



OF GREAT BRITAIN AND IRELAND

# Outcomes after Elective Repair of Infra-renal Abdominal Aortic Aneurysm



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## Glossary

AAA	Abdominal Aortic Aneurysm. This is an abnormal expansion of the aorta. If left untreated, it may enlarge and rupture causing fatal internal bleeding
ASA	American Society of Anesthesiologists score. This is a score used to define broad categories of operative risk from 1 (very low risk) to 5 (moribund)
ECG	An electrocardiogram (ECG) is a test that records the electrical activity of the heart
EVAR	Endovascular Aneurysm Repair. A method of repairing an abdominal aortic aneurysm by placing a graft within the aneurysm from a small cut in the groin. The placing of the graft may be performed by a vascular surgeon or an interventional radiologist.
HES	Hospital Episode Statistics. HES is the national statistical data warehouse for England whose records describe the care provided to inpatients and day cases in NHS hospitals and for NHS patients treated in independent hospitals. There are equivalent agencies in Northern Ireland, Scotland and Wales. In this report, the term HES is used generically to describe data that are collected by any of these national agencies.
LOS	Length of stay. The number of days that a patient stays in hospital, calculated as the day of discharge – the day of admission
NAAASP	National Abdominal Aortic Aneurysm Screening Programme. A programme funded by the Department of Health to screen men over the age of 65 years for AAA
NCAPOP	The National Clinical Audit and Patient Outcomes Programme
NHS	The National Health Service
NVD	National Vascular Database. An on-line database funded by The Vascular Society to collect data on major vascular procedures. Surgeons can enter data about procedures and outcomes performed in the NHS.
OPCS	Office of Population and Censuses Surveys. A procedural classification list for describing procedures undertaken during episodes of care in the NHS

## Acknowledgements

The National Vascular Registry is commissioned by the Healthcare Quality Improvement Partnership (HQIP) and is part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP).

We would like to acknowledge the support of the vascular specialists and hospital staff that have participated in this Audit and the considerable time devoted to data collection.

We would also like to thank Ms Kate Williams, RCS Patient Liaison Group, for providing comments on the draft report.

## Foreword

This is the second report on outcomes following elective infra-renal abdominal aortic aneurysm (AAA) surgery in the United Kingdom. It builds on the Quality Improvement Programme (QIP) undertaken by the Vascular Society to improve outcomes after AAA surgery. The first report in 2012 demonstrated a significant improvement in outcomes with our published mortality being 2.4% in 8380 cases of aortic aneurysm surgery.

Our previous report was the first demonstration of improved outcomes following the implementation of a national Quality Improvement Programme (QIP) in the UK. It exceeded our stated target of a reduction in death rates to below 3.5% by 2014. We now present data for 13,413 procedures undertaken between January 2010 and December 2012. There is some overlap with the previous report, but this is deliberate to allow us to report annual outcomes in the future. In this report, the in-hospital mortality rate for the past three years was 1.8%. That over 98% of patients survive this very major operation is a credit to NHS vascular surgical services.

This report is based on data submitted by Vascular Society members to the National Vascular Database (NVD) for the three year period between 1 January 2010 and 31 December 2012. We are grateful for the effort that each NHS vascular unit has made to contribute its data. The majority of NHS trusts are now submitting over 90% of cases when compared against activity figures from routine hospital data, and this allows us to have some confidence that the figures reported here are an accurate reflection of practice within the UK.

There remain concerns about the quality of data submission and the coding of procedures. There is potential for the under-reporting of data to give an overly optimistic view of death rates, but obtaining a complete match with the information in routine hospital data (such as HES) is extremely time consuming and bedevilled by local practices in coding of procedures. There is an urgent need for a national standard for coding vascular procedures to which both NHS organisations and clinical teams can adhere. Missing clinical audit data can raise concerns about clinical performance and inaccurate coding may lead to a loss of valuable income to NHS trusts. The Vascular Society recommends that clinicians and coders meet regularly to review their work and ensure agreement in coding of clinical activity. The Society also recommends that vascular surgeons are supported by vascular nurse specialists in the on-going delivery of the AAA quality improvement programme.

I would like to thank the UK vascular surgeons and their teams who contributed data for this report. It is the intention of the National Vascular Registry that we will publish outcome data on a regular basis, to monitor practice and to provide evidence on the quality of vascular surgery within the NHS.

**David Mitchell**

Chair, Audit Committee of the Vascular Society

## Executive Summary

This report presents information on patients undergoing an elective repair of an infra-renal abdominal aortic aneurysm (AAA) between January 2010 and December 2012 in the National Health Service (NHS). It includes all UK NHS acute trusts and Health Boards currently providing this vascular surgery, and gives the number of procedures performed by NHS organisations, the proportion of patients who died before discharge after their surgery (post-operative mortality) and the risk-adjusted mortality rate.

The report summarises information on 13,413 patients who had an elective infra-renal AAA repair. The procedure tended to be performed on older people, with the majority being aged between 75 and 85 years. The condition is more common in men and the majority of AAA repairs were carried out on men, with 1 in 8 procedures performed on women.

Over the three year period, around two-thirds of the procedures were performed as endovascular (EVAR) repairs. The proportion of EVAR procedures increased from 62% in 2010 to 67% in 2012.

The overall elective postoperative mortality in this report is 1.8%. Mortality was 3.8% for the 4,701 open repairs and 0.8% for the 8,712 endovascular repairs. The decision to have an open repair or EVAR depends on various factors, and not all patients are suitable for EVAR (e.g. when the anatomy is unfavourable). The higher short-term risk of open repair arises because it is a more invasive procedure than EVAR.

Mortality rates for NHS trusts can differ from the national average because of random variation – some were slightly higher and some lower. Differences in the outcomes of NHS trusts were examined using a funnel plot, which tests whether the risk-adjusted outcomes of any NHS trust differed from the national rate by more than expected. All reported NHS trust outcomes were within the expected range of these differences.

The variation in NHS trust outcomes was consistent with differences caused by random variation, and we do not recommend that the organisations are ranked by their mortality rates. The effect of random variation is not communicated when figures are ranked. Consequently, ranking these NHS trust figures would be misleading and it could make people draw the wrong conclusion about their performance.

Between 1 January 2010 and 31 December 2012, the NHS trusts / Health Boards submitted 13,413 procedures to the NVD. The number of elective AAA procedures identified in routine hospitals datasets over the same period was 15,303, giving an overall case-ascertainment of

87.6%. The estimated case-ascertainment figures for the four nations were: 91.5% for England, 73.7% for Northern Ireland, 53.6% for Scotland and 74.5% for Wales. The case-ascertainment was higher among NHS organisations that are still actively offering vascular surgery to patients, being estimated to be 89.4% for the UK.

This report has focused on mortality after elective infra-renal abdominal aortic aneurysm surgery, a measure of the safety of the procedure. Nonetheless, it only reflects one part of the spectrum of outcomes that are important to patients. It is an aim of the National Vascular Registry that future reports describe a wider set of outcomes for patients and health professionals. The NVR has undertaken a review of the NVD dataset, and made revisions to improve the range of information it can capture and also to reflect recent changes in clinical practice. The new dataset will start being used from December 2013.

## Recommendations

- NHS trusts / Health Boards are encouraged to adopt the care pathway and standards outlined in the Vascular Society's quality improvement programme. This can be accessed at [www.aaqip.com](http://www.aaqip.com) and [www.vsqip.org.uk](http://www.vsqip.org.uk)
- All team members should be involved in implementation of the pathway. 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.
- The Department of Health has stated that measuring outcomes through clinical audit is at the heart of high quality care. Surgeons (and hospital management) need to recognise this and allow time for collecting audit data within job plans.
- NHS trusts and their clinical teams are encouraged to undertake regular (e.g. quarterly) reviews of coding and clinical audit data.
- Where case-ascertainment is less than 90%, clinicians and NHS trusts should focus on improving data entry.
- Where case-ascertainment exceeds 100%, clinicians and NHS trusts should undertake coding reviews with their clinical teams, to ensure that clinical activity is being fully captured.



## Introduction

This is the second report on unit-level outcomes after elective repair of infra-renal abdominal aortic aneurysm (AAA). The first report was published in March 2012, and contained information about outcomes for elective AAA repairs between October 2008 and September 2010 [VSGBI 2012]. This report contains outcomes for patients undergoing an elective repair of their infra-renal AAA between January 2010 and December 2012.

This report was produced as part of the National Vascular Registry. In 2013, the National Vascular Registry was formed by the amalgamation of the National Vascular Database and UK Carotid Interventions Audit projects. These projects had been used by vascular surgical services in the UK to monitor their practice and outcomes since 2005, and were part of a broad quality improvement programme undertaken by the Vascular Society in collaboration with other organisations. One part of this programme was the Abdominal Aortic Aneurysm Quality Improvement Programme funded by the Health Foundation (an independent charity) which ran from 2008 until 2013 [AAAQIP 2012]. During this time, the mortality rate following elective infra-renal AAA repair in the United Kingdom fell from 7% to 2.4%. The Vascular Society will continue its quality improvement activities using the NVR, and is running the NVR in partnership with the Clinical Effectiveness Unit of the Royal College of Surgeons of England.

The National Vascular Registry was commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP) to measure the quality and outcomes of care for patients who undergo vascular surgery in England and Wales. It will capture information on the main procedures performed by vascular surgeons – repair of abdominal aortic aneurysm, carotid endarterectomy, lower limb bypass and lower limb amputation. However, all NHS hospitals in England, Wales, Scotland and Northern Ireland will be encouraged to participate in the National Vascular Registry, so that it continues to support the Vascular Society to improve the care provided by vascular services within the UK.

## **Elective repair of infra-renal abdominal aortic aneurysm**

An abdominal aortic aneurysm (AAA) 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, and the National Abdominal Aortic Aneurysm Screening Programme (NAAASP) was introduced in 2010 to identify and treat at risk aneurysms prior to rupture. Once detected, treatment to repair the AAA 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/>

## **Findings of the first report for elective AAA surgery in the UK**

The first report on outcomes after elective surgery for infra-renal AAA was published by the Vascular Society in March 2012 [VSGBI 2012]. It contained information on procedures performed between 1 October 2008 and 30 September 2010 using data submitted by UK vascular units to the National Vascular Database.

The report described the outcomes for 8380 procedures. The overall in-hospital mortality after surgery was 2.4%. The mortality rate was 4.3% for the 3584 open repairs, and 0.9% for the 4796 EVAR procedures. There is no evidence that any vascular unit had a significantly high mortality rate, although the assessment was limited to an analysis of unadjusted rates due to a lack of information on risk factors at the time.

## Patient data used in this report and method of analysis

This report describes the outcomes of patients who had surgery for an infra-renal AAA after an elective admission in NHS hospitals within the UK, and whose operation was performed in the three-year period between 1 January 2010 and 31 December 2012. The analysis excludes supra-renal and thoracic aortic aneurysms.

### Method of data collection

The data on these vascular procedures were collected using the National Vascular Database (NVD). The NVD is a secure web-based data collection system used by vascular surgeons and other members of the vascular team to enter clinical data on each patient undergoing an operation.

The data used in this report were extracted from the NVD on 19 August 2013. In the preceding months, the Registry had undertaken several rounds of communication with vascular surgical units. The units were asked to validate the data, ensuring that all eligible patients were entered into the NVD and that their data was complete and accurate. To support this, units were provided with information on the cases entered in the NVD. In addition, since 2011, vascular units have been provided with regular information on the number of AAA repairs identified in HES so that levels of case-ascertainment can be reviewed, and the coding of procedures in both the NVD and HES is correct.

### Data collected on patients, their surgery and outcomes

The NVD captures information about the demographics of a patient (their age, sex, and region of residence), as well as where and when the patient was admitted to hospital. Further information is captured on the severity of a patient's condition, the type and timing of surgery received, and the care prior to discharge from hospital. The NVD uses Office for Population and Census Surveys (OPCS) procedure codes to describe the type of surgery that a patient has undergone:

- Open repairs are described using OPCS codes L19.4, .5, .6, .8
- EVAR procedures are described using OPCS codes L27.1, .5, .6, .8, .9 and L28.1, .5, .6, .8, .9

The list of OPCS codes used for this report can be found in Appendix 1.

## Analysis

In this report, we present summary information on patient characteristics and hospital activity. We also present tables that contain for each NHS trust or Health Board

- the number of operations they did as recorded in the NVD,
- estimated case-ascertainment in the NVD using activity figures derived from HES,
- the proportion of patients who died after the operation while in hospital,
- the risk-adjusted mortality for the NHS trust

The activity figures from HES used to estimate case-ascertainment were derived for the same three year timeframe (1 January 2010 to 31 December 2012) and were created by identifying all elective admissions that included the relevant OPCS codes in the HES procedure fields.

## Risk adjustment

Risk adjustment takes into account factors that differ between patients and that can affect the risk of an operation. These factors are ones that clinical teams cannot control and reflect patient characteristics, such as AAA diameter, the presence of heart and lung diseases or kidney failure. Risk-adjustment produces figures for organisations that indicate what we expect to have happened if all surgeons operated on similar groups of patients, and consequently, we are able to compare the outcomes of NHS organisations. For example, larger units that treat more complex patients can be compared to smaller units that refer their complex cases to larger specialist centres.

Multiple logistic regression was used to derive the unit-level risk-adjusted mortality rates, and take into account differences in the patient case-mix across the NHS organisations. The regression model contained the factors from the prognostic model developed for AAA repair by Grant et al [2013]. These were:

- patient age and sex
- AAA diameter
- type of procedure (EVAR, open AAA repair) and ASA fitness grade
- abnormal serum creatinine, abnormal white cell count, abnormal serum sodium
- cardiac disease, abnormal electrocardiogram (ECG), and previous aortic surgery or stent

Not all patient records contained complete information on these risk factors. Multiple imputation by chained equations was used to address missing values on these case-mix variables when modelling postoperative complication rates for NHS organisations [White et al 2011]. See Appendix 2 for information on the level of missing values.

The risk-adjusted mortality rates were produced by dividing the observed number of deaths at each organisation with the predicted number and multiplying this ratio with the national mortality rate.

### **Graphical presentation**

A funnel plot was used to assess whether there are systematic differences in mortality rates between NHS organisations. This is a widely used graphical method for comparing the outcomes of surgeons or hospitals [Spiegelhalter, 2005]. In these plots, each dot represents an NHS organisation. The solid horizontal line is the national average. The vertical axis indicates the outcome with dots higher up the axis showing trusts with a higher mortality rate. The horizontal axis shows NHS trust activity with dots further to the right showing the trusts that perform more operations. The benefit of funnel plot is that it shows whether the outcomes of NHS trusts differ from the national average by more than would be expected from random fluctuations. Random variation will always affect outcome information like mortality rates, and its influence is greater among small samples. This is shown by the two funnel-shaped dotted lines. These lines define the region within which we would expect the outcomes of NHS trusts to fall if their outcomes only differed from the national rate because of random variation.

If the risk-adjusted mortality rate fell outside the outer control limits of the funnel plot, the organisation would be flagged as an outlier. If this occurred, there could be a systematic reason for the higher or lower rate, and they would be flagged for further investigation. In this report, outliers are managed according to the outlier policy of the Vascular Society, drawn up using guidance from the Department of Health. This policy can be found at

<http://www.vsqip.org.uk/wp/wp-content/uploads/2013/07/National-Vascular-Registry-Outlier-Policy.pdf>.

The tables in this report contain the risk-adjusted mortality for all procedures undertaken at the NHS organisation. This provides an overall measure of the performance of each vascular unit, and also increases our ability to detect outliers using the funnel plots by increasing their statistical power (the organisations are plotted in narrower parts of the funnel). However, each unit performs a different proportion of open repairs and EVAR procedures, and so it is not immediately clear whether units are performing each of these types of procedures with the same degree of safety. To assess whether this was so, we also produced separate funnel plots for these two individual procedures.

Finally, differences in proportions between patient subgroups were tested using the chi-square test, and P values lower than 0.05 were judged to be statistically significant. Stata 11 (StataCorp LP, College Station, TX, USA) was used for all statistical calculations.

## Overview of patient characteristics and surgical activity

The report contains the information on 13,413 patients who had an elective repair of an infra-renal AAA between 1 January 2010 and 31 December 2012. The patients underwent surgery in 123 NHS organisations: 104 in England, 6 in Wales, 10 in Scotland, and 3 in Northern Ireland.

Surgery tended to be performed on older people with the majority being aged between 75 and 85 years. The condition affects men more commonly than women, and 1 in 8 procedures were performed on women.

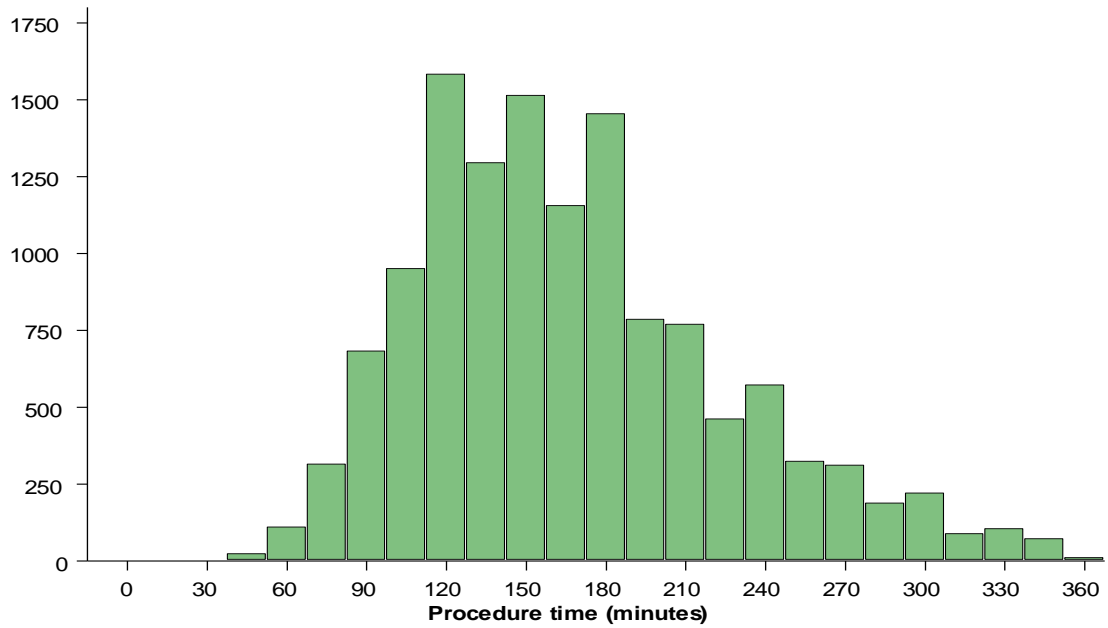
Over the three year period, the majority of the elective AAA repairs were performed as endovascular (EVAR) procedures, increasing from 62% in 2010 to 67% in 2012 (see Table 1). The median time to perform a repair was 175 minutes (Figure 1). The majority of patients remained in hospital for 2 to 4 days (Figure 2).

Both procedures are relatively safe, with over 98% of patients surviving the procedure. The risk of a complication after either procedure increases slightly with age. The effect of different patient characteristics on postoperative mortality is summarised in Table 2.

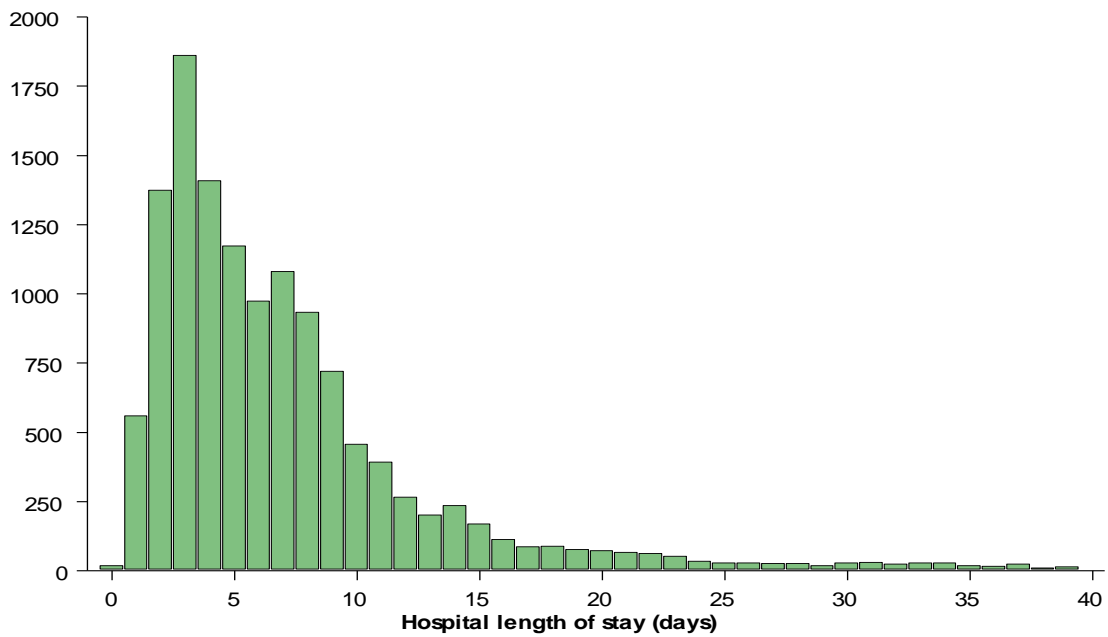
**TABLE 1: Type of elective infra-renal AAA repair performed between 2010 and 2012**

	2010	2011	2012	Total
EVAR				
number of patients	2,734	2,976	3,002	8,712
% of patients	62.1	65.9	66.8	65.0
Open repair				
number of patients	1,667	1,539	1,495	4,701
% of patients	37.9	34.1	33.2	35.0
Total	4,401	4,515	4,497	13,413

**FIGURE 1: Distribution of operation durations for elective AAA repairs between 2010 and 2012**



**FIGURE 2: Hospital length of stay for elective AAA repairs between 2010 and 2012**



NB: Some patients had a length of stay of 0 days because they died on the day of surgery.

**TABLE 2: Description of patients undergoing AAA repair and their summary outcomes**

Patient characteristic	No. of patients	(%)	Per cent of patients discharged alive	Per cent of patients who died in hospital
<b>Age (years)</b>				
Under 66	1,871	13.9	99.4	0.6
66 to 75	5,350	39.9	98.4	1.6
76 to 85	5,495	41.0	97.6	2.4
86 and older	697	5.2	97.0	3.0
<b>Male</b>				
Male	11,739	87.5	98.3	1.7
<b>Female</b>				
Female	1,674	12.5	96.8	3.2
<b>All procedures</b>				
All procedures	13,413		98.2	1.8
Open repair	4,701	35.0	96.2	3.8
Endovascular repair	8,712	65.0	99.2	0.8
<b>Cardiac disease</b>				
No	7,512	56.0	98.7	1.3
Yes	5,901	44.0	97.4	2.6
<b>Abnormal ECG</b>				
No	9,277	69.2	98.6	1.4
Yes	4,136	30.8	97.2	2.8
<b>Previous aortic surgery</b>				
No	13,013	97.0	98.2	1.8
Yes	400	3.0	95.5	4.5
<b>White cell count (10<sup>9</sup>/l)</b>				
3-11	12,403	92.5	98.2	1.8
under 3 or over 11	1,010	7.5	97.5	2.5
<b>Serum sodium (mmol/l)</b>				
135-145	12,077	90.0	98.2	1.8
under 135 or over 145	1,336	10.0	97.4	2.6
<b>Serum creatinine (µmol/l)</b>				
120 or lower	10,892	81.2	98.5	1.5
more than 120	2,521	18.8	96.7	3.3
<b>AAA diameter (cm)</b>				
less than 6.5	8,565	63.9	98.5	1.5
6.5 or greater	4,848	36.1	97.6	2.4
<b>ASA fitness grade</b>				
1-2	5,636	42.0	99.3	0.7
3	7,267	54.2	97.4	2.6
4-5	510	3.8	96.3	3.7



The characteristics of patients undergoing EVAR and open procedures are described in Table 3. There were small differences in the characteristics of the two patient groups, with patients undergoing EVAR procedures being, on average, slightly older and having a greater burden of comorbid disease. EVAR procedures were performed less commonly than open repairs on aneurysms with a diameter of 6.5 cm or greater (34.1% v 40.0%,  $p < 0.001$ ).

The average length of stay (LOS) for patients undergoing EVAR procedures was shorter than for open repairs, with the median LOS being 4 and 9 days, respectively,

**TABLE 3: Description of patients undergoing elective open and EVAR repairs of infra-renal AAA**

Patient characteristic	Open repairs		EVAR procedures	
	No. of patients	(%)	No. of patients	(%)
No. of procedures	4701		8712	
Age (years)				
Under 66	1038	22.1	833	9.6
66 to 75	2157	45.9	3193	36.7
76 to 85	1420	30.2	4075	46.8
86 and older	86	1.8	611	7.0
Male	3980	84.7	7759	89.1
Female	721	15.3	953	10.9
Cardiac disease				
No	2881	61.3	4631	53.2
Yes	1820	38.7	4081	46.8
Abnormal ECG				
No	3427	72.9	5850	67.1
Yes	1274	27.1	2862	32.9
Previous aortic surgery				
No	4632	98.5	8381	96.2
Yes	69	1.5	331	3.8
White cell count (10 <sup>9</sup> /l)				
3-11	4371	93.0	8032	92.2
under 3 or over 11	330	7.0	680	7.8
Serum sodium (mmol/l)				
135-145	4286	91.2	7791	89.4
< 135 or > 145	415	8.8	921	10.6
Serum creatinine (µmol/l)				
120 or lower	3923	83.5	6969	80.0
more than 120	778	16.5	1743	20.0
AAA diameter (cm)				
less than 6.5	2822	60.0	5743	65.9
6.5 or greater	1879	40.0	2969	34.1
ASA fitness grade				
1-2	2183	46.4	3453	39.6
3	2381	50.6	4886	56.1
4-5	137	2.9	373	4.3

## Individual NHS trust outcomes for elective AAA repair

The following pages contain the surgical outcomes for NHS organisations undertaking elective AAA repair for infra-renal abdominal aortic aneurysms. NHS organisations are arranged by geographical region. The unadjusted and risk-adjusted in-hospital mortality rates are shown for each NHS trust.

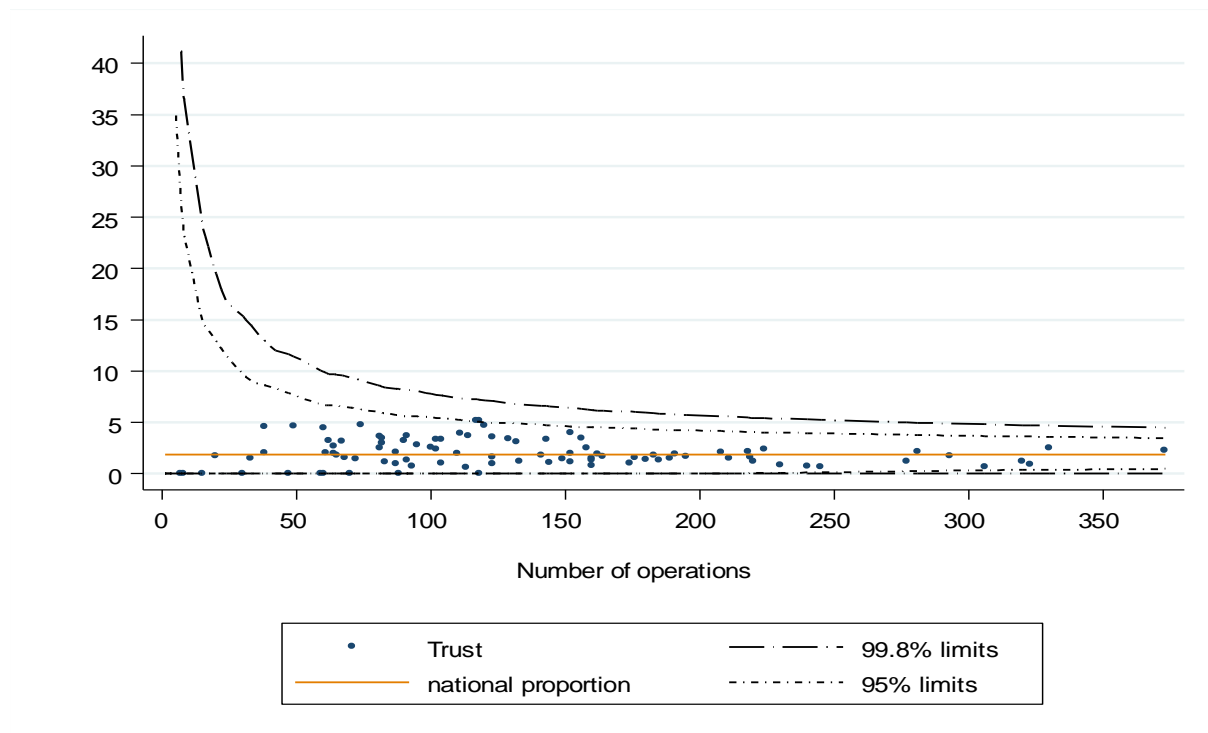
The tables contain the information for 97 NHS organisations: 81 in England, 5 in Wales, 10 in Scotland, and 1 in Northern Ireland who are currently performing vascular surgery. The organisations that stopped performing elective AAA repairs between 1 January 2010 and November 2013, are listed in Appendix 3.

In the following tables, the status column indicates whether the NHS trust had outcomes in the expected range given their level of overall activity (▲) or was found to be an outlier (X) in our assessment of their **risk-adjusted** outcomes based.

All the NHS trusts had a risk-adjusted rate of inpatient mortality that fell within the expected range given the number of procedures performed.

We did not find that any NHS trust had outcomes that differed from the national average by more than would be expected from random fluctuations alone. The comparative, risk-adjusted mortality rates for individual NHS trusts are shown in the funnel plot in Figure 3. All NHS trusts are within the range expected.

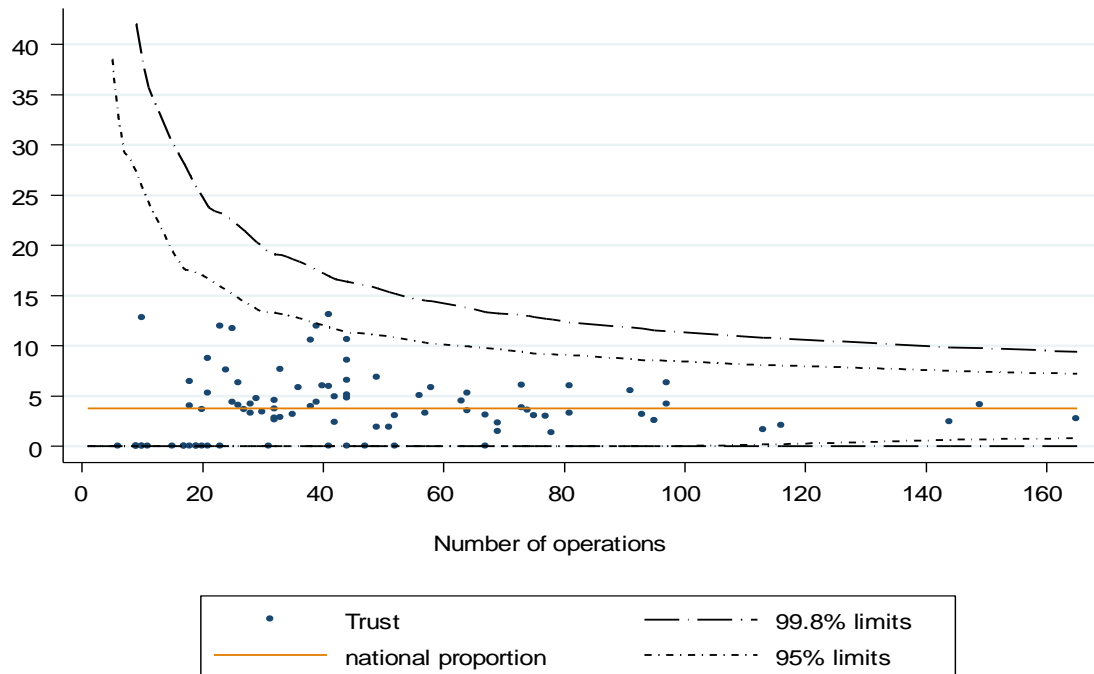
**FIGURE 3: Funnel plot of risk-adjusted in-hospital mortality after elective AAA repair, with trust figures shown in comparison to the national average rate of 1.8%**



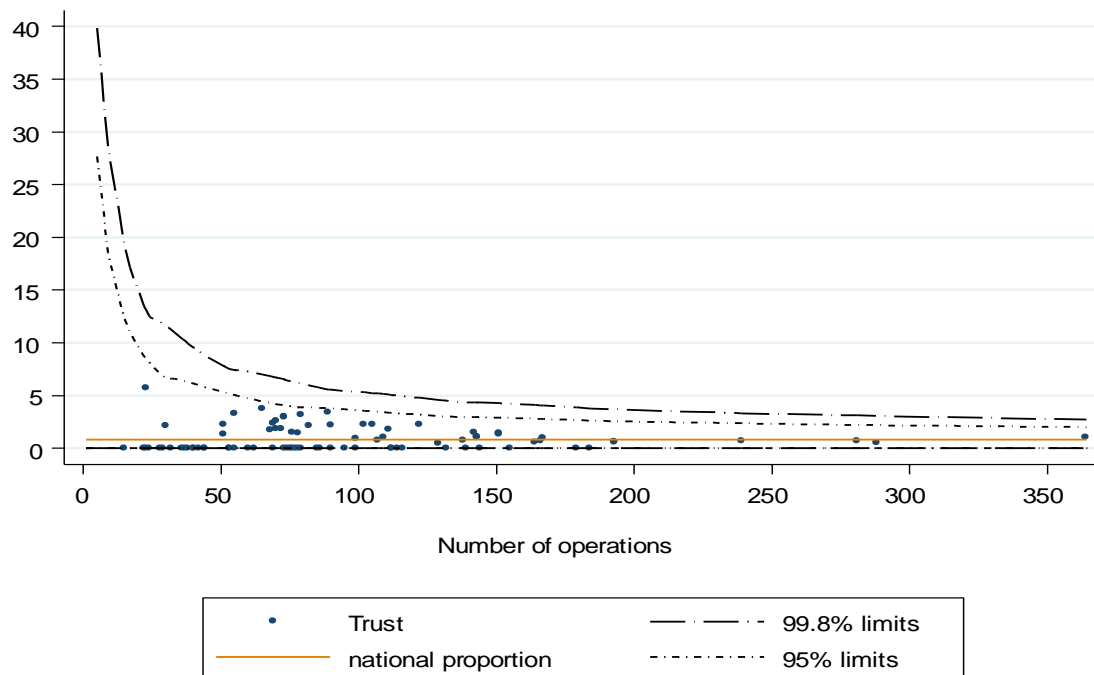
Figures 4A and 4B overleaf show the risk-adjusted rate of inpatient mortality among NHS trusts for open repair and EVAR procedures separately. Each funnel plot is centred on the national average mortality rate for these two procedures. As before, all NHS trusts had a risk adjusted rate that fell within the expected range given the number of procedures performed. No organisation had a mortality rate above the upper 99.8% control limit.

**FIGURES 4A and 4B: Funnel plot of risk-adjusted in-hospital mortality after elective AAA repair for open and EVAR procedures. The national average mortality rates for open and EVAR procedures were 3.8 and 0.8%, respectively.**

**4A: Open repairs**



**4B: EVAR procedures**



## Key to table column headings

Trust	Name of the NHS trust
AAA	Total number of AAA repair procedures performed
Open	Number of open repair procedures performed
EVAR	Number of EVAR procedures performed
Unadjusted Mortality	Proportion of patients who died prior to discharge from hospital after the procedure (both open and EVAR procedures)
Risk-Adjusted Mortality	The in-hospital mortality rate of AAA repair at the hospital after taking into account the characteristics of patients who had surgery at the hospital (both open and EVAR procedures)
Status	Whether the NHS trust mortality was within the expected range

A number of NHS trusts/health boards have stopped performing AAA repairs over the data collection period, due to the on-going reorganisation of vascular surgical services. The tables below show NHS trusts / health boards that are currently still performing the procedure.

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>YORKSHIRE AND THE HUMBER</b>						
Bradford Teaching Hospitals NHS Foundation Trust	64	32	32	3.1%	1.9%	▲
Calderdale and Huddersfield NHS Foundation Trust	72	21	51	1.4%	1.4%	▲
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	123	44	79	3.3%	3.5%	▲
Hull and East Yorkshire Hospitals NHS Trust	277	165	112	1.8%	1.2%	▲
Leeds Teaching Hospitals NHS Trust	83	30	53	1.2%	1.1%	▲
Sheffield Teaching Hospitals NHS Foundation Trust	132	81	51	4.5%	3.1%	▲
York Teaching Hospital NHS Foundation Trust	149	74	75	2.0%	1.4%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>NORTH EAST</b>						
City Hospitals Sunderland NHS Foundation Trust	114	9	105	2.6%	3.7%	▲
County Durham and Darlington NHS Foundation Trust	113	69	44	0.9%	0.6%	▲
Newcastle upon Tyne Hospitals NHS Foundation Trust	281	97	184	2.1%	2.2%	▲
South Tees Hospitals NHS Foundation Trust	160	44	116	1.3%	1.5%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>NORTH WEST</b>						
Blackpool Teaching Hospitals NHS Foundation Trust	7	2	5	0.0%	0.0%	▲
Bolton NHS Foundation Trust	68	28	40	1.5%	1.5%	▲
Central Manchester University Hospitals NHS Foundation Trust	195	52	143	1.0%	1.7%	▲
Countess of Chester Hospital NHS Foundation Trust	91	18	73	3.3%	3.7%	▲
East Lancashire Hospitals NHS Trust	90	17	73	2.2%	3.2%	▲
Lancashire Teaching Hospitals NHS Foundation Trust	152	9	143	0.7%	2.0%	▲
North Cumbria University Hospitals NHS Trust	81	21	60	2.5%	2.5%	▲
Pennine Acute NHS Trust	185	18	167	0.5%	1.3%	▲
Royal Liverpool and Broadgreen University Hospitals NHS Trust	330	49	281	2.1%	2.5%	▲
Tameside Hospital NHS Foundation Trust	47	23	24	0.0%	0.0%	▲
University Hospital of South Manchester NHS Foundation Trust	224	73	151	1.8%	2.4%	▲
University Hospitals of Morecambe Bay NHS Foundation Trust	60	23	37	6.7%	4.4%	▲
Warrington and Halton Hospitals NHS Foundation Trust	38	38	0	7.9%	4.6%	▲
Wirral University Teaching Hospital NHS Foundation Trust	65	64	1	4.6%	1.8%	▲
Wrightington, Wigan and Leigh NHS Foundation Trust	49	26	23	6.1%	4.7%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>EAST MIDLANDS</b>						
Derby Hospitals NHS Foundation Trust	180	42	138	1.1%	1.4%	▲
Northampton General Hospital NHS Trust	102	40	62	2.0%	2.4%	▲
Nottingham University Hospitals NHS Trust	219	26	193	0.9%	1.6%	▲
United Lincolnshire Hospitals NHS Trust	64	64	0	4.7%	2.7%	▲
University Hospitals of Leicester NHS Trust	240	47	193	0.4%	0.7%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>WEST MIDLANDS</b>						
Heart of England NHS Foundation Trust	191	69	122	1.0%	1.9%	▲
Shrewsbury and Telford Hospital NHS Trust	158	73	85	2.5%	2.5%	▲
The Dudley Group NHS Foundation Trust	144	32	112	0.7%	1.1%	▲
University Hospital of North Staffordshire NHS Trust	218	67	151	1.8%	2.1%	▲
University Hospitals Birmingham NHS Foundation Trust	123	41	82	1.6%	1.6%	▲
University Hospitals Coventry and Warwickshire NHS Trust	176	77	99	2.3%	1.6%	▲
Worcestershire Acute Hospitals NHS Trust	230	116	114	0.9%	0.9%	▲



Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>EAST OF ENGLAND</b>						
Basildon and Thurrock University Hospital NHS Foundation Trust	62	33	29	3.2%	3.2%	▲
Bedford Hospital NHS Trust	102	24	78	2.0%	3.3%	▲
Cambridge University Hospitals NHS Foundation Trust	306	67	239	0.7%	0.6%	▲
Colchester Hospital University NHS Foundation Trust	120	44	76	4.2%	4.7%	▲
East and North Hertfordshire NHS Trust	74	44	30	6.8%	4.7%	▲
Mid Essex Hospital Services NHS Trust	88	52	36	0.0%	0.0%	▲
Norfolk and Norwich University Hospitals NHS Foundation Trust	293	149	144	2.0%	1.7%	▲
Peterborough and Stamford Hospitals NHS Foundation Trust	15	15	0	0.0%	0.0%	▲
Princess Alexandra Hospital NHS Trust	82	27	55	3.7%	3.5%	▲
Southend University Hospital NHS Foundation Trust	95	25	70	2.1%	2.8%	▲
West Hertfordshire Hospitals NHS Trust	123	28	95	0.8%	0.9%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>LONDON</b>						
Barking, Havering and Redbridge University Hospitals NHS Trust	82	10	72	2.4%	2.9%	▲
Barts Health NHS Trust	129	39	90	3.1%	3.4%	▲
Guy's and St Thomas' NHS Foundation Trust	320	32	288	0.9%	1.2%	▲
Imperial College Healthcare NHS Trust	160	31	129	0.6%	0.8%	▲
King's College Hospital NHS Foundation Trust	174	10	164	0.6%	1.0%	▲
North West London Hospitals NHS Trust	81	11	70	2.5%	3.6%	▲
Royal Free London NHS Foundation Trust	152	10	142	2.0%	4.0%	▲
St George's Healthcare NHS Trust	373	9	364	1.3%	2.2%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>SOUTH CENTRAL</b>						
Buckinghamshire Healthcare NHS Trust	104	35	69	1.0%	1.0%	▲
Oxford University Hospitals NHS Trust	189	78	111	1.6%	1.5%	▲
Portsmouth Hospitals NHS Trust	141	63	78	2.1%	1.8%	▲
University Hospital Southampton NHS Foundation Trust	245	113	132	0.8%	0.6%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>SOUTH EAST COAST</b>						
Ashford and St Peter's Hospitals NHS Foundation Trust	118	19	99	0.0%	0.0%	▲
Brighton and Sussex University Hospitals NHS Trust	164	57	107	1.8%	1.6%	▲
East Kent Hospitals University NHS Foundation Trust	211	56	155	0.9%	1.5%	▲
East Sussex Healthcare NHS Trust	110	36	74	1.8%	2.0%	▲
Frimley Park Hospital NHS Foundation Trust	220	81	139	0.9%	1.2%	▲
Medway NHS Foundation Trust	156	91	65	4.5%	3.4%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>SOUTH WEST</b>						
Dorset County Hospital NHS Foundation Trust	33	33	0	3.0%	1.5%	▲
Gloucestershire Hospitals NHS Foundation Trust	183	97	86	1.6%	1.8%	▲
North Bristol NHS Trust	118	29	89	3.4%	5.2%	▲
Plymouth Hospitals NHS Trust	93	49	44	1.1%	0.7%	▲
Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	208	42	166	1.4%	2.1%	▲
Royal Cornwall Hospitals NHS Trust	111	21	90	2.7%	3.9%	▲
Royal Devon and Exeter NHS Foundation Trust	117	41	76	3.4%	5.1%	▲
Royal United Hospital Bath NHS Trust	143	41	102	3.5%	3.3%	▲
Salisbury NHS Foundation Trust	59	44	15	0.0%	0.0%	▲
South Devon Healthcare NHS Foundation Trust	87	19	68	1.1%	2.1%	▲
Taunton and Somerset NHS Foundation Trust	160	51	109	1.3%	1.3%	▲
University Hospitals Bristol NHS Foundation Trust	100	58	42	4.0%	2.5%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>NORTHERN IRELAND</b>						
Belfast Health and Social Care Trust	323	144	179	1.2%	0.9%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>SCOTLAND</b>						
NHS Ayrshire & Arran	<5	<5	0	*	*	▲
NHS Dumfries and Galloway	20	20	0	5.0%	1.7%	▲
NHS Fife	8	6	2	0.0%	0.0%	▲
NHS Forth Valley	38	38	0	2.6%	2.0%	▲
NHS Grampian	104	25	79	2.9%	3.3%	▲
NHS Greater Glasgow & Clyde	60	20	40	0.0%	0.0%	▲
NHS Highland	61	39	22	3.3%	2.0%	▲
NHS Lanarkshire	30	2	28	0.0%	0.0%	▲
NHS Lothian	133	95	38	2.3%	1.2%	▲
NHS Tayside	87	32	55	1.1%	0.9%	▲

Trust	Total AAAs	Open	EVAR	Unadjusted Mortality	Risk Adjusted Mortality	Status
<b>WALES</b>						
Abertawe Bro Morgannwg University Health Board	152	75	77	1.3%	1.1%	▲
Aneurin Bevan Health Board	91	18	73	1.1%	1.3%	▲
Betsi Cadwaladr University Health Board	162	93	69	2.5%	1.9%	▲
Cardiff and Vale University Health Board	70	17	53	0.0%	0.0%	▲
Cwm Taf University Health Board	67	44	23	4.5%	3.2%	▲




## Case ascertainment among NHS trusts and Health Boards








Between 1 January 2010 and 31 December 2012, the NHS trusts / Health Boards submitted 13,413 procedures to the NVD. The number of elective AAA procedures identified in the routine hospitals datasets over the same period was 15,303, which gives an overall case-ascertainment of 87.6%. The estimated case-ascertainment figures for the four nations were: 91.5% for England, 73.7% for Northern Ireland, 53.6% for Scotland and 74.5% for Wales.

The NHS trusts that are still performing vascular surgery have slightly better case-ascertainment figures. This may reflect their on-going work to enter data into the NVD and to review the coding of AAA procedures in the routine hospital datasets. Among these NHS organisations, the estimated case-ascertainment rate for the UK was 89.4% for the period between 1 January 2010 and 31 December 2012.

The tables below show the case-ascertainment figures for currently active NHS organisations. A traffic light system has been used to illustrate each NHS trust's contribution of cases compared to data from the national routine hospital datasets. For England, this was the Hospital Episode Statistics (HES) dataset.

- Red indicates that the NHS trust has submitted 75% or fewer of their cases compared to HES.
- Amber indicates that the trust has submitted between 76% and 90%.
- Green indicates that the trust has submitted 91% or more of their cases compared to HES.

Values above 100% are possible due to inconsistencies in the coding of HES data. Those above 110% have been highlighted as amber. The ,  or  in the final column is included to aid those who find it difficult to differentiate between red and green.

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>YORKSHIRE AND THE HUMBER</b>				
Bradford Teaching Hospitals NHS Foundation Trust	64	60	107%	
Calderdale and Huddersfield NHS Foundation Trust	72	78	92%	
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	123	130	95%	
Hull and East Yorkshire Hospitals NHS Trust	277	275	101%	
Leeds Teaching Hospitals NHS Trust	83	122	68%	
Sheffield Teaching Hospitals NHS Foundation Trust	132	227	58%	
York Teaching Hospital NHS Foundation Trust	149	142	105%	

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>NORTH EAST</b>				
City Hospitals Sunderland NHS Foundation Trust	114	124	92%	✓
County Durham and Darlington NHS Foundation Trust	113	113	100%	✓
Newcastle upon Tyne Hospitals NHS Foundation Trust	281	320	88%	✖
South Tees Hospitals NHS Foundation Trust	160	183	87%	✖

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>NORTH WEST</b>				
Blackpool Teaching Hospitals NHS Foundation Trust	7	53	13%	✖
Bolton NHS Foundation Trust	68	66	103%	✓
Central Manchester University Hospitals NHS Foundation Trust	195	211	92%	✓
Countess of Chester Hospital NHS Foundation Trust	91	94	97%	✓
East Lancashire Hospitals NHS Trust	90	110	82%	✖
Lancashire Teaching Hospitals NHS Foundation Trust	152	157	97%	✓
North Cumbria University Hospitals NHS Trust	81	93	87%	✖
Pennine Acute NHS Trust	185	161	115%	✖
Royal Liverpool and Broadgreen University Hospitals NHS Trust	330	363	91%	✓
Tameside Hospital NHS Foundation Trust	47	64	73%	✖
University Hospital of South Manchester NHS Foundation Trust	224	240	93%	✓
University Hospitals of Morecambe Bay NHS Foundation Trust	60	80	75%	✖
Warrington and Halton Hospitals NHS Foundation Trust	38	37	103%	✓
Wirral University Teaching Hospital NHS Foundation Trust	65	53	123%	✖
Wrightington, Wigan and Leigh NHS Foundation Trust	49	72	68%	✖

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>EAST MIDLANDS</b>				
Derby Hospitals NHS Foundation Trust	180	183	98%	✓
Northampton General Hospital NHS Trust	102	98	104%	✓
Nottingham University Hospitals NHS Trust	219	201	109%	✓
United Lincolnshire Hospitals NHS Trust	64	66	97%	✓
University Hospitals Of Leicester NHS Trust	240	244	98%	✓

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>WEST MIDLANDS</b>				
Heart of England NHS Foundation Trust	191	192	99%	✓
Shrewsbury and Telford Hospital NHS Trust	158	157	101%	✓
The Dudley Group NHS Foundation Trust	144	134	107%	✓
University Hospital of North Staffordshire NHS Trust	218	203	107%	✓
University Hospitals Birmingham NHS Foundation Trust	123	126	98%	✓
University Hospitals Coventry and Warwickshire NHS Trust	176	195	90%	✖
Worcestershire Acute Hospitals NHS Trust	230	272	85%	✖













Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>EAST OF ENGLAND</b>				
Basildon and Thurrock University Hospital NHS Foundation Trust	62	78	79%	🔴
Bedford Hospital NHS Trust	102	106	96%	✅
Cambridge University Hospitals NHS Foundation Trust	306	345	89%	🔴
Colchester Hospital University NHS Foundation Trust	120	123	98%	✅
East and North Hertfordshire NHS Trust	74	62	119%	🔴
Mid Essex Hospital Services NHS Trust	88	104	85%	🔴
Norfolk and Norwich University Hospitals NHS Foundation Trust	293	282	104%	✅
Peterborough and Stamford Hospitals NHS Foundation Trust	15	31	48%	❌
Princess Alexandra Hospital NHS Trust	82	94	87%	🔴
Southend University Hospital NHS Foundation Trust	95	89	107%	✅
West Hertfordshire Hospitals NHS Trust	123	141	87%	🔴


Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>LONDON</b>				
Barking, Havering and Redbridge University Hospitals NHS Trust	82	112	73%	❌
Barts Health NHS Trust	129	99	130%	🔴
Guy's and St Thomas' NHS Foundation Trust	320	393	81%	🔴
Imperial College Healthcare NHS Trust	160	212	75%	❌
King's College Hospital NHS Foundation Trust	174	185	94%	✅
North West London Hospitals NHS Trust	81	105	77%	🔴
Royal Free London NHS Foundation Trust	152	187	81%	🔴
St George's Healthcare NHS Trust	373	371	101%	✅



Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>SOUTH CENTRAL</b>				
Buckinghamshire Healthcare NHS Trust	104	92	113%	❖
Oxford University Hospitals NHS Trust	189	224	84%	❖
Portsmouth Hospitals NHS Trust	141	135	104%	✓
University Hospital Southampton NHS Foundation Trust	245	244	100%	✓

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>SOUTH EAST COAST</b>				
Ashford and St Peter's Hospitals NHS Foundation Trust	118	113	104%	✓
Brighton and Sussex University Hospitals NHS Trust	164	167	98%	✓
East Kent Hospitals University NHS Foundation Trust	211	145	146%	❖
East Sussex Healthcare NHS Trust	110	111	99%	✓
Frimley Park Hospital NHS Foundation Trust	220	230	96%	✓
Medway NHS Foundation Trust	156	152	103%	✓

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>SOUTH WEST</b>				
Dorset County Hospital NHS Foundation Trust	33	37	89%	
Gloucestershire Hospitals NHS Foundation Trust	183	198	92%	
North Bristol NHS Trust	118	118	100%	
Plymouth Hospitals NHS Trust	93	106	88%	
Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	208	234	89%	
Royal Cornwall Hospitals NHS Trust	111	115	97%	
Royal Devon and Exeter NHS Foundation Trust	117	118	99%	
Royal United Hospital Bath NHS Trust	143	155	92%	
Salisbury NHS Foundation Trust	59	55	107%	
South Devon Healthcare NHS Foundation Trust	87	93	94%	
Taunton and Somerset NHS Foundation Trust	160	175	91%	
University Hospitals Bristol NHS Foundation Trust	100	103	97%	

Trust Name	Total Cases in NVD	Total Cases in HES	%	
<b>NORTHERN IRELAND</b>				
Belfast Health and Social Care Trust	323	421	77%	

Trust Name	Total Cases in NVD	Total Cases in ISD	%	
<b>SCOTLAND</b>				
NHS Ayrshire & Arran	<5	41	<12%	✘
NHS Dumfries and Galloway	20	22	91%	✔
NHS Fife	8	38	21%	✘
NHS Forth Valley	38	58	66%	✘
NHS Grampian	104	144	72%	✘
NHS Greater Glasgow & Clyde	60	213	28%	✘
NHS Highland	61	84	73%	✘
NHS Lanarkshire	30	92	33%	✘
NHS Lothian	133	222	60%	✘
NHS Tayside	87	100	87%	◆

Trust Name	Total Cases in NVD	Total Cases in PEDW	%	
<b>WALES</b>				
Abertawe Bro Morgannwg University Health Board	152	194	78%	◆
Aneurin Bevan Health Board	91	112	81%	◆
Betsi Cadwaladr University Health Board	162	189	86%	◆
Cardiff and Vale University Health Board	70	132	53%	✘
Cwm Taf University Health Board	67	93	72%	✘

## Conclusion

Since 2005, vascular surgical services in the UK have been participating in a broad quality improvement programme undertaken by the Vascular Society. This report is the latest publication in its sequence of initiatives and aims to support NHS services to improve the care delivered to patients with an abdominal aortic aneurysm. It is pleasing to see that overall in-hospital mortality has continued to improve, and has fallen to 1.8%.

This improvement in care has coincided with a move to a more open, multi-disciplinary team structure, as advocated by the AAA quality improvement programme. To provide high quality outcomes, surgeons need to work closely with anaesthetists and radiologists. Specialist vascular nurses also play a critical part within a successful team, not least by acting as a clear focus for communication. In addition, vascular teams now have access to detailed information on standards and a care pathway for AAA surgery, as developed by the Vascular Society's quality improvement programme, and all team members should be involved in the implementation of the pathway. This information can be accessed at [www.aaqip.com](http://www.aaqip.com) or [www.vsqip.org.uk](http://www.vsqip.org.uk).

This report has focused on mortality after elective infra-renal abdominal aortic aneurysm surgery. It provides a measure of the safety of the procedure, and is a fundamental aspect of care. Nonetheless, it only reflects one part of the spectrum of outcomes that are important to patients. It is an aim of the National Vascular Registry that future reports describe a wider set of outcomes for patients and health professionals. To achieve this, the NVR has undertaken a review of the NVD dataset, and made revisions to improve the range of information it can capture and also to reflect recent changes in clinical practice. In particular, because the surgeon involvement in EVAR varies between NHS organisations around the country, the NVR has been designed to enable a number of consultants to be recorded as performing a single procedure. The new dataset will start being used from December 2013, with the launch of the new NVR IT system.

## References

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## Appendix 1: OPCS codes for elective AAA repair used in this report

Code	Description
L19.4	Other replacement of aneurysmal segment of aorta, Replacement of aneurysmal segment of infrarenal abdominal aorta by anastomosis of aorta to
L19.5	Other replacement of aneurysmal segment of aorta, Replacement of aneurysmal segment of abdominal aorta by anastomosis of aorta to aorta nec
L19.6	Other replacement of aneurysmal segment of aorta, Replacement of aneurysmal bifurcation of aorta by anastomosis of aorta to iliac artery nec
L19.8	Other replacement of aneurysmal segment of aorta, Replacement of aneurysmal segment of abdominal aorta by anastomosis of aorta to femoral artery
L27.1	Preferred EVAR code - Endovascular insertion of stent graft for infrarenal abdominal aortic aneurysm
L27.5	Preferred EVAR code -Endovascular insertion of stent graft for aortic aneurysm of bifurcation NEC
L27.6	Preferred EVAR code- Endovascular insertion of stent graft for aorto-monoiliac aneurysm
L27.8	Preferred EVAR code - Other specified transluminal insertion of stent graft for aneurysmal segment of aorta
L27.9	Preferred EVAR code - Unspecified transluminal insertion of stent graft for aneurysmal segment of aorta
L28.1	Endovascular stenting for infrarenal abdominal aortic aneurysm
L28.5	Endovascular stenting of aortic bifurcation NEC
L28.6	Endovascular stenting of aorto-uniiliac aneurysm
L28.8	Other specified transluminal operations on aneurysmal segment of aorta
L28.9	Unspecified transluminal operations on aneurysmal segment of aorta

## Appendix 2: Distribution of values among records with complete data and after the imputation of missing values for key variables

Patient characteristic	Imputed values		Values in submitted records		
	N	%	N	%	Missing
Age group					
<66	1871	13.9	1870	14.0	12
66-75	5350	39.9	5344	39.9	
76-85	5495	41.0	5490	41.0	
>85	697	5.2	697	5.2	
Female	1674	12.5	1673	12.5	13
Male	11739	87.5	11727	87.5	
Procedure					
EVAR	8712	65.0	8712	65.0	0
Open AAA	4701	35.0	4701	35.0	
Cardiac disease					
No	7512	56.0	6552	56.4	1804
Yes	5901	44.0	5057	43.6	
Abnormal ECG					
No	9277	69.2	7199	69.9	3116
Yes	4136	30.8	3098	30.1	
Previous aortic surgery					
No	13013	97.0	10796	97.1	2292
Yes	400	3.0	325	2.9	
White cell count (10 <sup>9</sup> /l)					
3-11	12403	92.5	10084	92.8	2541
under 3 or over 11	1010	7.5	788	7.2	
Serum sodium (mmol/l)					
135-145	12077	90.0	9903	89.9	2400
< 135 or > 145	1336	10.0	1110	10.1	
Serum creatinine (µmol/l)					
120 or lower	10892	81.2	9057	81.8	2337
more than 120	2521	18.8	2019	18.2	
AAA diameter (cm)					
Less than 6.5	8565	63.9	7147	65.6	2518
6.5 or more	4848	36.1	3748	34.4	
ASA fitness grade					
1-2	5636	42.0	4752	42.2	2160
3	7267	54.2	6060	53.9	
4-5	510	3.8	441	3.9	

## Appendix 3: NHS Trusts/Health Boards no longer performing elective AAA repairs

A number of NHS trusts/health boards have stopped performing AAA repair over the data collection period, due to the on-going reorganisation of vascular surgical services. These are shown below.

Region	NHS Trust/Health Board
<b>Yorkshire and The Humber</b>	Airedale NHS Foundation Trust
	Mid Yorkshire Hospitals NHS Trust
	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust
<b>North East</b>	Gateshead Health NHS Foundation Trust
<b>North West</b>	Aintree University Hospitals NHS Foundation Trust
	Mid Cheshire Hospitals NHS Foundation Trust
	Southport and Ormskirk Hospital NHS Trust
<b>East Midlands</b>	Chesterfield Royal Hospital NHS Foundation Trust
	Kettering General Hospital NHS Foundation Trust
	Sherwood Forest Hospitals NHS Foundation Trust
<b>West Midlands</b>	Mid Staffordshire NHS Foundation Trust
	Royal Wolverhampton Hospitals NHS Trust
	Sandwell and West Birmingham Hospitals NHS Trust
	Walsall Healthcare NHS Trust
<b>East of England</b>	Ipswich Hospital NHS Trust
	Queen Elizabeth NHS Trust
<b>London</b>	Barnet and Chase Farm Hospitals NHS Trust
	Ealing Hospital NHS Trust
	Epsom and St Helier University Hospitals NHS Trust
	Hillingdon Hospitals NHS Foundation Trust
	University College London Hospitals NHS Foundation Trust
	Whipps Cross University Hospital NHS Trust
<b>South Central</b>	Heatherwood and Wexham Park Hospitals NHS Foundation Trust
	Milton Keynes Hospital NHS Foundation Trust
	Royal Berkshire NHS Foundation Trust
<b>South East Coast</b>	Dartford and Gravesham NHS Trust
	Surrey and Sussex Healthcare NHS Trust
	Western Sussex Hospitals NHS Trust
<b>South West</b>	Great Western Hospitals NHS Foundation Trust
	Northern Devon Healthcare NHS Trust
<b>Northern Ireland</b>	Southern Health and Social Care Trust
	Western Health and Social Care Trust
<b>Wales</b>	Hywel Dda Health Board





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