

**UHCE OXFORD REPORT CR13  
GENERAL SURGERY: CASE FATALITY RATES**

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## **EXECUTIVE SUMMARY**

### **Purpose of study**

The Department of Health and the Healthcare Commission commissioned NCHOD to work with the appropriate professional bodies to develop for surgical specialties a set of outcome indicators that could help clinicians and the Healthcare Commission. This report covers the work done on general surgery case fatality rates.

### **Outline of study**

The study has been carried in the following phases:

- Professional bodies contacted to nominate clinicians to work with NCHOD.
- Agreement reached between NCHOD and nominated clinicians about:
  - aggregations of activity to be used for analysis
  - types of analysis to be done
  - specific operations to be studied
  - candidate indicators to be studied further.
- NCHOD develops detailed specifications for each of the candidate indicators to be agreed with the clinicians.
- NCHOD produces national figures for each candidate indicator to provide:
  - data about the number of events and admissions nationally so that the suitability of the indicator as a comparative measure could be assessed.
- NCHOD produces trust-based comparative figures for each of the candidate indicators considered suitable, with respect to numbers of events and admissions, to identify whether the measure is a useful comparative indicator.
- Agreement is reached between NHOD and nominated clinicians about a set of indicators to recommend to the Department of Health and the Healthcare Commission for implementation.

### **Recommendations**

After discussions with collaborating clinicians, it is recommended that the following case fatality indicators could be used for comparing trust general surgery performance:

- General indicators:
  - emergency admissions with an operation
  - emergency admissions without an operation.

The vascular procedures indicators had a few outlier trusts when three years of data were analysed. They are unlikely to be useful as annual comparative measures if annual data are required.

The general elective and elective procedure indicators had inadequate numbers of deaths to produce useful indicators.

## 1. BACKGROUND

### Purpose of study

The Department of Health and the Healthcare Commission commissioned the National Centre for Health Outcomes Development (NCHOD) at Oxford to work with the Royal College of Surgeons to develop for general surgery a set of outcome indicators that could help:

- Clinicians:
  - share information about prognosis with patients
  - assess outcomes in patients they have treated
  - compare outcomes of patients they have treated with colleagues' experience.
- Healthcare Commission to screen trusts as to whether their clinical performance needs further investigation.

The detailed work of indicator specification was carried out with nominees from:

- Association of Coloproctology of GB and Ireland
- Association of Upper Gastro-intestinal Surgeons of GB and Ireland
- Vascular Surgical Society of GB and Ireland

### Outcome indicators

For the purpose of studying outcomes, an indicator has been defined as an 'aggregated statistical measure, describing a group or whole population, compiled from measures on individuals that provide insights into the functioning of services'. Well-chosen indicators provide pointers as to where further investigation may be worthwhile but they do not necessarily provide definitive answers on whether services are good or inadequate.

As well as direct indicators of outcome such as mortality or re-admission rates, consideration in this study will be given to the inclusion of proxy or indirect indicators of outcome such as the 'inappropriate' selection of cases.

### Case fatality rates

Death after a hospital admission may be an unavoidable event, a consequence of the natural history of illness or it may be an adverse event that reflects poorly on the care provided. Case fatality rates (CFR) are used by the Department of Health and the NHS to compare hospital performance and were recommended in five of the ten condition-specific reports published in 1999 by NCHOD:

- asthma
- acute myocardial infarction
- diabetes
- fractured proximal femur
- stroke.

Case fatality rates have also been used as clinical indicators and in star ratings. Those produced have included indicators for deaths within 30 days of:

- elective admission operation
- emergency admission operation
- heart by-pass
- angioplasty

- emergency admission for fractured hip
- emergency admission for acute myocardial infarction
- emergency admission for stroke.

## **General surgery**

General surgery is a specialty with a number of discrete sub-specialties and with an increasing number of surgeons working only in a sub-specialty. The specialty and sub-specialties can be described by the operations done or by the diagnoses of the admissions.

The operations usually done by general surgeons relate to:

- Endocrine glands.
- Breast.
- Upper and lower gastro-intestinal tract.
- Abdominal organs.
- Arteries/veins:
  - aorta
  - iliacs/femorals and other arteries
  - veins.
- Soft tissues:
  - abdominal wall and peritoneum
  - lymphatics.

The diagnoses related to general surgery are:

- malignant and benign neoplasms
- disease of arteries, arterioles and capillaries
- diseases of veins and lymphatic system
- diseases of oral cavity, salivary glands and jaws
- diseases of oesophagus, stomach and duodenum
- diseases of appendix
- hernia
- non-infective enteritis and colitis
- other disease of intestines
- diseases of peritoneum
- disease of liver, gall bladder, biliary tract and pancreas
- other disease of digestive system
- disorders of breast
- signs and symptoms relating to digestive system
- complications of surgical care.

For clinical organisation purposes, general surgery is now considered as four sub-specialties:

- breast surgery
- upper gastro-intestinal surgery
- colo-rectal surgery
- vascular surgery.

## 2. METHODS

### Outline of the study

The study was carried in the following phases:

- Royal College of Surgeons was contacted to:
  - participate in the study
  - nominate surgical specialist societies to work with NCHOD.
- Specialist societies nominated clinicians to work with NCHOD.
- Agreement was reached between NCHOD and nominated clinicians about:
  - aggregations of activity to be used for analysis
  - types of analysis to be done
  - specific operations to be studied
  - candidate indicators to be studied further.
- NCHOD developed detailed specifications for each of the candidate indicators which were agreed with the clinicians.
- NCHOD produced national figures for each candidate indicator to provide:
  - national information about prognosis
  - data about the number of events and admissions nationally so that the suitability of the indicator as a comparative measure could be assessed.
- NCHOD produced trust-based comparative figures for each of the candidate indicators considered suitable, with respect to numbers of events and admissions, to identify whether the measure was a useful comparative indicator.
- Agreement was reached between NHOD and nominated clinicians about a set of indicators to recommend to the Department of Health and the Healthcare Commission.

### Groups of general surgery activity used

With the assistance of the collaborating clinicians a model of general surgery has been developed, dividing the activity into different groups relating to:

- Suitability for measuring the performance of the specialty
- Appropriateness of using indicators derived from a linked file
- Relative risk of the occurrence of adverse events.

The finished consultant episode (FCE) is the measure for counting specialty activity. From routinely collected data, a FCE can be classified as:

- One which is:
  - first FCE in a continuous in-patient spell (CIPS), or
  - subsequent FCE when the patient is transferred from the original specialty of admission.
- One containing:
  - diagnostic code for cancer, or
  - no such codes.
- If a first FCE, one with mode of admission (if known) coded as:
  - emergency, or
  - elective, or
  - transfer from another hospital.
- If an elective admission, one coded as:
  - day case intended to be and discharged on the same day, or
  - overnight stay.

- One in which:
  - an operative procedure took place, or
  - no operative procedure took place.

The diagnostic codes used to identify cancer patients were those used for the specification of clinical indicator AS401 and are ICD-10 codes C00-97, D37-48 and Z51.1 (patient on chemotherapy for cancer).

In specifying the groups which had operations, FCEs which only had certain operative procedure codes were excluded and included in the non-operation group. A list of these codes, developed for clinical indicator AS401, is shown at Annex A.

The collaborating clinicians have agreed that, when comparing performance between hospital trusts, only admissions with a general surgery first FCE should be used. The quality of care given in the originating FCE will greatly influence that delivered in subsequent FCEs and, indeed, the transfer may often occur because an adverse event has occurred in the initiating FCE.

Admissions with cancer diagnoses have been separately identified. The routine databases of HES and ONS mortality are not the best sources from which to derive comparative cancer outcome statistics in that:

- Cancer survival measures are more appropriate indicators for comparing performance than case fatality rates.
- Comparative cancer mortality performance needs to be based on cancer networks not individual hospitals or trusts.
- Cancer diagnoses are associated with a disproportionately high rate of deaths during or following admission, thus masking less common causes of death.

Previous NCHOD work has shown that FCEs with different modes of admission and with and without an operative procedure performed have varying risks of adverse events occurring after them. Day cases, discharged on the same day as admission, very rarely lead to significant adverse events and there is little purpose in producing linked file indicators for this group of patients. Any patient intended to be a day case but who died rather than being discharged should be the subject of an investigation.

Whether the remaining groups of activity can be used for producing comparative outcome indicators from a linked file is a matter of statistical power and will depend on the number of:

- adverse events being measured
- admissions in the group
- NHS trusts being compared.

For the calendar year 2000 there were on 1,438,351 general surgery FCEs, of which 1,332,799 (93%) were the first FCE in a continuous in-patient spell (CIPS). Of those FCEs which were not first in a spell, 62% were in a CIPS starting with a general surgery FCE.

**Exhibit 1: Annual number of first FCEs and 0-29 day deaths and crude case fatality rates (per 100 FCEs)**

Group	First FCEs		0-29 day deaths		
	Number	%	Number	%	Rate %
With cancer diagnosis	133786	10.0	10735	36.7	8.0
Elective without cancer:					
• day cases	467205	35.0	452	1.6	0.1
• overnight with operation	236615	17.8	1265	4.3	0.5
• overnight no operation	44870	3.4	582	2.0	1.3
Emergency without cancer:					
• with operation	132078	9.9	4336	14.8	3.3
• no operation	303820	22.8	10299	35.2	3.4
Transfer without cancer	9057	0.7	1114	3.8	12.3
Admission source not known	5368	0.4	484	1.6	9.0
Total	1332799	100.0	29267	100.0	2.2

Exhibit 1 shows, for sub-groups of the first FCE admissions, the number admitted annually and the number and case fatality rate for deaths occurring 0-29 days after admission.

**Database used**

The database used was a linked file of English hospital episodes and ONS mortality data developed at Oxford. Index admissions were for the calendar years 1999-2001 and there was a further 90 days of data to allow the recording of the events of interest post-admission.

**Analyses done**

Analyses of trends over time require a means of dividing time into discrete periods. For most specifications, only the first recorded admission in the year for an individual has been included in the indicator denominator. However, it is recognised that that the first recorded event may not necessarily be the first relevant event.

For most analyses, continuous in-patient spells starting with a general surgery FCE were used as the index admissions rather than finished consultant episodes. CIPS, relating to the duration of stay in a hospital, have been used rather than FCEs because they:

- are a more clinically relevant measure than FCEs
- obviate having to handle transfers between FCEs in an analysis.

The issues that were considered, in specifying the indicators, were:

- Inclusion of:
  - deaths recorded on death certificate *or*
  - deaths recorded on death certificate and/or HES record.
- Inclusion of:
  - all deaths recorded on death certificate regardless of cause *or*
  - deaths with specific diagnoses given as main cause of death *or*
  - deaths with specific diagnoses recorded anywhere on the record?
- Time interval from start of an index admission to death.

For all the specifications it was decided to include in the numerator, deaths:

- recorded on death certificate and/or HES
- from any cause.

For day case, elective admission and mode not known indicators, the time interval chosen was 0-29 days after start of index admission.

For emergency and transfer admission indicators, the time interval chosen was 0-89 days as the SMR for this period was markedly raised.

Case fatality rates were age/sex standardised. In common with the clinical indicator specifications, indirect standardisation was used and the indicators were standardised for age and sex. Indirect standardisation is to be preferred because it is:

- More robust with small numbers and avoids the distortions caused by direct standardisation based on unstable age-specific rates.
- More flexible with respect to future requirements such as standardising for other factors such as deprivation.

### **Funnel plots**

Results have been shown graphically as funnel plots which show standardised case fatality rates (SCFRs) on the y axis plotted against expected deaths on the x axis in a scatter plot. The horizontal line in the middle of each plot shows the national overall mortality rate around which the SCFRs cluster and this clustering is much more pronounced as the expected deaths get larger leading to a funnel shape. Poisson confidence intervals (95 and 99%) for each value of the expected are superimposed on top of the SCFRs. These confidence intervals are tabulated values for expected deaths less than 100 and calculated from a formula giving approximate values for expected deaths greater than 100 (from Bland).

### **3. MORTALITY INDICATOR SPECIFICATIONS: GENERAL**

#### **General specifications**

Specifications have been developed for the following general mortality indicators:

- 1A. 0-29 day CFR for day cases
- 2A. 0-29 day CFR for overnight elective admissions which did have an operation
- 3A. 0-29 day CFR for overnight elective admissions which did not have an operation
- 4A. 0-89 day CFR for emergency admissions which had an operation
- 5A. 0-89 day CFR for emergency admissions which did not have an operation
- 6A. 0-89 day CFR for admissions starting with a transfer
- 7A. 0-29 day CFR for admissions with mode of admission unknown.

## GENERAL INDICATOR SPECIFICATIONS

### Indicator type/number: Mortality 1A

#### Definition

Proportion of general surgery day cases (excluding those with a cancer diagnosis) that died 0-29 days after the start of the index admission.

#### Denominator

General surgery elective day case admission, occurring first in the calendar year for an individual:

- Day case defined as intended to be a day case and discharged same day as admission
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included

### Indicator type/number: Mortality 2A

#### Definition

Proportion of elective CIPS, starting with a general surgery FCE (excluding day cases and those with a cancer diagnosis) in which an operative procedure took place, that died 0-29 days after the start of the index admission.

#### Denominator

Elective CIPS starting with a general surgery FCE that had an operative procedure, occurring first in the calendar year for an individual:

- Day case admissions are excluded
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- Admissions which only have the operation codes listed in Annex A are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included

### **Indicator type/number: Mortality 3A**

#### **Definition**

Proportion of elective CIPS, starting with a general surgery FCE (excluding day cases and those with a cancer diagnosis) in which no operative procedure took place, that died 0-29 days after the start of the index admission.

#### **Denominator**

Elective CIPS starting with a general surgery FCE in which no operative procedure took place, occurring first in the calendar year for an individual:

- Day case admissions are excluded
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- Admissions which only have the operation codes listed in Annex A are included
- All ages
- Both sexes.

#### **Numerator**

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included

### **Indicator type/number: Mortality 4A**

#### **Definition**

Proportion of emergency CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) in which an operative procedure took place, that died 0-89 days after the start of the index admission.

#### **Denominator**

Emergency CIPS starting with a general surgery FCE in which no operative procedure took place, occurring first in the calendar year for an individual:

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- Admissions which only have the operation codes listed in Annex A are excluded
- All ages
- Both sexes.

#### **Numerator**

Death recorded 0-89 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 5A**

### **Definition**

Proportion of emergency CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) in which no operative procedure took place, that died 0-89 days after the start of the index admission.

### **Denominator**

Emergency CIPS starting with a general surgery FCE in which no operative procedure took place, occurring first in the calendar year for an individual:

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- Admissions which only have the operation codes listed in Annex A are included
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-89 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 6A**

### **Definition**

Proportion of transfer CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) that died 0-89 days after the start of the index admission.

### **Denominator**

CIPS started by a transfer from another hospital and starting with a general surgery FCE, occurring first in the calendar year for an individual:

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-89 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 7A**

### **Definition**

Proportion of CIPS with mode of admission not known and starting with a general surgery FCE (excluding those with a cancer diagnosis), that died 0-29 days after the start of the index admission.

### **Denominator**

CIPS with mode of admission not known and starting with a general surgery FCE, occurring first in the calendar year for an individual:

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## 4. MORTALITY INDICATOR SPECIFICATIONS: UPPER G-I SURGERY

### Introduction

Two high volume upper gastro-intestinal procedures for conditions other than cancer were considered to be a potentially useful CFR indicator:

- elective cholecystectomy
- anti-reflux and hiatus hernia surgery.

However upper gastro-intestinal surgeons consider that certain operations should only be done in specialist centres and that outcome measures should be calculated for clinically relevant groups of these procedures. The specialist operations relate to:

- oesophagus
- stomach
- pancreas
- liver.

### Elective cholecystectomy

About 39,000 admissions with a cholecystectomy code (J18) occur per year of which 87% are elective admissions and:

- In 94 % of the FCEs in which the operation took place the code was recorded in the first position (the main operation).
- The commonest diagnostic codes were:
  - K80 cholelithiasis in 74.2% of admissions
  - K81 cholecystitis in 16.9%

About 28,200 laparoscopic cholecystectomies (recorded as J18.3 with Y50.8) occur each year and in 99.3% of the FCEs in which the operation took place the code was recorded in the first position (the main operation).

The specification used for indicator 8A was elective admissions with cholecystectomy recorded as main operation.

### Operations for hiatus hernia and anti-reflux surgery

Over 90% of operations for hiatus hernia and anti-reflux surgery occurred in elective admissions with the average annual numbers being:

- G23 repair of diaphragmatic hernia 254
- G24 anti-reflux procedures 1601.

The proportion of G23 and 24 procedures carried out as the main procedure in elective admissions was 91%.

The specification used for indicator 9A was elective admissions with G23 or 24 recorded as the main operation.

## UPPER G-I SURGERY INDICATOR SPECIFICATIONS

### Indicator type/number: Mortality 8A

#### Definition

Proportion of elective CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having a cholecystectomy recorded as the main operation, that died 0-29 days after the start of the index admission.

#### Denominator

Elective CIPS starting with a general surgery FCE having a cholecystectomy recorded as the main operation, occurring first in the calendar year for an individual:

- Operative code J18
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

### Indicator type/number: Mortality 9A

#### Definition

Proportion of elective CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having hiatus hernia or anti-reflux surgery recorded as the main operation, that died 0-29 days after the start of the index admission.

#### Denominator

Elective CIPS starting with a general surgery FCE having hiatus hernia or anti-reflux surgery recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes G23-24
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## 5. MORTALITY INDICATOR SPECIFICATIONS: VASCULAR SURGERY

### Introduction

The following procedures were considered to be potentially useful CFR indicators:

- abdominal aneurysm surgery using codes L19.4-19.6, L49.1-49.6, L25.4 and L21.4-21.6.
- carotid endarterectomy using codes L29.4 and 29.5
- leg arterial by-pass grafts using codes L58.2-58.7 and 59.2-59.7.

Exhibit 2 shows the number of admissions, deaths and 0-29 day CFRs for admissions without cancer diagnoses which had a carotid endarterectomy. The CFRs for emergency and transfer admissions for abdominal aneurysm procedures and leg arterial by-pass grafting are similar.

Specifications have been done for the following indicators:

- elective abdominal aneurysm procedures, indicator 10A
- emergency and transfer abdominal aneurysm procedures, indicator 11A
- elective carotid endarterectomy, indicator 12A
- elective leg arterial by-pass grafts, indicator 13A
- emergency and transfer leg arterial by-pass grafts, indicator 14A

### Exhibit 2: Number of admissions, deaths and CFRs for selected vascular surgery procedures occurring in elective, emergency and transfer admissions without cancer in 1999-2001

Operative procedure	Number of admissions	0-29 day deaths	
		Number	CFR (%)
<b>Abdominal aneurysm:</b>			
Elective	10606	938	9
Emergency	2053	537	26
Transfer	359	84	23
<b>Carotid endarterectomy</b>			
Elective	12471	302	2
Emergency	935	43	5
Transfer	252	24	11
<b>Leg arterial by-pass graft</b>			
Elective	11646	690	6
Emergency	5922	941	16
Transfer	514	86	17

## VASCULAR SURGERY INDICATOR SPECIFICATIONS

### Indicator type/number: Mortality 10A

#### Definition

Proportion of elective CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having abdominal aneurysm surgery recorded as the main operation, that died 0-29 days after the start of the index admission.

#### Denominator

Elective CIPS starting with a general surgery FCE having abdominal aneurysm surgery recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes L19.4-19.6, L21.4-21.6, L25.4 and L49.1-49.6
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

### Indicator type/number: Mortality 11A

#### Definition

Proportion of emergency and transfer CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having abdominal aneurysm surgery recorded as the main operation, that died 0-89 days after the start of the index admission.

#### Denominator

Emergency and transfer CIPS starting with a general surgery FCE having abdominal aneurysm surgery recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes L19.4-19.6, L21.4-21.6, L25.4 and L49.1-49.6
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

#### Numerator

Death recorded 0-89 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 12A**

### **Definition**

Proportion of elective CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having carotid endarterectomy recorded as the main operation, that died 0-29 days after the start of the index admission.

### **Denominator**

Elective CIPS starting with a general surgery FCE having carotid endarterectomy recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes L29.4-29.5
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 13A**

### **Definition**

Proportion of elective CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having leg arterial by-pass grafting recorded as the main operation, that died 0-29 days after the start of the index admission.

### **Denominator**

Elective CIPS starting with a general surgery FCE having leg arterial by-pass grafting recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes L58.2-58.7 and L59.2-59.7
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-29 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## **Indicator type/number: Mortality 14A**

### **Definition**

Proportion of emergency and transfer CIPS, starting with a general surgery FCE (excluding those with a cancer diagnosis) and having leg arterial by-pass grafting recorded as the main operation, that died 0-89 days after the start of the index admission.

### **Denominator**

Emergency and transfer CIPS starting with a general surgery FCE having leg arterial by-pass grafting recorded as the main operation, occurring first in the calendar year for an individual:

- Operative codes L58.2-58.7 and L59.2-59.7
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- All ages
- Both sexes.

### **Numerator**

Death recorded 0-89 days after start of index admission:

- Recorded on HES record and/or death certificate
- Deaths for all causes are included.

## 6. MORTALITY INDICATOR PLOTS

### Funnel plots

Exhibits 3 and 4 show for each indicator the number of:

- trusts that had consistent codes across the three years that were analysed
- admissions
- deaths
- case fatality rates.

The figures in Exhibit 3 are obtained from a file of general surgery FCEs occurring first in a CIPS in 2000 and those in Exhibit 4 are CIPS starting with a general surgery FCE in 1999-2001.

Exhibit 5 shows for the years 1999-2001 for indicators selected to proceed to plots:

- crude case fatality rate
- number and proportion of trusts that had CFRs which were outside the funnel plot 95% confidence limits.

For the analyses relating to the components of surgical activity, only indicators 4A and 5A had adequate numbers of admissions and deaths to be worthwhile proceeding to producing plots. Funnel plots for these two indicators and the vascular surgery indicators 10A to 13A are shown in Exhibits 6-11.

Funnel plots are a type of control chart which are useful when the sample size of plot data points vary. Control charts attempt to compare the degree of variation in some performance measure which was observed, compared to what would statistically be expected. The funnel plots we have presented show how SCFRs vary with expected deaths around the national average mortality rate. The Poisson confidence intervals represent the variation in SCFR we expect statistically. If only random variation is present for any given condition we would see 95% (for example), of the data points to be within these limits (for that level of confidence). In only presenting one set of confidence limits (for the expected deaths) the charts are clear and allow an idea of how much variation is present in the data to be ascertained quickly.

Thus the comparison of SCFRs (with confidence limits) to a national average to determine statistical significance means that the number of trusts appearing in Exhibit 5 will not correspond entirely to the number of trusts appearing outside the funnel limits, since they are calculated by two different methods.

**Exhibit 3: Numbers of trusts, admissions and deaths and CFRs for year 2000 using FCE file**

<b>Indicator (days)</b>	<b>Number of trusts</b>	<b>Number of admissions</b>	<b>Number of deaths</b>	<b>CFR %</b>
1A Day cases 0-29	198	467205	452	0.1
2A Elective with op 0-29	198	236615	1265	0.5
3A Elective no op 0-29	193	44870	582	1.3
4A Emergency with op 0-89	179	132078	8189	6.2
5A Emergency no op 0-89	188	303820	16406	5.4
6A Transfer 0-89	188	9057	1331	14.7
7A Mode not known 0-29	184	5368	484	9.0

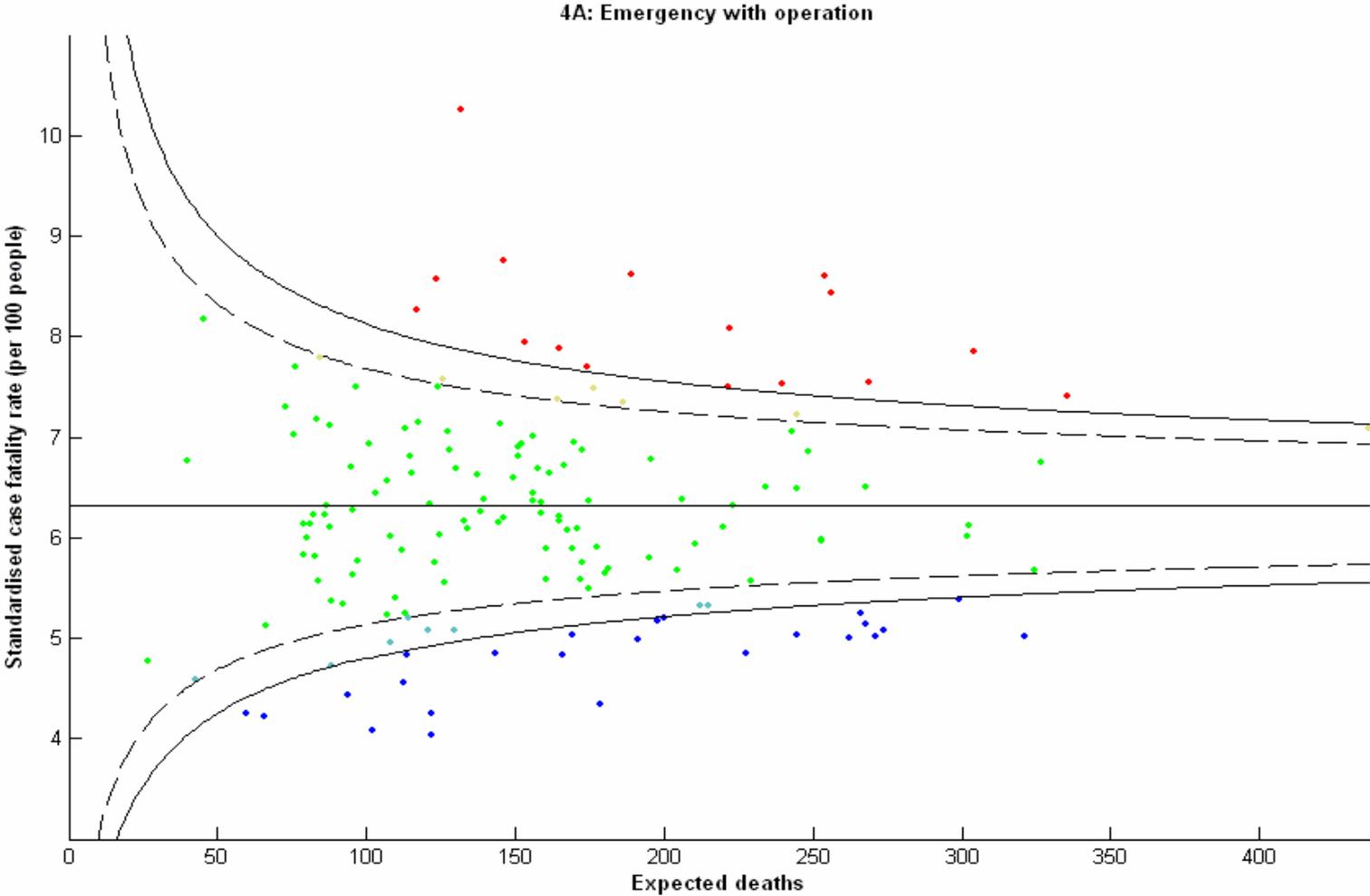
**Exhibit 4: Numbers of trusts, admissions and deaths 1999-2001 using CIPS file**

<b>Indicator (days)</b>	<b>Number of trusts</b>	<b>Number of admissions</b>	<b>Number of deaths</b>
4A Emergency with op 0-89	156	394779	24915
5A Emergency no op 0-89	157	664238	36226
8A Elective cholecystectomy 0-29	158	85015	168
9A Elective hiatus hernia 0-29	97	3989	15
10A Elective abdo aneurysm 0-29	126	6224	409
11A Emerg/transfer abdo aneurysm 0-89	58	1418	373
12A Elective carotid endarterectomy 0-29	102	6756	103
13A Elective leg arterial by-pass 0-29	133	6394	146
14A Emerg/transfer leg arterial by-pass 0-89	94	2578	372

**Exhibit 5: 0-29 and 0-89 day crude CFRs and the number and proportion of trusts with CFR values outside 95% observed confidence intervals for 1999-2001 using CIPS file**

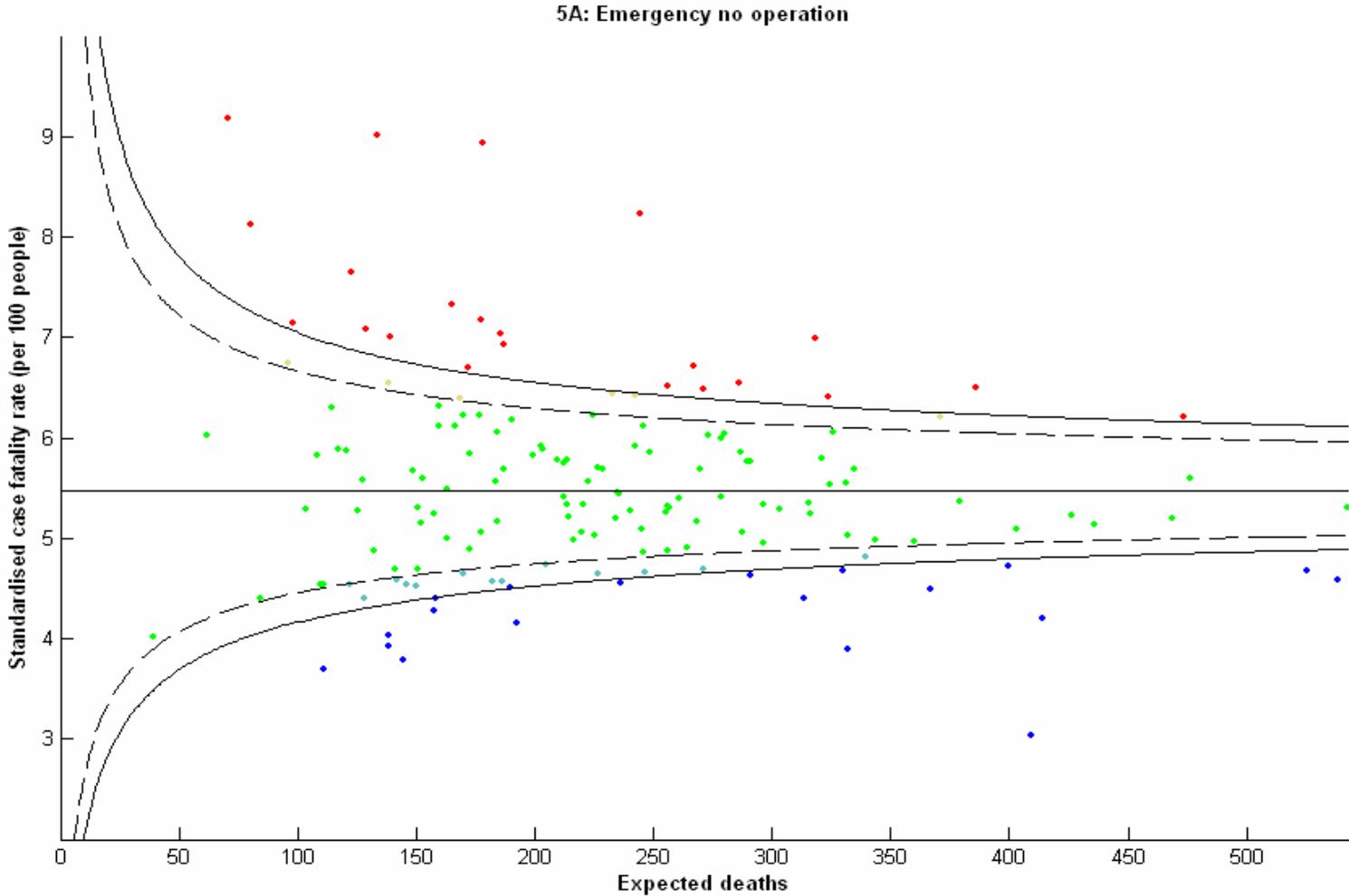
<b>Indicator (days)</b>	<b>CFR %</b>	<b>Number and (%) trusts outside CIs</b>
4A Emergency with op 0-89	6.3	54 (35)
5A Emergency no op 0-89	5.5	58 (37)
8A Elective cholecystectomy 0-29	0.2	1 (1)
9A Elective hiatus hernia 0-29	0.4	0 (0)
10A Elective abdo aneurysm 0-29	6.6	5 (4)
11A Emerg/transfer abdo aneurysm 0-89	26.3	5 (9)
12A Elective carotid endarterectomy 0-29	1.5	3 (3)
13A Elective leg arterial by-pass 0-29	2.3	3 (2)
14A Emerg/transfer leg arterial by-pass 0-89	14.4	0 (0)

**Exhibit 6: Indicator 4A emergency admissions with operation**



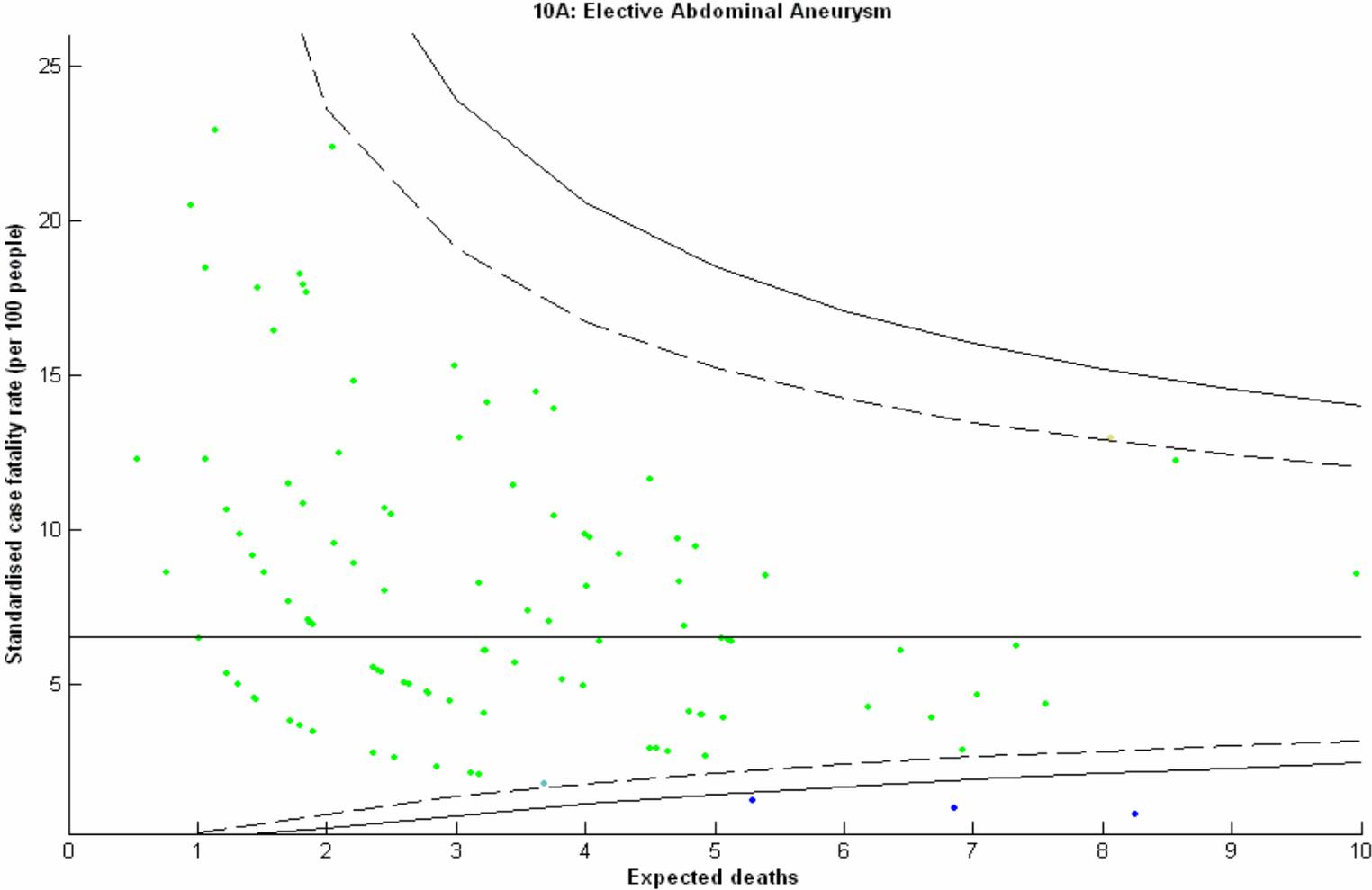
Broken and solid lines show 95% and 99% confidence intervals respectively

**Exhibit 7: Indicator 5A emergency admissions with no operation**



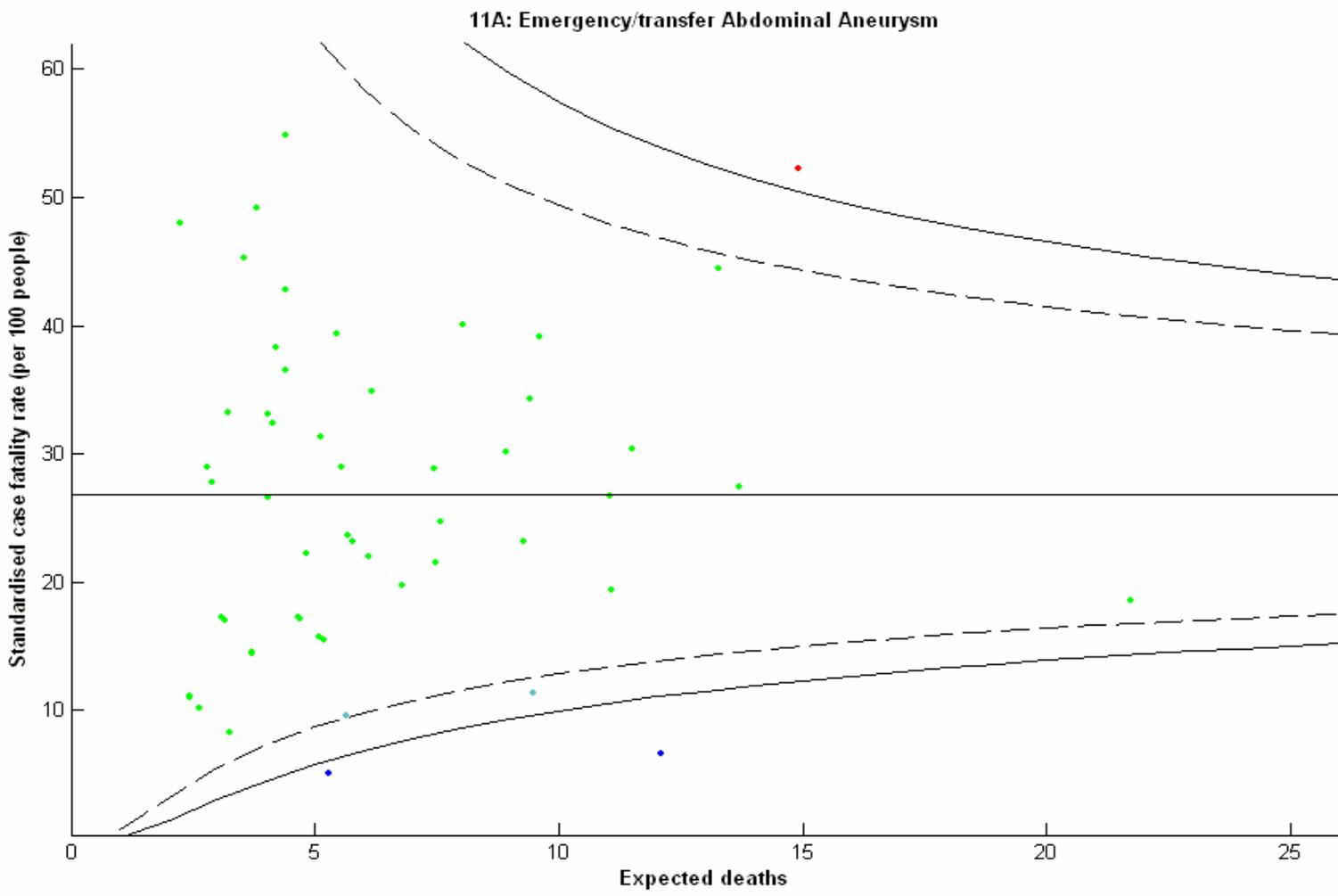
Broken and solid lines show 95% and 99% confidence intervals respectively

**Exhibit 8: Indicator 10A elective abdominal aneurysm procedures**



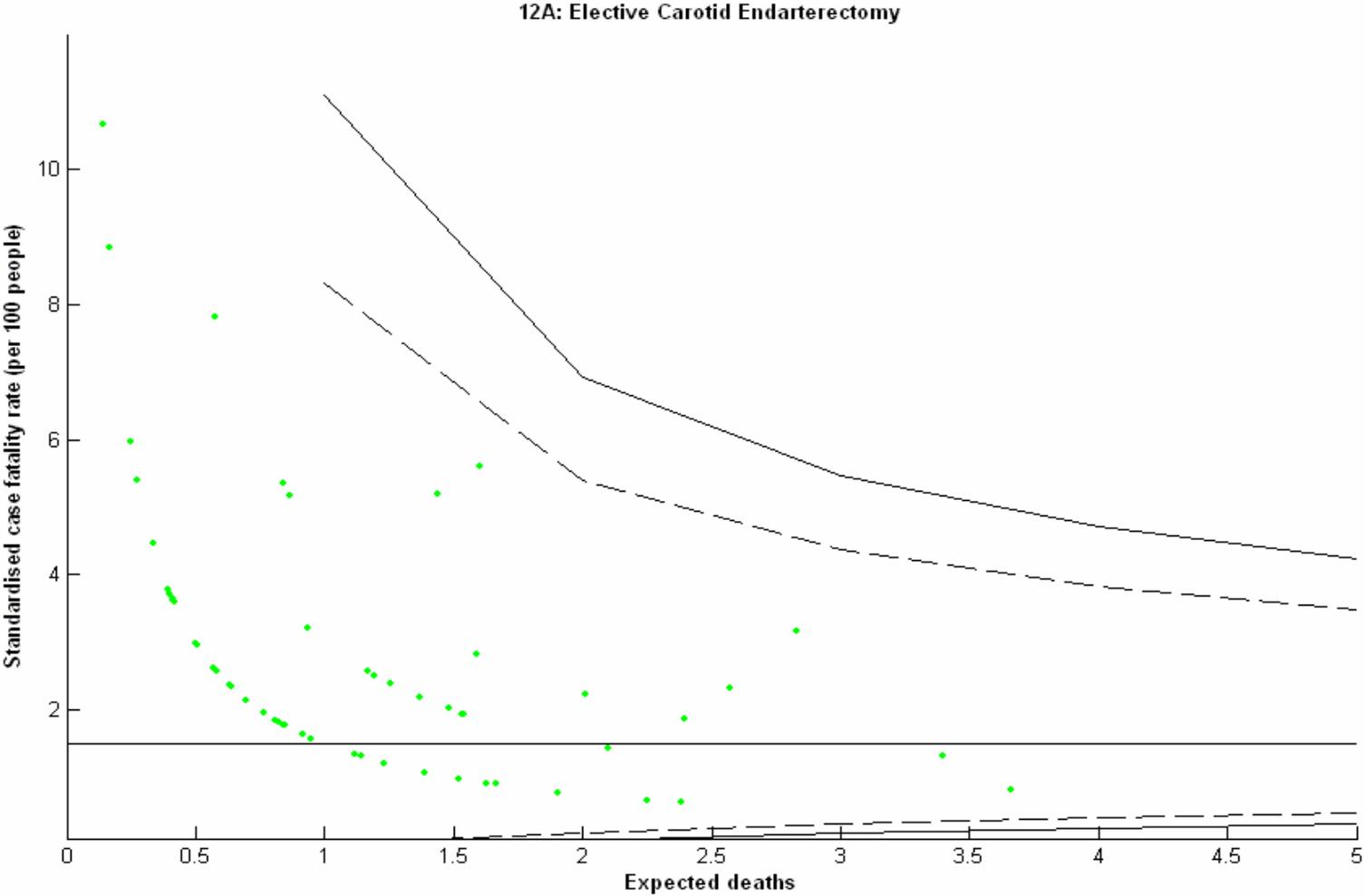
Broken and solid lines show 95% and 99% confidence intervals respectively

**Exhibit 9: Indicator 11A emergency and transfer abdominal aneurysm procedures**



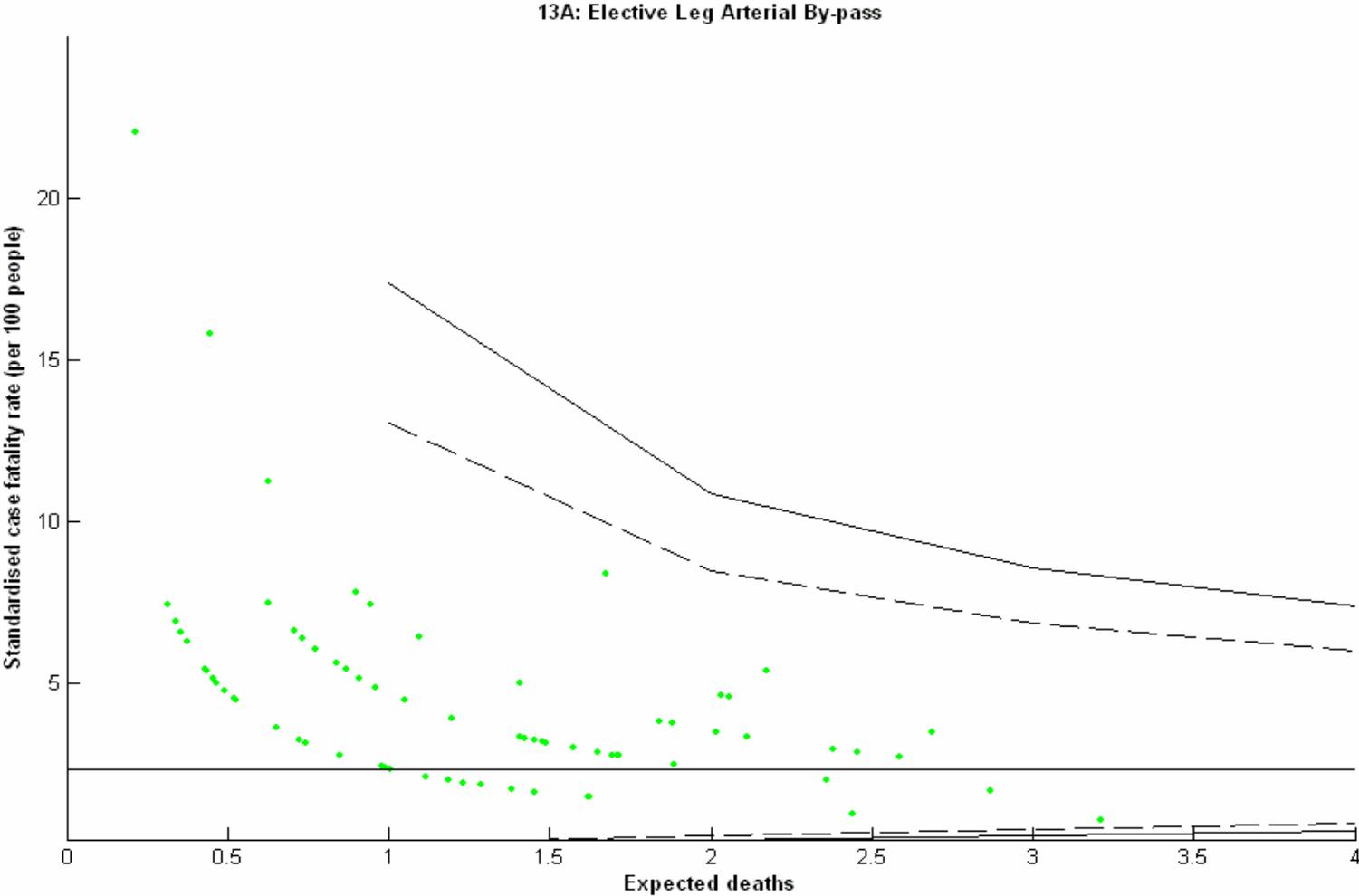
Broken and solid lines show 95% and 99% confidence intervals respectively

Exhibit 10: Indicator 12A elective carotid endarterectomy



Broken and solid lines show 95% and 99% confidence intervals respectively

Exhibit 11: Indicator 13A elective leg arterial by-pass procedures



Broken and solid lines show 95% and 99% confidence intervals respectively

## **7. OUTLIER TRUSTS AND RECOMMENDATIONS**

### **Outlier trusts**

Exhibit 12 shows for emergency admission indicators 4A and 5A all those trusts which have CFR values higher than the 95% CI (marked H). Some also have a low value (marked L).

Exhibit 13 shows for the vascular surgery operation indicators (except 14A which had no outliers) those trusts which have CFR values higher than the 95% CI (marked H) or lower than them (marked L).

### **Recommendations**

After discussions with collaborating clinicians, it is recommended that the following indicators could be used for comparing trust performance:

- General indicators:
  - emergency admissions with an operation
  - emergency admissions without an operation.

The vascular procedures indicators had a few outlier trusts when three years of data were analysed. They are unlikely to be useful as annual comparative measures if annual data are required.

The general elective and elective procedure indicators had inadequate numbers of deaths to produce useful indicators.

**Exhibit 12: Trusts with standardised case fatality rates (SCFRs) significantly higher (H) than the national fatality rate for emergency admission mortality indicators. Statistical significance was assessed using 95% confidence intervals which were based on a Poisson distribution on the observed number of deaths.**

TRUST	EMERGENCY ADMISSION INDICATORS		NUMBER OF Hs
	5A NO OP	4A OP	
BARTS & THE LONDON	H	H	2
CITY SUNDERLAND	H	H	2
ESSEX RIVERS	H	H	2
HEATHERWOOD & WEXHAM PARK	H	H	2
NORTH STAFFORDSHIRE	H	H	2
NORTHERN GENERAL	H	H	2
UNIVERSITY HOSPITAL BIRMINGHAM	H	H	2
BASILDON & THURROCK		H	1
BIRMINGHAM HEARTLANDS & SOLIHULL		H	1
BLACKPOOL VICTORIA	H		1
BRADFORD		H	1
BURNLEY	H		1
BURTON		H	1
CENTRAL MANCHESTER	H		1
CITY HOSPITAL		H	1
DARTFORD & GRAVESHAM		H	1
EPSOM & ST HELIER		H	1
FOREST	H		1
GEORGE ELIOT	H		1
GOOD HOPE	H		1
ISLE OF WIGHT	H	L	1
KING'S COLLEGE	H	L	1
LEEDS TEACHING		H	1
LUTON & DUNSTABLE	H		1
MAYDAY	H	L	1
MEDWAY	H		1
NORTH MANCHESTER		H	1
NORTH MIDDLESEX	H		1
PORTSMOUTH	H		1
PRESTON		H	1
QUEEN MARY'S SIDCUP	H		1
QUEEN'S MEDICAL CENTRE NOTTINGHAM		H	1

<b>TRUST</b>	<b>5A</b>	<b>4A</b>	<b>NUMBER Hs</b>
ROYAL UNITED HOSPITAL BATH	H	L	1
SALFORD ROYAL		H	1
SANDWELL	H		1
SCARBOROUGH & NE YORKSHIRE		H	1
SOUTHERN DERBYSHIRE		H	1
SURREY & SUSSEX	H	L	1
TAMESIDE & GLOSSOP	H		1
KINGS MILL CENTRE		H	1
LEWISHAM	H	L	1
NEWCASTLE UPON TYNE		H	1
ROYAL WOLVERHAMPTON	H		1
UNIVERSITY COVENTRY & WARWICKS		H	1
WARRINGTON	H	L	1
WEST MIDDLESEX UNIVERSITY	H		1

**Exhibit 13: Trusts with standardised case fatality rates (SCFRs) significantly different from the national fatality rate for vascular surgery indicators. H and L denote a SCFR significantly higher and lower than the national fatality rate respectively. Statistical significance was assessed using 95% confidence intervals which were based on a Poisson distribution on the observed number of deaths.**

NHS TRUST	VASCULAR SURGERY PROCEDURES			
	10A	11A	12A	13A
CITY SUNDERLAND				H
DARTFORD & GRAVESHAM			H	
EASTBOURNE				H
GOOD HOPE	H			
NORFOLK & NORWICH			H	
PRESTON				H
ROYAL LIVERPOOL & BROADGREEN	H			
SCARBOROUGH & NE YORKSHIRE	H			
ST GEORGE'S		H		
UNIVERSITY COVENTRY & WARWICKS		H		
WIRRAL			H	
ADDENBROOKE'S	L			
OXFORD RADCLIFFE	L			
PLYMOUTH		L		
NEWCASTLE UPON TYNE		L		
UNITED BRISTOL		L		

## ANNEX A: OPCS4 CODES EXCLUDED FROM GROUPS WITH OPERATIONS

A18	Diagnostic endoscopic exam of ventricle of brain	M47	Urethral catheterisation of bladder
A52	Therapeutic epidural injection	M77	Diagnostic endoscopic exam of urethra
ASS	Diagnostic spinal puncture	Q12	Intrauterine contraceptive device
A84	Neurophysiological operations	Q55	Exam of female genital tract
B32	Biopsy of breast	R02	Diagnostic endoscopic exam of foetus
B37	Other operations on breast	R05	Diagnostic percut exam of foetus
E25	Diagnostic endoscopic exam of pharynx	R14	Surgical induction of labour
E36	Diagnostic endoscopic exam of larynx	R15	Other induction of labour
E42.3	Exteriorisation of trachea - temporary tracheostomy	R24	Normal delivery
E49	Diagnostic fiberoptic endoscopic exam of lower resp tract	R27	Other operations to facilitate delivery
E51	Diagnostic endoscopic exam of lower resp tract using rigid bronchoscope	S13	Punch biopsy of skin
E63	Diagnostic endoscopic exam of mediastinum	S14	Shave biopsy of skin
G16	Diagnostic fiberoptic endoscopic exam of oesophagus	S15	Other biopsy of skin
G19	Diagnostic endoscopic exam of oesophagus using rigid oesophagoscope	S50	Introduction of other inert substance into subcutaneous tissue
G45	Diagnostic fiberoptic endoscopic exam of UGI tract	S51	Introduction of destructive substance into subcutaneous tissue
G55	Diagnostic endoscopic exam of duodenum	S52	Introduction of therapeutic substance into subcutaneous tissue
G65	Diagnostic endoscopic exam of jejunum	S53	Introduction of substance into skin
G80	Diagnostic endoscopic exam of ileum	T11	Diagnostic endoscopic exam of pleura
H22	Diagnostic endoscopic exam of colon	T12	Puncture of pleura
H25	Diagnostic endoscopic exam of lower bowel using fiberoptic sigmoidoscope	T43	Diagnostic endoscopic exam of peritoneum
H28	Diagnostic endoscopic exam of colon using rigid sigmoidoscope	T46	Other drainage of peritoneal cavity
J09	Diagnostic endoscopic exam of liver using laparoscope	T81	Biopsy of muscle
J13	Diagnostic percut liver operation	T86	Lymph node sampling
J25	Diagnostic percut gall bladder operation	T90	Lymphangiography
J43	Diagnostic endoscopic retro exam of bile & pancreatic duct	V47	Biopsy of spine
J44	Diagnostic endoscopic retro exam of bile duct	V49	Exploration of spine
J45	Diagnostic endoscopic retro exam of pancreatic duct	W36	Diagnostic bone puncture
J67	Diagnostic percut pancreatic operation	W87	Diagnostic endoscopic exam of knee joint
K58	Diagnostic transluminal heart operation	W88	Diagnostic endoscopic exam of other joint
L71.4	Therapeutic transluminal artery operation	X29	Cont infusion of therapeutic substance
L72	Diagnostic transluminal artery operation (not femoral/iliac)	X30- X39	Injection/transfusion
L91	Other vein related operations	X40- X49	Dialysis/donation
L95	Diagnostic transluminal vein operation	X50	External resuscitation
M11	Diagnostic endoscopic exam of kidney	X51	Body temperature change
M30	Diagnostic endoscopic exam of ureter	X55.8	Other operations on unspecified organ other specified
M45	Diagnostic endoscopic exam of bladder	X55.9	Other operations on unspecified organ other unspecified

**Z and Y codes (sites and methods) are also excluded from these indicators.**

