Using indicators to describe the quality and safety of New Zealand hospitals

Enhancing Hospital Outcomes (EcHO) study - Work in progress

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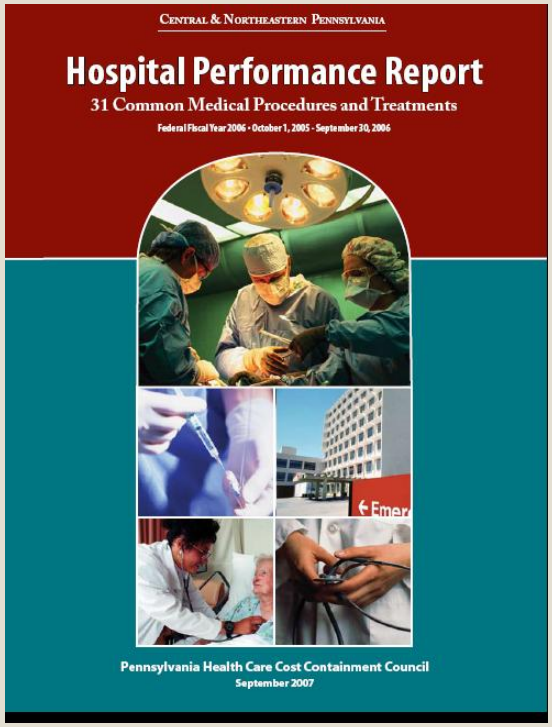
Outline

- Indicators
- Aims and methods
  - Preparation of indicators
  - Development and selection of indicators
- Empirical analyses
  - Benchmarking
  - Descriptive results
  - Risk adjustment and Bayesian modeling

Indicators using administrative data

- Many advantages
  - International experience developing, measuring and reporting indicators as key measures of hospital quality
  - All hospitals included
  - Existing definitions, collection processes.
  - Easy/cheap
- Limitations
  - Collected for other purposes
  - Limited data
  - Not definitive…



Theme aim and hypotheses

- Use indicators to describe inpatient quality and safety across public hospitals (2001-2009)
- For each indicator it is hypothesised that there is variation in appropriately adjusted results for:
  - Hospitals in the same year
  - A hospital over the study period
  - Similar groups of hospitals in a year and over the study period

Key steps

- Preparation of datasets and data linkage
- Development of indicators
- Empirical analyses

Preparation of datasets and indicators

- Obtain datasets and linkage (NMDS; Mortality)
  - Stage 2 (Non-admitted NNPACS; Cancer Registry; Bookings NBRS)
- Data filtering (deletion duplicates, errors, well babies, rehab etc)
- Selection of core list of 35 hospitals (3 groups; med/surg; >500 admissions/yr; closures)
- Use of Bestgrid computing platform

Development of indicators

- Literature review
  - Systematic search to identify potential indicators
  - Find studies assessing indicator validity and reliability (clinical panel review, predictive modeling, clinical record review and published empirical analyses)
  - Selection based on criteria (quality dimension, relevance to hospitals and NZ datasets, validation and reliability)

- Coding review
  - Definitions of indicators and ensure correspondence between concepts and coding practices in NZ
  - Coding of indicators with SAS for ICD-9-AM and ICD-10-AM (v3)
  - Validation by medical record review

Selected quality and safety indicators – 137

- 18 Patient safety indicators
- 15 Other specific indicators – e.g. ulcers, SMR

- Mortality
- Readmission
- Length of stay
- Throughput

26 each:
- all admissions
- medical admissions
- surgical admissions
- 23 conditions/procedures

Indicator definitions

Example PSI 9: Postoperative haemorrhage or haematoma

Numerator	Discharges with ICD-10-AM codes for postoperative haemorrhage or postoperative hematoma in any secondary diagnosis field AND code for postoperative control of haemorrhage or drainage of hematoma (respectively) in any secondary procedure code field per 100 surgical discharges. Procedure code for postoperative control of haemorrhage or hematoma must occur on the same day or after the principal procedure.
Denominator	All surgical discharges aged 18 years or over defined by an ICD-10-AM procedure code for an operating room procedure or anaesthetic. Exclude all obstetric admissions (MDC 14 and 15) or episodes with an ICD-10-AM diagnosis code for postoperative haemorrhage or haematoma in the principal diagnosis field or episodes where the only operating room procedure is postoperative control of haemorrhage or drainage of haematoma.

Medical record validation

- Indicator positive medical records reviewed in one hospital – ongoing for all PSIs
- Results PPV for some high e.g. postoperative PE/DVT 82% (n=160). Others lower e.g. postoperative haemorrhage/haematoma 67% (n=412).
- Common errors are present on admission or minor conditions.

Empirical analyses

- Benchmarking
- Assess rates over time, variation among hospitals
- Develop methods to account for differences in risk (propensity scores)
- Develop methods to consider random variation (Bayesian modeling)

Benchmark admission rates

Rates – admission rates per 100 resident population	NZ	Aust
Asthma record	0.17	0.18
Cerebrovascular accident (stroke) record	0.24	0.27
Acute myocardial infarction record	0.28	0.42
Pneumonia record	0.34	0.33
Gastrointestinal haemorrhage record	0.14	0.16
Chronic obstructive pulmonary disease record	0.23	0.27
Diabetes record	0.25	0.39
Oncology – breast, lung, colon/rectum record	0.18	0.35
Congestive heart disease record	0.17	0.22
Appendectomy record	0.13	0.14
Cholecystectomy record	0.11	0.22
Coronary artery bypass graft record	0.03	0.13
Percutaneous transluminal coronary angioplasty record	0.11	0.17
Large bowel resection record	0.06	0.11
Prostatectomy record	0.10	0.14
Hip replacement record	0.12	0.16
Hysterectomy record	0.13	0.14
Knee replacement record	0.07	0.18
Cataract surgery record	0.22	0.88
Tonsillectomy record	0.08	0.26
Caesarean section delivery record	0.94	0.42

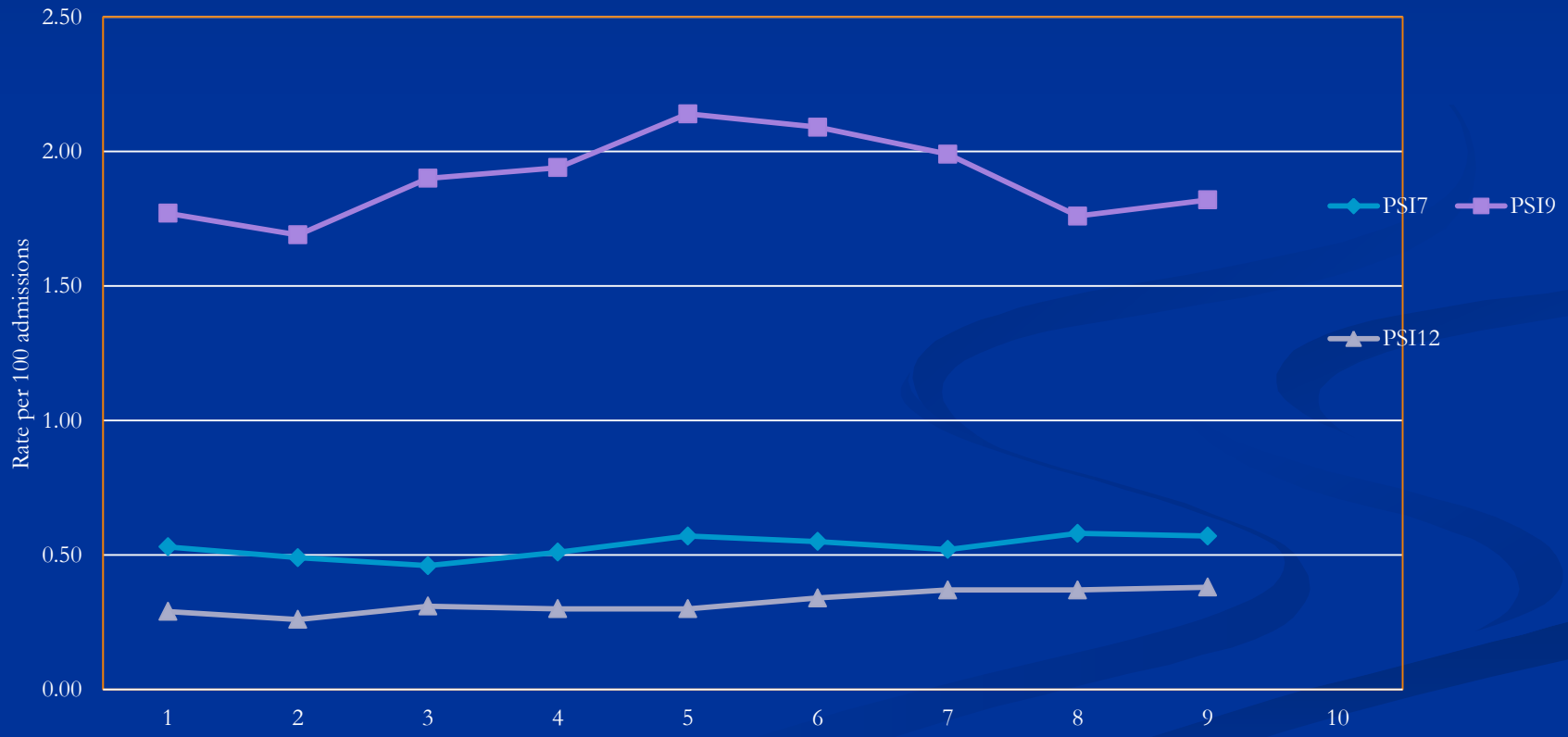
Benchmarking PSIs

PSI (2007)	Other countries	Min rate %	Max rate %	NZ rate %
FB left from procedure	14	0.002	0.011	0.009
Medical infection	15	0.04	0.44	0.43
Post-op PE/DVT	14	0.11	1.45	0.82
Post-op sepsis	15	0.14	8.01	0.51
Accidental puncture	14	0.013	0.40	0.36
Obstetric trauma instrument	16	1.56	16.6	7.05
Obstetric trauma non-instrument	17	0.19	6.68	1.70

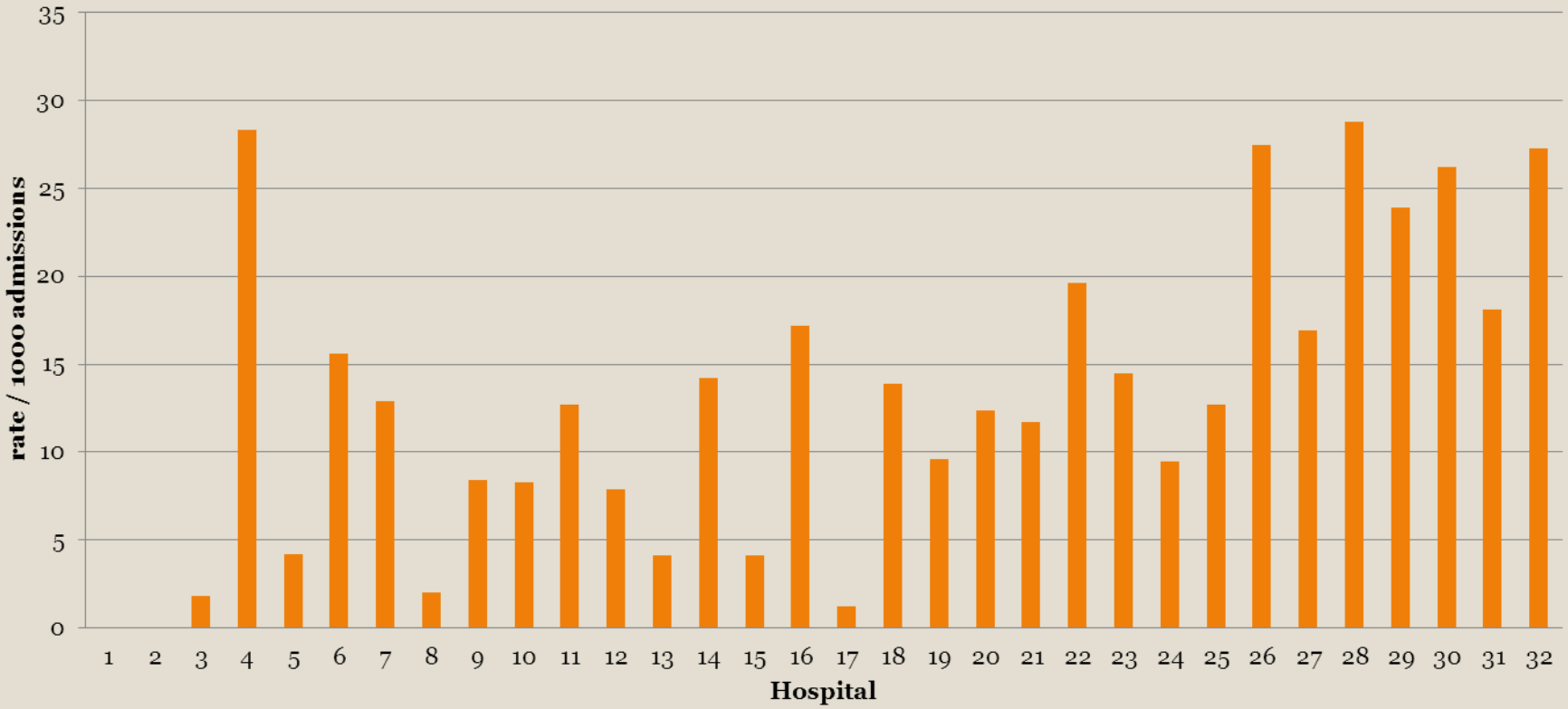
Source: OECD 2008

Assessing PSI rates over time

Rates of PSI7 infections, PSI9 postop haemorrhage and PSI12 postop DVT/PE



Variation across hospitals



Risk adjustment and Bayesian modeling

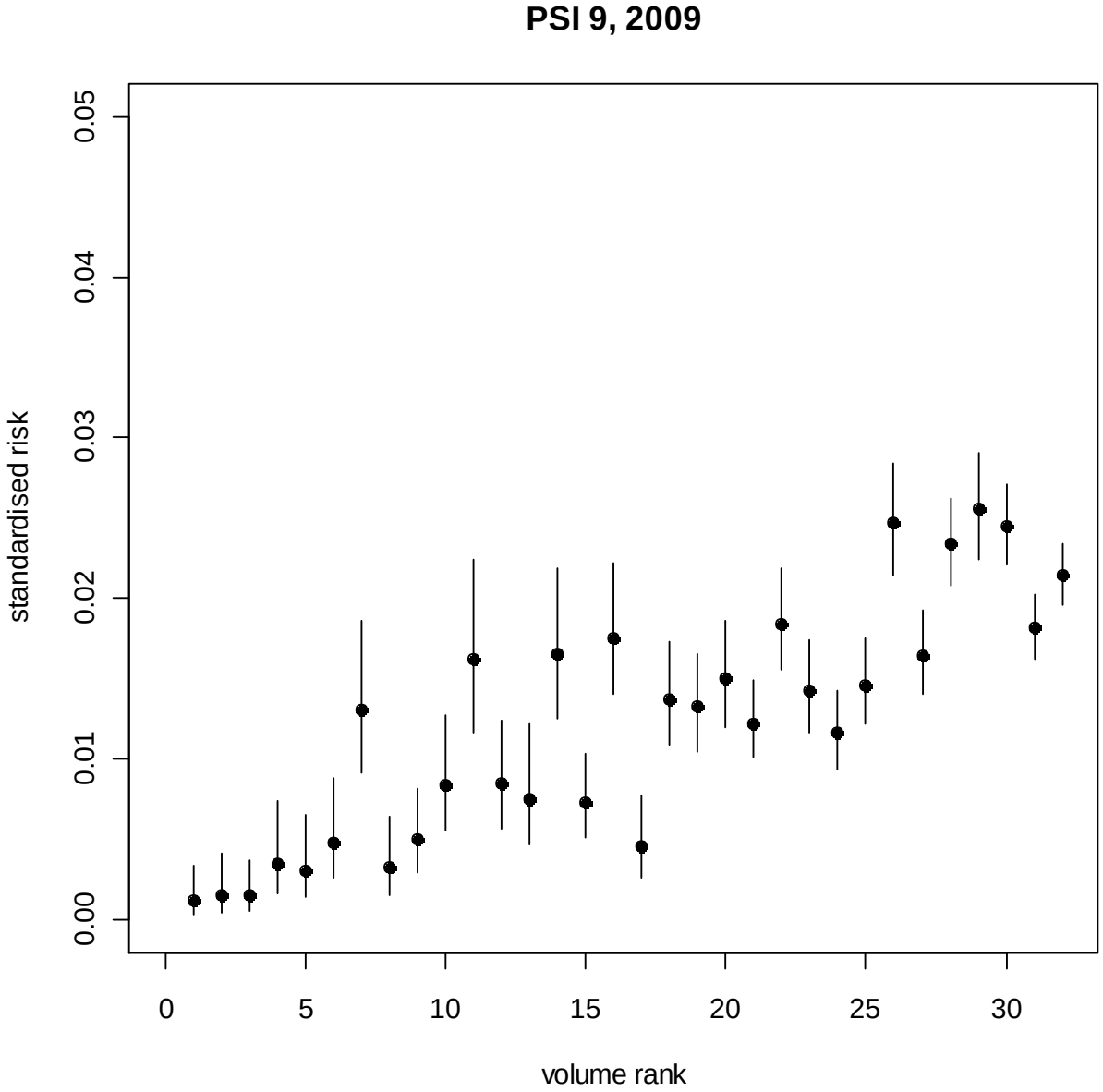
Risk adjustment – propensity scores to summarise case mix confounders (age, sex, ethnicity, deprivation, comorbidities)

Hierarchical Bayesian models – allows for pooling of information to take account of hospital covariates and address random variation:

- Hospitals – type, size

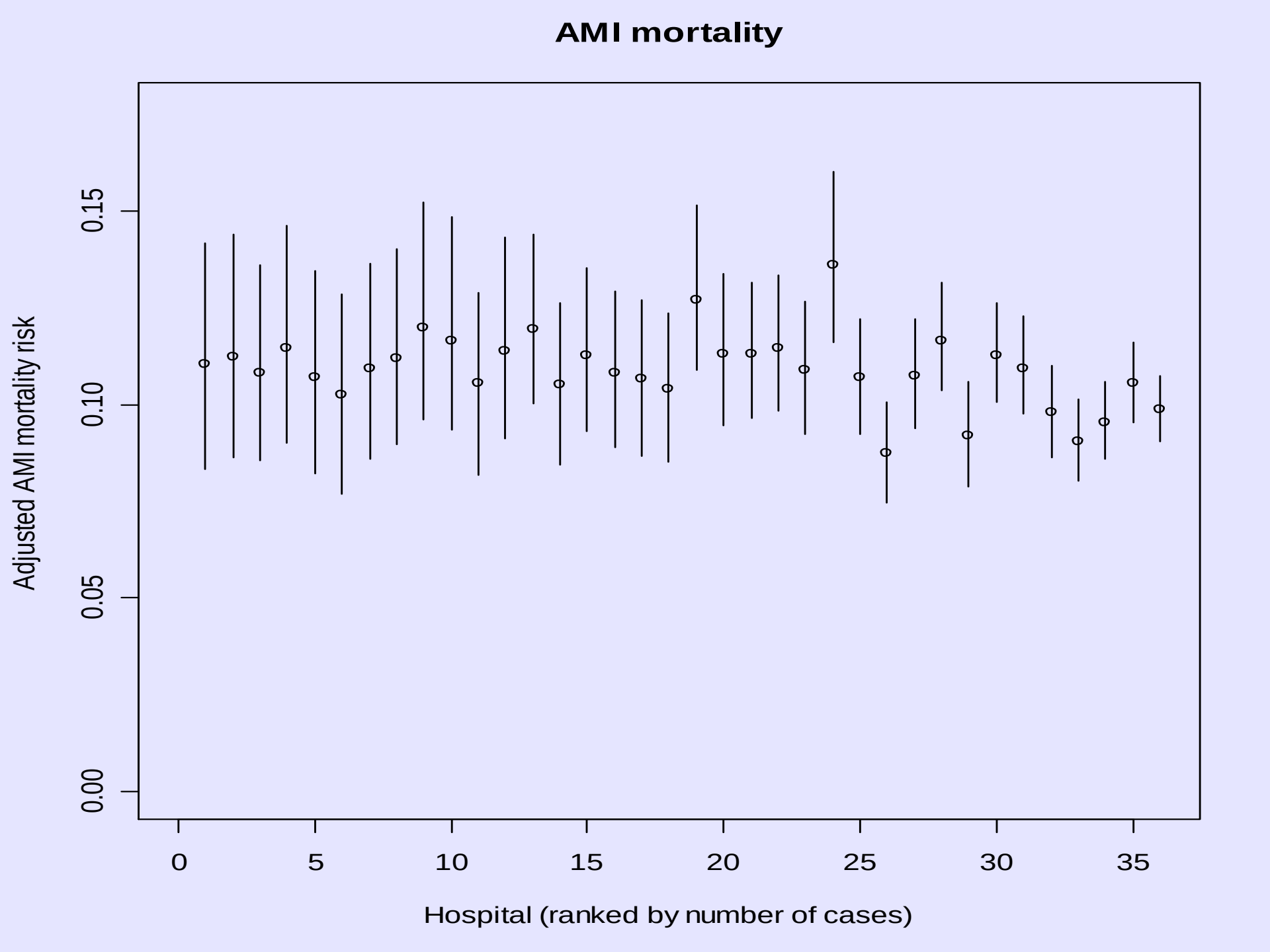
Hierarchical Bayesian estimates of case-mix adjusted PSI9 risk across NZ hospitals in 2009

	PSI9 Postoperative haemmorhage or haematoma	
Quintile	Pt. est.	95% CI
10%	0.27%	0.16% - 0.41%
25%	0.57%	0.41% - 0.75%
Median (50%)	1.29%	1.14% - 1.43%
75%	1.73%	1.57% - 1.91%
90%	2.28%	2.11% - 2.45%


PSI 9, 2009
standardised risk
0.00
0.01
0.02
0.03
0.04
0.05
0
5
10
15
20
25
30
volume rank

AMI mortality

Contrast	HB	
	Estimate	95% CI
Rel. Risk		
Max v Min	1.7	1.4, 2.2
90% v 10%	1.4	1.2, 1.6
75% v 25%	1.2	1.1, 1.3
Risk Diff.(%)		
Max v Min	5.9	3.7, 8.8
90% v 10%	3.3	2.1, 4.8
75% v 25%	1.7	1.0, 2.6


AMI mortality
Adjusted AMI mortality risk
0.00
0.05
0.10
0.15
0
5
10
15
20
25
30
35
Hospital (ranked by number of cases)

Summary

- A range of indicators have been adapted to assess the performance of NZ public hospitals 2001 – 2009
- The indicators are undergoing extensive empirical investigation
- Preliminary results suggest that there is considerable variation among hospitals in adjusted rates of patient safety indicators although many are relatively infrequent events
- Variation between hospitals in adjusted mortality indicators is relatively lower than PSIs but events are more common.

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Supplement: List of Indicators 1

- 18 Patient safety indicators

1. Complications of anaesthesia	7. Selected infections due to medical care	13. Postoperative sepsis
2. Death in low mortality drgs	8. Postoperative hip fracture	14. Postoperative wound dehiscence
3. Decubitus ulcers	9. Postoperative haemorrhage or haematoma	15. Accidental puncture or laceration
4. Failure to rescue	10. Postoperative physiologic and metabolic derangement	16. Transfusion reaction
5. Foreign body left during procedure	11. Postoperative respiratory failure	17. Birth trauma - injury to neonate
6. Iatrogenic pneumothorax	12. Postoperative pulmonary embolism or dvt	18. Obstetric trauma

List of Indicators 2

- 15 Other specific indicators - **ulcers**, SMR

Ambulatory sensitive hospitalisations (ASH, 20)	Diabetes Complications	SMR (Standardised mortality ratio)
1. Chronic (8)	<u>Short term</u>	RSI (Relative Stay index)
2. Acute (10)	1. Ketoacidosis	
3. Vaccine preventable (2)	2. Coma	
	<u>Long term</u>	
	1. Renal	
	2. Ophthalmic	
	3. Peripheral circulatory	
	4. Neurological	
	5. Unspecified	
	6. Other	

List of Indicators 3

- Mortality (74)

1.	In hospital death				
2.	30d post-admission mortality				
3.	60d post-admission mortality				
4.	<u>Avoidable mortality (x 71)</u>				
a.	Infections (6)	f.	Cardiovascular (6)	j.	Maternal (3)
b.	Neoplasms (17)	g.	Genitourinary (3)	k.	Unintentional injuries (6)
c.	Nutritional (3)	h.	Respiratory (4)	l.	Intentional injuries (3)
d.	Drug use (3)	i.	Digestive (4)	m.	Other (11)
e.	Neurological (2)				

List of Indicators 4

- Readmission
  - Planned
  - Unplanned
- Length of stay
- Throughput
  - Number of admissions (inpatient/daystay)
  - Utilised beds
  - Emergency admissions

List of Indicators 5 - Conditions

- Asthma, Heart failure, Myocardial Infarction, Stroke, pneumonia, Chronic Obstructive Pulmonary Disease, Diabetes, Gastro-intestinal haemorrhage, 3 cancers

- As well as . . .
  - Sleep apnoea
  - Mental health
  - Cot death

List of Indicators 6 - Procedures

- Appendectomy, cholecystectomy, coronary bypass, coronary angioplasty, bowel resection, prostatectomy, hip and knee replacements, hysterectomy, cataract removal, tonsillectomy, caesarean section.

- As well as . . .
  - Dialysis, Chemotherapy, Blood transfusion, Lithotripsy, Colposcopy, Cystoscopy, Colonoscopy, Endoscopic retrograde cholangiopancreatography, Bronchoscopy, Gastroscopy