The Effect of Previous AMI on Mortality Following Subsequent AMI

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Acute Myocardial Infarction (AMI)

• Also known as Heart Attacks
• Leading cause of death in U.S.
  – One-year post-AMI mortality is 30% (in Medicare)
• High Prevalence
  – 1.1 million people in U.S. have AMI each year
  – 395K AMI hospitalizations in Medicare population
• Expensive
  – Estimated $3.6 billion in costs

Original Hypothesis about the Role of Previous AMI

Advances in practice and technology
  More survivors
  More deaths
  More admissions for second AMIs

Methods - Case Identification

• All Medicare patients with a principal inpatient diagnosis code of AMI in 1995
  – ICD9-CM code 410xx, except 410x2
  – Using MedPAR
• Include only if eligible for part A (HI) and part B (SMI) for entire prior year
  – To ensure data completeness
  – Excluded/included similar with respect to gender, age, race, comorbidity
• Transfers (11.3%) rolled up into one record
  – Admission within 1 day of discharge
  – In line with published literature

Acknowledgements

• Arlene Ash, Ph.D.
• Eric Green, M.D., M.Sc.
Methods - Comorbidity Burden

• Diagnoses observed in the 365 “pre-” period
  – Using MedPAR, Outpatient, Carrier (Not labs)
• DCG Score
  – Hierarchical categorization of diagnoses
  – Relative Risk score: expected cost in the upcoming year, relative to average cost
  – RR = 2.0 \(\rightarrow\) “expected to cost 2 times average”
• Calculated based on pre and index separately
  – Index diagnoses may reflect complications caused by the admission

Methods – Identifying Previous AMI

• Inpatient admission for AMI
  – Principal MedPAR diagnosis 410xx (not 410x2)
• Sensitivity Analyses
  – 1. Any MedPAR diagnosis 410xx (not 410x2)
  – 2. Any diagnosis (MedPAR, outpatient, carrier) of 410xx (not 410x2)
  – 3. Any diagnosis of 410xx or 412xx (old MI)

Methods - Statistical Analysis: Multiple Logistic Regression

• Outcome: One-year mortality
• Exposure: previous AMI
• Covariates:
  – Age
  – Gender
  – Original Reason for Entitlement (aged vs ESRD/disabled)
  – DCG score (in categorical ranges)

Results - Population Characteristics

<table>
<thead>
<tr>
<th>Cases</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td>305,468</td>
<td>287,358</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Age (mean)</td>
</tr>
<tr>
<td>ESRD/Disabled ORE</td>
</tr>
<tr>
<td>Mean DCG (pre)</td>
</tr>
<tr>
<td>Mean DCG (index)</td>
</tr>
<tr>
<td>prev AMI (Inpt Adm)</td>
</tr>
<tr>
<td>prev AMI (Any Dx)</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>CHF</td>
</tr>
</tbody>
</table>

Results - Bivariate Analysis

• AMI in previous year (n=56,889)
  – 27% died
• No AMI in previous year (n=248,579)
  – 33% died
• Crude estimate: 25% lower odds of dying within one year of an AMI for those with previous AMI relative to those without a previous AMI

Note: p-values are always significant in huge data sets \( (p-value = 2.24 \times 10^{-166}) \)

Results - Multivariate Analysis

<table>
<thead>
<tr>
<th>Odds Reduction</th>
<th>c-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude</td>
<td>25%</td>
</tr>
<tr>
<td>Core</td>
<td>15%</td>
</tr>
<tr>
<td>+index</td>
<td>26%</td>
</tr>
<tr>
<td>+pre</td>
<td>44%</td>
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</tbody>
</table>

Odds Reduction = % reduced odds of post-AMI mortality with previous AMI
Results – Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th>Main Analysis</th>
<th>Sensitivity Any Dx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude</td>
<td>25%</td>
<td>6%</td>
</tr>
<tr>
<td>Core</td>
<td>15%</td>
<td>-2%</td>
</tr>
<tr>
<td>+index</td>
<td>26%</td>
<td>10%</td>
</tr>
<tr>
<td>+pre</td>
<td>44%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Table presents Odds Reductions

Conclusions/Discussion

• Previous AMI is protective against mortality following subsequent AMI
• Examining what changed between first and second AMI might help understand what factors are associated with increased survival following AMI

Possible Explanations

• Change in Personal Habits or Lifestyle
  – Diet
  – Exercise
• Change in Medical Profile
  – Medication
• Change in AMI awareness
  – Early Identification of onset of AMI
• Subsequent AMIs are different
  – Side-effects of interventions (re-stenosis)
  – Recurrent AMIs are milder?
• “Hardy person” effect

Impact on Medical System

• Identify when someone is at risk
  – “Missed Opportunities” Paper (under review)
  – Further research
• Targeted group - modify behavior/knowledge
  – Diet
  – Exercise
  – Medicines
  – Detection

Questions?

CMS Project on AMI Trend

• Apply risk-adjustment models to explain trend
  – “Risk Adjustment Models to Examine AMI Mortality Trend”
    • Ash, Posner, Chaisson, Speckman, Franco, Yacht, Caldwell, Hadad, Medkowitz
    • Report to CMS (HCFA) in 2001, updated in 2002
  – “Using Claims Data to Examine Mortality Trends Following Hospitalizations for Heart Attack in Medicare”
    • Ash, Posner, Speckman, Franco, Yacht, Bramwell
    • Health Services Research (2003), vol. 38, no.5, pp.1253-1262