Surgeon-level reporting and risk-adjustment

Clinical Effectiveness Unit

Royal College of Surgeons of England

Kate Walker
Jan van der Meulen
Nigel Scott
Kimberley Greenaway

Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- **Why adjust?**
- How to adjust
- Risk adjustment model
- Comorbidity
- Comparison to POSSUM

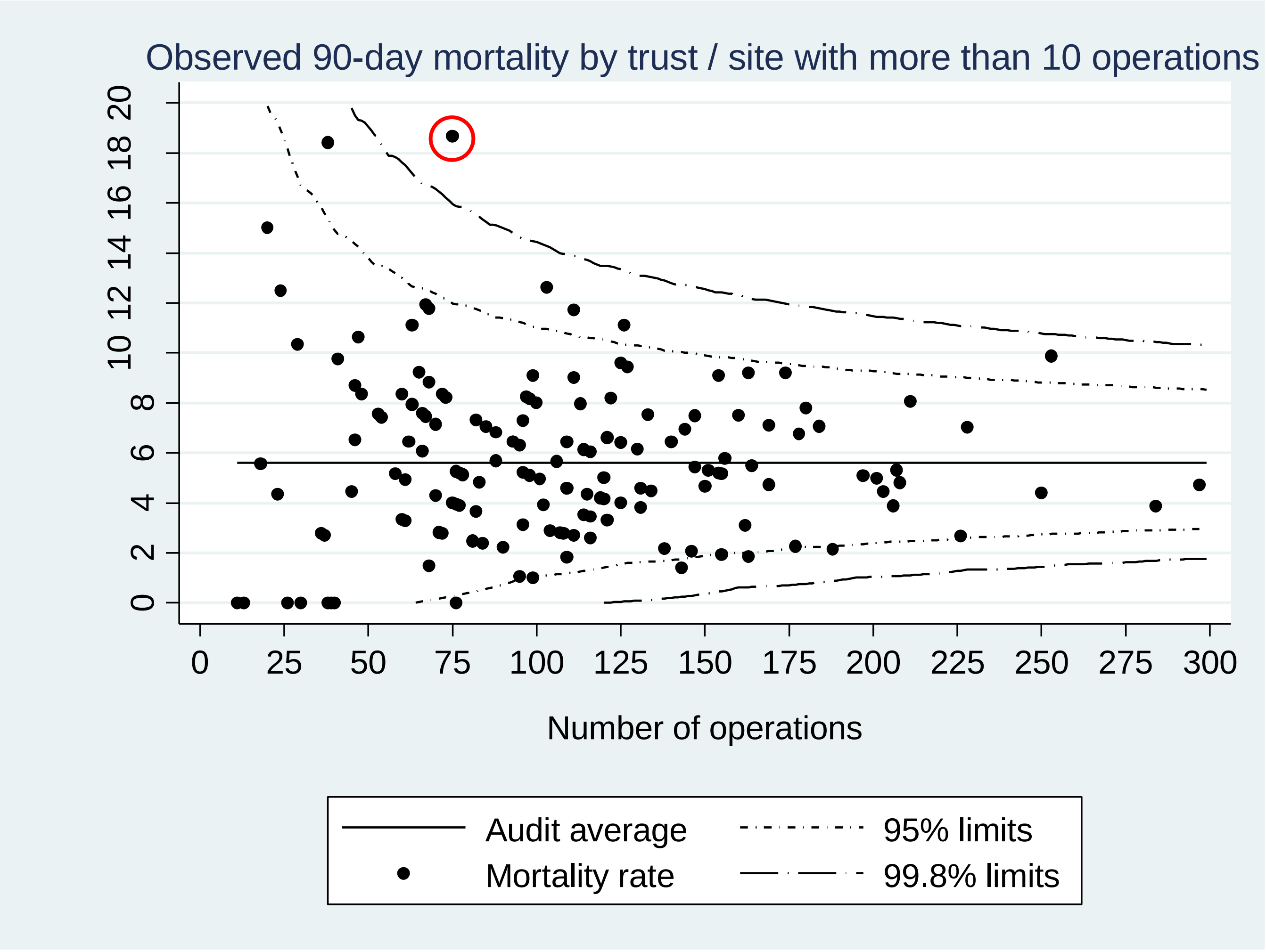
Risk adjustment

Why adjust?

- Trusts may have different patient characteristics
- And surgeons may take on different risks of patients
  - eg. older patients, more advanced tumours etc.
  - eg. tertiary referral centres
- Need to adjust for this “case-mix” for fair comparisons of postoperative mortality between surgeons

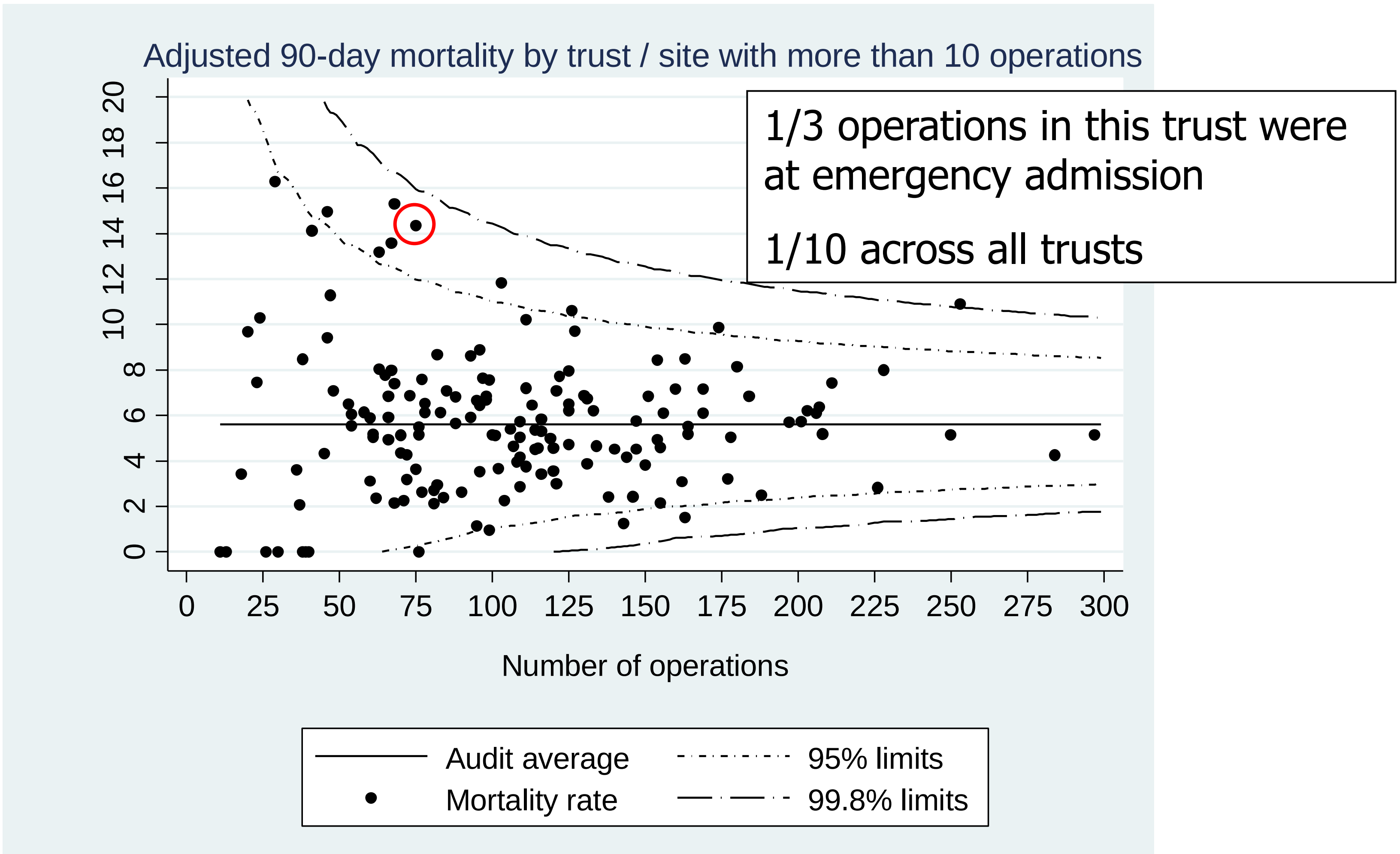
Risk adjustment

Why adjust?



Risk adjustment

Why adjust?



Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- Why adjust?
- **How to adjust**
- Risk adjustment model
- Comorbidity
- Comparison to POSSUM

Risk adjustment

How to adjust

1. Accurately predict mortality for each patient
2. Predict expected no. deaths for the surgeon
3. Adjusted mortality for the surgeon =

$$\frac{\text{Observed no. deaths for surgeon}}{\text{Expected no. deaths for surgeon}} \times \text{overall mortality}$$

More deaths than expected $\longrightarrow$ adjusted is higher
Fewer deaths than expected $\longrightarrow$ adjusted is lower

Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- Why adjust?
- How to adjust
- **Risk adjustment model**
- Comorbidity
- Comparison to POSSUM

Risk adjustment

Risk adjustment model

- Developed and tested on 62,000 cases
- Largest previous model used 7,400 cases
- Includes predictors which:

  - Cannot be influenced by the provider

  e.g. not surgical access, surgical urgency, procedure

  - Are routinely available in clinical data

Risk adjustment

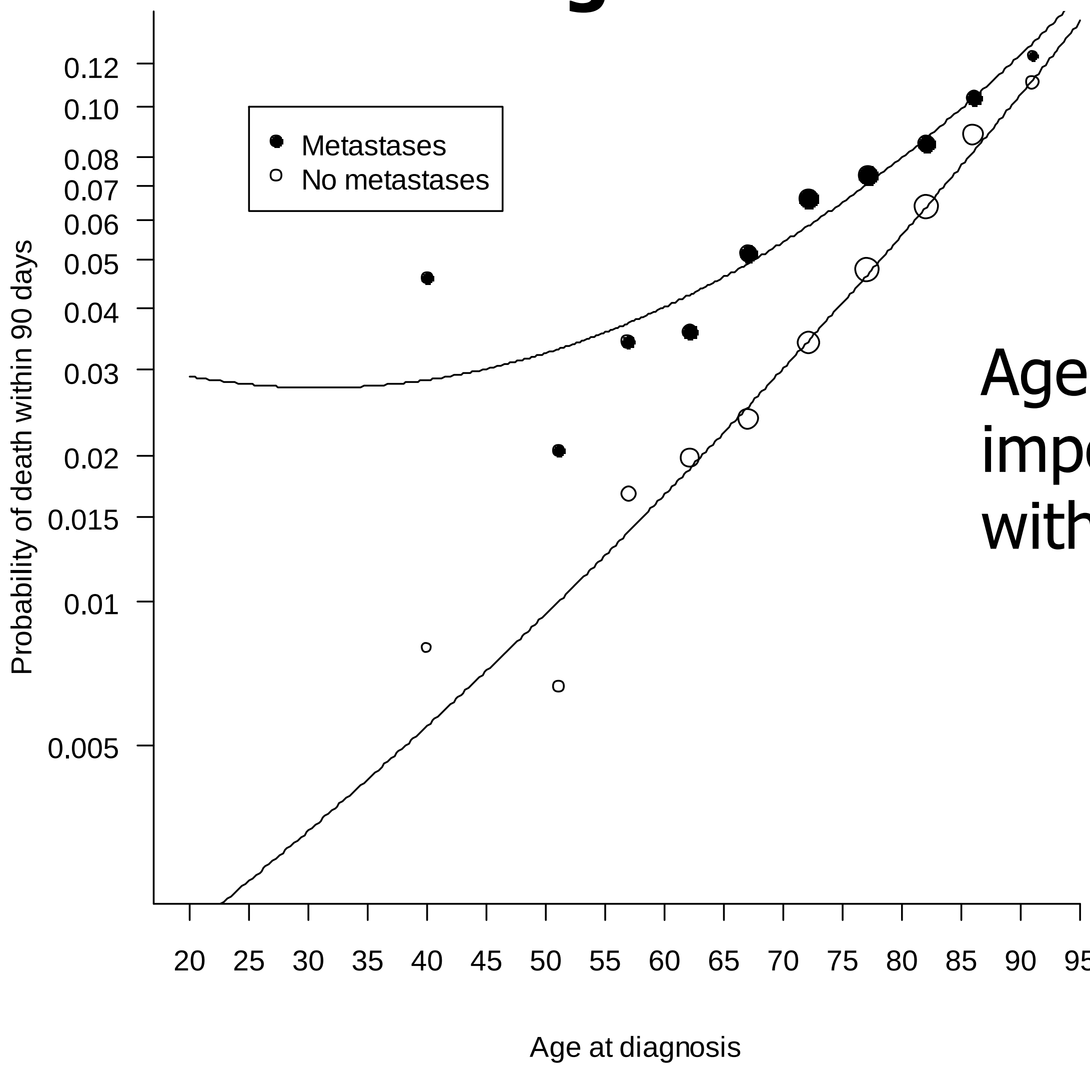
Risk adjustment model

Age	Sex	ASA grade	TNM stage	Cancer site
Calendar year	Mode of admission	No. of comorbidities		

- Model age as continuous (with curvature)
- Allow effect of age to differ by metastases

Risk adjustment

Effect of age on mortality



Age much less important in patients with metastases

Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- Why adjust?
- How to adjust
- Risk adjustment model
- **Comorbidity**
- Comparison to POSSUM

Risk adjustment

Comorbidities

RCS Charlson Score

Criticisms of Charlson Score:

1. Only includes comorbidities recorded at an admission in previous year (HES)
2. Not designed as operative risk score.
3. Not validated in non-vascular abdominal surgery

Risk adjustment

Comorbidities

Only includes comorbidities recorded at an admission in previous year

- Patients do not need to have been admitted to hospital for that comorbidity
- Comorbidity must have been recorded at the time of an admission
  - *including admission for bowel resection*

Risk adjustment

Comorbidities

Not designed as operative risk score.

- Score developed to predict postoperative mortality after a variety of common surgical procedures:

AAA repair   Aortic valve replacement   Total hip replacement   TURP

- Score associated with
  - known risk factors for comorbidity (e.g. age, type of admission)
  - increased length of hospital stay
  - higher mortality (in-hospital and 1-year)

- Inclusion of score improves discrimination of models for mortality (in-hospital and 1-year)

Risk adjustment

Comorbidities

Not validated in non-vascular abdominal surgery

- Now validated on 60,000 patients undergoing major resection for bowel cancer
- Strongly associated with 90-day mortality
  - mortality 2x in patients with 1 comorbidity
  - mortality 3x in patients with 2+ comorbidities

Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- Why adjust?
- How to adjust
- Risk adjustment model
- Comorbidity
- **Comparison to POSSUM**

Risk adjustment

Comparison to POSSUM

- NBOCAP model discriminates well between low and high risk patients: c-index = 0.80
- ACPGBI model has similar discrimination. Includes:

Age-group, ASA grade, Dukes' stage, operative urgency, procedure

- ACPGBI model directly compared to POSSUM in external data has similar discrimination:

	C-index
ACPGBI model	0.70
CR-POSSUM	0.69
POSSUM	0.63
P-POSSUM	0.65

- NBOCAP model has far fewer items to collect than POSSUM

Risk adjustment

Comparison to POSSUM

- NBOCAP model uses 9 risk-factors available in Audit / administrative data
- Model discriminates well
- Other models (e.g. CR-POSSUM) have many items. Some difficult to collect e.g. SBP, Urea, Haemoglobin
- NBOCAP risk-factors likely to be more complete

Outline

Surgeon-level reporting

1. Play of chance

- Volume required to detect poor performance
- Are surgeon volumes sufficient?
- What proportion of outliers have truly poor performance?

2. Risk adjustment

- Why adjust?
- How to adjust
- Risk adjustment model
- Comorbidity
- Comparison to POSSUM

ACPGBI vs. POSSUM reference

Ferjani et al *Lancet Oncol* 2007; 8: 317-322

Articles

A newly devised scoring system for prediction of mortality in patients with colorectal cancer: a prospective study

Ali M Ferjani, Damian Griffin, Nigel Stallard, Ling S Wong

Summary

Background Postoperative morbidity and mortality from colorectal cancer varies widely across hospitals in the UK. We aimed to assess whether a newly developed score from the Association of Coloproctology of Great Britain and Ireland (ACPGBI) could predict mortality from colorectal cancer surgery as accurately as the Physiology and Operative Severity Score for enUmeration of Mortality and morbidity (POSSUM), Portsmouth POSSUM (P-POSSUM), or the ColoRectal POSSUM (CR-POSSUM).

Methods We analysed prospectively 618 patients with histologically confirmed colorectal cancer who had surgery to remove primary tumours done by colorectal surgeons or non-colorectal surgeons in a 3-year period. We compared observed mortality with those predicted by the ACPGBI, POSSUM, P-POSSUM, and CR-POSSUM scoring systems using the Hosmer-Lemeshow test and Receiver Operating Characteristic (ROC) curve analysis.

Findings Between April 1, 2002, and May 31, 2005, 618 consecutive patients with colorectal cancer had surgery to remove primary tumours. Overall observed 30-day mortality over the 3 years was 10·2% (95% CI 8·0–12·9). Overall predicted mortality (mean score) by use of POSSUM was 12·7% (11·7–13·7), by use of P-POSSUM was 4·4% (3·4–5·4), by use of CR-POSSUM was 9·6% (8·6–10·6), and by use of ACPGBI score was 8·1% (7·3–8·8).

Interpretation POSSUM overpredicted mortality, whereas P-POSSUM underpredicted mortality from colorectal-cancer surgery. CR-POSSUM was a more-accurate predictor of mortality in most analyses than was POSSUM and P-POSSUM. Although CR-POSSUM gave the closest prediction of overall mortality, analyses of subgroups of patients showed that ACPGBI score predicted overall mortality most accurately.

Lancet Oncol 2007; 8: 317–22

Published Online
March 1, 2007
DOI:10.1016/S1470-2045(07)70045-1

See Reflection and Reaction page 282

Department of Surgery, Walsgrave Hospital, Coventry, UK (A M Ferjani FRCS, L S Wong FRCS); **and Warwick Medical School, Coventry, UK** (Prof D Griffin FRCS, Prof N Stallard PhD)

Correspondence to:
Mr Ling S Wong, University Hospitals Coventry and Warwickshire NHS Trust, Clifford Bridge Road, Coventry CV2 2DX, UK
ling.wong@uhcw.nhs.uk

Charlson reference

Armitage et al *Br J Surg* 2010; 97: 772-781

Original article

Identifying co-morbidity in surgical patients using administrative data with the Royal College of Surgeons Charlson Score

J. N. Armitage[1] and J. H. van der Meulen[1,2] on behalf of the Royal College of Surgeons Co-morbidity Consensus Group

[1]Clinical Effectiveness Unit, The Royal College of Surgeons of England, and [2]Health Services Research Unit, London School of Hygiene and Tropical Medicine, London, UK

Correspondence to: Dr J. H. van der Meulen, Clinical Effectiveness Unit, The Royal College of Surgeons of England, 35–43 Lincoln's Inn Fields, London WC2A 3PE, UK (e-mail: jan.vandermeulen@lshtm.ac.uk)

Background: Surgical outcomes are influenced by co-morbidity. The Royal College of Surgeons (RCS) Co-morbidity Consensus Group was convened to improve existing instruments that identify co-morbidity in International Classification of Diseases tenth revision administrative data.

Methods: The RCS Charlson Score was developed using a coding philosophy that enhances international transferability and avoids misclassifying complications as co-morbidity. The score was validated in English Hospital Episode Statistics data for abdominal aortic aneurysm (AAA) repair, aortic valve replacement, total hip replacement and transurethral prostate resection.

Results: With exception of AAA, patients with co-morbidity were older and more likely to be admitted as an emergency than those without. All patients with co-morbidity stayed longer in hospital, required more augmented care, and had higher in-hospital and 1-year mortality rates. Multivariable prognostic models incorporating the RCS Charlson Score had better discriminatory power than those that relied only on age, sex, admission method (elective or emergency) and number of emergency admissions in the preceding year.

Conclusion: The RCS Charlson Score identifies co-morbidity in surgical patients in England at least as well as existing instruments. Given its explicit coding philosophy, it may be used as a co-morbidity scoring instrument for international comparisons.

Paper accepted 28 October 2009

Published online 19 March 2010 in Wiley InterScience (www.bjs.co.uk). **DOI:** 10.1002/bjs.6930

90-day postoperative mortality

- Deaths in and out of hospital
- 90-day not 30-day

90-day mortality

- Captures all 30-day deaths + more (esp. in young)
- Short-term follow-up -> most deaths will be as a result of surgery

  - Visser et al showed that most deaths within 90 days had postop complication
- Should they have had surgery if were going to die within 90 days, even if not as a result of surgery?
- Greater accuracy (more events)

90-day mortality reference

Visser et al *Arch Surg* 2009; 144: 1021-1027

ORIGINAL ARTICLE

Death After Colectomy

It's Later Than We Think

Brendan C. Visser, MD; Hugh Keegan, BS; Molinda Martin, BSN; Sherry M. Wren, MD

Background: Clinical outcomes are increasingly subject to objective assessment and professional accountability. Informed consent relies on accurate estimation of operative risk. Current scoring systems for assessment of operative mortality after colorectal surgery (CRS) almost uniformly report 30-day mortality and may not represent true risk.

Design: Prospective cohort.

who underwent CRS, including 148 patients who underwent elective procedures (79.6%) and 38 patients who underwent emergency procedures (20.4%). All but 8 patients were men, with a median age of 67 years (range, 26-92 years). Laparoscopic operations comprised 24.2% and open operations comprised 75.8%. Most (60.8%) were performed for neoplasms. The actual 30-day mortality rates (all, elective, and emergency procedures) were 4.3%, 1.4%, and 15.8%, respectively.

Risk adjustment

Modelling stage

Dukes'

A

B

C

D

TNM

T1/T2 → T3/T4

N0 → N1/N2

M0 → M1