



# Monitoring performance of cardiac surgery: the SCTS governance programme

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Part of this research was funded by Heart Research UK [Grant Number RG2583]

# Background

## The Guardian

### NHS heart surgery

#### The data explained 244 doctors and the problem of comparing mortality rates

Figures on mortality rates are collected and analysed in various ways by different heart units in hospital trusts across the country, making it impossible to compare individual heart surgeons. Under the Guardian's request for information, all units were able to give "near mortality data for surgeons who do 10 or more cases a year" - number of cases, and number and percentage of those dying. But these figures will vary little. Sometimes the best surgeons have the

highest rates, because they operate on those closest to death and with the most to gain from surgery. So we requested three years of risk-adjusted data for the commonest operation, coronary artery bypass graft, to give a more complete picture of mortality rates. Some surgeons, over time, learn to assess risk and therefore have to operate on fewer patients. Some say the north-west trusts have risk-adjusted EuroSCORE, a check-list of a surgeon's age, state of his or her heart, and so on. Each factor scores a point.

Following the example of four trusts in the north-west who published their results in the British Medical Journal, we asked heart units to eight cases into low risk of the point or fewer, and high risk of six or more.

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#### Coronary Artery Bypass Graft

Hospital	Risk adjusted data (EuroSCORE)				Hospital			
	Surgeon	Cases	Deaths %	Risk ratio	Surgeon	Cases	Deaths %	Risk ratio
Belfast Victoria Hospital	McIntyre	305	1.2	0.89	McIntyre	237	1.7	1.27
	McIntyre	503	1.2	0.89	McIntyre	449	2	0.45
	McIntyre	503	1.2	0.89	McIntyre	290	1.7	1.27
	McIntyre	290	1.4	1.09	McIntyre	239	1.3	0.97
	McIntyre	290	1.4	1.09	McIntyre	239	1.3	0.97
Bristol & Sussex University Hospitals	Chahal	140	4	2.9	Chahal	140	4	2.9
	Chahal	461	17	3.7	Chahal	461	17	3.7
	Chahal	461	17	3.7	Chahal	461	17	3.7
	Chahal	461	17	3.7	Chahal	461	17	3.7
	Chahal	461	17	3.7	Chahal	461	17	3.7
Cardiff Bay Health Board	Chahal	527	13	2.5	Chahal	527	13	2.5
	Chahal	527	13	2.5	Chahal	527	13	2.5
	Chahal	527	13	2.5	Chahal	527	13	2.5
	Chahal	527	13	2.5	Chahal	527	13	2.5
	Chahal	527	13	2.5	Chahal	527	13	2.5
Cardiff Health Board	Chahal	508	7	1.4	Chahal	508	7	1.4
	Chahal	508	7	1.4	Chahal	508	7	1.4
	Chahal	508	7	1.4	Chahal	508	7	1.4
	Chahal	508	7	1.4	Chahal	508	7	1.4
	Chahal	508	7	1.4	Chahal	508	7	1.4
Croydon and Wexham Health Trust	Chahal	96	2.3	1.66	Chahal	96	2.3	1.66
	Chahal	96	2.3	1.66	Chahal	96	2.3	1.66
	Chahal	96	2.3	1.66	Chahal	96	2.3	1.66
	Chahal	96	2.3	1.66	Chahal	96	2.3	1.66
	Chahal	96	2.3	1.66	Chahal	96	2.3	1.66
Guy and St Thomas Hospital	Chahal	236	5	2.1	Chahal	236	5	2.1
	Chahal	236	5	2.1	Chahal	236	5	2.1
	Chahal	236	5	2.1	Chahal	236	5	2.1
	Chahal	236	5	2.1	Chahal	236	5	2.1
	Chahal	236	5	2.1	Chahal	236	5	2.1
John Radcliffe	Chahal	271	5	1.8	Chahal	271	5	1.8
	Chahal	271	5	1.8	Chahal	271	5	1.8
	Chahal	271	5	1.8	Chahal	271	5	1.8
	Chahal	271	5	1.8	Chahal	271	5	1.8
	Chahal	271	5	1.8	Chahal	271	5	1.8
MRC Manchester Heart Centre	Chahal	362	7	1.9	Chahal	362	7	1.9
	Chahal	362	7	1.9	Chahal	362	7	1.9
	Chahal	362	7	1.9	Chahal	362	7	1.9
	Chahal	362	7	1.9	Chahal	362	7	1.9
	Chahal	362	7	1.9	Chahal	362	7	1.9
Plymouth Hospital Trust	Chahal	103	6	1.1	Chahal	103	6	1.1
	Chahal	103	6	1.1	Chahal	103	6	1.1
	Chahal	103	6	1.1	Chahal	103	6	1.1
	Chahal	103	6	1.1	Chahal	103	6	1.1
	Chahal	103	6	1.1	Chahal	103	6	1.1
Royal Victoria Hospital	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8



Helping doctors make better decisions

BMJ 2005; 330 doi: 10.1136/bmj.330.7490.506 (Published 3 March 2005)  
Cite this as: BMJ 2005;330:506

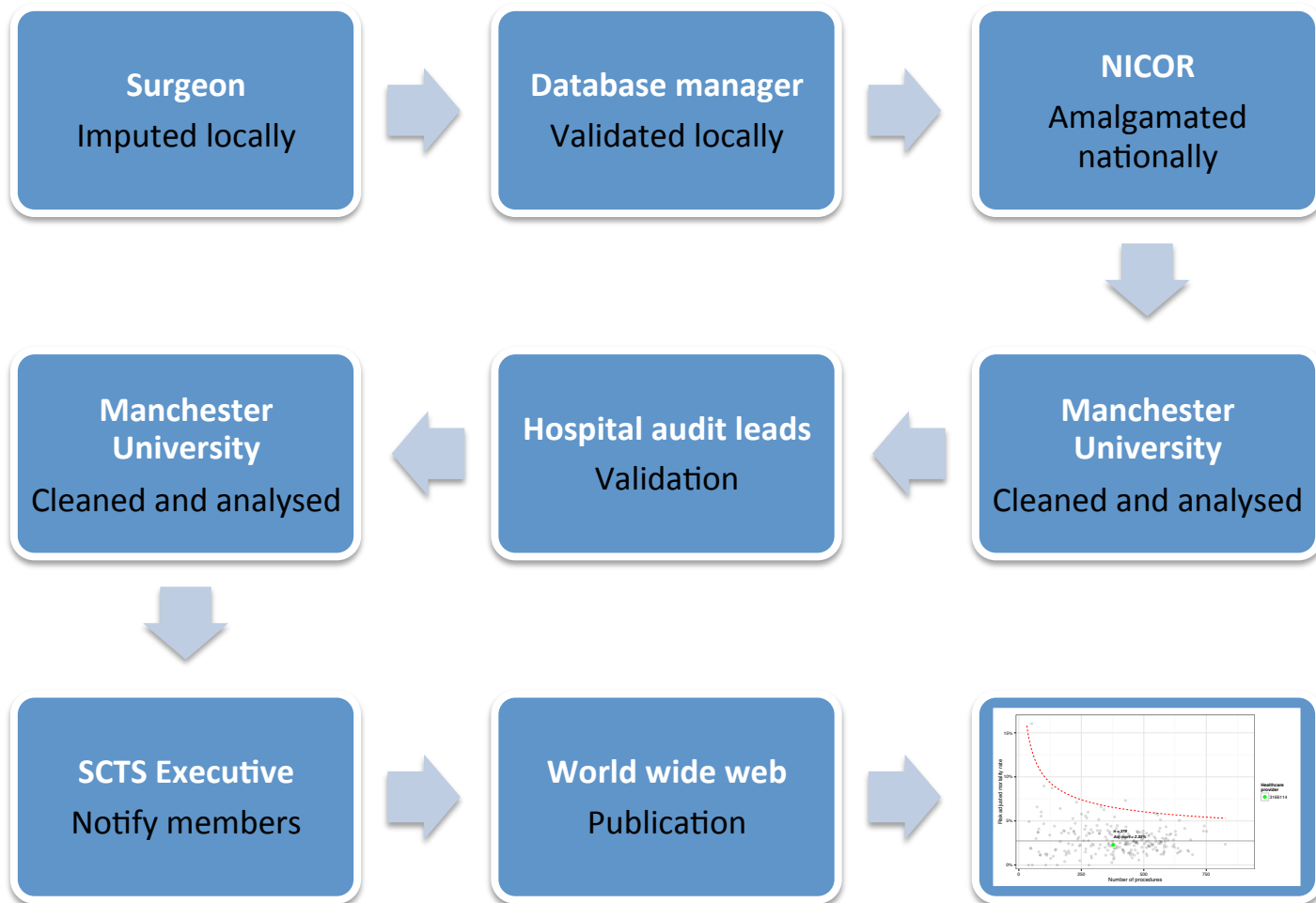
## Mortality data in adult cardiac surgery for named surgeons: retrospective examination of prospectively collected data on coronary artery surgery and aortic valve replacement

Ben Bridgewater on behalf of the adult cardiac surgeons of north west England

# Publishing mortality rates by named hospital and consultant since 2001 and 2005 respectively

Hospital	Risk adjusted data (EuroSCORE)				Hospital			
	Surgeon	Cases	Deaths %	Risk ratio	Surgeon	Cases	Deaths %	Risk ratio
Belfast Victoria Hospital	McIntyre	237	1.7	1.27	McIntyre	449	2	0.45
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	Chahal	508	7	1.4	Chahal	508	7	1.4
	Chahal	508	7	1.4	Chahal	508	7	1.4
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	Chahal	103	6	1.1	Chahal	103	6	1.1
	Chahal	103	6	1.1	Chahal	103	6	1.1
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	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8
	Chahal	144	4	2.8	Chahal	144	4	2.8

# The flow of data

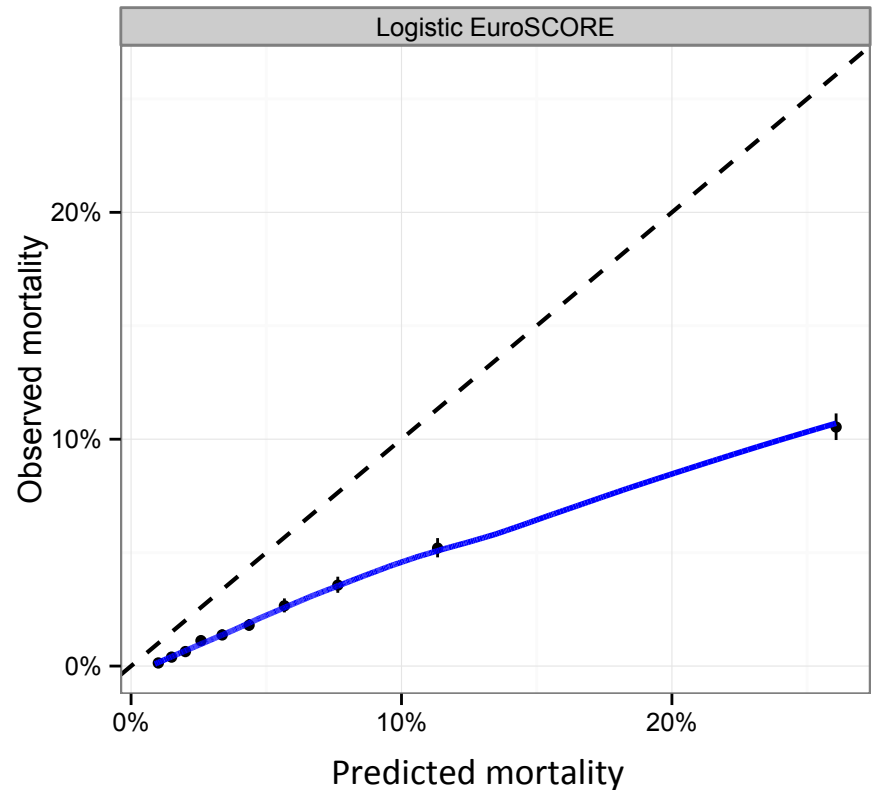


# Data preprocessing

- **The registry is cleaned:**
  - transcriptional, numerical, temporal & clinical errors resolved
  - duplicate and non-cardiac records removed
- **The data is filtered:**
  - operations between 1<sup>st</sup> April 2008 & 31<sup>st</sup> March 2011
  - exclude transplantations; trauma; primary VADs
  - exclude minors (<18 years)
  - exclude private hospitals
  - exclude emergency & salvage procedures

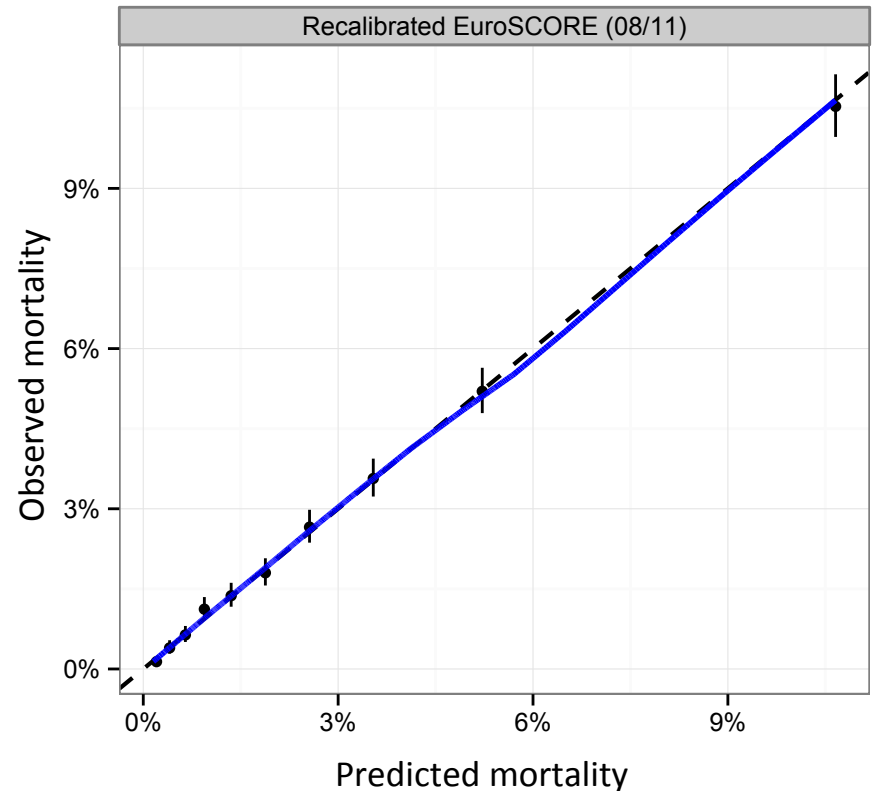
# Risk-adjustment

- Necessary to **risk-adjust** outcome measures
- Old models, e.g. logistic EuroSCORE, are **miscalibrated**
- Would lead to all units being identified as below the target



# Risk-adjustment

- **Build a new model**
  - incomplete data
  - procedure specific?
- **Refit** existing model
  - does not fit contemporary cohort well
- **Recalibrate** existing model
  - only adjusts for single variable
- **Other** options...

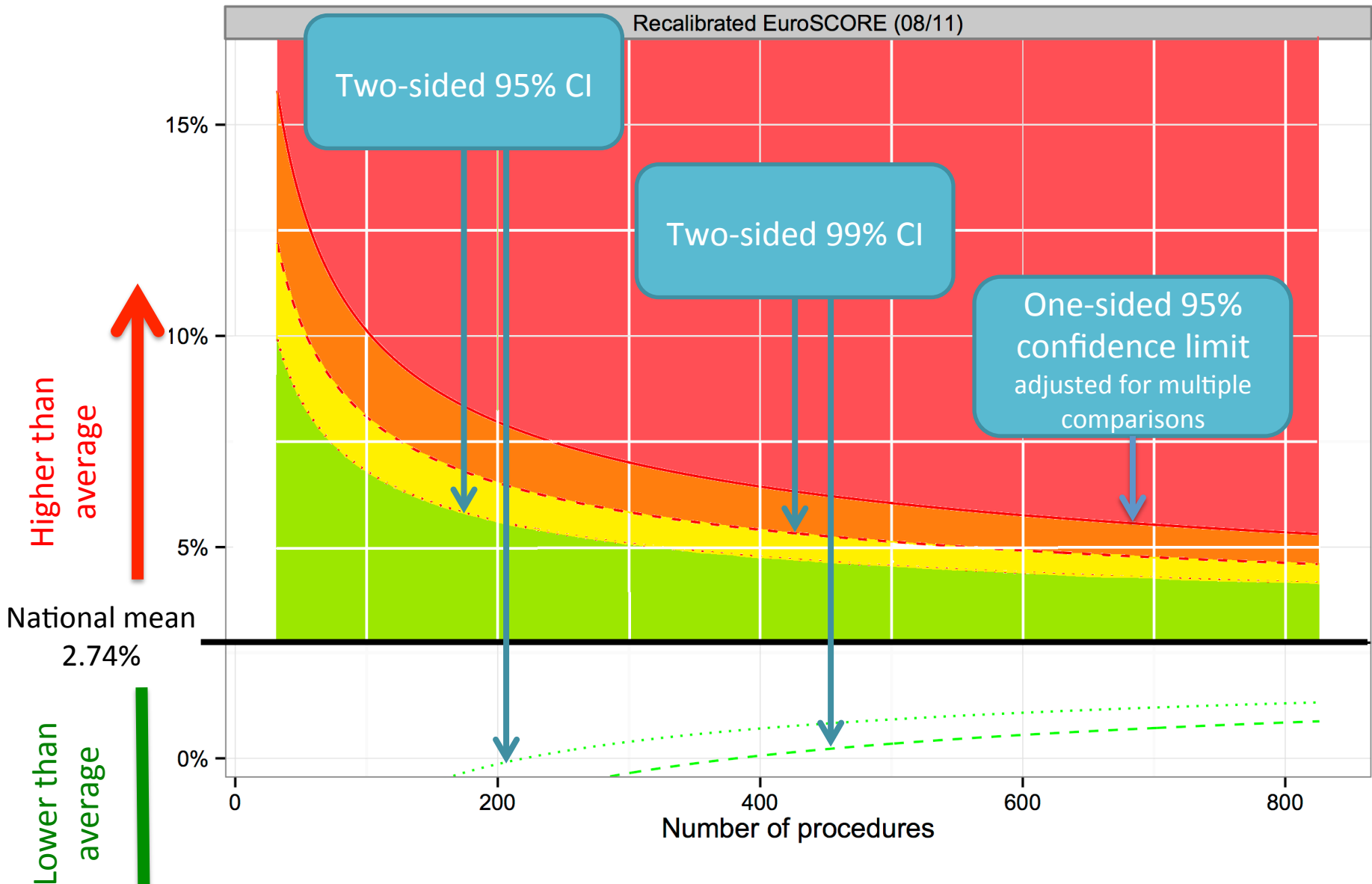


**Goodness-of-fit:** Hosmer-Lemeshow  $P = 0.56$

**Discrimination:** AUC = 0.78

# Defining divergence

- Funnel plot methodology
- Confidence intervals used to classify 'outliers'
- For consultant-level analysis we adjust for **multiple comparisons** (when making comparisons of many surgeons, high probability of identify  $\geq 1$  'outlier' due to chance)
- Standard errors are inflated due to observed **over-dispersion** (greater variability than expected by the binomial model)



Two-sided 95% CI

Two-sided 99% CI

One-sided 95% confidence limit adjusted for multiple comparisons

Higher than average

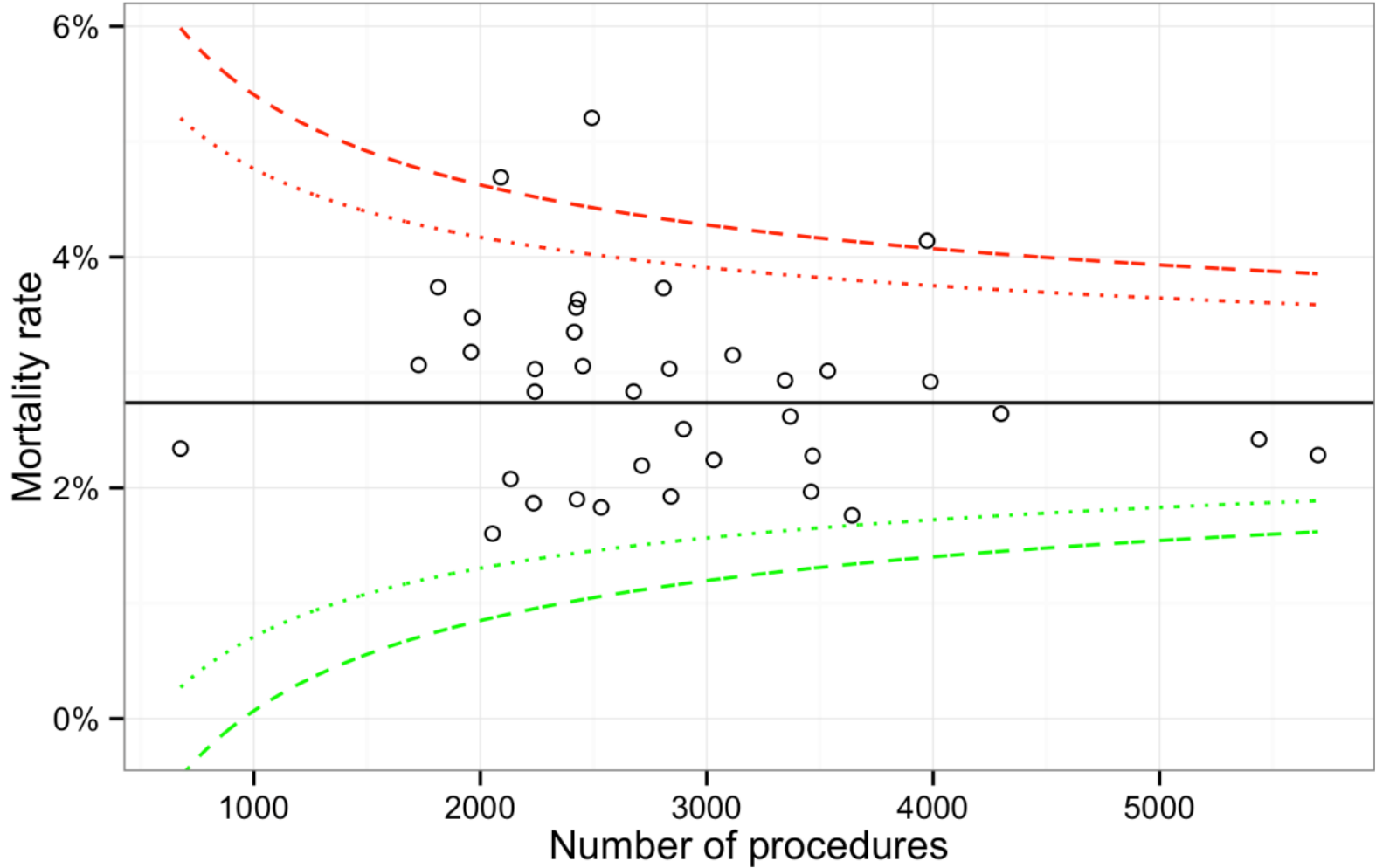
Lower than average

National mean  
2.74%

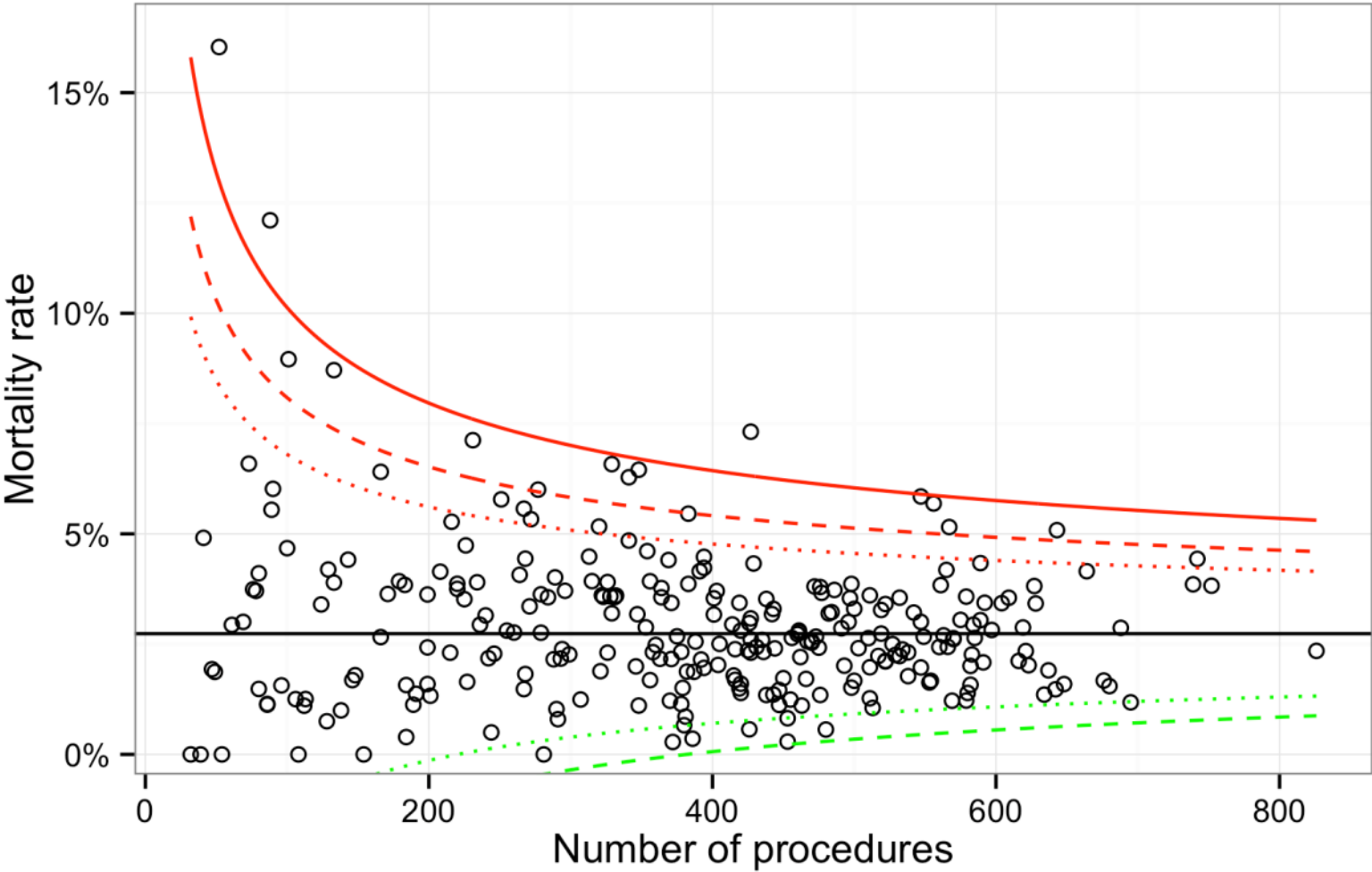
Outliers **above** the 'target' categorised as **yellow** (low level) / **amber** (higher level) / **red** (alert)



# Results: hospitals



# Results: consultants



# Conclusions

- Identifying 'outlier' healthcare providers is **methodologically** (and politically) **challenging**
- **Combining** clinical and analytical **expertise** can reduce errors in classification
- An 'outlier' **does not necessarily imply poor practice**; can be attributable to data quality or case mix
- Future analyses to explore using more sophisticated statistical methodology