# UHCE OXFORD REPORT CR12
# MEDICAL EMERGENCIES:
# 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 Royal College of Physicians (RCP) to develop for emergency admissions in the medical specialties a set of outcome indicators. This Report contains the results of the work on case fatality rates and the recommendations have been endorsed by the collaborating clinicians.

### Recommendations

*It is recommended* that:

- The medical sub-specialties that manage emergency admissions should be analysed as a group for the purposes of producing case fatality rates (CFR). Analyses of individual specialties or consultants are not clinically relevant.
- Patients with cancer should be excluded from the calculation of the CFRs.
- CFRs should be calculated including all deaths regardless of location. Analyses based solely on deaths occurring in hospital are not clinically relevant.
- The most clinically appropriate approach is to develop CFRs which are diagnosis specific in order to minimise the difficulties of accounting for the differences in case-mix between trusts.
- Diagnosis-based CFRs will be more robust and acceptable to clinicians if there:
    - are adequate numbers of admissions and deaths to produce statistically sound information.
    - is little or no effect of social deprivation.

*It is recommended* that the most clinically relevant CFRs for comparing acute trust activity are those associated with the diagnoses COPD, heart failure and stroke and specifications for their calculation are included in this report. These diagnoses:

- Have comparatively high overall CFRs.
- Show no effect of social deprivation for heart failure and stroke CFRs and only a small effect for COPD with the least deprived having higher CFRs.

*It is recommended* that both 0-29 and 0-89 day CFRs be calculated.

*It is recommended*, that in addition to CFRs obtained from a linked HES/mortality database, information from the national snapshot audits of COPD and stroke be used to screen acute trust performance.

*It is recommended* that the usefulness to clinicians of a global CFR for all medical emergency admissions be investigated further.

It must be recognised that a high CFR does not automatically imply poor performance. Trusts which operate successful procedures for keeping moderately ill people with medical conditions out of hospital may have comparatively high CFRs.

*It is recommended* that the Royal College of Physicians be commissioned to test the acceptability of the recommended CFR indicators to a wide group of practising clinicians.

# 1. BACKGROUND AND APPROACH

## 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 Physicians (RCP) to develop for emergency admissions in the medical specialties 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 with acute hospitals as to whether their clinical performance needs further investigation.

## Outline of the study approach

The study was carried in the following phases:

- Royal College of Physicians was contacted to:
  - participate in the study
  - nominate 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 diagnoses 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 for implementation.

## 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 may be worthwhile but they do not necessarily provide definitive answers on whether services are good or inadequate.

## 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.

## Emergency admissions in the medical specialties

In most general hospitals, emergency admissions in the medical specialties are managed as a 'whole' not by individual specialties. Therefore, this study addresses all emergency admissions starting with a 'medical FCE' (defined as HES specialties 300-430 less 420, paediatrics).

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

- One which is:
    - first FCE in a 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.

Admissions with cancer diagnoses have been separately identified in this study and omitted from the analyses because the routine databases of HES and ONS mortality are poor sources from which to derive 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.

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).

Exhibit 1 shows for the medical specialties the number of FCEs for the different groups of activity in the year 2000. The group with which this report is primarily concerned, emergency CIPS starting with a 'medical' FCE (excluding admissions with cancer diagnoses), includes:

- first 'medical' FCEs (accounting for 39% of the total)
- subsequent 'medical' FCEs (accounting for 16% of the total).

**Exhibit 1: Relative proportions of the components of medical specialties**

| **Group** | **FCEs in 2000** | |
|---|---|---|
| | **Number** | **%** |
| FCE not first in CIPS in: | | |
| • emergency CIPS with 'medical' first FCE | 561719 | 15.6 |
| • other | 62400 | 1.7 |
| First FCE with cancer | 495661 | 13.8 |
| First FCE no cancer: | | |
| • emergency | 1413008 | 39.4 |
| • elective overnight | 212202 | 5.9 |
| • day case | 760332 | 21.2 |
| • transfer | 66165 | 1.8 |
| • not known | 23094 | 0.6 |
| **Total** | **3594581** | **100.0** |

**Specification of case fatality indicators**

Analyses of trends over time require a means of dividing time into discrete periods. For all 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.

It was decided to use CIPS as the unit for counting admissions. When comparing the performance between hospital trusts, it was decided to analyse only those CIPS in which the first FCE was attributed to a medical specialty dealing with medical emergencies. The quality of care given in the originating FCE will greatly influence that delivered in subsequent FCEs and, indeed, the transfer may occur because an adverse event has occurred in the initiating FCE. Transfers may often occur between medical specialties to allow patients access to the most appropriate specialty care.

It was agreed with the medical advisers that the most clinically useful way of developing the requisite indicators would be to use diagnosis-specific indicators.

The issues that needed to be considered, in specifying the diagnosis-specific indicators, were:

- In addition to emergency admissions starting with a 'medical' FCE (less those with cancer diagnoses), which diagnoses or diagnosis groups to analyse.
- With regard to the position of the diagnosis code on the record. Inclusion of:
    - all admissions with the diagnosis regardless of position on the record *or*
    - only those admissions in which the diagnosis is the 'main' one.
- 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.

The diagnoses chosen for analysis were:

- angina pectoris
- acute myocardial infarction (AMI)
- heart failure
- stroke
- chronic bronchitis/COPD
- asthma.

For all specifications, inclusion of an index case necessitated the chosen diagnosis being the 'main' diagnosis in that it was the first in the last FCE of the CIPS.

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

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

The time intervals chosen were 0-29 and 0-89 days after start of index admission.

**Specification issues associated with acute myocardial infarction**

Although it was decided to include acute myocardial infarction among the diagnoses to be addressed, it was recognised that there are some specific issues with mortality indicators for this condition that might make it clinically unsuitable.

A major component of the outcome of an AMI admitted to hospital is determined by what happens before admission and the length of time between the onset of the attack and arrival at hospital. Case fatality rates for AMI are thus not a good measure for comparing trust performance but could potentially be used as an indicator of primary care trust commissioning.

Superficially, acute myocardial infarction case-fatality rates are a leading candidate for a comparative health outcome indicator. The condition is common, treatable and there are a considerable number of deaths associated with it.

In practice calculating a clinically relevant CFR for AMI is extremely difficult because of specific issues relating to:

- The diagnosis of AMI:
    - Recent adoption of a new enzyme test, troponin, has led to a significant increase in the diagnosis of AMI with the additional patients having a much milder condition and thus lower risk of death than those diagnosed with the old test.
    - Significant numbers of patients thought originally to have had a clinical AMI on admission may not have had one.
- The deaths to be included:
    - Death from AMI may happen quickly after the onset of symptoms, occurring before arriving at hospital.
    - Death may occur in hospital before a record has been entered on the patient administration system.

The natural history of death from AMI shows that between 50 and 70% of all people who die in the acute attack die outside hospital. An individual hospital's CFR rates are thus greatly influenced by:

- referral patterns
- speed with which patients are transported to hospital
- speed with which they are formally admitted and thus appear on HES.

NCHOD has been engaged on an extensive programme to research those issues. From the work done to date, a 'basic' CFR for AMI can be calculated, along the lines of other diagnostic-specific indicators, the using the specification in this report.

However, work has been done to show the effect of:

- Removing from the basic CFR definition:
    - admissions misdiagnosed as AMI
    - deaths occurring early in the stay that might not be attributable to the hospital care.
- Adding to the definition of the basic CFR indicator:
    - deaths of patients arriving at the hospital but dying before being admitted.

From the work to date, the most clinically relevant way of compiling CFRs for comparative hospital performance may probably be to start with the basic CFR and then exclude:

- admissions misdiagnosed as AMI
- deaths occurring on day 0.

This specification has not been used in this Report.

**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.

**Analyses and plots**

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.

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).

In order to determine the extent of similarity between the diagnosis-specific SCFRs for 30 and 90 day mortality, scatter plots were done with an ordinary least squares (OLS) regression model fitted to the data using Microsoft Excel chart trendline function. The intercept term represents the difference in the magnitude of the SCFRs, whilst the slope represents the similarity in terms of the relationship between the SCFRs of the two indicators. The $R^2$ value quantifies the degree of fit overall for each model, and multiplying by 100 allows this value to be interpreted as a percentage. The square root of the $R^2$ gives the correlation between the two indicators. Statistical significance of the two OLS parameters in each model has not been presented as the plots are meant only as a simple visual comparison.

The effect of social deprivation has also been studied. The Index of Multiple Deprivation 2000 (IMD 2000), assigned for each patient to the patient's address at ward level, was used as the measure of socio-economic status. For each measure, the admissions were grouped into quintiles based on the patients' IMD 2000 score. Case-fatality rates were calculated taking the number of admissions as the denominator and

the number of deaths occurring within 30 or 90 days of admissions regardless of the place of death as the numerator. The case-fatality rates for the quintiles were indirectly age- and sex-standardised, taking all admissions for the condition as the standard. Confidence intervals for these rates were calculated (assuming a Poisson distribution for the observed numbers of deaths).

**Structure of the Report**

Chapter 2 contains the information used to choose the diagnoses used for specifying the indicators.

Chapter 3 contains the indicator specifications.

Chapter 4 contains funnel plots for the 14 indicators specified.

Chapter 5 shows the correlation between 0-29 and 0-89 day CFRs.

Chapter 6 shows for 0-29 day CFRs whether there is a social deprivation effect as measured by the Index of Multiple Deprivation.

Chapter 7 contains the recommendations about which of the 14 indicators should be used.

## 2. CHOICE OF DIAGNOSIS-SPECIFIC INDICATORS

### Diagnoses chosen

Analyses were done on emergency admissions with specific individual or groups of diagnoses. The diagnoses most commonly occurring in any position on the records of emergency medical admissions are shown in Exhibit 2 in descending order of average annual frequency. R codes for symptoms, mental illness F codes and Z codes have been omitted. As well as the average annual number of occurrences of the diagnostic code, information is shown about:

- Proportion of continuous in-patient spells (CIPS) in which the diagnosis is the 'main' one in that it is the first code recorded in the last (or only) finished consultant episode (FCE) in the CIPS.
- Ratio of CIPS to people for the year when:
    - diagnosis occurs anywhere on the record
    - diagnosis occurring in the 'main' position.

Exhibit 3 shows the frequency with which common codes appear on CIPS in the 'main' position as defined above. The groupings of codes that it was decided to consider for candidate indicators with the average annual frequency with which each code was the 'main' diagnosis were:

- Ischaemic heart disease and acute myocardial infarction:
    - I20 Angina pectoris (92733)
    - I21 Acute myocardial infarction (61149)
- Heart failure
    - I50 Heart failure (63745).
- Stroke:
    - I61 Intracerebral haemorrhage (6796)
    - I62 Other non-traumatic intracranial haemorrhage (1807)
    - I63 Cerebral infarction (26110)
    - I64 Stroke not specified as haemorrhage or infarction (31031).
- COPD and asthma:
    - J40 Bronchitis not specified as acute or chronic (935)
    - J41 Simple chronic bronchitis (22)
    - J42 Unspecified chronic bronchitis (242)
    - J43 Emphysema (3217)
    - J44 Other chronic obstructive pulmonary disease (85046)
    - J45 Asthma (26894)
    - J46 Status asthmaticus (3766).

The frequency with which the diagnosis is recorded in the position for 'main' diagnosis, rather than elsewhere on the record, differs according to condition as shown in Exhibit 2. There are two conventions for the identification of a 'main'diagnosis in a CIPS, namely designation of:

- first diagnosis code for the first FCE as the 'main' diagnosis of the spell *or*
- first diagnosis code for the last FCE as the 'main' diagnosis of the spell.

The decision about which convention to use needs to be informed, for any given clinical condition, by information about how commonly the diagnosis differs

according to whether the first or last FCE is chosen, and, when they differ, whether there is a sound clinical reason for selecting the first or last. Factors to be considered in deciding whether to include as index admissions all records with the diagnosis or only those with the diagnosis in the first position in either the first or last FCE are:

- Relative clinical importance of other diagnoses recorded in the main position compared to the diagnosis under study.
- Whether the diagnosis, such as asthma, is a common co-morbidity.
- Possibility of an event such as a stroke or acute MI occurring in hospital rather than being present at start of the admission.
- Possibility of an event, such as a stroke, being the most important diagnosis in an initial FCE but other diagnoses, such as pneumonia, being important later.
- Variability between hospitals of identifying the first diagnosis in a FCE.

Exhibit 4 relates to emergency CIPS with the first FCE a 'medical' one. It shows for those admissions in which the diagnosis was recorded first in at least one FCE, the percentage of first and last FCEs in which this occurred. There was little difference for any of the diagnoses except for acute myocardial infarction. It was decided for all analyses to use the convention of designating the 'main' diagnosis as the first code in the last or only FCE of a CIPS.

**Co-morbidities**

Emergency medical admissions frequently have multiple diagnostic codes recorded. Exhibit 5 shows for the chosen diagnostic groups the number of CIPS in which the diagnosis under study was the 'main' diagnosis and the frequency with which the commonest co-morbidities were recorded.
It should be noted that co-morbidities recorded in more than 20% of CIPS were:

- Essential hypertension and chronic ischaemic heart disease when angina pectoris was the 'main' diagnosis.
- Chronic ischaemic heart disease and atrial fibrillation/flutter when heart failure was the 'main' diagnosis.
- Essential hypertension when stroke was the 'main' diagnosis.

Exhibit 6 shows the frequency with which the diagnoses under study occur with each other. It should be noted that co-morbidities recorded in more than 10% of CIPS were:

- Heart failure when AMI was the 'main' diagnosis.
- Heart failure when chronic bronchitis/COPD was the 'main' diagnosis.
- Chronic bronchitis disease/COPD when heart failure was the 'main' diagnosis.

**Exhibit 2: Diagnostic codes most commonly recorded (annual averages) for medical emergency admissions (less F, R and Z codes)**

| Code and condition | Continuous in-patient spells | | CIPS: people | |
|---|---|---|---|---|
| | No | % | Ratio | Ratio |
| I10 Essential hypertension | 250601 | 2 | 1.17 | 1.03 |
| I25 Chronic ischaemic heart | 223817 | 7 | 1.33 | 1.05 |
| **I20 Angina pectoris** | **177272** | **52** | **1.27** | **1.19** |
| **I50 Heart failure** | **170428** | **37** | **1.27** | **1.15** |
| I48 Atrial fibrillation/flutter | 167780 | 26 | 1.21 | 1.10 |
| **J44 Other COPD** | **160374** | **53** | **1.46** | **1.41** |
| E11 Non-insulin diabetes | 141893 | 6 | 1.31 | 1.06 |
| J45 Asthma | 99174 | 27 | 1.20 | 1.18 |
| N39 Other dis urinary system | 89396 | 40 | 1.08 | 1.06 |
| J22 Unspecified acute LRI | 88838 | 59 | 1.06 | 1.05 |
| J18 Pneumonia unspecified | 88521 | 67 | 1.05 | 1.03 |
| **I21 Acute myocardial infarct** | **70505** | **87** | **1.04** | **1.03** |
| E78 Lipoprotein disorders | 59910 | <1 | 1.14 | 1.01 |
| E10 Insulin diabetes | 55394 | 23 | 1.43 | 1.22 |
| D64 Other anaemias | 54481 | 22 | 1.11 | 1.09 |
| K92 Other dis digestive system | 50254 | 41 | 1.17 | 1.06 |
| G40 Epilepsy | 46334 | 43 | 1.32 | 1.24 |
| M79 Other soft tissue disorder | 44270 | 67 | 1.12 | 1.03 |
| L03 Cellulitis | 43671 | 62 | 1.09 | 1.07 |
| **I64 Stroke** | **40855** | **76** | **1.03** | **1.03** |
| E03 Other hypothyroidism | 40151 | 2 | 1.19 | 1.02 |
| K 52 Non-inf gastroenteritis | 39826 | 47 | 1.05 | 1.03 |
| N18 Chronic renal failure | 36712 | 21 | 1.42 | 1.25 |
| K29 Gastritis and duodenitis | 33723 | 26 | 1.16 | 1.03 |
| **I63 Cerebral infarction** | **32315** | **81** | **1.03** | **1.02** |
| I80 Phlebitis/thrombophlebitis | 32160 | 71 | 1.10 | 1.07 |

The diagnostic codes shown in bold are those chosen for further study

**Exhibit 3: Diagnostic codes most commonly recorded as the 'main' diagnosis (annual averages) for medical emergency admissions (F,R and Z codes omitted)**

| Code and condition | Total CIPS |
|---|---|
| **I20 Angina pectoris** | **92733** |
| **J44 Other COPD** | **85046** |
| **I50 Heart failure** | **63745** |
| **I21 AMI** | **61149** |
| J18 Pneumonia unspecified | 59411 |
| J22 Acute LRI unspecified | 52706 |
| I48 Atrial flutter/fibrillation | 42989 |
| N39 Other disease of urinary system | 35766 |
| **I64 Stroke** | **31031** |
| M79 Other soft tissue disorder | 29811 |
| L03 Cellulitis | 27245 |
| **J45 Asthma** | **26894** |
| **I63 Cerebral infarction** | **26110** |
| I80 Phlebitis/thrombophlebitis | 22950 |
| T39 Poison by certain drugs | 20801 |
| K92 Other disease of digestive system | 20539 |

The diagnostic codes shown in bold are those chosen for further study

**Exhibit 4: Emergency CIPS with a 'medical' first FCE in which diagnostic code is recorded first in at least one of the FCEs: Proportion of first and last FCEs that had the diagnosis as the first diagnosis**

| Code and condition | FCE with diagnosis recorded as first | |
|---|---|---|
| | First % | Last % |
| 120 Angina pectoris | 96 | 97 |
| 121 Acute myocardial infarction | 93 | 98 |
| 150 Heart failure | 95 | 96 |
| 161-64 Stroke | 92 | 91 |
| J40-44 Chronic bronchitis/COPD | 96 | 99 |
| J45-46 Asthma | 98 | 99 |

**Exhibits 5 and 6: Frequency of occurrence of co-morbidities in emergency admissions**

**Exhibit 5: Most common co-morbidities**

| | | Frequency of occurrence of other diagnostic codes | | | | | |
|---|---|---|---|---|---|---|---|
| **Main diagnoses** | **CIPS** | **E11 %** | **E78 %** | **I10 %** | **I25 %** | **148 %** | **150 %** |
| I20 | 92733 | 9.7 | 11.2 | 20.9 | 36.5 | 6.6 | 6.6 |
| I21 | 61149 | 9.2 | 10.6 | 18.0 | 12.5 | 7.8 | 13.6 |
| I50 | 63745 | 13.3 | 2.1 | 15.2 | 30.6 | 22.0 | - |
| I61-64 | 65717 | 9.1 | 3.2 | 24.0 | 9.3 | 13.3 | 4.5 |
| J40-44 | 89462 | 5.5 | <1.0 | 8.7 | 11.4 | 7.0 | 12.0 |
| J45-46 | 30660 | 2.9 | <1.0 | 4.6 | 2.7 | 1.3 | 1.8 |

**Exhibit 6: Relationships between codes being analysed**

| | | Frequency of occurrence of other diagnostic codes | | | | | |
|---|---|---|---|---|---|---|---|
| **Main diagnoses** | **CIPS** | **I20 %** | **I21 %** | **I50 %** | **I61-64 %** | **J40-44 %** | **J45-46 %** |
| I20 | 92733 | - | <1.0 | 6.6 | <1.0 | 4.8 | 4.3 |
| I21 | 61149 | 7.6 | - | 13.6 | 1.1 | 4.1 | 3.0 |
| I50 | 63745 | 7.8 | 1.7 | - | <1.0 | 11.2 | 3.1 |
| I61-64 | 65717 | 3.4 | <1.0 | 4.5 | - | 3.4 | 1.9 |
| J40-44 | 89462 | 5.6 | <1.0 | 12.0 | <1.0 | - | 3.8 |
| J45-46 | 30660 | 1.8 | <1.0 | 1.8 | <1.0 | 2.4 | - |

**Key to diagnostic codes**

E11. Non-insulin dependent diabetes
E78. Disorders of lipoprotein metabolism and other lipidaemias
I10. Essential hypertension
I20. Angina pectoris
I21. Acute myocardial infarction
I25. Chronic ischaemic heart disease
I48. Atrial fibrillation and flutter
I50. Heart failure
I61-64. Stroke
J40-44. Chronic bronchitis/COPD
J45-46. Asthma

# 3. INDICATOR SPECIFICATIONS

## Specifications

The candidate mortality indicators that have been specified are:

- 1A. 0-29 day CFR for emergency admissions (excluding cancer)
- 1B. 0-89 day CFR for emergency admissions (excluding cancer)
- 2A. 0-29 day CFR for emergency admissions with angina pectoris as 'main' code (excluding cancer)
- 2B. 0-89 day CFR for emergency admissions with angina pectoris as 'main' code (excluding cancer)
- 3A. 0-29 day CFR for emergency admissions with acute myocardial infarction as 'main' code (excluding cancer)
- 3B. 0-89 day CFR for emergency admissions with acute myocardial infarction as 'main' code (excluding cancer)
- 4A. 0-29 day CFR for emergency admissions with heart failure as 'main' code (excluding cancer)
- 4B. 0-89 day CFR for emergency admissions with heart failure as 'main' code (excluding cancer)
- 5A. 0-29 day CFR for emergency admissions with stroke as 'main' code (excluding cancer)
- 5B. 0-89 day CFR for emergency admissions with stroke as 'main' code (excluding cancer)
- 6A. 0-29 day CFR for emergency admissions with chronic bronchitis/COPD as 'main' code (excluding cancer)
- 6B. 0-89 day CFR for emergency admissions with chronic bronchitis/COPD as 'main' code (excluding cancer)
- 7A. 0-29 day CFR for emergency admissions with asthma as 'main' code (excluding cancer)
- 7B. 0-89 day CFR for emergency admissions with asthma as 'main' code (excluding cancer).

## MORTALITY INDICATOR SPECIFICATIONS

### Indicator type/number: Mortality 1A

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis), that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 1B

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis), that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 1A

**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 2A

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis angina pectoris, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Angina pectoris code (I20) as first diagnosis code in the last FCE

- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 2B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code angina pectoris, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 2A

**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 3A**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis acute myocardial infarction, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:
- Acute myocardial infarction code (I21) as first diagnosis code in the last FCE
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 3B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code acute myocardial infarction, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 3A

**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 4A**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis heart failure, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Heart failure code (I50) as first diagnosis code in the last FCE
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 4B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code heart failure, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 4A

**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 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis stroke, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Stroke codes (I61-64) as first diagnosis code in the last FCE
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 5B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code stroke, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 5A

**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 emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis chronic bronchitis/COPD, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Chronic bronchitis/COPD codes (J40-44) as first diagnosis code in the last FCE
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 6B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code chronic bronchitis/COPD, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 6A

**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 emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis asthma, that died 0-29 days after the start of the index admission.

**Denominator**
Emergency CIPS starting with a 'medical' FCE, occurring first in the calendar year for an individual:

- Asthma codes (J45-46) as first diagnosis code in the last FCE
- Admissions with cancer diagnoses C00-97, D37-48 and Z51.1 are excluded
- 'Medical' FCEs are HES specialties 300-430 less 420 (paediatrics)
- 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 7B**

**Definition**
Proportion of emergency CIPS, starting with a 'medical' FCE (excluding those with a cancer diagnosis) with the 'main' diagnosis code asthma, that died 0-89 days after the start of the index admission.

**Denominator**
Same as for 7A

**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

# 4. FUNNEL PLOTS

## Basic statistics

Exhibit 7 shows for each indicator for the years 1999-2001 the number of:

- admissions
- 0-29 day deaths
- 0-89 day deaths.

Exhibit 8 shows for each indicator for the years 1999-2001:

- crude 0-29 and 0-89 day case fatality rates
- number and proportion of trusts that had CFRs which were significant at the 95% significance level using confidence intervals (CI) on the observed deaths.

**Exhibit 7: Numbers of trusts, admissions and deaths 1999-2001**

| Indicator | Number of admissions | Number of deaths | |
|---|---|---|---|
| | | 0-29 day | 0-89 day |
| 1A&B All | 1140692 | 84255 | 126336 |
| 2A&B Angina | 202584 | 3093 | 6790 |
| 3A&B AMI | 151955 | 24954 | 29039 |
| 4A&B Heart | 144659 | 27265 | 40668 |
| 5A&B Stroke | 160687 | 43640 | 55783 |
| 6A&B COPD | 164083 | 16333 | 26473 |
| 7A&B Asthma | 69660 | 684 | 1257 |

**Exhibit 8: 0-29 and 0-89 day crude CFRs and the number and proportion of trusts with CFR values significantly different from the national average at the 95% significance level using observed confidence intervals**

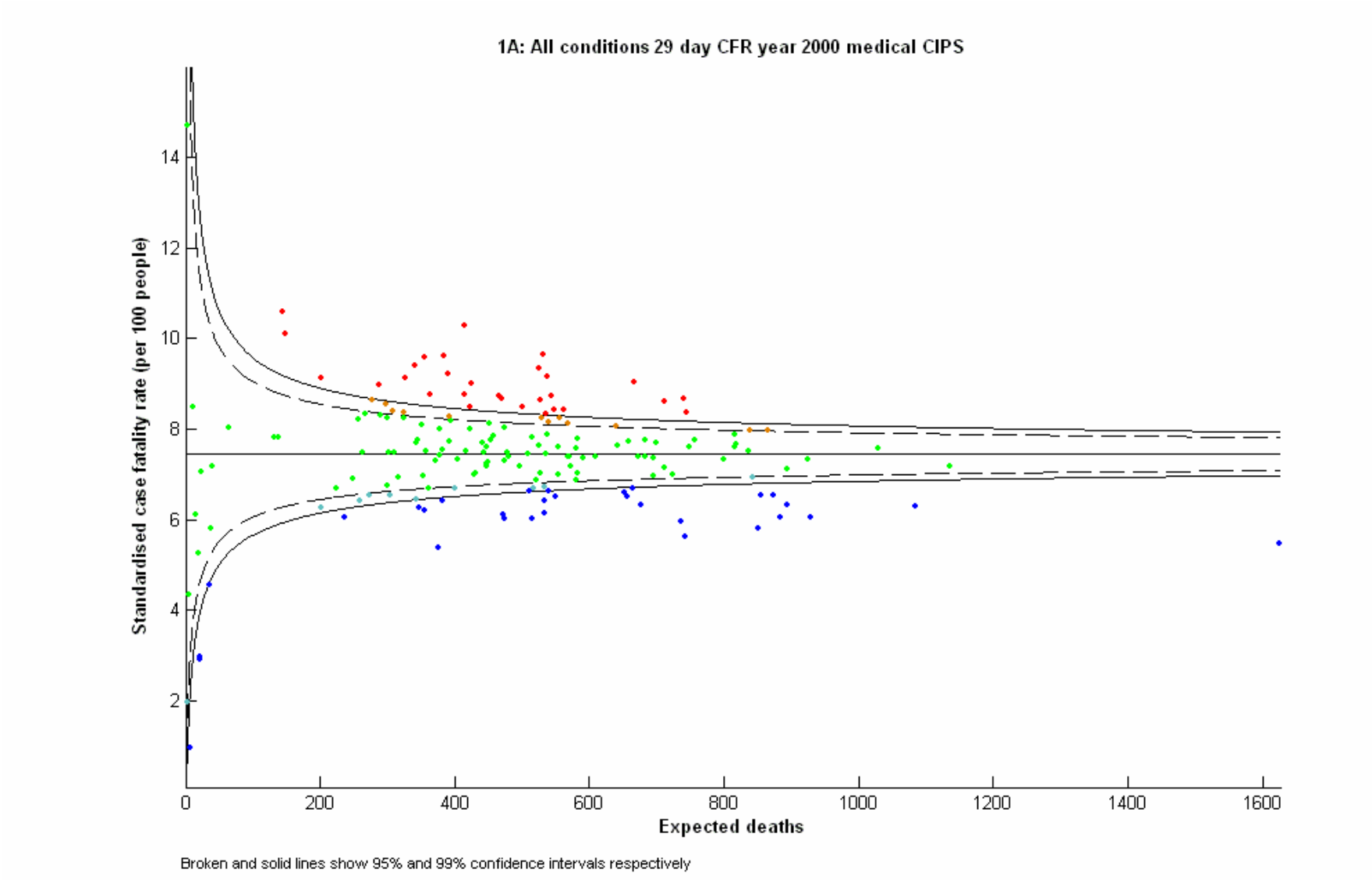
| Indicator | Case fatality rate | | Number and (%) of trusts outside CIs | | |
|---|---|---|---|---|---|
| | 0-29 day | 0-89 day | 0-29 day | 0-89 day | Both |
| 1A&B All | 7.4 | 11.1 | 80 (45) | 92 (52) | 69 (39) |
| 2A&B Angina | 1.5 | 3.4 | 28 (17) | 18 (11) | 11 (7) |
| 3A&B AMI | 16.4 | 19.1 | 38 (24) | 39 (24) | 31 (19) |
| 4A&B Heart | 18.9 | 28.1 | 48 (30) | 48 (30) | 40 (25) |
| 5A&B Stroke | 27.1 | 34.7 | 61 (38) | 61 (38) | 53 (33) |
| 6A&B COPD | 10.0 | 16.1 | 50 (31) | 50 (31) | 41 (25) |
| 7A&B Asthma | 1.0 | 1.8 | 8 (5) | 8 (5) | 2 (1) |

## Funnel plots

This Chapter contains funnel plots for each of the mortality indicators specified shown as Exhibits 9-15

Plotting funnel plot confidence intervals calculated on the expected rather than the observed deaths leads to a clear picture in the absence of confidence intervals being plotted for each trust. These confidence intervals replicate the funnel shape of the data showing statistically how much variability in standardised CFRs we expect to see for all values of expected deaths. Those trusts falling outside any of the confidence intervals demonstrate variability which statistically is not expected.

**Exhibit 9A and B: All conditions 0-29 and 0-89 day CFR**



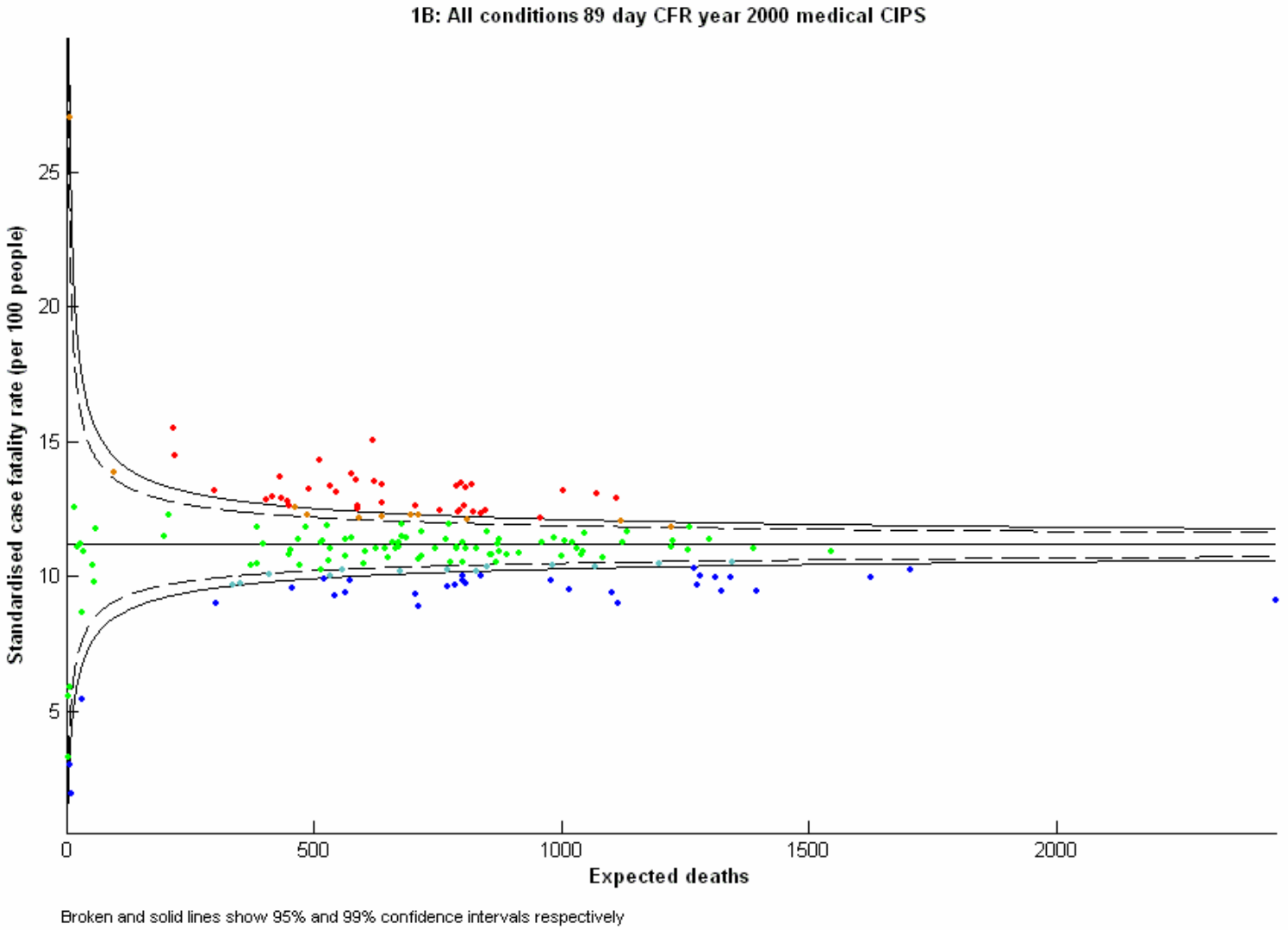
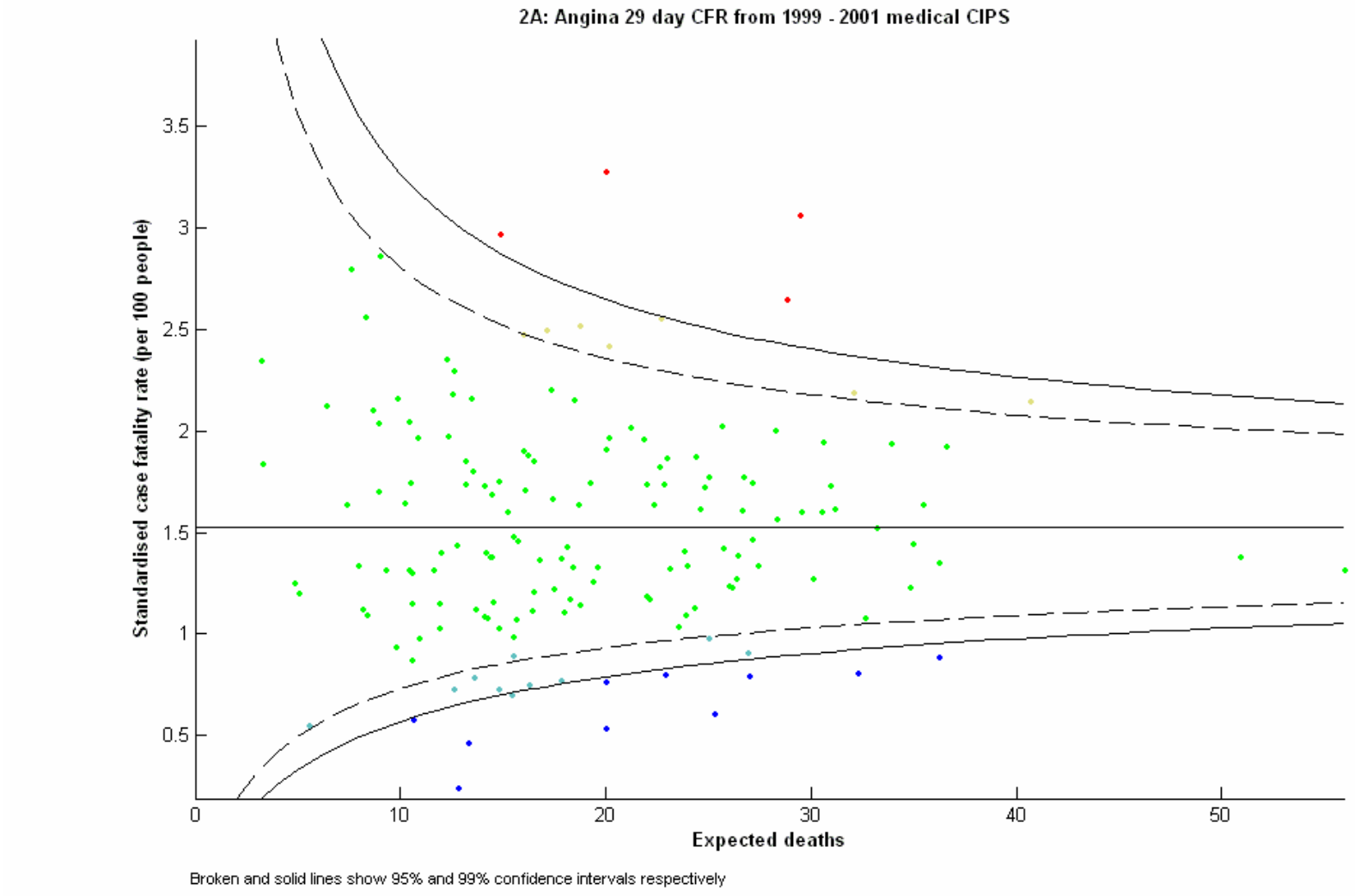

1B: All conditions 89 day CFR year 2000 medical CIPS
Standardised case fatality rate (per 100 people)
25
20
15
10
5
0
500
1000
1500
2000
Expected deaths
Broken and solid lines show 95% and 99% confidence intervals respectively

**Exhibit 10A and B: Angina 0-29 and 0-89 day CFR**



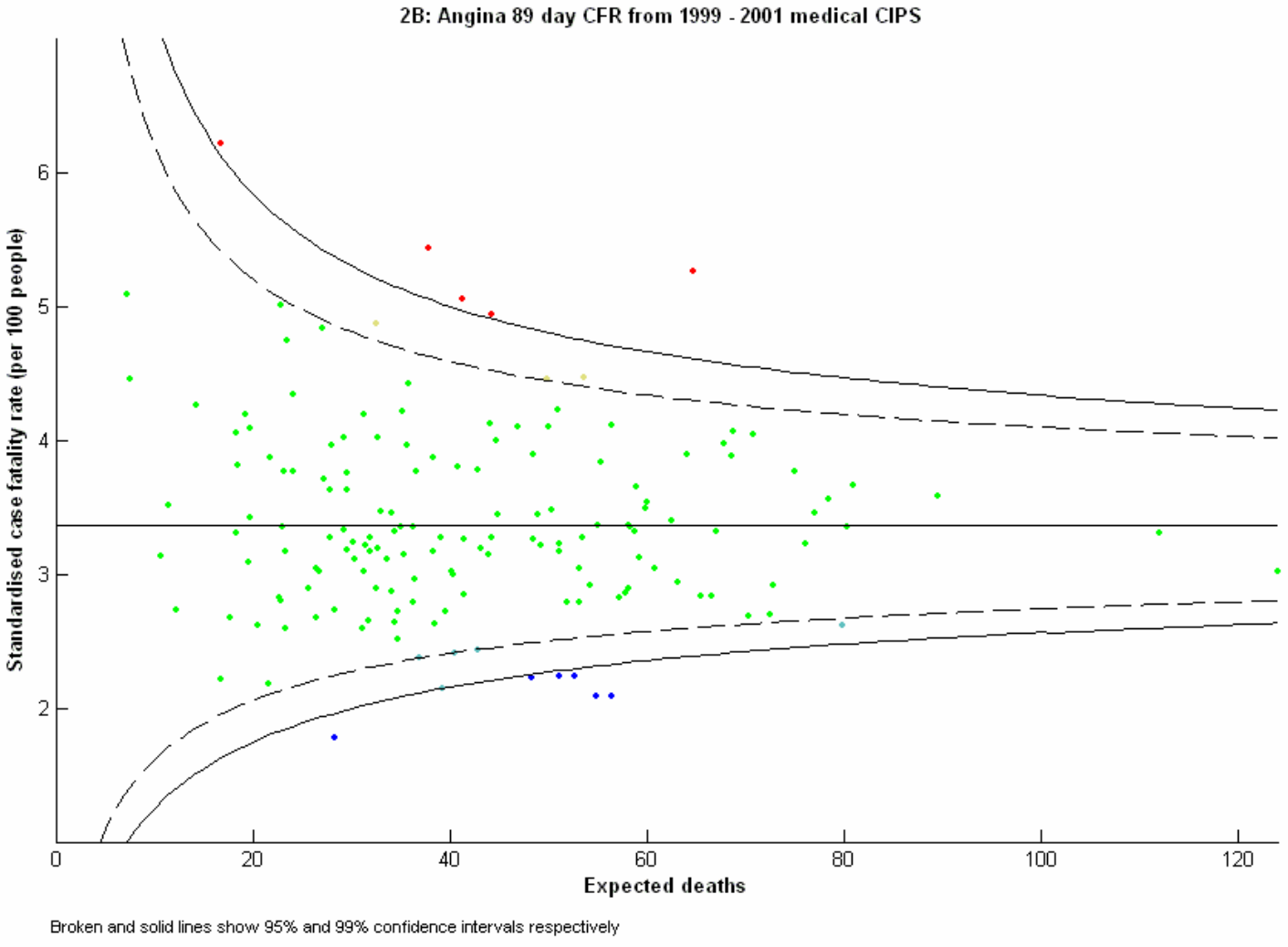
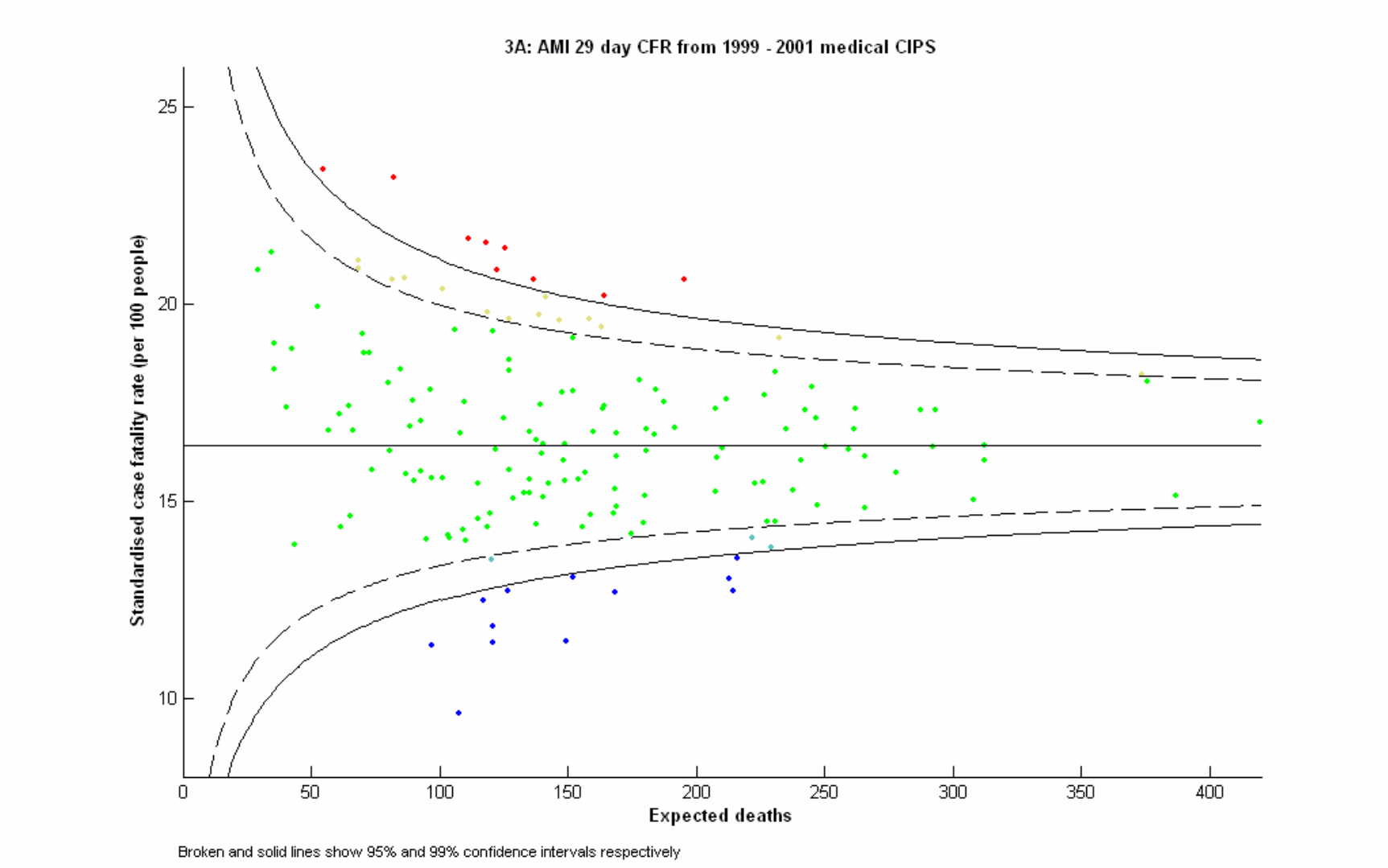
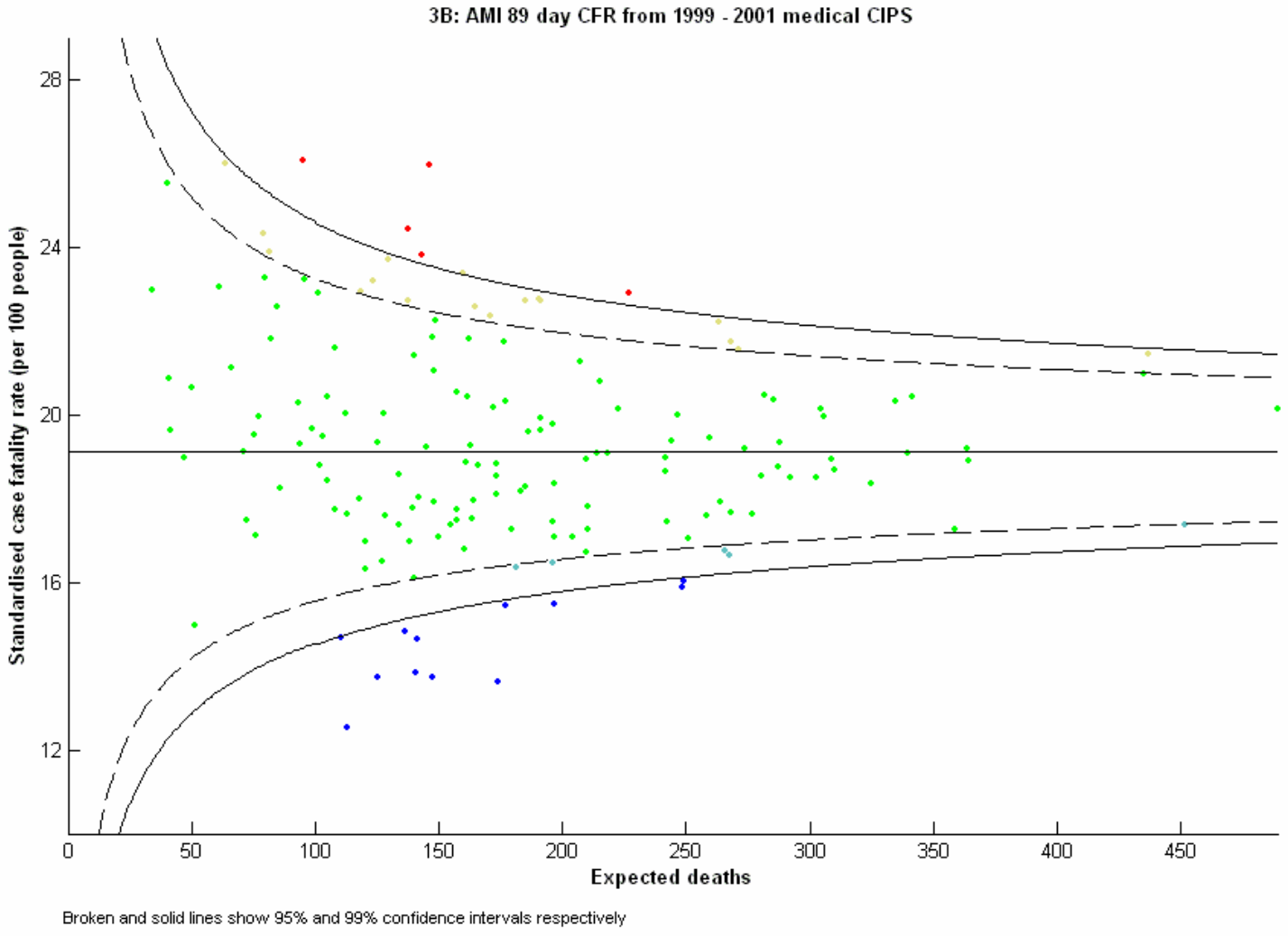
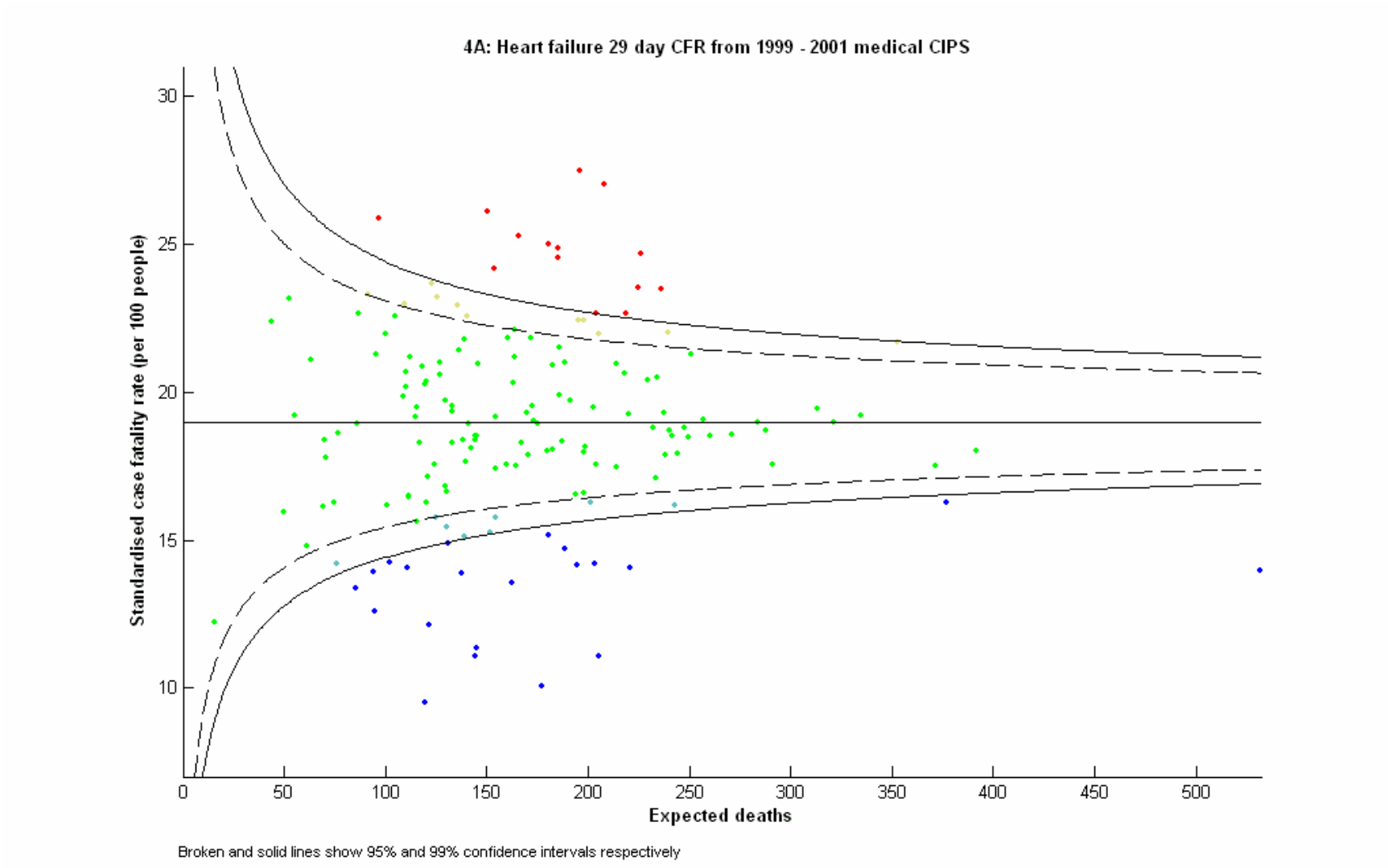

2B: Angina 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
Expected deaths
0
20
40
60
80
100
120
2
3
4
5
6
Broken and solid lines show 95% and 99% confidence intervals respectively

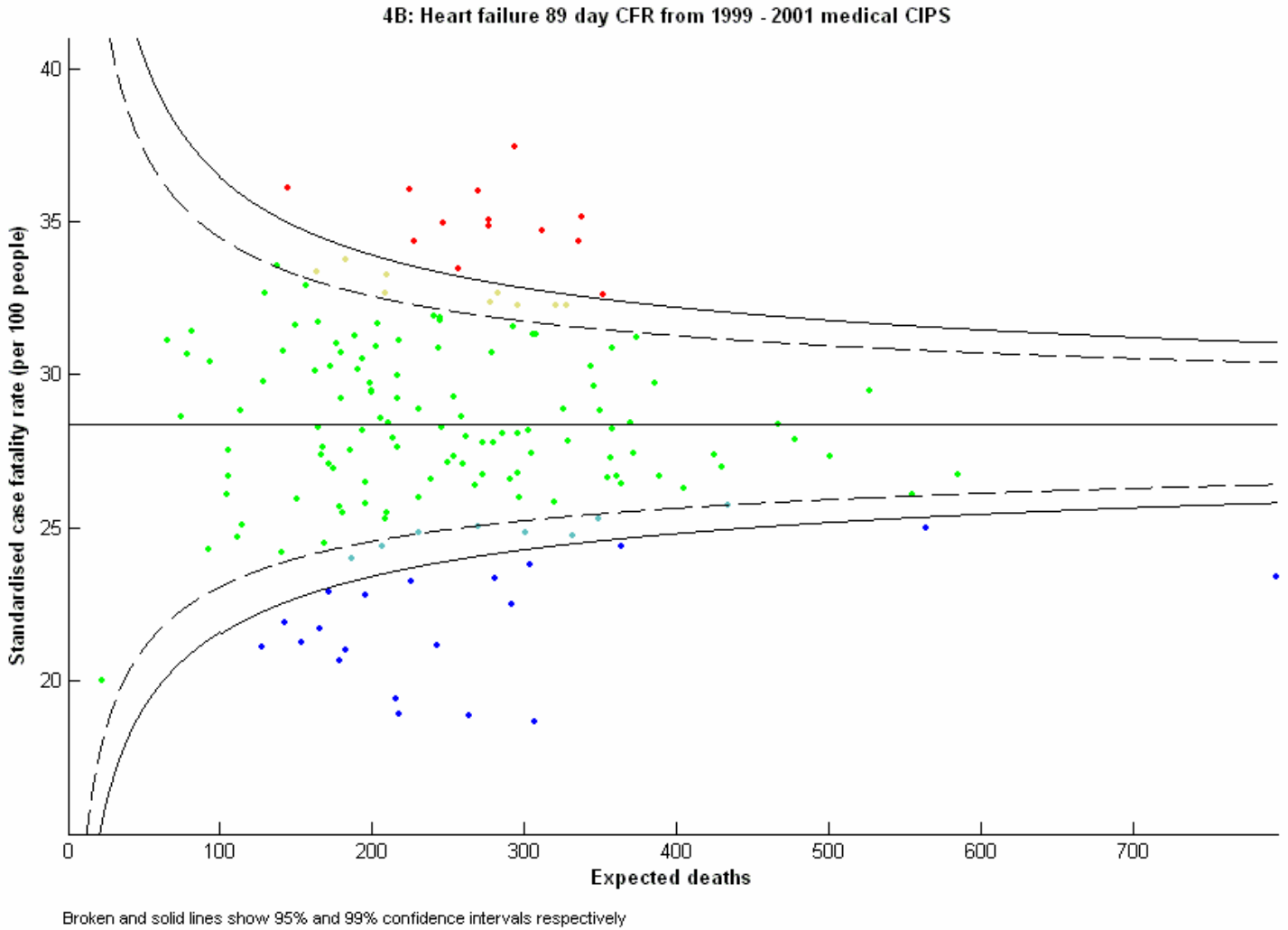
**Exhibit 11A and B: AMI 0-29 and 0-89 day CFR**



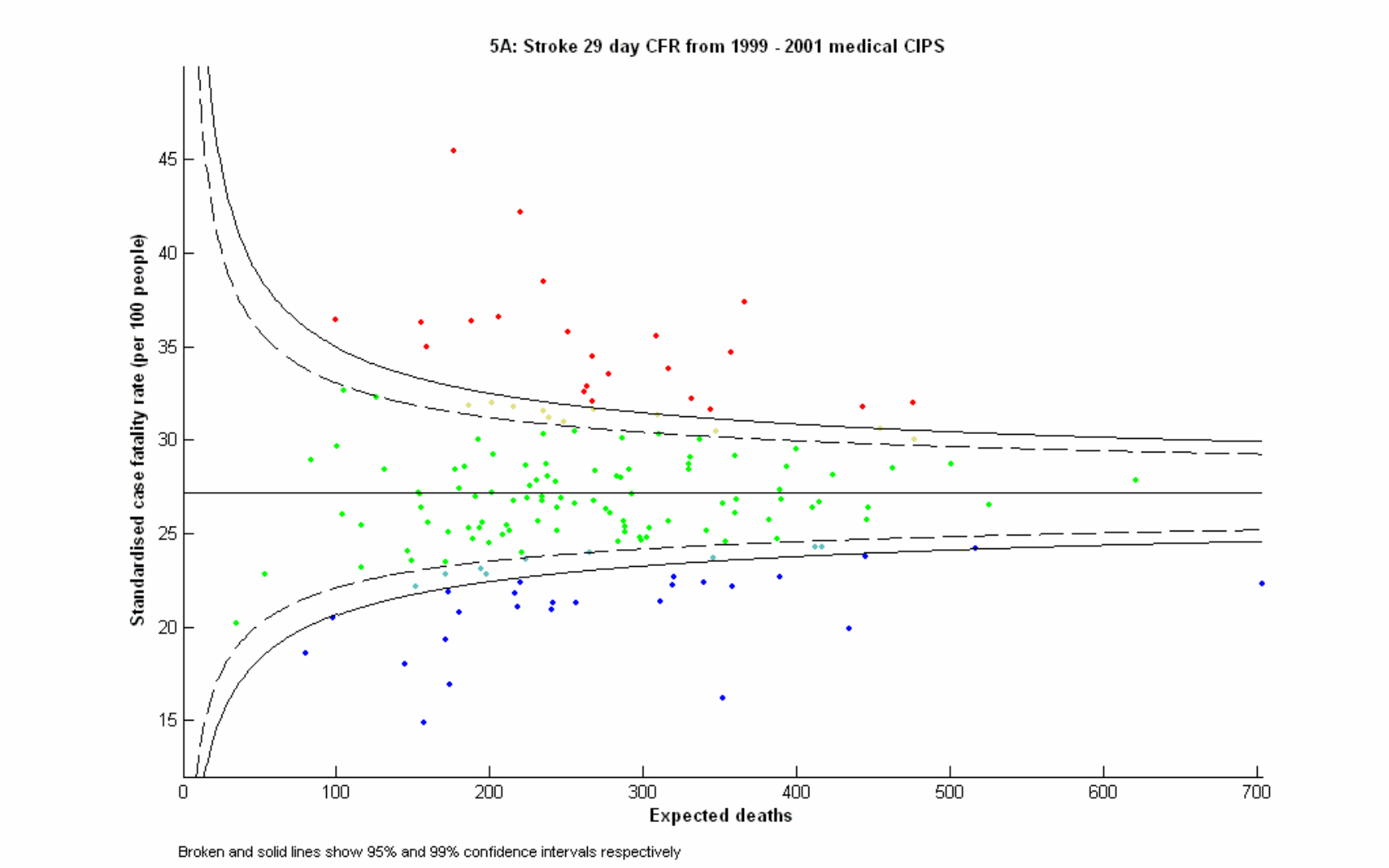

3B: AMI 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
28
24
20
16
12
0
50
100
150
200
250
300
350
400
450
Expected deaths
Broken and solid lines show 95% and 99% confidence intervals respectively

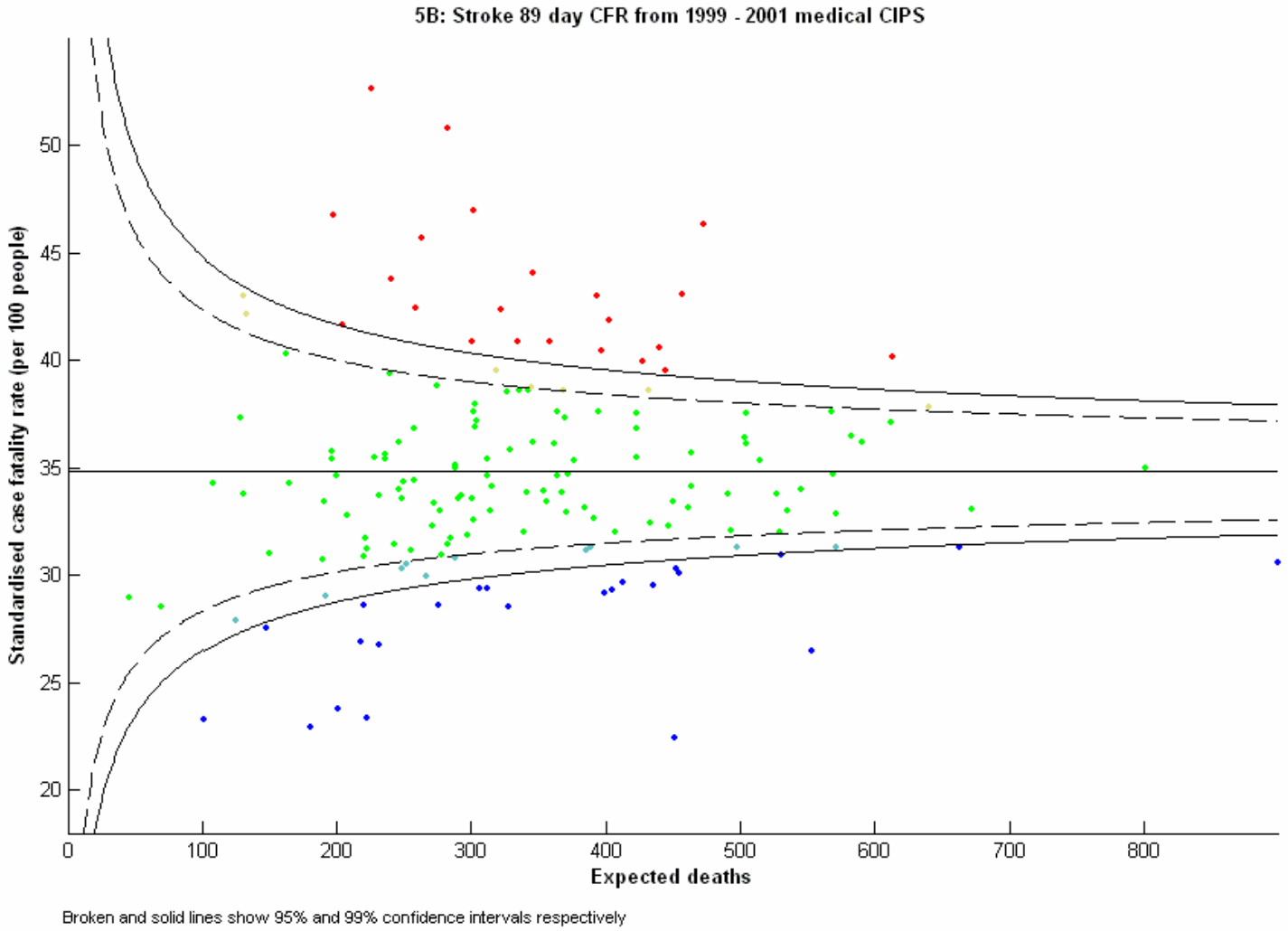
**12A and B: Heart failure 0-29 and 0-89 day CFR**



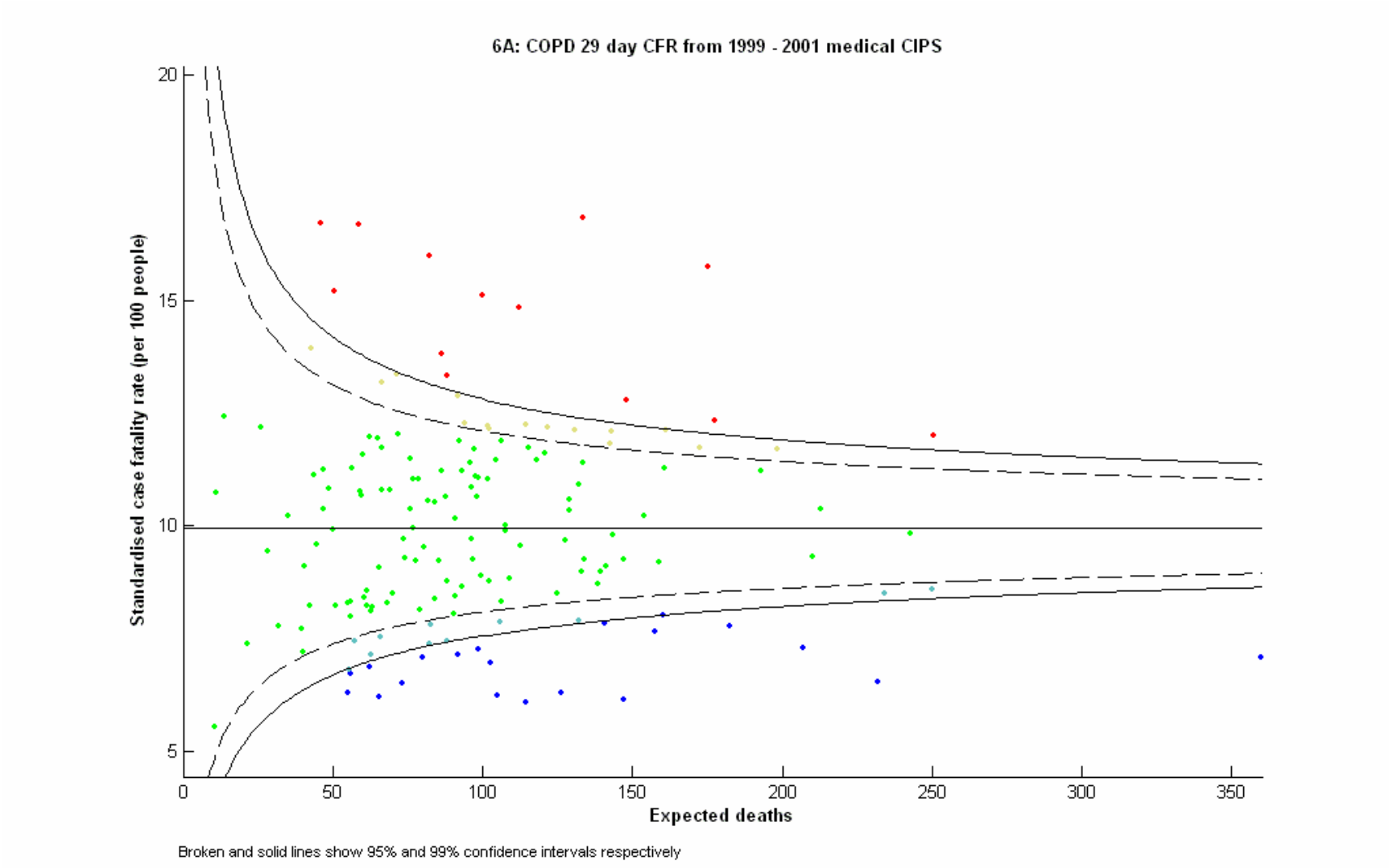

4B: Heart failure 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
40
35
30
25
20
0
100
200
300
400
500
600
700
Expected deaths
Broken and solid lines show 95% and 99% confidence intervals respectively

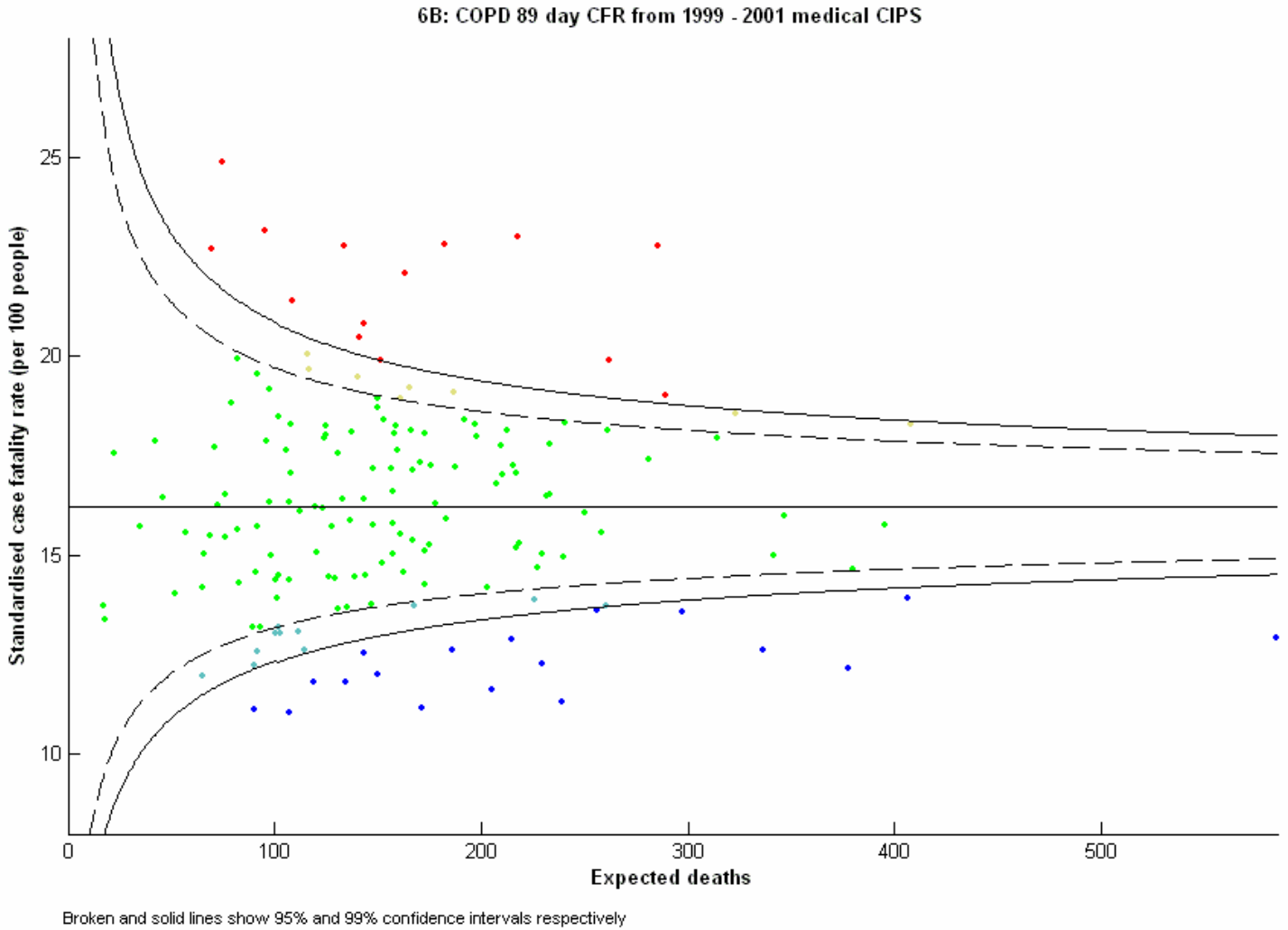
**13A and B: Stroke 0-29 and 0-89 day CFR**



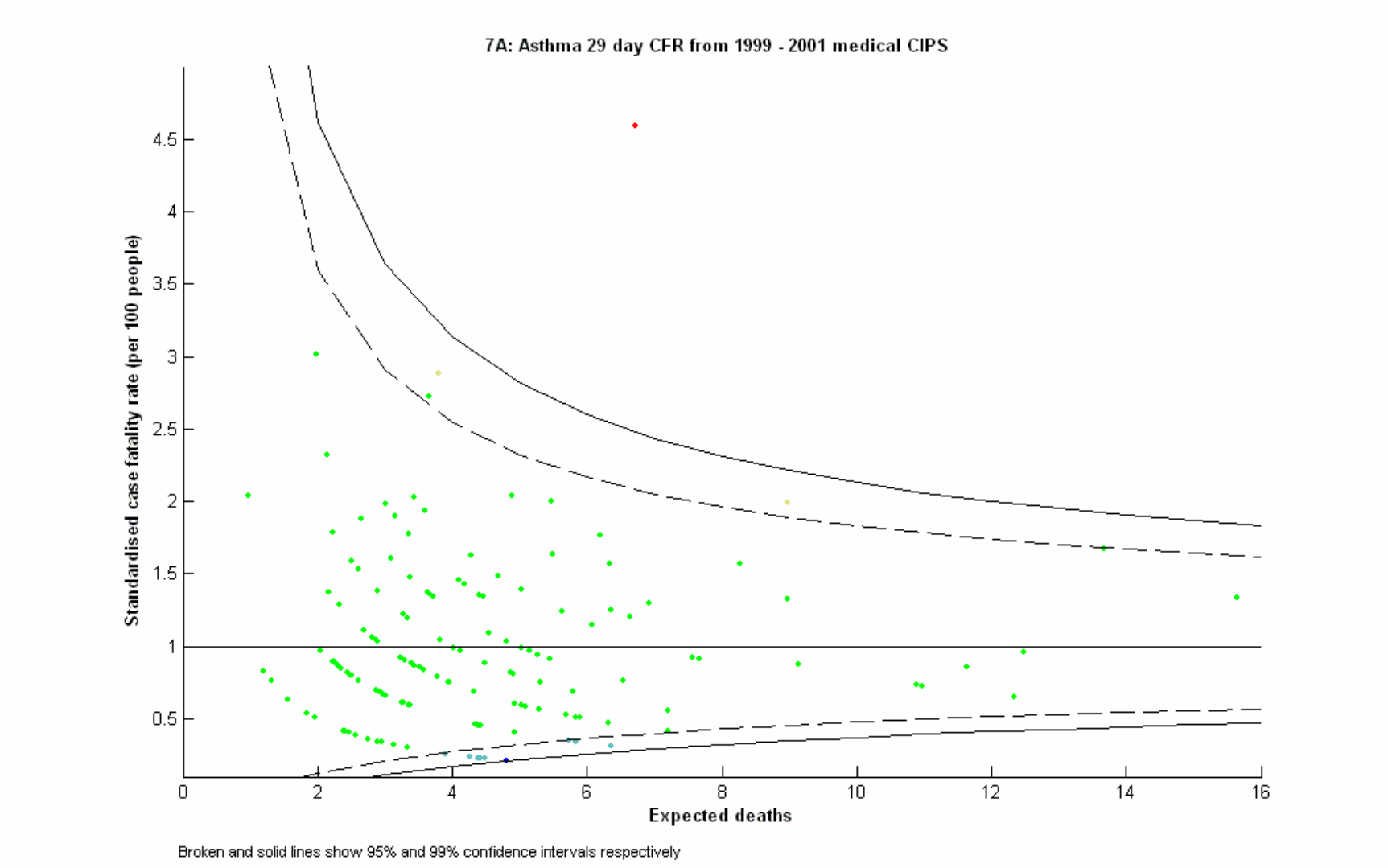

5B: Stroke 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
50
45
40
35
30
25
20
0
100
200
300
400
500
600
700
800
Expected deaths
Broken and solid lines show 95% and 99% confidence intervals respectively

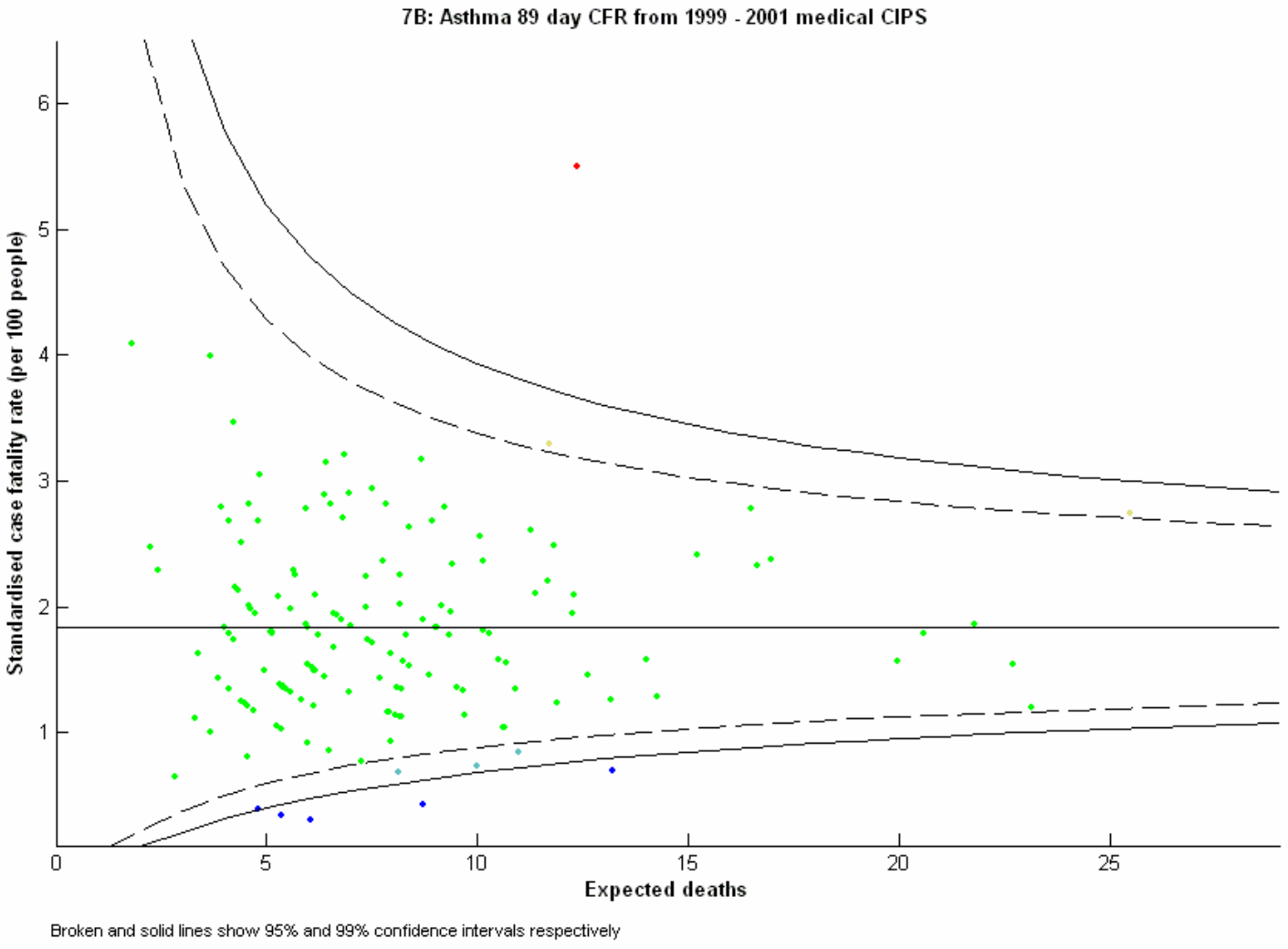
**14A and B: COPD 0-29 and 0-89 day CFR**




6B: COPD 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
25
20
15
10
0
100
200
300
400
500
Expected deaths
Broken and solid lines show 95% and 99% confidence intervals respectively

**15A and B: Asthma 0-29 and 0-89 day CFR**




7B: Asthma 89 day CFR from 1999 - 2001 medical CIPS
Standardised case fatality rate (per 100 people)
Expected deaths
0
5
10
15
20
25
1
2
3
4
5
6
Broken and solid lines show 95% and 99% confidence intervals respectively

## 5. CORRELATION BETWEEN 0-29 AND 0-89 DAY CFRs

### Methods and results

Both 0-29 and 0-89 day values were calculated for the global and the six diagnosis-specific CFRs.

In order to determine the extent of similarity between the diagnosis-specific SCFRs for 0-29 and 0-89 day mortality, scatter plots (Exhibits 16-22) were done with an ordinary least squares (OLS) regression model fitted to the data using Microsoft Excel chart trendline function. The intercept term represents the difference in the magnitude of the SCFRs, whilst the slope represents the similarity in terms of the relationship between the SCFRs of the two indicators.

For example, all the intercept terms are negative showing that the 0-29 day mortality SCFRs are lower compared to 0-89 day mortality SCFRs. Values close to one for the slope indicate very strong relationships between the SCFRs. The $R^2$ value quantifies the degree of fit overall for each model, and multiplying by 100 allows this value to be interpreted as a percentage. The square root of the $R^2$ gives the correlation between the two indicators. The $R^2$ values were as follows:

- stroke 0.95
- acute myocardial infarction 0.93
- heart failure 0.91
- COPD 0.87
- all conditions 0.86
- asthma 0.63
- angina 0.54.

**Exhibit 16: All conditions correlation between 0-29 and 0-89 day CFR**

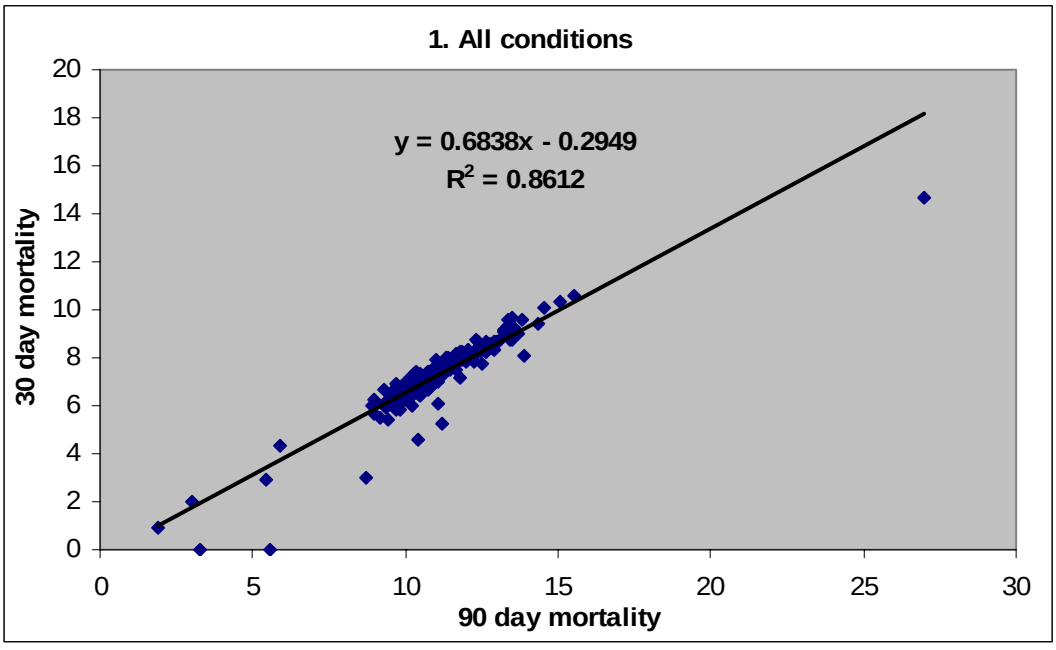


**Exhibit 17: Angina correlation between 0-29 and 0-89 day CFR**

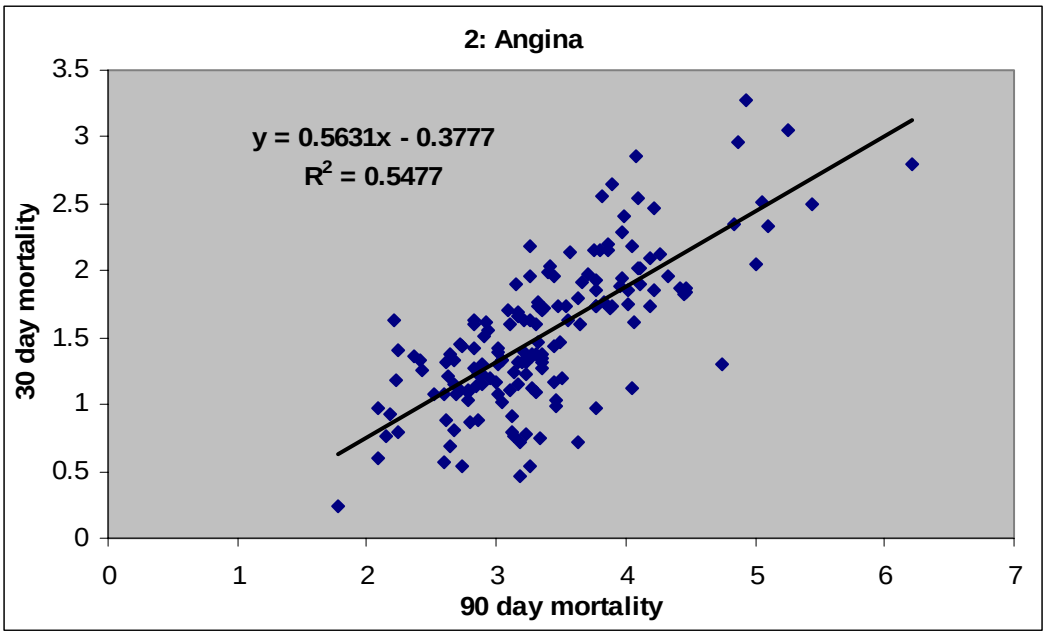



**Exhibit 18: AMI correlation between 0-29 and 0-89 day CFR**

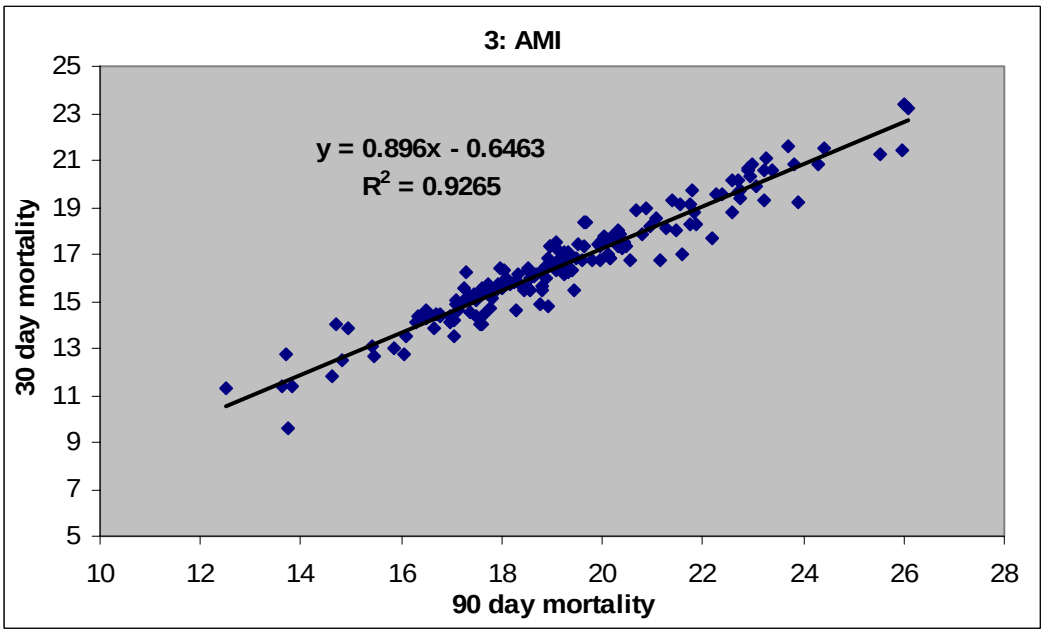


**Exhibit 19: Heart failure correlation between 0-29 and 0-89 day CFR**

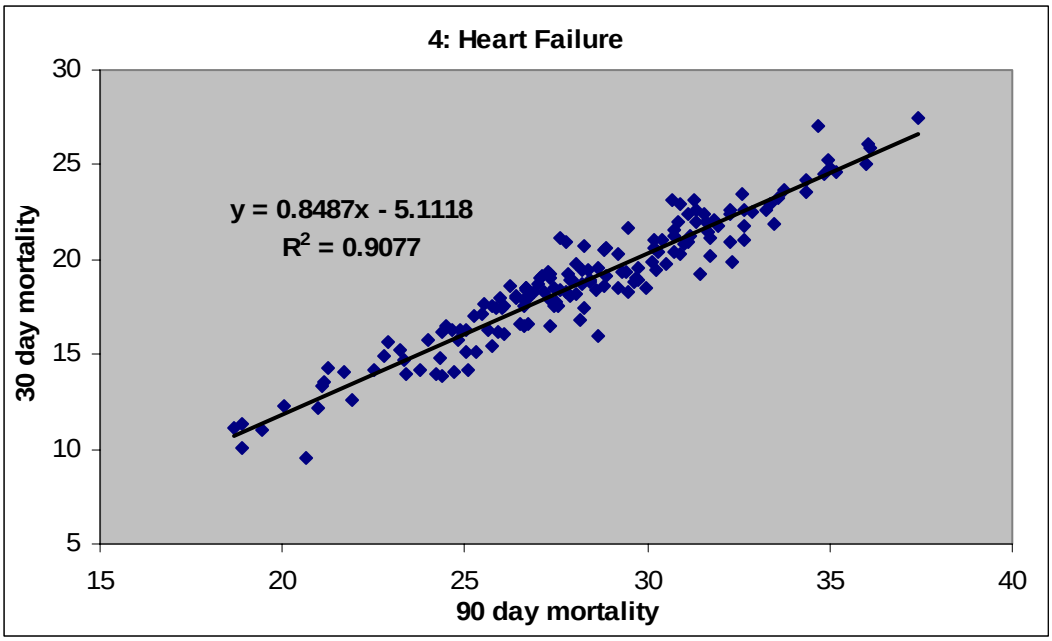



**Exhibit 20: Stroke correlation between 0-29 and 0-89 day CFR**

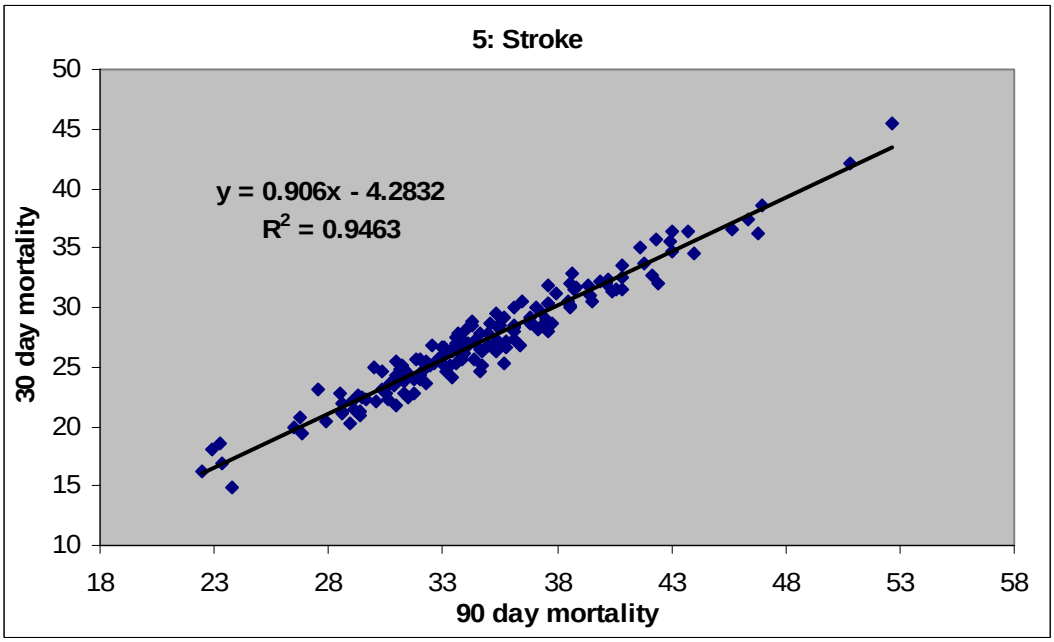


**Exhibit 21: COPD correlation between 0-29 and 0-89 day CFR**

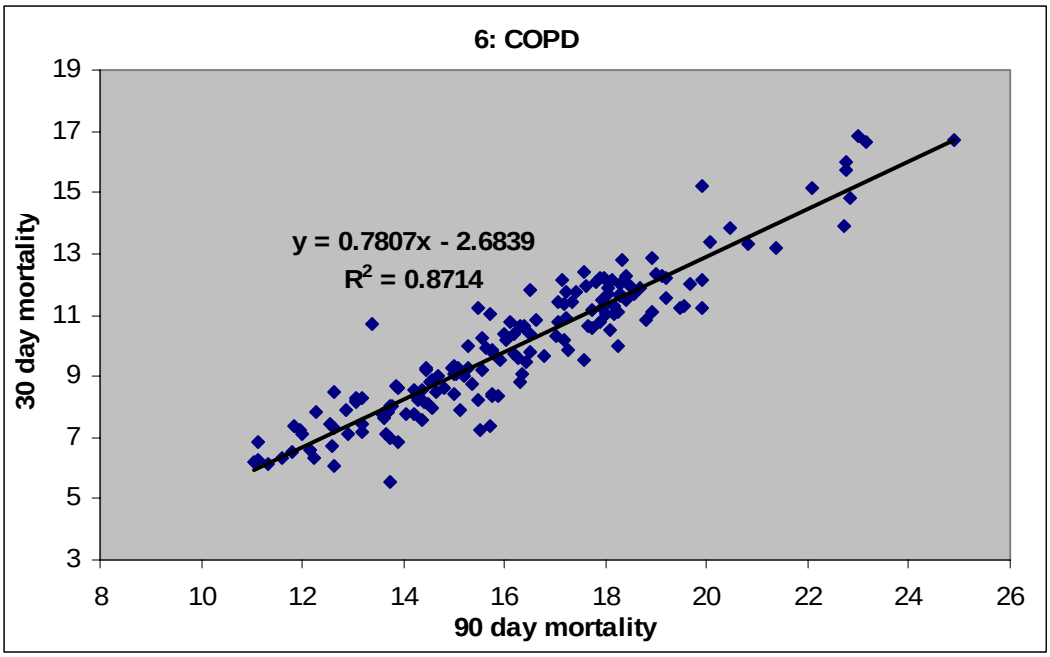
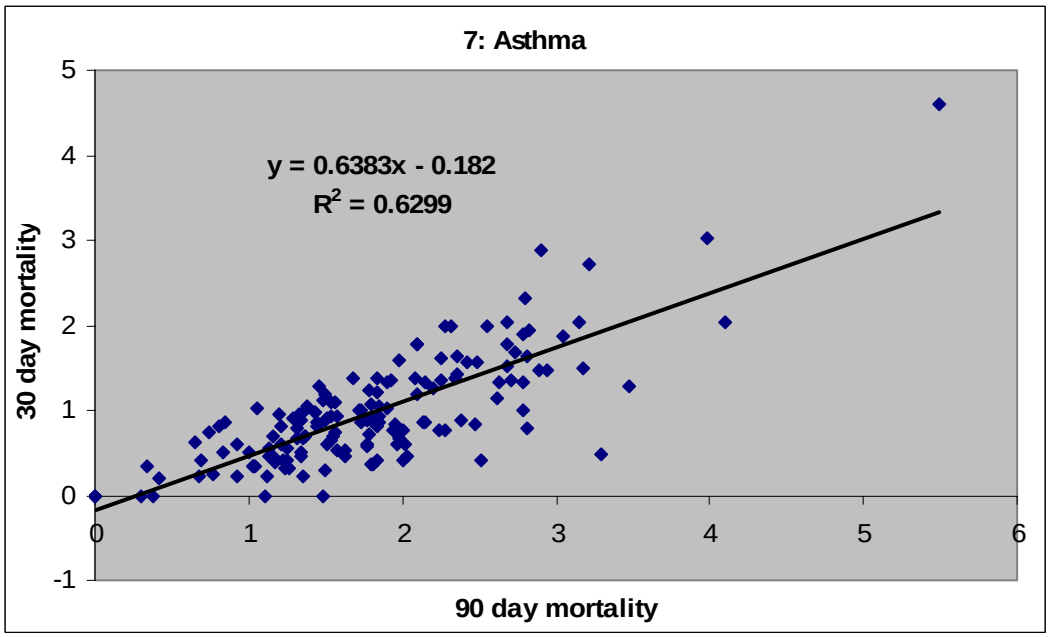



**Exhibit 22: Asthma correlation between 0-29 and 0-89 day CFR**



# 6. EFFECT OF SOCIAL DEPRIVATION

## Introduction

Social deprivation is known to be associated with increased mortality and morbidity. However, little is known about how deprivation is associated with outcome after hospital care. The clinical advisers felt that mortality indicators which were not significantly affected by social deprivation are likely to be more robust and acceptable to clinicians. In this chapter the relationship between deprivation and mortality for the diagnostic-specific indicators is analysed. Exhibits 23-28 show for each diagnosis and each multiple deprivation quintile (with quintile 1 being the most deprived) the number of admissions, number of deaths, and 0-29 and 0-89 day age/sex-standardised case-fatality rates (SCFR) with 95% confidence intervals (CI).

## Results

The results show that there was no significant difference between the multiple deprivation quintiles for case fatality rates for:

- angina
- heart failure
- stroke
- asthma.

The results show that there was a significant but small difference between the quintiles for case fatality rates for:

- AMI for which the most deprived group has the highest mortality
- COPD for which the least deprived group has the lowest morality

**Exhibit 23: Acute myocardial infarction, effect of social deprivation on SCFRs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 56492 | 9224 | 17.3 (17.0-17.7) | 10799 | 20.3 (19.9-20.7) |
| Quintile 2 | 40349 | 6789 | 16.6 (16.2-17.0) | 7866 | 19.3 (18.8-19.7) |
| Quintile 3 | 32400 | 5360 | 16.0 (15.6-16.4) | 6211 | 18.5 (18.1-19.0) |
| Quintile 4 | 25555 | 4175 | 15.7 (15.3-16.2) | 4900 | 18.4 (17.9-19.0) |
| Quintile 5 | 23006 | 3675 | 15.4 (14.9-15.9) | 4289 | 17.9 (17.4-18.4) |

**Exhibit 24: Angina, effect of social deprivation on SCRFs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 83869 | 1191 | 1.6 (1.5-1.7) | 2653 | 3.5 (3.4-3.7) |
| Quintile 2 | 53812 | 808 | 1.5 (1.4-1.6) | 1791 | 3.3 (3.2-3.5) |
| Quintile 3 | 40685 | 641 | 1.5 (1.4-1.6) | 1425 | 3.3 (3.1-3.5) |
| Quintile 4 | 31263 | 498 | 1.5 (1.3-1.6) | 1092 | 3.2 (3.0-3.4) |
| Quintile 5 | 27901 | 498 | 1.6 (1.5-1.8) | 1068 | 3.4 (3.2-3.7) |

**Exhibit 25: Heart failure, effect of social deprivation on SCRFs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 57244 | 10072 | 18.5 (18.1-18.8) | 15287 | 28.0 (27.5-28.4) |
| Quintile 2 | 38772 | 7398 | 19.1 (18.6-19.5) | 10949 | 28.2 (27.7-28.7) |
| Quintile 3 | 29640 | 5814 | 19.2 (18.7-19.7) | 8648 | 28.6 (28.0-29.2) |
| Quintile 4 | 23764 | 4826 | 19.5 (19.0-20.1) | 7178 | 29.1 (28.4-29.8) |
| Quintile 5 | 21069 | 4245 | 19.1 (18.6-19.7) | 6358 | 28.7 (28.0-29.5) |

**Exhibit 26: Stroke, effect of social deprivation on SCRFs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 59524 | 15308 | 27.1 (26.7-27.5) | 19657 | 35.0 (34.5-35.5) |
| Quintile 2 | 41948 | 11644 | 27.8 (27.2-28.3) | 14882 | 35.5 (34.9-36.0) |
| 5uintile 3 | 33378 | 9317 | 27.3 (26.7-27.8) | 11972 | 35.0 (34.3-35.6) |
| Quintile 4 | 27618 | 7721 | 26.9 (26.3-27.6) | 9903 | 34.4 (33.8-35.1) |
| Quintile 5 | 26110 | 7342 | 26.7 (26.1-27.3) | 9436 | 34.1 (33.5-34.8) |

**Exhibit 27: Asthma, effect of social deprivation on SCFRs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 32306 | 323 | 1.1 (0.9-1.2) | 596 | 2.0 (1.8-2.1) |
| Quintile 2 | 18414 | 166 | 0.9 (0.8-1.1) | 316 | 1.8 (1.6-2.0) |
| Quintile 3 | 12540 | 140 | 1.0 (0.9-1.3) | 253 | 1.9 (1.7-2.2) |
| Quintile 4 | 9373 | 93 | 0.9 (0.7-1.1) | 164 | 1.6 (1.3-1.8) |
| Quintile 5 | 8148 | 87 | 1.0 (0.8-1.2) | 167 | 1.8 (1.6-2.1) |

**Exhibit 28: COPD, effect of social deprivation on SCFRs**

| QUINTILE | Number of admissions | 0-29 day deaths | | 0-89 day deaths | |
|---|---|---|---|---|---|
| | | Number | SCFR (with 95% CI) | Number | SCFR (with 95% CI) |
| Quintile 1 | 82920 | 7457 | 9.4 (9.2-9.6) | 12394 | 15.7 (15.4-15.9) |
| Quintile 2 | 42976 | 4402 | 10.2 (9.9-10.5) | 7080 | 16.4 (16.0-16.8) |
| Quintile 3 | 29117 | 3176 | 10.5 (10.1-10.9) | 5101 | 16.8 (16.4-17.3) |
| Quintile 4 | 20920 | 2273 | 10.3 (9.9-10.7) | 3688 | 16.7 (16.1-17.2) |
| Quintile 5 | 16979 | 1938 | 10.6 (10.1-11.1) | 3072 | 16.7 (16.2-17.4) |

# 7. RECOMMENDATIONS

## Introduction

The analyses have been discussed with the clinical advisers working at the Royal College of Physicians, Professor Michael Pearson and Professor John Williams. They have been involved in and they support the formulation of the recommendations that follow, which are:

- General about the overall approach to be taken.
- Specific about individual indicators.

## General recommendations

*It is recommended* that:

- The medical specialties that manage emergency admissions should be analysed as a group. Analyses of individual medical sub-specialties or individual consultants are not clinically relevant as there is considerable local variation in whether and how sub-specialties are designated and clinicians work in teams, not as individuals, to deal with medical emergencies.
- Patients with cancer should be excluded from the calculation of the CFRs.
- CFRs should be calculated including all deaths regardless of location. Analyses based solely on deaths occurring in hospital are not clinically relevant.
- The most clinically appropriate approach is to develop CFRs which are diagnosis specific in order to minimise the difficulties of identifying and interpreting the differences in case-mix between trusts.
- Diagnosis-based CFRs will be more robust and acceptable to clinicians if there:
    - are adequate numbers of admissions and deaths to produce statistically sound information.
    - is little or no effect of social deprivation.

## Recommendations about specific indicators

Six diagnoses were considered for potential CFR indicators:

- AMI
- angina
- asthma
- COPD
- heart failure
- stroke.

*It is recommended* that AMI CFRs not be used as indicators of acute trust performance because of the important contribution of care given before admission. They could possibly be used as indicators of PCT commissioning but there are significant methodological difficulties that make their interpretation difficult. Commissioning performance may be better judged by using information from the national AMI audit (MINAP).

*It is recommended* that asthma and angina CFRs not be used. The overall CFRs are comparatively low and angina is a symptom rather than a disease. It is also interesting to note that the correlations between 0-29 and 0-89 day CFRs were poor for these diagnostic codes.

*It is recommended* that, as asthma deaths are potentially preventable, a national count of asthma deaths and where they occurred be produced annually.

*It is recommended* that the most clinically useful CFRs are those associated with the diagnoses COPD, heart failure and stroke. Their specifications are included in this report. It should be noted that:

- They have comparatively high overall CFRs.
- The analyses done in this study were on data for three years and a single year's data will have less statistical power.
- There is no effect of social deprivation for heart failure and stroke CFRs and only a small effect for COPD with, interestingly, the least deprived having higher CFRs. One possible explanation for this might be that in the least deprived areas there is a greater likelihood that patients will be managed at home and that only the seriously ill will be admitted.

*It is recommended* that both 0-29 and 0-89 day CFRs be calculated. Although for all three diagnoses there is a close correlation between the two CFRs, current understanding of which analysis may be more clinically relevant is poor. When more is known about these issues, it may be possible to recommend that one CFR timescale is more appropriate than the other one.

*It is recommended*, that in addition to CFRs obtained from a linked HES/mortality database, information from the national snapshot audits of COPD and stroke be used to screen acute trust performance.

*It is recommended* that the usefulness to clinicians of a global CFR for all medical emergency admissions be investigated further. The case-mix between acute trusts may vary considerably and a CFR encompassing such heterogenous activity is difficult to interpret. Preliminary findings in our present study show that the diagnosis-specific and global approaches may produce different answers. Exhibits 29 and 30 show, using the six recommended diagnosis-specific indicators, the trusts that have the greatest number of raised values at the 95% and 99.8% significance levels as these organisations might be considered a priority for further investigation by the Health Commission. These findings do not necessarily correlate with the results from the global (all diagnosis) indicators, which are also shown. Only three of the five trusts identified by the diagnosis screening indicators in Exhibit 29 would also have been identified by one of the global indicators. Eight of the twelve trusts in Exhibit 30 would have been identified by both approaches.

It must be recognised that a high CFR does not automatically imply poor performance. Trusts which operate successful procedures for keeping moderately ill people with the medical conditions studied out of hospital will have comparatively high CFRs.

*It is recommended* that the Royal College of Physicians be commissioned to test the acceptability of the recommended CFR indicators to a wide group of practising clinicians.

**Exhibit 29: Trusts with at least one CFR, either 0-29 or 0-89 day, significantly raised for all three diagnoses**

| | 0-29/0-89 day CFR ratings | | | |
|---|---|---|---|---|
| **Trust** | **Stroke** | **COPD** | **Heart failure** | **Global** |
| Mid Essex | A/A | A/B | A/A | B/C |
| Essex Rivers | A/A | B/C | A/A | A/A |
| St Helens & Knowsley | A/A | A/B | B/B | C/C |
| Southport | B/B | B/C | A/A | A/B |
| Queen's Nottingham | A/C | A/C | B/C | C/C |

**Exhibit 30: Trusts with at least one CFR, either 0-29 or 0-89 day, significantly raised for two diagnoses**

| | 0-29/0-89 day CFR ratings | | | |
|---|---|---|---|---|
| **Trust** | **Stroke** | **COPD** | **Heart failure** | **Global** |
| Basildon | C/C | A/A | A/A | B/C |
| Sandwell | A/A | A/A | C/C | A/A |
| Mid Cheshire | A/A | A/A | C/C | C/B |
| Walsall | B/A | C/C | A/A | A/A |
| Thames Gateway | A/B | A/A | C/C | A/A |
| Blackpool Victoria | A/A | B/A | C/C | A/A |
| James Paget | A/A | B/B | C/C | C/C |
| Blackburn | B/B | C/C | A/A | C/C |
| George Elliot | A/A | C/B | C/C | A/A |
| Eastbourne | A/A | C/B | C/C | C/C |
| University Hospitals Coventry & Warwick | C/B | B/B | C/C | B/C |
| West Suffolk | C/C | C/B | C/B | C/C |

**Key to ratings:**
A = significantly high CFR at the 99.8% significance level.
B = significantly high CFR at the 95% significance level.
C = not significantly high CFR at the 95% significance level.