Session Objectives

1. Compare and contrast readmission analytics developed by Midas+ and CMS
2. Describe the scoring program tied to the Hospital Readmission Reduction Program
3. Review the 3M Potentially Preventable Readmissions methodology
4. Discuss predictive analytics models emerging in today’s marketplace and how to interpret their “predictive power”
5. Suggest workflow and dataflow requirements for “next generation” prescriptive analytics
Readmission Metrics Circa 1993

Clinical Nurse Case Management: A Service Line Approach

EXHIBIT I

<table>
<thead>
<tr>
<th></th>
<th>Average Age of Patient</th>
<th>Average Length of Stay</th>
<th>*Total Readmission Days</th>
<th>**Total Adverse Medical Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Case Managed Group</td>
<td>59</td>
<td>6</td>
<td>3</td>
<td>19</td>
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<tr>
<td>N=25</td>
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<tr>
<td>Non-Case Managed</td>
<td>63</td>
<td>9</td>
<td>30</td>
<td>45</td>
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<tr>
<td>Group N=25</td>
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</tr>
</tbody>
</table>

*Non-elective readmissions 90 days after discharge
**Adverse medical outcomes as identified by Carondelet Quality Assurance MIDS System
Process for Evaluating Readmissions

- All Medical Records “pulled” for 50 patients
- Manual review of over 200 charts
- Arbitrary decisions made about which readmissions were expected vs. not expected
- Data findings were not easily verifiable
- Findings did not “match” readmission counts in our hospital information system
- HIS System readmission counts didn’t match those in Midas!
Backwards and Forward Readmission Rates

Hospital Encounter

Count of patients with previous encounter 30 Days Before Admission

Count of patients readmitted within 30 Days After Discharge
Midas+ Defined Metric
CHF % Readmit within 30 Days
yields five qualifying patients in June

Drill-down to the INDEX encounter reveals five encounters
Measure Results Calculated by Vendors Only
Approximate Measures Calculated by CMS

Denominator Exclusion Criteria:

- Patients less than 65 years of age at admission
- Payer Type equivalent to Medicare (excluding Medicare Advantage)
- Encounter is a readmission within 30 days of discharge of the previous encounter
- Length of stay longer than 365 days
- All encounters with overlapping dates (all are ignored)
- Discharge disposition equivalent to death, discharge to outside acute care or Left AMA
- Non-acute care encounters for rehab, psychiatric, SNF or hospice care
- Inpatient delivery or newborn encounters

Drill-down to the INDEX encounter reveals only one encounter but won’t always match what CMS counts!
CMS Readmission Measures

- Calculated from Medicare Part A and B Claims Data
- Include readmissions back to ANY facility not just YOUR facility
- Individual hospitals and vendors can’t replicate exactly
- Unplanned readmissions are now excluded
- Complex Risk Model
- Getting more complex!

Note: The Hospital Readmissions Reduction Program includes only subsection(d) hospitals and hospitals paid under section 1814(b)(3) (i.e. Maryland hospitals), while the IQR calculations include non-Inpatient Prospective Payment System (IPPS) hospitals such as critical access, territories, and cancer hospitals, as well as Veterans Health Administration (VA) hospitals. Consequently, your hospital's results for AMI, HF, and PN may differ from those calculated for IQR because they are calculated using a different set of hospitals.
CMS Readmission Measures
Crunch Data Your Vendor Can’t Always See

All derived from Medicare Claims

Inclusions for Index Admissions

• Medicare FFS Part A and B for 12 months prior to index admission
• VA beneficiaries (no 12-month enrollment requirement applies)
• Admissions that were discharged and readmitted to same hospital on the same day with DIFFERENT diagnoses

Exclusions for Index Admissions

• Patients discharged and readmitted to same hospital on the same day with SAME diagnoses (the readmit will be combined with the previous index admission and considered to be one single encounter for measure purposes)
• Discharged against medical advise
• Less than 30 days post-discharge enrollment in Medicare FFS program
• Transferred to another acute care facility (admissions to another hospital within 1 day of discharge are considered transfers regardless of discharge disposition)
• Acute MI patients admitted and discharged on same day
Multiple Readmissions

- If a patient has more than one admission within 30-days, **only the first one is counted** as a readmission.
- No hospitalization will be counted as both a readmission and an index admission within the same measure.
- However, because the cohorts for the various readmission measure populations are determined independently, a readmission in one measure may qualify as an index admission in another CMS readmission measure.
Planned Readmission Exclusions to CMS
Readmission Methodology Started in 2013

- **Planned readmission algorithm** added to all readmission measures to avoid penalizing hospitals for performing scheduled procedures within 30 days of discharge.

- This method also avoids counting unplanned readmissions that occur after a planned readmission, but within 30 days of discharge from the index admission.

- This modified measurement technique reduced hospital wide 30-day all cause readmission rates from **16.5% to 16.0%** in the July 1, 2011 to June 30, 2012 data set.
Planned Readmission Exclusions

Always Planned
- Transplants (bone, kidney, organ)
- Cesarean section
- Normal pregnancy and/or delivery
- Forceps, vacuum and breech delivery
- Maintenance Chemotherapy
- Rehabilitation

Potentially Planned
When discharge diagnosis of readmission is NOT acute or a complication of care
- Laminectomy, spinal fusion
- Knee and hip replacement
- Limb amputation
- Thyroidectomy and endocrine surgery
- Lung resections
- Hernia repairs
- Oophorectomy, hysterectomy
- TURP, prostatectomy
- Colorectal and gastrectomy surgery
- Cardiac surgery (CABG, Valve Repair)
- Wound and burn debridement
- Laryngectomy, tracheostomy revisions
- More!
# Acute or Complication Categories

Determined by Using AHRQ Diagnoses CCS Codes

## Table PR4 – Acute Diagnosis Categories (Version 2.1 – General Population)

<table>
<thead>
<tr>
<th>Diagnosis CCS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>2</td>
<td>Septicemia (except in labor)</td>
</tr>
<tr>
<td>3</td>
<td>Bacterial infection, unspecified site</td>
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<tr>
<td>4</td>
<td>Meningitis</td>
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<tr>
<td>5</td>
<td>HIV infection</td>
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<td>6</td>
<td>Viral infection</td>
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<tr>
<td>7</td>
<td>Other infections, including parasitic infections</td>
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<tr>
<td>8</td>
<td>Sexually transmitted infections</td>
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<tr>
<td>9</td>
<td>Injuries, poisoning</td>
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<tr>
<td>10</td>
<td>Other injuries, poisoning, corrosive, or other substance use, unspecified site</td>
</tr>
<tr>
<td>11</td>
<td>Trench fever</td>
</tr>
<tr>
<td>12</td>
<td>Other causes of unspecific clinical symptoms</td>
</tr>
<tr>
<td>13</td>
<td>Other diagnoses, unspecified site</td>
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<tr>
<td>14</td>
<td>Other diagnoses, unspecified site, including drug use</td>
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<td>15</td>
<td>Other diagnoses, unspecified site, including drug use, unspecified site</td>
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<td>16</td>
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</tbody>
</table>

### Notes

- AHRQ Diagnoses CCS Codes
- Acute or Complication Categories
- Table PR4 – Acute Diagnosis Categories (Version 2.1 – General Population)
AHRQ Clinical Classification Software (CCS)

• Developed by AHRQ as part of the Healthcare Cost and Utilization Project (HCUP)
• Categorization scheme for ICD-9 diagnose and procedure codes
• Clusters over 14,000 diagnosis codes and 3,900 procedure codes into a manageable number of clinically meaningful categories
  • Single level diagnosis CCS: 285 mutually exclusive categories
  • Single level procedure CCS: 231 mutually exclusive categories
• Useful in research and statistical analysis
• Files downloaded and used with SAS or SPSS to convert ICD-9 codes to CCS codes
• Mental health populations have unique CCS-Mental Health and Substance Abuse (MHSA) tools
• See http://www.hcup-us.ahrq.gov/toolssoftware/ccs/CCSUsersGuide.pdf
Variables Used to Adjust Data in CMS Risk-standardized Readmission Rates

Variables Used

- Age
- Gender
- Cardiovascular disease*
- Comorbidities*

- Renal Disease
- COPD, Asthma, Pneumonia
- Fluid & electrolyte imbalance
- Urinary Tract Infection
- Psychiatric Disorders
- Liver or biliary disease
- Drug or alcohol abuse
- Peptic Ulcer Disease
- Decubitus Ulcers
- Anemia

Variables NOT used

- Admission source
- Discharge disposition
- Socioeconomic status

- Infection
- Cancer
- Diabetes
- Malnutrition
- Dementia
- Stroke
- Paralysis
- Sepsis
- Shock

* Each clinical population, including the hospital-wide 30-day all cause readmission measure has slightly different variables for cardiovascular disease and comorbidities.
Impact on National Readmission Rates when Unplanned Readmissions are Excluded

<table>
<thead>
<tr>
<th>Condition</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute MI</td>
<td>19.2%</td>
<td>18.2%</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>24.6%</td>
<td>23.1%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>18.5%</td>
<td>17.8%</td>
</tr>
</tbody>
</table>

For More Information on Readmission Measure Methodology

Resources
Hospital Readmissions Reduction Program
Timeline, PDF-17 KB (06/12/13) – a general timeline for the implementation of the proposed FY 2014 Hospital Readmissions Reduction Program

Frequently Asked Questions, PDF-69 KB (06/12/13) – a list of questions and answers regarding the calculation and public reporting of the CMS 30-day Risk-Standardized Readmission measures for the Hospital Readmissions Reduction Program.

Fiscal Year 2013 Hospital Readmissions Reduction Program Measure Methodology Report, PDF-237 KB (6/20/12) – a detailed explanation of the methodology for the 30-day Risk-Standardized Readmission measures for the Hospital Readmissions Reduction Program.

Use the Hospital General Information table to locate provider ID numbers (CMS Certification Numbers, or CCNs) and names of hospitals. With provider IDs from the discharge-level data file accompanying the hospital-specific report (HSR), this table can also be used to determine where a patient was readmitted.

https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1228772412995
Risk-standardized Readmission Rates

Excess Readmission Ratio < 1 = lower-than-expected readmission rates (or better quality)

**Predicted Rate** = The number of readmissions predicted based on the hospital’s performance with its observed case mix. Predicted values are based on hierarchical logistic regression models that include variables about the patient, such as age, gender, comorbid diseases and indicators of patient frailty.

**Expected Rate** = The number of readmissions expected on the basis of the nation’s performance with that hospital’s case mix.
Interpreting QNET Reports

http://www.medicare.gov/hospitalcompare/

Interval performance with overlap on either side of the crude unadjusted national rate are reported as “same as” other hospitals.
Interpreting QNET Reports
http://www.medicare.gov/hospitalcompare/

- Interval performance completely to the right of the national crude unadjusted national rate are “worse than” other hospitals.
- Interval performance completely to the left of the national crude unadjusted national rate are “better than” other hospitals.
Interpreting QNET Reports

http://www.medicare.gov/hospitalcompare/

- Interval performance with overlap on either side of the crude unadjusted national rate are reported as “same as” other hospitals.
Hospital-specific Reports

• Go to qualitynet.org for your hospital’s HSR workbook
• Preview period started April 18, 2013
• Must be a QNET administrator to download into your secure inbox
<table>
<thead>
<tr>
<th>Hospital's Performance on 30-Day Risk-Standardized Readmission for AMI, HF, PN, and THA/TKA</th>
<th>National and State Comparison</th>
<th>Patient Detail for Readmissions</th>
<th>Hospital-specific Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table I. Your Hospital’s Performance on 30-Day Risk-Standardized Readmission for AMI, HF, PN, and THA/TKA</strong></td>
<td><strong>Your hospital’s performance</strong></td>
<td><strong>Patient Detail for Readmissions</strong></td>
<td><strong>Hospital-specific Reports</strong></td>
</tr>
<tr>
<td><strong>July 2009 through June 2012</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Items Available on Hospital Compare</strong></td>
<td><strong>AMI 30-Day Readmission</strong></td>
<td><strong>HF 30-Day Readmission</strong></td>
<td><strong>PN 30-Day Readmission</strong></td>
</tr>
<tr>
<td>Your Hospital’s Comparative Performance</td>
<td>Number of Cases Too Small</td>
<td>No Different than U.S. National Rate</td>
<td>Worse than U.S. National Rate</td>
</tr>
<tr>
<td>Total Number of Eligible Discharges (Denominator) at Your Hospital</td>
<td>23</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>RSRR at Your Hospital</td>
<td>18.8%</td>
<td>24.3%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Lower Limit of 95% Interval Estimate</td>
<td>15.6%</td>
<td>20.0%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Upper Limit of 95% Interval Estimate</td>
<td>23.8%</td>
<td>28.6%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Crude Readmission Rate (Numerator/ Denominator) in the U.S.</td>
<td>18.3%</td>
<td>23.0%</td>
<td>17.0%</td>
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<tr>
<td>Additional Performance Information</td>
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<td></td>
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<tr>
<td>Total Number of Unplanned 30-Day Readmissions (Numerator) at Your Hospital</td>
<td>4</td>
<td>6</td>
<td></td>
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<tr>
<td>Crude Readmission Rate (Numerator/ Denominator) in Your State</td>
<td>17.4%</td>
<td>24.3%</td>
<td></td>
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<tr>
<td>Average RSRR in Your State</td>
<td>20.6%</td>
<td>25.1%</td>
<td></td>
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<tr>
<td>Total Number of Unplanned 30-Day Readmissions (Numerator) in Your State</td>
<td>95</td>
<td>405</td>
<td></td>
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<tr>
<td>Number of Eligible Discharges (Denominator) in Your State</td>
<td>527</td>
<td>1,032</td>
<td></td>
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<tr>
<td>Crude Readmission Rate (Numerator/ Denominator) in the U.S.</td>
<td>18.0%</td>
<td>24.8%</td>
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<tr>
<td>Total Number of Unplanned 30-Day Readmissions (Numerator) in the U.S.</td>
<td>93,066</td>
<td>291,063</td>
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<tr>
<td>Number of Eligible Discharges (Denominator) in the U.S.</td>
<td>513,331</td>
<td>1,926,826</td>
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</tbody>
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**Table II. National and State Performance Categories for the HWR Measure**

| Of the Total Number of U.S. Hospitals: | 4,809 |
| Number that Performed Better than U.S. National Rate | 304 |
| Number that Performed No Different than U.S. National Rate | 3,903 |
| Number that Performed Worse than U.S. National Rate | 304 |
| Of the Total Number of Cases Too Small | 158 |
| Number that Performed Better than U.S. National Rate | 20 |
| Number that Performed No Different than U.S. National Rate | 20 |
| Number that Performed Worse than U.S. National Rate | 20 |

**Table III. Discharge-Level Information for the Hospital-Wide Readmission Measure**

<table>
<thead>
<tr>
<th>ID Number</th>
<th>Provider ID</th>
<th>Measure</th>
<th>Specialty Cohort</th>
<th>HCNCD</th>
<th>Medical Record Number</th>
<th>Beneficiary ID</th>
<th>DOB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A001</td>
<td>07/01/1961</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A002</td>
<td>09/30/1941</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A003</td>
<td>03/26/1939</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A004</td>
<td>02/10/1934</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A005</td>
<td>10/09/1924</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A006</td>
<td>06/03/1942</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>999999</td>
<td>HWR</td>
<td>Medicine</td>
<td>1234567890</td>
<td>A007</td>
<td>08/28/1033</td>
<td></td>
</tr>
</tbody>
</table>

*To locate provider ID numbers (CMS Certification Numbers, or CCNs) and names information table, which can be found here: https://data.medicare.gov/
Medicare Hospital Quality Chartbooks

- Regional variation
- Racial disparities
- Reasons for readmissions
- Proportion by Medicare
- Small hospital data
- Large hospital data
- Measure methodology
Is the rate of unplanned readmissions after admission to the hospital for all conditions changing over time?

Downward Trends in Acute MI 30-day Readmissions Reflected in Midas+ Comparison Pool

Public Reporting Began July 2009

Official Start Date For Hospital Readmission Reduction Program October 1, 2012
Downward Trends in CHF 30-day Readmissions Reflected in Midas+ Comparison Pool

Official Start Date
For Hospital Readmission Reduction Program
October 1, 2012

Public Reporting Began
July 2009
Stable Trend in Pneumonia 30-day Readmissions Reflected in Midas+ Comparison Pool

Official Start Date
For Hospital Readmission Reduction Program
October 1, 2012

Public Reporting Began
July 2009
Chartbook 2013 Observation Stays On The Rise

Looks like we're just readmitting patients as observation status!

AMI, Heart Failure, and Pneumonia

Did the use of observation stays after hospitalization for AMI, heart failure, and pneumonia change with the start of public reporting?

Figure A.27. Trend in Median Observation Stay Rates, 2008-2010

Observation stays are a subset of return-to-hospital events that have recently garnered significant media attention. CMS defines observation stays as services furnished by a hospital which are reasonable and necessary to determine the need for a possible inpatient admission. CMS currently does not count these events as outcomes in the publicly reported readmission measures. Although CMS has noted an overall increase in observation stay utilization in recent years, observation stay trends related to hospitalization for AMI, heart failure, and pneumonia have not been specifically examined. There appears to be a slight increase in the number of observation stays without readmission over the past three years following a hospitalization for AMI, heart failure, or pneumonia. However, this increase seems to have begun prior to public reporting.

Return-to-hospital rates after hospitalizations for AMI, heart failure, and pneumonia were stable from 2008 to 2010. Public reporting is not associated with a change in return-to-hospital rates.

Unlike return-to-hospital rates, rates of observation stays after hospitalizations for AMI, heart failure, and pneumonia increased by 0.5%, 0.4%, and 0.3% respectively between 2008 and 2010. The start of public reporting in July 2009 is not associated with a change in observation stay utilization.
Is the trend in hospital-level observation stays and ED visits following AMI hospitalizations continuing to rise?

FIGURE A.2.17. Trends in the Median Hospital’s Readmission Rate, Emergency Department Visit Rate and Observation Stay Rate for AMI, July 2009 – June 2012.
Do hospitals with high use of observation stays have lower AMI risk-standardized readmission rates?

FIGURE A.2.18. Correlation of RSRR and Observation Stay Rate (Observed) for AMI, July 2009 – June 2012.
National Trends to Readmit to Observation Status Increasing

MidasPlus, Inc. Comparative Database (N = 793 Hospitals)
Recommended Reading
http://www.rwjf.org/content/dam/farm/reports/reports/2013/rwjf404178

The Revolving Door: A Report on U.S. Hospital Readmissions
An Analysis of Medicare Data by the Dartmouth Atlas Project
Stories From Patients and Health Care Providers by PerryUndem Research & Communication

February 2013
30-DAY READMISSION RATES TO U.S. HOSPITALS

Healthcare Cost and Utilization Project (HCUP) data from 2010 provide the most comprehensive national estimates of 30-day readmission rates for specific procedures and diagnoses.* Examples include:

By Procedure

Nearly one in five patients with these common procedures was readmitted:
- 23% Amputation of lower extremity
- 19% Heart valve procedures
- 19% Debridement of a wound, infection, or burn

Nearly one in three patients with these less frequent procedures was readmitted:
- 29% Kidney transplant
- 29% Ileostomy and other enterostomy

By Diagnosis

Nearly one in four patients with these common diagnoses was readmitted:
- 25% Congestive heart failure
- 22% Schizophrenia
- 22% Acute and unspecified renal failure

Nearly one in three patients with these less frequent diagnoses was readmitted:
- 32% Sickle cell anemia
- 32% Gangrene

Released July 27, 2013 by The Healthcare Cost and Utilization Project (HCUP)
AHRQ Analysis on 2010 Data
Released July 27, 2013

Readmission Rates by Payer

Medicaid and Medicare patients have a higher percentage of readmissions than other payers

- Procedure: Amputation of lower extremity
- Diagnosis: Congestive heart failure

**Medicare**
- **26%**

**Medicaid**
- **22%**

**Privately Insured**
- **17%**

**Uninsured**
- **13%**

**Medicaid**
- **30%**

**Medicare**
- **25%**

**Privately Insured**
- **20%**

**Uninsured**
- **17%**

*Readmissions were for all causes and did not necessarily include the same procedure or diagnosis as the original admission (index stay).*

Source: HCUP Statistical Briefs #153 and #154:
http://www.hcup-us.ahrq.gov/reports/statbriefs/statbriefs.jsp
Reducing hospital readmission rates has captured the imagination of U.S. policymakers because readmissions are common and costly, and their rates vary — and at least in theory, a reasonable fraction of readmissions should be preventable. Policymakers therefore believe that reducing readmission rates represents a unique opportunity to simultaneously improve care and reduce costs. As part of the Affordable Care Act (ACA), Congress directed the Centers for Medicare and Medicaid Services (CMS) to penalize hospitals with “worse than expected” 30-day readmission rates. This part of the law has stimulated hospitals, professional societies, and independent organizations to invest substantial resources in finding and implementing solutions for the “readmissions problem.”

Although a focus on readmissions may have good face validity, we believe that policymakers’ emphasis on 30-day readmissions is misguided, for three reasons:

First, the metric itself is problematic: only a small proportion of readmissions at 30 days after initial discharge are probably preventable, and much of what drives hospital readmission rates are patient- and community-level factors that are well outside the hospital’s control. Furthermore, it is unclear whether readmissions alone

Critics to CMS 30-day Readmission Reduction Initiatives

1. Only a small proportion of 30-day readmissions are probably preventable.

2. Readmission rates have weak signaling value for identifying high-quality hospitals.
   - No clear link between readmission rates and quality of care.
   - Higher readmission rates can be the result of low mortality rates or good access to hospital care.

3. Hospitals are expending so much energy on readmissions they may forgo other important quality improvement efforts.

4. Readmissions 3 to 7 days after discharge are much more under the hospital’s control than 30-day readmissions.

5. Financial penalties for high readmission rates dwarf the penalties for higher mortality rates and unsafe care.

6. Much of what drives hospital readmission rates are patient and community-level factors outside of the hospital’s control; e.g., mental illness, poor social support, and poverty.

Recent Findings show Community Factors NOT Hospital Factors Account for 58% of Variation in Hospital Readmission Rates


Demographic factors associated with **Higher** readmission rates include:

- Proportion of the population never married
- Number of Medicare beneficiaries *per capita*
- Low education area status

Demographic factors associated with **Lower** readmission rates include:

- Rural areas
- Retirement areas
- Primary care access (physician mix)
- Quality of Nursing Homes

**Conclusion:** “Hospital readmission rates might be more effectively reduced if community-based readmission reduction strategies are added to ongoing, hospital-focused improvement efforts.”
Calculating Financial Impact of Hospital Readmission Reduction Program

• Hospital Readmission Reduction Program began with October 1, 2012, discharges for initial populations Acute MI, Heart Failure & Pneumonia

• 2,225 hospitals were assessed a penalty ranging from 0.01 to 2 percent of their Medicare revenue in FY 2014 (cap is increasing to 3% in 2015)

• CMS reports there were approximately $280 million in readmission penalties for FY 2014

• Original projections published last year by CMS estimated approximately $175 million (0.2 percent) reduction in payment to hospitals
Calculating Financial Impact for Your Hospital’s Performance in the Readmission Reduction Program

Hospital’s Base Operating DRG Amount
(before any adjustments made by Value-based purchasing)

Adjustment Factor
determined by the higher of Two Values

Hospital Specific Adjustment Factor

Floor Adjustment Factor

FY 2013  0.9900
FY 2014  0.9800
FY 2015  0.9700

The GREATER value of the two becomes your hospital’s adjustment factor for any given fiscal year.
Steps to Calculate Your Hospital’s Adjustment Factor

**Adjustment Factor** = 1 - \( \frac{\text{Aggregate payments for excess readmissions}}{\text{Aggregate payments for all discharges}} \)

**Step 1:** Calculate aggregate payments for all discharges.

\[
\text{(Current Base DRG payment} \times \text{Medicare Part A Volume)} \\
\text{(July 1, 2009 to June 30, 2012)}
\]

\[
$7830 \times 27,601 = $216,115,830
\]
Steps to Calculate Your Hospital’s Adjustment Factor

Adjustment Factor = 1 - \left( \frac{\text{Aggregate payments for excess readmissions}}{\text{Aggregate payments for all discharges}} \right)

**Step 2:** Go to Hospital Compare to obtain population volumes and calculate your hospital’s excessive readmission ratio (ERR) for Acute MI, Heart Failure and Pneumonia.

We will use this volume value in Step 3

We will use this ERR value in Step 3
Steps to Calculate Your Hospital’s Adjustment Factor

Step 3: Calculate aggregate payments for excessive readmissions.

\[
\text{Adjustment Factor} = \frac{\text{Aggregate payments for excess readmissions}}{\text{Aggregate payments for all discharges}} = 1
\]

We got the ERR values in Step 2

We got the ERR values in Step 2

(Base DRG payment x Acute MI volume) x (ERR – 1) =
($7830 \times 415) \times [(20.6 \text{ Hospital} /19.7 \text{ National}) – 1] = \$148,500 \text{ in Excess Payments}

(Base DRG payment x Heart Failure volume) x (ERR – 1) =
($7830 \times 673) \times [(25.6 \text{ Hospital} /24.7 \text{ National}) – 1] = \$191,813 \text{ in Excess Payments}

(Base DRG payment x Pneumonia volume) x (ERR -1) =
($7830 \times 255) \times [(21.5 \text{ Hospital} /18.5 \text{ National}) – 1] = \$323,857 \text{ in Excess Payments}

\text{Aggregate payments for excess readmissions} = \$664,170 \text{ Total Excess Payment}

You have to have zero excess payments in all three populations in order to avoid a reduction in your hospital’s adjustment factor

COPD, Total Hip/Knee to be added in FY 2015
Steps to Calculate Your Hospital’s Adjustment Factor

Step 4: Plug in your numbers.

\[
\text{Adjustment Factor} = \frac{1}{\text{Aggregate payments for excess readmissions}} \cdot \frac{\text{Aggregate payments for all discharges}}{}
\]

\[
\text{Adjustment Factor} = \frac{1}{\$664,170 \text{ from step 3}} \cdot \frac{\$216,115,830 \text{ from step 1}}{}
\]

\[
\text{Adjustment Factor} = 0.9693
\]
Step 5: Compare your hospital’s adjustment factor to the floor adjustment factor for the selected fiscal year. The larger value becomes your hospital’s adjustment value!

Floor adjustment set at 0.9900 for FY 2013, 0.9800 for FY 2014, and 0.9700 for FY 2015 and subsequent fiscal years

Hospital’s Base Operating DRG Amount (before any adjustments made by Value-based purchasing) x Adjustment Factor determined by Hospital’s Readmission Rates

Ratio = 0.9693
Floor Adjustment = 0.9800

$7830 \times 0.9800 = \text{Reduced Base DRG Payment to $7673 in FY 2014}

Meaning an overall payment reduction of $157 in FY 2014 for each Medicare claim. In this example this could translate to lost revenue of approximately $4.3 Million Dollars!
Readmission Penalties for FY 2014 Payments are Publicly Available at http://www.kaiserhealthnews.org/stories/2013/august/02/readmission-penalties-methodology.aspx

- Only 18 Hospitals were assigned the full 2% penalty

- CMS charged a total of 2,225 hospitals about $280 million in readmission penalties...but the real savings are in dollars saved by reducing readmissions!

- MedPAC estimates that reducing one out of every 10 readmissions could save Medicare $1 billion
Excess Readmission Ratio
Replication Instructions

QualityNet

Resources
Hospital Readmissions Reduction Program

Excess Readmission Ratio Replication Instructions, PDF-60 KB (06/20/12) – instructions on how to replicate Excess Readmission Ratios. This document was included with each hospital’s Hospital-Specific Report (HSR) and discharge-level data file along with an example of how to do the replication in Excel. If your hospital did not receive an HSR and would like the example of how to do the replication instructions, contact cms_readmissions_reduction@mathematica-mpr.com.

Fiscal Year 2013 Hospital Readmissions Reduction Program Measure Methodology Report, PDF-237 KB (5/20/12) – a detailed explanation of the methodology for the 30-day Risk-Standardized Readmission measures for the Hospital Readmissions Reduction Program.

Use the Hospital General Information table to locate provider ID numbers (CMS Certification Numbers, or CCNs) and names of hospitals. With provider IDs from the discharge-level data file accompanying the hospital-specific report (HSR), this table can also be used to determine where a patient was readmitted.
27% of readmission are preventable

- 12% were deemed preventable in studies that used clinical data
- 59% were deemed preventable in studies that used only administrative data

Total number of readmissions vary substantially among hospitals, but the rate of preventable readmissions does not
Potentially Preventable Readmissions

- Proprietary methodology developed by 3M (requires software and a license with 3M or other third party vendor like Midas+)

- Populations are defined using APR DRGs (instead of ICD-9 defined populations used by CMS methodology)

- A “Preventable” readmission is determined by evaluating the relationship between the APR DRG assignment of the “Initial Admission” and the readmission (this is done by examining ICD-9 diagnosis and procedure codes, discharge status and other variables found in the administrative claims data)
Clinical Relationship Reasons

Readmissions are assigned to one of 17 “buckets” when determining if an subsequent encounter is “potentially preventable”.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Medical readmission for a <strong>continuation or recurrence</strong> of the reason for the initial admission or for a closely related condition.</td>
</tr>
<tr>
<td>2A</td>
<td>Ambulatory care-sensitive conditions as designated by AHRQ.</td>
</tr>
<tr>
<td>2B</td>
<td>All other readmissions for a <strong>chronic problem</strong> that might be related to care either during or after the initial admission.</td>
</tr>
<tr>
<td>3</td>
<td>Medical readmission for an <strong>acute medical condition or complication</strong> that might be related to or might have resulted from care during the initial admission or in the postdischarge period after the initial admission.</td>
</tr>
<tr>
<td>4</td>
<td>Readmission for a <strong>surgical procedure</strong> to address a continuation or a recurrence of the problem that caused the initial admission.</td>
</tr>
<tr>
<td>5</td>
<td>Readmission for a surgical procedure to address a complication that might be related to or might have resulted from care during the initial admission.</td>
</tr>
<tr>
<td>6A</td>
<td>Readmission for <strong>mental health reasons</strong> after an initial admission for a non–mental health, non–substance abuse reason.</td>
</tr>
</tbody>
</table>
Readmissions are assigned to one of 17 “buckets” when determining if an subsequent encounter is “potentially preventable”.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6C</td>
<td>Mental health or substance abuse readmission after an initial admission for a substance abuse or mental health diagnosis.</td>
</tr>
<tr>
<td>NC</td>
<td>Not clinically related</td>
</tr>
<tr>
<td>T</td>
<td>Trauma</td>
</tr>
<tr>
<td>C</td>
<td>Catastrophic</td>
</tr>
<tr>
<td>NP</td>
<td>Clinically related, not preventable</td>
</tr>
<tr>
<td>P</td>
<td>Probably planned readmission</td>
</tr>
<tr>
<td>E</td>
<td>Error</td>
</tr>
<tr>
<td>OB</td>
<td>Obstetrics</td>
</tr>
<tr>
<td>TR</td>
<td>Transplants</td>
</tr>
<tr>
<td>M</td>
<td>Malignancy</td>
</tr>
</tbody>
</table>
Counts Readmission Chains vs. Encounter Pairs

- A readmission chain is a sequence of Potentially Preventable Readmissions that are all clinically related to the initial admission.
- A readmission chain can consist of an Initial admission and only one PPR, which is the most common situation, or can include multiple PPRs after initial admission.
Chains Can Be Broken When:

- Readmissions are not clinically related to the Initial Admission
- Clinically related, but not preventable
- Admission date exceeds the time interval from the preceding admission’s discharge date
- Readmission with a status of
  - Left against medical advice
  - Expired
- Occurrence of an excluded admission
  - Malignancy
  - Neonatal
  - Human Immunodeficiency Virus
  - Trauma and burn
  - Other global exclusions such as cystic fibrosis, eye procedures/care
  - Obstetrics
- Age combined with specific APR DRG
  - For example, APR DRG 248 Major gastrointestinal and peritoneal infections if less than 6 years old
### 30-day PPR Example

<table>
<thead>
<tr>
<th>APR DRG</th>
<th>Encounter</th>
<th>Clinical Relationship</th>
<th>Days Between</th>
<th>Admit Date</th>
<th>DC Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heart failure</td>
<td>Initial admission</td>
<td>01-Jan</td>
<td>05-Jan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heart failure</td>
<td>Medical readmission</td>
<td>19-Jan</td>
<td>21-Jan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cardiac structural and valvular disorders</td>
<td>All other readmissions</td>
<td>19-Feb</td>
<td>20-Feb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other circulatory system diagnoses</td>
<td>Medical readmission</td>
<td>20-Feb</td>
<td>21-Feb</td>
<td></td>
</tr>
</tbody>
</table>

**Chain 1**
### 30-day PPR Example

<table>
<thead>
<tr>
<th>APR DRG</th>
<th>Encounter</th>
<th>Days Between</th>
<th>Admit Date</th>
<th>DC Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CMS CHF 30-day All Cause Readmission Indicator Pairs vs. PPR Chains

<table>
<thead>
<tr>
<th>APR</th>
<th>DRG</th>
<th>Encounter</th>
<th>Days Between</th>
<th>Admit Date</th>
<th>DC Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>194</td>
<td>Heart failure</td>
<td>01-Jan</td>
<td>5-Jan</td>
<td>05-Jan</td>
<td>12-Jan</td>
</tr>
<tr>
<td>194</td>
<td>Heart failure</td>
<td>19-Jan</td>
<td>10-Jan</td>
<td>12-Jan</td>
<td>20-Jan</td>
</tr>
<tr>
<td>200</td>
<td>Cardiac structural and valvular disorders</td>
<td>7-Jan</td>
<td>19-Jan</td>
<td>21-Jan</td>
<td>26-Jan</td>
</tr>
<tr>
<td>207</td>
<td>Other circulatory system diagnoses</td>
<td>26-Feb</td>
<td>16-Feb</td>
<td>20-Feb</td>
<td>31-Mar</td>
</tr>
<tr>
<td>463</td>
<td>Kidney/Urinary Tract Infection</td>
<td>10-Apr</td>
<td>10-Apr</td>
<td>12-Apr</td>
<td>12-Apr</td>
</tr>
</tbody>
</table>

CMS will only count one readmission pair within 30 days. No encounter can be both an index encounter and a readmission encounter.
Midas+ CHF 30-day Readmission Indicator Pairs vs. PPR Chains

<table>
<thead>
<tr>
<th>APR DRG</th>
<th>Encounter</th>
<th>Days Between</th>
<th>Admit Date</th>
<th>DC Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heart failure</td>
<td>5</td>
<td>10-12 Jan</td>
<td>21-23 Jan</td>
</tr>
<tr>
<td></td>
<td>Cardiac structural and valvular disorders</td>
<td>7</td>
<td>19-20 Jan</td>
<td>21-22 Jan</td>
</tr>
<tr>
<td></td>
<td>Other circulatory system diagnoses</td>
<td>26</td>
<td>16-17 Feb</td>
<td>20-21 Feb</td>
</tr>
<tr>
<td></td>
<td>Heart failure</td>
<td>33</td>
<td>25-27 Mar</td>
<td>31-33 Mar</td>
</tr>
<tr>
<td></td>
<td>Kidney/Urinary Tract Infection</td>
<td>10</td>
<td>10-11 Apr</td>
<td>12-13 Apr</td>
</tr>
</tbody>
</table>

Midas+ will count the second Heart Failure encounter because it was a qualifying encounter for the population of interest. If the second case had been RENAL failure, this case would NOT have been counted.

Chain 1

Chain 2
CMS All Cause 30-day Readmissions vs. PPR Chains

Chain 1

Chain 2
Midas+ % Readmit to Acute Care within 30-day Readmission vs. PPR Chains
Benefits of 3M PPR

• All payer
• Risk adjusted so tends to be more accepted by clinical stakeholders
• Focuses on cases that you can affect through improved clinical and care management processes
• Helps you identify benchmarks and target thresholds for your key populations
• Optimally used with APR DRG LOS and Mortality findings to understand changing populations

……but this methodology is still retrospective
Analytics: Improving Insight and Business Value

- Descriptive Analytics: What happened? Reporting, dashboards
- Diagnostic Analytics: Why did it happen? Ad-hoc query, data mining
- Predictive Analytics: What will happen? Statistics, planning
- Prescriptive Analytics: What should happen? Simulation, optimization

Original Source: Gartner Business Intelligence & Analytics Summit 2013 (Blue)
Study Finds Readmission “Prediction” Software has Weakness …..But Read the Fine Print!

Study Finds Automated Software Methods Inadequate to Replace Manual Review for Identifying Potentially Preventable Readmissions


- "Automated classification identified 78% (358) of readmissions as potentially preventable.
- Manual classification identified 47% (227).
- Overall, the methods agreed about the preventability of 56% (258) of readmissions.
- Using manual review as the reference, the sensitivity of 3M PPR was 85% and specificity was 28%."
Predictive Analytics: A Definition

“If we could know x, then we could DO y”

• Predictive analytics is a data mining practice of extracting information from existing data sets (multi-dimensional) in order to determine patterns and predict future outcomes and trends.

• Predictive modeling is a process used in predictive analytics to create a statistical model of future behavior. Predictive modeling may involve “machine learning” techniques to “learn” which variables correlate to trends or outcomes.

• Predictive analytics does NOT tell you what will happen in the future! “If we could know x, then we could DO y”
Variables presumed to impact hospital readmissions

- Premature discharge
- Poor patient compliance
- Age of the patient
- Male sex
- Chronic disability
- Patient living alone
- Unavoidable relapse
- Inadequate medical management

- Poor self-rated general health
- Inadequate rehabilitation
- Poor discharge planning
- Inadequate follow up care
- Cognitive impairment
- Ethnic disparities
Risk Prediction Models for Hospital Readmission
A Systematic Review

Devan Kansagara, MD, MCR
Honora Englebard, MD
Amanda Salanitro, MD, MS, MSPH
David Kagen, MD
Cecelia Theobald, MD
Michele Freeman, MPH
Sunil Kripalani, MD, MSc

AN INCREASING BODY OF LITERATURE ATTEMPTS TO DESCRIBE AND VALIDATE HOSPITAL READMISSION RISK PREDICTION TOOLS. INTEREST IN SUCH MODELS HAS GROWN FOR 2 REASONS. FIRST, TRANSITIONAL CARE INTERVENTIONS MAY REDUCE READMISSIONS AMONG CHRONICALLY ILL ADULTS. READING RISK ASSESSMENT COULD BE USED TO HELP TARGET THE DELIVERY OF THESE RESOURCE-INTENSIVE INTERVENTIONS TO THE PATIENTS AT GREATEST RISK. IDEALLY, MODELS DESIGNED FOR THIS PURPOSE WOULD PROVIDE CLINICALLY RELEVANT STRATIFICATION OF RISK ASSESSMENT AND GIVE INFORMATION EARLY ENOUGH DURING THE HOSPITALIZATION TO TRIGGER A TRANSITIONAL CARE INTERVENTION, MANY OF WHICH INVOLVE DISCHARGE PLANNING AND BEGIN WELL BEFORE HOSPITAL DISCHARGE. SECOND, THERE IS INTEREST IN USING READMISSION RATES AS A QUALITY METRIC. THE CENTERS FOR MEDICARE & MEDICAID SERVICES (CMS) RECENTLY BEGAN USING READMISSION RATES AS A PUBLICLY REPORTED METRIC AND HAS PLANS TO LOWER REIMBURSEMENT TO HOSPITALS.

CME available online at www.jamanetworkme and questions on p 1716.

Context Predicting hospital readmission risk is of great interest to identify which patients would benefit most from care transition interventions, as well as to risk-adjust readmission rates for the purposes of hospital comparison.

Objective To summarize validated readmission risk prediction models, describe their performance, and assess suitability for clinical or administrative use.

Data Sources and Study Selection The databases of MEDLINE, CINAHL, and the Cochrane Library were searched from inception through March 2011, the EMBASE database was searched through August 2011, and hand searches were performed of the retrieved reference lists. Dual review was conducted to identify studies published in the English language of prediction models tested with medical patients in both derivation and validation cohorts.

Data Extraction Data were extracted on the population, setting, sample size, follow-up interval, readmission rate, model discrimination and calibration, type of data used, and timing of data collection.

Data Synthesis Of 7843 citations reviewed, 30 studies of 26 unique models met the inclusion criteria. The most common outcome used was 30-day readmission; only 1 model specifically addressed preventable readmissions. Fourteen models that relied on retrospective administrative data could be potentially used to risk-adjust readmission rates for hospital comparison. Of these, 9 were tested in large US populations and had poor discriminative ability (c statistic range: 0.56-0.65). Seven models could potentially be used to identify high-risk patients for intervention early during a hospitalization (c statistic range: 0.56-0.72), and 5 could be used at hospital discharge (c statistic range: 0.68-0.83). Six studies compared different models in the same population and 2 of these found that functional and social variables improved model discrimination. Although most models incorporated variables for medical comorbidity and use of prior medical services, few examined variables associated with overall health and function, illness severity, or social determinants of health.

Conclusions Most current readmission risk prediction models that were designed for either comparative or clinical purposes perform poorly. Although in certain settings such models may prove useful, efforts to improve their performance are needed as use becomes more widespread.
CMS Readmission Calculator

Resources

Readmission Measures

General Resources

Medicare Hospital Quality Chartbooks (located on CMS website; see Downloads section of Outcome Measures page) — The Centers for Medicare & Medicaid Services (CMS) explores hospital performance in the Medicare Hospital Quality Chartbooks. The Chartbooks review national performance trends, distribution, and regional variation, as well as other analyses relevant to questions and concerns raised by stakeholders.

- Chartbook 2012 — for the mortality, readmission, and complication measure sets
- Chartbook 2011 — for the AMI, HF, PN readmission measures

Resources for 2013 Public Reporting of AMI, HF, HWR, PN, and THA/TKA

Readmission Measures

- Frequently Asked Questions (FAQs), PDF: 567 KB (Updated 10/07/12) — includes general as well as measure-specific questions and responses for all publicly reported risk-standardized outcome measures.
- Readmission Measures Fact Sheet, PDF: 331 KB (04/11/13) — a general overview of the readmission measures, their development, and their purpose. A helpful introduction to the project for hospital staff and executives.
- Timeline, PDF: 55 KB (04/11/13) — a general timeline showing relevant dates from pre-implementation to the current reporting of the risk-standardized outcome measures.
- Readmission Calculator — a tool that uses patient demographic and clinical characteristics to predict a patient’s estimated risk of hospital readmission within 30 days of discharge for heart attack, heart failure, or pneumonia.
- HWR Case Assignment Flow Diagram, PDF: 303 KB (04/11/13) — an illustration and description of the process by which the HWR cohort is identified and an admission is assigned to one of the five mutually exclusive specialty cohorts.

AMI, HFR, HWR, and THA/TKA 2013 Condition Category — ICD-9-CM and Clinical Classification Software (CCS) — ICD-9 Crosswalks

The following documents show the relationship between ICD-9-CM codes and the condition categories (CCs) or condition and procedure categories used to adjust for patient risk factors in each readmission measure.
Free and available to public

**Readmission Risk Calculators**

Select a Reason for Initial Hospitalization:

<table>
<thead>
<tr>
<th>Reason</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Attack</td>
<td>→</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>→</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>→</td>
</tr>
</tbody>
</table>
Readmission Risk Score for Heart Failure

This readmission calculator is based on a statistical model developed from chart abstracted data. It is intended for use with patients age 65 and older.

**DEMOGRAPHICS**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>72</td>
<td>years</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
</tr>
</tbody>
</table>

**PRESENTATION**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital Cardiac Arrest</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HISTORY**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart Failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior PCI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aortic Stenosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke, ischemic or hemorrhagic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dementia</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PHYSICAL EXAM (ON ADMISSION)**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure</td>
<td>165 mmHg</td>
<td>N/A</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>64 beats per min</td>
<td>N/A</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>22 breaths per min</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**DIAGNOSTICS (ON ADMISSION)**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>130 mmoL</td>
<td>N/A</td>
</tr>
<tr>
<td>Blood Urea Nitrogen</td>
<td>28 mg/dL or</td>
<td>mmol/L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>2.4 mg/dL or</td>
<td>mmol/L</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>48 %</td>
<td>N/A</td>
</tr>
<tr>
<td>Glucose</td>
<td>132 mg/dL or</td>
<td>mmol/L</td>
</tr>
<tr>
<td>LV Ejection Fraction</td>
<td>34 %</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Calculate Re-Admission Risk Score**  **Clear all Data**
How Accurate Are These Tools?

Readmission Risk Score for Heart Failure

26%

RISK SCORE

This represents the estimated risk of readmission within 30 days from discharge for a patient whose principal diagnosis was heart failure.

This readmission score is the best estimate of a patient's risk of readmission given the information provided. The risk for any individual could vary from this estimate as there may be other factors beyond what are in the model that may influence readmission risk.

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Statistical Model for Prediction = ROC Curve 0.60 to 0.63
Four possible outcomes in Predictive Analytics

- **True Positive** (Sensitivity)
- **False Positive** (Specificity)
- **False Negative**
- **True Negative**
Statistical Primer for Predictive Analytics

Four possible outcomes in Predictive Analytics

- True Positive (Sensitivity)
- False Positive (Specificity)
- False Negative
- True Negative

Patient tests positive for the disease but doesn’t really have it!
Statistical Primer for Predictive Analytics

Four possible outcomes in Predictive Analytics:

- **True Positive (Sensitivity)**
- **False Positive (Specificity)**
- **False Negative**
- **True Negative**

Patient tests negative suggesting they are healthy but they actually have the disease.
Statistical Primer for Predictive Analytics

True Positive (Sensitivity)

False Positive (Specificity)

False Negative

True Negative

100% True Positive Rate
ROC Curve is the Area Under the Line
Also known as the C-Statistic

- True Positive (Sensitivity)
- False Positive (Specificity)
- False Negative
- True Negative

1.0 = Perfect Line of no-discrimination

0.5 = Random Coin Toss

Points above the Diagonal line Represent better Than random
Points below the Diagonal line Represent Worse Than random
CMS Readmission Calculator
C-Statistic = .60 to .63

CMS Prediction Model Using Logistic Regression and Hierarchical logistic regression models on 2008 to 2010 data performed better than random guessing

Acute MI = .63
Heart Failure = .60
Pneumonia = .63
Other Predictive Analytic Tools

LACE Assessment

✓ Length of Stay
✓ Acute Admit via ED
✓ Comorbidities (modified)
✓ ED visits in past six months

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Points</th>
<th>Prior Admit</th>
<th>Present Admit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay</td>
<td>Less than 1 day</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 day</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 days</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 days</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4-5 days</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6-7 days</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7-10 days</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 or more days</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute admission</td>
<td>Inpatient</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Observation</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comorbidity:</td>
<td>No prior history</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DM no complications, Cerebrovascular disease, Hx of MI, PVD, PUD</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mild liver disease, DM with end organ damage, CHF, COPD, Cancer, Leukemia, lymphoma, any tumor, cancer, moderate to severe renal dz</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dementia or connective tissue disease</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate or severe liver disease or HIV Infection</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metastatic cancer</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Room visits during previous 6 months</td>
<td>0 visits</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 visit</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 visits</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 visits</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 or more visits</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Take the sum of the points and enter the total.

C Statistic = .70 but data must be collected POST Discharge, so usefulness to identify patients in-house for proactive management is limited.
Other Predictive Analytic Tools

Probability of Repeated Admission Instrument (Pra™)
- 17 item questionnaire
- Medical history
- Functional ability
- Living circumstances
- Nutrition
- Depression
- Licensing available from Johns Hopkins

*C Statistic = .53 to .61 depending on which study you review*

*Published in Kansagara (2011) systematic review paper*

Tells me about estimated risk of readmission for this patient but not what to do about it
Next generation analytics will likely require machine learning techniques and “big data” manipulation of complex human and systems variables.

Source: Gartner Business Intelligence & Analytics Summit 2013
What are the interventions presumed to reduce readmissions?

- Define and arrange post discharge medical services
- Define and arrange post discharge ancillary services e.g. PT, OT, Home Health
- Review medication changes
- Self care education and coaching
- Provide readable copy to patient and family
- Send discharge plan of care to all providers
- Red flag symptoms
- Assess home safety and ADLs
- Follow up call to Patient/Family
Analytics: Improving Insight and Business Value

- Descriptive Analytics: What happened?
  Reporting, dashboards

- Diagnostic Analytics: Why did it happen?
  Ad-hoc query, data mining

- Predictive Analytics: What will happen?
  Statistics, planning

- Prescriptive Analytics: What should happen?
  Simulation, optimization

- Qualitative Analysis: Who did it happen to?
  Stories, Experiential

Original Source: Gartner Business Intelligence & Analytics Summit 2013 (Blue)
Future Midas+
Analytic Solutions

- Readmission Reduction Calculator
- Predictive Readmission Service
- Patient engagement wearable device
Closing Thoughts

• Readmissions are proxy measures of quality of care.
• Not all readmissions are undesirable.
• Not all readmissions are preventable.
• A certain percentage of readmissions can be influenced by proper medical management, discharge planning and continuity of care.
• The ultimate purpose of readmission rates are to help you identify those patients and conditions for whom you can most likely make a difference.
• Different readmission metrics will give you different results.
• Advanced computer science and machine learning are likely to emerge to bring us prescriptive analytics to better manage readmissions in the future.
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Time for Questions!