Welcome

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Presenters

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Disclosures

- None

“Hospital readmissions are sometimes indicators of poor care or missed opportunities to better coordinate care.”

“...failure to adequately attend to the care transition at discharge from the hospital results in additional Medicare spending; 17.6 percent of admissions result in readmissions within 30 days of discharge, accounting for $15 billion in spending. Not all of these readmissions are avoidable, but some are.”
The Congress should require the Secretary to confidentially report readmission rates and resource use around hospitalization episodes to hospitals and physicians. “

To encourage providers to collaborate and better coordinate care, the Congress should direct the Secretary to reduce payments to hospitals with relatively high readmission rates.”
“Almost one fifth (19.6%) of the 11,855,702 Medicare beneficiaries who had been discharged from a hospital were rehospitalized within 30 days, and 34.0% were rehospitalized within 90 days.....In the case of 50.2% of the patients who were rehospitalized within 30 days after a medical discharge to the community, there was no bill for a visit to a physician’s office between the time of discharge and rehospitalization.”

NEJM, 2009
Readmission Rates Have Not Improved Over Time

Rates are authors’ calculations based on Medicare data.

Section 3025 of Affordable Care Act

111th Congress
Public Law 111–148

An Act
Entitled The Patient Protection and Affordable Care Act.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE: TABLE OF CONTENTS.
(a) SHORT TITLE.—This Act may be cited as the “Patient Protection and Affordable Care Act.”
(b) TABLE OF CONTENTS.—The table of contents of this Act is as follows:

| Title I—QUALITY, AFFORDABLE HEALTH CARE | Sec. 3001. Establishment of the Patient-Centered Outcomes Research Institute
| Title II—IMPROVEMENTS IN MEDICARE AND MEDICAID | Sec. 3002. Improvements in Medicare and Medicaid programs under title XIX and title XVIII
| Title III—PRIVATE HEALTH INSURANCE | Sec. 3003. Improvement in the health insurance marketplaces
| Title IV—PRIVATE HEALTH INSURANCE MARKETPLACE | Sec. 3004. Improvements in the health insurance marketplaces
| Title V—MEDICAID AND SCHOLARSHIPS | Sec. 3005. Improvements in Medicaid and SCHOLARSHIPS
| Title VI—SECRETARY OF HEALTH AND HUMAN SERVICES | Sec. 3006. Improvements in the Secretary of Health and Human Services
| Title VII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3007. Improvements in the Affordable Care Act
| Title VIII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3008. Improvements in the Affordable Care Act
| Title IX—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3009. Improvements in the Affordable Care Act
| Title X—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3010. Improvements in the Affordable Care Act
| Title XI—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3011. Improvements in the Affordable Care Act
| Title XII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3012. Improvements in the Affordable Care Act
| Title XIII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3013. Improvements in the Affordable Care Act
| Title XIV—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3014. Improvements in the Affordable Care Act
| Title XV—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3015. Improvements in the Affordable Care Act
| Title XVI—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3016. Improvements in the Affordable Care Act
| Title XVII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3017. Improvements in the Affordable Care Act
| Title XVIII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3018. Improvements in the Affordable Care Act
| Title XIX—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3019. Improvements in the Affordable Care Act
| Title XX—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3020. Improvements in the Affordable Care Act
| Title XXI—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3021. Improvements in the Affordable Care Act
| Title XXII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3022. Improvements in the Affordable Care Act
| Title XXIII—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3023. Improvements in the Affordable Care Act
| Title XXIV—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3024. Improvements in the Affordable Care Act
| Title XXV—IMPROVEMENTS IN THE AFFORDABLE CARE ACT | Sec. 3025. Hospital Readmissions Reduction Program

SEC. 3025. HOSPITAL READMISSIONS REDUCTION PROGRAM.
(a) IN GENERAL.—Section 1886 of the Social Security Act (42 U.S.C. 1395ww), as amended by sections 3001 and 3008, is amended by adding at the end the following new subsection:

HOSPITAL READMISSIONS REDUCTION PROGRAM—

1) IN GENERAL.—With respect to payment for discharges an applicable hospital (as defined in paragraph (5)(C)) during a fiscal year beginning on or after October 1, in order to account for excess readmissions in the fiscal year, the Secretary shall reduce the payments that would otherwise be made to such hospital under subsection (d) (or in 1814(b)(3), as the case may be) for such a discharge amount equal to the product of—

(A) the base operating DRG payment amount (as defined in paragraph (2)) for the discharge; and

(B) the adjustment factor (described in paragraph (A)) for the hospital for the fiscal year.

2) BASE OPERATING DRG PAYMENT AMOUNT DEFINED.—

(A) IN GENERAL.—Except as provided in subparagraphs (B) and (C), in this subsection, the term ‘base operating DRG payment amount’ means, with respect to a hospital for a fiscal year—

(i) the payment amount that would otherwise be made under subsection (d) (determined without regard to subsection (o)) for a discharge if this subsection
Hospital Readmission Reduction Program

- Hospital reimbursement for all its discharges will be reduced if hospital’s readmission rate for AMI, heart failure, and pneumonia exceed predicted.

- Program begins in 2013 with a maximum 1% reduction, increasing to 2% in 2014 and 3% in 2015.

- Beginning in 2015, the number of diagnoses for which readmission rates will be monitored will expand, now including chronic obstructive lung disease and joint replacement— in 2017, CABG.

Report to Congress

National Strategy for Quality Improvement in Health Care

March 2011

3. Promoting Effective Communication and Coordination of Care

When all of a patient’s health care providers coordinate their efforts, it helps ensure that the patient gets the care and support she needs and wants, when and how she needs and wants it. Effective care coordination models have begun to show that they can deliver better quality and lower costs in settings that range from small physician practices to large hospital centers.

Health care systems need to encourage coordination and help providers care for patients with chronic diseases so they get the kind of seamless care that is most effective. Gaps and duplication in patient care delivery can be reduced or eliminated through proven technologies such as electronic health records, e-prescribing, and telemedicine. Hospitals and long-term care and rehabilitation facilities, along with physicians, nurses, and other clinicians working together, are helping recently discharged patients avoid unnecessary rehospitalization. All too often, however, the way health care is paid for does not foster coordination but instead pays more to providers for doing more instead of working together. Policies advanced by the National Quality Strategy will help change that.
**Issues with Readmission Penalties**

- To be readmitted, you first have to survive!
- What is a **preventable** readmission
- What is **excess** readmission (requires “Expected” value, which is problematic)
- Include **SES** factors?
- How much is **controllable** by hospital
- Unintended **negative consequences**
  - Penalizing safety net and other hospitals serving disadvantaged populations
  - Discouraging appropriate, early readmissions that may prevent more serious problems

**Preventable Readmissions**

- Most credible determinations of readmission preventability come from chart reviews by expert clinicians
- Chart review typically reveals lower rates of preventability than those determined from automated algorithms (e.g., 3M)
- Clinician review not feasible to scale
- For profiling purposes, risk-adjusted, automated, rate-based approaches will be required
Estimating Expected Readmission Rates

- Compared with mortality risk estimation, broader and more complex range of risk factors for readmission, some not under control of index hospital
  - Patient characteristics and illness severity on admission
  - Quality of care during the index admission (failure to adequately treat and resolve the original condition, complications of care)
  - Discharge and transition planning (inadequate prep of patient/family, poor communication with PCP’s)
  - Local environmental factors (inadequate community healthcare resources to support patients post-discharge)
  - SES factors (risk adjust or stratify)
  - Recurrence of the original chronic condition
  - Development of an unrelated new condition
  - Discretionary, local threshold to admit

Readmission Risk Models

- Readmission risk models have mediocre performance
- Hospitals do not receive credit for some of the most important risk factors for readmission
- Suboptimal models, high stakes: increased potential for adverse unintended consequences
  - Denial of care to patients at high risk of readmission
  - Excessive penalties for hospitals serving disadvantaged populations (“take from the poor, give to the rich”)
Unintended Negative Consequences

Larger teaching hospitals and safety net hospitals most likely to be penalized.

### Table: Hospital Characteristics by Penalty Level

<table>
<thead>
<tr>
<th>Category</th>
<th>High Penalties (n = 1097)</th>
<th>Low Penalties (n = 1692)</th>
<th>No Penalties, Unadjusted Rates, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted Rates, No. (%)</td>
<td>Multivariate-Adjusted OR (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>Size of hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large (&gt;200 beds)</td>
<td>178 (47)</td>
<td>1.98 (1.44-2.74)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Medium (200-399 beds)</td>
<td>202 (65)</td>
<td>2.09 (1.78-2.46)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Small (&lt;200 beds)</td>
<td>290 (69)</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Teaching hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>156 (44)</td>
<td>1.96 (1.04-3.62)</td>
<td>.03</td>
</tr>
<tr>
<td>Not major</td>
<td>579 (53)</td>
<td>1 [Reference]</td>
<td></td>
</tr>
<tr>
<td>Safety net hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>337 (44)</td>
<td>2.36 (1.91-2.95)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>No</td>
<td>260 (65)</td>
<td>1 [Reference]</td>
<td></td>
</tr>
</tbody>
</table>

CABG Readmission

- CABG readmissions: a marker of care quality and an opportunity to improve care
  - Most CABG readmissions unplanned—result from delayed occurrence or recognition of complications
  - Not a result of shorter LOS initiatives
  - High mortality in readmitted patients
  - Readmission and mortality rates are complementary performance measures

Joynt and Jha, JAMA 2013
CABG Readmission

- Frequency and financial impact of CABG readmissions
- If count ED visits, doubles # of “returns” to hospital
- Ascertainment issues: 50% CABG readmissions to other than index hospital
- Lack of improvement in CABG readmission rates
- Significant inter-hospital variation in rates
- CMS adding CABG as readmission target

CABG Readmission

- Feasible opportunities for improvement
  - Proactively address common readmission causes before discharge
  - Educate patients, families, cardiologists, and PCPs
  - Always contact original surgeon before readmission
  - Outpatient visits by NPs, PAs; Smartphone pix, videos; earlier return visits
READMISSION AFTER CARDIAC OPERATIONS: PREVALENCE, PATTERNS, AND PREDISPOSING FACTORS

Richard S. D'Agostino, MD
Jenilynn Jacobson, MA
Mandy Clarkson, RN
Lars G. Svensson, MD, PhD
Christina Williamson, MD
David M. Shahian, MD

Objectives: This study was undertaken (1) to determine the prevalence of hospital readmission within 1 month of discharge after cardiac operations, (2) to categorize diagnoses responsible for readmission, and (3) to examine predischarge patient factors that influenced readmission.

Methods: Data at 1 month after discharge were obtained for 1665 (98.4%) of 1692 patients who underwent cardiac operations between January 1996 and July 1998. Results: Two hundred twenty-five patients (13.5%) were readmitted to a hospital within a 1-month period after discharge. Forty-eight percent of readmissions were to other hospitals. The most common readmission problems were congestive heart failure (15.6%), atrial fibrillation (12.9%), chest pain (12.5%), wound problems (10.2%), and gastrointestinal problems (8.0%). Hospital discharge on or before the fifth postoperative day was associated with a lower prevalence of subsequent readmission. The independent predictors of a readmission for congestive heart failure were postoperative stay longer than 5 days, diabetes, New York Heart Association functional class IV, preoperative congestive heart failure, total blood product use, the need for postoperative inotropes, body mass index greater than 28 kg/m², and reoperation for bleeding. Conclusions: The prevalence of rehospitalization during the first month after discharge is not trivial. Other than postoperative atrial fibrillation, readmission is probably the single most likely adverse event to befall a patient in the early postoperative period. Patients who are discharged early do not appear to be at increased risk. Patterns in readmission diagnoses suggest opportunities for preventive strategies. (J Thorac Cardiovasc Surg 1999;118:823-32)

Most Readmissions Early = Opportunity
Table 1. Causes of READMISSION after cardiac procedure

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac (4%)</td>
<td>105</td>
</tr>
<tr>
<td>Angina</td>
<td>22</td>
</tr>
<tr>
<td>CHF</td>
<td>22</td>
</tr>
<tr>
<td>Myocardial infarction problems</td>
<td>30</td>
</tr>
<tr>
<td>Heart block or cardiomyopathy</td>
<td>7</td>
</tr>
<tr>
<td>Ruptured aortic dissection</td>
<td>7</td>
</tr>
<tr>
<td>Vasospasm</td>
<td>1</td>
</tr>
<tr>
<td>Prosthetic valve</td>
<td>1</td>
</tr>
<tr>
<td>SEMA/AVI</td>
<td>1</td>
</tr>
<tr>
<td>Mitral valve stenosis</td>
<td>1</td>
</tr>
<tr>
<td>Mitral regurgitation</td>
<td>1</td>
</tr>
<tr>
<td>Atrial septal defect</td>
<td>1</td>
</tr>
<tr>
<td>Dextorsat</td>
<td>4</td>
</tr>
<tr>
<td>Percutaneous aortic stenosis</td>
<td>5</td>
</tr>
<tr>
<td>Pulmonary hypertension (1%)</td>
<td>45</td>
</tr>
<tr>
<td>Plural effusion</td>
<td>31</td>
</tr>
<tr>
<td>Pericarditis</td>
<td>12</td>
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<tr>
<td>COPD exacerbation</td>
<td>5</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>1</td>
</tr>
<tr>
<td>GI bleed</td>
<td>11</td>
</tr>
<tr>
<td>Sepsis</td>
<td>11</td>
</tr>
<tr>
<td>Gastrointestinal abdominal pain</td>
<td>1</td>
</tr>
<tr>
<td>Perioperative mortality</td>
<td>1</td>
</tr>
<tr>
<td>C. diff colitis</td>
<td>1</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>1</td>
</tr>
<tr>
<td>Ischemic bowel</td>
<td>1</td>
</tr>
<tr>
<td>Repeated appendicitis</td>
<td>1</td>
</tr>
<tr>
<td>Progression of renal failure</td>
<td>3</td>
</tr>
<tr>
<td>UTI</td>
<td>1</td>
</tr>
<tr>
<td>Sternal wound problems (7%)</td>
<td>18</td>
</tr>
<tr>
<td>Deep sternal infection</td>
<td>13</td>
</tr>
<tr>
<td>Stomal stricture</td>
<td>5</td>
</tr>
<tr>
<td>Extremity complications (9%)</td>
<td>17</td>
</tr>
<tr>
<td>Septicemia valve harvest site cellulitis infection</td>
<td>7</td>
</tr>
<tr>
<td>DVT</td>
<td>9</td>
</tr>
<tr>
<td>Thoracosternal pleural graft</td>
<td>1</td>
</tr>
<tr>
<td>Metabolic disturbances (4%)</td>
<td>11</td>
</tr>
<tr>
<td>Dehydration</td>
<td>7</td>
</tr>
<tr>
<td>Hypokalemia</td>
<td>7</td>
</tr>
<tr>
<td>Hypomagnesemia</td>
<td>1</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>1</td>
</tr>
<tr>
<td>Neuroleptics (38%)</td>
<td>9</td>
</tr>
<tr>
<td>Stroke (1%)</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2. Risk Factors Associated With Readmission

<table>
<thead>
<tr>
<th>Variable</th>
<th>HR (95% CI)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.35 (1.16 to 1.57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes mellitus, yes/no</td>
<td>1.35 (1.15 to 1.59)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>COPD, yes/no</td>
<td>1.42 (1.19 to 1.68)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Creatinine</td>
<td>1.10 (1.05 to 1.15)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.94 (0.88 to 0.99)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of operation, h</td>
<td>1.15 (1.10 to 1.20)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Procedure (ref: CABG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve</td>
<td>1.35 (1.11 to 1.60)</td>
<td>0.002</td>
</tr>
<tr>
<td>CABG + valve</td>
<td>1.52 (1.25 to 1.88)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LVAD + transplant</td>
<td>3.36 (2.54 to 4.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Thoracic aortic</td>
<td>1.40 (1.06 to 1.85)</td>
<td>0.017</td>
</tr>
<tr>
<td>Other</td>
<td>1.41 (1.06 to 1.89)</td>
<td>0.019</td>
</tr>
</tbody>
</table>

From the Division of Cardiothoracic Surgery, Duke University Medical Center, Durham, North Carolina. Health Outcomes and Innovation Research (HOIR), Department of Health Evidence and Policy, Duke School of Nursing, New York, New York. Duke Clinical Research Institute, Duke University Medical Center, Durham, North Carolina. Cardiothoracic Surgery, Cleveland Clinic, Cleveland, Ohio. Department of Cardiothoracic Surgery, Duke University Medical Center, Durham, North Carolina.

**Risk factors for early hospital readmission after cardiac operations**

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Suelen P. Ferraris, PhD
B. Christopher Hennen, BS
Boyd D. Evans, BS

Objective: Early hospital readmissions after cardiac procedures are both costly and harmful to patients. We investigated the factors that predispose to readmission to develop strategies to minimize this problem.

Method: As part of a prospective data collection, patients having cardiac procedures at our institution are routinely tracked for 30 days after discharge from the hospital. We reviewed 2,574 patients in our cardiac database who underwent operations over the past 5 years. We used univariate and multivariate statistical techniques to identify risk factors for readmission.

Results: Of 2,574 discharged patients, 252 (9.8%) required readmission. The most common causes of readmission are cardiac (42%), pulmonary (19%), gastrointestinal (19%), and venous complications (5.7%); deep vein thrombophlebitis, peripheral arterial vascular disease, and superficial vein harvest site problems; sternal wound infection (7.5%); and metabolic problems (4.5%). Of more than 70 variables studied, only 6 are significant multivariate predictors of readmission: female sex (P = 0.002); diabetes (P < 0.001); chronic lung problems (P = 0.011); increased distance between home and hospital (P < 0.001); pro-rate aortic stenosis (P < 0.002); and preoperative chronic renal insufficiency (P < 0.002). Type of operation, age, procedures, and other noninvasive and postoperative variables are not important multivariate predictors of readmission. Prolonged hospital length of stay for the initial procedure did not cause more frequent readmission. The costs of initial hospitalization, together with the costs combined with postoperative hospitalization, were not significantly increased in patients who required readmission.

Conclusion: The high-risk patient for readmission is a woman with diabetes, chronic lung disease, renal insufficiency, and preoperative atrial fibrillation who lives a distance from the hospital. Readmission does not depend on postoperative variables (e.g., cardiovascular bypass time) or on postoperative complications. High procedural costs from the initial hospitalization do not predispose to readmission. These results support interventions that may reduce readmission.
Mortality and readmission rates are measuring different aspects of quality

Hannan et al, 2011

Figure 2. Hospital Risk-Adjusted In-Hospital/30-Day Mortality Rate Versus Hospital Risk-Adjusted 30-Day Readmission Rate

Scatterplot was used to access the strength of relationship between risk-adjusted in-hospital/30-day mortality rate and 30-day readmission rate in hospital level. Each blue diamond represents 1 hospital. Statistical analysis showed that the Pearson Correlation Coefficient for the 2 rates is 0.52 (p = 0.007). It implies that correlation between the hospital risk-adjusted in-hospital/30-day mortality rate and hospital 30-day readmission rate was weak.

Reliability of Readmission Rates as a Hospital Quality Measure in Cardiac Surgery

Terry Shih, MD, and Justin B. Dimick, MD, MPH
Center for Healthcare Outcomes and Policy, University of Michigan, Ann Arbor, Michigan

Background. Recent policy interventions have reduced payments to hospitals with higher-than-predicted risk-adjusted readmission rates. However, whether readmission rates reliably disseminate hospital quality is uncertain. We explored the ability of 30-day readmission rates as a measure of hospital quality and examined whether hospital variations in readmission rates reflect the effect of hospital case load on readmission rates.

Methods. We examined data for consecutive years from 2006 to 2008 (n = 345) for 53 hospitals. First, we performed a regression examining patient-reported readmission rates and adjusted readmission rates as dependent variables. Next, we performed hierarchical modeling of the factors: patient characteristics, hospital characteristics, and the interaction of hospital characteristics and patient characteristics. Finally, we estimated the proportion of unexplained variability attributable to measurement error.

Results. A median of 151 (25% to 75% interquartile range, 79 to 265) coronary artery bypasses were performed per hospital during the 3-year period. The median risk-adjusted 30-day readmission rate was 17.6% (25% to 75% interquartile range, 14.4% to 20.8%). Of the variation in readmission rates, 55% was explained by measurement noise, 4% could be attributed to patient characteristics, and the remaining 41% represented true signal in readmission rates. Only 53 hospitals (4.4%) achieved a proficient level of reliability exceeding 0.70. To achieve this reliability, 599 cases were required during the 3-year period. In 33.7% of hospitals, a moderate degree of reliability exceeding 0.5 was achieved, which required 218 cases.”
Development of a Clinical Registry-Based 30-Day Readmission Measure for Coronary Artery Bypass Grafting Surgery

David M. Shahian, MD; Xia He, MS; Sean M. O’Brien, PhD; Frederick L. Grover, MD; Jeffrey P. Jacobs, MD; Fred H. Edwards, MD; Karl F. Welke, MD; Lisa G. Satter, MD; Elizabeth Drye, MD, SM; Cynthia M. Shewan, PhD; Lein Han, PhD; Eric Peterson, MD, MPH

Background—Reducing readmissions is a major healthcare reform goal, and reimbursement penalties are imposed for higher-than-expected readmission rates. Most readmission risk models and performance measures are based on administrative rather than clinical data.

Methods and Results—We examined rates and predictors of 30-day all-cause readmission following coronary artery bypass grafting surgery by using nationally representative clinical data (2008–2010) from the Society of Thoracic Surgeons National Database linked to Medicare claims records. Among 265,434 eligible Medicare records, 226,960 (86%) were successfully linked to Society of Thoracic Surgeons records. 162,572 (61%) isolated coronary artery bypass grafting admissions constituted the study cohort. Logistic regression was used to identify readmission risk factors; hierarchical regression models were then estimated. Risk-standardized readmission rates ranged from 12.6% to 23.6% (median, 16.8% among 846 US hospitals with ≥30 eligible cases and ≥50% of eligible Centers for Medicare and Medicaid Services records linked to the Society of Thoracic Surgeons database. Readmission predictors odds ratios (95% confidence interval) included dialysis (3.02 [1.87–2.19]), severe chronic lung disease (1.58 [1.49–1.68]), creatinine (2.5 versus 1.0 or lower: 1.49 [1.41–1.57]; 2.0 versus 1.0 or lower: 1.37 [1.32–1.43]), insulin-dependent diabetes mellitus (1.43 [1.39–1.51]), obesity in women (body surface area 2.2 versus 1.8: 1.44 [1.35–1.53]), female sex (1.38 [1.33–1.43]), immunosuppression (1.38 [1.28–1.49]), preoperative atrial fibrillation (1.36 [1.30–1.42]), age per 10-year increase (1.36 [1.33–1.39]), recent myocardial infarction (1.24 [1.08–1.42]), and low body surface area in men (1.22 [1.14–1.30]).

Conclusions—A coronary artery bypass grafting surgery readmission measure suitable for public reporting was developed by using the national Society of Thoracic Surgeons clinical data linked to Medicare readmission claims. (Circulation. 2014;130:399–409.)

Key Words: coronary artery bypass ▪ patient readmission ▪ registries ▪ risk adjustment

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ICD-9 CABG code in any position  
\( n = 410,741 \) admissions, 1,210 hospitals

Excluded:

- CMS providers with \( < 10 \) Medicare CABG admissions 2008–2010  
  \( (n = 107 \) admissions, 38 hospitals)
- Incomplete transfer chain information  
  \( (n = 86 \) admissions)
- < 65 years old  
  \( (n = 44,731 \) admissions)
- Not discharged alive  
  \( (n = 12,776 \) admissions)
- Not eligible Medicare fee for service for at least one month postop or until discharge  
  \( (n = 86,964 \) admissions)
- Left against medical advice  
  \( (n = 101 \) admissions)
- Invalid readmission information  
  \( (n = 542 \) admissions)
- CMS admissions not linked to STS  
  \( (n = 38,474 \) admissions, 160 hospitals)
- Not isolated CABG (per project definition)  
  \( (n = 64,388 \) admissions)

Final study cohort  
\( n = 162,572 \) admissions, 1,012 hospitals

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Based on preop factors only, and no SES
STS/NQF Sociodemographic Factors Study

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Number of readmissions</th>
<th>Readmission rate</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic</td>
<td>26,042</td>
<td>16.7%</td>
<td>155,780</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1,143</td>
<td>19.1%</td>
<td>5,982</td>
</tr>
</tbody>
</table>

**Race categories**

1. - Black 1,576 20.2% 7,792
2. - Asian 410 18.0% 2,277
3. - Native American 94 20.5% 459
4. - Pacific Islander 39 16.6% 235
5. - Other 627 17.6% 3,554
6. - Caucasian 24,287 16.6% 146,625
7. - Multiracial 152 18.5% 820

**Payor categories**

1. - Medicare+Medicaid dual eligible 2,143 22.9% 9,347
2. - Medicare+Commercial without Medicaid 12,885 15.9% 80,966
3. - Medicare without Medicaid/Commercial 12,157 17.0% 71,449
Overall 27,185 16.8% 161,762

Pearson correlation coefficient 0.995
Only 8 of 846 hospitals changed classification

<table>
<thead>
<tr>
<th>Model with SDS factors (race/ethnicity and payor)</th>
<th>Better than expected</th>
<th>As Expected</th>
<th>Worse than expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model without SDS factors</td>
<td>20</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Better than expected</td>
<td>2</td>
<td>795</td>
<td>2</td>
</tr>
<tr>
<td>As expected</td>
<td>0</td>
<td>1</td>
<td>23</td>
</tr>
</tbody>
</table>

Better than expected = 95% interval estimate of RSRR entirely below population aggregated rate
Worse than expected = 95% interval estimate of RSRR entirely above population aggregated rate
As expected = 95% interval estimate of RSRR neither entirely above nor entirely below population aggregated rate

The outlier status based on the two models agreed for 99.1% (838/846) of all hospitals.
Readmission

- Major national concern
- Inter-hospital variation exists
- Readmission prediction models, including CABG, perform poorly compared with mortality or morbidity models
- SES factors do not change CABG performance classification for vast majority of hospitals
- For CABG, potential exists to mitigate likelihood of readmission

Reducing Readmissions after Isolated CABG: Guidelines for Perioperative Care

Frank L. Shannon, MD

William Beaumont Hospital
Cardiovascular Surgery

Associate Professor
Oakland University
William Beaumont School of Medicine
Disclosures

• None

General Considerations

• Risk factors for surgical morbidity and mortality are not the same as those for hospital readmission.

• Reducing readmission rates for CABG patients requires a “bundled” approach
  • Multiple unrelated causes of readmissions with a low incidence
  • Some causes are unavoidable complications of surgery
  • Socioeconomic and insurance coverage factors are unchangeable
Strategies to Reduce Readmission Rates after CABG

- Provide better peri-operative care
  - Strict glycemic control
  - Prevent Retained Blood Syndrome
- Completely resolve post-operative issues
  - Atrial fibrillation – rate control and anti-coagulation
  - Congestive heart failure – appropriate medication regimen
  - Pleural effusions – early thoracentesis
- Proactively identify patients “At Risk” for readmission
  - Better management of co-morbidities
  - Plan enhanced post-discharge follow-up

Summary of Primary Reasons for Readmission

<table>
<thead>
<tr>
<th>Administrative Reviews</th>
<th>Clinical Reviews</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reasons</strong></td>
<td><strong>Range</strong></td>
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<tr>
<td>Surgical site infection</td>
<td>12 – 17%</td>
</tr>
<tr>
<td>CHF</td>
<td>10 – 13%</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>3 – 4%</td>
</tr>
<tr>
<td>Chest pain</td>
<td>3 – 5%</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>3 – 6%</td>
</tr>
<tr>
<td><strong>Reasons</strong></td>
<td><strong>Range</strong></td>
</tr>
<tr>
<td>Surgical site infection</td>
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<td>CHF</td>
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<tr>
<td>Pleural effusion</td>
<td>12 – 15%</td>
</tr>
<tr>
<td>Chest pain</td>
<td>8 – 12%</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>5 – 13%</td>
</tr>
</tbody>
</table>
1. Glycemic Control

The effectiveness of tight glycemic control on decreasing surgical site infections and readmission rates in adult patients with diabetes undergoing cardiac surgery: A systematic review

Lyn Boreland, MSN, RN, FNP-BC, DNPC, Marcia Scott-Hudson, MSN, RN, FNP-BC, DNPC

- Review identified 11 studies of isolated CABG patients
- 4 were randomized control trials of strict glucose management in known diabetics with insulin infusion vs subcutaneous insulin injections on a sliding scale
- 7 were cohort studies with prospective comparison of IV vs subcutaneous insulin for glycemic control

Boreland L et al. Heart & Lung 2015

- 10 out 11 studies show significant reduction of sternal and leg wound infections
- Best results with insulin infusion beginning pre-op through POD 3 with target glucose ≤ 200
- Readmission reduction specifically demonstrated in 2 studies

Boreland L et al. Heart & Lung 2015
2. Prevention of Retained Blood Syndrome (RBS)

- Retained blood is believed to be root cause for persistent and recurrent fluid collections

Boyle EM et al, Innovations 2015

Preventing Retained Blood Syndrome

- Eliminate agents that produce coagulopathy prior to surgery
- Meticulous hemostasis
- Satisfactory chest tube drainage
- Re-exploration and washout for excessive bleeding (early)
- Pre-discharge thoracentesis for pleural effusions > 25% of hemithorax volume
Complete Resolution of Post-operative Issues

CHF – Optimal Medication Management

1. HFrEF (LVEF < 40%)
   - Diuretics
   - ACE inhibitors titrated to effect
   - Aldosterone antagonists
   - Avoid calcium channel blockers

2. HFpEF (LVEF ≥ 40%)
   - Diuretics for fluid overload
   - Anti-hypertensives to modulate BP and prevent SBP “spikes”
   - Beta blockers to prevent tachycardia
   - Aldosterone antagonists

Complete Resolution of Post-operative Issues

New Onset Atrial Fibrillation

1. Incidence and Time Course
   - 95% of cases occur within 3 days of surgery
   - Incidence: 15 – 40%
   - Self-limited: 80% terminate within 24 hours of onset

2. Prevention of Post-op AF
   - Beta blockers reduce incidence of NOAF by 30%
   - Amiodarone lowers the incidence of NOAF by 50%, but has more adverse cardiac events (bradycardia requiring temporary pacing – 5.7%)
Complete Resolution of Post-operative Issues

New Onset Atrial Fibrillation

3. **Treatment**
   - Rate Control with beta blocker, amiodarone and/or cardiazem to achieve resting HR < 90 and 6MWT HR < 125
   - Cardiovert:
     - if symptomatic and rate control difficult
     - LVEF < 40%

4. **Anticoagulation**
   - Indicated for multiple episodes of AF or one episode > 24 to 48 hours
   - Warfarin without bridging heparin to achieve INR of 2.5 to 3.0
     - Unless prior history of thromboembolic complications of AF
   - Maintain anticoagulation for 4 weeks from onset of AF

Complete Resolution of Post-operative Issues

Pleural Effusions

1. **Natural History**
   - 10% develop effusion that occupies > 25% of hemi-thorax within 30 days
   - Only half of these patients require thoracentesis

2. **Evaluation**
   - Pleural ultrasound to differentiate fluid from atelectasis
   - Post-cardiotomy syndrome work-up if progressive enlargement > 2 weeks

3. **Treatment**
   - Medical management (diuresis ± NSAIDs)
   - Pre-discharge ultrasound-guided thoracentesis if > 25% hemithorax
Risk Factors for Readmission

STS National Cardiac Database 2008 – 2010

162,572 Isolated CAB patients

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESRD on hemodialysis</td>
<td>2.02</td>
<td>Immunosuppression</td>
<td>1.38</td>
</tr>
<tr>
<td>Severe COPD</td>
<td>1.58</td>
<td>Pre-op atrial fibrillation</td>
<td>1.36</td>
</tr>
<tr>
<td>IDDM</td>
<td>1.45</td>
<td>Age (10 year increments)</td>
<td>1.36</td>
</tr>
<tr>
<td>Obesity (woman)</td>
<td>1.44</td>
<td>Recent MI</td>
<td>1.24</td>
</tr>
<tr>
<td>CKD – creatinine &gt; 2.5</td>
<td>1.40</td>
<td>BMI &lt; 21 (males)</td>
<td>1.22</td>
</tr>
</tbody>
</table>

Shahian DM et al, Circulation 2014

Benefits of Recognizing “At Risk” Patients for Readmission

- Conscientious guideline implementation
  - Adjust for co-morbidities
- Higher index of suspicion for complications
  - Infections and borderline cardiopulmonary function
- Plan post-discharge resources for frailty support
  - PT and nursing care to facilitate full recovery
- Avoid post-surgical variant of “post-hospital syndrome”
  - Urgent surgery challenges pre-hospital compensation
Discharge Checklist

- No signs of wound infection
- Resolution of any post-op complications
- Glycemic control
- Absence of heart failure
  - No ankle swelling
  - CXR – no pulmonary congestion
  - Medication review for proper regimen (HFpEF vs HFrEF)
- Stable heart rhythm
  - If AF, resting HR < 90 and exertional HR < 130
- Sustainable pulmonary status
  - CXR clear or < 25% pleural effusion
  - Bronchodilator therapy for COPD
  - Independent ambulation
- Disposition appropriate and discharge summary complete

Readmission Strategies & Outcomes

Kevin W. Lobdell, MD

Director of Quality
Sanger Heart & Vascular Institute
Carolinas HealthCare System

Clinical Professor of Surgery
University of North Carolina
Disclosures

• None

Quality Improvement Program (QIP)

2004-Present

• Common Aspiration Goals
  • Mortality
  • Major Morbidity
  • LOS
  • Readmissions
  • Cost/case

• Alignment of Guiding Coalition
  • Leaders
  • Managers
  • Multidisciplinary, expert ‘teaming’

• Accountability

• Learn Quickly & Continuously Improve
  • Real time data management, analysis, and reporting
QIP - People & Process Highlights
Admissions, Monitoring, and Multidisciplinary Rounds

Goal Sheets

Multidisciplinary Rounds

QIP - Process Highlights
Checklists

Scantron Completion Rates (v4.0)

Real-Time Reports Encourage Ongoing Discipline

Comprehensive Approach Yields Impressive Results

2018 Goal: 28% extubated by 6 hrs

Weekly Report
CVPOD Cardiac Surgery Patients
Total patients extubated: 77
Patients extubated:
Within 6 hrs: 39.5%
Between 6 and 24 hrs: 28.8%
After 24 hrs: 21.7%

Average Extubation Time
Mean (hrs): 11.4
Median (hrs): 10.3

Reasons for Extended Extubation
CV instability: 11%
Return to OR: 11%
Other: 5%

Identifying cause of extended extubation helps team identify areas for improvement

Cardiac surgery patients extubated within six hours, July 2018

78%
### QIP - Technology

**Point of Care Database**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preop Beta Blocker</th>
<th>Renal Failure</th>
<th>L. Davis Preop nasal bactroban</th>
<th>L. Davis Preop hibiclens shower/bath</th>
<th>M. Sullivan High risk antibiotic periop regimen</th>
<th>DC order by 0900</th>
<th>L. Davis DC by Noon</th>
<th>Review of Core Measures</th>
<th>Review of NQF Process Measures</th>
<th>Hemodilution Calculation</th>
<th>RAP</th>
<th>TEG and Coags</th>
<th>Fentanyl Total (ml) %&lt;30ml</th>
<th>Versed Total (mg) %&lt;10mg</th>
<th>Cardiac Index &gt;=2.2 L/min/m² (Last - Prior to CVRU)</th>
<th>Cardiac Index &gt;=2.2 L/min/m² (within 30 min. in CVRU)</th>
<th>Hourly Review</th>
<th>Early Extubation***</th>
<th>Prolonged Ventilation***</th>
<th>Prophylactic Antibiotics L. Lilley</th>
<th>POD #1 0600&lt;200mg/dL</th>
<th>POD #2 0600&lt;200mg/dL</th>
<th>Urinary Catheter Removal</th>
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</thead>
<tbody>
<tr>
<td>Goal</td>
<td>89%</td>
<td>100%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>74%</td>
<td>29%</td>
<td>99%</td>
<td>93%</td>
<td>99%</td>
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<td>96%</td>
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<td>100%</td>
<td>100%</td>
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<td>YTD</td>
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</tbody>
</table>

**Goal:** 89% of Patients Excluded < 4 hours of antibiotics to CVRU

**CMC Cardio Surgery Patients**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Exclusion Times (Min)</th>
<th>Exclusion Times (Hour)</th>
<th>Average Exclusion Time</th>
<th>Exclusion Times (Day)</th>
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</thead>
<tbody>
<tr>
<td>Preop Beta Blocker</td>
<td>30</td>
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<tr>
<td>Renal Failure</td>
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<td>30</td>
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<td>30</td>
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<tr>
<td>L. Davis DC by Noon</td>
<td>30</td>
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<td>Review of Core Measures</td>
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<td>30</td>
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<tr>
<td>Hourly Review</td>
<td>30</td>
<td>30</td>
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</tr>
</tbody>
</table>

**QIP - Accountability**

**Process Compliance**

**Table:**

<table>
<thead>
<tr>
<th>Issue Owner</th>
<th>Corrective Actions Taken / Planned</th>
<th>Historic Data</th>
<th>MTD</th>
<th>YTD</th>
<th>Goal</th>
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</thead>
<tbody>
<tr>
<td>M. Sullivan</td>
<td>Pre-Op Beta Blocker 89% 81% 100%  No Data</td>
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<td></td>
</tr>
<tr>
<td>M. Sullivan</td>
<td>High Risk RF patient: Nephrology consulted 100% 100% 100%  No data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. Davis</td>
<td>Preop nasal bactroban 99% 98.9% 100% 97% ↑↓↑</td>
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<td></td>
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</tbody>
</table>

**Graphs and Tables:**

- **Pie Chart:** Calculated Within 6 Hrs
- **Line Graphs:** Comparison to Last Month

**Legend:**

- Green = Meeting goal
- Yellow = On target to achieving
- Red = Not meeting goal

**Notes:**

- Comparison to Last Month
- Measure of Success

---

**Additional Notes:**

- QIP - Intraop Working Group
- QIP - Critical Care Working Group
- QIP - Medications
- QIP - Blood Sugars
- QIP - Preop / Discharge Working Group

---

**Learning & Insight:**

- Actions
- Outcomes

---

**Figure:**

- Learning
- Actions
- Outcome
Readmission Reduction

1. Risk Assessment
2. Clinical Care Management
3. Transitions
4. SNF and Home Health Community Collaborative
Readmission Risk Assessment
Existing Models

Several Risk Stratification Models Substituting in Absence of Perfect Algorithm

Within the search for the perfect risk stratification model continues, many hospital members have adopted predictive models that have been widely published on, adopting the formula to meet the needs of their particular organizations.

A sample of models used by CV programs include the LACE Index, the Pessimis Tool, and the Kohn model. Though variations exist between each, certain factors such as hospital staff, within the post-90 days, insurance status, and other demographics tied to zip code time and again.

Hospitals Adopting Models to Suit Patient Cohort

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LACE Index</td>
<td>Predict risk of readmission (based on length of stay, acute (urgent) admission, comorbidities, and ED visits during previous x months)</td>
</tr>
<tr>
<td>Pessimis Tool</td>
<td>Factors including race, insurance status, discharge disposition, diagnosis, and interventions performed during index admission, patient is assigned score of 0 to 10</td>
</tr>
<tr>
<td>赞叹工具</td>
<td>ORDERED DETERMINATION OF RISK USING AGED PATIENTS. TAKES INTO ACCOUNT DEMOGRAPHICS, ASSESSMENTS OF ACUTE SYMPTOMS, MEDICATION HISTORY, AND DIAGNOSES (such as BP, Hb, creatinine, LVEF)</td>
</tr>
</tbody>
</table>

CHS Risk Model Development
30-day, Patient Specific, & Dynamic

Leverage our information infrastructure

Build highly predictive model

Within & out of hospital:
Improve care quality
Increase coordination
Target resources on high risk patients
### Readmission Risk (& LOS) Key Variables

#### Demographics
- Age
- Race Code
- Insurance
- Hospital Name
- Service Provided
- Admission Type
- Transfer Type

#### Primary Diagnosis
- Any Malignancy
- Cerebrovascular Disease
- Charlson Comorbidity Score
- Chronic Pulmonary Disease
- >9 Meds and >9 Problems
- End Stage Renal Disease
- Cancer Cohort
- Myocardial Infarction
- Number of diagnoses in the problem list
- Number of orders
- Pulmonary Disorder
- Solid Tumor without Metastasis

#### Co-morbidities
- Clinical Nutrition Consult
- Psychosocial
- Living Situation
- Need Transportation Assistance
- Physical Therapy Consult
- Days since last discharge (w/in 6 months)
- Number of inpatient visits in the last 6 months
- Number of ED visits in the last 6 months
- Number of Transfers
- Discharged to home in the last 30 days

#### Labs/Vitals/Meds
- Recorded/Home Meds
- Medications in the last 24 Hrs
- Albumin Level
- Ammonia level
- Arterial Lactate
- Blood Transfusion
- BNP
- BMI
- Braden Skin Score
- Cardiac Rhythm
- Edema
- Fall Risk Score
- Gastrointestinal Normal
- Glomerular Filtration Rate
- Feeding Tube
- Hemoglobin
- HGB A1C
- Inability to Verbalize Needs
- Musculoskeletal Normal
- Neurological Normal
- Nutrition Braden Score

- O2 saturation
- Proton Pump Inhibitor
- Orientation
- Oxygen Flow Rate
- Oxygen Improved Status
- Oxygen Therapy Type
- Pain Intensity
- Radiology Count
- Respiratory Braden Score
- Respiratory Normal
- Respiratory Rate
- Safety and Judgment
- Scooting
- Sit to Stand
- Sit to Supine
- Skin Description
- Systolic BP
- Toilet Use Mobility
- Tracheal Post Treatment
- Venous Lactate
Readmission Risk Model

- ModelAccuracy: C-stat = 0.77
- CHS Readmission model is better than any other predictive models found in published literature

Validation of Readmission CHS Risk Model

![Validation Diagram](image)
Clinical Care Management View

Individual Patient Risks
Intervention & Treatment Options

Clinical Care Management

Patient Risk Assessment

Then

- Done After EMR and Patient Review
  Care managers need to review the patient’s chart and examine the patient prior to assessing risk

- Limited Capability
  Care managers assign risk based on a few simple criteria that group patients into two buckets: low risk and high risk

- Case Manager Variation
  Care manager ability to find and assess risk factors varies

- Done at Admission
  Care managers only have capacity to assess patient risk at admission

Now

- Done Prior to Seeing Patient
  Allows care managers to work more effectively by prioritizing their workflow and more efficiently through automating the risk assessment.

- Done Prior to Seeing Patient
  Allows care managers to work more effectively by prioritizing their workflow and more efficiently through automating the risk assessment.

- Automation Decreases Variation
  Patient risk is automatically calculated for the care managers

- Updated Hourly
  A patient’s condition and likelihood for readmission can change throughout a hospital stay; our tool captures these changes hourly as clinical data change
Clinical Care Management

Interventions

- Difficult to Hardwire
  Care managers required to recognize a certain patient type and remember what interventions are to be assigned to the patient.

- Difficult to Measure Interventions
  Current care management tools do not allow for evaluation of intervention efficacy; limits our ability to leverage our System.

- Recommendations Assigned Automatically
  Patients automatically assigned interventions based on their personal characteristics.

- Measure Efficacy Interventions
  Capture of interventions and data around outcomes will allow us to measure the efficacy of interventions and determine patients who optimally benefit.

Clinical Workgroup

Clinical Effectiveness (LOS & Readmissions) & Clinical Optimization (Value)

Clinical Database: STS-NCD (QIP)

Admin Database: Premier

Readmissions: Predixion

Clinical Optimization: Tableau
Clinical Workgroup Readmission Reduction Strategies

QIP-Risk Assessment & Mitigation Strategies
Stroke, Prolonged Ventilation, and Renal Failure
Phase-of-Care Approach
Heart Success
HF & TeleHealth

Algorithm, Physician Orders Allow Treatment

Disease Management Aided by Virtual “Visits”

Readmission Reduction
Transition Clinic and Digital Health

Dysrhythmia
Fluid Overload

Future Biomarkers
### Clinical Effectiveness

#### CAB-only LOS

<table>
<thead>
<tr>
<th></th>
<th>CMC</th>
<th>STS Ave</th>
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<tbody>
<tr>
<td>Op Mort %</td>
<td>1.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Major Morb %</td>
<td>10.2</td>
<td>12.2</td>
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<tr>
<td>PV %</td>
<td>8.6</td>
<td>7.9</td>
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<table>
<thead>
<tr>
<th>LOS</th>
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<tbody>
<tr>
<td>Mean d</td>
<td>6.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Median d</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Short &lt;6d</td>
<td>41.6</td>
<td>46.8</td>
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<tr>
<td>Readmission %</td>
<td>6.3</td>
<td>10.0</td>
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#### Total Length of Stay (CABG Only)

- STS Avg: Total LOS (Mean) = 9.1 days
- Total LOS (Median) = 8.0 days

### Clinical Effectiveness

#### CAB-only Readmissions

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<tr>
<td>All Facilities 30 Day Readmission</td>
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- CMC 30 Day Readmission
- Readmission STS Avg.
- CMC-NE 30 Day Readmission
- CMC-P 30 Day Readmission
Lessons Learned

“Success often comes from doing common things uncommonly well”

1. Teamwork makes the dream work
2. Keep score
3. Learn quickly
4. Continuously Improve
5. Tell the world about it
6. Upward Spiral of Success

Reducing Readmission

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Intermountain Heart Institute
Cardiothoracic Surgery
Intermountain Medical Center
Disclosures

• None

The Readmission Problem

• Current 30-day readmission rate in the STS Adult Cardiac Surgery Database is ~10%

• Avoidable readmission is associated with
  • Opportunities to improve transition of care strategies
  • Significantly increased healthcare costs

• Readmission rates are increasingly scrutinized and reported, and will increasingly impact reimbursement
Once again, reviewing our STS data helped us recognize an area where we could improve our quality of care.

CAB (2013-H3)

30-Day Readmission

Percent of Patients

2011 2012 2013 2013 2013

Participant Like STS
How Can We Intervene to Prevent Readmission?

- Multiple risk factors for Readmission have been outlined in the medical literature
- CMS has published a Readmission prediction model based on claims data, much of which isn't available until after patient discharge
- What can Intermountain’s STS patient data tell us about how to predict which patients are at highest risk for readmission?

Intermountain Healthcare Cardiac Surgery

- Four programs throughout Utah
Intermountain Readmission Data

• Study patient population:
  • 1,607 patients who underwent isolated coronary artery bypass surgery
  • Includes patients operated at all four of Intermountain’s cardiac surgical hospitals

• Data set
  • All STS database v. 2.73 registered patients
  • 59 easily obtainable *pre-operative* data elements were analyzed.

Intermountain Readmission Data

• Of 1,607 isolated CABG patients, 147 (9.15%) were readmitted
• Multi-variate analysis identified five variables that were significantly predictive of 30-day Readmission:

  1. Age (OR 1.027, *p*=0.004))
  2. Heart failure symptoms within 2 weeks of admission (OR 1.547, *p*=0.02)
  3. Low serum albumin level (OR 1.454, *p*=0.021)
  4. Previous MI (OR 1.442, *p*=0.05)
  5. Diabetes (OR 1.543, *p*=0.015)

*C*-statistic = 0.63, which is comparable to the CMS readmission prediction model
Intermountain Readmission Data

• Validation
  • The model was validated prospectively with 539 CABG patients
  • Readmitted patients were compared with those who were not
  • The predicted risk of readmission was significantly higher among readmitted CABG patients ($F = 4.67, p = 0.031$)

What do we now do with these data?
The Key to Success of all Quality Improvement Initiatives:

A Multi-disciplinary Monthly Process Improvement Meeting

Process Improvement Involves Every Team Member

- Surgeons
- Anesthesiologists
- Cardiovascular Critical Care Physicians
- OR Nursing
- ICU Nursing
- Acute Care Nursing
- Perfusion
- Respiratory Therapists
- Physical Therapists
- Occupational Therapists
- Speech Therapists
- CT Surgery Physician Assistants
- Case Managers
- Infection Control

Cardiac Surgery Is a Team Sport!
Identify High Risk Patients Preoperatively

- Diabetics
- Patients with CHF symptoms in the past two weeks
- Patients who have suffered a prior MI
- Patients with poor nutritional status

Also:
- Patients who are deconditioned
- Patients who have poor family/social support
- Patients with frailty

Preoperative Identification Is Only The First Step

- The rest of the hospitalization should be spent preventing readmission.
  - Discharge needs are reassessed throughout the hospital stay
  - All caregivers focus on ensuring safe transitions of care
  - APCs are empowered to arrange early follow-up in high risk patients which may include:
    - Early telephone calls to patients following discharge
    - Home health nursing visits
    - Early clinic follow-up visits
    - CV surgeon is contacted for all post-discharge ED visits
Detailed, Clear Instructions at Discharge

- Clear list of diagnoses
- List of medications
- Follow-up phone numbers
- Follow-up office visits with
  - Primary Care Provider
  - Cardiologist
  - Cardiac Surgeon

Home Health Visits

- Visit patients after discharge within 3 – 4 days
- Review medications
- Watch for common problems
  - Volume overload
  - Arrhythmias
  - Infections
- Have a clear point of contact when problems are identified
Skilled Nursing Facilities

- Must be used with care
- Recent studies suggest patients discharged to a Skilled Nursing Facility are >50% more likely to require readmission
- Intermountain has a new pilot program to work with SNFs to recognize problems early and reduce readmissions

![30-Day Readmission Graph]

CAB (2015-H3)
Questions

Please direct questions, comments and feedback to Sydney Clinton, STS Quality Metrics & Initiatives Coordinator, at sclinton@sts.org.

Thank you for viewing the STS Readmission after CABG Webinar.

Please note that webinar slides and other materials are posted on the STS website.