

# Estimating Readmission Rates using Incomplete Data: Implications for Two Methods of Hospital Profiling

William J. O'Brien, Qi Chen, Hillary J. Mull, Ann Borzecki,  
Michael Schwartz, Amresh Hanchate, Amy K. Rosen

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VA Boston Healthcare System  
Center for Organization, Leadership and Management Research



# Poll

What is your primary professional role?

Researcher

Clinician

Quality manager

Hospital administration

Other

# Background

- Readmission rates are reported on CMS and VA Hospital Compare sites.
- CMS penalizes hospitals under the ACA's Hospital Readmissions Reduction Program.
- Both potentially omit information about dual users.
- Purpose of study is to determine changes in VA readmission rates and hospital profiles after including Medicare fee-for-service records.

# CMS Hospital Compare

30-Day Outcomes Readmission and Deaths Details - Mozilla Firefox

www.medicare.gov/HospitalCompare/details.aspx?msrCd=prnt3grp1&ID=220031,220071,22010F&stsltd=MA

**The U.S. National Rate of readmission for heart attack patients = 19.7%**

| Hospital Name                               | Better Than U.S. National Rate<br>(Adjusted readmission is lower than U.S. National Rate) | No Different Than U.S. National Rate (Adjusted readmission is about the same as U.S. National Rate or difference is uncertain) | Worse Than U.S. National Rate<br>(Adjusted readmission is higher than U.S. National Rate) |
|---|---|--|---|
| BOSTON MEDICAL CENTER CORPORATION           |   |  | X   |
| MASSACHUSETTS GENERAL HOSPITAL              |   | X  |   |
| VA BOSTON HEALTHCARE SYSTEM - JAMAICA PLAIN |   | X  |   |

The 'total number' of hospitals in the table below is the total number of hospitals that had eligible admissions for this measure. See [30-Day Death and Readmission Measures](#) for additional information about the data collection for the readmission measures.

|   |   |   |  |
|---|---|---|--|
| <b>Out of 4519 in the United States →</b>   | 30 hospitals in the United States were Better than U.S. National Rate | 2338 hospitals in the United States were No different than U.S. National Rate | 41 hospitals in the United States were Worse than U.S. National Rate |
| 2110 hospitals in the United States did not have enough cases to reliably tell how well they are performing |   |   |  |

# CMS Payment Penalties

Readmissions PUF-FY 2013 IPPS Correction-March 2013.xlsx - Microsoft Excel

Home Insert Page Layout Formulas Data Review View

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|    | A      | B   | C                         | D                                      | E                             | F  | G   | H  |
|----|--------|---|---------------------------|--|-------------------------------|--|---|--|
|    | PROV   | FY 2013 Readmission Payment Adjustment Factor | Number of Pneumonia Cases | Excess Readmission Ratio for Pneumonia | Number of Heart Failure Cases | Excess Readmission Ratio for Heart Failure | Number of Acute Myocardial Infarction Cases | Acute Myocardial Infarction Excess Readmission Ratio |
| 5  | PROV   |   |                           |  |                               |  |   |  |
| 6  | 010001 | 1.0000  | 400                       | 0.9137                                 | 894                           | 0.9406                                     | 728   | 0.9664   |
| 7  | 010005 | 1.0000  | 374                       | 0.9547                                 | 264                           | 0.9126                                     | 21  | 0.0000   |
| 8  | 010006 | 1.0000  | 842                       | 0.9134                                 | 614                           | 0.8033                                     | 342   | 0.9021   |
| 9  | 010007 | 0.9929  | 254                       | 1.0439                                 | 135                           | 1.0942                                     | 1   | 0.0000   |
| 10 | 010008 | 1.0000  | 56                        | 0.9767                                 | 59                            | 0.9981                                     | 4   | 0.0000   |
| 11 | 010009 | 1.0000  | 110                       | 0.9929                                 | 133                           | 0.9561                                     | 9   | 0.0000   |
| 12 | 010010 | 0.9994  | 326                       | 1.0106                                 | 173                           | 0.9664                                     | 13  | 0.0000   |
| 13 | 010011 | 0.9952  | 452                       | 0.9540                                 | 417                           | 0.8641                                     | 213   | 1.1661   |
| 14 | 010012 | 0.9972  | 210                       | 0.9585                                 | 160                           | 1.0674                                     | 79  | 1.0140   |
| 15 | 010015 | 1.0000  | 67                        | 0.9343                                 | 117                           | 0.9914                                     | 2   | 0.0000   |
| 16 | 010016 | 0.9978  | 332                       | 0.9199                                 | 323                           | 1.0164                                     | 199   | 1.0432   |
| 17 | 010018 | 1.0000  | 0                         | 0.0000                                 | 0                             | 0.0000                                     | 0   | 0.0000   |
| 18 | 010019 | 0.9982  | 336                       | 1.0401                                 | 289                           | 0.8763                                     | 43  | 1.0699   |
| 19 | 010021 | 1.0000  | 183                       | 0.9585                                 | 128                           | 0.9167                                     | 15  | 0.0000   |
| 20 | 010022 | 0.9969  | 112                       | 0.9325                                 | 77                            | 1.0548                                     | 5   | 0.0000   |
| 21 | 010023 | 0.9925  | 214                       | 1.1577                                 | 531                           | 0.9716                                     | 379   | 1.1247   |
| 22 | 010024 | 0.9981  | 358                       | 1.0852                                 | 533                           | 0.9625                                     | 208   | 0.9708   |
| 23 | 010025 | 0.9971  | 113                       | 1.0250                                 | 220                           | 1.0145                                     | 56  | 1.0221   |

Ready

File Layout FINAL FY 2013-Aug 1, 2012 Correction FY 2013

100%

# VA Hospital Compare

VA Hospital Compare - Congestive Heart Failure Measures for the State of TX - Detail Version - Mozilla Firefox

File Edit View History Bookmarks Tools Help

VA Hospital Compare - Congestive Heart Fail... +

www.hospitalcompare.va.gov/apps/Compare/index.asp?state=TX&DiseaseBox=2&Detail=1

20.87% is the VA National Readmission Rate for Congestive Heart Failure within 30 days [Show Summary](#)

| Medical Center   | Medical Center Rate | Interval Estimate                | VA National Rate | Lower Than National VA Rate | Within The National VA Rate | Higher Than National VA Rate |
|--|---------------------|----------------------------------|------------------|-----------------------------|-----------------------------|------------------------------|
| Dallas VA Medical Center (VA North Texas Healthcare System)      | 25.59%              | (22.76%,28.42%)                  | 20.87%           |                             |                             | ✓                            |
| Houston VA Medical Center  | 22.77%              | (20.08%,26.04%)                  | 20.87%           |                             | ✓                           |                              |
| San Antonio VA Medical Center (VA South Texas Healthcare System) | 25.46%              | (21.83%,29.46%)                  | 20.87%           |                             |                             | ✓                            |
| Temple VA Medical Center (VA Central Texas Healthcare System)    | 19.35%              | (16.81%,22.63%)                  | 20.87%           |                             | ✓                           |                              |
| VA Amarillo Healthcare System                                    | 18.66%              | (14.78%,23.32%)                  | 20.87%           |                             | ✓                           |                              |
| VA West Texas Healthcare System                                  |                     | <a href="#">Not Enough Cases</a> |                  |                             |                             |                              |

www.hospitalcompare.va.gov/Includes/DescriptionHeadings.htm#Better\_Than\_U.S.\_National\_Rate

# Poll

Do you know anyone who has used VA or CMS Hospital Compare to guide healthcare decisions?

Yes

No

# Study Description

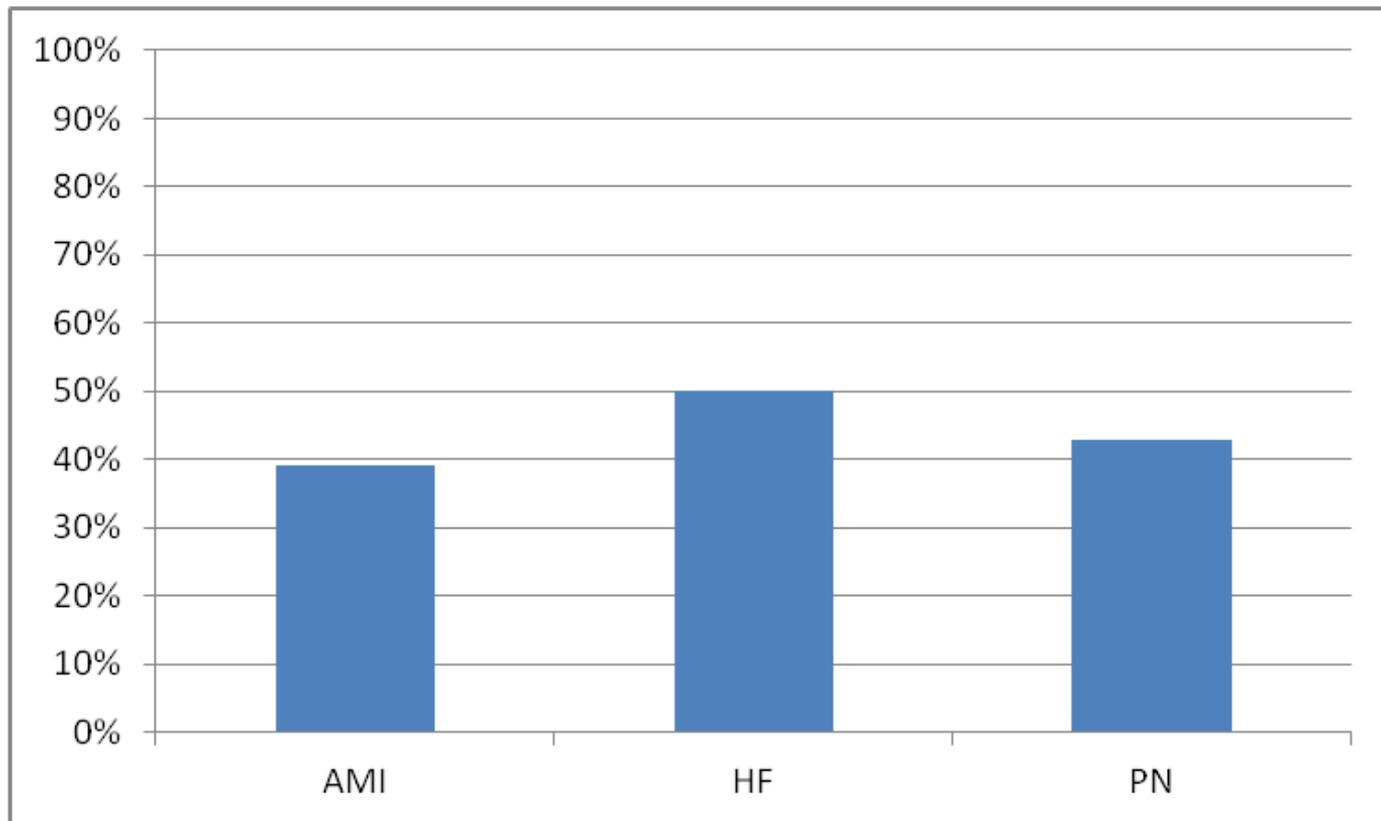
- Study period: FY 2008-2010
- Patient sample: dual eligible Veterans age 65+
- Data sources:
  - VA Patient Treatment File, Outpatient Encounter File
  - MedPAR, Carrier (physician/supplier Part B), Hospital Outpatient

# Definitions

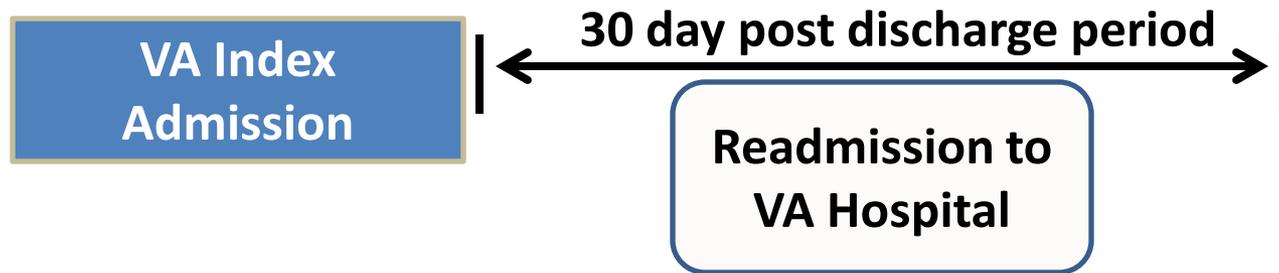
- *Index* is an acute hospitalization where:
    - patient is discharged alive to non-acute setting
    - principal diagnosis is AMI, HF or PN
    - no other index discharge in past 30 days
  - *Readmission* is the first admission during the 30 day post-discharge period
    - In AMI model, planned procedures are excluded
- \* Rule: a hospitalization cannot be both an index and a readmission within the same model.

# Dual Use Rate in Our Sample

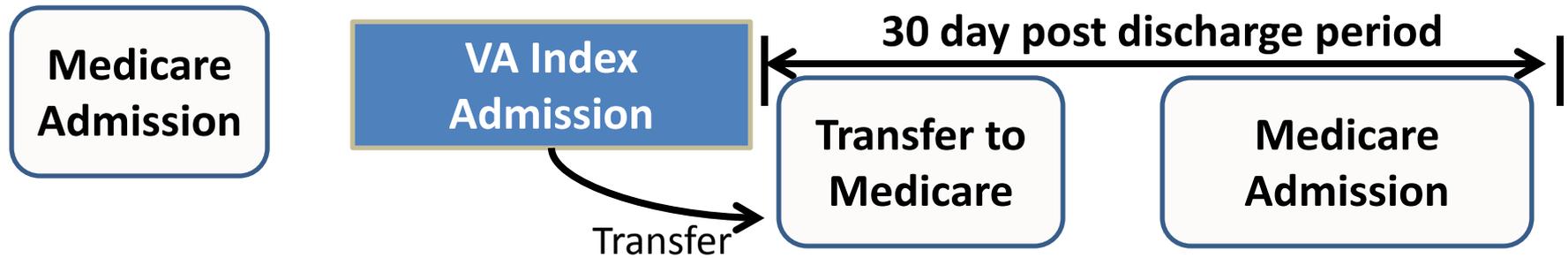
Proportion of VA index admissions having at least one Medicare inpatient claim during study period (FY08-10).



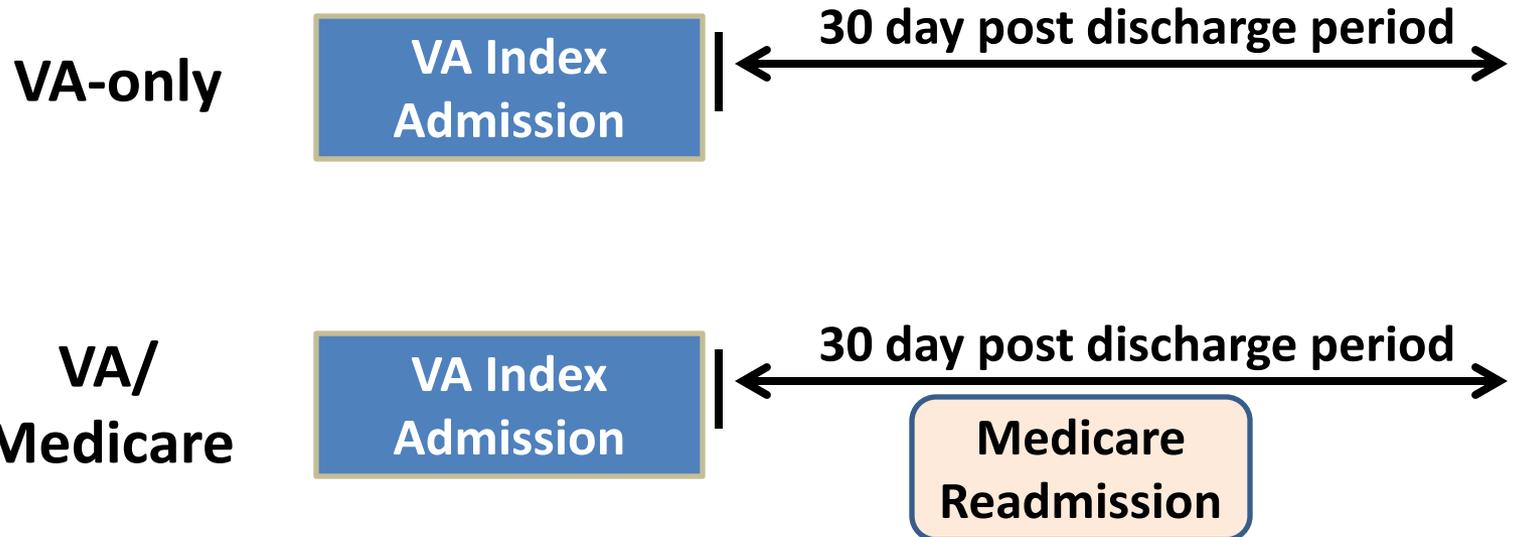
# Identifying Readmissions with VA-only Data



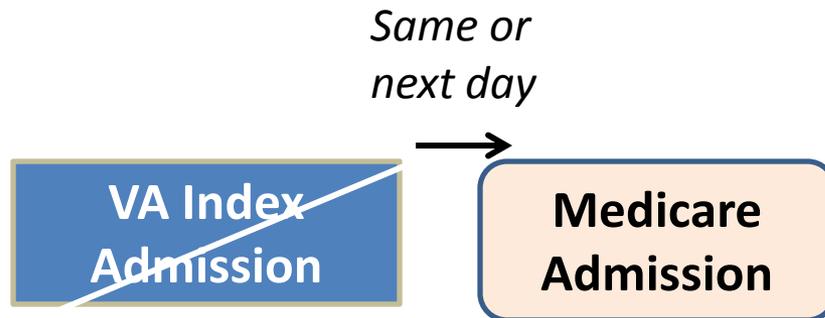
# Including Medicare Records



# Finding New Readmissions



# Additional Exclusions of VA Index Admissions

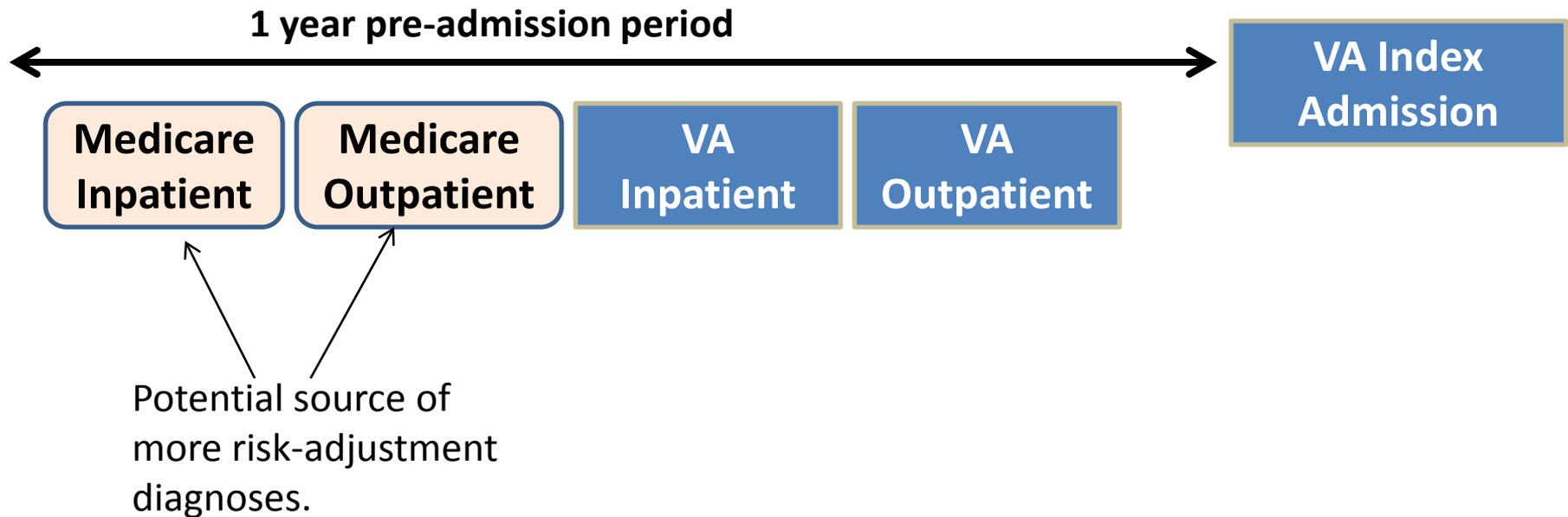


# Effect on Observed Rates

| Cohort | VA-only |                       | VA/Medicare |                       |
|--------|---------|-----------------------|-------------|-----------------------|
|        | N Index | N Readmissions (Rate) | N Index     | N Readmissions (Rate) |
| AMI    | 10,636  | 2,205 (20.7%)         | 10,394      | 2,519 (24.2%)         |
| H F    | 37,203  | 8,355 (22.5%)         | 36,378      | 9,646 (26.5%)         |
| PN     | 31,068  | 5,494 (17.7%)         | 30,758      | 6,405 (20.8%)         |

- After adding Medicare inpatient data, we excluded 0.3-1.3% of initially identified VA index admissions due to a prior Medicare index hospitalization.
- A further 0.5-2.0% were excluded because the patient was transferred to a Medicare-reimbursed hospital.
- Observed rates increased by 3.1-4.0% points.

# Additional Clinical Data for Risk Adjustment



# Poll

Will the additional Medicare clinical data increase the prevalence of risk factors for readmission?

Slight increase

Significant increase

No change

Not sure

# Additional Clinical Data for Risk Adjustment

| PN cohort  | Prevalence (%) |        | Relative % $\Delta$ |
|--|----------------|--------|---------------------|
|  | VA-only        | VA/CMS |                     |
| Risk Factors for readmission                                   |                |        |                     |
| Septicemia/shock (CC2)   | 2.8            | 4.9    | 74.1                |
| Pleural effusion/pneumothorax (CC 114)                         | 5.3            | 8.3    | 56.5                |
| Cardio-respiratory failure or shock (CC 79)                    | 9.6            | 14.6   | 51.1                |
| Acute coronary syndrome (CC 81-82)                             | 4.7            | 6.8    | 44.8                |
| Vertebral fractures (CC 157)                                   | 1.4            | 2.0    | 42.0                |
| Valvular or rheumatic heart disease (CC 86)                    | 9.9            | 12.7   | 28.0                |
| Fibrosis of lung or other chronic lung disorders (CC 109)      | 8.5            | 10.8   | 27.1                |
| Other lung disorders (CC 115)                                  | 24.0           | 30.4   | 27.0                |
| Pneumonia (CC 111-113)   | 31.4           | 38.8   | 23.8                |
| Protein-calorie malnutrition (CC 21)                           | 5.7            | 7.1    | 23.3                |
| ...  | ...            | ...    | ...                 |
| Severe hematological disorders (CC 44)                         | 3.4            | 3.7    | 8.0                 |
| Metastatic cancer or acute leukemia (CC 7)                     | 4.5            | 4.9    | 7.3                 |
| Other gastrointestinal disorders (CC 36)                       | 57.1           | 60.8   | 6.4                 |
| Drug/alcohol abuse/dependence/psychosis (CC 51-53)             | 21.2           | 22.4   | 6.0                 |
| Iron deficiency or other anemias and blood disease (CC 47)     | 47.1           | 49.8   | 5.8                 |
| Coronary atherosclerosis or angina (CC 84-84)                  | 45.2           | 47.7   | 5.4                 |
| Other major cancers (CC 9-10)                                  | 23.0           | 24.1   | 4.8                 |
| Lung or other severe cancers (CC 8)                            | 9.4            | 9.8    | 4.4                 |
| COPD (CC 108)  | 56.5           | 58.9   | 4.2                 |
| Diabetes mellitus (DM) or DM complications (CC 15-20, 119-120) | 40.7           | 42.0   | 3.2                 |

# Risk-adjustment Models

- Follows methodology of CMS readmission measures.
- Hierarchical generalized linear model accounting for clustering within hospitals.
- Dependent variable: 30-day all-cause readmission outcome (0/1).
- Independent variables: patient demographic and clinical characteristics.
- Medicare data affects risk adjusted rates by changing readmission outcomes (from no to yes) and adding information about patient risk factors.

# Poll

What is the effect of the additional outcome and risk information on models' predictive ability of 30-day readmission?

Slight improvement

Significant improvement

No change

Not sure

# Effect on Model Discrimination

Model Performance in VA-only and  
VA/Medicare Analyses. FY2008-2010.

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|                    | C Statistic | Mean Predicted<br>Readmission Rate<br>by Decile of<br>Predicted Risk |         |
|--------------------|-------------|--|---------|
|                    |             | Lowest   | Highest |
| <i>VA-only</i>     |             |  |         |
| AMI                | 0.614       | 13.2   | 33.8    |
| HF                 | 0.613       | 13.0   | 35.4    |
| PN                 | 0.631       | 10.0   | 31.8    |
| <i>VA/Medicare</i> |             |  |         |
| AMI                | 0.621       | 14.9   | 38.6    |
| HF                 | 0.609       | 16.1   | 40.3    |
| PN                 | 0.630       | 12.0   | 36.7    |
| <i>Difference</i>  |             |  |         |
| AMI                | 0.007       |  |         |
| HF                 | -0.004      |  |         |
| PN                 | -0.001      |  |         |

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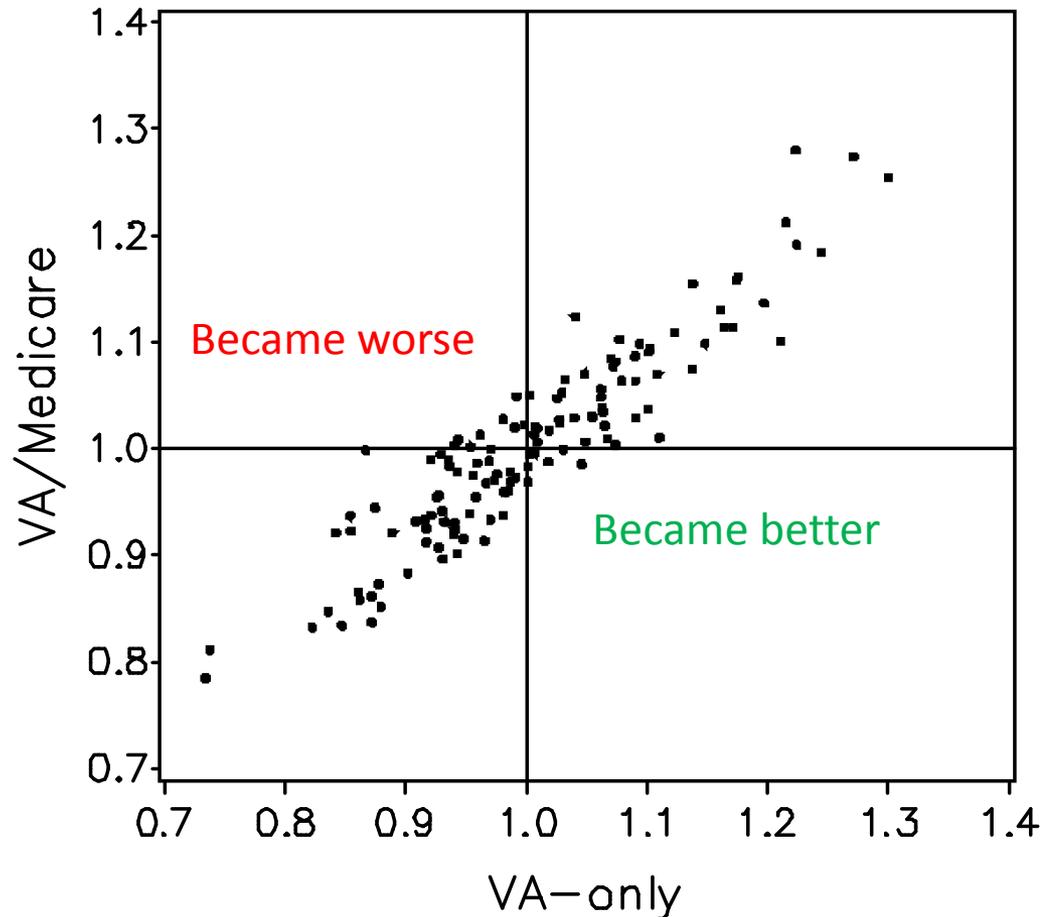
AMI=acute myocardial infarction; HF=heart failure; PN=pneumonia

# Output from Models: P/E Ratio

- Predicted probability of readmission uses both fixed effects and hospital random effects.
- Expected probability uses only fixed effects.
- P/E ratio: did this hospital have more or fewer readmissions than would be expected from a typical VA hospital?

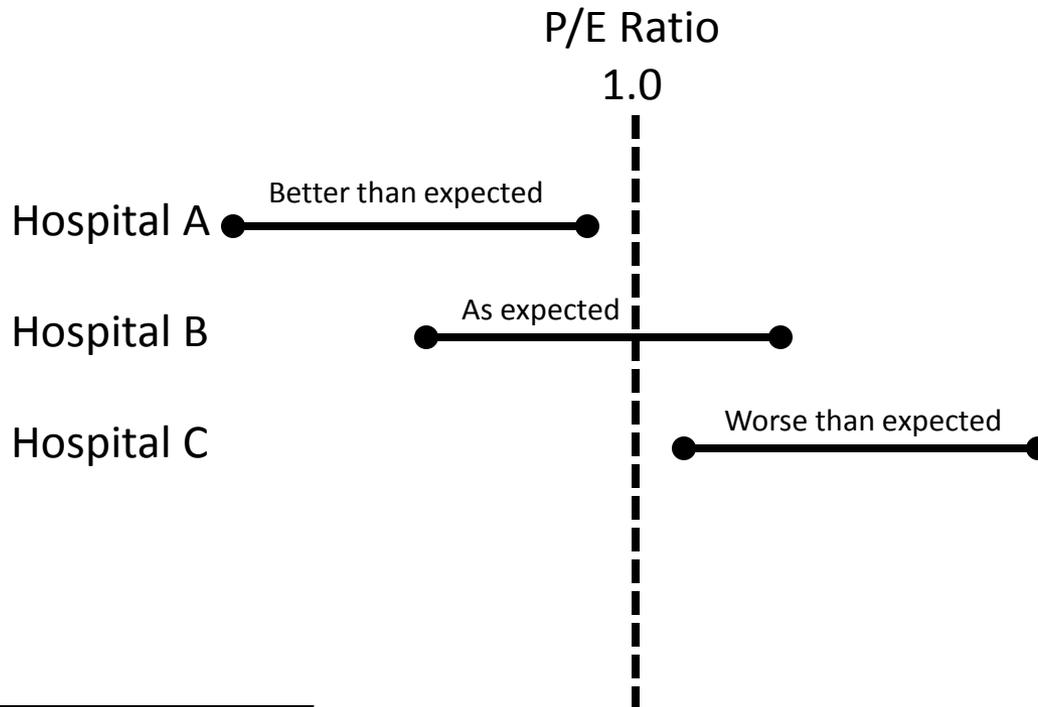
# Effect on P/E Ratios

PN Cohort



\* Risk-standardized readmission rate = P/E ratio times national observed rate.

# Hospital Compare Profiling



  
= 95% CI of P/E Ratio

# Results Using Hospital Compare Method: VA-only vs. VA/Medicare Data

## AMI

| <i>VA-Only</i>       | <i>VA/Medicare</i>  |             |                      | Total     |
|----------------------|---------------------|-------------|----------------------|-----------|
|                      | Worse-than-expected | As-expected | Better-than-expected |           |
| Worse-than-expected  | 0                   | 1           | 0                    | 1         |
| As-expected          | 0                   | 93          | 0                    | 93        |
| Better-than-expected | 0                   | 0           | 0                    | 0         |
| <b>Total</b>         | <b>0</b>            | <b>94</b>   | <b>0</b>             | <b>94</b> |

## HF

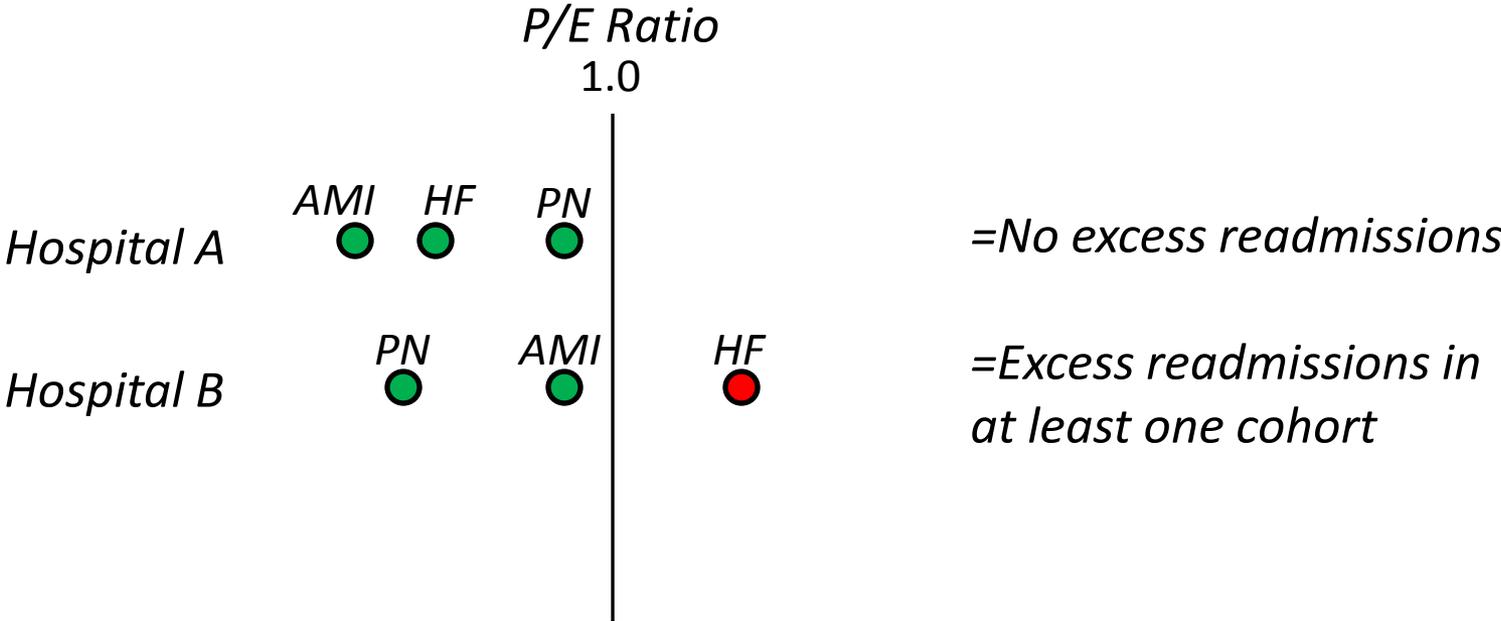
| <i>VA-Only</i>       | <i>VA/Medicare</i>  |             |                      | Total      |
|----------------------|---------------------|-------------|----------------------|------------|
|                      | Worse-than-expected | As-expected | Better-than-expected |            |
| Worse-than-expected  | 6                   | 0           | 0                    | 6          |
| As-expected          | 0                   | 119         | 0                    | 119        |
| Better-than-expected | 0                   | 2           | 2                    | 4          |
| <b>Total</b>         | <b>6</b>            | <b>121</b>  | <b>2</b>             | <b>129</b> |

## PN

| <i>VA-Only</i>       | <i>VA/Medicare</i>  |             |                      | Total      |
|----------------------|---------------------|-------------|----------------------|------------|
|                      | Worse-than-expected | As-expected | Better-than-expected |            |
| Worse-than-expected  | 8                   | 0           | 0                    | 8          |
| As-expected          | 0                   | 118         | 2                    | 120        |
| Better-than-expected | 0                   | 0           | 2                    | 2          |
| <b>Total</b>         | <b>8</b>            | <b>118</b>  | <b>4</b>             | <b>130</b> |

\* Cell values indicate n hospitals.

# CMS Payment Penalty Profiling



● ● Point estimates of hospital risk-adjusted rates

# Results Using CMS IPPS Payment Rule: VA-only vs. VA/Medicare Data

|                |                               | <i>VA/Medicare</i>            |                            | <b>Total</b> |
|----------------|-------------------------------|-------------------------------|----------------------------|--------------|
|                |                               | <b>No excess readmissions</b> | <b>Excess readmissions</b> |              |
| <b>VA-only</b> | <b>No excess readmissions</b> | 23                            | 6                          | 29           |
|                | <b>Excess readmissions</b>    | 11                            | 90                         | 101          |
|                | <b>Total</b>                  | 34                            | 96                         | 130          |

# Summary of Results

- Medicare data changed the readmission performance rating of only 1-2% of VA hospitals in the Hospital Compare method.
- However, 13% of VA hospitals were classified discordantly in the method CMS uses to penalize IPPS hospitals for excess readmissions.
- Additional risk and outcome information did not improve model performance.

# Conclusion

- Inclusion of Medicare data in an assessment of VA hospital readmission rates provides a more comprehensive view of the care patients receive.

# Policy Implication

- An assessment of a healthcare system's readmission rates should use all available information, to the extent possible, about patients' care from outside sources.
- Hospital QI initiatives should be based on information about all readmissions, including those to outside providers.

# Future Research

- Are there other ways to improve model performance?
  - Additional data sources.
  - Social support/SES data appropriate?
- Are hospital characteristics associated with Medicare dual use?
  - Urban vs. rural location
  - Proximity to other acute care hospitals
  - Patient preferences

# Thank You

William J. O'Brien

[william.obrien@va.gov](mailto:william.obrien@va.gov)

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Amy Rosen, PI.