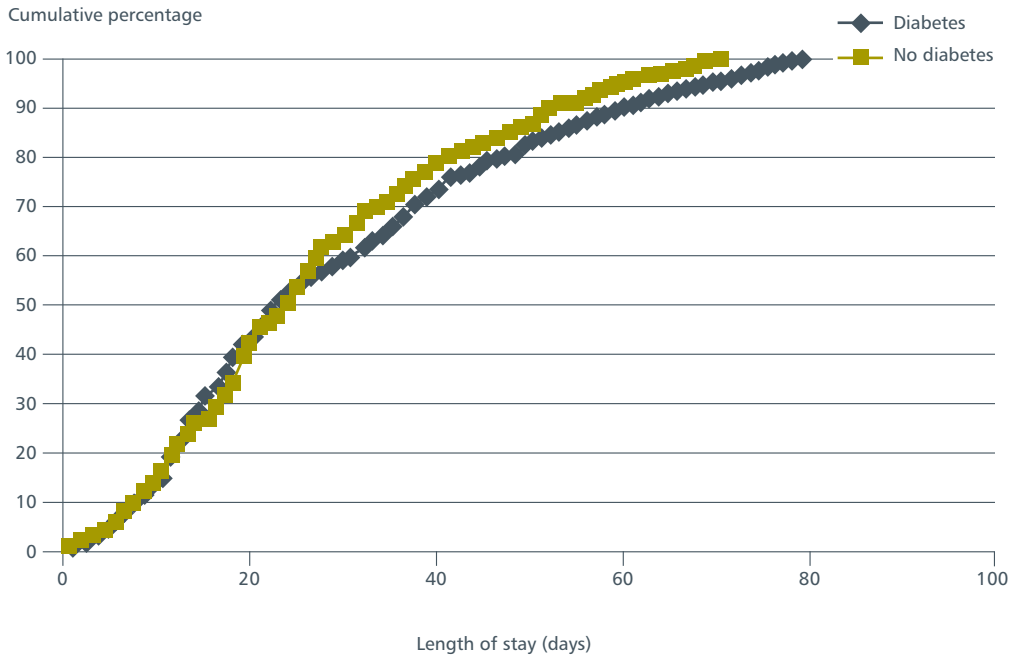

Figure 9.2 Length of stay (in patients discharged alive) by the presence of diabetes
(Clinical questionnaire data)

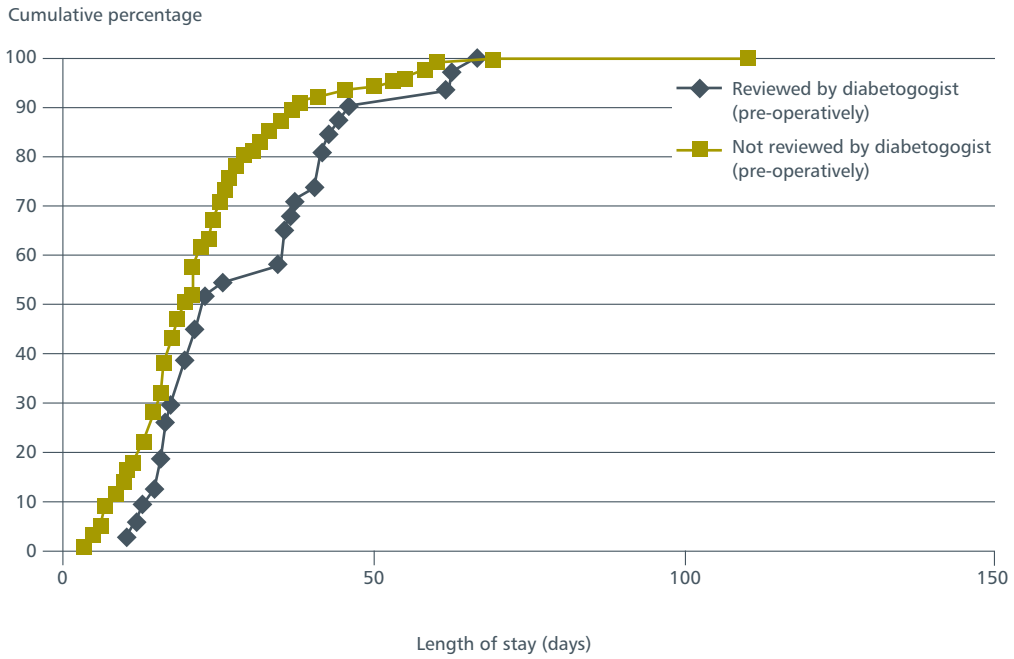

Figure 9.3 Length of stay (in patients discharged alive) by pre-operative diabetes review if not admitted under the diabetes team. *(Clinical questionnaire data)*

difference in length of stay when patients with diabetes were reviewed by the diabetes service pre-operatively (Figure 9.3). This may be because patients who were referred had worse diabetes control or more complex medical problems. Length of stay will be influenced by complication rates as well as the need for rehabilitation and complex discharge planning.

Mortality

Peri-operative mortality rates have been quoted in many studies, and as being up to 50% higher in patients with diabetes than in the non-diabetic population.[53] In the present study, the 30 day mortality was 11.6% in patients with diabetes and 13.3% in patients without diabetes.

Patients in this study with diabetes were younger (average 68 years) than those without diabetes (average 71 years). This is unlikely to explain the difference between the data on mortality presented here and in previously published work. The different rates of co-morbidities present in patients with diabetes and those without diabetes have also been discussed in chapter 3.

Overall the Advisors rated the care of diabetes as good in just under a third of patients (84/269; 31.2%) and poor or unacceptable in 28/269 (10.4%) (Figure 9.4)

It is clear from the data presented in this chapter that there is room for improvement in the care of patients with diabetes who undergo lower limb amputation. Organisation of services to provide specialist diabetes team input for this group of patients has the potential to improve diabetes control, reduce prescribing errors and deliver improved quality of care.

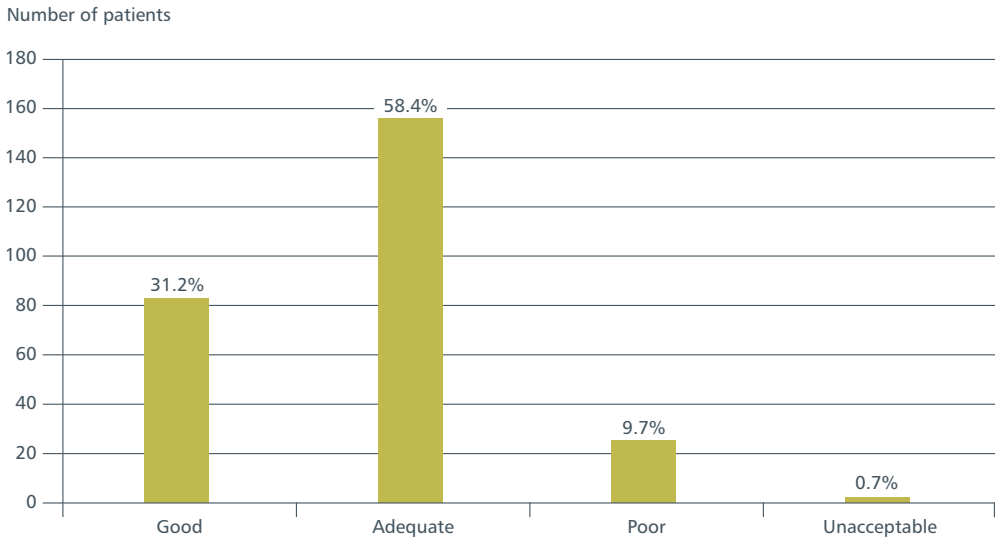

Figure 9.4 Rating of overall diabetes care *(Advisors' opinion)*

Key findings

1. 349/628 (55.6%) patients included in the study had diabetes. Patients with diabetes had a higher than average incidence of both type 1 diabetes and insulin use compared to the general population.

2. Only 41/310 (12.8%) patients with diabetes were admitted under the care of the diabetes service.

3. 160/274 (58.4%) patients with diabetes were reviewed pre-operatively by a diabetes nurse specialist.

4. The Advisors considered that glycaemic control was poor or unacceptable in 43/161 (26.7%) patients at some point within the surgical pathway.

5. Prescribing errors for both insulin and oral hypoglycaemic agents occurred commonly. The failure to prescribe insulin dose (unit abbreviated to 'U' or written unclearly) was the most frequent error occurring in 45/279 (16.1%) patients.

Organisational data

7. 140/143 (97.9%) hospitals had clinical/diabetes nurse specialists, however, where present they routinely reviewed patients under the care of the vascular unit in only 73/132 (55.3%) hospitals.

8. Diabetic foot clinics were present in 130/143 (90.9%) of hospitals.

9. Although diabetes specialists are the main specialty involved in the staffing of diabetes foot clinics (always present in 106/125 hospitals), diabetology input was less frequent at the point of MDT discussion (51/107 hospitals) and there was no presence at morbidity and mortality meetings.

10 – Outcomes

The 30-day outcome for patients included in this study are shown in Table 10.1.

The Vascular Society of Great Britain and Ireland published a Quality Improvement Framework for Major Amputation in November 2010.[1] This followed presentation of data at the 2009 AGM reporting mortality rates of 17% and 9% from Hospital Episode Statistics (HES) and the National Vascular Database (NVD) respectively. Given that the mortality rate for the present study is 12.4% (77/622) it appears that there has been little progress in respect of the VSGBI's aim to reduce mortality rates to <5% by 2015. Further, mortality rates in the UK for major amputation remain higher than that recently reported in a large study of 6839 patients from the United States (9.1% (6.5% below-knee, 12.7% above-knee).[54] The study also identified risk factors that were associated with death, most of which could not be modified. Thus if the aims of the Vascular Society's QIF are to be achieved, wide ranging improvements in the clinical care pathway of amputees are likely to be required.

Outcomes and mortality rates were also examined according to the mode of admission. This is shown in Tables 10.2 and 10.3.

Table 10.1 Outcome at 30-days *(Clinical questionnaire data)*

	n	%
Discharged alive (≤=30 days of surgery)	407	65.4
Still in hospital (≥=30 days of surgery)	138	22.2
Died (≤=30 days of surgery)	77	12.4
Subtotal	**622**	
Not answered	6	
Total	**628**	

Table 10.2 Mortality rates according to mode of admission *(Clinical questionnaire data)*

	Died (≤=30 days of operation)	Total number of cases
	n	n
Elective	7	118
Planned	10	73
Emergency	59	432
Subtotal	**76**	**623**
Not answered	1	5
Total	**77**	**628**

Table 10.3 Overall outcomes according to mode of admission *(Clinical questionnaire data)*

	Elective	Planned	Emergency	Subtotal	Not answered	Total
Discharge alive (≤=30 days of operation)	102	48	254	**404**	3	**407**
Still in hospital (≥=30 days of operation)	9	14	114	**137**	1	**138**
Died (≤=30 days of operation)	7	10	59	**76**	1	**77**
Subtotal	**118**	**72**	**427**	**617**	**5**	**622**
Not answered	0	1	5	**6**	0	**6**
Total	**118**	**73**	**432**	**623**	**5**	**628**

These data highlight that any improvement in outcomes for amputation will need to particularly focus on the management of urgent and emergency admissions.

The clinical questionnaire also asked if patients were discussed at a multidisciplinary audit or morbidity and mortality meeting (Table 10.4) or were submitted to the NVD (Table 10.5).

Table 10.4 Patients were discussed at a multidisciplinary audit or morbidity and mortality meeting *(Clinical questionnaire data)*

	n	%
Yes	202	39.4
No	311	60.6
Subtotal	**513**	
Unknown	55	
Not answered	60	
Total	**628**	

The constitution of the multidisciplinary audit or morbidity and mortality meeting is unclear. In general it is likely that this question was answered on the basis of a conventional surgical audit meeting given that the management of so few patients was discussed at an appropriate MDT pre-operatively.

Table 10.5 Patient data was submitted to the NVD *(Clinical questionnaire data)*

	n	%
Yes	295	67.2
No	144	32.8
Subtotal	**439**	
Unknown	163	
Not answered	26	
Total	**628**	

This information confirms that a third of cases were not submitted to the database. At the time of data collection for this study submission was not compulsory. However, a separate analysis (Table 10.6) suggests that it was less likely that patients in whom our Advisors considered that the overall level of care was other than "Good Practice" were submitted.

Table 10.6 Details submitted to NVD compared to level of care *(Advisors' opinion)*

	Reported to NVD					
	Yes		No		Unknown	Not answered
	n	%	n	%	n	n
Good practice	120	50.0	42	37.9	53	7
Room for improvement - clinical care	55	22.9	37	33.3	24	8
Room for improvement - organisational care	20	8.3	11	9.9	17	1
Room for improvement - clinical and organisational care	41	17.1	17	15.3	20	6
Less than satisfactory	4	1.7	4	3.6	9	0
Subtotal	**240**		**111**		**123**	**22**
Insufficient data	4		4		1	0
Not answered	1		0		0	0
Total	**245**		**115**		**124**	**22**

Adherence to Vascular Society of Great Britain & Ireland's Quality Improvement Framework

The QIF for Major Amputation Surgery developed by the Vascular Society of Great Britain and Ireland identified 8 pre-operative, 7 peri-operative and 8 post operative areas where current practice should be improved. Table 10.7 identifies those that on the basis of this report seem to have been implemented for the majority of patients, whilst Table 10.8 highlights those where adherence to the framework requires significant improvement.

Table 10.7 Aspects of QIF that have largely been implemented

Pre-operative	The decision with the patient to perform amputation should be timed and recorded in the notes
	Controllable risk factors should be optimised
	Antithrombotic prophylaxis should be prescribed and continued at least until discharge from hospital
Peri-operative	Anaesthesia should be given by a senior anaesthetist (post FRCA); a trainee should have consultant supervision available
	Amputation should only be undertaken in a facility with ready access to blood products and access to level III critical care
	All patients to have antibiotic prophylaxis, type of antibiotic according to local policy
Post operative	Amputation should be undertaken in a unit with 24/7 network or local vascular cover, with access to multi-professional support (cardiac, renal, respiratory, diabetes)

Table 10.8 Areas of QIF that have not been widely implemented

Pre-operative	Pain should be controlled, and the pain team involved as needed
	Patients should be assessed and managed by a specialist multidisciplinary team
	A named individual, identified pre-operatively should be responsible for each patient (support, co-ordinate care, rehabilitation and discharge planning)
	All patients should have formal risk assessment by, or in consultation with a consultant anaesthetist
	Discharge planning and rehabilitation should be considered pre-operatively, and review by the rehabilitation team encouraged
Peri-operative	Operation should be undertaken on a planned operating list during normal working hours (target 75% of all major amputations)
	Patients not on a planned list should have surgery within 48h of decision to operate and no patient should be deferred more than once (unless new medical contraindications)
	All patients to have antibiotic prophylaxis, type of antibiotic according to local policy
	Aim to undertake below-knee amputation (BKA) wherever appropriate and have below-knee: above-knee ratio > 1
Post operative	There should be a formal pain management protocol, and access to an acute pain team
	There should be prompt access to a local amputee rehabilitation team including early mobilisation and physiotherapy
	There should be continued discharge planning home, or to an appropriate facility
	There should be formal referral to a specialist amputee rehabilitation team (prosthetics)
	Optimal medical management and health education should be completed before discharge

For two other areas of the QIF adherence by vascular surgery teams is mixed. These are the recommendations that a trained surgeon, with a regular practice in amputation, and who has knowledge of the implications for rehabilitation should undertake operation and submission of amputations to the National Vascular Database. The latter is likely to improve now that amputation is listed as an index procedure.

The guidelines published by the British Association of Chartered Physiotherapists in Amputee Rehabilitation (BACPAR) published in 2006[20] also require consideration when aiming to improve the management of these patients.

Key findings

1. Many of the aims of the Vascular Society of Great Britain & Ireland's Quality Improvement Framework have not been implemented by the clinicians submitting data to this study.

11 – Overall quality of care

Overall quality of care

The Advisors were asked to grade the level of care of each case considering all aspects of management. Their opinion is presented in Figure 11.1.

This assessment is disappointing with only 229/519 (44.1%) of patients receiving a standard of care with which the Advisors would be happy for themselves or their family and friends. Of the remainder there was room for improvement in clinical care in all but 10%. In other words clinical management could have been better in half of the patients included in the study.

This highlights the urgent need for implementation of the Quality Improvement Framework proposed by the Vascular Society of Great Britain and Ireland and the recommendations made in this report.

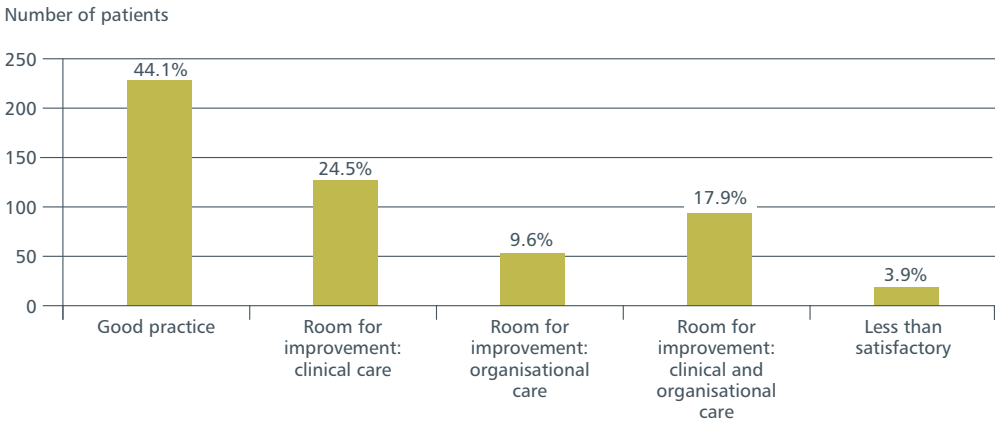

Figure 11.1 Overall assessment of care *(Advisors' opinion)*

Recommendations

1) A 'best practice' clinical care pathway, supporting the aims of the Vascular Society's Quality Improvement Framework for Major Amputation Surgery, and covering all aspects of the management of patients requiring amputation should be developed. This should include protocols for transfer, the development of a dedicated multidisciplinary team (MDT) for care planning of amputees and access to other medical specialists and health professionals both pre- and post operatively to reflect the standards of the Vascular Society of Great Britain and Ireland, the British Association of Chartered Physiotherapists in Amputee Rehabilitation and the British Society of Rehabilitation Medicine. It should promote greater use of dedicated vascular lists for surgery and the use of multidisciplinary records. *(Vascular Society of Great Britain & Ireland (development), Medical Directors (implementation))*

2) All patients with diabetes undergoing lower limb amputation should be reviewed both pre- and post operatively by the specialist diabetes team to optimise control of diabetes and management of co-morbidities. The pre-operative review should not delay the operation in patients requiring emergency surgery. *(Consultant Diabetologists)*

3) As recommended in the Quality Improvement Framework for Major Amputation Surgery (VSGBI), all patients undergoing major lower limb amputation should have a named individual responsible for the co-ordination of their rehabilitation and discharge (amputation/discharge co-ordinator). Their role should include the provision of detailed written information for patients and their relatives covering the whole clinical pathway. *(Medical Directors, Clinical Directors)*

4) The decision to undertake a major amputation should be made by a multidisciplinary team (MDT) including vascular surgery, physiotherapy, occupational therapy, diabetology, radiology, specialist nursing and an amputation/discharge co-ordinator. Where the urgency of surgery prevents this, as a minimum patients should be discussed with a consultant vascular surgeon and reviewed by a consultant anaesthetist, before amputation. *(Medical Directors)*

5) All Trusts should have formal access to a consultant service in rehabilitation medicine that includes the post operative care of patients after major lower limb amputation. *(Medical Directors)*

6) When patients are admitted to hospital as an emergency with limb-threatening ischaemia, including acute diabetic foot problems, they should be assessed by a relevant consultant within 12 hours of the decision to admit or a maximum of 14 hours from the time of arrival at the hospital, in line with current guidance. If this is not a consultant vascular surgeon then one should be asked to review the patient within 24 hours of admission. *(Medical Directors)*

7) A model for the medical care of amputees, should be introduced which includes regular review by a physician and a surgeon throughout the in-patient stay. The existing orthogeriatric model serves as a good example in current practice. *(Specialist Commissioners)*

8) NICE recommends that a nutritional assessment of all patients should be made within the first 48 hours of admission (CG32). This guidance should be implemented for all patients requiring lower limb amputation. *(All Health Care Professionals)*

9) All patients admitted electively for lower limb amputation should be seen in a pre-assessment clinic to optimise medical co-morbidities and to plan post operative rehabilitation. *(Clinical Directors, Consultant Anaesthetists)*

10) For patients undergoing major limb amputation, planning for rehabilitation and subsequent discharge should commence as soon as the requirement for amputation is identified. All patients should have access to a suitably qualified amputation/discharge co-ordinator. *(Medical Directors)*

11) Clear guidelines on obtaining consent from patients requiring amputation should be developed to address the deficiencies identified in this study. *(Vascular Society of Great Britain & Ireland)*

12) A consultant vascular surgeon should be present in the operating theatre for all amputations performed by a non-CCT trainee. *(Medical Directors)*

13) A care bundle should be developed to ensure the structured management of amputation patients. Audit of this should form part of the National Vascular Registry *(Vascular Society of Great Britain & Ireland, Vascular Anaesthesia Society of Great Britain and Ireland)*

14) All patients undergoing lower limb amputation must be screened pre-operatively for MRSA, as recommended by the Department of Health. *(All Consultant Surgeons)*

15) As recommended in the Quality Improvement Framework for Major Amputation Surgery (VSGBI), amputations should be done on a planned operating list during normal working hours and within 48 hours of the decision to operate. Any case waiting longer than this should be the subject of local case review to identify reasons for delay and improve subsequent organisation of care. *(Medical Directors)*

16) Hospitals require a properly funded and staffed acute pain service with capacity to manage patients with critical limb ischaemia and both pre- and post-amputation pain. *(Medical Directors)*

17) Insulin should be prescribed according to National Patient Safety Agency (NPSA) recommendations. *(All Doctors)*

18) Hospitals should have clear guidelines for the management of blood glucose levels when they are outside the acceptable range. These guidelines should be implemented for all patients undergoing lower limb amputation. *(Medical Directors, All Consultants)*

19) A falls risk assessment should be undertaken in all patients undergoing lower limb amputation, and measures should be put in place to reduce the risk of a subsequent fall during the in-patient stay. *(Medical Directors, Physiotherapists)*

20) As recommended by the British Association of Chartered Physiotherapists in Amputee Rehabilitation and British Society of Rehabilitation Medicine, when it is possible to choose the level of amputation, the physiotherapist should be consulted in the decision making process regarding the most functional level of amputation for the individual. Post operative physiotherapy should commence on the first day where possible and should include exercise, oedema management and use of early walking aids as appropriate. *(Consultant Vascular Surgeons, Physiotherapists)*

Summary

Although amputation is often perceived as a simple procedure, this study has demonstrated that the pathway of care is complex. This complexity brings with it the challenge of organising appropriate acute medical and surgical care and providing subsequent rehabilitation. Better co-ordination of these aspects of management is required to deliver good care.

In the care pathway, there were often delays. These included delay in referral to and in review by a vascular surgeon and then between the decision to operate and the operation itself. The consent form was frequently found to be inadequate, failing to detail the benefits of the procedure as well as serious complications including mortality. The operation was often performed out of hours in an emergency operating theatre and unsupervised non-consultant grade surgeons did a third of all amputations. Post operatively both medical and surgical complications occurred frequently. There is clear room to improve practice in these areas.

Co-existing medical problems were common and occurred in both the pre- and post operative periods. These frequently required non-surgical specialist care but this was provided inconsistently. More than half of the patients had diabetes and blood sugar control was often poorly managed. There were other care issues related to diabetes which could be improved by routine involvement of the specialist diabetes team.

Pain was also a common feature throughout the peri-operative period. Optimal pain management was not consistently provided. Pain also limited the ability of the therapy teams to commence rehabilitation. Review of all patients by a specialist pain team would improve patient experience and has the potential to improve early mobilisation and shorten length of stay.

Physiotherapists were often not involved early enough in the patient pathway. Structured involvement of physiotherapists in the multidisciplinary team should include pre-operative discussion of rehabilitation potential and the level of amputation as well as early post operative rehabilitation and co-ordination of discharge plans.

In addition to improved co-ordination of specialist involvement for these patients, other apparently small details have the potential to improve patient experience and outcomes. Screening for MRSA, nutritional assessment, falls risk assessment and documentation of timely antibiotic administration all fell below an acceptable level.

The development of a co-ordinated pathway, which delivers care by all of the relevant specialists when it is needed, should ensure delivery of optimum care and improve outcomes. The National Vascular Database provides an opportunity to measure the standards set within this pathway and would enable units to assess their own performance and potentially reduce mortality to <5%, the target set by the Vascular Society of Great Britain and Ireland.

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Appendices

Appendix 1 – Glossary

Above-knee amputation	Surgical removal of the lower limb above the knee
Below-knee amputation	Surgical removal of the lower limb below the knee
Dehiscence	Wound dehiscence is a surgical complication in which a wound ruptures along surgical stitches
Hip disarticulation	Surgical removal of the entire lower limb at the hip level
Ischaemia	Ischaemia is a restriction in blood supply to tissues, causing a shortage of oxygen and glucose needed to keep tissue alive
Necrosis	Necrosis is death of body tissue. It occurs when there is not enough blood flowing to the tissue, whether from injury, radiation, or chemicals. Necrosis is not reversible
Normal glucose range	NICE guidelines recommend a fasting blood sugar between 4 and 7 mmol/l and < 9 mmol/l two hours after a meal
Oedema	Oedema is the medical term for fluid retention in the body. It often causes swelling in the feet and ankles
Osteomyelitis	Osteomyelitis is the medical term for a bone infection that is usually caused by bacteria
Through-knee amputation	Surgical removal of the lower limb through the knee
VSGBI	Vascular Society of Great Britain and Ireland
Atherosclerosis	Atherosclerosis is a potentially serious condition where arteries become clogged up by fatty substances
Revascularisation	Revascularisation is the restoration of blood flow to a body part or organ that has suffered a restriction in flow
Glycaemic crontol	Glycaemic control is a medical term referring to the typical levels of blood sugar (glucose) in a person with diabetes
Thrombus	A thrombus is a blood clot that forms locally in a blood vessel
Type 1 diabetes	This is a form of diabetes where the pancreas does not produce any insulin
Type 2 diabetes	This is a form of diabetes where the pancreas does not produce enough insulin or the body's cells don't react to insulin
DNACPR	Do Not Attempt Cardio Pulmonary Resuscitation
ICU/HDU	Intensive care unit/high dependency unit
NICE	National Institute for Health and Care Excellence

Appendix 2 - The role and structure of NCEPOD

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is an independent body to which a corporate commitment has been made by the Medical and Surgical Colleges, Associations and Faculties related to its area of activity. Each of these bodies nominates members on to NCEPOD's Steering Group.

Steering Group as at 14th November 2014

Dr W Harrop-Griffiths	Association of Anaesthetists of Great Britain and Ireland
Mr F Smith	Association of Surgeons of Great Britain and Ireland
Dr C Mann	College of Emergency Medicine
Vacancy	Faculty of Public Health Medicine
Ms S Payne	Lay Representative
Mr S Barasi	Lay Representative
Dr J Fazackerley	Royal College of Anaesthetists
Dr A Batchelor	Royal College of Anaesthetists
Dr D Cox	Royal College of General Practitioners
Mrs J Greaves	Royal College of Nursing
Dr E Morris	Royal College of Obstetricians and Gynaecologists
Mr W Karwatowski	Royal College of Ophthalmologists
Dr I Doughty	Royal College of Paediatrics and Child Health
Dr M Osborn	Royal College of Pathologists
Dr A McCune	Royal College of Physicians
Dr M Ostermann	Royal College of Physicians
Dr M Cusack	Royal College of Physicians
Dr T Sabharwal	Royal College of Radiologists
Mr J Abercrombie	Royal College of Surgeons of England
Mr M Bircher	Royal College of Surgeons of England
Mr K Altman	Faculty of Dental Surgery, Royal College of Surgeons of England

Observers

Dr R Hunter	Coroners' Society of England and Wales
Mrs J Mooney	Healthcare Quality in Partnership (HQIP)
Dr M Jones	Royal College of Physicians of Edinburgh
Mr W Tennant	Royal College of Surgeons of Edinburgh

Trustees

Mr B Leigh	Chair
Dr D Mason	Honorary Treasurer
Professor L Regan	
Professor R Endacott	
Mr I Martin	
Professor T Hendra	

Company Secretary Dr M Mason

NCEPOD is a company, limited by guarantee (Company number: 3019382) and a registered charity (Charity number: 1075588)

Clinical Co-ordinators

The Steering Group appoint a Lead Clinical Co-ordinator for a defined tenure. In addition there are six Clinical Co-ordinators who work on each study. All Co-ordinators are engaged in active academic/clinical practice (in the NHS) during their term of office.

Lead Clinical Co-ordinator	Dr M Juniper (Medicine)
Clinical Co-ordinators	Dr K Wilkinson (Anaesthesia)
	Dr A P L Goodwin (Anaesthesia)
	Professor M J Gough (Surgery)
	Mr M Sinclair (Surgery)
	Dr S McPherson (Radiology)
	Dr V Srivastava (Medicine)

Supporting organisations

This project was undertaken as part of the Clinical Outcome Review Programme into Medical and Surgical Care.

The Clinical Outcome Review Programme into Medical and Surgical Care is commissioned by the Healthcare Quality Improvement Partnership (HQIP) on behalf of NHS England, NHS Wales, the Northern Ireland Department of Health, Social Services and Public Safety (DHSSPS), the States of Jersey, Guernsey, and the Isle of Man.

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Aspen Healthcare
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BMI Healthcare
BUPA Cromwell
East Kent Medical Services Ltd
Fairfield Independent Hospital
HCA International
Hospital of St John and St Elizabeth
King Edward VII's Hospital Sister Agnes
New Victoria Hospital
Nuffield Health
Ramsay Health Care UK
Spire Health Care
St Anthony's Hospital
St Joseph's Hospital
The Horder Centre
The London Clinic
Ulster Independent Clinic

Appendix 3 – Participation

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Abertawe Bro Morgannwg University Health Board	5	4	14	11	14
Aintree Hospitals NHS Foundation Trust	1	1	2	2	2
Airedale NHS Foundation Trust	1	1	1	1	1
Aneurin Bevan Local Health Board	4	2	10	6	2
Ashford & St Peter's Hospital NHS Trust	2	2	7	7	7
Barking, Havering & Redbridge University Hospitals NHS Trust	1	1	7	7	7
Barnsley Hospital NHS Foundation Trust	1	1	0	0	0
Barts Health NHS Trust	2	2	10	6	9
Basildon & Thurrock University Hospitals NHS FoundationTrust	1	1	6	5	5
Bedford Hospital NHS Trust	1	1	7	5	4
Belfast Health and Social Care Trust	3	1	9	4	5
Berkshire Healthcare NHS Foundation Trust	3	0	0	0	0
Betsi Cadwaladr University Local Health Board	15	14	9	7	5
Birmingham Community Healthcare NHS Trust	1	1	0	0	0
Blackpool Teaching Hospitals NHS Foundation Trust	1	1	7	7	7
Bradford Teaching Hospitals NHS Foundation Trust	1	1	7	7	7
Brighton and Sussex University Hospitals NHS Trust	2	2	7	5	7
Buckinghamshire Healthcare NHS Trust	7	3	7	7	7
Burton Hospitals NHS Foundation Trust	2	2	3	3	3
Calderdale & Huddersfield NHS Foundation Trust	1	1	7	6	5
Cambridge University Hospitals NHS Foundation Trust	1	1	7	5	5
Cardiff and Vale University Health Board	2	2	7	6	7

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Central Manchester University Hospitals NHS Foundation Trust	1	1	8	4	0
Chesterfield Royal Hospital NHS Foundation Trust	1	1	5	5	5
City Hospitals Sunderland NHS Foundation Trust	1	1	7	7	7
Colchester Hospital University NHS Foundation Trust	1	1	7	6	5
Countess of Chester Hospital NHS Foundation Trust	1	1	7	7	7
County Durham and Darlington NHS Foundation Trust	2	2	13	13	13
Croydon Health Services NHS Trust	1	1	3	3	3
Cwm Taf Local Health Board	5	5	7	7	7
Dartford & Gravesham NHS Trust	1	0	3	0	0
Derby Hospitals NHS Foundation Trust	1	1	7	7	7
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	3	3	7	6	4
Dorset County Hospital NHS Foundation Trust	1	1	3	3	3
Dorset Healthcare University NHS Foundation Trust	2	2	0	0	0
Ealing Hospital NHS Trust	1	0	0	0	0
East & North Hertfordshire NHS Trust	1	1	7	7	7
East Cheshire NHS Trust	1	1	0	0	0
East Kent Hospitals University NHS Foundation Trust	1	0	7	4	4
East Lancashire Hospitals NHS Trust	5	5	7	7	7
East Sussex Healthcare NHS Trust	1	1	7	7	7
Epsom and St Helier University Hospitals NHS Trust	2	2	1	1	0
Frimley Park Hospitals NHS Trust	1	1	7	7	7
Gateshead Health NHS Foundation Trust	1	1	2	1	1
George Eliot Hospital NHS Trust	1	1	0	0	0
Gloucestershire Care Services NHS Trust	8	8	0	0	0

Appendix 3 – Participation (continued)

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Gloucestershire Hospitals NHS Foundation Trust	2	2	10	9	9
Great Western Hospitals NHS Foundation Trust	4	4	7	7	7
Guy's & St Thomas' NHS Foundation Trust	1	1	7	7	7
Hampshire Hospitals NHS Foundation Trust	2	2	5	1	0
Harrogate and District NHS Foundation Trust	1	1	0	0	0
Health and Social Services Department, States of Guernsey	1	1	1	1	1
Heart of England NHS Foundation Trust	1	1	7	7	7
Heatherwood & Wexham Park Hospitals NHS Foundation Trust	1	1	3	3	3
Hillingdon Hospitals NHS Foundation Trust (The)	1	1	2	1	1
Homerton University Hospital NHS Foundation Trust	1	1	0	0	0
Hull and East Yorkshire Hospitals NHS Trust	2	2	8	8	8
Hywel Dda Local Health Board	5	5	8	3	3
Imperial College Healthcare NHS Trust	3	3	14	13	13
Ipswich Hospital NHS Trust	1	1	7	4	0
Isle of Man Department of Health & Social Security	1	1	3	3	3
James Paget Healthcare NHS Trust	1	1	3	3	3
Kent Community Health NHS Trust	8	8	0	0	0
King Edward VII's Hospital Sister Agnes	1	1	0	0	0
King's College Hospital NHS Foundation Trust	1	1	6	2	6
Kingston Hospital NHS Trust	1	0	0	0	0
Lancashire Teaching Hospitals NHS Foundation Trust	1	1	7	3	3
Lewisham and Greenwich NHS Trust	2	2	2	2	2
Medway NHS Foundation Trust	1	1	7	7	7

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Mid Cheshire Hospitals NHS Foundation Trust	1	1	4	3	3
Mid Essex Hospitals NHS Trust	1	1	3	0	0
Mid Staffordshire NHS Foundation Trust	2	2	2	2	2
Mid Yorkshire Hospitals NHS Trust	1	1	8	8	8
Milton Keynes Hospital NHS Foundation Trust	1	1	6	6	6
Newcastle upon Tyne Hospitals NHS Foundation Trust	1	1	8	8	8
Norfolk & Norwich University Hospital NHS Trust	1	1	7	7	7
North Bristol NHS Trust	1	0	6	6	6
North Cumbria University Hospitals NHS Trust	2	1	11	9	7
North Middlesex University Hospital NHS Trust	1	1	1	1	1
North Tees and Hartlepool NHS Foundation Trust	2	2	0	0	0
North West London Hospitals NHS Trust	1	1	6	6	6
Northampton General Hospital NHS Trust	1	1	7	7	7
Northern Devon Healthcare NHS Trust	16	16	6	6	6
Northern Health & Social Care Trust	3	3	0	0	0
Northern Lincolnshire & Goole Hospitals NHS Foundation Trust	2	2	0	0	0
Northumbria Healthcare NHS Foundation Trust	8	7	5	3	1
Nottingham University Hospitals NHS Trust	2	2	7	7	7
Oxford University Hospitals NHS Trust	3	3	7	6	4
Pennine Acute Hospitals NHS Trust (The)	1	1	7	7	7
Peterborough & Stamford Hospitals NHS Foundation Trust	1	1	7	7	7
Plymouth Hospitals NHS Trust	1	1	7	7	7
Portsmouth Hospitals NHS Trust	1	1	7	4	3

Appendix 3 – Participation (continued)

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Ramsay Health Care UK	1	0	0	0	0
Royal Berkshire NHS Foundation Trust	1	1	6	6	6
Royal Bolton Hospital NHS Foundation Trust	1	1	6	2	4
Royal Bournemouth and Christchurch Hospitals NHS Trust	1	1	7	7	7
Royal Cornwall Hospitals NHS Trust	1	1	7	7	7
Royal Devon and Exeter NHS Foundation Trust	1	1	7	7	7
Royal Free London NHS Foundation Trust	3	1	7	7	7
Royal Liverpool & Broadgreen University Hospitals NHS Trust	1	1	7	7	7
Royal United Hospital Bath NHS Trust	1	1	7	7	7
Salford Royal Hospitals NHS Foundation Trust	1	1	2	2	2
Salisbury NHS FoundationTrust	1	1	7	7	7
Sheffield Teaching Hospitals NHS Foundation Trust	2	2	6	6	6
Sherwood Forest Hospitals NHS Foundation Trust	1	1	0	0	0
Shrewsbury and Telford Hospitals NHS Trust	1	1	7	7	7
South Devon Healthcare NHS Foundation Trust	1	1	5	5	5
South Tees Hospitals NHS Foundation Trust	2	2	5	5	5
South Warwickshire NHS Foundation Trust	3	3	1	1	1
Southampton University Hospitals NHS Trust	1	1	7	7	7
Southend University Hospital NHS Foundation Trust	1	0	7	1	0
Southern Health & Social Care Trust	4	1	7	7	7
Southport and Ormskirk Hospitals NHS Trust	2	2	4	4	4
Spire Healthcare	1	1	0	0	0
St George's Healthcare NHS Trust	2	1	7	5	5

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
States of Jersey Health & Social Services	1	1	3	3	3
Stockport NHS Foundation Trust	1	0	1	1	1
Surrey & Sussex Healthcare NHS Trust	1	1	0	0	0
Tameside Hospital NHS Foundation Trust	1	1	5	5	5
Taunton & Somerset NHS Foundation Trust	1	1	6	6	6
The Dudley Group NHS Foundation Trust	1	1	7	6	6
The Leeds Teaching Hospitals NHS Trust	1	1	7	7	7
The Princess Alexandra Hospital NHS Trust	3	1	5	5	5
The Queen Elizabeth Hospital King's Lynn NHS FoundationTrust	1	1	7	2	2
The Rotherham NHS Foundation Trust	1	1	0	0	0
The Walton Centre NHS Foundation Trust	1	1	0	0	0
United Lincolnshire Hospitals NHS Trust	1	1	7	7	6
Univ. Hospital of South Manchester NHS Foundation Trust	1	1	6	1	0
University College London Hospitals NHS Foundation Trust	1	1	3	3	3
University Hospital of North Staffordshire NHS Trust	1	1	7	4	3
University Hospitals Birmingham NHS Foundation Trust	1	1	7	7	7
University Hospitals Coventry and Warwickshire NHS Trust	2	2	7	7	7
University Hospitals of Bristol NHS Foundation Trust	1	1	7	6	6
University Hospitals of Leicester NHS Trust	2	2	11	11	11
University Hospitals of Morecambe Bay NHS Trust	2	2	7	7	7
Walsall Healthcare NHS Trust	1	1	3	3	3

Appendix 3 – Participation (continued)

Trust	*Number of hospitals participating	Number of organisational questionnaires received	Number of included cases	Number of clinical questionnaires returned or valid reason for non return	Number of case notes returned
Warrington & Halton Hospitals NHS Foundation Trust	1	1	7	6	0
West Hertfordshire Hospitals NHS Trust	2	2	7	5	4
West Suffolk NHS Foundation Trust	1	1	0	0	0
Western Health & Social Care Trust	4	4	6	3	3
Western Sussex Hospitals NHS Trust	2	2	8	8	8
Weston Area Health Trust	1	0	0	0	0
Wirral University Teaching Hospital NHS Foundation Trust	2	2	7	7	7
Worcestershire Acute Hospitals NHS Trust	1	1	7	5	6
Wrightington, Wigan & Leigh NHS Foundation Trust	1	1	6	5	6
Wye Valley NHS Trust	1	1	2	2	2
York Teaching Hospitals NHS Foundation Trust	4	4	7	7	7