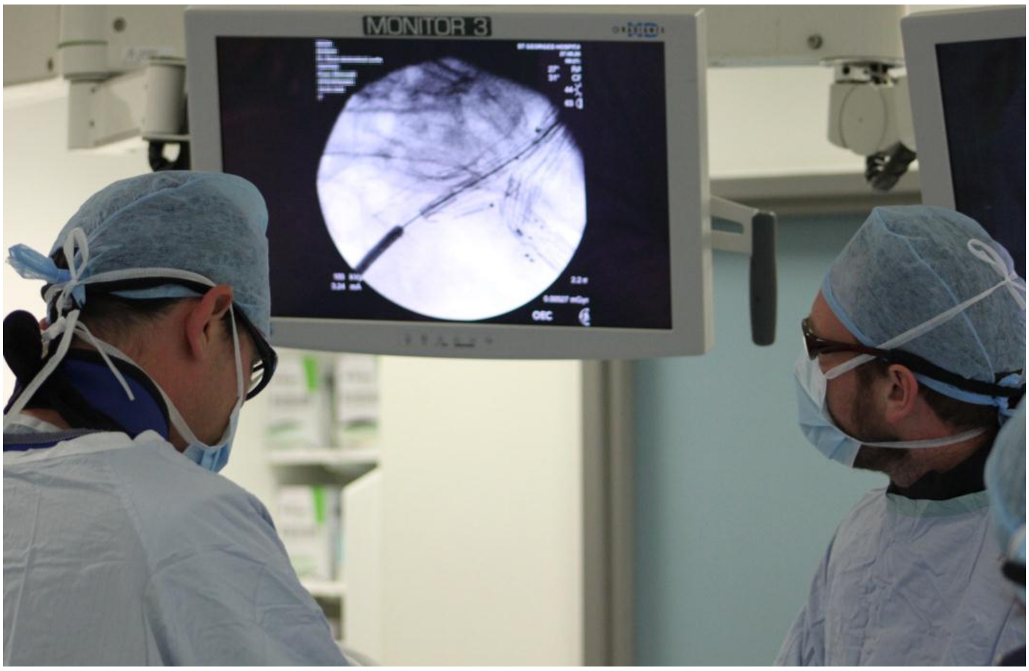
NATIONAL VASCULAR REGISTRY

2015 Annual report



November 2015

This report was prepared by

Clinical Effectiveness Unit, The Royal College of Surgeons of England
Mr Sam Waton, NVR Project Manager
Dr Amundeep Johal, Quantitative Analyst
Dr Katriina Heikkila, Lecturer
Dr David Cromwell, Reader / CEU Director

Vascular Society of Great Britain and Ireland (VSGBI)
Prof Ian Loftus, Consultant Vascular Surgeon

The Royal College of Surgeons of England is an independent professional body committed to enabling surgeons to achieve and maintain the highest standards of surgical practice and patient care. As part of this it supports Audit and the evaluation of clinical effectiveness for surgery.

The RCS managed the publication of the 2015 Annual report.

The Vascular Society of Great Britain and Ireland is the specialist society that represents vascular surgeons. It is one of the key partners leading the audit.

Commissioned By

HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement, and in particular to increase the impact that clinical audit has on healthcare quality in England and Wales. HQIP holds the contract to manage and develop the NCA Programme, comprising more than 30 clinical audits that cover care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual audits, also funded by the Health Department of the Scottish Government, DHSSPS Northern Ireland and the Channel Islands.

Contents

Acknowledgements

The National Vascular Registry is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit Programme (NCA). HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement, and in particular to increase the impact that clinical audit has on healthcare quality in England and Wales. HQIP holds the contract to manage and develop the NCA Programme, comprising more than 30 clinical audits that cover care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual audits, also funded by the Health Department of the Scottish Government, DHSSPS Northern Ireland and the Channel Islands.

We would like to acknowledge the support of the vascular specialists and hospital staff who have participated in the National Vascular Registry and the considerable time devoted to data collection.

We would also like to thank

- VSGBI Audit and Quality Improvement Committee
- Fiona Miller, Chair of Audit Committee, British Society of Interventional Radiology
- Derek McShane, Caroline Junor and Peter Rottier from Northgate Public Services (UK) Limited

Please cite this report as:

Waton S, Johal A, Heikkila K, Cromwell D, Loftus I. *National Vascular Registry: 2015 Annual report*. London: The Royal College of Surgeons of England, November 2015.

Foreword

As President of the Vascular Society of Great Britain and Ireland, I am delighted to introduce the 2015 Annual Report of the National Vascular Registry. I want to thank the NVR team for their hard work. I also particularly want to thank the vascular surgeons and their staff who continue to submit detailed information about patient care despite the increasing pressures on their time and resources.

Overall, the results show an improvement in outcomes for patients. In-hospital mortality for AAA repair is reported as 1.5% compared to almost 8% ten years ago. The delay for patients requiring carotid endarterectomy following a TIA or stroke has reduced with the majority of patients receiving an intervention within fourteen days. It is worth noting that no units currently identified as having unusual surgical outcomes for either elective infra-renal AAA repair or carotid arterial interventions.

The NCEPOD report in 2014 on lower limb major amputation made it clear that the management of patients with critical limb ischaemia needs to improve. This will be the focus of a new Vascular Society Quality Improvement Framework, and guidelines on the clinical pathway for these patients are contained in Society's Provision of Vascular Services 2015 document. Data submission rates for lower limb revascularisation need to improve if the NVR is going to reach its full potential in supporting us to make these improvements.

Another welcome feature of this report is the information from the organisational audit of vascular services. There is a noticeable trend to a smaller number of larger vascular units in keeping with the recommended hub and spoke model. The data from NVR is particularly useful when undertaking local reviews of vascular services and commissioning groups are increasingly like to rely on this information.

Vascular surgeons are required to perform procedures in a safe and timely manner with established and audited timelines for an increasing number of conditions. It is important that surgeons and their units are resourced appropriately to fulfil these requirements and provide the best care for patients.

Paul Blair

President, Vascular Society of Great Britain & Ireland

Executive Summary

The National Vascular Registry is commissioned by the Healthcare Quality Improvement Partnership (HQIP) to measure the quality and outcomes of care for patients who undergo major vascular surgery in NHS hospitals in England and Wales. It aims to provide comparative information on the performance of NHS vascular units and thereby support local quality improvement as well as inform patients about major vascular interventions delivered in the NHS. As such, all NHS hospitals in England, Wales, Scotland and Northern Ireland are encouraged to participate in the Registry.

The measures used to describe the patterns and outcomes of care are drawn from various national guidelines including: the “Provision of Services for Patients with Vascular Disease” document and the Quality Improvement Frameworks published by the Vascular Society, and the National Institute for Health and Care Excellence (NICE) guidelines on stroke and peripheral arterial disease.

This report provides a description of the care provided by NHS vascular units, and contains information on the process and outcomes of care for: (i) patients undergoing abdominal aortic aneurysm (AAA) repair, (ii) patients undergoing carotid endarterectomy, (iii) patients undergoing a revascularisation procedure (angioplasty/stent or bypass) or major amputation for lower-limb peripheral arterial disease (PAD). In addition, the report presents the findings of an organisational audit conducted in August 2015.

Elective repair of infra-renal abdominal aortic aneurysm

The elective repair of an infra-renal abdominal aortic aneurysm (AAA) is an important aspect of vascular services work. We examined the process of care delivered by NHS vascular units to patients who had the procedure between 1 January 2014 and 31 December 2014.

The VSGBI AAA Quality Improvement Framework [VSGBI 2012] made various recommendations about the standard of care to be delivered on the preoperative pathway. We found that the majority of patients had care that was consistent with these standards:

- 98.0% of patients underwent a formal anaesthetic review (4,156/4,239)
- 90.0% of patients who had an anaesthetic review had this performed by a consultant vascular anaesthetist (3,740/4,156)
- 73.7% of patients had a fitness measurement (3,120/4,233), the most common method being CPET (48.1% of measurements)
- 94.0% of patients with an AAA diameter ≥ 5.5cm deemed suitable for repair had a pre-operative CT/MR angiography assessment (3,635/3,866)
- 80.2% of elective patients were discussed at MDT meetings (3,401/4,239)

The overall rates for patients having pre-operative CT/MR angiography and MDT assessment are comparatively low, but the figures include patients for whom the dates were unknown as well as patients who did not receive these aspects of care. Hospitals should try to ensure complete data are available, particular when the diagnostic assessment and procedure are undertaken in different hospitals.

The median delay at the majority of vascular units tended to fall within the range of 60 to 90 days. Nonetheless, the upper limit of the inter-quartile ranges shows that, at almost a half of the vascular units (38 of 81), 25% of patients operated on in 2014 waited more than 120 days. While there are legitimate reasons for some patients to wait for surgery, such as the investigation and optimisation of comorbid medical conditions, we note that 120 days is well over the National AAA Screening Programme target of 8 weeks from date of referral to surgery and the analysis also only covers the period from vascular assessment to surgery.

The use of endovascular (EVAR) procedures has become increasingly common. In 2014, they accounted for 66% of elective infra-renal AAA repairs. A feature of some EVAR procedures can be the development of an endoleak, in which blood may continue to flow outside the stent but is contained within the aneurysm sac. Type 1 endoleaks are rare but potentially serious as they may be due to a problem with the junction between normal aortic wall and the stent. Type 2 endoleaks are slightly more common but less serious, and they can occur because of blood flow from small arteries connected to the aneurysm sac. Among the 2014 EVAR procedures, we found that:

- 85.1% of procedures experienced no endoleak
- Type 1 and Type 2 endoleaks occurred in 125 (4.5%) and 273 (9.9%) procedures, respectively. 132 endoleaks required intervention at the time of EVAR.

We examined the postoperative in-hospital mortality rate across NHS organisations undertaking elective infra-renal AAA repairs performed between 1 January 2012 and 31 December 2014. The comparative, risk-adjusted mortality rates for individual NHS trusts were all within the expected range given the number of procedures performed. The overall in-hospital mortality for this procedure was 1.5%.

Repair of ruptured abdominal aortic aneurysms

Ruptured abdominal aortic aneurysms remains a common vascular emergency. The IMPROVE trial, which compared the outcomes of open repair and EVAR among patients with ruptured AAAs, reported 30 day mortality of 37.4% and 35.4%, respectively.

We examined the outcomes of patients with a ruptured AAA who had their procedure between 1 January 2012 and 31 December 2014. These are the first results published by the NVR for this procedure.

The principal outcome measures was in-hospital postoperative mortality. The rates for open and EVAR procedures were, respectively, 37.2% (95% CI 35.1 to 39.4) and 19.9% (95% CI 16.7 to 23.4).

While the results show a clear difference between the approaches, this is likely to reflect differences in the severity of patients' conditions and anatomical suitability for EVAR in the two groups arising from the selection process. We also note that the postoperative mortality rates are lower than those reported by the IMPROVE trial and other observational studies. This might be due to the NVR reporting in-hospital mortality rather than 30-day mortality rates. It may also be due to incomplete records of the sickest patients being submitted to the NVR. In addition, we would expect these patients to have an ASA grade of 4 or 5, given the serious nature of the condition. NHS vascular units will be encouraged to review the completeness of their submissions for ruptured AAA patients and reduce possible data entry errors.

Overall, 80% of these patients had an open repair. The fact that EVAR procedures only constituted 20% of patients may reflect limitations in the availability of endovascular facilities and skill sets in some vascular units. Further work is required to establish whether pathway factors are a limitation on the use of EVAR for ruptured AAA patients.

Repair of complex aortic conditions

While most AAAs occur below the point where arteries branch from the aorta to the kidneys, aneurysms may occur in other locations. Until recently, open surgery was the standard technique to repair these complex aneurysms. However, EVAR procedures have become more popular as endovascular grafts evolved. Indeed, the delivery of care to patients with complex AAA has been changing rapidly and the results in this report are primarily provided to support the commissioning of vascular services in this area.

During 2014, there were 555 records related to these complex AAA procedures submitted to the NVR. These were submitted by 65 vascular units, and the volume of activity within these units ranged from 1 to 76 procedures (median=4). Of these procedures, 485 (87%) were endovascular.

The in-hospital postoperative mortality rates for complex open and EVAR procedures were around 4-times greater than the rates for infra-renal AAA for both open repair and EVAR. The rates were 18.6% (95% CI 10.3 to 30.0) and 4.3% (2.7 to 6.5), respectively. This reflects the complex nature of the disease and surgery. Further interpretation of the figures is difficult however. The level of case-ascertainment for these procedures is unclear because the coding of complex aortic procedures in HES is poor which prevents these procedures from being clearly identified. We will be undertaking further work in this area

Carotid endarterectomy

As people age, the carotid arteries can become narrow due to the build-up of atherosclerotic plaque. For some patients with a symptomatic narrowing of a carotid artery between 50% and 99%, it is recommended that they have a carotid endarterectomy to remove the plaque, and thereby reduce the risk of a stroke. The current NICE guideline for stroke recommends a two week target time from initial symptom to operation.

In the years between 2009 and 2012, the NVR reported that there was a steady decline in the median time from the index symptom to operation for symptomatic patients, falling from 20 days to 13 days. Since then, the overall median time has been fairly stable. In 2014, the median times along the care pathway were similar for patients with symptoms of stroke or TIA. Patients with amaurosis fugax took comparatively longer to progress from symptom onset to surgery, with the median delay being 21 days (IQR 10 to 44 days).

The NVR examined the median time (and inter-quartile range) from symptom to procedure by NHS trust / Health Boards for procedures done between January and December 2014. There was considerable variation among NHS trusts in the median time to surgery during 2014. The median was 14 days or less for 62 organisations, but the median exceeded 20 days for a minority of vascular units.

Patients may experience various complications following carotid endarterectomy, including: bleeding, myocardial infarct, cranial nerve injury, or stroke. The risk of a complication remains low, with rates (and 95% confidence intervals (CI)) from 2012 to 2014 summarised below.

Complication	Procedures in 2012-2014	Complication rate (%)	95% CI
Myocardial Infarct within admission	15,817	0.9	0.8-1.1
Bleeding within admission	15,817	2.8	2.6-3.1
Death and/or stroke within 30 days	15,847	2.0	1.8-2.2
Cranial Nerve Injury within admission	15,846	1.6	1.4-1.8

All the NHS trusts had a risk adjusted rate of death/stroke within 30 days that fell within the expected range given the number of procedures performed at the organisation.

Lower limb revascularisation for peripheral arterial disease

This is the first time that national figures have been presented together for lower limb endovascular and bypass procedures. It describes how interventional radiologists and vascular surgeons have responded to the clinical evidence on the two procedures and reveals the differences in the selection of patients for the two interventions.

The outcomes of the revascularisation procedures were generally good. In-hospital postoperative mortality rates were low, being 1.7% (95% CI 1.3 to 2.3) for endovascular procedures and 2.7% (95% CI 2.3 to 3.2) for lower limb bypass. Complications were also relatively uncommon and over 90% of patients did not require further unplanned intervention. Nonetheless, 1 in 10 patients required re-admission within 30 days for both bypass and endovascular procedures. The NVR does not have information on the reasons for readmission but local services should review their local data and seek ways to reduce these re-admission rates.

These results were based on 2871 endovascular and 5387 bypass procedures performed in the 2014 calendar year. This corresponds to an estimated case-ascertainment of 15% and 90%, respectively. The low case-ascertainment rate for endovascular procedures was unexpected, although this is the first year of data collection and a cohort of 2871 procedures enables an initial overview of practice in the few participating NHS trusts. Nonetheless, it prevents the Registry from making any firm statements about the national picture. It is vital for hospital governance, medical revalidation and commissioning that NHS trusts encourage a more active approach to submitting data on endovascular procedures to the NVR.

Major lower limb amputation

In 2014, the National Confidential Enquiry into Patient Outcomes and Deaths (NCEPOD) published its review of the care received by patients who underwent major lower limb amputation. It highlighted a number of areas related to the preoperative pathway that varied between NHS hospitals. In response to this report, we adapted the NVR amputation dataset to capture key issues highlighted by the review.

The NVR data on lower limb amputation supports the NCEPOD observations about variation between NHS trusts in the pre-operative process of care. For procedures performed between January and December 2014, there was considerable variation among NHS trusts / Health Boards in the time patients waited from vascular assessment to surgery. There may be legitimate clinical reasons for patients to wait different times for an amputation, although this is unlikely to explain the extent of the variation we observed. Vascular units should investigate the causes of this variation in delays before surgery.

The in-hospital mortality rates for above- and below-knee amputations were 11.6% (95% CI 9.9 to 13.5) and 6.1% (95% CI 4.8 to 7.6), and are much lower than those reported from analyses of routine hospital data [Waton et al 2015]. It is possible that the difference is due to some patients deteriorating after discharge, but we found that only 1 in 10 patients required readmission within 30 days, and it seems more likely that the cohort of patients captured by the NVR in 2014 were less sick than all patients having a major lower limb amputation. It may also reflect the nature of vascular networks, where patients are transferred from a hub centre to the spoke hospital for rehabilitation but subsequently decline. Changes to the way data are captured within NVR will allow us to analyse this in more detail in 2016.

From routine hospital data, we estimate that there were approximately 2300 below knee and 2500 above knee amputations performed in UK hospitals for peripheral arterial disease during 2014. Vascular units submitted 1200 of the former and 1265 of the latter, giving an estimated case-ascertainment of approximately 50% for both procedures. This is the same level as reported in the final year of the National Vascular Database, and it is disappointing that there has not been an increase during the year, particularly given the attention given to this aspect of care by the NCEPOD report. NHS hospitals and commissioners must encourage more complete data submission to the NVR for these high risk vascular procedures.

Organisational Audit

An organisational audit of NHS vascular services was undertaken to examine the current structure of vascular services, document the evolution of vascular networks within the UK, and investigate the extent to which NHS vascular services meet the organisational recommendations set by the Vascular Society of Great Britain and Ireland (VSGBI). The audit was undertaken during August and October 2015, and 84 responses (93%) were received from the 89 NHS trusts / Health Boards performing major vascular surgery.

It is recommended that vascular surgery in the UK is organised into regional networks consisting of arterial hub and spoke hospitals. At the time of the audit, the process of the reconfiguration of vascular services was still under way, with 70 (83%) NHS vascular units reporting that they were a part of a completed or near-completed reconfigured network.

In terms of recommended levels of staffing and facilities:

- 96% of vascular units had a vascular surgeon available 24/7; 92% of units reported having at least one vascular nurse specialist, but just one unit had a vascular anaesthetist on-call rota
- 54% of units reported having 6 or more full-time equivalent consultant vascular surgeons and 26% of units reported having 6 or more full-time equivalent consultant interventional radiologists
- 96% of units had wards dedicated to vascular patients and 90% had at least one full-day operating list per week,
- 43% of units had at least one hybrid theatre.
- Out-of-hours access to diagnostic CT scans was available at 96% of units but only 12% had out-of-hours access to duplex ultrasound by a vascular technologist

In relation to recommended preoperative care protocols:

- preoperative nutritional assessment was performed in 55% of units and cardiac assessment in 58%
- Involvement of the Care of the Elderly team occurred in 21% of units
- Multidisciplinary management for (i) diabetic foot disease and (ii) stroke was provided in 87% and 93% of units. For patients undergoing amputations, 62% had a pain management protocol and 70% had wound/pressure area care protocol.

Only four of the 84 responders reported not carrying out elective AAA repairs. Standard endovascular repairs (EVARs) were typically planned and conducted by both vascular surgeons and radiologists. In addition, 71 units reported the provision of emergency EVARs for ruptured aneurysms, usually planned by surgeons and radiologists together (69%) and also carried out by both professions (82%).

For patients requiring a major lower limb amputation:

- 84% of trusts reported that all patients undergoing major amputations were preoperatively assessed by a consultant vascular surgeon.
- 80% reported that all patients were assessed by a rehabilitation physiotherapist
- 61% reported that all patients were assessed by an occupational therapist
- 25% reported preoperative assessments were available from a prosthetics service

In terms of postoperative care of patients having major amputation, 75% of units reported that they met the NCEPOD recommendation of having a complex discharge co-ordinator. However, only 14% reported having a timeline for repatriation.

In terms of the assessment and treatment of diabetic foot problem, 85% of vascular units had at least one diabetic foot clinic and 60% had at least one diabetic MDT per week. The foot clinics were typically staffed by diabetes physicians, vascular surgeons, nurses and podiatrists; physiotherapists and occupational therapists while infection disease specialists were less commonly involved. All vascular units provided debridement for diabetic feet during normal office hours, and an out-of-hours service was available in 78 of the 84 responding units.

In conclusion, a large proportion of the NHS trusts in the survey had appropriate levels of facilities but some elements of service organisation could be improved in many trusts. NHS trusts reported having staff and services available for a wide range of procedures, had access to at least one full-day operating lists, and in-hours access to diagnostic services. However, only one-half of NHS trusts had six or more full-time equivalent vascular consultants and one-quarter of NHS trusts had six or more interventional radiologists. Out-of-hours access to diagnostic services was also limited for duplex and MR angiography. There was also variable levels of availability to elements of the care pathway for lower limb amputation and for patients with peripheral arterial disease.

RECOMMENDATIONS

Vascular units within NHS trusts / Health Boards

Vascular units should review the results for their organisation to ensure care is consistent with the recommendations in national clinical guidance on patients requiring major arterial surgery with vascular conditions.

- Vascular units are encouraged to adopt the care pathway and standards outlined in the Vascular Society's AAA quality improvement programme. This can be accessed at the Vascular Society's website. A clinical lead should be nominated to monitor and report on the adoption of the pathway and this should be reflected in their job planning
- There is wide variation in the time patients take from vascular assessment to elective AAA repair. All team members should review the implementation of the care pathway for elective AAA repair to reduce waiting times
- The mortality rates for emergency aneurysm repair remain high. One factor might be the lack of availability of endovascular repair out of hours. We recommend NHS vascular units examine their local practice to determine reasons behind the low proportion of endovascular cases
- All staff involved in organising and delivering care to patients who require carotid surgery need to examine their data and assess their performance against standards within NICE Guideline CG68
- There remain considerable variations between NHS vascular units with regard to the provision of carotid endarterectomy within 14 days of symptoms. NHS trusts should optimise referral pathways within their networks and implement improvements to drive down the waiting times
- The case ascertainment for major amputation and endovascular procedures needs to be improved. Data collection by all clinicians within vascular units (surgeons and interventional radiologists) should review how data can be routinely entered into the NVR
- Vascular units should undertake a detailed analysis of the pathways of care and outcomes for amputation, and are encouraged to adopt the care pathway and standards outlined in the Vascular Society's Quality Improvement Framework

For Medical Directors of NHS trusts / Health Boards

Medical Directors should review the results for their organisation and ensure that sufficient resources are available for vascular units (1) to provide high quality care to patients requiring elective and emergency arterial procedures, and (2) collect and submit the data requested by the National Vascular Registry.

For Commissioners / Regional Networks

There is variation between NHS vascular units in the provision of various elements of care along the care pathway for patients undergoing major arterial surgery. Commissioners (in England) and Regional Health Boards should review the results for organisations within their regions to assure themselves of the quality of care provided to their patients, and should work with NHS providers to develop strategies for addressing areas of variation. In particular:

- Commissioners / Health Boards should encourage their local providers to adopt the care pathway and standards outlined in the Vascular Society's Quality Improvement Frameworks and Provision of Vascular Services documents
- Commissioners / Health Boards should support local data entry to the NVR to ensure the reliable evaluation of the process and outcomes of care

For Vascular Society of GB&I / British Society of Interventional Radiology

The VSGBI and BSIR should encourage them members to collect and submit the data requested by the National Vascular Registry, in particular, the details of patients who undergo lower limb procedures.

1. Introduction

The National Vascular Registry (NVR) was established in 2013 to measure the quality and outcomes of care for patients who undergo major vascular surgery in NHS hospitals. It was commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP).

The primary purpose of the Registry is to provide comparative figures on the performance of vascular services in NHS hospitals to support local benchmarking and quality improvement. While NHS hospitals in England and Wales are required to report on their participation in the Vascular Registry as part of their Quality Account, all NHS hospitals in England, Wales, Scotland and Northern Ireland are encouraged to participate in the Registry, so that it continues to support the work of the Vascular Society of Great Britain and Ireland (VSGBI) to improve the care provided by vascular services within the UK.

The NVR captures data on adult patients undergoing emergency and elective procedures in England and Wales for following patient groups:

1. patients with peripheral arterial disease (PAD) who undergo either (a) lower-limb angioplasty/stent, (b) lower-limb bypass surgery, and (c) lower-limb amputation
2. patients who have a repair procedure for abdominal aortic aneurysm (AAA), both open and endovascular (EVAR).
3. patients who undergo carotid endarterectomy or carotid stenting.

The National Vascular Registry was created from an amalgamation of the National Vascular Database (NVD) and the Carotid Interventions Audit. As part of this process, the Registry team and VSGBI Audit Committee revised the datasets used to capture information on patients having one of the four procedures in the old NVD IT system (AAA repair, carotid endarterectomy, lower-limb bypass and amputation). A new dataset for lower-limb angioplasty/stent procedures was also added. These datasets began to be used in January 2014.

In this NVR report, we provide information on a range of process and outcome measures on all five procedures for the first time. We also present results of the first organisational audit undertaken since the widespread reconfiguration of vascular services throughout UK.

Being a procedure-based clinical audit, the primary focus remains on outcomes rather than the process of care. Short-term survival after surgery is the principal outcome measure for all vascular procedures, but this is complemented by measures on the clinical complications associated with individual procedures, e.g., stroke after carotid endarterectomy. The provision of comparative benchmark information on outcomes supports vascular specialists to reduce the risk of complications and postoperative death.

Additional contextual information is provided by the process measures. These are linked to standards of care that are drawn from various national guidelines. The "Provision of Services for Patients with Vascular Disease" document produced by the Vascular Society [VSGBI 2015] provides an overall framework for the organisation of vascular services, while a number of other sources describe standards of care for the individual procedures, including:

For elective AAA repair

- The Vascular Society of GB&I "Quality Improvement Framework for AAA" [VSGBI 2012]
- Standards and outcome measures for the National AAA Screening Programme (NAAASP) [NAAASP 2009]

For carotid endarterectomy

- National Institute for Health and Clinical Excellence (NICE). Stroke: The diagnosis and acute management of stroke and transient ischaemic attacks [NICE 2009]
- National Stroke Strategy [DH 2007] and its associated publication "Implementing the National Stroke Strategy – an imaging guide".

For peripheral arterial disease

- The Vascular Society of GB&I "Quality Improvement Framework for Major Amputation Surgery" [VSBGI 2012]
- National Institute for Health and Clinical Excellence (NICE). Guidance for peripheral arterial disease (CG147) [NICE 2012]

1.1 Aim of the 2015 Annual Report

The aim of this report is to give an overall picture of the care provided by NHS vascular units. It provides information on the process and outcomes of care for:

- patients undergoing the elective repair of abdominal aortic aneurysms (AAA), both infra-renal (below the kidneys) and juxta-/supra-renal (adjacent / above)
- patients undergoing emergency repair of a ruptured AAA
- patients having a carotid endarterectomy
- patients having a revascularisation procedure (angioplasty/stent or bypass) for lower-limb peripheral arterial disease (PAD)
- patients having major lower-limb amputation for PAD

In addition, the report presents the findings of an organisational audit. This evaluated the current arrangement of hospital vascular services, which are in the process of being re-organised into vascular networks in England and the degree to which services were meeting the organisational standards described by the "Provision of Services for Patients with Vascular Disease (POV)" document from the Vascular Society of Great Britain and Ireland.

The report is primarily aimed at vascular surgeons and their teams working within hospital vascular units. Nonetheless, the information contained in the report on patterns of care is relevant to other health care professionals, patients and the public who are interested in having an overall picture of the organisation of services within the NHS.

1.2 How to read this report

The results in this report are based primarily on vascular interventions that took place within the UK between 1 January 2014 and 31 December 2014. To allow for hospitals to enter follow-up information about the patients having these interventions, the data used in this report was extracted from the NVR IT system in August 2015. Only records that were locked (ie, the mechanism used in the IT system for a hospital to indicate that data entry is complete) were included in the analysis.

The scope of the NVR extends only to patients who underwent a procedure. Details of patients who were admitted to hospital with a vascular condition (eg, a ruptured AAA) but are not operated upon are not captured in the Registry.

Results are typically presented as totals and/or percentages, medians and inter-quartile ranges (IQR). Where appropriate, numerators and denominators are given. In a few instances, the percentages do not add up exactly to 100%, which is typically due to the rounding up or down of the individual values.

Where individual NHS trust and Health Board results are given, the denominators are based on the number of cases for which the question was applicable and answered. The number of cases included in each analysis may vary depending on the level of information that has been provided by the contributors and the total number of cases that meet the inclusion criteria for each analysis. Details of data submissions are given in the Appendices.

For clarity of presentation, the terms NHS Trust or Trusts has been used generically to describe NHS trusts and Health Boards.

2. Repair of abdominal aortic aneurysm

2.1 Abdominal aortic aneurysms

An abdominal aortic aneurysm is the local expansion of the abdominal aorta, a large artery that takes blood from the heart to the abdomen and lower parts of the body. It is a condition that tends not to produce symptoms until the aneurysm ruptures. A rupture can occur without warning, causing sudden collapse or death of the patient. Most abdominal aortic aneurysms occur below the kidneys (i.e., are infra-renal).

A ruptured AAA requires emergency surgery. Screening and intervening to treat larger AAAs reduces the risk of rupture. An aneurysm may be detected incidentally when a patient is treated for another condition, and is then kept under surveillance. However, to provide a more comprehensive preventative service, the National Abdominal Aortic Aneurysm Screening Programme (NAAASP) was introduced in 2010. This invites men for AAA screening (a simple ultrasound scan) in the year they turn 65 years old (the condition is much less common in women). Once detected, treatment to repair the aorta before it ruptures can be planned with the patient, and surgery is typically performed as an elective procedure.

Aneurysms may be treated by either open surgery, or by an endovascular repair (EVAR). In open surgery, the AAA is repaired through an incision in the abdomen. An EVAR procedure involves the insertion of a stent graft through the groin. Both are major operations. The decision on whether EVAR is preferred over an open repair is made jointly by the patient and the clinical team, taking into account characteristics of the aneurysm as well as the patient's age and fitness.

More information about abdominal aortic aneurysms and their treatment can be found on the Circulation Foundation website at:

http://www.circulationfoundation.org.uk/help-advice/abdominal-aortic-aneurysm/

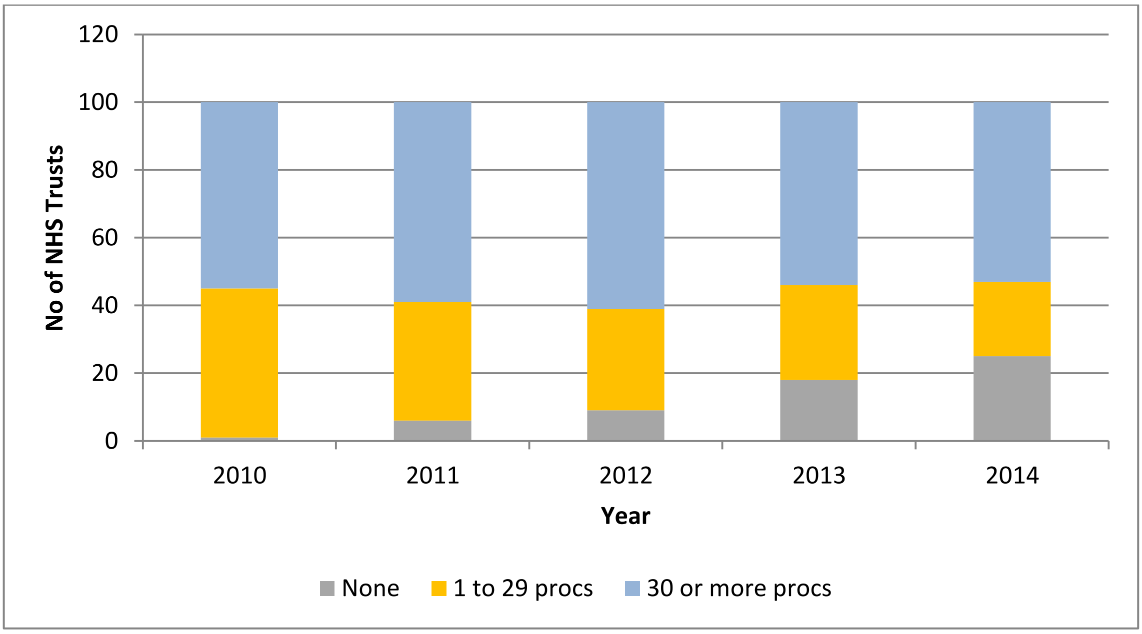
2.2 Patterns of care for elective repair for infra-renal AAA

There have been on-going changes in the organisation and delivery of NHS vascular services for elective AAA repair since 2010. An important driver of this has been the accumulating evidence on the benefits of delivering major vascular surgery in hospitals with high caseloads. In response to this, the VSGBI has recommended that vascular units need to be of sufficient size to enable consultant surgeons undertake a reasonable number of procedures (alongside an emergency on call rota) [VSGBI 2012; VSGBI 2015]. This recommendation has been supported by NHS England and is one of the principles underpinning the establishment of Vascular Networks. There has also been investment to improve the operating environment for vascular specialists, with the increasing availability of theatres that incorporate radiological imaging equipment (so-called hybrid theatres).

The changes in the number of NHS trusts providing elective repair of infra-renal AAA in England is summarised in Figure 2.1. In 2010, this procedure was performed in 99 NHS trusts, and 44 (44%) of these had performed fewer than 30 operations. By 2014, 25 of the NHS trusts had stopped performing elective AAA repairs, and in the remaining 75, the number of NHS trusts performing fewer than 30 operations had fallen to 22.

A similar centralisation process has occurred in Northern Ireland, with all AAA repairs being performed in Belfast. The number of NHS hospitals in Wales and Scotland performing surgery has not changed significantly since 2010.

Figure 2.1: Number of English NHS trusts performing elective infra-renal AAA surgery



In August 2015, the Registry published the results of elective infra-renal AAA repairs on the www.vsqip.org.uk website for all UK NHS trusts that currently perform these procedures. For each organisation, the website gives the number of operations, the typical length of stay, and the adjusted in-hospital mortality rate for operations performed over the five years between 1 January 2010 and 31 December 2014. For English NHS trusts, the same information was also published for individual consultants currently working at the organisation, as part of NHS England's "Everyone Counts: Planning for Patients 2013/4" initiative. Consultant-level information was also published for NHS hospitals in Wales, Scotland and Northern Ireland for surgeons who consented.

This report complements the figures on the VSqip website and provides additional information at an NHS trust level on elective repair of an infra-renal AAA. Focusing on NHS providers means the analysis can use a shorter period of time and still have sufficient cases to produce robust statistics. This also results in more up-to-date information and the ability to derive process measures introduced in the 2014 datasets. For postoperative mortality rates, it has still been necessary to use data on procedures performed between 1 January 2012 and 31 December 2014 in order to have sufficient sample sizes.

Between 1 January 2012 and 31 December 2014, the NVR received information from 110 NHS organisations: 92 in England, 6 in Wales, 10 in Scotland, and 2 in Northern Ireland. These organisations submitted 12,894 procedures to the NVR. The number of elective infra-renal AAA procedures identified in the routine hospitals datasets over the same period was 15,296, which gives an overall case-ascertainment of 84%. The estimated 2014 case-ascertainment figures for the four nations were: 83% for England, 100% for Northern Ireland, 65% for Scotland and 100% for Wales. The overall case-ascertainment has remained fairly stable over the last three years (Table 2.1).

The estimated case-ascertainment figures for individual NHS trusts may differ slightly from those published on www.VSqip.org.uk website due to the different time periods covered.

Table 2.1: Estimated case-ascertainment of elective infra-renal AAA repairs**

	2012	**2013**	**2014**	**Total**
Audit procedures	4,442	4,213	4,239	12,894
Expected procedures	5,130	5,108	5,058	15,296
Estimated case-ascertainment	87%	82%	84%	84%

** It is possible that the a small number of complex EVAR procedures that were carried out for infra-renal aneurysms are included in the expected procedures figures due to issues related to their coding. Thus, the case ascertainment rates shown above, and in appendix 3, may be an underestimate for those NHS trusts that carry out complex EVAR procedures.

2.3 Overview of patient characteristics and surgical activity

The characteristics of patients who underwent an elective repair of an infra-renal AAA during 2014 are summarised in Table 2.2. Patients were typically elderly, and 7 in 8 procedures were performed on men. The majority of procedures were performed for patients with an AAA diameter between 5.5 and 7.4 cms. Few had AAAs with a diameter of less than 5.5cm, the typical threshold at which patients may be advised to have surgery.

The percentage of patients with asymptomatic disease was 95.7%. About one quarter of patients were referred for vascular assessment after the aneurysm was detected by some form of screening. Most of these are likely to correspond to patients under local surveillance after an infra-renal AAA was detected incidentally rather than patients whose aneurysm was detected through the national screening programme. Indeed, the majority of patients were referred for assessment from other sources.

Table 2.2: Characteristics of patients who had elective infra-renal AAA repair between January and December 2014. Column percentages

		Open AAA	**%**	**EVAR**	**%**	**Total**
Total procedures		1,460		2,779		4,239
Age group (years)	Under 66	373	25.6	233	8.4	606
	66 to 75	699	48.0	990	35.7	1,689
	76 to 85	370	25.4	1,313	47.4	1,683
	86 and over	13	0.9	235	8.5	248
Male		1,283	87.9	2,449	88.1	3,732
Female		177	12.1	330	11.9	507
Previous AAA surgery		98	6.7	254	9.1	352
Indication	Screen detected	419	29.7	658	23.9	1,077
	Non-screen	867	61.4	1,808	65.7	2,675
	Other	125	8.9	284	10.3	409
AAA diameter (cm)	Under 4.5	26	1.8	89	3.2	115
	4.5 to 5.4	83	5.7	172	6.2	255
	5.5 to 6.4	858	58.8	1,733	62.4	2,591
	6.5 to 7.4	264	18.1	499	18.0	763
	7.5 and over	228	15.6	284	10.2	512

The risk profile of patients is summarised in Table 2.3. In general, patients are rated as having poor levels of fitness, with severe systemic disease (ASA grade 3). Perhaps not surprisingly, the prevalence of other cardiovascular diseases is high, with two-thirds having hypertension and about one-half suffering from some form of heart disease. This is also reflected in the high proportion of patients on medication when assessed pre-operatively.

Table 2.3: Risk profile of patients who had elective infra-renal AAA repair between January and December 2014. Column percentages

		Open AAA	**%**	**EVAR**	**%**	**Total**
Total procedures		1,460		2,779		4,239
ASA fitness grade	1,2	571	39.1	751	27.0	1,322
	3	850	58.3	1,889	68.0	2,739
	4,5	38	2.6	137	4.9	175
Current Smoker		411	28.2	491	17.7	902
Comorbidities	Diabetes	181	12.4	506	18.2	687
	Hypertension	943	65.6	1,888	68.0	2,831
	Chronic lung disease	294	20.2	706	25.4	1,000
	Ischemic heart disease	452	31.0	1,191	42.9	1,643
	Chronic heart failure	26	1.8	167	6.0	193
	Chronic renal failure	96	6.6	407	14.7	503
	Stroke	87	6.0	212	7.6	299
White cell count	3 to 11	1,288	88.3	2,523	90.8	3,811
(10^9/l)	under 3 or over 11	170	11.7	255	9.2	425
Serum sodium	135 to 145	1,312	90.0	2,489	89.6	3,801
(mmol/l)	under 135 or over 145	146	10.0	289	10.4	435
Serum creatinine	120 or lower	1,298	89.0	2,291	82.5	3,589
(μmol/l)	more than 120	160	11.0	487	17.5	647
Medication	Antiplatelet	1,127	77.2	2,100	75.6	3,227
	Statin	1,181	80.9	2,208	79.5	3,389
	Beta blocker	424	29.1	913	32.9	1,337
	Ace Inhibitor	519	35.6	1,050	37.8	1,569

2.4 Preoperative care pathway for elective infra-renal AAA

The VSGBI AAA Quality Improvement Framework [VSGBI 2012] made various recommendations about the preoperative pathway of care for elective patients with infra-renal AAA. These included:

- All patients should undergo standard preoperative assessment and risk scoring, including cardiac, respiratory, renal, diabetes, peripheral vascular disease, as well as CT angiography to determine their suitability for EVAR
- All patients should be seen in pre-assessment by an anaesthetist with experience in elective vascular anaesthesia
- Ideally, a vascular anaesthetist should also be involved to consider fitness issues that may affect whether open repair or EVAR is offered
- All elective procedures should be reviewed preoperatively in an MDT that includes surgeon(s) and radiologist(s) as a minimum

The changes in the NVR dataset at the beginning of 2014 enabled several new measures related to these standards of care to be derived. In summary:

- 98.0% of patients underwent a formal anaesthetic review (4,156/4,239)
- 90.0% of patients who had an anaesthetic review had one by a consultant vascular anaesthetist (3,740/4,156)
- 73.7% of patients had their fitness measured (3,120/4,233), the most common assessment method being CPET (48.1% of measurements).
- 94.0% of patients with an AAA diameter ≥ 5.5cm deemed suitable for repair had a pre-operative CT/MR angiography assessment (3,635/3,866).
- 80.2% of elective patients were discussed at MDT meetings (3,401/4,239)

These results suggest that the majority of patients are receiving care that is consistent with the recommended pathway. The overall rates for patients having pre-operative CT/MR angiography and MDT assessment are lower than expected, but they might be conservative. The rates include the patients for whom the dates were unknown as well as patients who did not receive these values. We have chosen to report the figures in this way because, for audit purposes, hospitals should know the values.

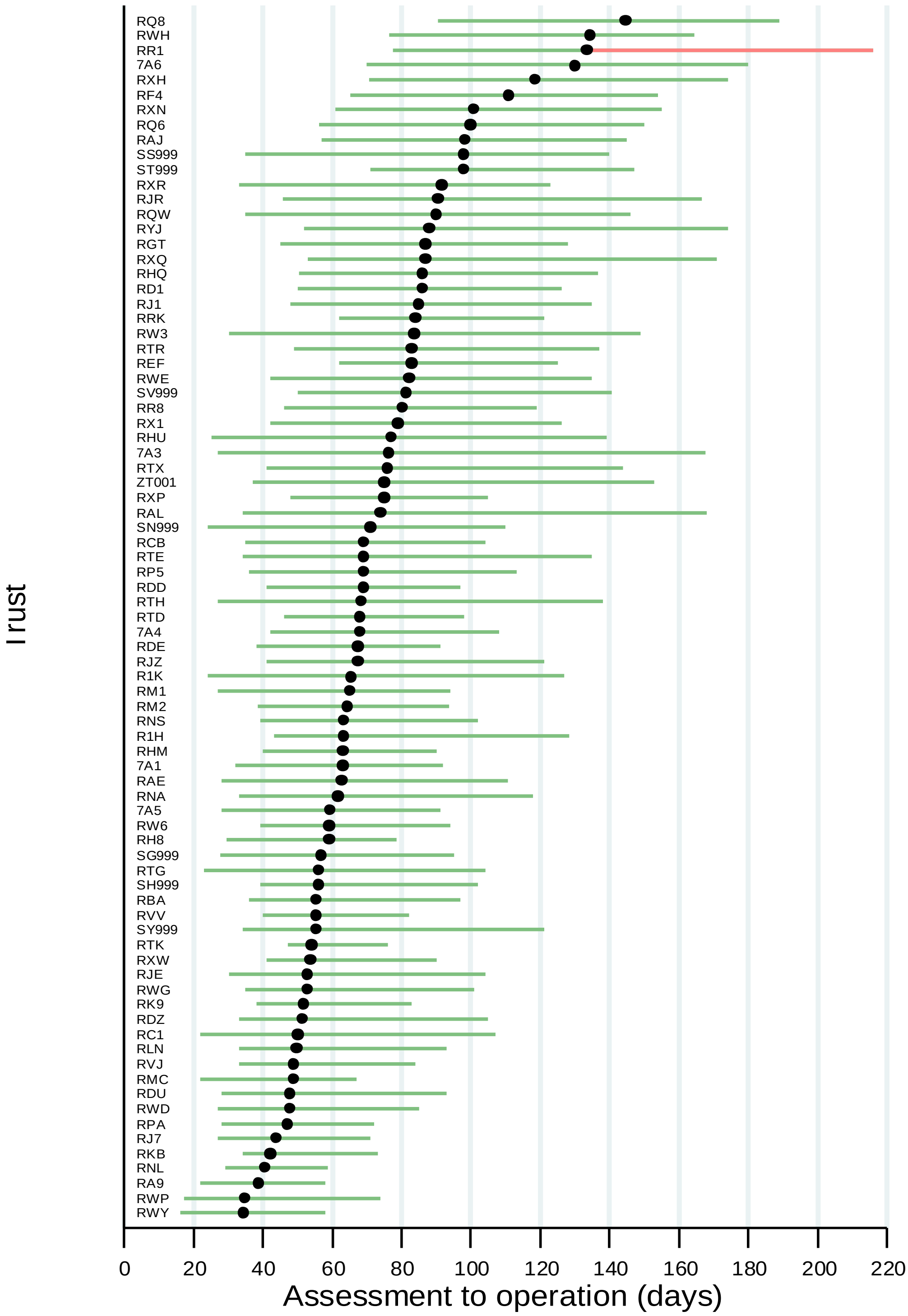
The National AAA Screening Programme has emphasised the importance of the timely scheduling of an elective repair to mitigate the risk of a patient's AAA rupturing while waiting for intervention. This is a small absolute risk, but the NAAASP recommends a target of 8 weeks from date of referral from the NAAASP to the date of the repair.

The changes in the dataset enabled us to examine the time from vascular assessment to surgery for elective infra-renal AAA repairs. This covers an important component of the referral process that is under the direct control of vascular services. Figure 2.2 (overleaf) summarises the variation among NHS trusts in the median (IQR) time from vascular assessment to surgery for procedures performed in 2014. The graph contains figures for all organisations that had 10 or more infra-renal AAA repairs cases with assessment and procedure dates. The median time is represented by a black dot. The inter-quartile ranges (IQRs) are shown by horizontal green lines. Any upper quartile line that is red indicates that the upper quartile value was above 200 days. This typically occurs when the number of patients with assessment and procedure dates for the NHS organisation was relatively small.

The median delay at the majority of vascular units tended to fall within the range of 60 to 90 days. Nonetheless, the upper limit of the inter-quartile ranges shows that, at almost a half of the vascular units (38 of 81), 25% of patients operated on in 2014 waited more than 120 days. While there are legitimate reasons for some patients to wait for surgery, such as the investigation and optimisation of comorbid medical conditions, we note that 120 days is well over the National AAA Screening Programme target of 8 weeks from date of referral to surgery and the analysis also only covers the period from vascular assessment to surgery.

The values for the individual organisations can be found in Appendix 3.

Figure 2.2. Median (IQR) time from assessment to treatment (days) for patients who had elective infra-renal AAA repair between January and December 2014



2.4 Details of surgical practice and postoperative outcomes

The use of endovascular (EVAR) procedures has become increasingly common since its introduction in 1991. In 2014, they accounted for 66% of elective infra-renal AAA repairs. There were small differences in the characteristics of patients who had EVAR and open procedures (Table 2.2), with those undergoing EVAR procedures being, on average, slightly older and having a greater burden of comorbid disease (Table 2.3).

Open repairs accounted for 34% of procedures. Among these, the most common type of repair was with a straight 'tube' graft (65.4%), followed by a bifurcated graft (29.5%).

The 2014 NVR dataset featured an expanded set of data items that characterise different aspects of an aneurysm and its relationship to the adjoining normal (eg, the length and angle of the normal aorta). These features can make an EVAR procedure more complex and can influence patient outcomes. Overall, among elective infra-renal EVAR repairs:

- The neck angle was less than 60 degrees for 90.3% of procedures
- The median (IQR) proximal aortic neck diameter and length were 24 (22 to 26) mm and 24 (17 to 31) mm, respectively
- There were 440 (16.1%) procedures that unilaterally extended into the iliac artery and 142 (5.2%) procedures required bilateral limb extensions

A complication of EVAR procedures are endoleaks, in which blood still enters the aneurysm sac after the repair. Type II endoleaks (in which blood flows into the sac from other branches of the aorta) are the most common, and least serious type. These may not require immediate treatment as some will resolve spontaneously. Type I endoleaks (in which blood leaks at the points the graft is attached are more serious and generally require intervention. Among the 2014 EVAR procedures:

- 2,339 (85.1%) procedures experienced no endoleak while the patient was in hospital
- Type 1 and Type 2 endoleaks occurred in 125 (4.5%) and 273 (9.9%) procedures, respectively
- 132 endoleaks required intervention

The overall patterns of postoperative care are summarised in Table 2.4. There are some notably differences between patients having open and EVAR procedures. For EVAR procedures, over half of patients are returned to a normal hospital ward after surgery. Among those admitted to either level 2 or 3 critical care, the median length of stay was 1 day. The median length of the overall postoperative stay was 3 days. For patients undergoing open repair, 95% of patients were admitted to a level 2 or level 3 critical care unit. They typically remained there for 2 days, and the median overall postoperative stay was 8 days. Patients having open repair were more susceptible to respiratory complications, and the rate of return to theatre was also slightly higher on average.

Table 2.4 Postoperative details of elective infra-renal AAA repairs for procedures undertaken between January and December 2014

		Open AAA (n=1,460)		**EVAR (n=2,779)**	
Admitted to	Ward	3.5%		56.2%	
	Level 2	52.5%		38.8%	
	Level 3	44.0%		5.0%	
		Median	***IQR***	***Median***	***IQR***
Days in critical care:	Level 2	2	1 to 3	1	0 to 1
	Level 3	2	2 to 4	1	1 to 3
Hospital length of stay (days)		8	7 to 12	3	2 to 5
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital postoperative mortality		3.2	2.3 to 4.2	0.8	0.5 to 1.2
Defined complications					
	Cardiac	5.7	4.6 to 7.0	1.6	1.2 to 2.2
	Respiratory	12.3	10.7 to 14.1	2.1	1.6 to 2.7
	Haemorrhage	2.1	1.4 to 2.9	1.1	0.8 to 1.6
	Limb ischaemia	3.3	2.4 to 4.3	1.2	0.8 to 1.6
	Renal failure	4.2	3.3 to 5.4	1.2	0.8 to 1.7
	Other	0.8	0.4 to 1.4	0.2	0.1 to 0.4
None of predefined		76.5	74.2 to 78.6	93.8	92.8 to 94.7
Return to theatre		6.7	5.5 to 8.1	2.4	1.9 to 3.1
Re-admission within 30 days		5.7	4.4 to 7.3	6.6	5.6 to 7.7

2.5 Postoperative in-hospital mortality for elective infra-renal AAA repair

The principal performance measure used by the NVR for elective infra-renal AAA repair is the postoperative in-hospital mortality rate. In this section, we report these outcomes for NHS organisations undertaking these AAA repairs during the period from 1 January 2012 to 31 December 2014. We used this 3-year period to give a robust estimate of outcomes.

The comparative, risk-adjusted mortality rates for individual NHS trusts are shown in the funnel plot in Figure 2.3 [Spiegelhalter 2005]. The horizontal axis shows surgical activity with dots further to the right showing the hospitals who perform more operations. The 99.8% control limit defines the region within which the mortality rates would be expected to fall if their outcomes only differed from the national rate because of random variation.

All the NHS trusts had a risk-adjusted rate of inpatient mortality that fell within the expected range given the number of procedures performed. Figures 2.4A and 2.4B overleaf show the risk-adjusted rate of inpatient mortality among NHS trusts for open repair and EVAR procedures separately. Each funnel plot is centred on the national average mortality rate for these two procedures.

Figure 2.3: Risk-adjusted in-hospital mortality rates after elective infra-renal AAA repair among NHS vascular units for procedures performed between Jan 2012 and Dec 2014. The overall in-hospital mortality rate was 1.5%.

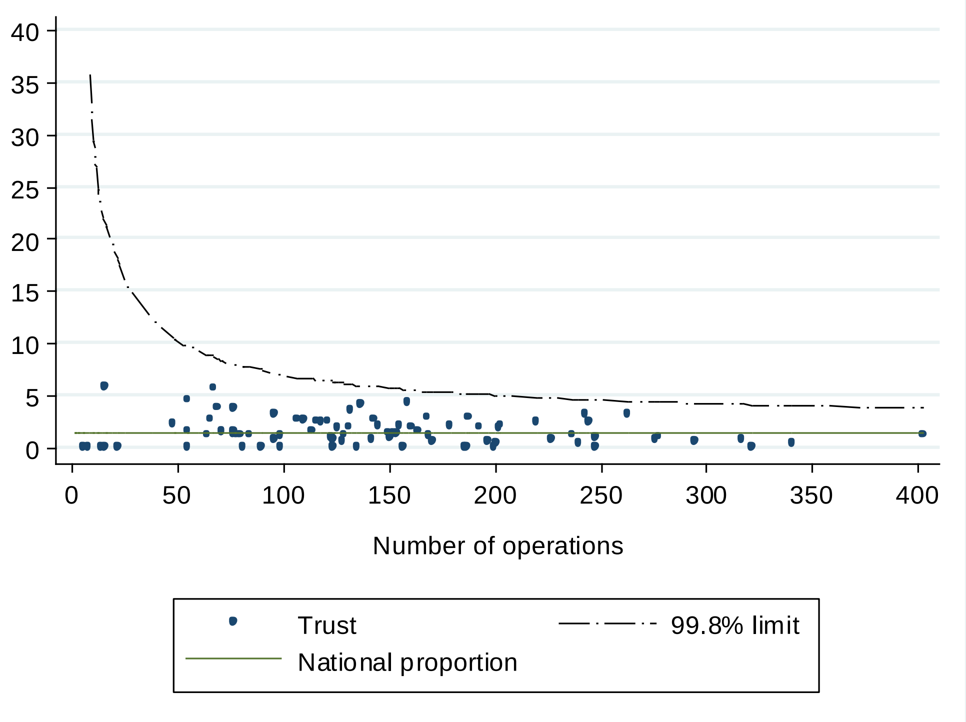
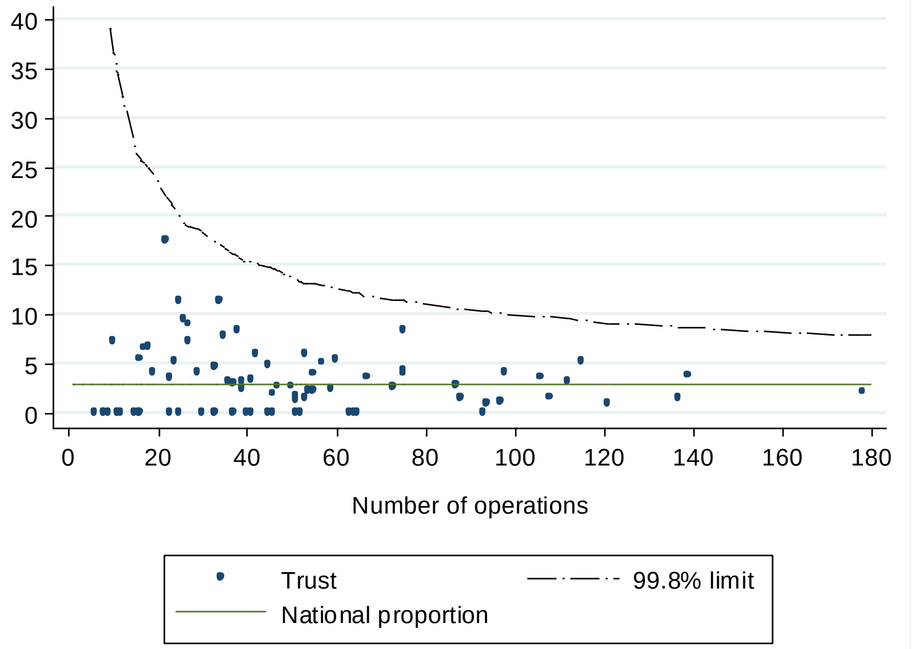
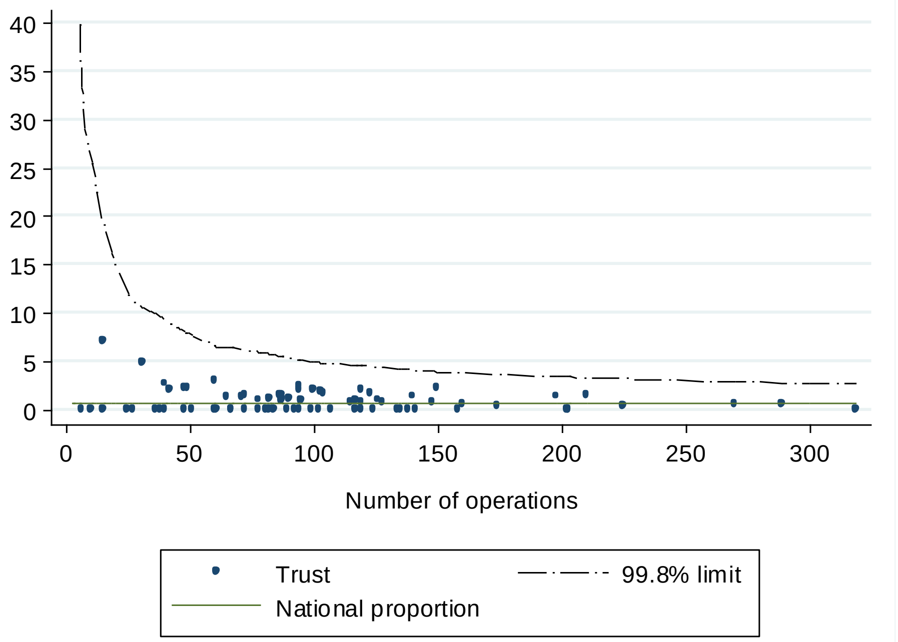


Figure 2.4: Funnel plot of risk-adjusted in-hospital mortality after elective AAA repair for open and EVAR procedures. The overall in-hospital mortality rates for open and EVAR procedures were 3.0 and 0.7%, respectively.

A: Open repairs



B: EVAR procedures



3. Repair of complex abdominal aortic aneurysms

3.1 Repair of ruptured abdominal aortic aneurysms

Although there has been a steady decline in the incidence of ruptured abdominal aortic aneurysms, it remains a common vascular emergency. For a long time, the only surgical technique for a ruptured AAA was open repair. Recently, it has been possible to take an endovascular approach. Some observational studies had reported that EVAR procedures might have lower 30 day mortality rates than open repairs. However, many patients with ruptured aneurysms are unsuitable for conventional EVAR, and so these results might reflect differences in the patients selected for each technique. Indeed, the results of the IMPROVE trial [Powell et al 2014], which compared the outcomes of EVAR and open repair among patients with ruptured AAAs reported 30 day mortality of 35.4% and 37.4%, respectively. It concluded that endovascular repair was not associated with any significant reduction in short-term mortality.

In this section, we report on the characteristics of patients with a ruptured AAA into the NVR who had their procedure between 1 January 2012 and 31 December 2014. We estimate the case-ascertainment for these patients is 75%.

The vast majority of patients having surgery for ruptured AAA are men (Table 3.1). The cohort of patients is older on average compared to patients who had an elective repair for an infra-renal AAA, with most being over 75 years of age at the time of surgery. The average diameter of the aneurysm is also larger, with over half of the patients having an aneurysm greater than 7.5cm. Open repairs constitute 78% of all procedures. On average, patients undergoing an open repair have worse ASA grades and a larger AAA diameter.

Given the serious nature of a ruptured AAA, we would expect patients to have an ASA grade of 4 or 5. We encourage NHS trusts to review the records of patients not given this ASA rating for possible data entry errors. The over-estimation of patient fitness that results from mis-entered ASA grades would lead to risk-adjusted outcomes being too high.

Table 3.1: Characteristics of patients who had a repair of a ruptured AAA between January 2012 and December 2014

		Open AAA	%	EVAR	%	Total
Total procedures		1,976		577		2,553
Age group (years)	Under 66	209	10.6	44	7.6	253
	66 to 75	783	39.6	159	27.6	942
	76 to 85	848	42.9	276	47.8	1,124
	86 and over	135	6.8	98	17.0	233
Male		1,622	82.1	493	85.4	2,115
Female		354	17.9	84	14.6	438
Previous AAA surgery		138	7.2	86	15.3	224
AAA diameter (cm)	<4.5	9	0.5	17	3.3	26
	4.5 to 5.4	63	3.5	34	6.5	97
	5.5 to 6.4	268	15.0	91	17.4	359
	6.5 to 7.4	375	21.0	107	20.5	482
	7.5 and over	1,072	60.0	273	52.3	1,345
ASA fitness grade	1 or 2	146	7.9	44	8.1	190
	3	236	12.8	123	22.6	359
	4	860	46.6	304	55.8	1,164
	5	603	32.7	74	13.6	677
Serum creatinine (µmol/l)	120 or lower	990	58.8	313	59.1	1,303
	more than 120	693	41.2	217	40.9	910

The outcomes of the surgical repair for patients with a ruptured AAA are summarised in Table 3.2. The in-hospital postoperative mortality rates for open and EVAR procedures were, respectively, 37.2% (95% CI 35.1 to 39.4) and 19.9% (95% CI 16.7 to 23.4). While this show a clear difference between the approaches, this is likely to reflect differences in the severity of patients' conditions and anatomical factors in the two groups arising from the selection process.

We note that the postoperative mortality rates are lower than those reported by the IMPROVE trial [Powell et al 2014] and other observational studies. This might be due to the NVR reporting in-hospital mortality rather than 30-day mortality rates. It may also be due to the records of the sickest patients not being submitted to the NVR.

Table 3.2 Postoperative details of emergency repairs for ruptured AAAs undertaken between January 2012 and December 2014 (unless otherwise stated)

	Open AAA (n=1,976)		EVAR (n=577)	
	Median	***IQR***	***Median***	***IQR***
Hospital length of stay (days)	11	5 to 21	9	5 to 17
	Rate	***95% CI***	***Rate***	***95% CI***
In-hospital mortality	37.2	35.1 to 39.4	19.9	16.7 to 23.4
Defined complications				
Cardiac	29.1	26.7 to 31.5	17.7	14.0 to 22.0
Respiratory	34.3	31.8 to 36.9	21.4	17.4 to 25.9
Haemorrhage	7.5	6.2 to 9.1	3.2	1.7 to 5.5
Limb ischaemia	11.0	9.4 to 12.7	6.1	3.9 to 9.0
Renal failure	37.3	34.7 to 39.8	20.9	16.9 to 25.4
Other	1.7	1.1 to 2.5	1.3	0.4 to 3.1
None of predefined	30.2	27.8 to 32.7	54.8	49.6 to 59.9
Return to theatre	35.2	32.3 to 38.2	10.0	7.4 to 13.2

Other information on the outcomes of care for ruptured AAA patients was only available for those admitted between January and December 2014 due to the introduction of the new NVR dataset. Among these patients:

- 5.1% of patients died in theatre
- 91.3% of all patients were admitted to level 2 and level 3 critical care wards
- The median (IQR) length of stay in level 2 and level 3 critical care wards was 1 (0 to 3) days and 4 (2 to 8) days, respectively

In summary, these results highlight a number of issues. First, a ruptured AAA remains a very serious condition, with high postoperative mortality and morbidity. This highlights the important role that the screening programme can play in preventing these events.

Second, only 20% of patients undergo an EVAR procedure for a ruptured AAA, in contrast to the two-thirds of elective infra-renal AAA repairs being performed this way. There are likely to be various clinical factors resulting in the selection of one technique over the other, including anatomical suitability and the physiological of patients. Indeed, the comparatively favourable results for EVAR procedures suggest that it is being introduced cautiously in patients for whom it is most clearly appropriate. We stress that the results here provide no evidence of the relative merits of the two techniques, and the initial results of the IMPROVE trial showed that the open and EVAR procedures produced equivalent results.

Nonetheless, it is also possible that the use of EVAR in only 20% of patients reflects limitations in the availability of endovascular facilities and skills in some vascular units. Further work is required to establish whether pathway factors are a limitation on the use of EVAR for ruptured AAA patients.

3.2 Elective repair of complex aortic conditions

Most abdominal aortic aneurysms occur below the point where arteries branch from the aorta to the kidneys. Aortic aneurysms may occur in other locations, however, and are typically more complex in their morphology. Those that occur above this point are categorised into three types:

- Juxta-renal (immediately below the renal arteries)
- Supra-renal (that occur above the renal arteries) and
- Thoraco-abdominal (more extensive aneurysms involving the thoracic and abdominal aorta).

Until recently, open surgery has been the standard technique to repair complex aneurysms. However, as endovascular grafts have developed to deal with these more complicated situations, EVAR procedures have become more popular. Collectively these procedures are known as complex EVAR repairs, but cover a number of techniques. The most common are:

- fenestrated EVAR (FEVAR) involves the use of a graft which has holes (fenestrations) to allow the passage of blood vessels from the aorta
- branched EVAR (BEVAR) in which separate grafts are deployed on each blood vessel from aorta after the main graft has been fitted
- thoracic endovascular aortic/aneurysm repair (TEVAR)

The EVAR approach may also be used when an abdominal aneurysm extends down to the common iliac arteries. Here, an iliac branch device is used to preserve the blood flow to the internal iliac arteries.

In 2012, results on the use of fenestrated EVAR procedures for supra-renal AAA performed between 2007 and 2010 were published by the British Society of Endovascular Therapy / GLOBALSTAR registry [BSET 2012]. They reported a 30-day mortality rate of 3.5% (11 of 318), but observed mortality of 9.4% (6 of 64) for FEVAR procedures involving the coeliac trunk. To complement these findings, Karthikesalingam et al used routine hospital data to produce results for open procedures between 2000 and 2010 [Karthikesalingam et al 2013]. They reported a 30-day mortality rate of 14% overall, but noted that direct comparison with the FEVAR results was difficult because the location of the aneurysm could not be determined from the data, and their study was likely to include thoraco-abdominal aneurysms which are associated with higher risk.

In this section, we provide the first results on the outcomes of elective surgery for patients with complex abdominal aortic aneurysms. We report on both open and complex EVAR procedures performed between January 2014 and December 2014.

There were 555 records related to these complex AAA procedures in the NVR. These were submitted by 65 vascular units, and the volume of activity within these units ranged from 1 to 76 procedures (median=4). Of these procedures, 485 (87%) were endovascular (Table 3.3), with just over half being fenestrated EVARs. The patients undergoing these repairs were similar in their distribution of age and sex to the patients having elective infra-renal AAA repairs.

Table 3.3: Characteristics of patients who had an elective repair of complex AAA between January 2014 and December 2014

		Open AAA	%	EVAR	%	Total
Total procedures		70		485		555
Age group (years)	Under 66	19	27.1	77	15.9	96
	66 to 75	33	47.1	183	37.9	216
	76 to 85	18	25.7	196	40.6	214
	86 and over	0	0	27	5.6	27
Male		63	90.0	415	85.6	478
Female		7	10.0	70	14.4	77
Type of procedure	FEVAR			263	54.2	
	BEVAR			47	9.7	
	TEVAR			75	15.5	
	Iliac branch graft			84	17.3	
	Other (eg, chimney / snorkel / periscope)			16	3.3	

The outcomes of elective repairs for patients with non infra-renal AAA are summarised in Table 3.4. The in-hospital postoperative mortality rates for open and EVAR procedures were around four-times greater than the rates for infra-renal AAA for both open and EVAR repair, reflecting the complex nature of the disease and surgery. For EVAR procedures, three-quarters of patients are admitted to either level 2 or 3 critical care, and the median length of the overall postoperative stay was 6 days. For patients undergoing open repair, 97% of patients were admitted to a level 2 or level 3 critical care unit, where they typically remained there for 2-3 days. The median overall postoperative stay was 9 days. Just over 1 in 10 patients having open repair were readmitted to critical care or returned to theatre. A similar proportion of patient having EVAR repair returned to theatre, and were also more likely to be readmitted within 30 days than open repairs.

Table 3.4 Postoperative details of complex AAA repairs undertaken between January 2014 and December 2014

		Open AAA (n=70)		EVAR (n=485)	
Admitted to	Ward	2.9%		24.9%	
	Level 2	51.4%		50.5%	
	Level 3	45.7%		24.3%	
		Median	*IQR*	*Median*	*IQR*
Days in critical care:	Level 2	2	0 to 4	1	0 to 2
	Level 3	3	2 to 4	2	1 to 2
Hospital length of stay (days)		9	7 to 14	6	3 to 9
		Rate	*95% CI*	*Rate*	*95% CI*
In-hospital postoperative mortality		18.6	10.3 to 30.0	4.3	2.7 to 6.5
Re-admission to critical care		11.4	5.1 to 21.3	4.1	2.5 to 6.3
Return to theatre		12.9	6.1 to 23.0	9.7	7.2 to 12.7
30 day readmission rate		2.2	0.1 to 11.8	9.7	6.8 to 13.2

This section provides the first national results on the repair of complex AAA. They are included to provide some information about the current situation within the UK as clinical practice has been changing rapidly with the introduction of more complex EVAR grafts. The results are primarily provided to support the commissioning of vascular services in this area.

Complex aortic aneurysm repairs comprise a relatively small part of the overall vascular surgical workload, but they consume a greater proportion of the health care resources than infra-renal AAA repair, as shown by the increased use of critical care facilities, LOS and complications compared to non-complex aortic procedures. The figures also highlight the increased risk associated with these procedures compared to infra-renal AAA repair. Further interpretation of the figures is difficult, however. We are unsure of the level of case-ascertainment for these procedures because the coding of complex aortic procedures in HES prevents these procedures from being clearly identified. Consequently, we do not know if these results are representative of the country as a whole. Nonetheless, the high postoperative mortality rate, particularly for open repairs, suggests that NHS trusts and Commissioners should be focused on ensuring the care for these patients is as safe as possible. We would recommend that considerations about where complex aortic surgery takes place should be based on the submission of accurate data on caseload and outcomes to the NVR.

4. Carotid Endarterectomy

4.1 Background to audit of patients having surgery for carotid stenosis

The carotid arteries are the main vessels that supply blood to the brain, head and neck. As people age, these arteries can become narrow because of a build-up of atherosclerotic plaque on the arterial wall. The plaque may cause turbulent blood flow and thrombosis. Material breaking off can lodge in the blood vessels of the brain causing either transient symptoms or a stroke. Those with transient symptoms have the highest risk of stroke in the period immediately following the onset of symptoms.

The risk of stroke can be reduced if surgery is performed quickly following the onset of symptoms. For some patients with a narrowing of a carotid artery between 50% and 99%, it is recommended that surgery to remove the plaque, a carotid endarterectomy, is performed within two weeks.

An audit of the care received by patients who undergo interventions (either surgery or endovascular stenting) for carotid stenosis was initiated in 2005 as a collaboration between the Vascular Society of Great Britain & Ireland and the Royal College of Physicians. The Carotid Interventions Audit regularly published information on surgical carotid endarterectomy (CEA), evaluating care against clinical standards from two principal sources:

1. National Clinical Guidelines 2009 Stroke: The diagnosis and acute management of stroke and transient ischaemic attacks [NICE 2009]

2. National Stroke Strategy [DH 2007] and its associated publication "Implementing the National Stroke Strategy – an imaging guide".

The figures in this report summarise carotid procedures performed between 1 January 2014 and 31 December 2014. During this period, data were submitted by 445 surgeons, who were working at 98 NHS trusts and Health Boards in England, Wales, Scotland and Northern Ireland. Data were submitted to the Registry on a total of 4,862 interventions, which covered:

- 4,464 symptomatic patients
- 4,862 cases with complete 30 day survival information
- 3,492 cases for whom information was submitted on a follow-up appointment

The information in this report broadly follows the structure of the previous reports on carotid endarterectomy. Figures of the median time from symptom onset to carotid surgery focused on the most recent year, being derived for symptomatic patients operated on between 1 January 2014 and 31 December 2014. Information on the outcomes of care was derived from three years of data, covering years 2012 to 2014.

From 2012 to 2014, data were submitted to the NVR on 15,847 carotid endarterectomies. The number of procedures identified in the routine hospitals datasets over the same period was 17,759, giving an overall case-ascertainment of 89%. The 2014 estimated case-ascertainment figures for the four nations were: 88% for England, 100% for Northern Ireland, 70% for Scotland and 100% for Wales. The overall case-ascertainment has been consistently high over the previous three years (Table 4.1).

Table 4.1: Estimated case-ascertainment of carotid endarterectomy

	2012	2013	2014	Total
Audit procedures	5,859	5,126	4,862	15,847
Expected procedures	6,368	5,880	5,511	17,759
Estimated case-ascertainment	92%	87%	88%	89%

4.2 Characteristics of patients and treatment pathways

Table 4.2 summarises the characteristics of patients who underwent carotid endarterectomy during 2014. The procedure was more common among men than women, with 65.9% of patients undergoing these procedures being male. The mean age of patients was 71.9 years.

Nearly three-quarters of the patients had at least 70% stenosis in their ipsilateral artery at the time of operation, and 91.8% were symptomatic. Among the 4,464 patients with symptomatic disease, TIA was the most common symptom (47.8%) followed by stroke (34.1%). Only 1.6% of patients had a previous ipsilateral treatment.

Table 4.2: Patient characteristics of patients who underwent carotid endarterectomy between 1 January 2014 and 31 December 2014

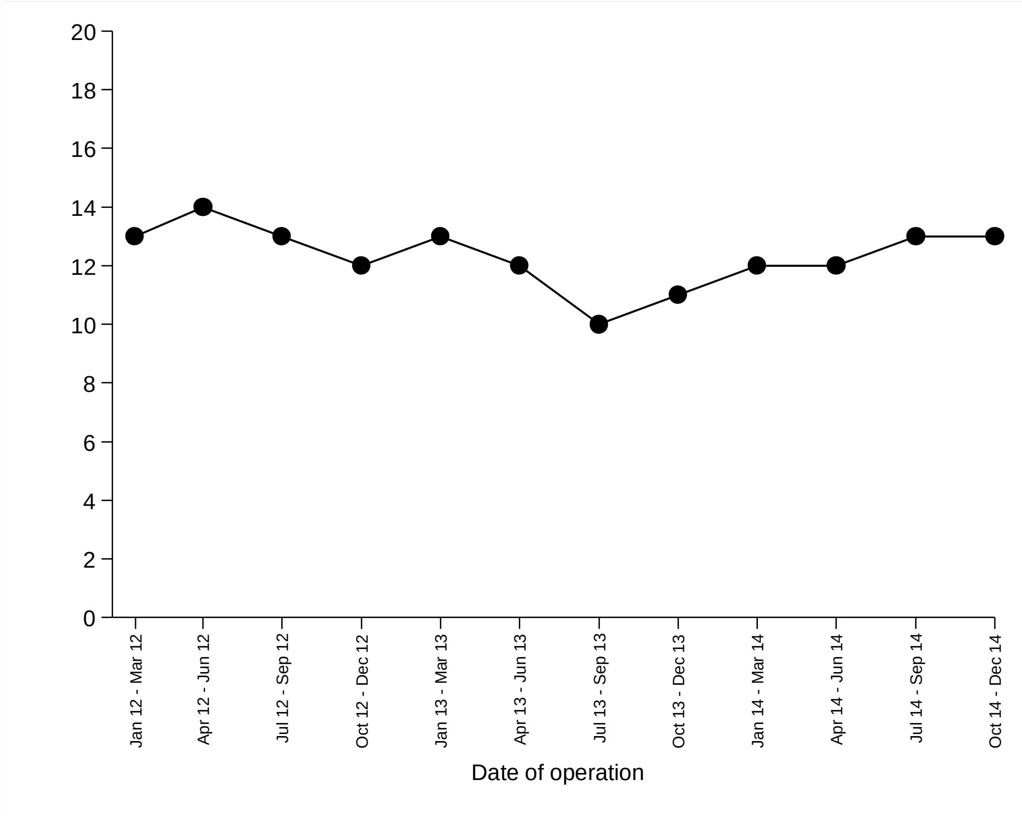
Patient characteristics	**No. of procedures**	**%**
Total procedures	4,862	
Age (years), (n=4850)		
Under 66	1,317	27.2
66 to 75	1,691	34.9
76 to 85	1,541	31.8
86 and over	301	6.2
Male	3,206	65.9
Female	1,656	34.1
Co-morbidities (n=4861)		
Diagnosed diabetic	1,142	23.5
Current symptoms/ treatment ischaemic heart disease	1,602	32.9
Rankin score prior to surgery (n=4862)		
0-2	4,418	90.9
3	383	7.9
4-5	61	1.3
Patients symptomatic for carotid disease		
Index symptom if symptomatic: (n=4464)		
TIA	2,135	47.8
Amaurosis fugax	680	15.2
Stroke	1,522	34.1
None of the three above	127	2.8
Grade of ipsilateral carotid stenosis* (n=4,831)		
<50%	97	2.0
50-69%	1,158	24.0
70-89%	2,171	44.9
90-99%	1,393	28.8
Occluded	12	0.2
Pre-op drugs prior to surgery(n=4860)		
Antiplatelet	4,493	92.4
Statin therapy	4,250	87.4
Beta Blocker	1,245	25.6
Ace inhibitor	1,816	37.4

* level of stenosis recorded at the time of initial imaging.

Patients may be referred for carotid endarterectomy from various medical practitioners. The stroke physician is the increasingly common source of referral, increasing from 73.1% in 2012 to 79.1% in 2014. The next most common referral sources in 2014 were: neurologists (4.7%), general practitioners (4.3%) and vascular surgeon (2.4%)

The current NICE guideline recommends two weeks as the target time from symptom to operation in order to minimise the chance of a high risk patient with TIA developing a stroke [NICE 2009]. In the years from 2009 to 2012, there was a steady decline in the median time from the index symptom to operation for symptomatic patients, falling from 20 days to 13 days [Waton et al 2013b]. Figure 4.1 shows that the overall median time since has been fairly stable.

Figure 4.1 Index symptom to operation (number of days) for symptomatic patients between 1 January 2012 and 31 December 2014.



The distribution of symptom to operation times for all NHS trusts is summarised in Figure 4.2. The graph contains figures for all organisations that had 10 or more symptomatic cases with exact symptom and procedure dates. The median time is represented by a black dot. The inter-quartile ranges (IQRs) are shown by horizontal green lines. Any upper quartile line that is red indicates that the upper quartile value was above 100 days. This typically occurs when the number of patients with exact symptom and procedure dates for the NHS organisation was relatively small. The vertical red line in the graph represents the current NICE Guideline of 14 days from symptom to procedure.

Figure 4.2: Median time (and inter-quartile range) from symptom to procedure by NHS trust for procedures done between January and December 2014

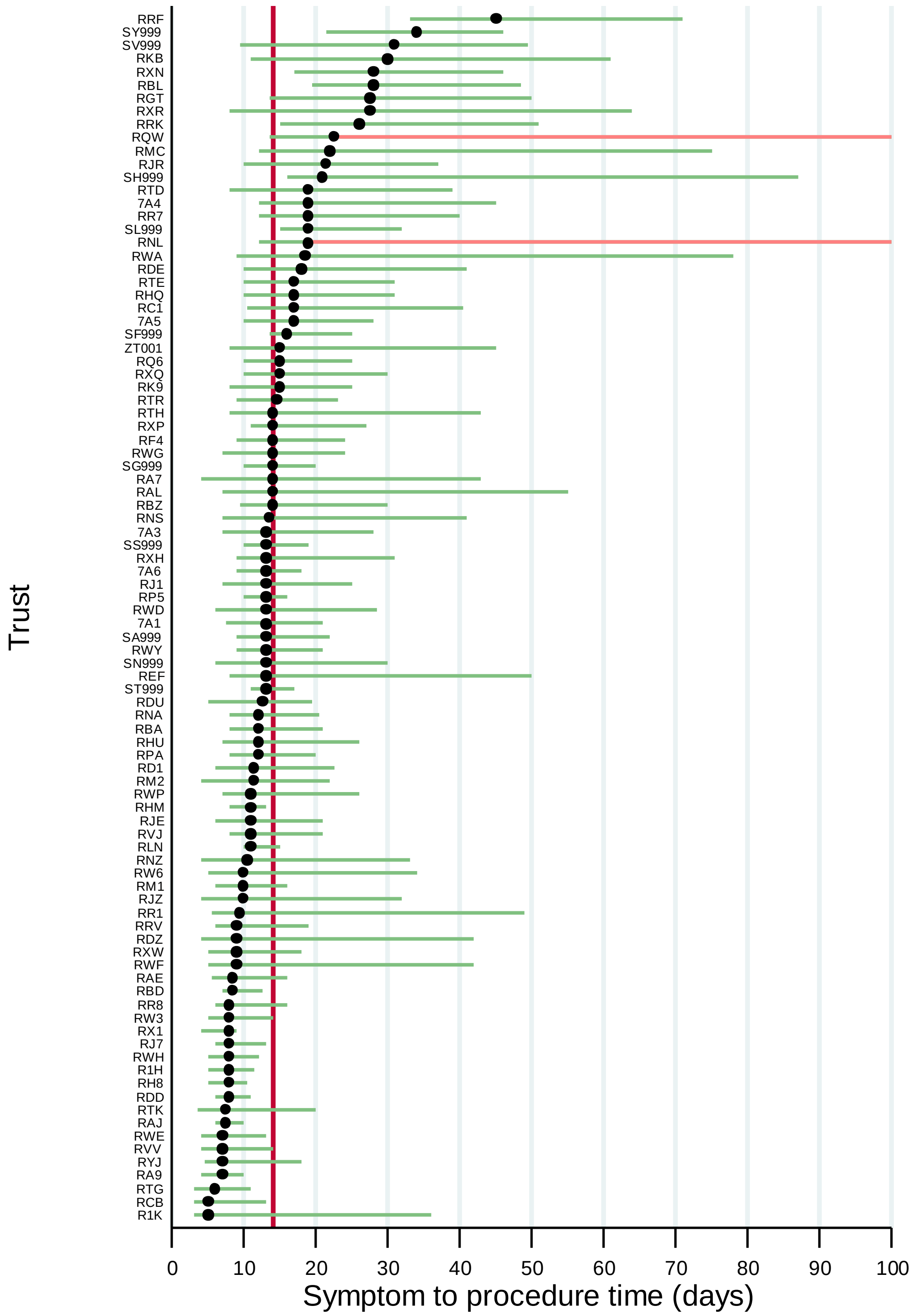


Figure 4.2 shows that there was considerable variation among NHS trusts in the median time to surgery during 2014. The median was 14 days or less for 62 organisations, but the median exceeded 20 days for a minority of vascular units. The values for the individual organisations can be found in Appendix 3.

In 2014, the median times along the care pathway were similar for patients with symptoms of stroke or TIA. Patients with amaurosis fugax, where the stroke risk is lower and greater delay acceptable, took comparatively longer to progress from symptom onset to surgery, with the median delay being 21 days (IQR 10 to 44 days).

4.3 Operative details and postoperative surgical outcomes

Table 4.3 summarises the operative details for unilateral carotid endarterectomy procedures. These correspond to the majority of procedures. There were only four bilateral procedures. There were 1.1% of procedures that used an endovascular carotid stent.

There are various aspects of the operative technique that may influence the outcome of a carotid endarterectomy. For example, shunts may be placed to ensure blood supply is maintained to the brain during the procedure. The need for shunting is reduced when local anaesthetic is used as the patient can be assessed for signs of cerebral ischaemia. Among procedures performed during 2014, 49.6% involved the use of a shunt.

Table 4.3 Details of unilateral carotid endarterectomy procedures undertaken between January and December 2014

Operation details		**Procedures (n=4,862)**	**(%)**
Anaesthetic	General only	2,530	52.0
	Local only	1,329	27.3
	Other	1,003	20.6
Type of Endarterectomy	Standard	832	17.1
	Standard + patch	3,566	73.3
	Eversion	449	9.2
Carotid shunt used		2,410	49.6
Ipsilateral Patency check		2,520	51.8

Postoperatively, 45.8% of patients were admitted to either level 2 or level 3 critical care wards, although their stay was typically short. The median (IQR) length of stay in level 2 and level 3 critical care wards was 1 (0 to 1) days and 1 (1 to 2) days, respectively. Overall, the median (IQR) length of stay in hospital was 4 (2 to 6) days.

The most common type of endarterectomy involved using a carotid patch after the endarterectomy. A review of the clinical evidence on the effectiveness of patching reported that its use was associated with a reduction in the risk of stroke of any type or death during the perioperative period and long term follow-up [Bond et al., 2004].

Patients may experience various complications following carotid endarterectomy, such as:

- Bleeding.
- Cardiac complications including a myocardial infarct
- Cranial Nerve Injury (CNI), which describes damage to one of the nerves to the face and neck.
- Transient Ischaemic Attack: a "mini-stroke" or TIA occurs when the blood supply to the brain is briefly interrupted.

The Audit has collected data on various complications following carotid endarterectomy since its inception. The risk of a complication has remained low; Table 4.4 summarises rates of specific complications (and 95% confidence intervals (CI)) from 2012 to 2014.

Table 4.4 Postoperative outcomes following carotid endarterectomy

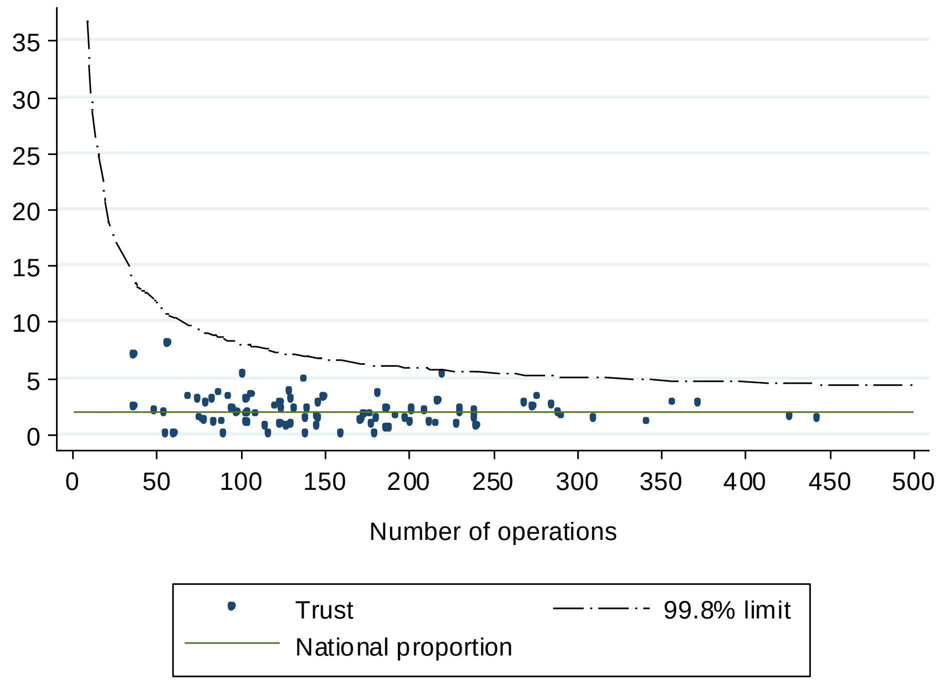
Complication	Procedures in 2012-2014	Complication rate (%)	95% Confidence interval
Myocardial Infarct within admission	15,817	0.9	0.8-1.1
Bleeding within admission	15,817	2.8	2.6-3.1
Death and/or stroke within 30 days	15,847	2.0	1.8-2.2
Cranial nerve injury within admission	15,846	1.6	1.4-1.8

4.4 Rates of stroke/death within 30 days among NHS trusts

Risk-adjusted rates of death/stroke were calculated for each by NHS trust. A logistic regression model was used to adjust the rates for differences between patients treated at the various organisations and took into account the following characteristics: age, diabetes, degree of ipsilateral stenosis, and the preoperative Rankin Scale.

All the NHS trusts had a risk adjusted rate of death/stroke within 30 days that fell within the expected range given the number of procedures performed. They all fell within the 99.8% control limits. Appendix 3 gives the figures for each organisation.

Figure 4.3: Funnel plot of risk-adjusted rate of stroke/death within 30 days of a carotid endarterectomy for NHS trusts, shown in comparison to the overall average of 2% for procedures performed between January 2012 and December 2014



In summary, these results show that stroke and other peri-operative complications of carotid surgery remain low and that carotid surgery continues to be performed effectively in the NHS. The vast majority of patients undergo one form of carotid endarterectomy, with few centres adopting carotid stenting. This perhaps reflects the lack of evidence for stenting conferring any advantage to patients.

The median time from referral and treatment seems to have stabilised around 14 days after several years of improvement, but the results also show considerable variation in the time to intervention among NHS hospitals. A number need to improve their performance.

Quality Improvement represents a challenge to organisations. The clinical teams and the executives of organisations with excessive times to surgery need to examine how they can meet the NICE recommendations. Discussions with high performing centres indicate that a focus on a facilitated pathway of referral, seven day TIA clinic access and working in teams (as opposed to the traditional consultant firm approach) are the keys to improving access to treatment for patients.

5 Lower-limb procedures for peripheral arterial disease

5.1 Introduction

Peripheral arterial disease (PAD) is a restriction of the blood flow in the lower-limb arteries that can severely affect a patient's quality of life [Peach et al 2012]. The disease can affect various sites in the legs, and produces symptoms that vary in their severity from pain in the legs during exercise to persistent ulcers, or gangrene.

There are an increasing number of treatment options for patients with PAD [Peach et al 2012]. Endovascular or open surgical interventions (such as bypass) become options when conservative therapies have proved to be ineffective. The indication for either procedure depends upon the site(s) and length of the diseased arteries as well as vessel size but there is a degree of overlap between the two therapies, and they are increasingly used in combination.

Despite these treatments, PAD can gradually progress in some patients to critical limb ischaemia for whom bypass is not a viable option. In these situations, patients will require amputation of the lower limb. About half of all these amputation procedures are below the ankle. Nonetheless, around 5000 patients in the UK require a major amputation each year, either above or below the knee.

It is mandatory for individual clinicians to collect data on the outcomes of these procedures for medical revalidation, and the NVR is designed to facilitate this. Outcome information also plays a crucial role in the commissioning of vascular services. Surgeons were able to submit data on lower-limb bypass and major amputation procedures for peripheral arterial occlusive disease (PAD) to the National Vascular Database, but this facility was not promoted to the same degree as the components for AAA repair and carotid interventions. The NVR has begun to encourage submission of these procedures since the introduction of the new datasets for lower-limb bypass and amputation in 2014. In addition, the Registry has worked with the British Society of Interventional Radiology (BSIR) on the introduction of a dataset for lower-limb angioplasty.

5.2 Lower-limb revascularisation

In this section, we give results on the processes and outcomes of lower-limb revascularisation procedures. We focus on the data entered into the NVR since January 2014 because the Registry has only collected data on endovascular as well as bypass procedures from this time. Prior to this, data was only captured on lower limb bypass.

From routine hospital data, we estimate that there were approximately 20,000 lower limb endovascular procedures and 6000 lower limb bypass procedures performed in UK hospitals for peripheral arterial disease during 2014. Vascular units submitted 2871 of the former and 5387 of the latter, giving an estimated case-ascertainment of 15% for lower limb endovascular procedures and 90% for lower limb bypass. The low case-ascertainment rate for endovascular procedures is disappointing, although a cohort of 2871 procedures enables an initial overview of practice to be produced.

Tables 5.1 and 5.2 summarise the patient characteristics and risk factors of patients undergoing these two procedures. As might be expected, the distributions of age and sex are comparable. Both procedures were used for treating patients with the full range of disease (asymptomatic, intermittent claudication, critical limb ischemia (Fontaine scores 3 and 4)), although endovascular interventions were more common for patients with less severe symptoms. The same picture is provided by the ankle brachial pressure index (ABPI). On this measure, a value of less than 0.9 is interpreted as indicating arterial disease. The average ABPI for endovascular procedures of 0.63 is in the middle of the range associated with moderate disease (0.5 to 0.7). The average ABPI for bypass procedures of 0.49 is just within the range associated for severe disease (under 0.5).

The prevalence of diabetes, hypertension and coronary heart disease was high, and only a minor of patients were reported to have no comorbid disease. Not surprisingly, most patients were on some form of medication.

Table 5.1: Patient characteristics of patients undergoing lower limb revascularisation between January and December 2014

	Endovascular		Bypass	
	No. of procs	**%**	**No. of procs**	**%**
Total procedures	2,871		5,387	
Age group (years)				
Under 60	463	16.2	1,051	19.6
60 to 64	328	11.5	701	13.1
65 to 69	432	15.1	975	18.2
70 to 74	498	17.4	906	16.9
75 to 79	464	16.3	806	15.0
80 and over	670	23.5	930	17.3
Men	1,874	65.3	3,885	72.1
Women	997	34.7	1,502	27.9
Smoking				
Current smoker	713	24.9	1,825	33.9
Ex-smoker	1,626	56.7	2,940	54.6
Never smoked	527	18.4	622	11.5
Previous Ipsilateral limb procedure	946	33.0	2,074	38.5
Fontaine score				
1 Asymptomatic	85	3.0	105	2.1
2 Intermittent claudication	1,154	40.8	1,601	31.8
3 Nocturnal &/or resting pain	574	20.3	1,828	36.3
4 Necrosis &/or gangrene	1,014	35.9	1,503	29.8
Ipsilateral ankle compressible	232	8.1	478	9.0
	Mean	***95% CI***	***Mean***	***95% CI***
Ipsilateral preoperative ankle brachial pressure index	0.63	0.57 to 0.70	0.49	0.44 to 0.53

Table 5.2: Risk factors among patients undergoing lower limb revascularisation between January and December 2014

		Endovascular		Bypass	
		No. of procs	%	No. of procs	%
Total procedures		2,871		5,387	
ASA grade**					
1	Normal	295	10.4	49	0.9
2	Mild disease	1,145	40.3	1,359	25.2
3	Severe, not life-threatening	1,274	44.8	3,601	66.8
4/5	Severe, life-threatening or Moribund patient	130	4.6	378	7.0
Comorbidities					
None		419	14.6	754	14.0
Hypertension		1,740	60.6	3,614	67.1
Ischaemic heart disease		917	32.0	2,005	37.2
Diabetes		1,104	38.5	1,641	30.5
Stroke		241	8.4	432	8.0
Chronic lung disease		394	13.7	1,061	19.7
Chronic renal disease		405	14.1	487	9.0
Chronic heart failure		187	6.5	305	5.7
Medication					
None		226	7.9	301	5.6
Anti-platelet		2,216	77.3	4,585	85.1
Statin		2,153	75.1	4,414	81.9
Beta blocker		679	23.7	1,237	23.0
ACE inhibitor/ARB		984	34.3	2,035	37.8

** This was only captured for endovascular procedures in 2014

The outcomes of the revascularisation procedures are summarised in Table 5.3. Few patients required admission to critical care. Indeed, 3% of endovascular procedures were performed in day surgery units. In-hospital postoperative mortality rates were low, being 1.7% (95% CI 1.3 to 2.3) for endovascular procedures and 2.7% (95% CI 2.3 to 3.2) for lower limb bypass. Complications were relatively uncommon and over 90% of patients did not require further unplanned intervention. Nonetheless, 1 in 10 patients required re-admission within 30 days.

Table 5.3: Risk factors among patients undergoing lower limb revascularisation between January and December 2014

		Endovascular		Bypass	
		No. of procs	**%**	**No. of procs**	**%**
Total procedures		2,871		5,387	
Admitted to	Ward	2,683	93.5	3,858	71.6
	Level 2	66	2.3	1,197	22.2
	Level 3	17	0.6	331	6.1
	Day case unit	104	3.6	NA	NA
		Median	***IQR***	***Median***	***IQR***
Days in critical care:	Level 2	0	0 to 1	1	0 to 2
	Level 3	2	1 to 3	2	1 to 4
Hospital length of stay (days)		1	0 to 7	8	4 to 16
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital mortality rate		1.7	1.3 to 2.3	2.7	2.3 to 3.2
Defined complications					
Cardiac		1.7	1.2 to 2.2	3.5	3.1 to 4.1
Respiratory		1.3	0.9 to 1.8	4.8	4.3 to 5.4
Haemorrhage		0.8	0.5 to 1.2	2.0	1.6 to 2.4
Limb ischaemia		2.2	1.7 to 2.8	5.4	4.8 to 6.1
Renal failure		0.4	0.2 to 0.7	1.5	1.2 to 1.8
Other		0.2	0.1 to 0.4	0.5	0.3 to 0.7
None of predefined		94.1	93.2 to 94.9	85.7	84.7 to 86.6
Further unplanned lower limb procedure					
None		94.1	93.2 to 94.9	91.6	90.9 to 92.4
Angioplasty without stent		0.8	0.5 to 1.2	0.7	0.5 to 1.0
Angioplasty with stent		0.4	0.2 to 0.7	0.4	0.3 to 0.6
Lower limb bypass		1.1	0.8 to 1.6	2.8	2.3 to 3.2
Amputation at any level		3.6	2.9 to 4.3	5.0	4.4 to 5.6
Readmission within 30 days		8.7	7.6 to 9.9	10.0	9.1 to 10.9
Re-admission to higher care		0.9	0.6 to 1.4	2.8	2.4 to 3.3

This is the first time that national figures have been presented together for endovascular and bypass procedures. It describes how interventional radiologists and vascular surgeons have responded to the clinical evidence on the relative merits of the two procedures and reveals the differences in the selection of patients for the two interventions

The very low case-ascertainment rates for endovascular procedures are disappointing and it prevents the Registry from making any firm statements about the national picture. We are limited to commenting that, among those NHS trusts that have participated, care is being delivered safely. It is vital for hospital governance, medical revalidation and commissioning that NHS trusts encourage a more active approach to submitting data on endovascular lower limb procedures to the NVR.

The outcomes for lower limb bypass are in line with contemporary literature, with a postoperative in-hospital mortality of 2.7%. However, for both bypass and endovascular, the observed 10% unplanned readmission rate suggests this is an area for improvement. The NVR does not have information on the reasons for readmission but local services should review their local readmission rates to determine the cause of these readmissions.

Finally, it is worth emphasising that a key outcome measure for both endovascular and bypass procedures is amputation free survival. We present, for the first time, national rates of unplanned amputation at the same admission. These were low (<5%). Changes to the Registry data collection system at the start of 2016 will allow for a more detailed analysis of patients undergoing lower limb amputation. We also expect to report on longer term amputation-free survival rates in subsequent reports.

5.3 Major unilateral lower limb amputation

In this final section, we describe some aspects of the care pathway and patient outcomes for major unilateral lower limb amputations performed in NHS vascular units between January and December 2014. Bilateral amputations have fairly infrequent, accounting for only 2% of major lower limb amputations. Consequently, we chose to focus on the more homogenous group of unilateral above and below knee amputation.

From routine hospital data, we estimate that there were approximately 2300 below knee and 2500 above knee amputations performed in UK hospitals for peripheral arterial disease during 2014. Vascular units submitted 1200 of the former and 1265 of the latter, giving an estimated case-ascertainment of approximately 50% for both procedures. This is the same level as reported in the final year of the National Vascular Database, and that there has not been an increase during the year is disappointing.

Tables 5.4 and 5.5 summarise the patient characteristics and risk factors of patients undergoing these two procedures. The procedures were split evenly across both left (n=1,232) and right (n=1,233) legs. The mean age of patients was 70 years, but the distribution of ages illustrates that both middle-aged and elderly patients are at risk of amputation. Not surprisingly, the presenting problems represent serious arterial disease (limb ischaemia, tissue loss, uncontrolled infection). In comparison to patients undergoing lower limb revascularisation, patients have similar levels of comorbid disease but have a noticeably higher prevalence of diabetes.

Table 5.4: Patient characteristics for unilateral major amputation undertaken between January and December 2014

	Below knee Amputation		**Above knee Amputation**	
	No. of procs	**%**	**No. of procs**	**%**
Total procedures	1,200		1,265	
Age group (years)				
Under 60	359	30.1	207	16.5
60 to 64	130	10.9	125	10.0
65 to 69	189	15.8	201	16.0
70 to 74	164	13.7	211	16.8
75 to 79	150	12.6	194	15.5
80 and over	201	16.8	317	25.3
Sex				
Men	922	76.8	843	66.6
Women	278	23.2	422	33.4
Presenting problem				
Acute limb ischemia	141	11.8	279	22.1
Chronic limb ischemia	239	20.0	247	19.6
Neuropathy	18	1.5	15	1.2
Tissue loss	446	37.3	480	38.1
Uncontrolled infection	335	28.0	225	17.8
Trauma / Aneurysm	16	1.2	15	1.2
Previous ipsilateral treatment	826	68.9	776	61.4

Table 5.5: Risk factors for unilateral major amputation undertaken between January and December 2014

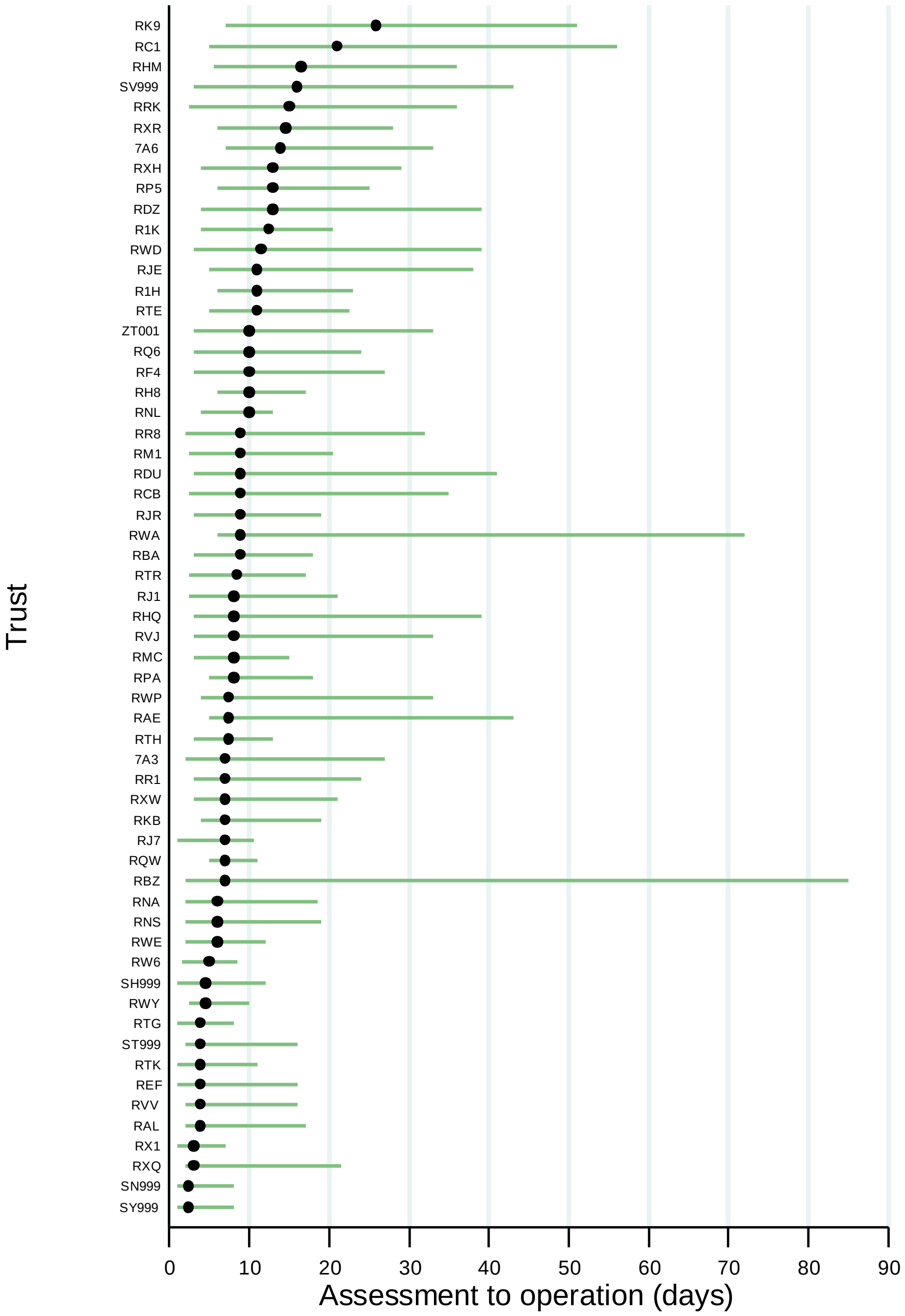
	Below knee		Above knee	
	No. of procs	**%**	**No. of procs**	**%**
Total procedures	1,200		1,265	
Smoker				
Current	346	29.0	419	33.3
Ex-smoker	571	47.8	615	48.8
Never smoked	278	23.3	226	17.9
ASA grade				
Normal / mild disease	139	11.6	78	6.2
Severe, not life-threatening disease	830	69.2	785	62.1
Severe, life-threatening disease or Moribund patient	231	19.3	402	31.8
Comorbidities				
None	118	9.9	156	12.4
Hypertension	693	58.0	783	62.2
Ischaemic heart disease	465	38.9	526	41.8
Diabetes	784	65.6	506	40.2
Stroke	102	8.5	181	14.4
Chronic lung disease	172	14.4	286	22.7
Chronic renal disease	249	20.8	227	18.0
Chronic heart failure	121	10.1	135	10.7
Medication				
Antiplatelet	879	73.3	900	71.1
Statin	881	73.4	872	68.9
Beta blocker	321	26.8	358	28.3
Ace Inhibitor	399	33.3	375	29.6

In 2014, National Confidential Enquiry into Patient Outcomes and Deaths (NCEPOD) published its review of the care received by patients who underwent major lower limb amputation due to vascular disease or diabetes [NCEPOD 2014]. It highlighted a number of areas related to the preoperative pathway that varied between NHS hospitals. The NVR amputation dataset has been adapted in 2015 to capture key issues highlighted by the review, such as the management of blood glucose levels when they are outside the acceptable range.

The NVR data on lower limb amputation supports the NCEPOD observations about variation between NHS trusts in the pre-operative process of care. Figure 5.1 describes the variation among NHS trusts in the median (IQR) time from vascular assessment to surgery. The graph contains figures for all organisations that had 10 or more major lower limb amputations with assessment and procedure dates. The median time is represented by a black dot. The inter-quartile ranges (IQRs) are shown by horizontal green lines.

There are various reasons for patients to wait different times for an amputation. In some circumstances, it is necessary to wait for adjunctive procedures which prevent a high-level of amputation or which promote good healing/recovery. However, this is unlikely to explain the extent of the wide variation between trusts shown in Figure 5.1 and vascular units should investigate the causes of this variation in delays before surgery.

Figure 5.1: Median (interquartile range) of delay from vascular assessment to surgery for unilateral major amputation procedures undertaken between January and December 2014



The outcomes of surgery are described in Table 5.6. For both procedures, patients typically stay in hospital for three weeks, although the duration exceeds 6 weeks for around 20% of patients. Only a minority of patients were admitted to critical care after surgery, and this was typically for less than a week.

Table 5.6: Postoperative details of unilateral major amputation procedures undertaken between January and December 2014

		Below-knee		Above-knee	
		No. of procs	**%**	**No. of procs**	**%**
Admitted to	Ward	1,051	87.6	945	74.9
	Level 2	114	9.5	206	16.3
	Level 3	34	2.8	104	8.2
		Median	***IQR***	***Median***	***IQR***
Days in critical care:	Level 2	1	0 to 2	1	0 to 3
	Level 3	3	2 to 14	5	2 to 10
Hospital length of stay (days)		24	15 to 42.5	23	13 to 40
		Rate	***95% CI***	***Rate***	***95% CI***
In hospital postoperative mortality		6.1	4.8 to 7.6	11.6	9.9 to 13.5
Complications					
	Cardiac	5.3	4.1 to 6.8	8.3	6.8 to 10.0
	Respiratory	7.3	5.9 to 8.9	12.6	10.8 to 14.5
	Haemorrhage	0.8	0.3 to 1.4	1.0	0.5 to 1.7
	Limb ischaemia	5.0	3.8 to 6.4	5.0	3.9 to 6.3
	Renal failure	3.8	2.8 to 5.0	5.8	4.6 to 7.2
	Other	0.8	0.3 to 1.4	1.0	0.5 to 1.7
None of predefined		81.8	79.5 to 84.0	76.2	73.7 to 78.5
Return to theatre		12.6	10.8 to 14.6	9.6	8.0 to 11.3
Re-admission within 30 days		9.2	7.3 to 11.3	10.0	8.2 to 12.3
Referred to rehabilitation / limb fit		85.6	83.4 to 87.7	73.0	70.2 to 75.7
Wound healed at discharge		74.3	71.6 to 76.9	76.1	73.4 to 78.7
Wound healed at 30 days		82.2	79.2 to 84.9	88.2	85.5 to 90.6

The in-hospital mortality rates for above- and below-knee amputations were 11.6% (95% CI 9.9 to 13.5) and 6.1% (95% CI 4.8 to 7.6), and are much lower than those reported from analyses of routine hospital data [Waton et al 2015]. It is possible that the difference is due to some patients deteriorating after discharge, but we found that only 1 in 10 patients required readmission within 30 days, and it seems more likely that the cohort of patients captured by the NVR in 2014 were less sick than all patients having a major lower limb amputation. It may also reflect the nature of vascular networks, where patients are transferred from a hub centre to the spoke hospital for rehabilitation but subsequently decline. Changes to the way data are captured within NVR will allow us to analyse this in more detail in 2016.

The recent NCEPOD report highlighted the need for improvements in the pathway of care for patients undergoing major lower limb amputation, and the need to reduce the high postoperative mortality and morbidity rates associated with these procedures. It is disappointing that case ascertainment rates have not improved in 2014 despite the NCEPOD report, and NHS hospitals and commissioners must encourage more complete data submission to the NVR for these high risk vascular procedures. There is significant variation in case-ascertainment rates across NHS trusts which make it difficult to interpret the individual outcome measures. But, it is clear from a clinical governance perspective that there is the need for better outcomes data alongside the implementation a quality improvement framework both locally and nationally.

The postoperative mortality rates are lower within NVR than those reported from studies using routine hospital data, and work will be undertaken to determine whether this is related to an under-reporting of death, or under-reporting of higher-risk cases. Irrespective of this, the complication and return to theatre rates are comparatively high.

NHS hospitals reported that 1 in 8 patients who had an above-knee amputation and 1 in 6 patients who had a below-knee amputation the amputation wound had not healed within 30 days. We note that, at the time of discharge, around a quarter of patients were reported as having wounds that had not healed. This second indicator is harder to interpret due to the transfer of patients from one hospital to another for the purposes of rehabilitation. Moreover, differences in local network arrangements mean that the pathways of care for rehabilitation will vary considerably, and this affects the reporting of both hospital length of stay and wound heal rates. Recent changes to the NVR data collection system will enable better tracking of patients following a transfer to another hospital facility, and should avoid some of these issues.

6 National Vascular Registry (NVR) Organisational Audit 2015

6.1 Background and methods

The NVR project team carried out an organisational audit of NHS hospital vascular services to examine the current structure of vascular services and the evolution of vascular networks within the UK.

The objectives of the organisational audit were:

1. to investigate the extent to which NHS vascular services meet the organisational recommendations set by the Vascular Society of Great Britain and Ireland (Provision of Services for Patients with Vascular Disease (POV))
2. to highlight areas of good performance and point to areas where improvement can be made, and
3. to map out how services are organised in vascular networks

As a part of the audit, a survey targeting hub hospitals in vascular networks was undertaken between 6 August and 22 October 2015. A link to an online questionnaire was emailed to hospitals, and respondents were asked to describe the services provided by their NHS trust and the role it played within its regional vascular network. The questionnaire contained questions on the availability of and access to arterial surgical services, personnel and facilities, as well as detailed information on how specific vascular operations were organised. The findings described below are based on the 84 responses received from 89 NHS trusts performing major vascular surgery.

6.2 Organisation of vascular care within regions

Current advice in the Provision of Services document by the Vascular Society of Great Britain and Ireland (VSGBI) is that major vascular surgery in the UK is best provided by organising vascular services into regional networks, consisting of a hub hospital providing arterial surgery and complex endovascular interventions, and spoke hospitals providing venous surgery, diagnostic services, vascular clinics, review of in-patient vascular referrals and rehabilitation [VSGBI 2015].

At the time of the audit, the process of the reconfiguration of vascular services was still under way throughout the UK. 70 (83%) of the responding NHS trusts reported that they were a part of a completely or near-completely reconfigured network. Respondents from nine (11%) NHS trusts stated that reconfiguration was planned within the next two years. In three (4%) NHS trusts, reconfiguration was not planned within this timeframe or the timeframe was unclear. Two hospitals acted as a standalone units.

6.3 Availability of staff, services and facilities

The VSGBI has set recommendations on the minimum numbers of staff at various levels of vascular care that hospitals in reconfigured vascular networks should provide in order to maintain and improve the quality of care before, during and after surgery. To ensure adequate emergency care, the VSGBI advises that:

- a hub hospital should have a 24/7 emergency call rota, covered by at least six consultant vascular specialists [VSGBI 2015], and
- a vascular anaesthetist available round-the-clock [VSGBI 2015].

These recommendations were not widely met (see Table 6.1). Although nearly all surveyed NHS trusts reported that a vascular surgeon was available 24/7, just over half of the NHS trusts employed six or more surgeons to cover on-call rotas. Only one hospital reported having a vascular anaesthetist on-call rota, and fewer than half of the hospitals reported that all vascular operating lists were staffed by a consultant vascular anaesthetist (Table 6.1).

With the reconfiguration of vascular services, the VSGBI anticipates that the role of the vascular nurse specialist (VNS) will become increasingly important, particularly in spoke hospitals, and the Society recommends that at least one VNS is needed within a hospital [VSGBI 2015]. At the time of the audit, 77 (92%) hospitals reported having at least one VNS.

In terms of facilities, VSGBI recommends that hub hospitals should have

- a 24/7 critical care facility that is able to provide mechanical ventilation and renal support [VSGBI 2015]
- at least one hybrid endovascular theatre, and
- wards dedicated to vascular patients [VSGBI 2015].

Dedicated vascular beds were available in all hospitals but fewer than half (43%) of the hospitals reported that they had at least one hybrid theatre.

The majority of the surveyed NHS trusts had vascular diagnostic services available in-hours but CT was the only one routinely available out-of-hours as well. A vascular laboratory, providing more specialised vascular physiology assessments, should be available in hubs [VSGBI 2015]. The majority of the hospitals (n=43, 68%) had vascular physiology assessment available in-hours and two hospitals had this service also available out-of-hours.

Table 6.1. Overall availability of staff, facilities and services

Availability of staff	**Number (%) NHS trusts (n=84)**
Hospital has consultant vascular surgeon available 24/7	81 (96)
Hospital provides major trauma surgery and has a protocol for 24/7 vascular team availability	37 (44)
Hospital provides out-of-hours general surgery and general surgeons sometimes cover vascular emergencies	3 (4)
6 or more consultant vascular surgeons in hospital[1]	45 (54)
6 or more consultant interventional radiologists[1]	22 (26)
Hospital has vascular anaesthetist on-call rota	1 (1)
Per cent of vascular operating lists staffed by a consultant vascular anaesthetist	
100%	35 (42)
75-99%	39 (46)
<=74%	10 (12)
At least one vascular nurse specialist[1]	77 (92)
Availability of facilities	
Diagnostic services available in-hours:	
Duplex	62 (98)
CT	53 (84)
MR angiography	60 (95)
Specialist vascular physiology assessments	43 (68)
Diagnostic services available out-of-hours:	
Duplex	10 (12)
CT	81 (96)
MR angiography	19 (23)
Specialist vascular physiology assessments	2 (2)
A&E admitting all emergency surgical patients	78 (93)
At least one hybrid operating theatre	36 (43)
Number of vascular ward beds	
None	3 (4)
1-20	30 (36)
21-40	48 (57)
41+	3 (4)
Number of critical care (levels 2 and 3) beds for adult surgical patients	
1-10	17 (20)
11-20	36 (43)
21-40	22 (26)
41+	9 (11)
Availability of services	
10 or more dedicated vascular/venous operating lists (half-day) per week	57 (68)
5 or more dedicated venous operating lists (half-day) per week	3 (4)
10 or more dedicated renal access operating lists (half-day) per week	0
At least one dedicated vascular/venous operating list (full day) per week	79 (94)

[1] Full-time equivalent

As many vascular operations take longer than a half-day session, it is recommended that NHS trusts undertaking vascular surgery should have at least one all day operating list per week for vascular surgery as well as access to additional, emergency theatre time as required [VSGBI 2015]. The majority of the hospitals (n=79, 94%) reported having at least one weekly full day vascular or venous operating list.

Alternative arrangements when services or facilities are not available

Of the 84 responding NHS trusts, 83 reported providing out-of-hours general surgery. In nine NHS trusts vascular surgeons sometimes provided cover for general surgery emergencies. In addition, three trusts reported that general surgeons sometimes covered vascular emergencies.

Though 81 NHS trusts had a consultant vascular surgeon available 24/7, 18 (21%) also reported that patients needed to be transferred when no consultant vascular surgeon was available.

Of the responding NHS trusts, two reported not having an A&E, and in four NHS trusts' A&E departments, no emergency care was available for vascular surgical patients, necessitating their transfers to other NHS trusts.

Pre- and postoperative care

The importance of adequate preoperative care in vascular procedures was highlighted in both the 2014 NCEPOD report *Lower Limb Amputation: Working Together* as well as the VSGBI's Provision of Vascular Services document [NCEPOD 2014; VSGBI 2015]. Of the NHS trusts in the current survey, preoperative nutritional assessment was available in 46 (55%), involvement of the Care of the Elderly team in 18 (21%) and cardiac assessment with Cardiology in 49 (58%) NHS trusts. Multidisciplinary management for diabetic foot disease was provided in 73 (87%) and for stroke in 78 (93%) NHS trusts. For patients undergoing amputations, 52 (62%) NHS trusts had a pain management protocol and 59 (70%) had wound/pressure area care protocol.

6.4 Abdominal aortic aneurysm (AAA) repair

Among the 84 responding NHS trusts, 77 (92%) reported undertaking elective as well as emergency AAA repair. Three trusts reported undertaking only elective procedures. Four trusts did not carry out AAA repairs. Details of the operations, staff and facilities at the 80 NHS trusts undertaking elective AAA repairs are summarised in Table 6.2.

Table 6.2. Characteristics of the provision of elective AAA repair

Operations performed	N (%) NHS trusts (n=80)
Supra-renal aneurysms	
Open repair	46 (58)
Endovascular repair	41 (51)
Hybrid repair	17 (21)
Thoraco-abdominal aneurysms	
Open repair	19 (24)
Endovascular repair	29 (36)
Hybrid repair	18 (23)
Thoracic aneurysms	
Open repair	20 (25)
Endovascular repair	44 (55)
Hybrid repair	13 (16)
Staff performing operations	
Staff who have access to 3D planning software for EVARs	
Surgeons	2 (3)
Radiologists	15 (19)
Surgeons and radiologists	55 (69)
3D planning software not available	4 (5)
Staff who usually plans standard EVARs	
Surgeons	9 (11)
Radiologists	15 (19)
Surgeons and radiologists	52 (65)
Staff who usually perform standard EVARs	
Surgeons	8 (10)
Radiologists	3 (4)
Surgeons and radiologists	65 (81)
Facilities available	
Facilities where standard EVARS are usually performed	
Standard operating theatre	21 (26)
Radiology department	23 (29)
Hybrid operating theatre	32 (40)
Facilities where complex EVARs are usually performed	
Standard operating theatre	9 (11)
Radiology department	23 (29)
Hybrid operating theatre	26 (33)

Standard endovascular repairs (EVARs) were typically planned and conducted by both vascular surgeons and radiologists. EVARs were performed by surgeons alone in only eight vascular units. Most NHS trusts (n=71, 89%) reported that lack of critical care bed availability was never or only occasionally a problem. However, in nine (11%) NHS trusts, this was reported to be a monthly problem.

In addition to elective procedures, 71 NHS trusts reported that they carried out emergency EVARs for ruptured aneurysms, with 37 (52%) NHS trusts providing these operations performing these on a 24/7 basis. In the majority of NHS trusts providing these operations, EVARs for ruptured AAAs were usually planned by surgeons and radiologists together (49 trusts, 69%) and also carried out by both professions (58 trusts, 82%). EVARs for ruptured AAAs were performed in standard operating theatres (25 trusts, 35%), radiology departments (21 trusts, 29%) or hybrid theatres (26 trusts, 36%). The trusts reported that the lack of critical care beds was never or only occasionally a problem in accepting patients for these procedures.

6.5 Carotid interventions

Overall, 81 (96%) NHS trusts reported carrying out carotid interventions. Just under half of these (37 trusts, 46%) had a specific carotid multidisciplinary team (MDT), and about a quarter (18 trusts, 22%) had a dedicated cerebrovascular audit meeting.

Carotid stenting was performed by vascular surgeons in two hospitals, by interventional radiologists in 16 (20%) NHS trusts and by neuro-radiologists in 12 (15%) NHS trusts. 56 (69%) NHS trusts did not perform stenting and reported referring patients to regional hubs.

6.6 Major lower limb amputations

Major lower limb amputations (above or through the ankle) for peripheral arterial disease are associated with high postoperative mortality and complication rates. Improving the outcomes of these procedures has been highlighted by the VSGBI and the NCEPOD, and both have made a series of recommendations related to the delivery of lower limb amputations, including:

- that amputations should be performed on an elective operating list
- that patients undergoing amputations should be reviewed pre-and postoperatively by a multidisciplinary team including specialists in vascular surgery, physiotherapy, occupational therapy, diabetology, radiology, and nursing [NCEPOD 2014]
- that a consultant vascular surgeon should undertake or at least be present in the operating theatre for all amputations [NCEPOD 2014]
- There should be a complex discharge co-ordinator for lower limb amputees [NCEPOD 2014]

All but one of the NHS trusts in the NVR organisational survey reported performing major lower limb amputations. On average, 66% of the surveyed NHS trusts reported that major amputations were performed on an elective list and in 70% of trusts patients undergoing these operations were also discussed at an MDT meeting (see Table 6.3).

Table 6.3. Availability of staff and services for major lower-limb amputations

Availability of pre-operative assessments	**Number (%) NHS trusts (n=83)**
Proportion of patients assessed by a consultant vascular surgeon	
90% or less	10 (12)
91-99%	3 (4)
100%	70 (84)
Proportion of patients discussed at an MDT	
Less than 25%	14 (17)
25-49%	5 (6)
50-74%	29 (35)
75-100%	34 (41)
Proportions of operations performed on an elective list	
Less than 25%	8 (10)
25-49%	9 (11)
50-74%	37 (44)
75-100%	29 (35)
Patients usually assessed by	
Consultant in Rehabilitation Medicine	11 (13)
Rehabilitation physiotherapist	66 (80)
Care for the Elderly physician	9 (11)
Occupational therapist	51 (61)
Podiatrist (for care of contralateral limb, if applicable)	27 (33)
Prosthetics service representative	21 (25)
Staff usually carrying out amputations	
In-hours:	
Vascular surgeons	82 (99)
General surgeons	1 (1)
Orthopaedic surgeons	5 (6)
Out-of-hours:	
Vascular surgeons	77 (93)
General surgeons	3 (4)
Orthopaedic surgeons	3 (4)
Post-operative care and discharge	
Complex discharge co-ordinator available	62 (75)
Dedicated rehabilitation ward available on site	19 (23)
Rehabilitation physiotherapy available >=5 days/week	79 (95)
Occupational therapy available >=5 days/week	80 (96)

In the majority of the NHS trusts (n=70, 84%), all patients undergoing major amputations were preoperatively assessed by a consultant vascular surgeon. In addition, patients were assessed by a rehabilitation physiotherapist in 66 (80%) NHS trusts, by an occupational therapist in 51 (61%) NHS trusts and by a podiatrist in 27 (33%) NHS trusts. However, preoperative assessments were available from a prosthetics service representative in only 21 (25%) NHS trusts, from a consultant in rehabilitation medicine in 11 (13%) and care for the elderly physician in 9 (11%) NHS trusts.

In relation to the presence of a consultant vascular surgeon in theatre for all amputations, 82 (99%) NHS trusts reported that major lower limb amputations were usually carried out by a vascular surgeon in-hours amputations and 77 (93%) reported that out-of-hours amputations were carried out by vascular surgeons as well.

In terms of postoperative care, 62 (75%) NHS trusts reported that they met the NCEPOD recommendation of having a complex discharge co-ordinator. However, only 12 (14%) NHS trusts had a timeline for repatriation following a major amputation and, of these, five trusts reported that the timeline was typically met in 50% or more of the cases. Major amputation patients were most often discharged home (50% on average), to a rehabilitation unit or rehabilitation ward (approximately 20% each) or spoke hospital (15%).

6.7 Other lower limb interventions for peripheral arterial disease (PAD)

All 84 responding NHS trusts performed lower limb angioplasties and lower limb bypasses. In addition, 78 (93%) hospitals reported performing open procedures and 80 (95%) performed endovascular procedures for varicose veins. All NHS trusts undertook minor amputations (below ankle).

The VSGBI recommends that a MDT be involved in assessment and treatment of diabetic foot problems in all hospitals [VSGBI 2015]. Table 6.4 shows that 71 (85%) NHS trusts had at least one diabetic foot clinic and 50 (60%) had at least one diabetic MDT per week. The foot clinics were typically staffed by diabetes physicians, vascular surgeons, nurses and podiatrists; orthotistis, orthopaedic surgeons, physiotherapists, occupational therapists and infection specialists were less commonly involved.

All NHS trusts provided debridements for diabetic feet in-hours. An out-of-hours service was available in all but one organisation. Debridements were most often performed by vascular surgeons (in-hours in 82 (98%) NHS trusts and out-of-hours in 78 (93%) NHS trusts). Debridements were also provided by podiatrists and general surgeons.

Table 6.4. Availability of staff and services for diabetic foot care

Staff and services	N (%) NHS trusts (n=84)
Number of weekly diabetic foot clinics	
None	7 (8)
Less than weekly (<1)	6 (7)
1	22 (26)
2-5	44 (52)
6 or more	5 (6)
Number of weekly diabetic MDTs	
None	23 (27)
Less than weekly (<1)	5 (6)
1 or more	50 (60)
Number of full-time diabetologists with vascular expertise	
None	11 (13)
1-2	46 (55)
3 or more	20 (24)
Staff who are always available to staff diabetic foot clinic	
Podiatrist	68 (88)
Diabetes physician	65 (84)
Vascular surgeon	44 (57)
CNS/DNS	39 (51)
Orthotist	26 (34)
Foot and ankle/orthopaedic surgeon	22 (29)
Infection specialist	10 (13)
Physiotherapist	9 (12)
Occupational therapist	3 (4)

6.8 Vascular training for medical professionals

There were 81 NHS trusts who reported providing training for vascular professionals, with the average number of full-time vascular surgery trainees in a hospital being two.

There were 61 (73%) NHS trusts that provided vascular interventional radiology training for surgical trainees and 33 (39%) NHS trusts that provided vascular surgery training for radiology trainees. Typically NHS trusts had one weekly peripheral angiography list and two EVAR lists available for vascular surgery trainees, and five angiography and one EVAR lists available for interventional radiology trainees.

6.9 Conclusion

Overall, the majority of the NHS trusts responding to the organisational audit reported that they were a part of a reconfigured network, although, for many NHS trusts, reconfiguration was still an on-going process.

In general, a large proportion of the NHS trusts in the survey have appropriate facilities but some elements of service organisation could be improved in many trusts.

NHS trusts reported having staff and services available for a wide range of procedures, had access to at least one full-day operating lists, and in-hours access to diagnostic services. However, only one-half of NHS trusts had six or more full-time equivalent vascular consultants and one-quarter of NHS trusts had six or more interventional radiologists. Out-of-hours access to diagnostic services was also limited to duplex and MR angiography.

The organisational audit findings suggest that the pathways and care for lower limb amputations are better than those reported in the NCEPOD report. Nonetheless, further work would help to ascertain whether these observations indicate a genuine change in the pathways of care and translate into improved outcomes for patients undergoing lower limb amputations.

In conclusion, the organisational audit provides important insights into the organisation of vascular services in the UK in 2015, highlighting areas of good practice and pointing to others, where improvements could be made. With the reconfiguration of services into vascular networks still ongoing in many NHS trusts, the provision of vascular services in the UK is still subject to change, and for this reason, further work will be needed to determine the extent to which the findings reported here indicate long-term, sustainable changes in the organisation of care, and their potential impact on the outcomes achieved by patients.

7 Conclusion

The reconfiguration of vascular services into large centres, and a hub and spoke network arrangement, is continuing in many parts of the UK. Most centres have undergone or will undergo a reconfiguration process in the next few years. The Vascular Society has supported the concept of reconfiguration with the Provision of Vascular Services document which has been updated during 2015. This sets out a series of standards that vascular units should meet to provide the best care for patients with vascular disease.

The results in this Annual Report add to the earlier findings from the NVD and Carotid Interventions Audit and demonstrate that patient outcomes after a major arterial procedure have improved over the last decade. These are in line with the expected benefits of reconfiguration, and this report highlights the year on year reduction in the number of low volume arterial centres. The outcomes achieved by vascular units for elective aortic aneurysm repair, carotid endarterectomy and lower limb bypass are very good. However, the pathways and outcomes from major lower limb amputation warrant further effort and the Vascular Society is updating its amputation quality improvement pathway to support this. In addition, better levels of data submission about major amputation are required to enable a detailed analysis of unit level outcomes.

Another concern is the low level of case ascertainment for lower limb endovascular procedures. Work to improve this is required at regional and national governance levels, potentially through the revalidation and commissioning processes. While the figures presented here can support local quality improvement, higher levels of case ascertainment would give the NVR a greater ability to give NHS trusts a detailed picture of comparative practice and the outcomes resulting from lower limb endovascular intervention.

Appendix 1: Organisation of the Registry

The NVR is assisted by the Audit and Quality Improvement Committee of the Vascular Society and overseen by a Project Board, which has senior representatives from the participating organisations and the commissioning organisation.

Members of Audit and Quality Improvement Committee of the Vascular Society

Prof I Loftus	Chair	Vascular Society of GB&I
Miss R Bell		Vascular Society of GB&I
Mr J Boyle		Vascular Society of GB&I
Mr J V Smyth		Vascular Society of GB&I
Mr J J Earnshaw		National AAA Screening Programme
Dr N Chalmers		British Society of Interventional Radiology
Dr A Pichel		Royal College of Anaesthetists

plus members of the CEU involved in the NVR: Dr David Cromwell, Dr Katriina Heikkila, Dr Amundeep Johal, and Mr Sam Waton.

Members of Project Board

Prof J van der Meulen, Chair	Royal College of Surgeons of England
Mr K Varty,	Vascular Society of GB&I
Dr F Miller	British Society of Interventional Radiology
Ms P Oomahdat	HQIP
Ms Z Ajdari	HQIP
Mr P Rottier	Northgate Public Services (UK) Limited

Plus members of the project / delivery team: Prof Ian Loftus (Lead Clinician), Dr David Cromwell, Dr Katriina Heikkila, Dr Amundeep Johal, and Mr Sam Waton, Caroline Junor (Northgate Public Services (UK) Limited)

Appendix 2: Organisational audit responses

Trust code	Trust Name	Country	Completed Organisational Audit
7A1	Betsi Cadwaladr University Local Health Board	Wales	Yes
7A3	Abertawe Bro Morgannwg University Local Health Board	Wales	Yes
7A4	Cardiff and Vale University Local Health Board	Wales	Yes
7A5	Cwm Taf Local Health Board	Wales	Yes
7A6	Aneurin Bevan Local Health Board	Wales	Yes
R1H	Barts Health NHS Trust	England	Yes*
R1K	London North West Healthcare NHS Trust	England	Yes
RA9	South Devon Healthcare NHS Foundation Trust	England	Yes
RAE	Bradford Teaching Hospitals NHS Foundation Trust	England	Yes
RAJ	Southend University Hospital NHS Foundation Trust	England	Yes
RAL	Royal Free London NHS Foundation Trust	England	Yes
RBA	Taunton and Somerset NHS Foundation Trust	England	Yes
RBD	Dorset County Hospital NHS Foundation Trust	England	Yes
RBZ	Northern Devon Healthcare NHS Trust	England	Yes
RC1	Bedford Hospital NHS Trust	England	Yes
RCB	York Teaching Hospital NHS Foundation Trust	England	Yes
RDD	Basildon and Thurrock University Hospitals NHS Foundation Trust	England	Yes
RDE	Colchester Hospital University NHS Foundation Trust	England	Yes
RDU	Frimley Health NHS Foundation Trust	England	Yes
RDZ	Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	England	Yes
REF	Royal Cornwall Hospitals NHS Trust	England	Yes
RF4	Barking, Havering And Redbridge University Hospitals NHS Trust	England	Yes
RGT	Cambridge University Hospitals NHS Foundation Trust	England	Yes
RH8	Royal Devon and Exeter NHS Foundation Trust	England	Yes
RHM	University Hospital Southampton NHS Foundation Trust	England	Yes
RHQ	Sheffield Teaching Hospitals NHS Foundation Trust	England	Yes
RHU	Portsmouth Hospitals NHS Trust	England	Yes*
RJ1	Guy's and St Thomas' NHS Foundation Trust	England	Yes
RJ7	St George's Healthcare NHS Foundation Trust	England	Yes
RJE	University Hospital of North Midlands NHS Trust	England	Yes
RJR	Countess of Chester Hospital NHS Foundation Trust	England	Yes
RJZ	King's College Hospital NHS Foundation Trust	England	Yes
RK9	Plymouth Hospitals NHS Trust	England	Yes
RKB	University Hospitals Coventry and Warwickshire NHS Trust	England	Yes
RLN	City Hospitals Sunderland NHS Foundation Trust	England	Yes
RM1	Norfolk and Norwich University Hospitals NHS Foundation Trust	England	Yes
RM2	University Hospital of South Manchester NHS Foundation Trust	England	Yes
RMC	Bolton NHS Foundation Trust	England	Yes**
RNA	The Dudley Group NHS Foundation Trust	England	Yes

Trust code	Trust Name	Country	Completed Organisational Audit
RNL	North Cumbria University Hospitals NHS Trust	England	Yes
RNS	Northampton General Hospital NHS Trust	England	Yes
RNZ	Salisbury NHS Foundation Trust	England	Yes
RP5	Doncaster and Bassetlaw Hospitals NHS Foundation Trust	England	Yes
RPA	Medway NHS Foundation Trust	England	Yes
RQ6	Royal Liverpool and Broadgreen University Hospitals NHS Trust	England	No
RQ8	Mid Essex Hospital Services NHS Trust	England	Yes
RQW	Princess Alexandra Hospital NHS Trust	England	Yes
RR1	Heart of England NHS Foundation Trust	England	Yes
RR7	Gateshead Health NHS Foundation Trust	England	Yes**
RR8	Leeds Teaching Hospitals NHS Trust	England	Yes
RRK	University Hospitals Birmingham NHS Foundation Trust	England	Yes
RRV	University College London Hospitals NHS Foundation Trust	England	Yes
RTD	Newcastle upon Tyne Hospitals NHS Foundation Trust	England	Yes
RTE	Gloucestershire Hospitals NHS Foundation Trust	England	Yes
RTG	Derby Teaching Hospitals NHS Foundation Trust	England	Yes
RTH	Oxford University Hospitals NHS Trust	England	Yes
RTK	Ashford And St Peter's Hospitals NHS Foundation Trust	England	Yes
RTR	South Tees Hospitals NHS Foundation Trust	England	Yes
RVJ	North Bristol NHS Trust	England	Yes
RVV	East Kent Hospitals University NHS Foundation Trust	England	Yes
RW3	Central Manchester University Hospitals NHS Foundation Trust	England	Yes
RW6	Pennine Acute Hospitals NHS Trust	England	Yes
RWA	Hull and East Yorkshire Hospitals NHS Trust	England	Yes
RWD	United Lincolnshire Hospitals NHS Trust	England	Yes
RWE	University Hospitals of Leicester NHS Trust	England	Yes
RWG	West Hertfordshire Hospitals NHS Trust	England	Yes
RWH	East and North Hertfordshire NHS Trust	England	Yes
RWP	Worcestershire Acute Hospitals NHS Trust	England	Yes
RWY	Calderdale and Huddersfield NHS Foundation Trust	England	Yes
RX1	Nottingham University Hospitals NHS Trust	England	Yes
RXH	Brighton and Sussex University Hospitals NHS Trust	England	Yes
RXL	Blackpool Teaching Hospitals NHS Foundation Trust	England	Yes**
RXN	Lancashire Teaching Hospitals NHS Foundation Trust	England	Yes
RXP	County Durham and Darlington NHS Foundation Trust	England	Yes
RXQ	Buckinghamshire Healthcare NHS Trust	England	Yes
RXR	East Lancashire Hospitals NHS Trust	England	Yes
RXW	Shrewsbury and Telford Hospital NHS Trust	England	Yes
RYJ	Imperial College Healthcare NHS Trust	England	Yes
SA999	NHS Ayrshire & Arran	Scotland	Yes
SF999	NHS Fife	Scotland	Yes
SG999	NHS Greater Glasgow and Clyde	Scotland	Yes
SH999	NHS Highland	Scotland	Yes

Trust code	Trust Name	Country	Completed Organisational Audit
SL999	NHS Lanarkshire	Scotland	Yes
SN999	NHS Grampian	Scotland	Yes
SS999	NHS Lothian	Scotland	Yes
ST999	NHS Tayside	Scotland	Yes
SV999	NHS Forth Valley	Scotland	Yes
SY999	NHS Dumfries and Galloway	Scotland	Yes
ZT001	Belfast Health and Social Care Trust	Northern Ireland	Yes

* These NHS trusts submitted the questionnaire after the deadline for analysis. Their results are not included in chapter 6 of the report, but are still shown in the appendices.

** These NHS trusts submitted the questionnaire stating that they were a vascular spoke and don't now carry out major arterial procedures or will be stopping soon. Their results therefore don't appear in the organisational audit appendices.

Appendix 3: Organisational level information (patient level data)

Organisational level information of AAA repair (based on AAA repairs carried out in 2014)

	Infra-renal								**Ruptured**	**Complex**
Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	#EVAR	% patients with date of assessment	% patients with anaesthetic review	Median delay and IQR from assessment to surgery	Adjusted in-hospital mortality	AAA Cases	AAA Cases
7A1	50	56	112%	43	80%	100%	63 (32-92)	2.1%	17	0
7A3	58	62	107%	34	100%	100%	77 (27-168)	0.5%	64	0
7A4	47	47	100%	25	100%	100%	68 (42-108)	1.2%	30	<5
7A5	26	30	115%	19	100%	100%	60 (28-91)	5.7%	10	<5
7A6	47	50	106%	40	98%	98%	130 (70-180)	2.4%	21	<5
R1H	42	43	102%	29	98%	100%	64 (43-129)	2.0%	27	11
R1K	56	47	84%	44	100%	100%	66 (24-127)	1.6%	19	<5
RA9	24	23	96%	17	100%	100%	39 (22-58)	0.0%	13	0
RAE	29	28	97%	19	100%	100%	63 (28-111)	3.7%	31	0
RAJ	28	29	104%	23	76%	100%	99 (57-145)	1.6%	16	<5
RAL	71	61	86%	58	100%	100%	74 (34-168)	2.0%	26	29
RBA	67	62	93%	39	98%	100%	56 (36-97)	2.0%	37	<5
RBD	7	8	114%	0	100%	100%	64 (55-136)	0.0%	<5	0
RC1	57	50	88%	40	100%	100%	50 (22-107)	1.4%	35	<5
RCB	75	75	100%	29	99%	100%	69 (35-104)	1.9%	32	<5
RDD	28	27	96%	20	100%	100%	69 (41-97)	0.0%	<5	<5
RDE	79	64	81%	37	97%	100%	68 (38-91)	0.6%	23	<5
RDU	68	55	81%	41	100%	100%	48 (28-93)	0.0%	45	16

	Infra-renal								**Ruptured**	**Complex**
Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	#EVAR	% patients with date of assessment	% patients with anaesthetic review	Median delay and IQR from assessment to surgery	Adjusted in-hospital mortality	AAA Cases	AAA Cases
RDZ	83	60	72%	34	88%	100%	52 (33-105)	0.0%	36	<5
REF	36	15	42%	10	93%	100%	83 (62-125)	1.2%	9	<5
RF4	34	31	91%	26	100%	100%	111 (65-154)	2.6%	28	<5
RGT	112	101	90%	86	93%	100%	87 (45-128)	0.8%	58	16
RH8	40	36	90%	23	100%	100%	59 (30-79)	1.9%	25	<5
RHM	87	78	90%	55	100%	100%	63 (40-90)	0.9%	37	7
RHQ	71	46	65%	19	89%	100%	86 (51-137)	4.2%	45	6
RHU	42	42	100%	35	98%	100%	77 (25-139)	0.0%	11	0
RJ1	122	118	97%	96	99%	100%	85 (48-135)	0.5%	40	76
RJ7	138	106	77%	105	97%	100%	44 (27-71)	0.0%	45	46
RJE	89	96	108%	46	98%	100%	53 (30-104)	3.2%	54	<5
RJR	73	48	66%	37	92%	98%	91 (46-167)	0.0%	10	<5
RJZ	25	21	84%	21	86%	100%	68 (41-121)	1.3%	<5	<5
RK9	42	38	90%	18	100%	100%	52 (38-83)	0.0%	19	0
RKB	69	60	87%	48	97%	100%	42 (34-73)	2.9%	18	<5
RLN	35	30	86%	20	67%	100%	50 (33-93)	1.2%	19	<5
RM1	101	109	108%	58	94%	100%	65 (27-94)	0.7%	85	12
RM2	114	50	44%	32	92%	100%	65 (39-94)	0.0%	21	<5
RMC	16	17	106%	14	100%	100%	49 (22-67)	1.2%	19	0
RNA	106	102	96%	81	100%	100%	62 (33-118)	0.8%	53	8
RNL	38	16	42%	8	75%	100%	41 (29-59)	1.6%	23	0
RNS	54	50	93%	32	100%	100%	64 (39-102)	3.5%	39	0
RNZ	6	6	100%	0	67%	100%	82 (49.5-93)	2.3%	9	0
RP5	42	40	95%	28	100%	100%	69 (36-113)	0.8%	26	<5
RPA	43	44	102%	33	100%	100%	47 (28-72)	4.3%	40	0

Trust code	**Infra-renal** Estimated cases from HES	NVR Cases	Case-ascert.	#EVAR	% patients with date of assessment	% patients with anaesthetic review	Median delay and IQR from assessment to surgery	Adjusted in-hospital mortality	**Ruptured** AAA Cases	**Complex** AAA Cases
RQ6	122	110	90%	73	97%	100%	100 (56-150)	1.0%	38	43
RQ8	39	20	51%	<5	100%	100%	145 (91-189)	1.6%	18	0
RQW	27	10	37%	<5	100%	100%	90 (35-146)	0.0%	6	<5
RR1	85	62	73%	50	100%	100%	134 (78-216)	0.9%	16	15
RR8	81	75	93%	49	100%	100%	81 (46-119)	0.0%	50	6
RRK	61	63	103%	43	100%	100%	84 (62-121)	2.1%	34	<5
RTD	100	49	49%	20	84%	86%	68 (46-98)	2.9%	53	20
RTE	83	70	84%	26	89%	100%	69 (34-135)	2.1%	30	<5
RTG	82	83	101%	58	100%	100%	56 (23-104)	0.8%	55	7
RTH	91	70	77%	33	97%	100%	69 (27-138)	1.3%	49	6
RTK	37	31	84%	21	97%	97%	54 (47-76)	1.3%	37	10
RTR	63	56	89%	31	100%	100%	83 (49-137)	2.7%	52	7
RVJ	45	37	82%	25	100%	100%	49 (33-84)	2.7%	22	<5
RVV	51	59	116%	41	100%	100%	56 (40-82)	0.7%	20	8
RW3	68	55	81%	45	95%	100%	84 (30-149)	1.6%	24	15
RW6	72	65	90%	61	95%	98%	59 (39-94)	2.4%	36	<5
RWA	77	71	92%	25	0%	0%	N/A	3.2%	47	18
RWD	26	27	104%	0	100%	100%	48 (27-85)	4.6%	22	<5
RWE	92	73	79%	59	100%	100%	82 (42-135)	0.0%	60	28
RWG	54	55	102%	38	100%	100%	53 (35-101)	0.7%	16	0
RWH	23	28	122%	16	100%	100%	135 (77-165)	1.4%	24	<5
RWP	80	84	105%	43	100%	100%	35 (17-74)	0.5%	19	<5
RWY	31	31	100%	22	84%	97%	35 (16-58)	3.2%	24	0
RX1	82	79	96%	69	100%	100%	79 (42-126)	2.4%	73	11
RXH	87	72	83%	50	100%	100%	119 (71-174)	2.1%	59	9

	Infra-renal								**Ruptured**	**Complex**
Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	#EVAR	% patients with date of assessment	% patients with anaesthetic review	Median delay and IQR from assessment to surgery	Adjusted in-hospital mortality	AAA Cases	AAA Cases
RXL	73	0	0%	N/A	N/A	N/A	N/A	N/A	0	0
RXN	38	36	95%	25	100%	100%	101 (61-155)	2.6%	16	0
RXP	40	41	103%	17	56%	100%	75 (48-105)	1.4%	38	0
RXQ	24	20	83%	16	40%	100%	87 (53-171)	3.8%	<5	<5
RXR	39	31	79%	28	100%	100%	92 (33-123)	0.8%	11	0
RXW	33	27	82%	16	100%	100%	54 (41-90)	0.9%	25	<5
RYJ	71	63	89%	38	38%	100%	88 (52-174)	1.1%	13	23
SA999	14	1	7%	0	100%	100%	79 (79-79)	0.0%	5	0
SG999	63	25	40%	17	100%	100%	57 (28-95)	1.5%	14	<5
SH999	25	29	116%	13	100%	100%	56 (39-102)	2.7%	8	0
SL999	32	2	6%	<5	100%	100%	67 (40-93)	0.0%	<5	0
SN999	45	32	71%	23	100%	100%	71 (24-110)	1.1%	18	<5
SS999	74	47	64%	17	100%	100%	98 (35-140)	0.8%	44	<5
ST999	44	36	82%	19	100%	100%	98 (71-147)	2.6%	49	5
SV999	12	24	200%	11	100%	100%	82 (50-141)	0.0%	19	<5
SY999	9	10	111%	0	100%	100%	56 (34-121)	5.9%	12	<5
ZT001	151	157	104%	92	99%	100%	75 (37-153)	1.3%	62	11

The table above only shows trusts who are still carrying out elective infra-renal AAA repairs. Therefore the numbers may not add up to the totals in chapters 2 and 3.

Organisational level information on carotid endarterectomy (based on carotid endarterectomies carried out in 2014)

Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	Symptomatic cases	Patients referred within 7 days of symptom	Patients receiving surgery within 7 days of referral	Patients receiving surgery within 14 days of symptom	Median delay and IQR from index symptom to surgery	% Adjusted Stroke and/or death rate
7A1	30	33	110%	32	18 (56%)	19 (58%)	18 (56%)	13 (78-21)	1.9%
7A3	101	110	109%	101	59 (58%)	67 (61%)	57 (56%)	13 (7-28)	2.9%
7A4	32	32	100%	25	18 (72%)	8 (25%)	10 (40%)	19 (12-45)	1.3%
7A5	22	26	118%	26	13 (50%)	16 (62%)	12 (46%)	17 (10-28)	2.8%
7A6	60	59	98%	51	37 (73%)	29 (49%)	35 (69%)	13 (9-18)	2.3%
R1H	42	35	83%	28	24 (86%)	20 (57%)	22 (79%)	8 (5-12)	3.8%
R1K	28	18	64%	17	15 (88%)	10 (56%)	12 (71%)	5 (3-36)	1.8%
RA9	28	28	100%	28	22 (79%)	23 (82%)	24 (86%)	7 (4-10)	3.1%
RAE	42	45	107%	41	29 (73%)	28 (64%)	29 (73%)	9 (6-16)	0.0%
RAJ	29	30	103%	30	25 (86%)	27 (90%)	29 (97%)	8 (6-10)	0.7%
RAL	19	17	89%	15	11 (79%)	7 (41%)	8 (53%)	14 (7-55)	2.1%
RBA	62	60	97%	60	44 (75%)	39 (65%)	38 (64%)	12 (8-21)	1.8%
RBD	16	16	100%	16	13 (81%)	11 (69%)	13 (81%)	9 (7-13)	0.0%
RBZ	13	13	100%	13	6 (55%)	5 (42%)	7 (58%)	14 (10-30)	8.1%
RC1	30	30	100%	24	14 (58%)	6 (20%)	11 (46%)	17 (11-41)	0.8%
RCB	124	121	98%	112	79 (71%)	102 (86%)	89 (81%)	5 (3-13)	2.8%
RDD	33	22	67%	21	16 (76%)	20 (91%)	18 (86%)	8 (6-11)	1.1%
RDE	72	67	93%	57	39 (68%)	21 (31%)	24 (42%)	18 (10-41)	1.8%
RDU	38	40	105%	40	30 (75%)	23 (58%)	23 (58%)	13 (5-20)	2.2%
RDZ	41	39	95%	37	29 (78%)	26 (67%)	23 (62%)	9 (4-42)	1.4%
REF	39	20	51%	19	14 (74%)	7 (35%)	11 (58%)	13 (8-50)	1.8%
RF4	50	51	102%	49	31 (66%)	23 (45%)	25 (51%)	14 (9-24)	3.1%

Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	Symptomatic cases	Patients referred within 7 days of symptom	Patients receiving surgery within 7 days of referral	Patients receiving surgery within 14 days of symptom	Median delay and IQR from index symptom to surgery	% Adjusted Stroke and/or death rate
RGT	103	81	79%	72	31 (44%)	21 (26%)	20 (28%)	28 (14-50)	1.8%
RH8	29	29	100%	28	23 (85%)	24 (83%)	22 (79%)	8 (5-11)	3.3%
RHM	85	82	96%	70	60 (86%)	47 (58%)	58 (83%)	11 (8-13)	1.7%
RHQ	89	47	53%	45	24 (53%)	22 (48%)	16 (36%)	17 (10-31)	1.7%
RHU	74	51	69%	51	35 (69%)	29 (58%)	35 (69%)	12 (7-26)	0.5%
RJ1	47	53	113%	49	21 (43%)	44 (83%)	28 (57%)	13 (7-25)	3.5%
RJ7	50	41	82%	39	30 (77%)	36 (88%)	32 (82%)	8 (6-13)	0.9%
RJE	81	79	98%	76	49 (66%)	57 (72%)	51 (67%)	11 (6-21)	1.0%
RJR	101	80	79%	79	60 (76%)	15 (19%)	32 (41%)	22 (10-37)	3.3%
RJZ	90	89	99%	72	49 (69%)	43 (48%)	42 (58%)	10 (4-32)	1.1%
RK9	53	52	98%	49	35 (71%)	28 (54%)	24 (49%)	15 (8-25)	0.0%
RKB	64	58	91%	56	26 (49%)	19 (33%)	17 (30%)	30 (11-61)	2.1%
RLN	37	38	103%	34	22 (65%)	21 (55%)	24 (71%)	11 (10-15)	0.9%
RM1	92	92	100%	83	59 (72%)	55 (61%)	60 (72%)	10 (6-16)	1.7%
RM2	118	54	46%	50	33 (66%)	36 (67%)	29 (58%)	12 (4-22)	2.1%
RMC	27	27	100%	27	16 (59%)	7 (26%)	9 (33%)	22 (12-75)	1.0%
RNA	113	111	98%	104	65 (64%)	65 (59%)	62 (60%)	12 (8-20.5)	1.9%
RNL	41	15	37%	14	9 (69%)	3 (20%)	5 (38%)	19 (12-127)	1.9%
RNS	52	52	100%	46	30 (65%)	28 (54%)	25 (54%)	14 (7-41)	2.8%
RNZ	24	24	100%	22	16 (73%)	15 (63%)	14 (64%)	11 (4-33)	1.5%
RP5	44	41	93%	41	32 (80%)	10 (24%)	25 (61%)	13 (10-16)	1.4%
RPA	33	31	94%	22	18 (82%)	13 (42%)	14 (64%)	12 (8-20)	3.7%
RQ6	136	122	90%	120	84 (72%)	42 (35%)	57 (48%)	15 (10-25)	2.5%
RQ8	39	8	21%	8	6 (75%)	4 (50%)	4 (50%)	18 (10-41)	0.0%
RQW	19	19	100%	18	7 (44%)	6 (33%)	4 (25%)	23 (14-169)	2.4%
RR1	48	44	92%	44	32 (76%)	24 (56%)	25 (57%)	10 (6-49)	0.7%
RR7	24	24	100%	24	12 (50%)	10 (42%)	10 (42%)	19 (12-40)	1.9%

Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	Symptomatic cases	Patients referred within 7 days of symptom	Patients receiving surgery within 7 days of referral	Patients receiving surgery within 14 days of symptom	Median delay and IQR from index symptom to surgery	% Adjusted Stroke and/or death rate
RR8	93	87	94%	86	61 (73%)	68 (78%)	62 (72%)	8 (6-16)	0.0%
RRK	69	70	101%	54	35 (67%)	10 (14%)	13 (25%)	26 (15-51)	3.6%
RRV	67	70	104%	62	46 (75%)	50 (72%)	40 (66%)	9 (6-19)	1.4%
RTD	70	67	96%	61	30 (53%)	36 (54%)	24 (41%)	19 (8-39)	2.0%
RTE	75	72	96%	67	40 (60%)	26 (37%)	29 (43%)	17 (10-31)	1.2%
RTG	41	46	112%	46	38 (83%)	42 (91%)	40 (87%)	6 (3-11)	4.9%
RTH	113	88	78%	63	32 (51%)	40 (47%)	32 (51%)	14 (8-43)	2.8%
RTK	55	57	104%	52	40 (77%)	36 (63%)	38 (73%)	8 (4-20)	0.5%
RTR	66	67	102%	67	53 (79%)	23 (35%)	33 (50%)	15 (9-23)	1.0%
RVJ	48	51	106%	51	40 (78%)	37 (73%)	36 (71%)	11 (8-21)	2.2%
RVV	85	85	100%	78	58 (74%)	63 (74%)	60 (77%)	7 (4-14)	1.0%
RW3	83	84	101%	74	53 (73%)	50 (63%)	54 (76%)	8 (5-14)	0.7%
RW6	153	152	99%	136	87 (64%)	85 (56%)	78 (57%)	10 (5-34)	1.6%
RWA	96	93	97%	90	46 (51%)	45 (48%)	38 (42%)	19 (9-78)	3.4%
RWD	39	36	92%	36	21 (58%)	26 (72%)	21 (58%)	13 (6-29)	2.3%
RWE	94	92	98%	83	61 (75%)	77 (84%)	64 (79%)	7 (4-13)	1.4%
RWG	55	50	91%	45	33 (75%)	22 (44%)	23 (51%)	14 (7-24)	2.2%
RWH	42	40	95%	35	27 (77%)	30 (77%)	29 (83%)	8 (5-12)	0.7%
RWP	91	90	99%	88	52 (60%)	61 (69%)	56 (64%)	11 (7-26)	0.9%
RWY	33	29	88%	25	17 (68%)	15 (52%)	13 (52%)	13 (9-21)	1.0%
RX1	73	71	97%	61	51 (84%)	55 (77%)	54 (89%)	8 (4-9)	2.2%
RXH	58	59	102%	59	33 (56%)	33 (57%)	32 (54%)	13 (9-31)	1.4%
RXL	52	0	0%	N/A	N/A	N/A	N/A	N/A	N/A
RXN	37	30	81%	27	12 (46%)	4 (13%)	6 (22%)	28 (17-46)	2.7%
RXP	60	56	93%	55	39 (72%)	13 (23%)	30 (55%)	14 (11-27)	0.0%
RXQ	89	86	97%	64	38 (59%)	27 (32%)	29 (46%)	15 (10-30)	2.4%
RXR	61	62	102%	54	39 (74%)	14 (23%)	20 (37%)	28 (8-64)	1.4%

Trust code	Estimated cases from HES	NVR Cases	Case-ascert.	Symptomatic cases	Patients referred within 7 days of symptom	Patients receiving surgery within 7 days of referral	Patients receiving surgery within 14 days of symptom	Median delay and IQR from index symptom to surgery	% Adjusted Stroke and/or death rate
RXW	42	37	88%	37	25 (68%)	30 (81%)	27 (73%)	9 (5-18)	2.5%
RYJ	75	68	91%	60	52 (87%)	38 (58%)	43 (72%)	7 (5-18)	2.9%
SA999	43	32	74%	31	15 (52%)	15 (47%)	18 (58%)	13 (9-22)	3.1%
SF999	14	12	86%	12	8 (67%)	3 (27%)	5 (42%)	16 (14-25)	7.1%
SG999	101	41	41%	41	21 (51%)	28 (72%)	21 (51%)	14 (10-20)	1.5%
SH999	35	31	89%	29	12 (41%)	9 (29%)	5 (17%)	21 (16-87)	1.0%
SL999	60	18	30%	18	10 (56%)	6 (33%)	4 (22%)	19 (15-32)	3.2%
SN999	26	22	85%	19	10 (53%)	16 (73%)	11 (58%)	13 (6-30)	1.3%
SS999	70	72	103%	72	57 (80%)	31 (43%)	43 (60%)	13 (10-19)	5.3%
ST999	26	14	54%	14	10 (77%)	6 (43%)	8 (62%)	13 (11-17)	3.4%
SV999	30	33	110%	32	14 (45%)	12 (36%)	10 (31%)	31 (10-50)	2.2%
SY999	30	29	97%	29	11 (41%)	2 (7%)	3 (11%)	34 (22-46)	0.0%
ZT001	148	154	104%	139	70 (51%)	79 (51%)	68 (49%)	15 (8-45)	1.4%

The table above only shows trusts who are still carrying out carotid endarterectomies. Therefore the numbers may not add up to the totals in chapter 4.

Country	Estimated cases from HES	NVR Cases	Case-ascert.	Symptomatic cases	Patients referred within 7 days of symptom	Patients receiving surgery within 7 days of referral	Patients receiving surgery within 14 days of symptom
England	4683	4144	88%	3793	2565 (69%)	2228 (54%)	2226 (59%)
N.I.	148	154	104%	139	70 (51%)	79 (51%)	68 (49%)
Scotland	435	304	70%	297	168 (58%)	128 (43%)	128 (43%)
Wales	245	260	106%	235	145 (62%)	139 (53%)	132 (56%)
UK Total	5511	4862	89%	4464	2948 (67%)	2574 (53%)	2554 (58%)

Appendix 4: Organisational level information (organisational audit based on services on 03/08/2015)

NHS Trust	Consultant Vascular surgeons	Consultant Interventional radiologists	Consultant Nurse specialists	Inpatient vascular beds	Total number of operation lists (half-day)	Full-day lists	1 or 2 day weekend operating	Hybrid theatre	% lists staffed by consultant vascular anaesthetist	24/7 vascular surgeon cover	24/7 interventional radiologist cover	Out-hours diagnostic services	No. of protocols (out of 7)	Training
7A1	2	1	2	8	5.5	Yes	0	No	**75-99%**	**C**		C	4	Yes
7A3	**8**	4	3	29	12	Yes	0	No	**75-99%**	**C**		C	2	Yes
7A4	3	3	1	26	10	Yes	0	No	**100%**	**C**		C	7	Yes
7A5	2	1	2	0	6	Yes	0	No	**75-99%**	**C**		C	4	Yes
7A6	2.3	2	1	10	8.5	Yes	0	No	**100%**	**C**		C	3	Yes
R1H	**6**	**7**	2	26	14	No	0	**Yes**	**50-74%**	**C**	C	C	6	Yes
R1K	**6**	**7**	1	40	10	Yes	0	**Yes**	50-74%	**CR**	C	C	4	Yes
RA9	2	3	2	6	4	No	0	**Yes**	50-74%	**C**	C	C	3	Yes
RAE	5	3	2	28	11	Yes	0	No	**75-99%**	**C**	C	DC	6	Yes
RAJ	2.5	2.5	2	30	9	Yes	2	No	**100%**	**C**		C	7	Yes
RAL	**13**	5	3	32	20	Yes	2	No	**100%**	**CR**	CR	C	6	Yes
RBA	5	5	4	32	11	Yes	0	No	**75-99%**	**C**	C	C	5	Yes
RBD	2	3	1	10	4	Yes	0	No	**75-99%**		C	DC	5	Yes
RBZ	1.5	1	0	8	3	Yes	0	No	**75-99%**	**C**		C	5	Yes
RC1	5	2	1.8	20	10	Yes	0	No	**100%**	**C**		C	6	No
RCB	5	5	1	30	17	Yes	0	No	50-74%	**C**	C	DCM	6	Yes
RDD	3	1	1	10	7	Yes	0	**Yes**	**75-99%**	**C**		C	4	Yes
RDE	**6**	**6**	2	20	10	Yes	0	**Yes**	**75-99%**	**C**	C	C	5	Yes
RDU	**7**	**6**	5	16	10	Yes	0	**Yes**	**100%**	**C**	C	CM	5	Yes
RDZ	3.8	4	2	22	9	Yes	0	No	**75-99%**	**C**	C	CM	7	Yes
REF	4	5	0	21	11	Yes	0	**Yes**	**100%**	**C**	C	C	3	Yes
RF4	**6**	5	1	30	12	No	0	**Yes**	**75-99%**	**C**	C	C	7	Yes
RGT	**6.9**	**6**	3	32	8	Yes	0	No	50-74%	**CR**	C	DC	6	Yes
RH8	3.5	3	0	19	10	Yes	0	No	**100%**	**C**	C	C	5	Yes

NHS Trust	Consultant Vascular surgeons	Consultant Interventional radiologists	Consultant Nurse specialists	Inpatient vascular beds	Total number of operation lists (half-day)	Full-day lists	1 or 2 day weekend operating	Hybrid theatre	% lists staffed by consultant vascular anaesthetist	24/7 vascular surgeon cover	24/7 interventional radiologist cover	Out-hours diagnostic services	No. of protocols (out of 7)	Training
RHM	6	6	5	24	10	Yes	0	No	75-99%	C	CR	DC	4	Yes
RHQ	8	6	2	28	11	Yes	0	No	75-99%	C	C	CM	4	Yes
RHU	2.5	5	2	20	8	Yes	0	No	50-74%	C		C	3	Yes
RJ1	10	9	7	62	28	Yes	0	Yes	75-99%	CR	CR	C	3	Yes
RJ7	6.8	8	3	24	14	Yes	1	Yes	75-99%	CR	C	C	5	Yes
RJE	11	4	2	32	21	Yes	0	Yes	100%	C	C	C	5	Yes
RJR	11	6	3	36	9	No	0	No	100%	CR	C	C	2	Yes
RJZ	6	6	1	20	14	Yes	1	No	100%	CR	CR	DCMP	7	Yes
RK9	4	4	1	12	9	Yes	0	No	75-99%	C	C	C	3	Yes
RKB	6	4	4	16	11	Yes	0	No	75-99%	C	C	CM	2	Yes
RLN	4.5	4	2	24	13	Yes	0	Yes	100%	C		C	6	Yes
RM1	6	5	1	34	13	Yes	0	No	75-99%	C	C	C	4	Yes
RM2	6	4	3	28	13	Yes	0	Yes	100%	CR	C	CM	4	Yes
RNA	9	5	5	36	18	Yes	0	No	100%	C		C	4	Yes
RNL	6	2	6	15	14	Yes	0	No	100%	C		C	7	Yes
RNS	6	3	5.2	28	9	Yes	0	No	75-99%	C		C	4	Yes
RNZ	1	1.5	2.5	49	1.25	No	0	No	50-74%	C	C	C	4	No
RP5	6	5	1.7	19	9.3	Yes	0	Yes	100%	C	C		2	Yes
RPA	6	5	2	1	8	Yes	1	Yes	100%	C	C	CM	7	Yes
RQ6	10	5	2	37	9	No	0	No	100%	C		C	6	Yes
RQ8	3	3	2	8	9	Yes	0	Yes	50-74%	R		C	5	Yes
RQW	2	2	1	10	4	Yes	0	Yes	100%	C	C	CM	6	Yes
RR1	6.5	4.5	2.5	13	17.6	Yes	0	Yes	100%	CR	C	C	3	Yes
RR8	9	7	1	36	19	Yes	0	No	100%	CR	C	DCM	4	Yes
RRK	6.75	8	0	24	16	Yes	0	Yes	100%	CR	C	CM	2	Yes
RRV	2	4	1	0	8	Yes	0	Yes	100%	C	CR	D	7	Yes

NHS Trust	Consultant Vascular surgeons	Consultant Interventional radiologists	Consultant Nurse specialists	Inpatient vascular beds	Total number of operation lists (half-day)	Full-day lists	1 or 2 day weekend operating	Hybrid theatre	% lists staffed by consultant vascular anaesthetist	24/7 vascular surgeon cover	24/7 interventional radiologist cover	Out-hours diagnostic services	No. of protocols (out of 7)	Training
RTD	**6**	5	0.5	31	17	Yes	0	**Yes**	**75-99%**	**CR**	C	C	3	Yes
RTE	**6**	4	4	30	13	Yes	0	**Yes**	**75-99%**	**C**		C	4	Yes
RTG	**8**	**6**	2	30	15.5	Yes	2	No	**75-99%**	**CR**	C	DCM	4	Yes
RTH	**7.5**	**6**	1	24	12	Yes	0	**Yes**	**100%**	**CR**	C	C	1	Yes
RTK	**6**	5	1	23	10	Yes	0	**Yes**	**75-99%**	**C**	C	C	6	Yes
RTR	**6**	4	3	26	9	Yes	0	**Yes**	**100%**	**C**		C	5	Yes
RVJ	**10**	**6**	2.3	39	25	Yes	0	**Yes**	**75-99%**	**C**	C	CM	5	Yes
RVV	4	4	4.6	24	12	Yes	0	**Yes**	**75-99%**	**CR**		C	6	Yes
RW3	5	5	2	28	16	Yes	0	**Yes**	**100%**	**CR**	C	C	6	Yes
RW6	**6**	5	2	24	15	Yes	0	**Yes**	**75-99%**	**CR**	C	CM	5	Yes
RWA	5.5	5	5	28	15	Yes	0	**Yes**	**75-99%**	**C**	C	C	7	Yes
RWD	5	5	3	25	9	Yes	0	No	**100%**	**C**		C	4	No
RWE	**6.5**	**6**	2	30	11	Yes	0	No	**75-99%**	**C**	C	DCM	2	Yes
RWG	4	2	1	0	12	Yes	0	No	**75-99%**	**C**		C	3	Yes
RWH	4	5	0	9	12	Yes	0	No	**75-99%**	**CR**		C	6	Yes
RWP	**6**	4	4	21	11	Yes	0	No	**75-99%**	**CR**		C	4	Yes
RWY	3.5	3	1	15	12	Yes	0	No	**75-99%**	**C**	C	C	6	Yes
RX1	**7**	**6**	3	28	13	Yes	0	No	**100%**	**C**	C	CM	4	Yes
RXH	**9**	5	1	37	13	Yes	0	**Yes**	**100%**	**CR**		C	2	Yes
RXN	**6**	**6**	3	20	10	Yes	0	**Yes**	**100%**	**C**		CM	3	Yes
RXP	**8**	2	3	30	12	Yes	0	**Yes**	**75-99%**	**C**		C	3	Yes
RXQ	2.5	3	2	5	7	Yes	0	No	**100%**	R		CM	5	Yes
RXR	5	4	2	12	14	Yes	0	**Yes**	**75-99%**	**C**		C	5	Yes
RXW	5	3	1	16	10	Yes	0	No	**100%**	**C**		C	4	Yes
RYJ	**8**	4	2	26	20	Yes	0	No	**100%**	**CR**	CR	C	6	Yes
SA999	4	2	1	24	10	Yes	0	**Yes**	**75-99%**	**C**		C	3	Yes

NHS Trust	Consultant Vascular surgeons	Consultant Interventional radiologists	Consultant Nurse specialists	Inpatient vascular beds	Total number of operation lists (half-day)	Full-day lists	1 or 2 day weekend operating	Hybrid theatre	% lists staffed by consultant vascular anaesthetist	24/7 vascular surgeon cover	24/7 interventional radiologist cover	Out-hours diagnostic services	No. of protocols (out of 7)	Training
SF999	2	1.5	2	16	6	Yes	0	No	<50%	**C**		C	3	Yes
SG999	**9**	**6**	1	48	12	Yes	0	**Yes**	**75-99%**	**CR**	C	C	2	Yes
SH999	3	2.5	1	12	7	Yes	0	**Yes**	50-74%	**C**		C	4	Yes
SL999	5	5	0	14	11	Yes	0	No	50-74%	**C**	C	C	3	Yes
SN999	5.5	3	1	23	10	Yes	0	No	**100%**	**C**		C	5	Yes
SS999	**7**	**6**	3	36	16	Yes	0	No	**75-99%**	**C**	C	C	6	Yes
ST999	5	**6**	1	24	12	Yes	0	No	**75-99%**	**C**	C	C	3	Yes
SV999	3	2	1	16	8	Yes	0	No	**75-99%**	**C**		C	0	Yes
SY999	2	0	1	8	4	Yes	2	No	50-74%	**C**			7	Yes
ZT001	**8**	**6**	2	26	20	Yes	0	No	100%	**CR**		C	5	Yes

The following NHS trusts/health boards have had their results in this table updated since the original publication: R1K, RNA, RQ6, and RXN.

Key

Indicator	Value	Response
24/7 vascular surgeon cover	C	Consultant available 24/7
24/7 interventional radiologist cover	R	Registrar available 24/7
Out-hours diagnostic services	D	Duplex
	C	CT
	M	MR Angiography
	S	Specialist vascular physiology assessments

NHS Trust	Ruptured AAA				Unruptured AAA						EVAR for unruptured AAA				
	EVAR possible	Who plans EVARs	Who performs EVARs	Where are EVARs performed	2-surgeon open AAA repairs	Complex aortic procedures	Infra-renal aneurysms	Supra-renal aneurysms	Thoraco-abdominal aneurysms	Thoracic aneurysms	Access to 3D planning software	Who plans EVARs	Who performs EVARs	Where are EVARs performed	Complex EVARs performed
7A1	Y (not 24/7)	I	B	S	<50%	No	OE				I	I	B	S	
7A3	N	B			<50%	Yes	OE	O		OE	B	B	B	R	R
7A4	Y (24/7)	B	I	R	<50%	Yes	OE	OE	OE	OE	N	B	B	R	R
7A5	Y (not 24/7)	B	B	R	<50%	Yes	OE	O			B	B	B	R	
7A6	Y (not 24/7)	B	B	S	50-74%	Yes	OE	O			B	B	B	S	S
R1H	Y (24/7)	B	B	R	50-74%	Yes	OE	E	E	E	B	B	B	H	H
R1K	Y (24/7)	I	B	H	<50%	Yes	OE	OE			I	I	B	H	H
RA9	Y (not 24/7)	I	B	H	75-99%	No	OE				B	I	B	H	
RAE	Y (not 24/7)	I	B	S	<50%	Yes	OE	O			B	B	B	R	
RAJ	Y (24/7)	B	B	S	<50%	Yes	OE				I	B	B	S	R
RAL	Y (24/7)	B	B	H	75-99%	Yes	OE	OE	OE	E	B	B	B	H	H
RBA	Y (not 24/7)	I	B	R	<50%	Yes	OE	O		E	B	B	B	R	R
RBD					75-99%	No	O								
RBZ	AAA repairs not carried out at this NHS trust														
RC1	Y (not 24/7)	V	V	S	<50%	Yes	OE	OE	E	E	V	V	V	S	R
RCB	Y (24/7)	B	B	R	<50%	Yes	OE	OE	OE		B	B	B	R	R
RDD	Y (not 24/7)	V	V	S	<50%	Yes	OE	O	O	E	B	V	V	H	H
RDE	Y (24/7)	B	B	H	<50%	Yes	OE	E			B	B	B	H	H
RDU	Y (24/7)	B	B	R	<50%	Yes	OE	OE			B	B	B	R	R
RDZ	Y (24/7)	B	B	R	<50%	Yes	OE	E		E	B	B	B	R	R
REF	Y (24/7)	B	B	H	<50%	Yes	OE			E	I	I	B	H	H
RF4	Y (not 24/7)	B	B	H	<50%	No	OE				I	B	B	H	
RGT	Y (24/7)	B	B	S	<50%	Yes	OE	OEH	OEH	EH	B	I	B	S	R
RH8	N				<50%	Yes	OE	OE		E	B	I	B	R	R
RHM	Y (not 24/7)	B	B	R	<50%	Yes	OE	OEH	OEH	OE	N	B	B	R	R

	Ruptured AAA				Unruptured AAA						EVAR for unruptured AAA				
NHS Trust	EVAR possible	Who plans EVARs	Who performs EVARs	Where are EVARs performed	2-surgeon open AAA repairs	Complex aortic procedures	Infra-renal aneurysms	Supra-renal aneurysms	Thoraco-abdominal aneurysms	Thoracic aneurysms	Access to 3D planning software	Who plans EVARs	Who performs EVARs	Where are EVARs performed	Complex EVARs performed
RHQ	Y (not 24/7)	I	I	R	<50%	Yes	OE	OEH	E	OEH	I	I	I	R	R
RHU	Y (not 24/7)	B	B	R	<50%	No	OE				B	I	B	R	
RJ1	Y (24/7)	B	B	H	50-74%	Yes	OE	OE	OEH	OE	B	B	B	H	H
RJ7	Y (24/7)	V	V	H	100%	Yes	OE	OEH	OEH	OEH	V	V	V	H	H
RJE	Y (24/7)	B	B	H	<50%	Yes	OE	O		E	B	B	B	H	H
RJR	Y (24/7)	B	B	S	<50%	Yes	OE	O			B	B	B	S	S
RJZ	Y (24/7)	B	B	R	<50%	Yes	OE	OEH	OEH	OEH	B	B	B	R	R
RK9	Y (not 24/7)	B	B	R	<50%	Yes	OE	O	OH	E	I	I	B	R	
RKB	Y (not 24/7)	B	B	S	75-99%	Yes	OE	E	E	OE	B	B	B	S	S
RLN	Y (not 24/7)	V	V	H	75-99%	Yes	OE	OE	E	E	B	V	V	H	H
RM1	Y (24/7)	B	B	S	<50%	Yes	OE	E		E	B	B	B	S	R
RM2	Y (24/7)	B	B	S	<50%	Yes	OE	O		OE	B	B	B	H	H
RNA	Y (not 24/7)	B	B	R	<50%	Yes	OE	E			B	B	B	R	R
RNL	Y (not 24/7)	B	B	S	<50%	No	OE				B	B	B	S	
RNS	Y (not 24/7)	B	B	S	100%	No	OE				B	B	B	S	
RNZ	EVARs not carried out				100%	No	O				EVARs not carried out				
RP5	Y (24/7)	V	V	S	75-99%	Yes	OE	O	O		B	V	V	S	S
RPA	Y (24/7)	B	B	H	75-99%	No	OE				N	B	B	H	
RQ6	Y (24/7)	V	V	S	<50%	Yes	OE	OE	E	E	B	V	V	S	S
RQ8	Y (not 24/7)	B	B	H	<50%	No	OE				I	B	B	H	
RQW	Y (24/7)	B	B	H	100%	Yes	OE	OE	E	E	I	B	B	H	H
RR1	Y (24/7)	V	V	S	75-99%	Yes	OE	OEH	EH	EH	B	V	V	H	H
RR8	Y (24/7)	I	B	R	<50%	Yes	OE	OEH	OH	OE	B	B	B	R	R
RRK	Y (not 24/7)	I	B	H	50-74%	Yes	OE	OE	OE	OE	B	I	B	H	H
RRV	AAA repairs not carried out at this NHS trust														

	Ruptured AAA				Unruptured AAA						EVAR for unruptured AAA				
NHS Trust	EVAR possible	Who plans EVARs	Who performs EVARs	Where are EVARs performed	2-surgeon open AAA repairs	Complex aortic procedures	Infra-renal aneurysms	Supra-renal aneurysms	Thoraco-abdominal aneurysms	Thoracic aneurysms	Access to 3D planning software	Who plans EVARs	Who performs EVARs	Where are EVARs performed	Complex EVARs performed
RTD	Y (not 24/7)	B	B	H	<50%	Yes	OE	OE	OEH	OE	B	B	B	H	H
RTE	Y (not 24/7)	B	B	H	<50%	No	OE				B	B	B	H	
RTG	Y (24/7)	B	B	S	<50%	No	OE				B	B	B	S	R
RTH	Y (not 24/7)	B	B	R	<50%	Yes	OE	OEH	OEH	OE	B	B	B	R	R
RTK	Y (24/7)	B	V	H	50-74%	Yes	OE	OEH	E	EH	B	B	B	H	H
RTR	Y (not 24/7)	B	B	H	75-99%	Yes	OE	OEH	EH	OEH	I	I	B	H	H
RVJ	Y (24/7)	B	B	H	75-99%	Yes	OE	OEH	EH	EH	B	B	B	H	H
RVV	Y (24/7)	B	B	H	<50%	Yes	OE				B	B	B	H	H
RW3	Y (24/7)	B	B	S	<50%	Yes	OE	E	EH	E	B	B	B	H	H
RW6	Y (24/7)	V	V	H	100%	Yes	OE	O			B	B	B	H	
RWA	Y (24/7)	I	B	H	<50%	Yes	OE	OEH	OEH	OEH	B	I	B	H	H
RWD	N				50-74%	No	O				EVARs not carried out				
RWE	Y (24/7)	B	B	S	50-74%	Yes	OE	OEH	EH	OEH	B	B	B	S	S
RWG	Y (24/7)	V	B	S	<50%	No	OE				B	B	B	S	
RWH	Y (24/7)	V	V	S	75-99%	Yes	OE	O			B	B	B	S	
RWP	Y (not 24/7)	B	B	S	<50%	Yes	OE	O			I	B	B	S	
RWY	Y (not 24/7)	I	B	R	50-74%	No	OE				I	I	I	R	
RX1	Y (24/7)	B	B	S	<50%	Yes	OE	OE		OE	B	B	B	S	S
RXH	Y (not 24/7)	V	B	H	<50%	Yes	OE	OEH	E	OE	B	V	B	H	H
RXN	Y (not 24/7)	I	B	R	<50%	Yes	OE			E	B	I	B	H	H
RXP	Y (not 24/7)	V	V	H	<50%	No	OE				B	V	V	H	
RXQ					<50%	Yes	OE	E			B	B	B	S	R
RXR	Y (not 24/7)	B	B	H	<50%	Yes	OE	O		E	I	B	B	H	H
RXW	Y (24/7)	B	B	S	<50%	No	OE				B	B	B	S	
RYJ	Y (24/7)	B	B	R	<50%	Yes	OE	OEH	OEH	EH	B	I	B	R	R

	Ruptured AAA				Unruptured AAA						EVAR for unruptured AAA				
NHS Trust	EVAR possible	Who plans EVARs	Who performs EVARs	Where are EVARs performed	2-surgeon open AAA repairs	Complex aortic procedures	Infra-renal aneurysms	Supra-renal aneurysms	Thoraco-abdominal aneurysms	Thoracic aneurysms	Access to 3D planning software	Who plans EVARs	Who performs EVARs	Where are EVARs performed	Complex EVARs performed
SA999	N				50-74%	No	O								
SF999	AAA repairs not carried out at this NHS trust														
SG999	Y (not 24/7)	I	B	H	<50%	Yes	OE	E		E	B	B	I	H	H
SH999	N				<50%	No	OE				I	B	B	H	
SL999	Y (not 24/7)	B	B	R	<50%	No	OE				B	I	B	R	R
SN999	Y (not 24/7)	B	B	R	<50%	Yes	OE	E	E	E	I	B	B	R	R
SS999	Y (not 24/7)	B	B	R	50-74%	Yes	OE	OEH	OH	OEH	B	B	B	R	R
ST999	Y (not 24/7)	B	B	R	50-74%	Yes	OE	E		E	B	B	B	R	R
SV999	N	B		R	<50%	No	OE				N	B	B	R	
SY999	AAA repairs not carried out at this NHS trust														
ZT001	Y (24/7)	B	B	S	<50%	Yes	OE	OEH	OEH	OEH	B	B	B	S	S

The following NHS trusts/health boards have had their results in this table updated since the original publication: 7A3, RAJ, RNA, RNS, RQ8, RVV and SH999.

Key

Indicator	Value	Response
Who plans EVARs Who performs EVARs Access to 3D planning software	V	Vascular surgeons
	I	Interventional radiologists
	B	Both vascular surgeons and interventional radiologists
	N	Not available
Where are EVARs performed Complex EVARs performed	S	Standard operating theatre
	R	Radiology department
	H	Hybrid operating theatre
Infra-renal aneurysms Supra-renal aneurysms Thoraco-abdominal aneurysms Thoracic aneurysms	O	Open repair
	E	Endovascular repair
	H	Hybrid repair

	Carotid		Major amputation									PAD care					
NHS Trust	Specific carotid MDT	Carotid stenting	Lower limb revascularisation	Assessed by surgeon	Discussed at MDT	Performed on elective list	Typical performed by (in hours)	Typical performed by (out-hours)	Rehabilitation	Rehab physio days	Occupational therapist days	Diabetic foot clinics	Diabetic MDTs	Diabetic ward rounds	Diabetologists	Debridements by (in-hours)	Debridements by (out-hours)
7A1			AB	100	25	66	V	V	On	**5**	5	1	0	5	**2**	VPO	V
7A3			AB	100	**80**	70	V	V	No	**5**	5	5	0	0	0	VP	V
7A4	Y	Ne	AB	100	10	75	VOr	VOr	Off	**5**	5	1	**1**	4	**3**	VP	V
7A5			AB	100	**60**	70	V	V	No	**5**	5	2	**1**	1	1	V	V
7A6			AB	100	**100**	70	V	V	Off	**5**	5	1	**1**	1	**2**	V	V
R1H	Y	Ne	AB	90	**70**	70	V	V	No	**7**	5	1	**1**	1	**2**	V	V
R1K			AB	100	**98**	**98**	V	V	No	**5**	5	4	**2**	1	**4**	V	V
RA9			AB	100	**70**	50	VOr	VOr	Off	**5**	5	0.25	0.25	0	1	VO	VO
RAE			AB	100	**100**	**80**	V	V	No	**5**	5	5				VP	V
RAJ	Y	Ne	AB	100	**80**	**90**	V	V	On	**5**	5	5	**2**	2	0	V	VG
RAL	Y	I	AB	100	**70**	60	V	V	No	**5**	5	5	**1**	1	**1.5**	V	V
RBA	Y		AB	100	**80**	**80**	V	V	No	**7**	5	5	0.5	1	**3**	VP	V
RBD			AB	100	**100**	**95**	V	O	No	**5**	5	4	**1**	1	**5**	V	
RBZ			AB	100	15	**90**	V	V	Off	**5**	5	1	**1**	0	0	V	VGO
RC1	Y		AB	100	**100**	20	V	O	No	**5**	5	5	0	1	**2**	V	V
RCB			AB	100	**60**	60	V	V	No	**5**	5	1	**1**	2	**3**	V	V
RDD			AB	95	**95**	60	V	V	No	**7**	7	8	**1**	5		O	VG
RDE	Y		AB	100	25	25	V	V	Off	**5**	5	3	**1**	1	**2**	VP	V
RDU	Y		AB	100	**90**	**90**	V	V	Off	**5**	5	2	**1**	1	1	VO	V
RDZ			AB	100	0	**80**	V	V	No	**5**	5	1	0.25	1	1	V	V
REF	Y		AB	100	**100**	**90**	V	V	Off	**5**	5	4	**1**	4	**3**	V	V
RF4	Y	Ne	AB	100	50	50	V	V	Off	**5**	5	2			**2**	VP	V
RGT	Y	Ne	AB	100	**80**	20	V	V	No	**5**	5	1	**1**	1	1	V	V
RH8		I	AB	100	**75**	**90**	V	V	On	**7**	7	10	**1**	7	**4**	V	V
RHM		I	AB	100	**60**	**95**	V	V	Off	**7**	7	1	**1**	1	1	V	V

NHS Trust	**Carotid** Specific carotid MDT	Carotid stenting	**Major amputation** Lower limb revascularisation	Assessed by surgeon	Discussed at MDT	Performed on elective list	Typical performed by (in hours)	Typical performed by (out-hours)	Rehabilitation	Rehab physio days	Occupational therapist days	**PAD care** Diabetic foot clinics	Diabetic MDTs	Diabetic ward rounds	Diabetologists	Debridements by (in-hours)	Debridements by (out-hours)
RHQ	Y	I	AB	100	**100**	50	V	V	No	**5**	5	2	0	2	**3**	V	V
RHU			AB	100	20	50	V	V	Off	**5**	5	5	0	2	0	V	V
RJ1	Y	VI	AB	90	**75**	75	V	V	Off	**7**	7	3	**2**	2	**2**	VP	VP
RJ7	Y	Ne	AB	90	50	70	V	V	Off	**5**	5	5	**1**	2	1	V	V
RJE			AB	100	**70**	**95**	V	V	Off	**5**	5	5	0	0	**2**	VP	V
RJR			AB	100	5	**95**	V	V	No	**5**	5	0	0	0	**2**	VO	V
RJZ	Y	Ne	AB	100	**100**	70	V	V	Off	**5**	5	2	**1**	2	**3**	VP	V
RK9			AB	90	30	**90**	V	V	No	**5**	5	7	**1**		1	VP	V
RKB	Y		AB	100	**60**	**80**	V	V	Off	**5**	5	2	**1**	1	**2**	V	G
RLN	Y		AB	100	50	**90**	V	V	On	**7**	5	2	**1**	7	**2**	V	V
RM1			AB	100		20	V	V	Off	**5**	5	5	**1**	1	1	V	V
RM2		I	AB	100	50	30	V	V	No	**5**	5	2	**1**		**2**	V	V
RNA			AB	100	**60**	70	V	V	Off	**5**	5	5	**1**			V	V
RNL	Y		AB	100	**70**	50	V	V	On	**7**	5	2	**1**	1	1	V	V
RNS	Y		AB	100	**60**	70	V	V	On	**5**	5	0.25	0	1	**3**	V	V
RNZ	Y		AB	99	**99**	**80**	VG	G	On	**5**	5	2	**1**	1	1	VG	G
RP5	Y		AB	100	**100**	50	V	V	No	**5**	5	0	0	0	0	V	V
RPA			AB	100	**100**	25	V	V	No	**5**	5	0	0	0	**2**	V	V
RQ6	Y		AB	100	**80**	70	VOr	V	No	**5**	5	3	**1**	3	**3**	VO	VO
RQ8	Y		AB	90	50	10	V	V	No	**3-4**	3-4	1	0	2	1	V	V
RQW	Y		AB	100	**90**	20	V	V	On	**5**	5	0	**1**	1	1	V	V
RR1			AB	100	10	10	V	V	No	**5**	5	1	0	0	0	V	V
RR8		I	AB	100	10	30	V	V	No	3-4	5	4	**2**	2	**2**	VP	V
RRK		Ne	AB	10	10	30	V	V	Off	**5**	5	1	0	6	1	V	V
RRV	Y	VINe	AB									2	**1**	1	**2**	VPO	GO
RTD	Y	I	AB	100	**70**	80	V	V	No	**5**	5	0.25	0.25	1	1	V	V

NHS Trust	Carotid: Specific carotid MDT	Carotid stenting	Major amputation: Lower limb revascularisation	Assessed by surgeon	Discussed at MDT	Performed on elective list	Typical performed by (in hours)	Typical performed by (out-hours)	Rehabilitation	Rehab physio days	Occupational therapist days	PAD care: Diabetic foot clinics	Diabetic MDTs	Diabetic ward rounds	Diabetologists	Debridements by (in-hours)	Debridements by (out-hours)
RTE			AB	100	30	50	V	V	No	5	5	3	1	1	3	VP	V
RTG	Y		AB	100	75	95	V	V	On	7	7	3	1	5	2	V	V
RTH		Ne	AB	100	25	25	V	V	No	5	5	5	0	0	3	V	V
RTK		I	AB	100	100	60	V	V	No	5	7	1	1	1	3	V	V
RTR	Y		AB	100	50	25	V	V	Off	5	5	2	1	3	1	VO	V
RVJ	Y	Ne	AB	100	70	80	V	V	No	5	5	5	1	5	2	V	V
RVV	Y		AB	100	65	65	V	V	No	5	5	2	1	1	1	V	V
RW3			AB	100	75	66	V	V	On	5	5	1	1	2	0	VP	V
RW6			AB	100	80	50	V	V	On	5	5	3	1	1	3	V	V
RWA		I	AB	100	70	70	V	V	Off	7	7	1	0	1	1	VP	V
RWD	Y		AB	100	75	10	V	V	No	7	5	1				V	V
RWE		I	AB	100	20	50	VOr	VOr	No	7	7	9		5		VPO	VO
RWG			AB	90	100	50	VOr	O	Off	5	5	1	1	1	4	V	V
RWH	Y		AB	100	90	20	VO	V	No	5	5	2	1	1	2	VO	VO
RWP			AB	100	20	50	V	V	No	5	5	0	0	3	3	VP	V
RWY			AB	100	50	60	V	V	On	5	5	1.5	0		2	V	V
RX1		Ne	AB	90	10	50	V	V	Off	5	5	2	1	3	3	V	V
RXH			AB	100	80	60		V	No	NA	5	1	1	0	0		V
RXN		I	AB	100	60	70	V	V	On	5	5	1	1	1	1	V	V
RXP	Y		AB	100	100	75	V	V	Off	5	5	5	1	5	2	VP	V
RXQ			AB	100	10	30	V	VG	On	5	5	0.5	0.5	3	1	V	VG
RXR			AB	100	70	80	V	V	Off	5	5	3	1	1	2	VPO	V
RXW	Y		AB	100	80	70	V	V	On	7	5	1.5	0	5	4	V	V
RYJ	Y	I	AB	90	90	75	V	V	On	5	5	2	0		2	V	V
SA999			AB	100	0	75	V	V	No	5	5	0.25				V	V
SF999			AB	90	70	90	V	G	Off	5	3-4	0	0	0	0	V	N

	Carotid		**Major amputation**									**PAD care**					
NHS Trust	Specific carotid MDT	Carotid stenting	Lower limb revascularisation	Assessed by surgeon	Discussed at MDT	Performed on elective list	Typical performed by (in hours)	Typical performed by (out-hours)	Rehabilitation	Rehab physio days	Occupational therapist days	Diabetic foot clinics	Diabetic MDTs	Diabetic ward rounds	Diabetologists	Debridements by (in-hours)	Debridements by (out-hours)
SG999	Y		AB	100	50	90	V	V	No	**5**	5	5	**1**	0	**3**	V	V
SH999			AB	100	**66**	33	V	V	No	**5**	5	0.25	**1**	3	1	VP	V
SL999	Y	I	AB	95	50	50	V	V	No	**5**	5	5	0	0	1	V	V
SN999			AB	100	50	75	V	V	No	1-2	1-2	0	0	0	0	V	V
SS999			AB	100	**70**	50	V	V	Off	**7**	5	4	**2**	2	1	VP	V
ST999			AB	100	**80**	50	V	V	On	**5**	5	1				VPO	V
SV999			AB	0	0	50	V	V	On	**5**	5	2	0	0	0	V	V
SY999	Y		AB	100	**100**	50	V	O	On	**5**	5	1	**1**	1	**2**	V	G
ZT001		INe	AB	100	10	60	V	V	No	**5**	5	13.5	0	0	0	VP	V

The following NHS trusts/health boards have had their results in this table updated since the original publication: RNA.

Key

Indicator	Value	Response
Carotid stenting	V	Vascular surgeons
	I	Interventional radiologists
	Ne	Neuro-radiologists
Lower limb revascularisation	A	Angioplasty
	B	Bypass
Typical performed by (in hours) Typical performed by (out-hours) Debridements by (in-hours) Debridements by (out-hours)	V	Vascular surgeons
	G	General surgeons
	Or	Orthopaedic surgeons
	O	Other
	P	Podiatrists

References

British Society of Endovascular Therapy (BSET). Early results of fenestrated endovascular repair of juxtarenal aortic aneurysms in the United Kingdom. Circulation 2012; 125: 2707–2715.

Department of Health. National Stroke Strategy (December 2007) http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081062

Department of Health Stroke Policy Team. Implementing the National Stroke Strategy - an imaging guide (2008). Available at: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_085145.pdf

Karthikesalingam A, Holt PJE, Patterson BO, Vidal-Diez A, Sollazzo G, et al. Elective Open Suprarenal Aneurysm Repair in England from 2000 to 2010 an Observational Study of Hospital Episode Statistics. PLoS ONE 2013; 8(5): e64163. doi:10.1371/journal.pone.0064163

National Confidential Enquiry into Patient Outcomes and Deaths. Lower Limb Amputation: Working Together 2014. London: NCEPOD, 2014

National Institute for Health and Clinical Excellence (NICE). Stroke: The diagnosis and acute management of stroke and transient ischaemic attacks. July 2008. Available at: http://www.nice.org.uk/guidance/CG68

National Institute for Health and Clinical Excellence (NICE). Guidance for peripheral arterial disease. August 2012. Available at: http://www.nice.org.uk/guidance/CG147

NHS Abdominal Aortic Aneurysm Screening Programme. Quality Standards and Service Objectives. August 2009. Available at: http://aaa.screening.nhs.uk/standards

Peach G, Griffin M, Jones KG, Thompson MM, Hinchliffe RJ. Diagnosis and management of peripheral arterial disease. BMJ. 2012; 345: e5208.

Powell JT, Sweeting MJ, Thompson MM, et al. Endovascular or open repair strategy for ruptured abdominal aortic aneurysm: 30 day outcomes from IMPROVE randomised trial. BMJ. 2014; 348: f7661. doi: 10.1136

Spiegelhalter DJ. Funnel plots for comparing institutional performance. Stat Med 2005; 24(8): 1185-202.

Vascular Society of Great Britain and Ireland (VSGBI). Abdominal Aortic Aneurysm Quality Improvement Programme (AAAQIP) Team. Delivering a national quality improvement programme for patients with abdominal aortic aneurysms. London: The Vascular Society, September 2012

Vascular Society of Great Britain and Ireland (VSGBI). Outcomes after Elective Repair of Infra-renal Abdominal Aortic Aneurysm. A report from The Vascular Society. London: The Vascular Society, March 2012

Vascular Society of Great Britain and Ireland (VSGBI). Quality Improvement Framework for Major Amputation Surgery London: The Vascular Society, November 2012. Available at: http://www.vascularsociety.org.uk/

Vascular Society of Great Britain and Ireland (VSGBI). 2015 The Provision of Services for Patients with Vascular Disease. London: The Vascular Society, November 2015. Available at: http://www.vascularsociety.org.uk/

Waton S, Johal A, Groene O, Cromwell D, Mitchell D, Loftus I. Outcomes after elective repair of infra-renal abdominal aortic aneurysm. London: The Royal College of Surgeons of England, November 2013a.

Waton S, Johal A, Groene O, Cromwell D, Mitchell D, Loftus I. UK Carotid Endarterectomy Audit. Round 5. London: The Royal College of Surgeons of England, October 2013b.

Waton S, Johal A, Heikkila K, Cromwell D, Loftus I. National Vascular Registry: 2015 Progress Report. London: The Royal College of Surgeons of England, January 2015.

Glossary

Abdominal Aortic Aneurysm (AAA)	This is an abnormal expansion of the aorta. If left untreated, it may enlarge and rupture causing fatal internal bleeding
Amaurosis fugax	Transient loss of vision in one eye due to an interruption of blood flow to the retina.
Asymptomatic Patient	A patient who does not yet show any outward signs or symptoms of plaque.
Carotid Endarterectomy (CEA)	Carotid Endarterectomy is a surgical procedure in which build-up is removed from the carotid artery.
Carotid Stenosis	Abnormal narrowing of the neck artery to the brain.
Cranial Nerve Injury (CNI)	Damage to one of the 12 nerves supplying the head and neck.
Debridement	Medical removal of dead, damaged, or infected tissue to improve the healing potential of the remaining healthy tissue
Endovascular Aneurysm Repair (EVAR)	A method of repairing an abdominal aortic aneurysm by placing a graft within the aneurysm from a small cut in the groin.
Hospital Episode Statistics (HES)	HES is the national statistical data warehouse for England regarding the care provided by NHS hospitals and for NHS hospital patients treated elsewhere. There are equivalent agencies in Northern Ireland, Scotland and Wales but in this report, the term HES is used generically to describe data that are collected by any of these national agencies.
Inter-quartile range (IQR)	Once the data are arranged in ascending order, this is the central 50% of all values and is otherwise known as the 'middle fifty' or IQR.
Hybrid operating theatre	An operating theatre with built-in radiological imaging capabilities. The imaging equipment is able to move and rotate around a patient and multiple monitors provide good visibility around the operating table.
Median	The median is the middle value in the data set; 50% of the values are below this point and 50% are above this point.
Myocardial Infarct (MI)	Otherwise known as a Heart Attack, MI involves the interruption of the blood supply to part of the heart muscle.
Occluded artery	An artery that has become blocked and stops blood flow.
National Abdominal Aortic Aneurysm Screening Programme (NAAASP)	A programme funded by the Department of Health to screen men over the age of 65 years for AAA
NHS	National Health Service

National Vascular Database (NVD)	An on-line database funded by The Vascular Society to collect data on major vascular procedures performed in the National Health Service. This was the predecessor of the National Vascular Registry.
OPCS	Office of Population and Censuses Surveys. A procedural classification list for describing procedures undertaken during episodes of care in the NHS
Plaque	Scale in an artery made of fat, cholesterol and other substances. This hard material builds up on the artery wall and can cause narrowing or blockage of an artery or a piece may break off causing a blockage in another part of the arterial circulation.
Strategic Health Authority (SHA)	An organisation, accountable to government, that assesses the health needs of local people and ensures that local health services are commissioned and provided to meet those needs.
Stroke	A brain injury caused by a sudden interruption of blood flow with symptoms that last for more than 24 hours.
Symptomatic	A patient showing symptoms is known to be symptomatic.
Transient ischaemic attack (TIA)	A “mini-stroke” where the blood supply to the brain is briefly interrupted and recovers within 24 hours.
Trust or Health Board	A public sector corporation that contains a number of hospitals, clinics and health provisions. For example, there were 4 hospitals in the trust and 3 trusts in the SHA.
Vascular Society of Great Britain and Ireland (VSGBI)	The VSGBI is a registered charity founded to relieve sickness and to preserve, promote and protect the health of the public by advancing excellence and innovation in vascular health, through education, audit and research. The VSGBI represents and provides professional support for over 600 members and focuses on non-cardiac vascular disease.

The Royal College of Surgeons of England is dedicated to enabling surgeons achieve and maintain the highest standards of surgical practice and patient care. To achieve this, the College is committed to making information on surgical care accessible to the public, patients, health professionals, regulators and policy makers.

Registered charity number: 212808