

## Distinguishing Hospital Complications from Pre-existing Conditions

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## Introduction

- 1999 IOM report on patient safety  
Up to 98,000 preventable deaths/year due to adverse events
- JCAHO ORYX initiative  
Requires measurement and comparison with other hospitals
- Publicly available "report cards"  
[www.Healthgrades.Com](http://www.Healthgrades.Com)

HealthGrades, Inc. - The Healthcare Quality Experts - Microsoft Internet Explorer provided by Mayo Foundation

HEALTHGRADES  
THE HEALTHCARE QUALITY EXPERTS

Hospital Report Cards

HealthGrades' Hospital Report Cards assigns a number of stars to each hospital's performance.

★★★★ Best  
★★★★☆ As Expected  
★ Four

2001 Analysis (3 years ending 1999)  
Back and Neck Surgery (Spinal Fusion)

Hospital	City	State	# of Medicare Cases	Main Complications
St. Marius Hospital	Marquette	MI	323	★★★★

Please note: The 2001 analysis changed from a five level star rating to a three level star rating. Therefore, a star change from five to four to five does not necessarily indicate that the hospital was worse or better than 2000 performance.

## Definition of Complication

### Complication

- Disease-related
1. Not preventable
  2. Preventable

- Healthcare-related
1. Iatrogenic
  2. Adverse event
  3. Error

## Computer Identification of Complications

- Existing data (ICD-9 diagnoses on billing)
- Several sets available (Iezzoni - Sachs, MedStat)
- Derived from complex clinical algorithms
- Calculated relative to specific risk groups

## Sample Complication

Complication of care #1:  
Postop Stroke

Present/absent definition:

Secondary dx 433.x1, 434.x1, 997.02 cerebral infarctions

At risk definition:

ANY PROCEDURE major or minor surgery

EXCLUDES Preop > 1 day

MDC = 1 (neurology body system)

## Purpose of Project

- Assess usefulness of computerized complications
  - Accuracy
    - False positives (pre-existing)
    - False negatives (not at-risk)
- Estimate effect of acquired complications

## Mayo's Acquired Conditions

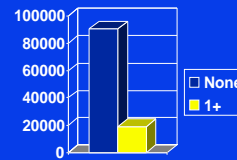
- Beginning in July 1990, Mayo collected "Pre-existing" flags on every secondary diagnosis
- P - Present on admission  
A - Acquired during hospitalization  
U - Uncertain
- Good reliability, <2 minutes/case  
*(Quality Assurance In Health Care, 3:257-262, 1991)*

## Reliability of Acquired Condition Code

Condition	Percent Agreement	Kappa
Acute Myocardial Infarction	91.3	0.823
Stroke	94.7	0.894
Pneumonia	80.8	0.606
Pulmonary Embolism	91.3	0.824
Renal Failure	80.0	0.583
Decubitus Ulcer	83.3	0.667
<b>Total</b>	<b>86.8</b>	<b>0.733</b>

*(Quality Assurance In Health Care, 3:257-262, 1991)*

## Acquired Conditions 1997-98



- Total discharges 109,397
- 17.4% with 1+ conditions overall
  - 27.0% of adult surgeries
  - 8.4% of adult medical
  - 15.2% of obstetrics
  - 9.9% of pediatrics
  - 6.2% of neonates

## Methodology

- Using Mayo data from 1998-1999
- Identified complications of care through computer screening
  - Risk group identified
  - Numerator identification algorithm
- Example: Postop stroke
  - At risk: All surgeries with exclusions
  - Numerator: Secondary dx of stroke

## Methodology

- False positive (FP)- any identified computer complication where flag indicates diagnosis was pre-existing
- False negative (FN)- patients with acquired condition meeting computer numerator who were not considered at risk

## Assessment of Complication A

Acquired Condition	Computer Complication	
	Yes	No
Yes	a(TP)	b(FN)
No	c(FP)	d(TN)

Sensitivity =  $a/(a+b)\%$

Positive PV =  $a/(a+c)\%$

## Results - I Postop Stroke CC #1

- 101 postop strokes identified (65% Positive PV)
  - 35 (35%) coded as pre-existing
- 77 acquired strokes were not at risk (46% Sensitivity)
  - 46 (60%) were surgical (neurosurgery or preop >1)
    - 7 (9%) were cardiovascular procedures
    - 3 (4%) were endoscopic
    - 17 (22%) were medical patients

## Results Postop Septicemia CC #7

- 25 complications identified (48% Positive PV)
  - 13 (52%) coded as pre-existing
- 226 acquired septicemias were not at risk (5% Sensitivity)
  - 144 (64%) were surgical
    - 4 (2%) were cardiovascular procedures
    - 10 (4%) were endoscopic
    - 65 (29%) were medical patients

## Complications Assessed - Accuracy

- 28 defined complications
  - 3 excluded due to complex algorithm
- 23 with any cases in two years
- 19 with 10+ cases
- 1 group had 100% of cases acquired

Refer to

## Identify True Complications

(Highest positive predictive value)

Comp 9 - Reopening of Surgical Site	100.0%
Comp 24 - Post-procedural Hemorrhage or Hematoma	66.2%
Comp 1 - Post-operative Stroke	65.3%
Comp 3 - Post-operative Pulmonary Compromise	59.8%
Comp 26 - Iatrogenic Complications	59.5%

## How Many are Missed?

Complications with highest surgical sensitivity

Comp 26 – Iatrogenic Complications	99.9%
Comp 23 – Wound Infection	99.3%
Comp 25 – Hip Fracture or Fall	90.0%
Comp 24 – Post-procedure Hemorrhage	88.7%
Comp 11 – Miscellaneous Complications	85.6%

## Summary

- Use of complications to compare hospitals in the US has problems
  - Issues with pre-existing conditions, particularly at tertiary care centers
  - Issues with coding differences between hospitals
    - Harder one looks, more likely one will find problem
  - Limitations of ICD-9-CM diagnosis codes
  - Restrictive risk groups miss acquired conditions

## Summary

- Complications are expensive, however costed Efforts to reduce their occurrence can be worthwhile
- Internal use of complication measures may be beneficial
  - Tracking overtime
  - Identification of areas for improvement

## Limitations

- Limited generalizability of accuracy rates
  - Rate of preexisting conditions may be higher at tertiary care referral center
- Cost of complications may be higher for sicker patients
- Administrative data limitations

## Future Directions

- Evaluation of other complication algorithms
- Collaboration with hospitals in New York (NY Presbyterian) and California (UCLA)
- Reassess reliability of acquired condition code
- Working with Patient Safety Committee
- Presenting to internal Mayo audiences

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