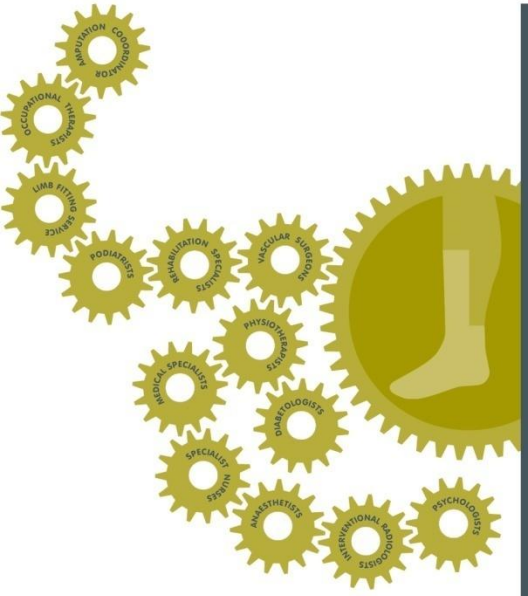
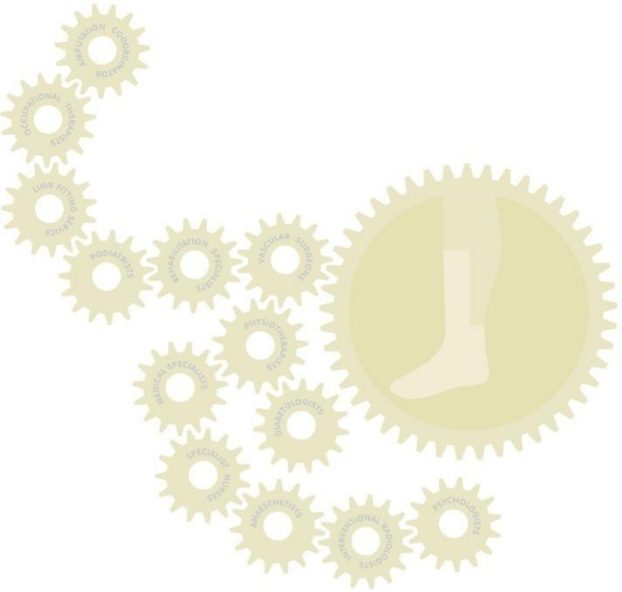


Lower Limb Amputation: Working Together

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

NCEPOD



Introduction

Introduction

- Peripheral arterial disease
  - Affects 20% adults in Europe and North America
  - In the UK 500-1000/million PAD, 1-2% require amputation
  - LLA 8-15% in people with diabetes with up to 70% dying <5 years of surgery
- Hospital inpatient data - 5,498 FCE (2009/10), & 530 deaths in England alone
- Previous reports indicate mortality is high reflecting age and comorbidites

Introduction

- Wide geographic variation in the number of amputations carried out
- Peri-operative cardiac complications are the leading cause of morbidity & mortality following surgery
- Previous guidelines
  - VSGBI
  - Diabetes UK
  - BACPAR

Aim

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

Objectives

- Pre-operative care
  - Access to multidisciplinary teams and a multiprofessional pathway of care
  - Pain management
  - Clinical care of the patient
  - Optimisation of comorbidities, 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 prophylaxis
  - Diabetes control
  - Anaesthetic care

Objectives

- Post operative care
  - Access to critical care
  - Diabetes control
  - Pain management
  - Wound care
  - Rehabilitation
- Organisational factors
  - Hub & spoke arrangements
  - Management of diabetic foot sepsis including multidisciplinary care
  - Access to surgery
  - Availability of rehabilitation and prosthetic services
  - Submission of data to the NVD (NVR)

Objectives

- Hospital participation
  - Organisational data
  - Clinical data
- Study population
  - 6 month data collection period
  - OPCS codes – amputation of leg or operations on amputation stump
  - ICD10 codes – diseases of the circulatory system or diabetes
- Case identification
  - Local reporters identified all cases
  - 7 cases per hospital/3 per clinician

Method

- Questionnaires
  - Organisational
  - Clinical
  - Advisor assessment form
  - Therapy assessment form
- Case notes
  - Medical notes from admission to discharge
  - MDT notes
  - Imaging reports
  - Consent forms
  - Operation notes (including anaesthetic records)
  - Nursing notes
  - Rehabilitation (including physiotherapy) notes
  - Drug charts

Data returns

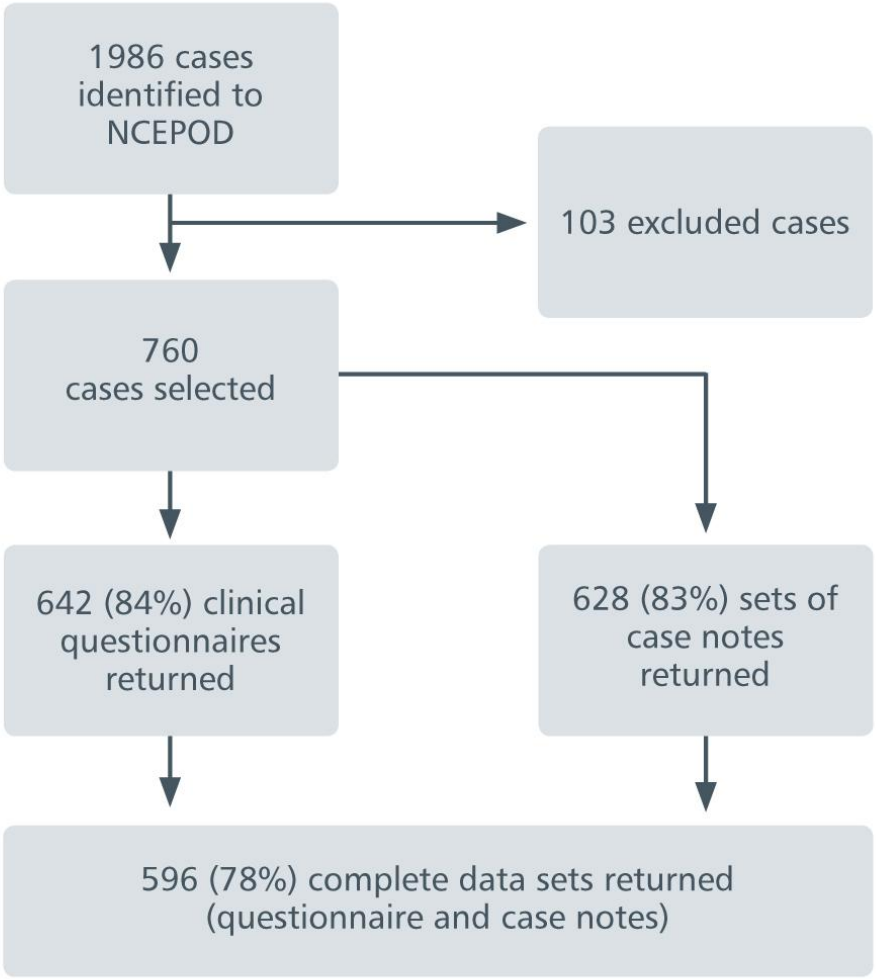


Figure 1.2 Data returns

Patient overview

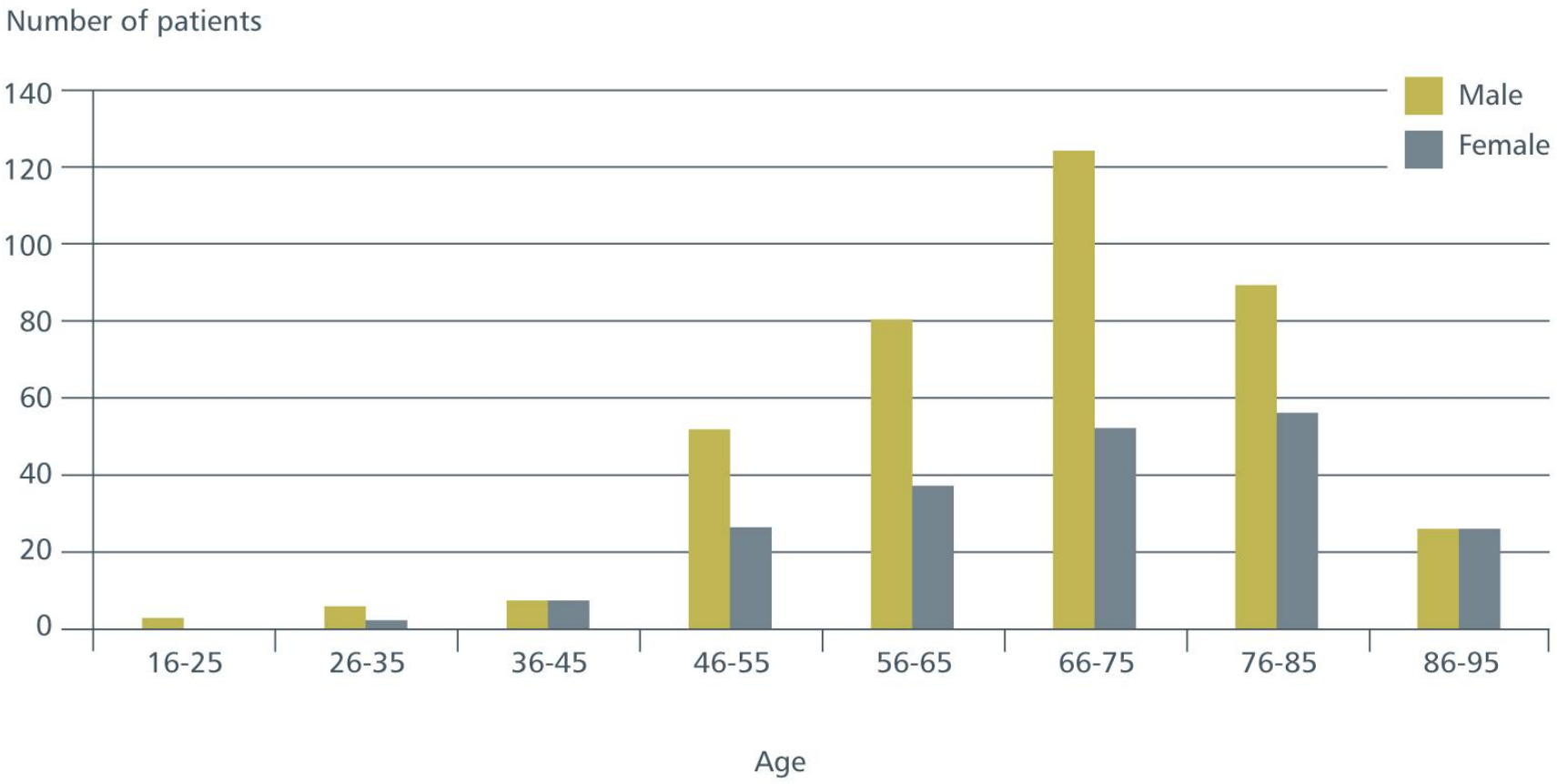


Figure 3.1 Age by gender *(Clinical questionnaire data)*

Reason for admission

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*

Admission category

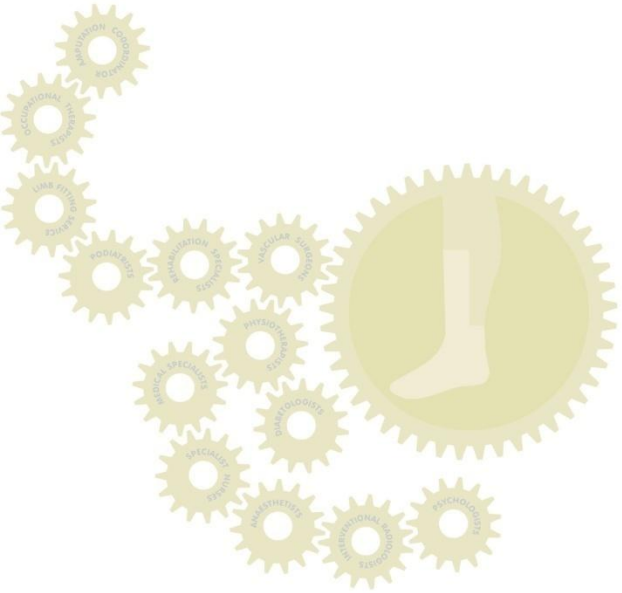
Table 3.3 Admission category *(Clinical questionnaire data)*

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

Organisation of care

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**



Pre-operative care

Pathway for admission

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**	

Admitting ward

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**	

First consultant review

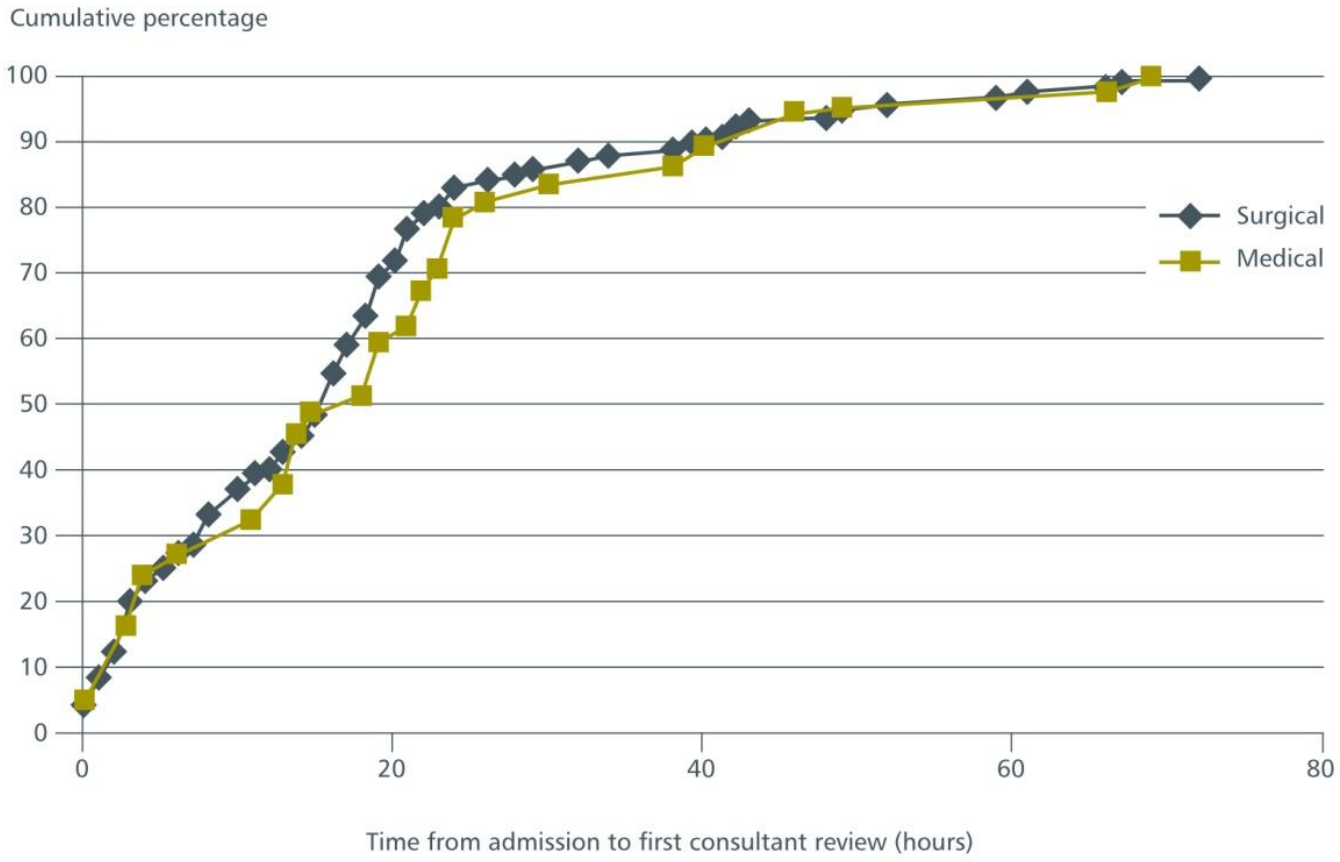


Figure 3.4 Time (hours) from admission to first consultant review by surgical/medical team
(Clinical questionnaire data and Advisors' opinion)

First consultant review

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**	

Co-morbidities

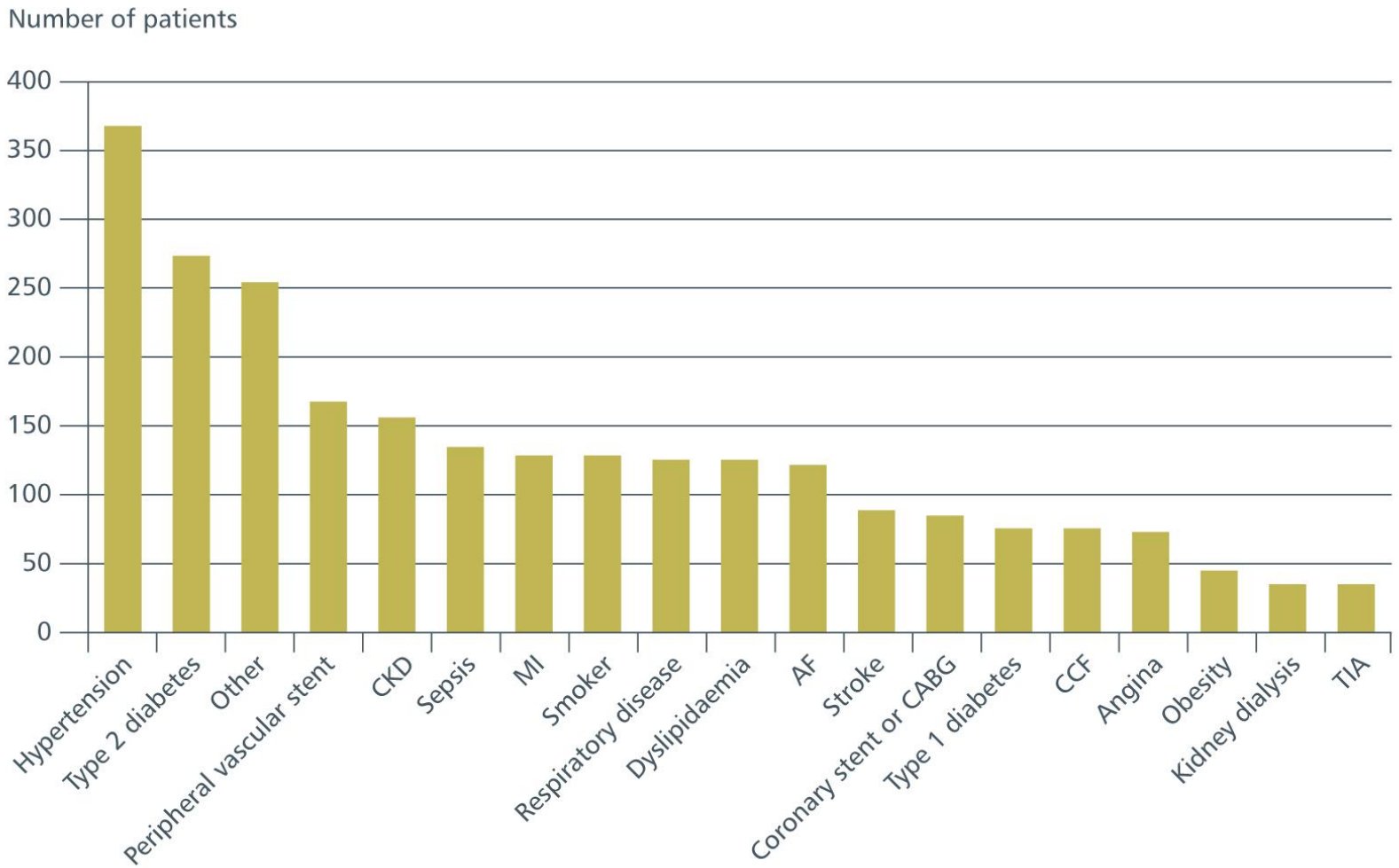


Figure 3.5 Co-morbidities on initial assessment
(Clinical questionnaire data)

Co-morbidities

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

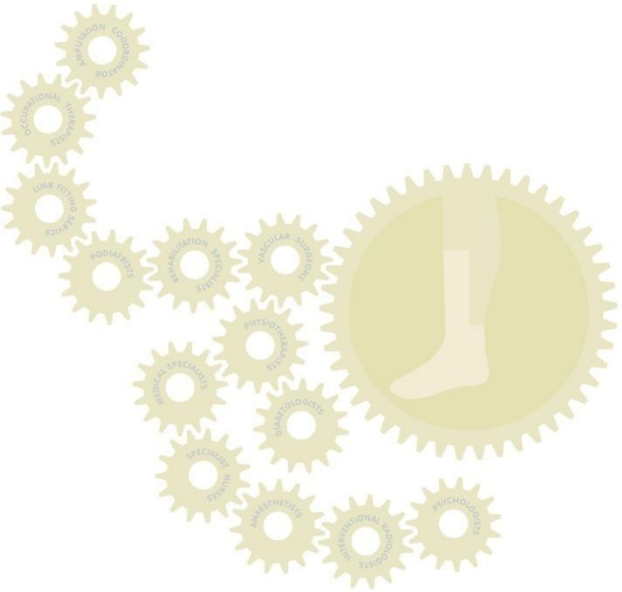
	n	%
Yes	147	32.2
No	310	67.8
Subtotal	**457**	
Unable to answer	54	
Not answered	18	
Total	**529**	

- In 123/138 patients an adequate attempt to control co-morbidities was made

Pre-operative medical review

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



Peri-operative care

Consultant vascular surgeon review

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**	

Consultant vascular surgeon review

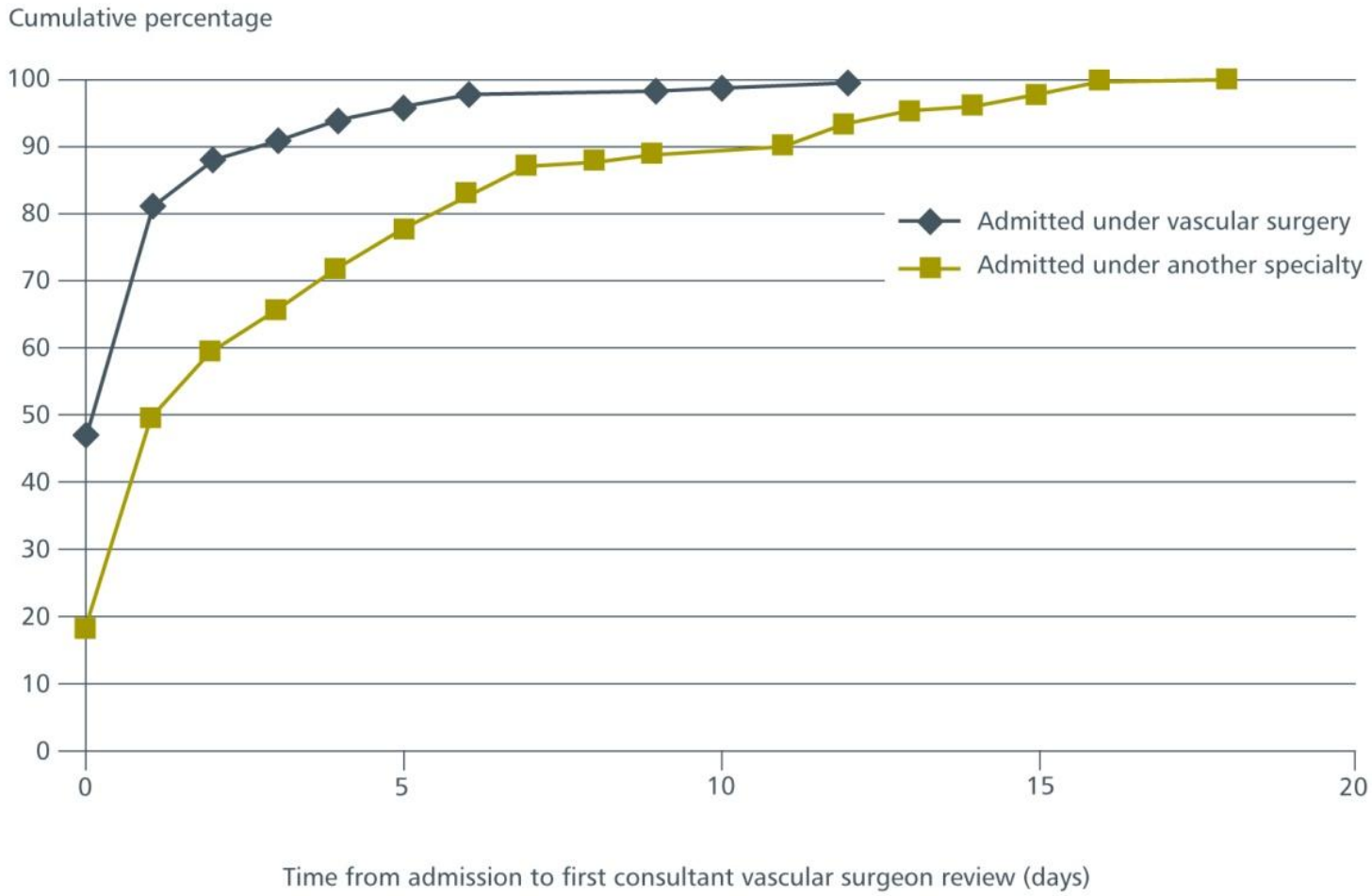


Figure 4.1 Time from admission to first consultant vascular surgeon review
(Clinical questionnaire data and Advisors' opinion)

Vascular surgeon review

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**	

1:4 emergency admissions not seen within 72h

Indication for amputation

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**	

Angiography and duplex ultrasound

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**

Inadequate assessment of limb

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**

Time from assessment to operation

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**	

Delay between assessment and surgery

Reasons delay between assessment and operation was not appropriate *(Advisors' opinion)*

	n
Patient decision	4
Operation cancelled	1
Delay without a clinical reason	9
Poor decision making	11
Waiting for imaging (angiography, CTA, MRA) or angioplasty	9
Delayed surgical decision to amputate	2
Delayed assessment by a vascular surgeon	9
Delayed transfer to a vascular bed	1
Delayed referral to a vascular surgeon	2
Non-availability of operating theatre	2
Sepsis	3
Total	**53**

Limb salvage prior to amputation

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**	

Advisors: appropriate in a further 22 (7.7%) patients

MDT

Table 2.13 Multidisciplinary team responsible for the care of amputees by hospital type *(Organisational data)*

	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**

58/140 (41%) had no MDT for amputees

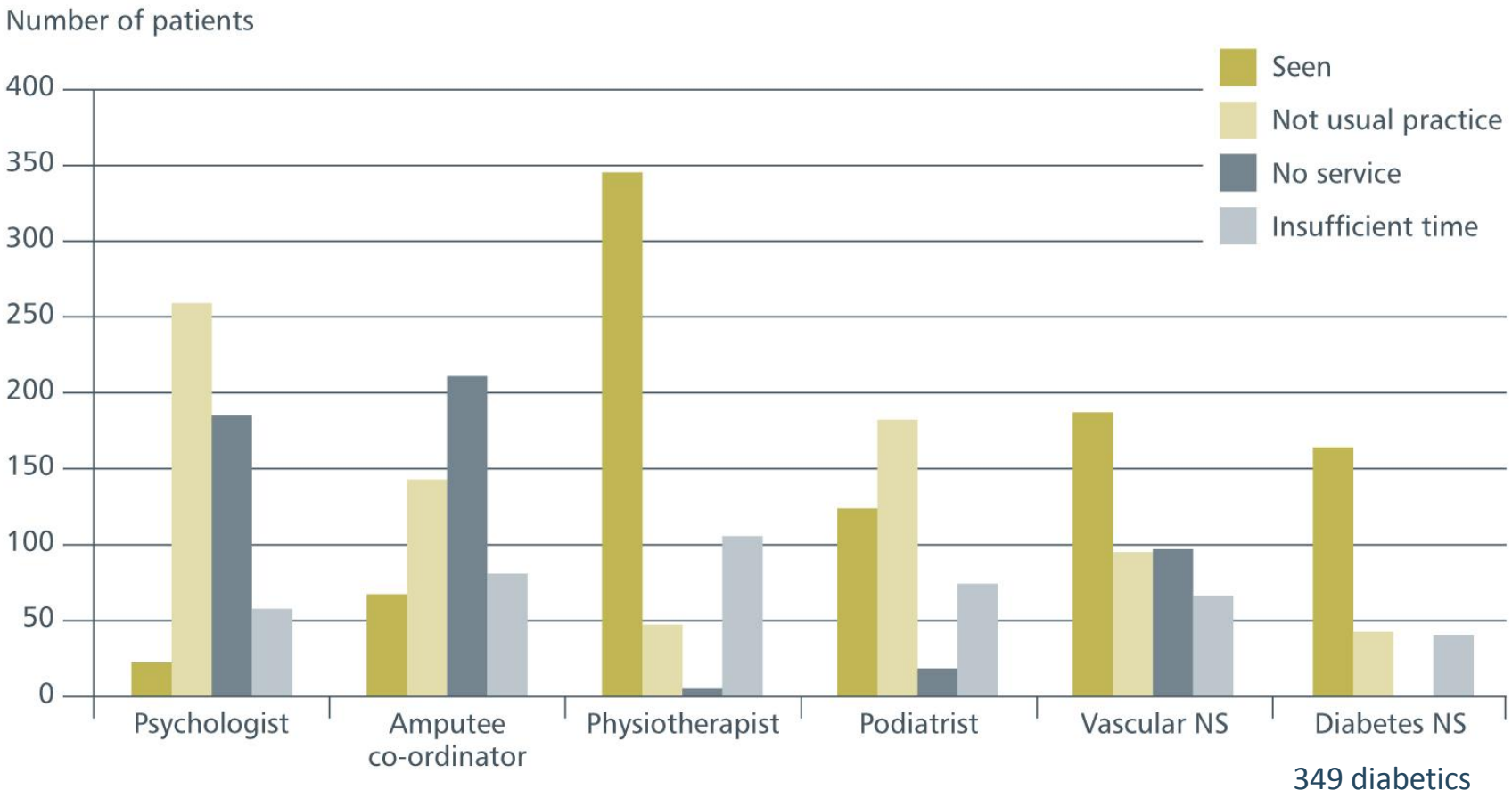
MDT discussion

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**

40% discussed: Centralisation should = dedicated MDT

Pre-operative support services



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

Potential impact on post-op recovery, rehab & discharge

Overall assessment of pre-operative care

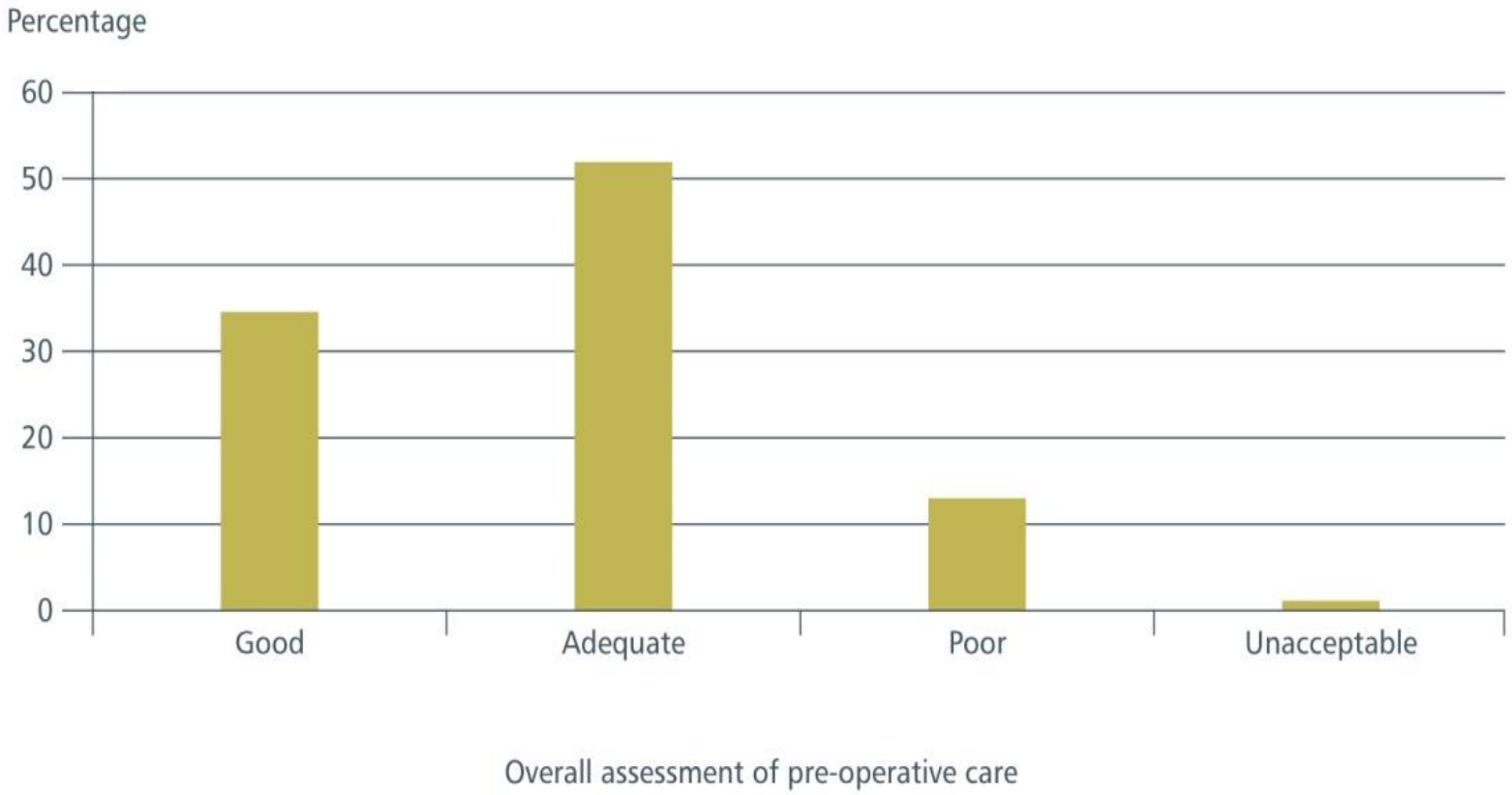


Figure 4.2 Overall assessment of the quality of pre-operative care *(Advisors' opinion)*

Overall assessment of pre-operative care

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	

Consent

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

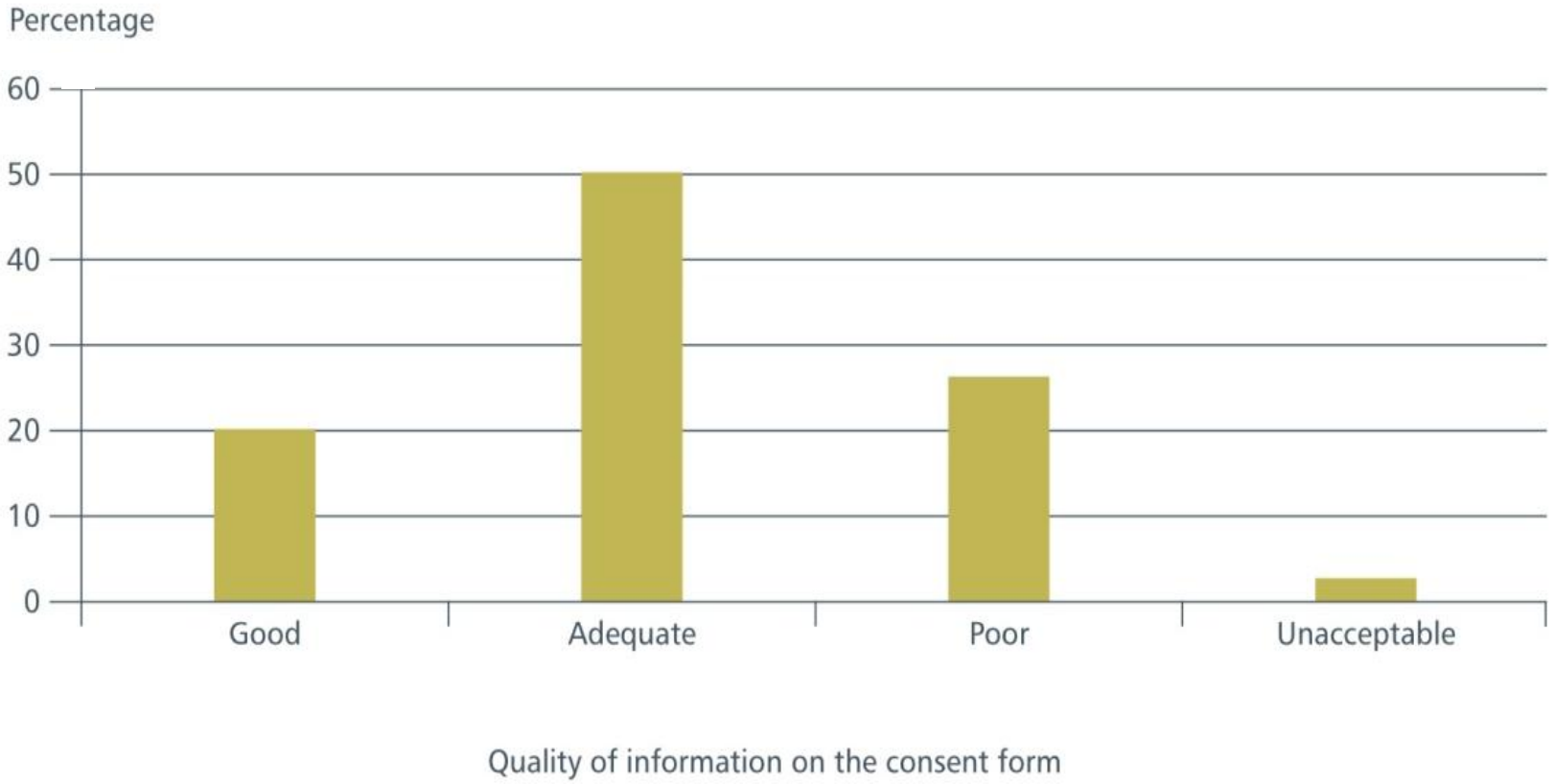


Figure 4.3 Quality of information on the consent form *(Advisors' opinion)*

Consent: Poor or unacceptable information

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**

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.

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.

Pre-operative investigations

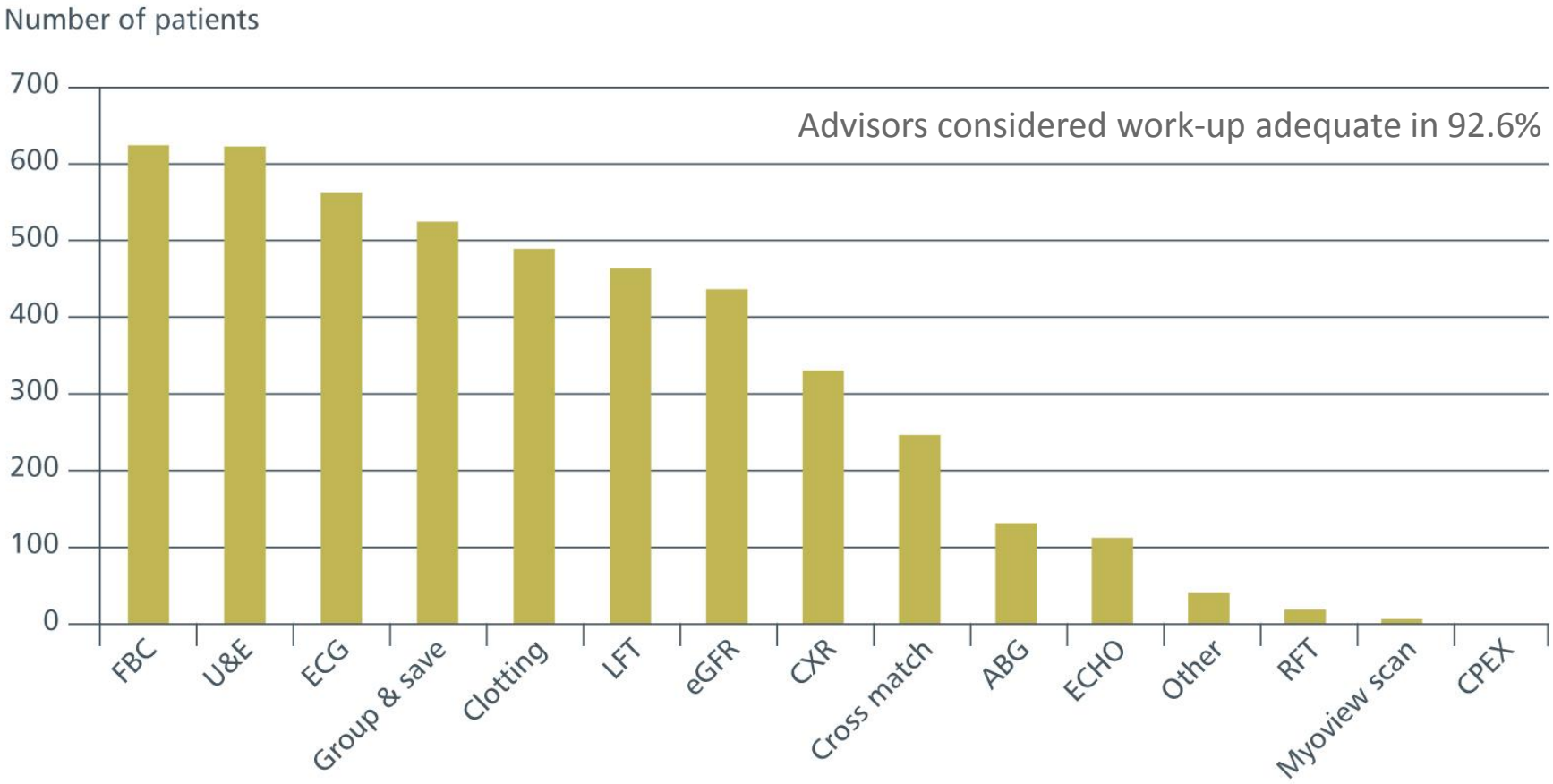


Figure 4.4 Pre-operative investigations for risk assessment *(Clinical questionnaire data)*

Prophylactic antibiotics

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**	

Organisational data: 131/137 (96%) had a protocol for prophylaxis

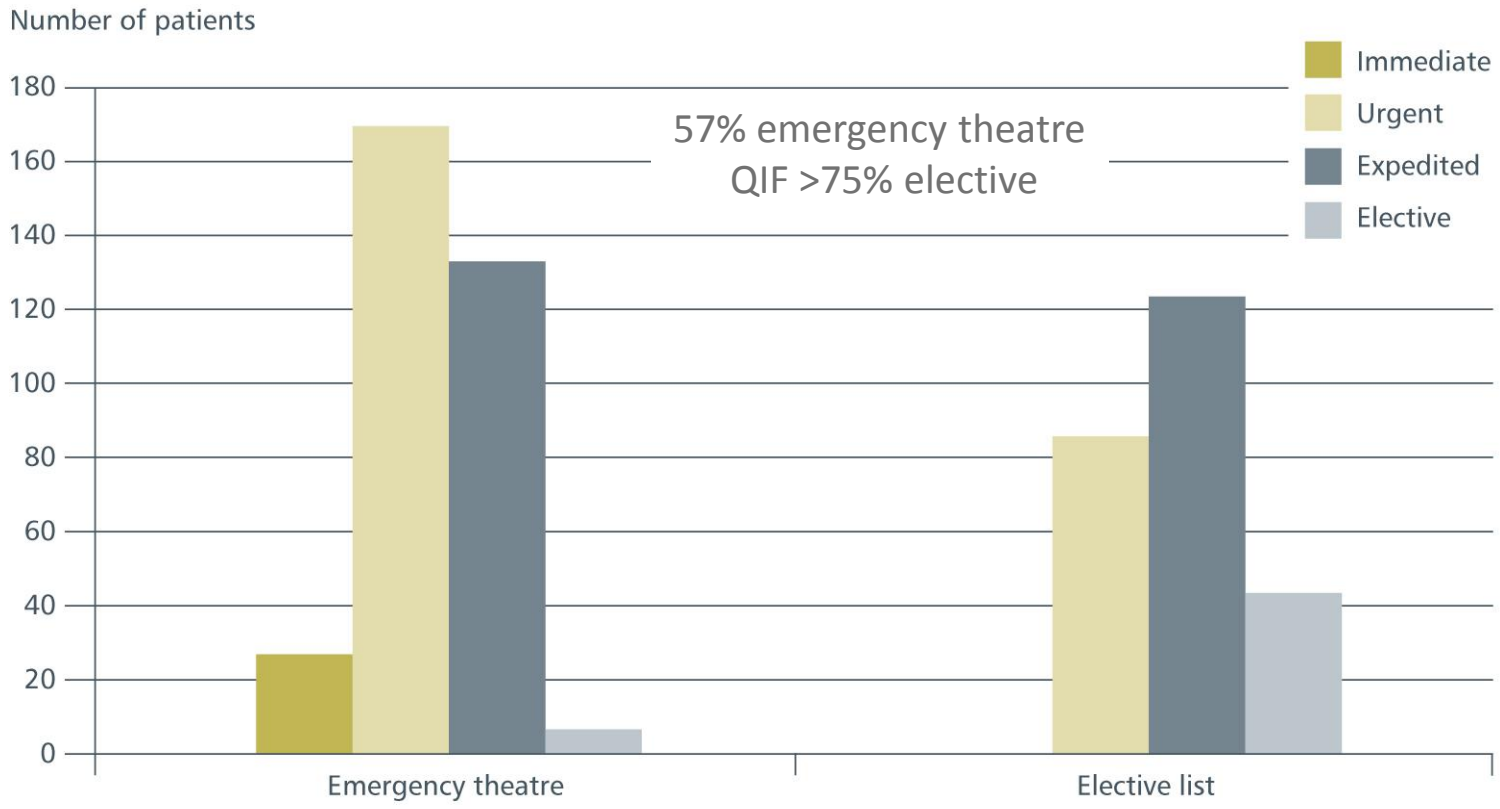
MRSA screening

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

85% screened: 96% units screen routinely (Organisational data)

Urgency of surgery and type of theatre



Urgency of surgery by type of operating theatre where surgery was performed

(Clinical questionnaire data)

Time to operation

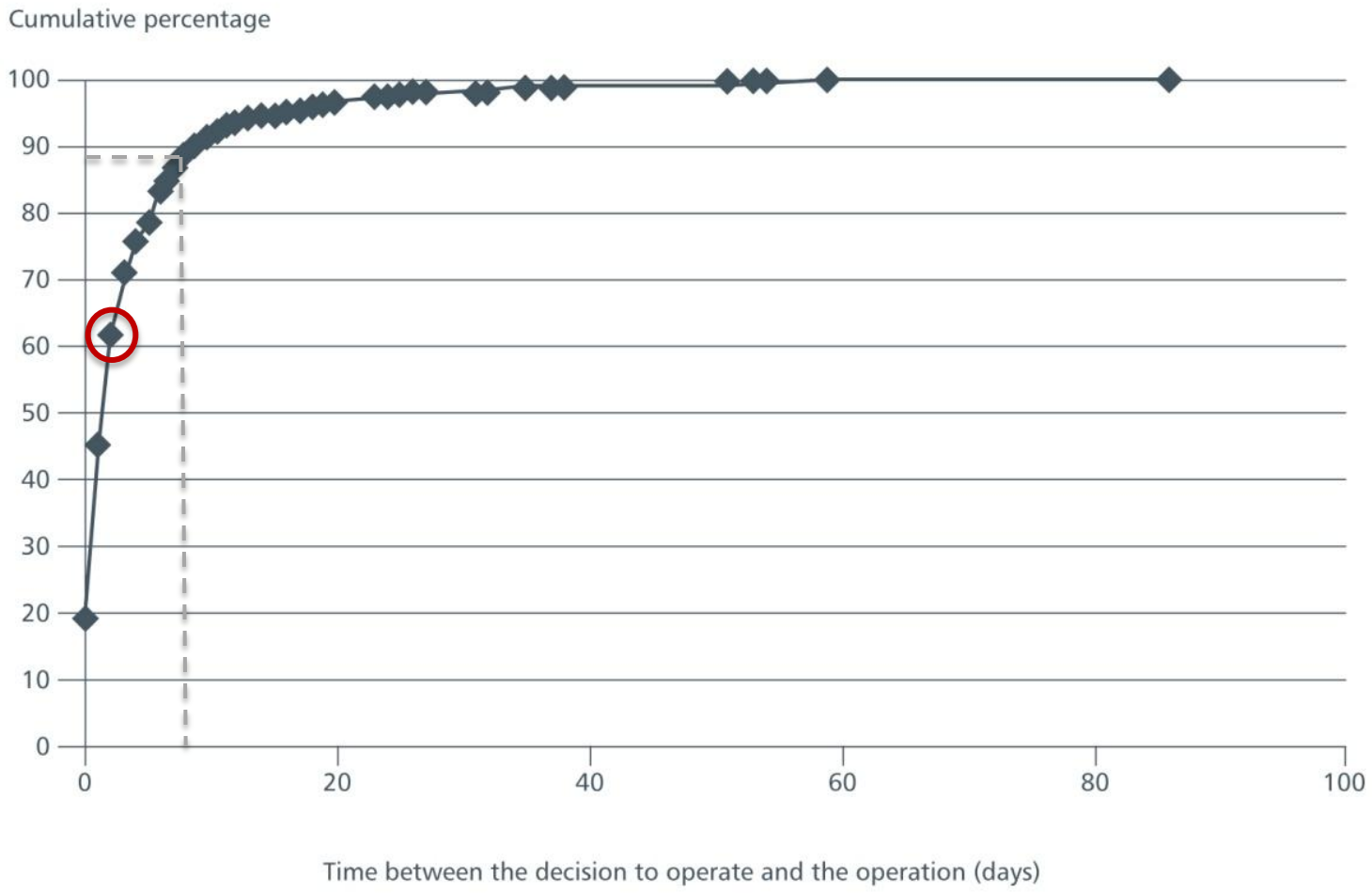


Figure 4.5 Time between the decision to operate and the operation (days)

Time to operation

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**	

Impact of the delay

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**

Duration of the delay

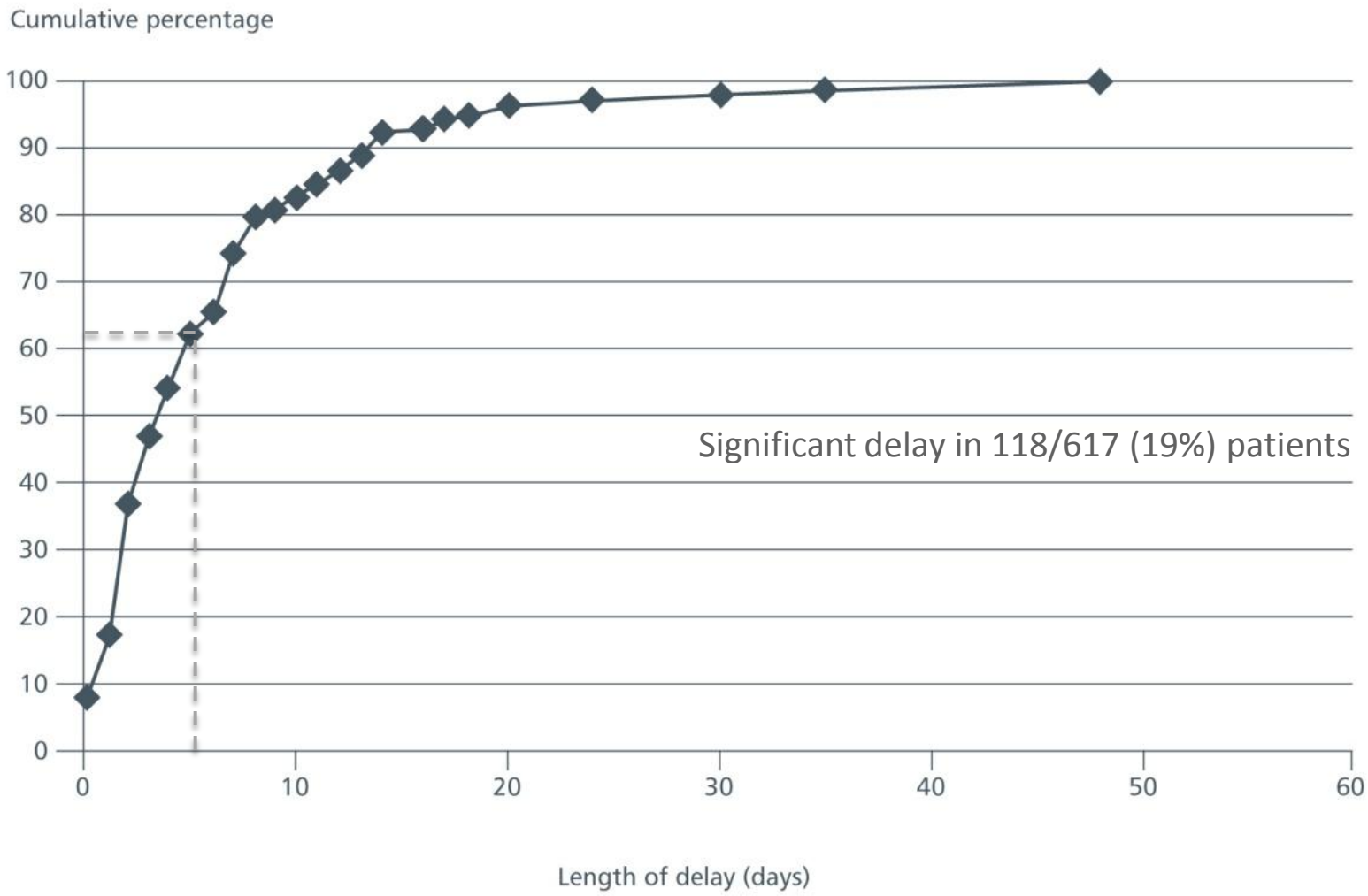
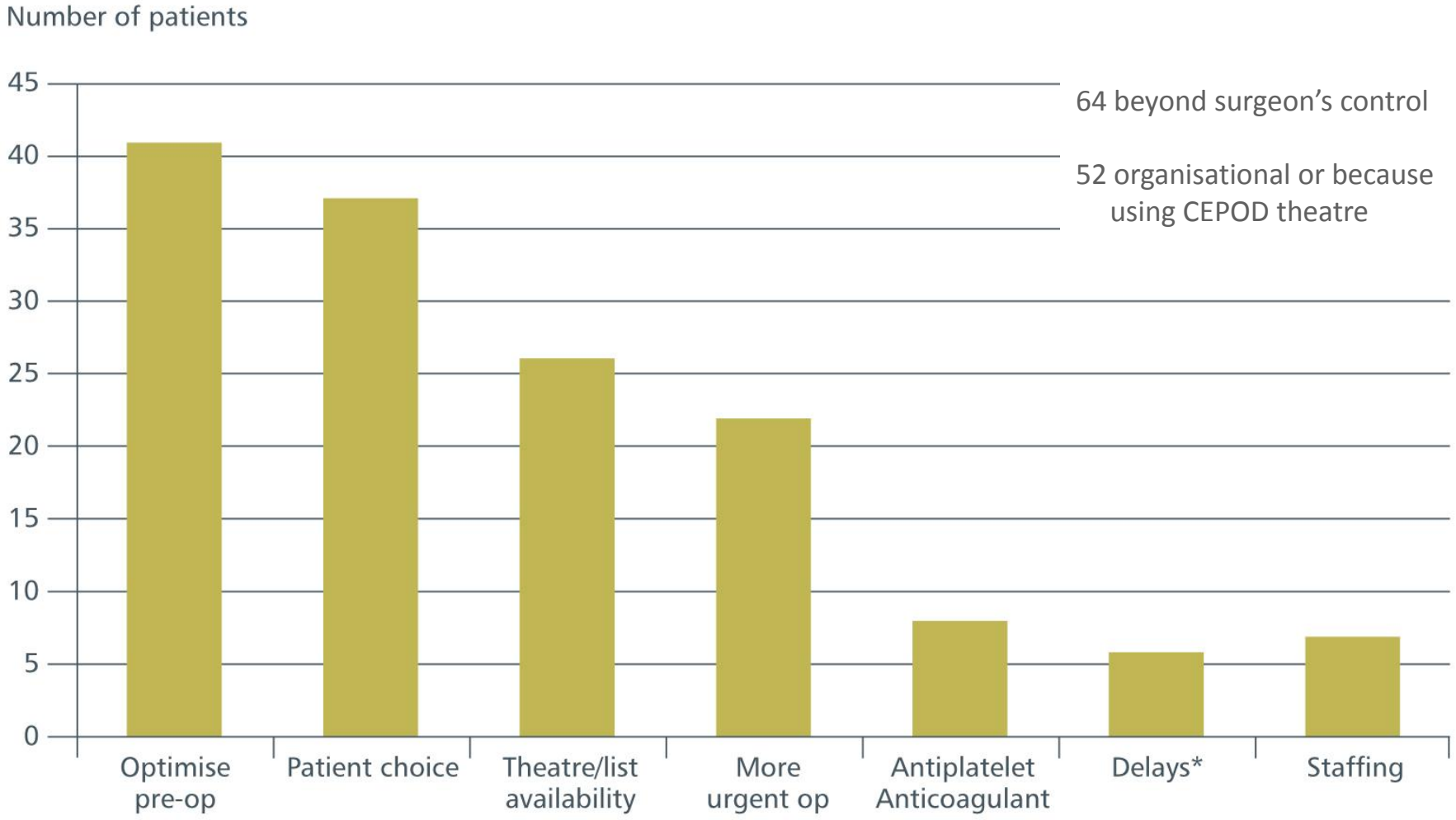


Figure 4.6 Duration of the delay in performing amputation *(Clinical questionnaire data)*

Reasons for delay in surgery



Reasons for delay in surgery *(Clinical questionnaire)*

Pre-operative anaesthetic review

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**

Pre-operative anaesthetic review

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**	

Surgery: consultant present for 85% cases

Anaesthetic care

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

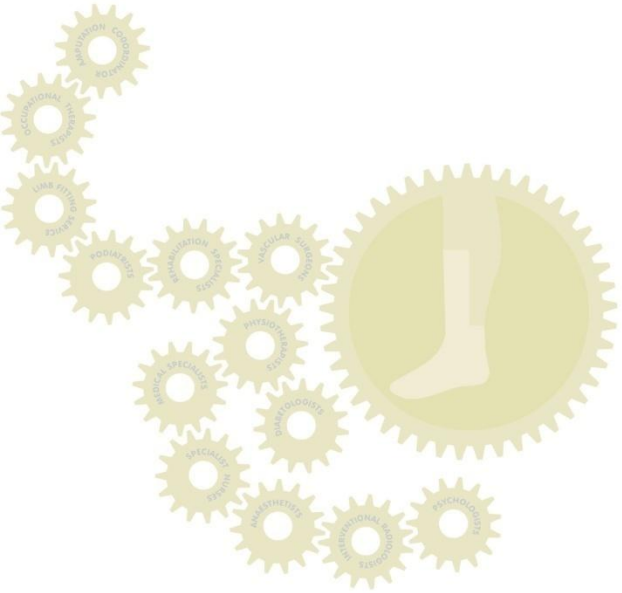
	n
Failure of documentation	20
Failure to undertake pre-op assessment	11
Seniority of clinician	3
Other	17
Subtotal	**51**
Not answered	4
Total	**55**

Methods of anaesthesia

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*



The operation

Type of amputation performed

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**		

Seniority of surgeon operating and in theatre

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**	

Grade of surgeon

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**	

48/533 patients booked & cancelled at least once

Appropriate procedure undertaken

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 5.3 Appropriate procedure undertaken

Reason for inappropriate 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**

Intra- and post operative monitoring

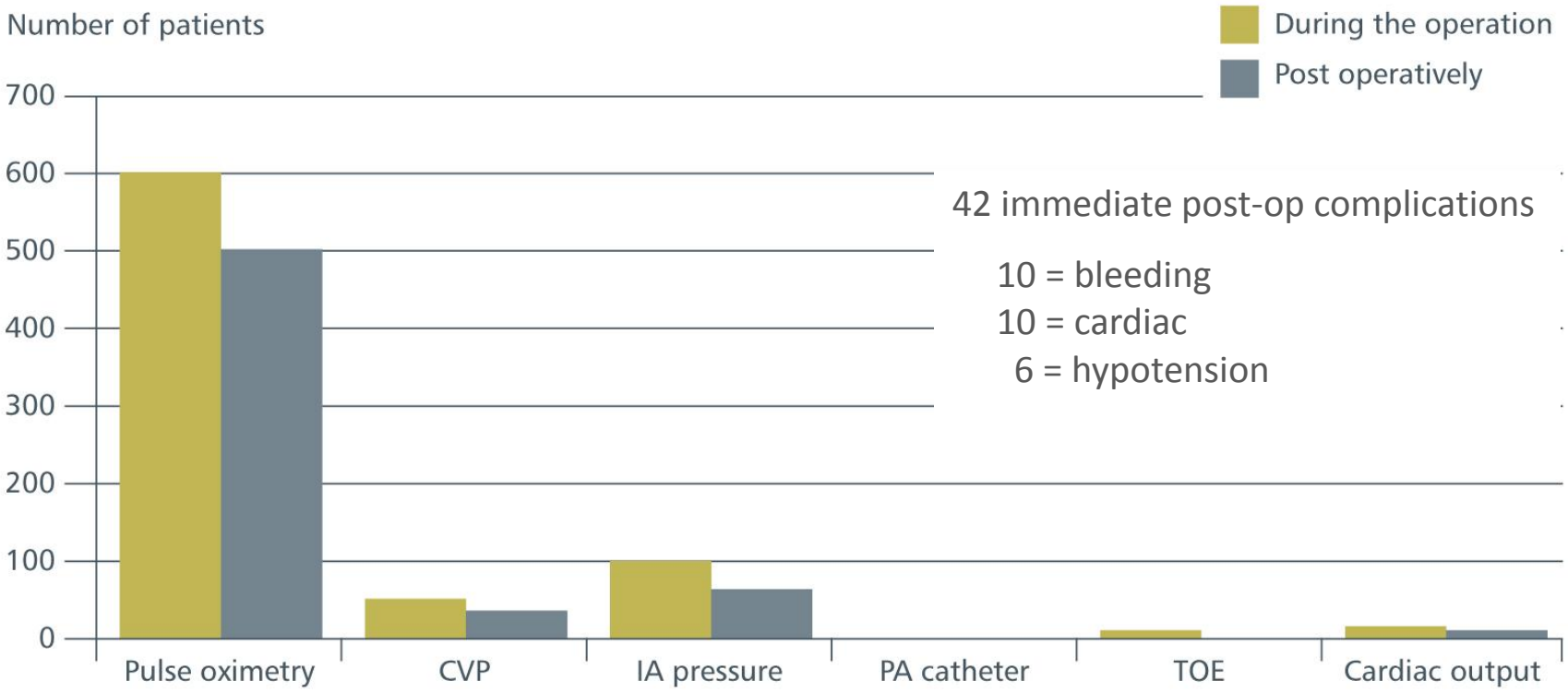
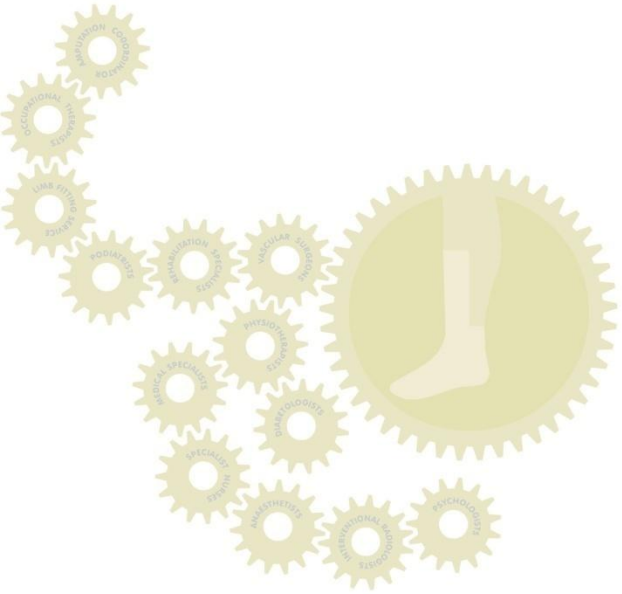


Figure 5.1 Intra- and post operative monitoring *(Clinical questionnaire data)*



Post operative surgical care

Post operative destination and outcome

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**

Escalation of care

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**	

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**	

2 delayed, 5 not transferred

Escalation of care

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**

Escalation of care

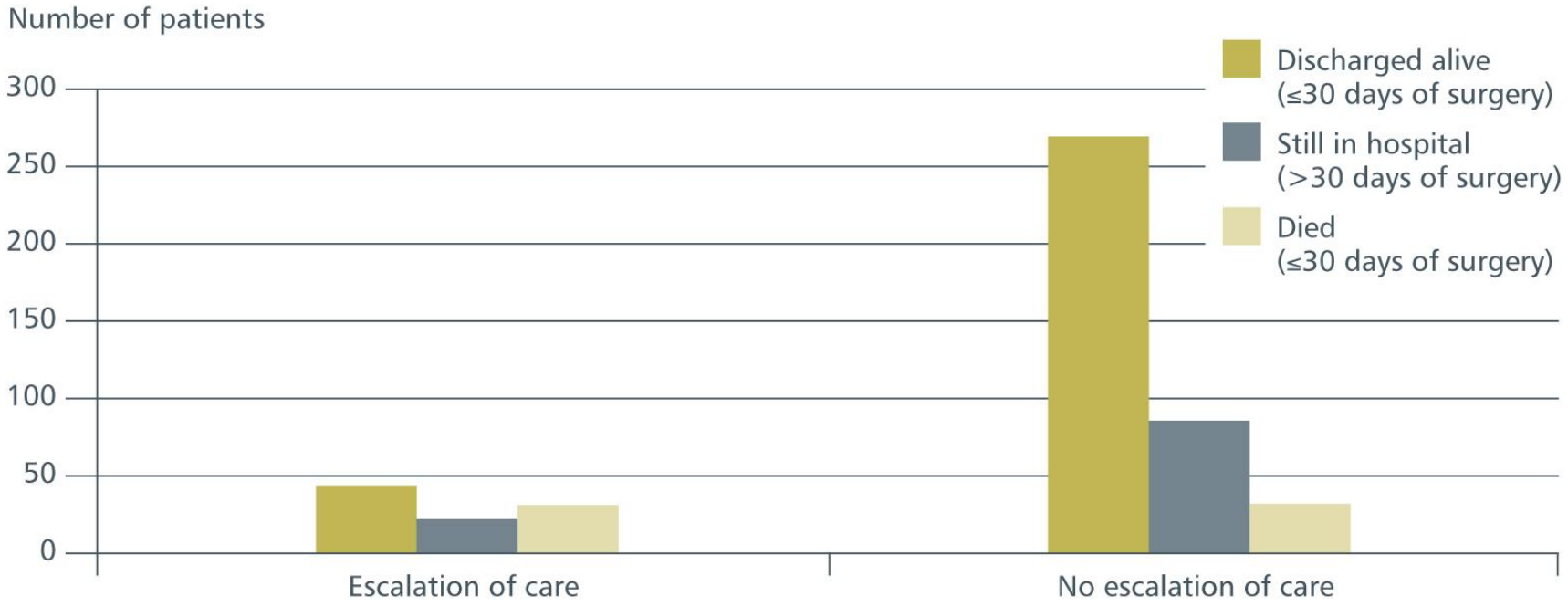


Figure 6.1 Patient outcome depending upon the need for a post operative escalation in care *(Advisors' opinion)*

Stump complications

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

164/437 (37%) had a complication

Stump complications

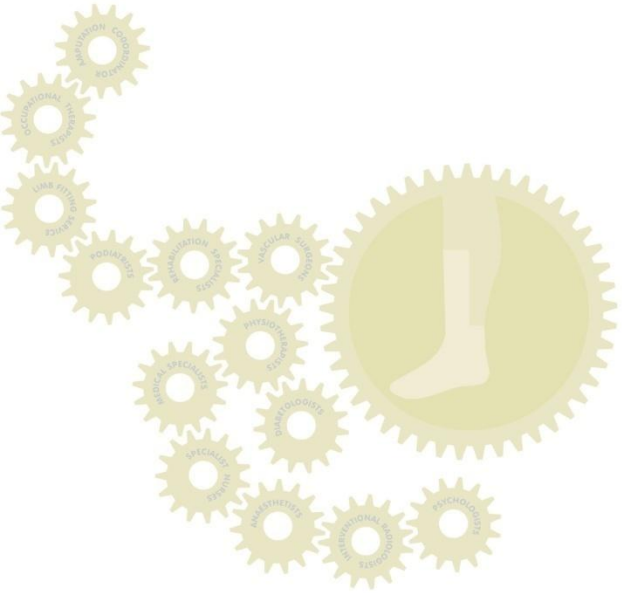
Table 6.7 Stump complications according to indication for surgery *(Clinical questionnaire data)*

	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**

Stump complications

Table 6.8 Frequency of stump complications by grade of primary surgeon

	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**



Post operative medical care

Post operative complications

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

Post operative complications

Frequent occurrence:

- 249/529 (47.1%) Advisor reviewed cases
- 290/628 (46.2%) Clinical questionnaire

- Medical twice as common as stump related complications

Post operative physician review

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**

- 319/529 (59.2%) patients reviewed by at least one non-surgical specialist (excludes microbiology)

Post operative physician review

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

No relationship between:

- Complications and physician review
- Kidney failure and renal medicine review
- Myocardial infarction/arrhythmia and cardiology review

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.

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.

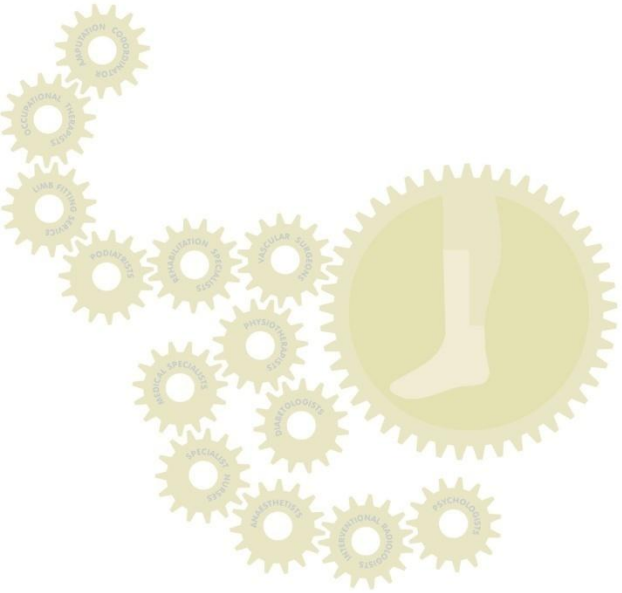
The Advisors felt that earlier referral to the medical team would have improved the care the patient received and resulted in a shorter length of stay.

Physician involvement

- Pre operative 39.7%
- Post operative 59.2%
- Whole pathway 66.1%

Recommendation:

Model of medical care that includes regular review by physician and surgeon throughout the in-patient stay.



Rehabilitation and discharge

Co-ordination of care

- Complex patients
- Mobility changes admission to discharge
- Planning and care co-ordination important

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**

Early planning of rehabilitation

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

Early planning of rehabilitation

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**	

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**	

Pre-operative discharge planning

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**

Named individual available

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**	

Rehabilitation

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**

- 91/409 (22.2%) cases additional review appropriate

Most common omissions:

- Psychology 38
- Amputee rehabilitation 33
- Foot care team 21

Post-operative physiotherapy

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**	

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**	

Physiotherapy

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**	

- 78/126 (62.4%) not suitable for early walking aids
- 36 cases where use delayed inappropriately

Falls risk assessment

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*

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**	

Falls

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 (Advisors):

- Eleven stump complications – 3 required further surgery
- One fracture

Prosthetic services

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**

- 124/169 hospitals formal arrangements for referral to prosthetics
- When prosthetics not available on site average distance 21 miles (<1– 100)
- Referral generally by combination of medical staff and physiotherapists

Prosthetics

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**	

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.

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.

Overall quality of rehabilitation

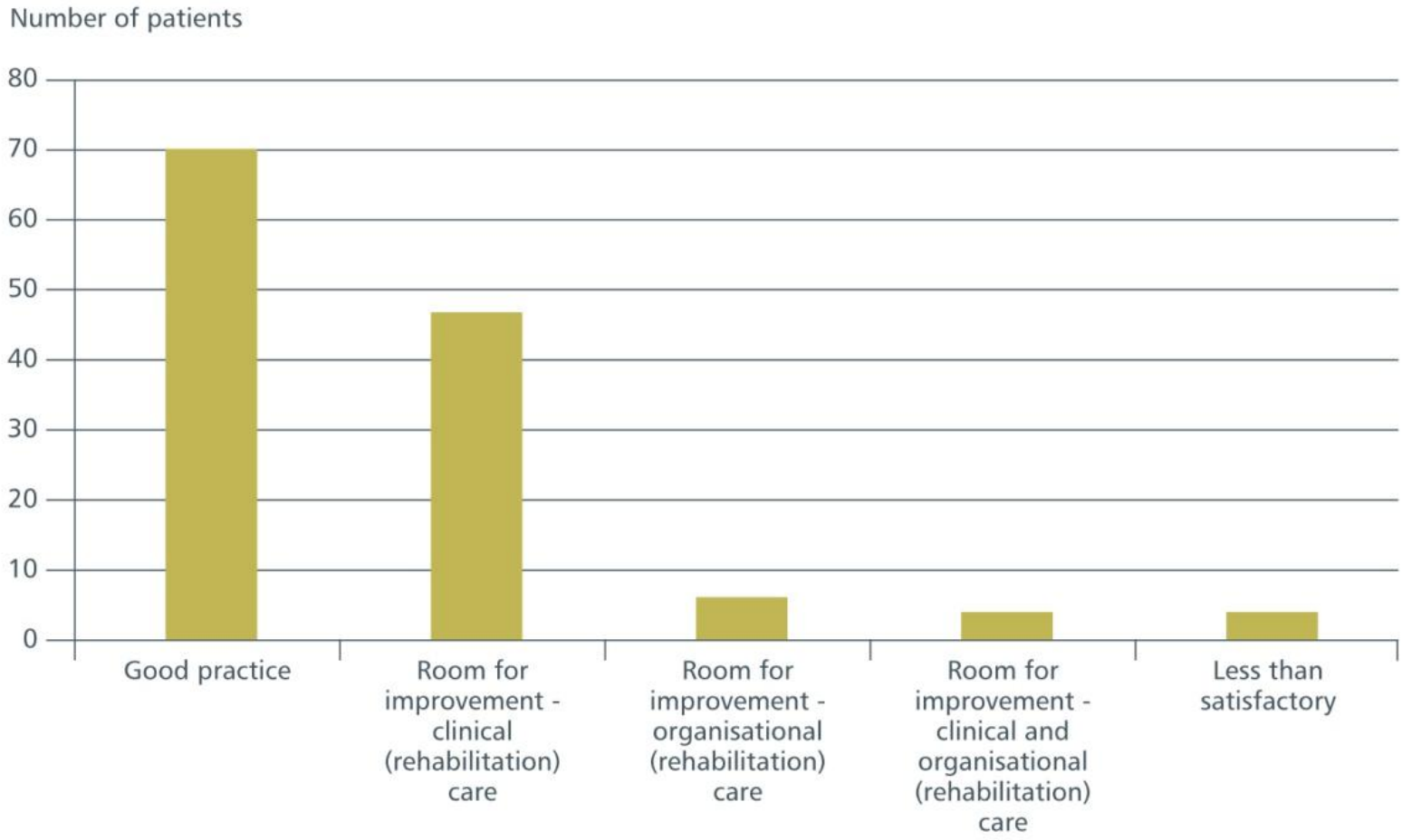


Figure 8.1 The overall quality of rehabilitation care *(Advisors' opinion)*

Discharge planning

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**

Discharge planning

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**	

Care beyond the acute hospital

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 2.24 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**	

Discharge from hospital

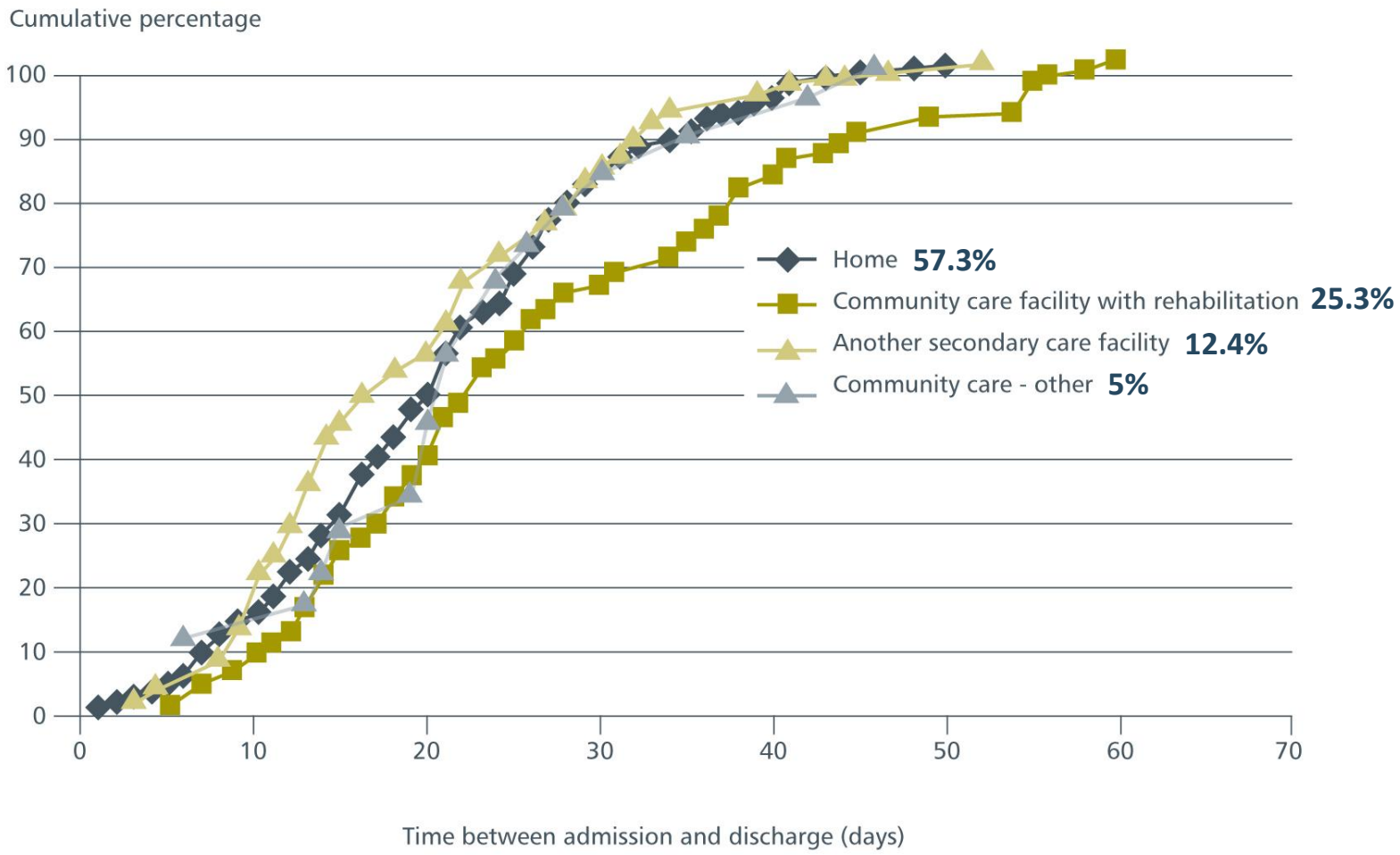


Figure 8.2 Length of stay and discharge destination *(Clinical questionnaire data)*

Delayed discharge

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**	

Delayed discharge

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*

- Overall 75 cases of delay for non-medical reasons

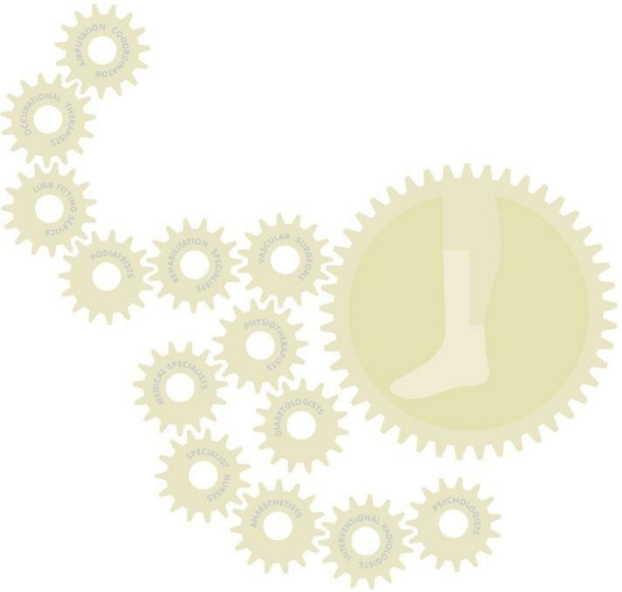
Case study 7

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.

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.



Diabetes care

Diabetes care

- 349/628 patients diabetes (55.6%)
- Age 68 (no diabetes, 71)

- “Complex” diabetes
  - 75/349 (21.5%) type 1 diabetes
  - Population 10% type 1 diabetes

  - 183/313 (58.5%) on insulin
  - Population 40% diabetic patients on insulin

Pre-operative review

- 73/132 (55.3%) hospitals performing amputations, policy of routine review by diabetes specialist nurse (DNS)
- 160/274 (58.4%) pre-op review by DNS
- 123/217 (56.7%) peer reviewed cases advice given by diabetes team on blood sugar control

Insulin use and DNS review

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

Advisors' view

- All patients would benefit from DNS review pre-op
- Review by diabetologist would potentially improve care and optimise co-morbidity

- Only 31 cases (9%) had surgery on day of admission

Insulin infusions - hypoglycaemia

- 173/278 (62.2%) patients received insulin infusion

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**	

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**

Insulin infusions - management

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**	

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**

Glycaemic control

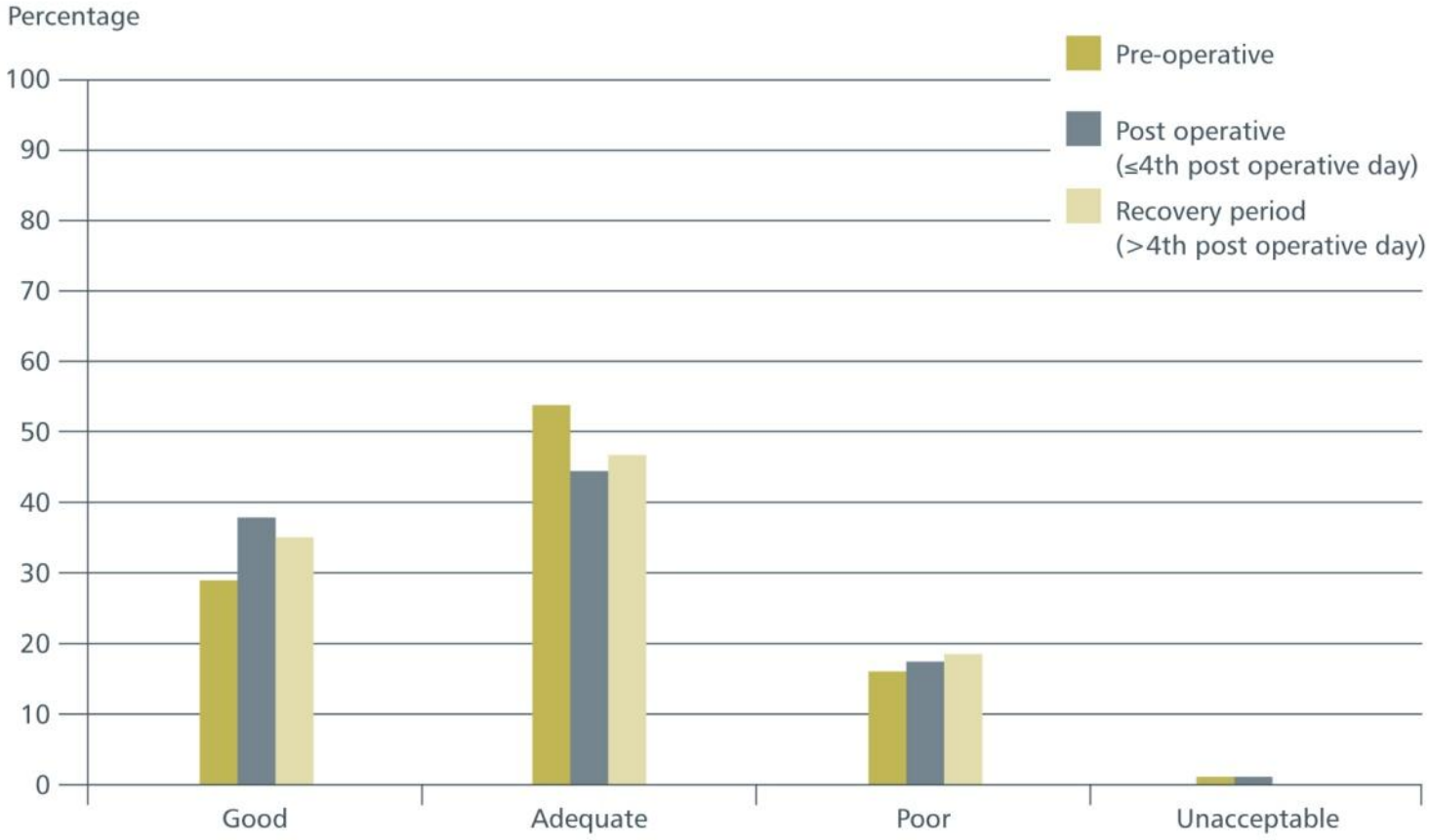


Figure 9.1 Overall rating of glycaemic control *(Advisors' opinion)*

- Poor or unacceptable at some point in pathway in at least 26.7% of cases

Diabetes treatments

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*

Diabetes prescribing

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

Diabetes prescribing

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

Outcomes and diabetes

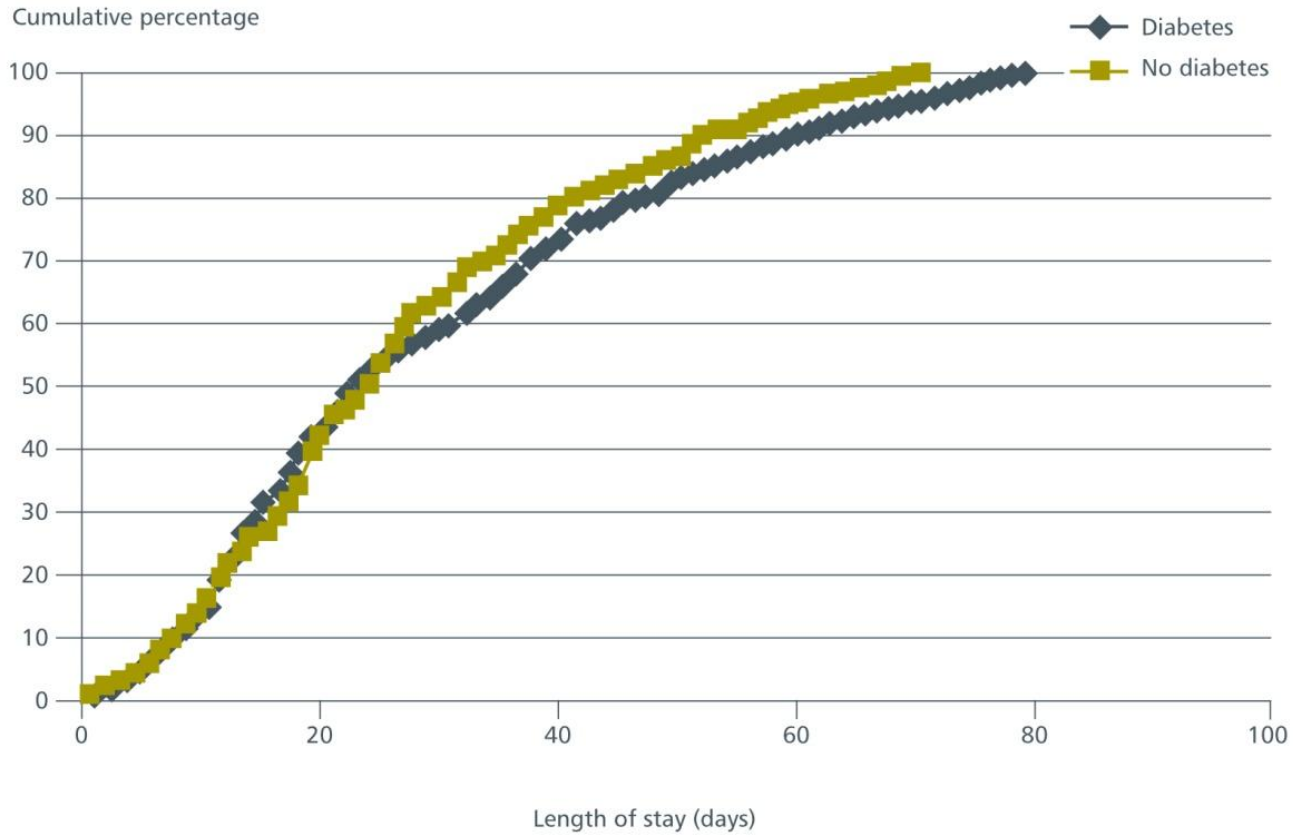


Figure 9.2 Length of stay (in patients discharged alive) by the presence of diabetes
(Clinical questionnaire data)

Complications:
(Clinical Questionnaire)
No differences:

- Individual complications
- Infections
- Cardiovascular

30 day mortality:

- Diabetes 11.6%
- No diabetes 13.3%

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.

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.

Diabetes care

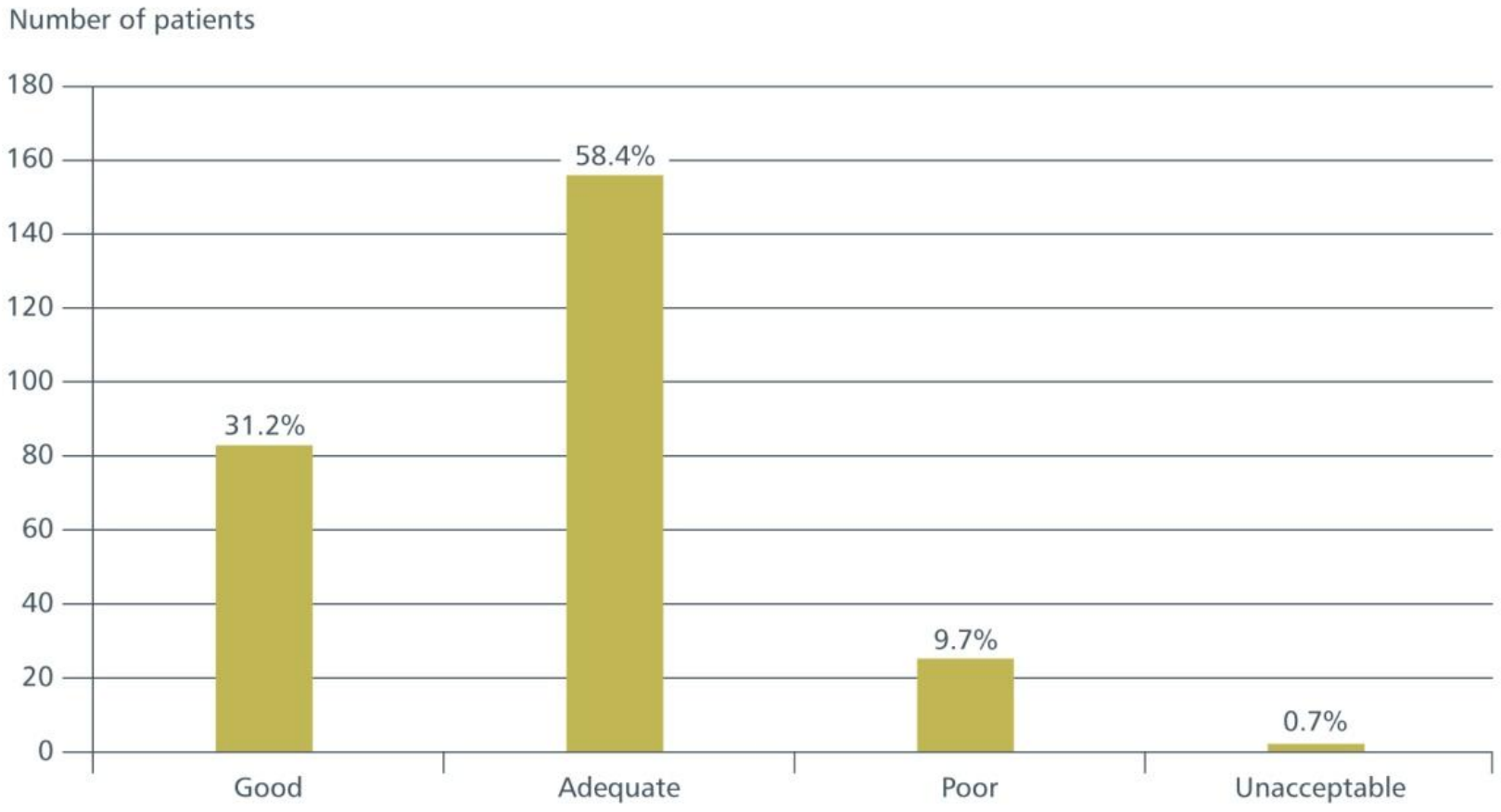
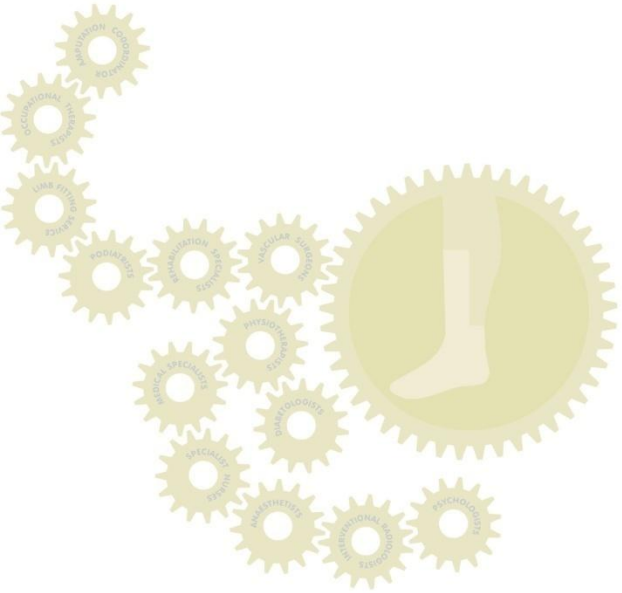
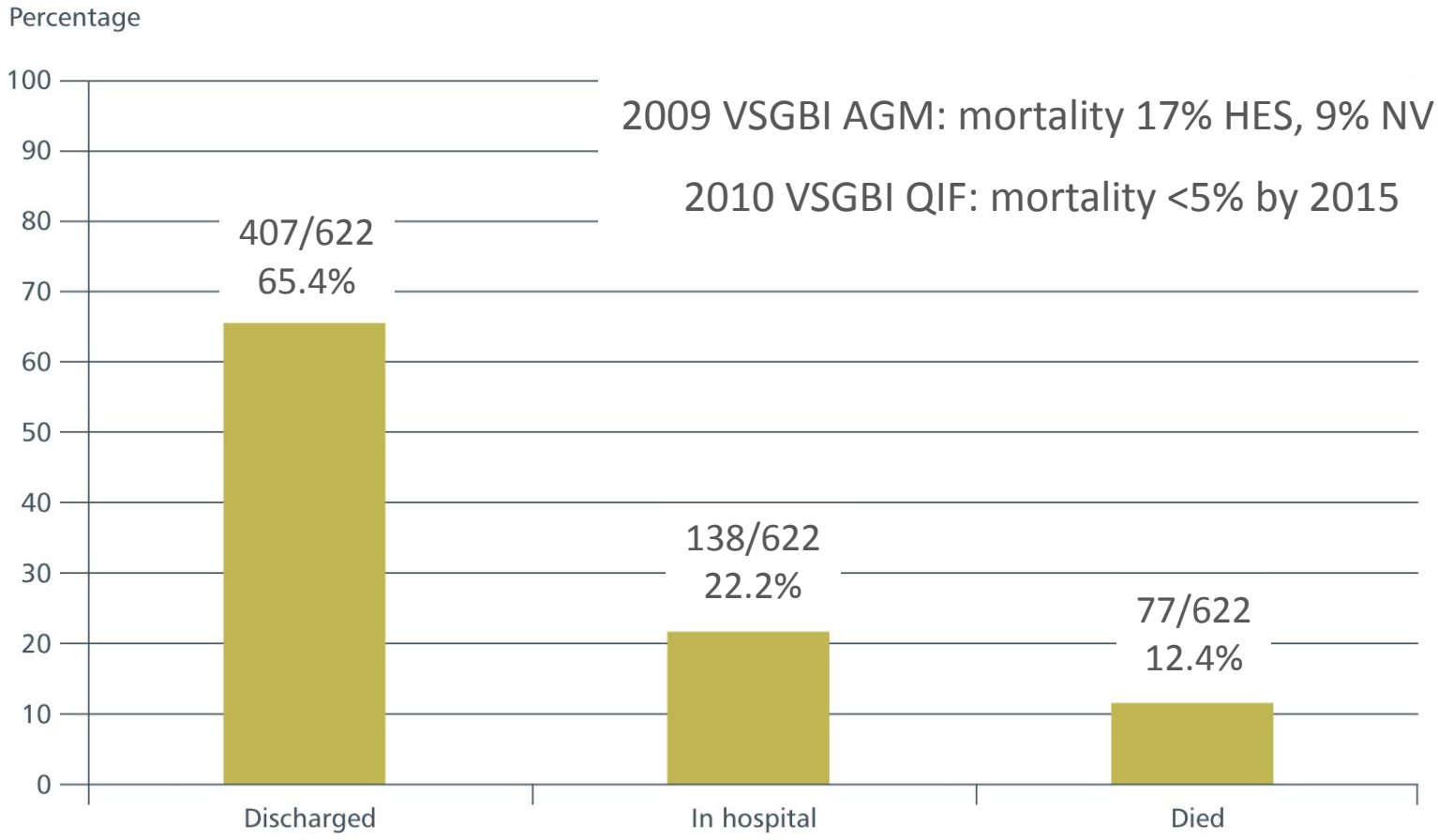


Figure 9.4 Rating of overall diabetes care *(Advisors' opinion)*



Outcomes

Outcomes at 30 days

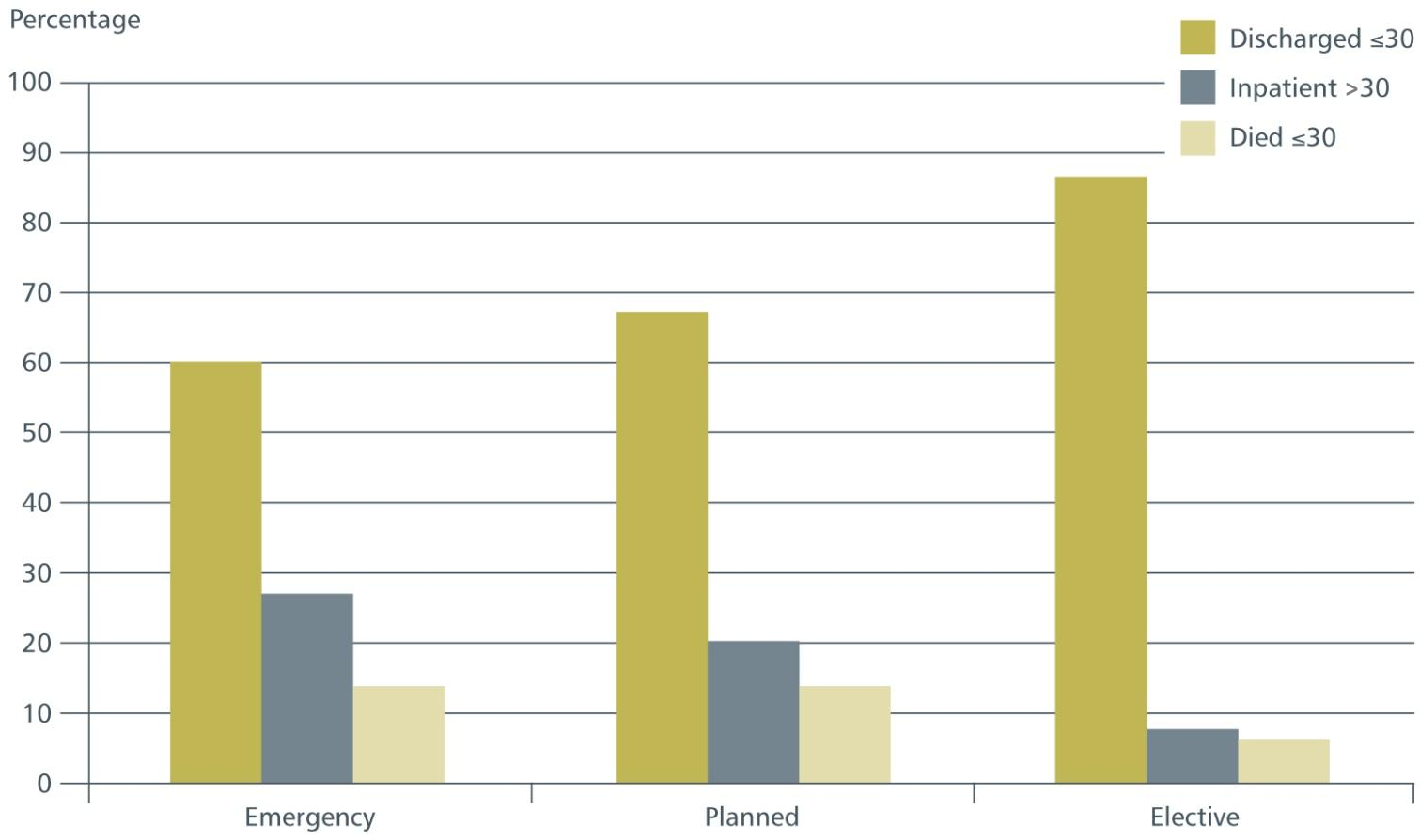


2009 VSGBI AGM: mortality 17% HES, 9% NVD

2010 VSGBI QIF: mortality <5% by 2015

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

Outcome by mode of admission



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

Morbidity & mortality meetings

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**	

VSGBI QIF
Pre-operative aspects of care

Implemented	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

VSGBI QIF
Pre-operative aspects of care

Implemented	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
Not implemented	Pain should be controlled, and the pain team involved if needed
	Patients should be assessed and managed by specialist MDT
	A named individual (identified pre-op) should be responsible for each patient (co-ordinate care, rehab 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

VSGBI QIF
Peri-operative aspects of care

Implemented	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

VSGBI QIF
Peri-operative aspects of care

Implemented	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
Not implemented	Operation should be undertaken on a planned operating list in 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)
	Aim to undertake below knee amputation (BKA) wherever appropriate and have below knee: above knee ratio > 1

VSGBI QIF
Post-operative aspects of care

Implemented	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)

VSGBI QIF
Post-operative aspects of care

Implemented	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)
Not implemented	There should be a formal pain management protocol, and access to an acute pain team
	There should be prompt access to a local amputee rehab 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 rehabilitation team (prosthetics)
	Optimal medical management and health education should be completed before discharge

Overall assessment of care

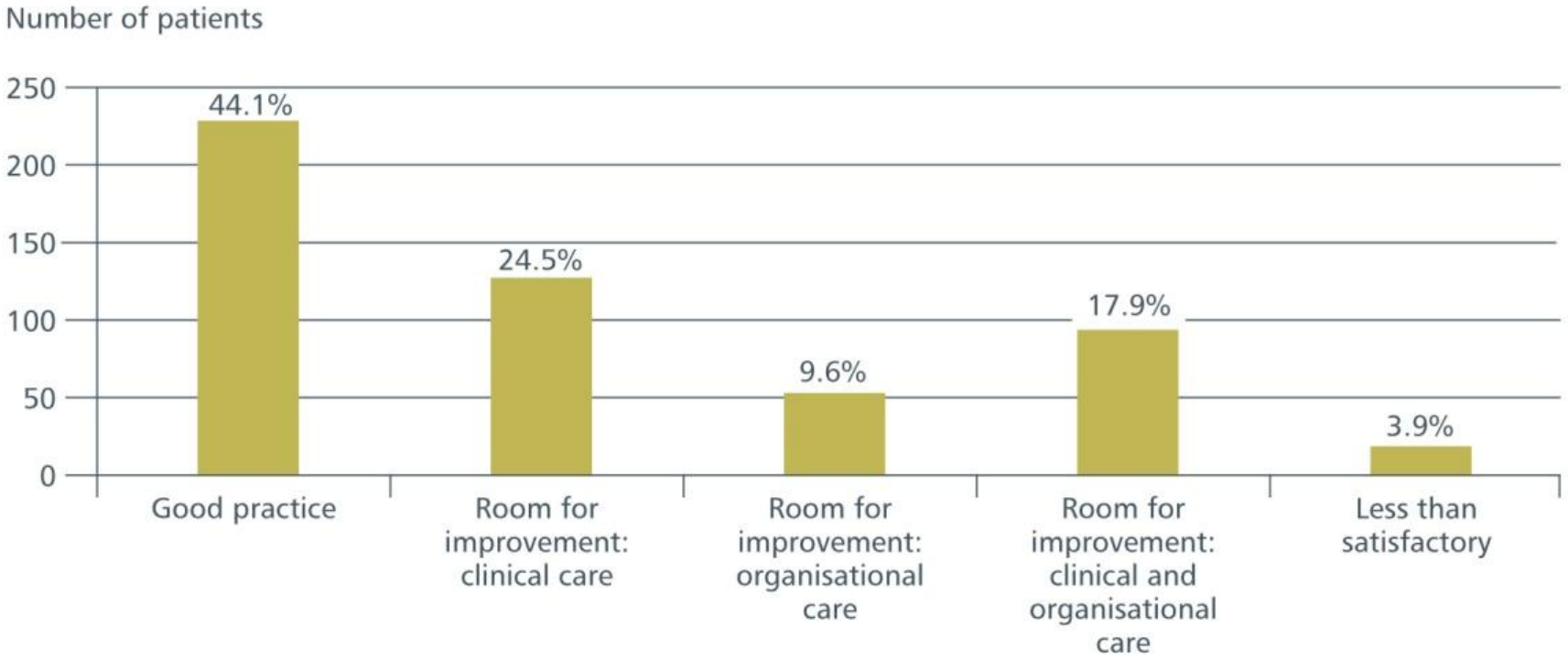


Figure 11.1 Overall assessment of care *(Advisors' opinion)*

Principal recommendations

Best practice clinical care pathway to support QIF

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.

Principal recommendations

Diabetics should be reviewed by specialist diabetes team both pre- and post-operatively

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.

Principal recommendations

Vascular review within 24 hours if admitted under another specialty

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.

Principal recommendations

Commence planning for rehabilitation and discharge as early as possible

For patients undergoing major limb amputation, planning for rehabilitation and subsequent discharge should commence as soon as the requirement for amputation is identified.

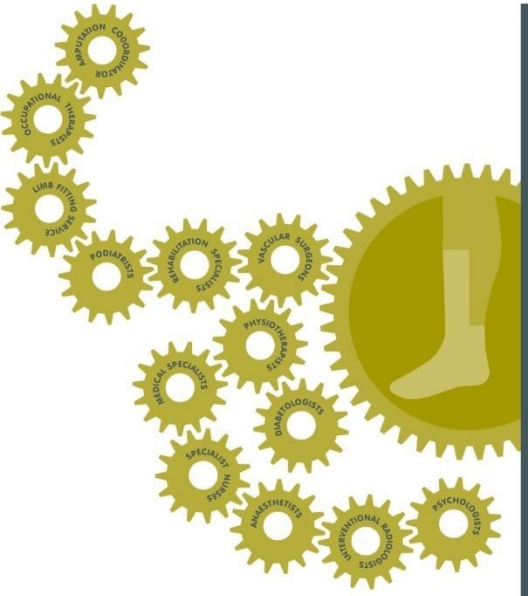
All patients should have access to a suitably qualified amputation/discharge co-ordinator.

Principal recommendations

Surgery on planned operating lists within 48 hours

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.



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

www.ncepod.org.uk
@ncepod

NCEPOD