Cardiovascular Event Identification in EHR & Claims Data

Bradley G. Hammill, DrPH
Duke Clinical Research Institute
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Bradley G. Hammill, DrPH

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Endpoint Selection in Electronic Healthcare Data

Most reliable if serious and results in immediate healthcare episode

Typical MACE components
- Myocardial infarction
- Stroke
- Congestive heart failure
- Coronary revascularization
- Major bleeding
- Cardiovascular death
Reliability of Endpoint Ascertainment is Variable

Mortality

Occurrence (but not cause) s/b highly reliable in claims

Procedure-based endpoints

Highly reliable due to need for reimbursement

Hospitalization-based endpoints

Dependent on coding of condition

Less Questionable

MI

~10 ICD-9-CM Dx codes w/in 1 3-digit code series

More Questionable

Stroke

~15 ICD-9-CM Dx codes w/in 5 3-digit code series

Bleeding

~80 ICD-9-CM Dx codes w/in ~20 3-digit code series
## Comparing to Adjudicated Trial Rates

<table>
<thead>
<tr>
<th>Myocardial Infarction</th>
<th>Adjudication criteria</th>
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<tbody>
<tr>
<td><strong>Claims criteria</strong></td>
<td><strong>Adjudication criteria</strong></td>
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</table>
| Inpatient encounter w/ ICD-9-CM diagnosis code 410.x0, 410.x1 in primary position | ECG or changes consistent with acute infarction or ischemia MI:  
• New diagnostic Q waves (Q wave in leads V2 and V3 ≥ 0.02 sec or QS complex in leads V2 and V3; Q wave ≥ 0.03 sec and ≥ 0.1 mV deep or QS complex in leads I, II, aVL, aVF or V4-V6 in any two leads of a contiguous lead grouping (I and aVL; V1-V6; II, III, aVF, R wave ≥ 0.04 sec in V1 and V2 and R/S ≥ 1 with a concordant positive T wave)) in the absence of conduction abnormalities  
• New significant ST-segment- T-wave changes in two or more contiguous leads: ST elevation at the J point ≥ 0.1 mV in all leads other than leads V2 and V3 where the following cut points apply: ≥ 0.2 mV in men ≥ 40 years; 0.25 mV in men < 40 years, or ≥ 0.15 mV in women. ST depression horizontal or downsloping ≥ 0.05 mV; or T wave inversion ≥ 0.1mV with prominent R wave or R/S ratio ≥ 1.  
• Development of new left bundle branch block (LBBB)  
• Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality  
• Intracoronary thrombus by angiography  
**AND**  
Elevated cardiac biomarkers (values according to each hospital's laboratory): A rise and/or fall in cardiac biomarker values (preferably troponin, CKMB, AST, LDH or myoglobin) with at least one value above the 99th percentile of the upper reference limit. |
Case-Identification Algorithms

Sources include…

Validation studies
Other published studies
Quality measure definitions
Reimbursement guidance (esp. procedures)

Direct code searches
Using Existing Algorithms

Validation study caveats

- Based on small sample?
- Based on single site data?
- Do not report sensitivity or specificity?
- Based on claims data, not EHR data?
- Discordant results from another study?

General considerations

- Algorithm for incident events or prevalent disease?
- Based on code sets you need?
New Algorithm: ADAPTABLE Major Bleeding

Need to understand…
– All possible coding for transfusions
– Insurance coverage allowances
– Reimbursement documentation requirements

Good practice: Validate a sample of your endpoints
EHR Data and Endpoint Ascertainment

Issues to consider

– Less structured and less consistent than claims
  
  *e.g. primary diagnosis not necessarily an EHR concept*

– Different coding systems
  
  *e.g., SNOMED-CT, site-specific*

– Mortality outside of the system is not well captured

– Potential for site-specific differences in…
  
  …completeness of patient healthcare received
  
  …coding practices
  
  …data availability
Other safety endpoints using EHR data?

“Additional parameters such as increase in body weight, oedema/fluid retention, occurrence of hypertension, significant changes in heart rate/arrhythmias, or increases in LDL-cholesterol could also be systematically collected whenever this is considered relevant (e.g. based on mechanism of action or pre-clinical findings). Clinically relevant changes in cardiac function should be evaluated by cardiac imaging, if there is an indication of a detrimental effect on cardiac function.”

Source: EMA, Reflection Paper on Assessment of Cardiovascular Safety Profile of Medicinal Products