HPA

HEALTH POLICY ANALYSIS

Cost impact of hospital acquired diagnoses

Authors: Jim Pearse, Deniza Mazevska,
Akira Hachigo, Terri Jackson

ABF Conference 2014

HPA

HEALTH POLICY ANALYSIS

Acknowledgements

Authors:

- Jim Pearse, Deniza Mazevska, Akira Hachigo - Health Policy Analysis
- Dr Terri Jackson, Northern Clinical Research Centre, University of Melbourne

Project sponsored by:

- Australian Commission on Safety and Quality in Health Care (ACSQHC)
- Independent Hospital Pricing Authority (IHPA)
- Joint Working Party on Safety and Quality

Specific thanks for input from:

- Janelle Painter IHPA
- Luke Clarke IHPA
- Caroline Coevoet IHPA
- Joanne Fitzgerald IHPA
- Luke Slawomirski ACSQHC

HPA
HEALTH POLICY ANALYSIS

Broader study questions

Questions specifically addressed by the study:

1. How well is the condition onset flag (COF) reported by hospitals?
2. What can we say about the quality of coding of COF?
3. How should the codes be interpreted?
4. What is the impact on Diagnosis Related Group assignment (using AR-DRGs) if hospital-acquired diagnoses are excluded?
5. What additional costs and/ or length of stay are there associated with hospital-acquired diagnoses, on a subset of DRGs?

Additional questions implicated by the analysis of COF:

6. What is the potential for hospitals to use the COF for monitoring patient safety?
7. How could the COF information be improved?

HPA
HEALTH POLICY ANALYSIS

Issue addressed in this presentation

- Estimates incremental impact of the presence of hospital-acquired conditions, both within the sample and scaling this to reflect all acute episodes allocated to the selected conditions/interventions (mapped to Adjacent DRGs) in public and private hospitals.
- Methods adopted
- Results

HPA
HEALTH POLICY ANALYSIS

The Condition Onset Flag (COF)

- Variables collected in hospital morbidity data sets.
- Recorded as a flag against each diagnosis for a patient, identifying:
  - Those that were pre-existing at the time of the patient's admission to hospital.
  - Those arising during the hospital stay (**referred to as hospital-acquired diagnoses/conditions or COF diagnoses** in the report).
- Has been collected in a standardised way on a national basis in Australia since 1 July 2008.

HPA
HEALTH POLICY ANALYSIS

Reporting of COF

% of episodes by sector

Sector	Percentage of episodes with at least one COF diagnosis reported		
	2009-10	2010-11	2011-12
Public hospitals	6.3%	7.9%	8.4%
Private hospitals	3.4%	3.8%	6.9%
Total	5.1%	6.3%	8.2%

HPA
HEALTH POLICY ANALYSIS

What are the limitations of the COF?

- Conditions acquired during hospitalisation are not necessarily conditions that can be prevented.
- Some hospital-acquired conditions relate to complications of the primary conditions leading to the hospital admission, rather than hospital care itself (e.g. vasospasm in SAH).
- But: Many hospital-acquired conditions have been shown to be amenable to a reduction in their rates in the literature.
- The COF is applied to diagnoses in the context of a **single episode of care**.
- The COF is **not applied to procedures.** Procedures arising from COF diagnoses are not identified.

HPA
HEALTH POLICY ANALYSIS

Data sources

- Admitted Patient Care (APC) National Minimum Data Set (NMDS):
  - Not reported on in this paper

- National Hospital Cost Data Collection (NHCDC):
  - Used for the analysis presented in this paper
  - NHCDC represents a sample of around 80% of APC episodes
  - Cost/LOS analysis constrained to:
    - Public hospitals reporting COF in AIHW peer groups A1 to C2 (Excluded hospitals with no reporting of COF)
    - Episodes with a care type of acute/newborn care with 'qualified' days
    - Financial year 2011-12
    - Selected (49) high volume AR-DRGs (22 ADRG)

HPA
HEALTH POLICY ANALYSIS

Sample examined

General Characteristics	Total sample	
	n	%
Total Episodes	406,401	100.0%
Any CoF diagnosis*	68,343	16.8%
PPCL:		
0	232,220	57.1%
1	2,255	0.6%
2	47,577	11.7%
3	59,787	14.7%
4	64,562	15.9%
Emergency Admission Status	302,423	74.4%
Day only admissions	64,171	15.8%
Transfer in < 2 days	13,051	3.2%
Episode ends with death	9,262	2.3%
Age Group:		
00-14 years	10,280	2.5%
15-44 years	77,462	19.1%
45-69 years	159,580	39.3%
70-84 years	116,737	28.7%
85 years +	42,342	10.4%

HPA
HEALTH POLICY ANALYSIS

Pre analysis processing

- Applications of the data cleansing algorithm developed by Jackson et al. 2009 related to the CHADx research.
  - Groups sequences of codes where these reflect a single underlying concept/diagnosis.
  - Picks up some additional diagnoses (maternity/newborns) which are, by their nature, likely to be hospital acquired (false negatives).
  - Removes some additional diagnoses which are, by their nature, unlikely to be hospital acquired (false positives) (e.g. neoplasms).
- Grouping hospital acquired diagnoses into:
  - Individual CHADx classes
  - Major CHADx groups
  - Subgroup of CHADx

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Methods

- Important to emphasise the methodological challenges
- Biases:
  - Selection bias: The comparison between the complicated and uncomplicated cases are driven by other factors that are not controlled for.
  - Endogeneity bias: Longer lengths of stay may be a 'causal' factor leading to incident cases on COF diagnoses, not the other way around (or there may be two way causation).
- Interaction between the underlying condition and the hospital acquired conditions
  - For example, there are many types of hospital acquired conditions and relative prevalence and impacts may vary between the many different underlying conditions.

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Methods

- Interaction between hospital acquired conditions
  - In most cases, episodes have more than one type of hospital acquired condition. Therefore, there is a need to control for presence of more than one type of condition.

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Methods

- General approach
  - Regression model run for each selected Adjacent DRGs
  - Generalized Linear Model (GLM) estimation with a log link function and a gamma distribution (OLS also estimated).
  - Repeated measures on hospital ID
  - Analysis at the adjacent DRG level, with PCCL as a control variable
  - Broad range of control variables:
    - Which are not 'contaminated' by the COF diagnoses. E.g. DRG assigned after removing COF diagnoses was used.
  - Range of different models in which COF diagnoses were introduced. These included models that estimated the impact of specific hospital acquired conditions, controlling for presence of other conditions.

HPA
HEALTH POLICY ANALYSIS

Specification of models estimated

OLS estimation

MODEL A1: $$Cost_i = \propto + \beta_1 COF_i + \sum_m \gamma_k Control_{ki} + \mu \quad (1)$$

MODEL A2: $$Cost_i = \propto + \sum_n \beta_j MCHADx_{ji} + \sum_m \gamma_k Control_{ki} + \mu \quad (2)$$

GLM estimation

MODEL A2: $$Cost_i = \exp(\propto + \sum_n \beta_j MCHADx_{ji} + \sum_m \gamma_k Control_{ki}) \quad (9)$$

Control variables

- PCCL
- Patient age (4 groups)
- Emergency admission status
- Discharge status of death
- Same day episodes

HPA
HEALTH POLICY ANALYSIS

Derivation of estimates

- Challenge with GLM vs OLS: Can't directly interpret the estimated coefficients.
- Approach taken:
  - Estimated parameters applied to each observation to identify the predicted cost/LOS.
  - Predicted costs compared for an episodes with same characteristics with and without COF diagnoses (or various combinations).
  - Preference for median differences rather than mean differences (as means are impacted by significant outliers).
  - For median comparisons GLM approach usually results in slightly more modest estimates of effects compared with OLS.

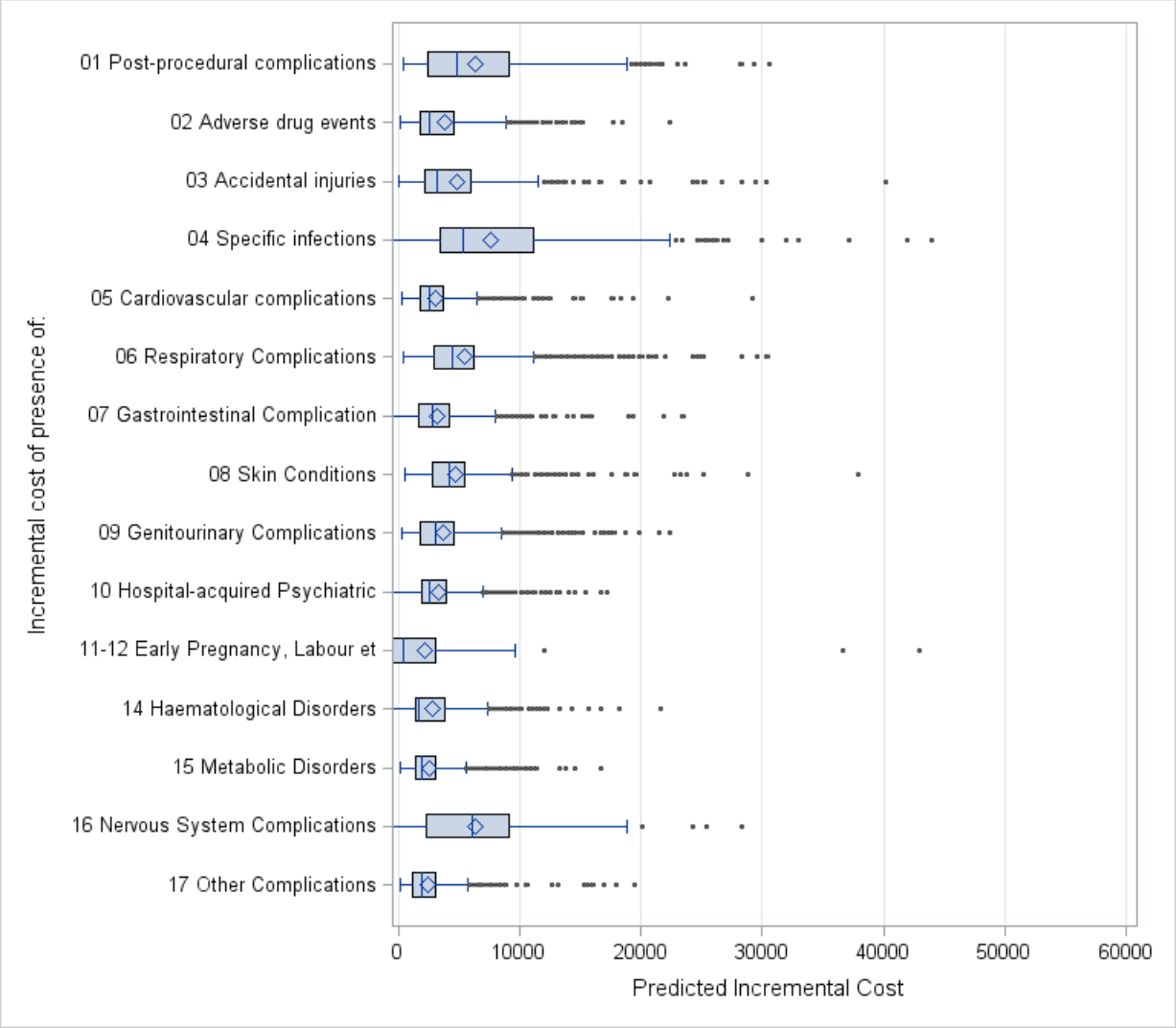
HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Results

- Mean incremental impact of the presence of any COF diagnosis was estimated to be $9,244 and 5.3 days.
- The median incremental cost impact of the presence of any COF was estimated to be $6,710.
- Many of these episodes have more than one hospital acquired diagnosis reported, so these estimates reflect the combined impact of all hospital acquired conditions present within a particular episode.

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Results



HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Results

- Costs of specific hospital acquired conditions were also estimated.
- High cost per episode:
  - Methicillin resistant agent - $9,208
  - Injury due to assault - $15,032.
- The numbers of episodes with these conditions was between 17 and 967. As a consequence, the total cost impact of these conditions was not always very high.

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact - Results

- Lower cost per episode, but higher total cost:
  - Pressure ulcers (1,866 episodes) - $10.9 million
  - Electrolyte disorders without dehydration (9,808 episodes) - $27.4 million.

- In setting priority for safety initiatives, in may be beneficial to consider conditions that have a relatively low cost impact on the individual episode of care, but are common.

HPA
HEALTH POLICY ANALYSIS

What additional costs and/ or length of stay are associated with hospital-acquired diagnoses?

	Episodes with COF diagnoses	GLM mean cost impact $	Total cost estimate $m	GLM mean length of stay impact (days)
Selected hospital acquired conditions with high cost per episode impact				
3.04 Injury due to assault	87	15,032	1.31	3.9
1.08 Disruption of wound	649	12,200	7.92	5.3
1.20 Post-procedural disorders: Respiratory system	967	10,604	10.25	2.5
1.06 Foreign body or substance left following procedure	17	9,821	0.17	1.6
2.17 Anaphylactic shock due to correct drug properly administered	68	9,447	0.64	2.8
4.03 Methicillin resistant agent	123	9,208	1.13	3.6
Selected hospital acquired conditions with high total cost impact				
15.02 Electrolyte disorders w/o dehydration	9,808	2,797	27.43	1.1
5.03 Cardiac arrythmias, conduction disturbances & abnormal heart beat	8,566	2,335	20.00	3.7
9.02 Urinary tract infection	3,449	4,950	17.07	0.9
5.06 Hypotension	9,331	1,735	16.19	0.8
6.03 Acute lower respiratory infections (incl influenza & pneumonia)	2,742	5,710	15.66	2.6
8.01 Pressure Ulcers	1,866	5,892	10.99	2.8

HPA
HEALTH POLICY ANALYSIS

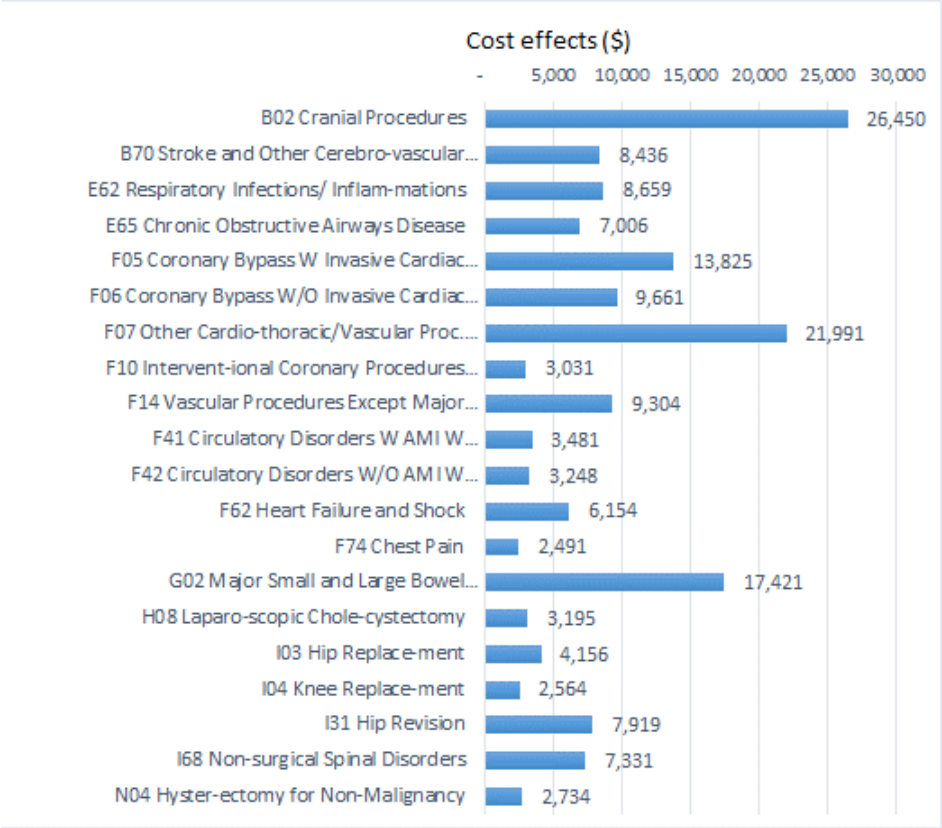
Cost and length of stay impact - Results

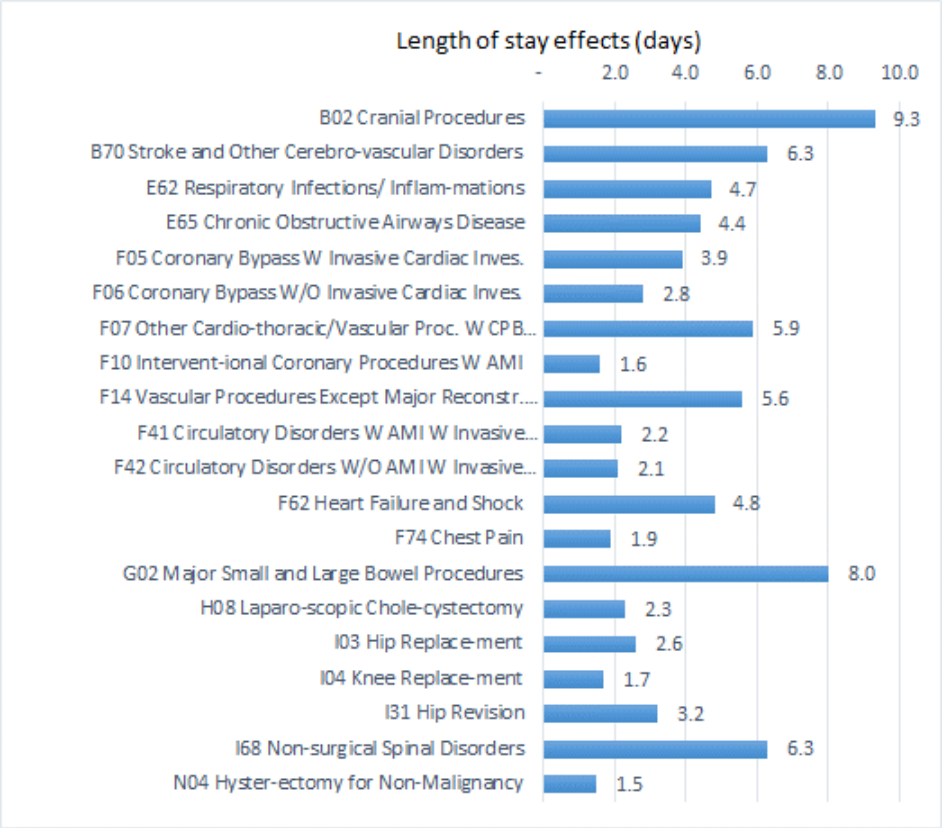
- Overall cost estimates for the selected DRGs:
  - Between 12.0% - 16.5% of costs
  - $634 million - $869 million across Australia

- Impacts varied significantly across Adjacent DRG
- Incidence of hospital acquired conditions varied across Adjacent DRG

HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact of presence of any COF – Results by ADRG





HPA
HEALTH POLICY ANALYSIS

Cost and length of stay impact – Proportion of episodes in which a major CHADx diagnosis is reported

	01 Post-proced-ural comp.	02 Adverse drug events	03 Accidental injuries	04 Specific infections	05 Cardio-vascular comp.	06 Respir-atory Comp.	07 Gastro-intestinal Comp.	08 Skin Conditions	09 Genito-urinary Comp.	10 Hospital-acquired psych. states	11-13 Early Pregnancy, Labour etc	14 Haemat-ological Disorders	15 Metabolic Disorders	16 Nervous System Comp.	17 Other Comp.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
B02 Cranial Procedures	15.7	3.2	1.8	2.3	14.5	7.7	8.4	4.5	10.3	7.7	0.1	3.9	15.7	9.0	17.3
B70 Stroke and Other Cerebro-vasc	1.5	1.8	1.2	1.1	5.6	3.4	3.9	2.3	5.5	2.7	0.0	0.4	4.4	0.8	5.2
E62 Respiratory Infections/ Inflam	0.9	1.9	0.7	0.7	4.3	2.0	2.9	1.6	2.0	1.4	0.0	0.8	3.9	0.2	2.6
E65 Chronic Obstructive Airways D	0.6	1.9	0.8	0.6	3.1	1.5	2.3	1.1	1.4	1.2	0.0	0.3	2.7	0.2	2.9
F05 Coronary Bypass W Invasive C	30.7	4.9	0.8	1.4	41.5	23.8	11.6	4.7	14.3	7.5	0.0	16.9	29.7	1.8	10.0
F06 Coronary Bypass W/O Invasiv	24.4	4.0	0.9	1.0	41.2	25.4	8.8	3.0	12.4	6.8	0.0	14.6	27.3	1.8	8.9
F07 Other Cardio-thoracic/Vascula	26.8	5.3	0.6	2.0	40.2	27.3	11.2	4.7	13.6	5.8	0.1	16.2	32.9	2.2	15.2
F10 Intervent-ional Coronary Proce	10.7	2.1	0.3	0.3	10.4	2.3	2.8	0.9	2.5	1.2	0.0	0.9	3.5	0.3	4.6
F14 Vascular Procedures Except M	9.6	1.6	0.4	0.4	5.2	1.6	1.8	1.3	2.2	0.9	0.0	1.5	3.4	0.4	3.0
F41 Circulatory Disorders W AMI V	5.8	1.8	0.3	0.3	6.0	1.5	2.1	0.8	2.0	0.9	0.0	0.7	2.5	0.3	3.1
F42 Circulatory Disorders W/O AM	3.6	0.8	0.1	0.1	2.8	0.5	0.7	0.4	0.7	0.3	0.0	0.2	1.1	0.1	1.9
F62 Heart Failure and Shock	1.2	2.5	1.1	0.5	5.6	2.1	3.0	1.8	3.9	1.4	0.0	0.6	4.8	0.4	3.1
F74 Chest Pain	0.1	0.3	0.1	0.0	0.5	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.5
G02 Major Small and Large Bowel I	26.9	4.1	0.9	2.8	17.4	10.8	15.0	4.8	10.5	5.4	0.0	7.5	20.9	0.9	9.3
H08 Laparo-scopic Chole-cystector	5.2	0.8	0.1	0.2	2.6	1.5	2.4	0.5	1.4	0.5	0.0	0.3	2.0	0.1	2.2
I03 Hip Replace-ment	10.9	4.4	1.1	0.8	17.7	7.0	9.3	4.8	10.4	7.1	0.0	14.3	13.6	0.7	10.4
I04 Knee Replace-ment	9.0	3.9	1.0	0.3	11.2	4.0	7.7	3.1	5.5	3.1	0.0	8.7	7.5	0.3	9.1
I31 Hip Revision	17.4	5.7	2.1	1.2	21.0	5.5	9.3	6.1	9.1	5.4	0.0	20.5	14.2	0.5	12.0
I68 Non-surgical Spinal Disorders	0.3	1.5	0.4	0.2	1.2	0.7	2.4	0.7	1.6	1.0	0.0	0.2	1.2	0.2	1.5
N04 Hyster-ectomy for Non-Malign	7.9	1.6	0.2	0.2	4.0	1.8	6.3	1.3	3.4	0.5	0.0	2.3	2.8	0.1	4.5
U61 Schizo-phrenia Disorders	0.2	1.4	1.2	0.4	1.2	1.1	2.0	1.0	0.9	1.9	0.0	0.1	0.8	0.5	3.0
U63 Major Affective Disorders	0.5	1.5	1.8	0.5	1.6	1.2	2.5	1.1	1.2	2.5	0.0	0.1	1.2	0.7	3.6

HPA
HEALTH POLICY ANALYSIS

Conclusions

- Cost and length of stay impacts of hospital acquired conditions are significant.
- While there are significant methodological challenges in estimating impacts, most international estimates and this study suggest that in excess of 10% of costs relate to the impact of hospital acquired conditions.
- The study suggests, commonly occurring conditions with lower average costs are very costly to the broader system and should be considered a legitimate target for safety and quality initiatives.
- Use of routinely coded data for identifying problem areas and monitoring performance on safety represents a legitimate and cost effective complement to other approaches such as registers and local audits.

HPA
HEALTH POLICY ANALYSIS

What is the potential for hospitals to use the COF for monitoring patient safety?

Routinely coded data

- Low cost
- Comprehensive
- Timely
- Interpretation as flags for investigation

Registers/External audits

- Higher cost
- Selective
- Less timely
- More precise identification of safety issues

Local audits

- Median cost
- Priority issues
- Timely: Potential for more immediate action
- Limits on standardisation and comparability

HPA
HEALTH POLICY ANALYSIS

What steps can be taken to improve the capture and utility of COF?

- ACSQHC has pursued further work on classifying high priority hospital acquired conditions.
- Additional work required to understand impact of:
  - **Breadth** of clinical coding with respect to COF; and
  - **Specificity** of clinical coding with respect to COF.
- Tools to flag problems with coding quality
- Integrating COF as a focus for clinical data audits
- Work towards coding procedures associated with COF diagnoses
- Understanding the nature of patients of COF diagnoses within specific clinical areas.