Automating Assessment of Asthma Care Quality

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Background

Quality of care in the US healthcare system is unacceptably low (IOM, JAMA 1998)

“...Serious and widespread quality problems exist throughout American medicine. These problems...occur in small and large communities alike, in all parts of the country, and with approximately equal frequency in managed care and fee-for-service systems of care. Very large numbers of Americans are harmed as a result....”
• On average, Americans receive about 55% of recommended medical care.

• A key component of any solution is the routine availability of information on care delivery performance at all levels.
  • Automated, comprehensive, care quality assessments
  • The EMR could make possible automated assessment of care, eliminating sampling, surveying, manual review of charts
  • A large portion of the data needed to perform this analysis lies within the text components of the EMR
A System for Automated, Comprehensive, Quality Measurement

Clinical Guideline

Population selection
Data element selection
Encounter-based extraction

Data Warehouse

EMRAdapter

CDA (XML)

Data Extraction

Terms, Concepts, Rules,
Operating Params,
for specific application

MediClass

CDA w/ MC concepts
(XML)

Concept Markup

Application-specific
extraction/filter

Postprocessor

EventStream
(Flat file)

Quality Measurement

Measures operationalized in
terms of temporally located
numerator and denominator
events

Measure Implementation

Data standardization
Site-specific data transforms
1. Takes in encounter record (CDA) and marks up each data section with identified clinical concepts.

2. Identifies concepts within text notes (using NLP algorithms) and coded elements of each encounter record.

3. Uses rules defining logical combinations of concepts to infer additional clinical events (classifications) of interest.

<table>
<thead>
<tr>
<th>Quality Measure</th>
<th>Denominator criteria [Index Date]</th>
<th>Numerator criteria [Measure Interval]</th>
<th>Operationalization</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with the diagnosis of persistent asthma should have a historical evaluation of asthma precipitants</td>
<td>Patients with persistent asthma [PA Qualification Date]</td>
<td>Patients with a subjective evaluation of precipitants or triggers [observation period]</td>
<td>Probably only found in the text progress notes</td>
<td></td>
</tr>
<tr>
<td>Patients with the diagnosis of persistent asthma should have spirometry performed annually</td>
<td>Patients with persistent asthma [PA Qualification Date]</td>
<td>Patients with orders for PFTs or documentation of office spirometry or of PFT results [subsequent 12 months]</td>
<td>Numerator satisfied with documentation of referral to pulmonary specialist if no PFT known available</td>
<td></td>
</tr>
<tr>
<td>Patients with the diagnosis of persistent asthma should have available short acting beta2-agonist inhaler for symptomatic relief of exacerbations</td>
<td>Patients with persistent asthma [PA Qualification Date]</td>
<td>Prescription for a short acting beta-2 agonist to use PRN [subsequent 12 months]</td>
<td>Numerator satisfied if prior / existing active Rx; also combination Rx (i.e. Combivent) or oral/nebulized PRN Rx will count. Exclusion if adverse reaction to b-agonists</td>
<td></td>
</tr>
<tr>
<td>All patients seen for an acute asthma exacerbation should have current medications reviewed</td>
<td>Patients with persistent asthma meeting criteria for outpatient exacerbation [Exac. Encounter]</td>
<td>Documentation that medications reviewed by provider [same visit]</td>
<td>Numerator satisfied if provider documents asthma specific medication history in notes or active management of current med list</td>
<td></td>
</tr>
</tbody>
</table>
Clinical Events Dataset File (portion)

Patient segment

Provider segment

Event segment

pat1,KPNW,19xx,F,'White','?',N,prov1,OBGN,'loc1',Outpatient,enc1,SmokeAsk,RFV,20010109
pat1,KPNW,19xx,F,'White','?',N,prov1,OBGN,'loc2',Outpatient,enc2,Smoker,Smk,20010109,,Y
pat1,KPNW,19xx,F,'White','?',N,prov1,OBGN,'loc2',Outpatient,enc2,SmokeAsk,Smk,20010109
pat2,KPNW,19xx,F,'White','?',N,prov2,ONC,'loc3',Outpatient,enc3,MedsReview,Note,20010110,,,,Main Note,
pat2,KPNW,19xx,F,'White','?',N,prov2,ONC,'loc3',Outpatient,enc3,ChestExam,Note,20010110,,,,Main Note,

.....

.....
<table>
<thead>
<tr>
<th>Patient</th>
<th>Provider</th>
<th>Date</th>
<th>Code</th>
<th>Description</th>
<th>Category</th>
<th>Notes</th>
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</thead>
<tbody>
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<td>pat3,KPNW,19xx,M,'?','?','?',prov3,FP,'loc4',Outpatient,enc4</td>
<td>MedOrd,cat2,20010111,,17,1, '00172-4390-18', '2P PO Q4-6H PRN', 'ALBUTEROL AER 90MCG', 'INHALATION'</td>
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<td>MedOrd,cat6,20010111,,20,1, '00179-1228-20', '4P PO BID', 'AZMACORT INHALER', 'INHALATION'</td>
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<td>PeakFlow,Note,20010111,,,,,Main Note</td>
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<td>pat3,KPNW,19xx,M,'?','?','?',prov3,FP,'loc4',Outpatient,enc4</td>
<td>AsthmaVisit,Note,20010111,,,,,'Persistent',,Main Note</td>
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<td>MedsReview,Note,20010111,,,,,Ancillary Note</td>
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<tr>
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<td>AsthmaVisit,Dx,20010111,493.90,</td>
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<td>SmokeAsk,Note,20010111,,,,,Main Note</td>
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<tr>
<td>pat3,KPNW,19xx,M,'?','?','?',prov3,FP,'loc4',Outpatient,enc4</td>
<td>Fluvac,Immun,20010111,,,,,'Done'</td>
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</tr>
</tbody>
</table>
The Clinical Events Necessary to Identify “Persistent Asthma”

- Meets any of the following within any 12 month window during qualification period
  - 4 “fills” ordered of asthma-specific meds
  - 2 “fills” ordered of asthma-specific meds and 4 outpatient visits coded with asthma Dx
  - Asthma-related ED visit or Hospitalization
  - Provider notation that patient has persistent asthma
Quality Profile for Patient “X”

- Chest Exam Performed
- Spirometry Ordered or Discussed
- Medications Reviewed
- Asthma Med Ordered
- Asked about smoking
- Asthma visit
- Asthma exacerbation
- Persistent asthma notation

1/1/01 1/1/02 1/1/03 12/31/03

Persistent Asthma

Exacerbation
Asthma Care Quality (ACQ) Findings

- Study populations identified (>12y.o. with an asthma visit within 3-year observation window)
  - Mid-sized HMO (“HMO”)
    - Multiple observation windows in 2001 – 2008 period
    - Roughly 35,775 study patients per window; 14,000 with persistent asthma
  - Consortium of FQHC (“SafetyNet”)
    - 8 orgs with the EMR installed in 2005-2008 period
    - Single observation window (all data available)
    - Roughly 6,880 study patients; 1,800 with persistent asthma
22 Outpatient asthma measures identified

- 18 (80%) were implemented
- 11 for routine care, 7 for exacerbation care
- 4 (20%) will require additional effort to implement
  - 2 relied on complex assessment of “control”
  - 2 relied on knowing patients baseline PFT values

8 of the 18 (37%) require processing clinician’s text notes, another 7 measures (32%) are enhanced by this processing because the text notes provide an important alternative source for the necessary numerator clinical events

- In addition, qualification for any measure in the ACQ measure set (as persistent asthma) occurred by text-based assessment in 26% of all patients. Of these, 30% qualified as persistent by text processing alone.
Chart Review Validation

- Most ACQ measures performed relatively well in the HMO healthcare system
  - Measure accuracy (agreement with chart review) ranged from 63% to 100% across all measures
  - Mean sensitivity was 77% Mean specificity was 84%

- The automated ACQ analysis was less accurate against the SafetyNet healthcare system
  - Mean accuracy was 80% and ranged from 36% to 99% across all measures.
  - Mean sensitivity was 52% Mean specificity was 82%
Overall we found that persistent asthma patients received 48.3% of recommended care on average across 166,606 retrospective care evaluations extracted from two electronic medical record systems.

- Routine care quality was higher at 48.8%.
- Acute exacerbation care quality was lower at 26.6%.

Care within SafetyNet system had somewhat lower quality scores compared to the HMO across all groups:

- Routine care: 42.1% vs. 50.3% of recommended.
- Exacerbation care: 22.6% vs. 27.1% of recommended.
Ongoing Work

- We have generalized this approach and are applying it to assessing obesity treatment (as prescribed by the NHLBI guideline)
  - R18 study funded by AHRQ
- We are 20mo into a 3-year project called the CER HUB, which makes this technology available through a central website hosting research projects that use it.
  - RO1 project that includes a network of 6 health systems
  - Conducting 2 CER studies in Asthma Control and Smoking Cessation counseling
Informatics Tools for Evaluating Health and Healthcare

CER Hub is a web-based informatics platform for conducting healthcare research. Research projects using CER Hub technologies are formed as investigator-led communities focused on Comparative Effectiveness Research.

Learn More »  View CER Projects »

Online collaboration for CER studies

The CER Hub is a web-based mechanism for conducting Comparative Effectiveness Research (CER) where researchers can collaboratively develop protocols to define and operationalize healthcare research questions and methods to answer these from electronic data.

Building clinical data infrastructure

Researchers can develop multi-institutional data sets using CER Hub’s centralized web-based services. These services provide automated tools and support for generating standardized data sets and allow analyses to answer CER questions.

Extracting EMR data

Standardized data processors built on the CER Hub make available natural language processing and knowledge-based systems technologies to automatically identify clinical events in all types of clinical data. Because the CER Hub uses an emerging standard for representing the complete medical record, data from any EMR implementation can be uniformly processed.
Asthma Care Quality (ACQ) Study

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