HL7 Reconciled Medication List (RML) Standard

Supporting management and exchange
An HL7 EHR System Standards Initiative

Documentation Burden Reduction Focus Team

Source: https://inspiredehrs.org/
Current Team (alphabetical)

- Samuel Almasi, D.O. (Family Practice Resident, Adventist Health Glendale)
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- Reed Gelzer, MD, MPH (Trustworthy EHR, LLC)
- Lisa Masson, MD, MBA (Cedars-Sinai Medical Center)
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- Keith Salzman, MD (Salzman HCIT Consulting/Military Health System CMIO, retired)
- David Schlossman, MD, PhD, MSHI (MedInfoDoc, LLC, Adjunct Faculty UAB Health Informatics)
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- James Tcheng, MD (Duke University Medical Center)
- Lincoln Weed, JD (Independent Researcher, Problem Oriented Health Records)

- With special thanks for additional end-user requirements input from UAB’s Dr. James Willig, Alfredo Gonzales
Data Quality Impacts Clinician Burden

Objective Scientific Clinical Care And Decision-Making Require Accurate, Trusted, Accessible, Fit-for-Use Data

Reducing Clinician Burden (RCB)

- Challenge from CMS Office of Burden Reduction and Health Informatics: Practical (utility and scale) project to address documentation burden
- Convened clinician interest group, reviewed options that met “utility and scale”
- Settled on “Trusted, accurate, current medication list” as impactful
  - EHR “Medication Lists” are inconsistent, often out of date, untrustworthy
  - Extensive evidence that medication errors contribute to ADE’s, patient harms, costs
  - A lot of work and rework expended in curating current medications, value is lost as results are difficult to find or lost in EHRs
  - Very high utility for clinical decision making
  - Good starting point for incremental address of complex interoperability challenges that also cause extensive burden (ex: Problem List, integration into Problem-Oriented Health Record)
Up To 70% Of Patients Have Errors on Their Medication Lists

“Improving admission medication reconciliation with pharmacists or pharmacy technicians in the emergency department: a randomized controlled trial”

Joshua M Pevnick, Caroline Nguyen, Cynthia A Jackevicius, Katherine A Palmer, Rita Shane, Galen Cook-Wiens, Andre Rogatko, Mackenzie Bear, Olga Rosen, David Seki, Brian Doyle, Anish Desai, Douglas S Bell


**Methods:** 306 ER patients at Cedars-Sinai were randomized to have their admission medical history taken and medication list reconciled by ED nurses, Pharmacists, or Pharmacist-Supervised Pharmacy Technicians (PSPTs)

**Conclusions** Pharmacists and technicians reduced admission medication history errors and resultant admission medication ordering errors by over 80%. Future research should examine other sites and patient-centered outcomes.
Cedars-Sinai Group’s
Problem, Solution, and Business Case
Infographic produced for the California State Legislature

Leveraging pharmacy staff prevents harm and increases clinician time for patient care functions

Problem
- 20% of admissions are medication-related
- High risk patients have 8 errors on admission medication lists.
- Only 5.3% of patients 65 year or older on ≥5 medications have accurate lists
- One third of inpatient orders have errors and 85% originate from the medication history
- Up to 59% of errors can cause harm
- Up to 80% of patients have at least 1 medication error at discharge

Solution
- On admission, studies demonstrate increased accuracy of medication lists obtained by pharmacy staff vs usual care
  - Accuracy rates: Nurses, 20%; Hospitalists, 50%; Technicians, 100%  
  - Nurses 14% vs pharmacy technicians 94% (p<0.0001)
  - At discharge, pharmacists identified errors in medication lists in 49% of patients and problems in an additional 16% vs usual care

Business Case
- Cost of adverse drug event (ADE): $2,262-$5,790
- Increased length of stay due to ADE: 3.1 days
- Cost/readmission ~ $12,300-13,800

Benefits
- 75% reduction in ADEs
- 41 minutes of nursing time saved/patient
- Cost-effective to utilize technicians for medication histories; $830,000
- Patients have an accurate medication list upon discharge
- Reduced readmissions
- Enables clinicians to practice at the highest level of their license and training

Recommendation: For high risk patients, pharmacy will ensure the accuracy of the medication list at admission and discharge
Outpatient Medication Records Are Also Error Prone

Electronic medication records could save billions in health care costs - and lives | COMMENTARY

By KRISTIN DINOTO
FOR THE BALTIMORE SUN | APR 11, 2021

One of the scariest things patients say in the pharmacy is, “I don’t know what medications I’m taking or what they’re for. My doctor prescribed them, so I just take them.”

- Up to 50% of patients do not take their medications as prescribed
- Up to 20% of admissions have a medication-related component
- $500 billion annual cost to the US healthcare system
Progress to Date

- Minimum parameters necessary for utility, impact
  - Capturing initial scope: inclusions and exclusions
  - Capturing next steps, Ex: Inpatient, Outpatient non-Rx/OTC meds
- End-user/implementer representation (UAB HIV clinic)
- Basic environmental scan via participants’ experience
- User scenario
- User story formalisms framework
- Usability factors formalisms (FMEA per Dr. Segall)
- Future state wireframe prototype (low fidelity)
  - Heuristic usability analysis nearly complete
User Story Formalisms Framework

### Outpatient Medication Reconciliation Scenario

Sally engages with the clinical information system (CIS) for her upcoming appointment. Sally observes CIS non-curated medication list and recognizes discrepancies. With some difficulty she figures out how to use the CIS tools to report the discrepancies. The discrepancies are recorded in the CIS.

<table>
<thead>
<tr>
<th>Event Step</th>
<th>Role</th>
<th>Event Action Taken</th>
<th>Event/Action Taken</th>
<th>Actual Medication Intake</th>
<th>As Recorded in System</th>
<th>Data Requirements</th>
<th>Data Records obrigated or updated during action</th>
<th>FMEA Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Patient</td>
<td>Subject of Care</td>
<td>Reviews Medication List (from Portal)</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Medication List</td>
<td>Medication List Discrepancies</td>
<td>Patient_reviews_medication_list</td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td>EHR HIT System 1</td>
<td>Persistent Data Store</td>
<td>Retains Medication List Discrepancies</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Medication List Discrepancies</td>
<td>Retained Medication List Discrepancies</td>
<td>EHR_stores_patient_4_input</td>
<td></td>
</tr>
</tbody>
</table>

Sally arrives at the appointment. The Medical Assistant (MA) has printed the CIS representation of her medication list. None of the discrepancies that Sally recorded in the CIS are in the rendered list. All the discrepancies are the same. Sally marks up the printout to correct it for her.

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<th>FMEA Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Medical Assistant</td>
<td>Clinical Assistant</td>
<td>Prints Medication List</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Medication List Discrepancies</td>
<td>Marked Up Hardcopy of Medication List Discrepancies</td>
<td>Marked_up_hardcopy_of_medication_list_discrepancies</td>
<td></td>
</tr>
</tbody>
</table>

The Medical Assistant spends time finding the data entry fields to note the changes in the Electronic Health Record. Due to the design of the system, the changes are noted for the physician, but do not actually change the permanent list.

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<th>FMEA Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>Medical Assistant</td>
<td>Clinical Assistant</td>
<td>Makes Preliminary Updates to Medication List</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Medication List Discrepancies</td>
<td>Preliminary Medication List Updates</td>
<td>Medical_assistant_reviews_medication_list</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>EHR HIT System 1</td>
<td>Persistent Data Store</td>
<td>Retains Preliminary Medication List Updates</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Preliminary Medication List Updates</td>
<td>Retained Preliminary Medication List Updates</td>
<td>Retained_preliminary_medication_list_updates</td>
<td></td>
</tr>
</tbody>
</table>

Brief (15 minutes) recheck visit scheduled for the NPI Clinician. A medication review is included. Previous edits to reconcile patient-actual with CIS-actual are difficult to impossible to access and do not inform the CIS list. The system provides no actionable rendering of the discrepancy querying controlled substances registers and the patient’s Pharmacy Benefit Management system’s data on actual prescriptions available to the patient, including whether or not they were actually dispensed to the patient (with a computed Medication Possession Ratio (MPR)). The physician finds the MA notes but overlooks the incorrect metronim dose on the list. She also does not remember what dose of Staglistin Sally mentioned, so she enters Staglistin PO without a dose. She changes the nitrofurantoin to ‘inactive’ so it no longer shows up on the current pharmacy.

The other tasks for the visit have been accomplished. Vital signs have been checked and all other problems are stable so the patient is released to home.

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<th>FMEA Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>NPI Clinician</td>
<td>Primary Care Physician (PCP)</td>
<td>Reviews and Updates Medication List</td>
<td>Staglistin 100 mg twice daily 2 Melatonin 500 mg twice daily 1 Metformin 1000 mg twice daily 2 Nitrofurantoin 100 mg four times daily for 7 days (dated 4 months ago)</td>
<td>Medication List Discrepancies</td>
<td>Reconciled Medication List</td>
<td>Reconciled_medication_list</td>
<td></td>
</tr>
</tbody>
</table>

[Image of medication administration device]
# Failure Mode and Effects Analysis

<table>
<thead>
<tr>
<th>Process Function</th>
<th>Potential Failure Mode</th>
<th>Potential Effect(s) of Failure</th>
<th>Occur</th>
<th>Current Process Controls</th>
<th>Recommended Action(s)</th>
<th>Responsibility and Target Completion Date</th>
<th>Action Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient reviews medication list</td>
<td>Difficult portal navigation</td>
<td>Inaccurate medication list</td>
<td>Poor portal usability</td>
<td>Portal help</td>
<td>Usability testing, portal redesign</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Inactive medication still listed</td>
<td>Lapsed medication; patient harm</td>
<td>EHR does not implement auto-stop</td>
<td>Patient review of medication list</td>
<td>Automatic stop date when medication's course is complete, or alert to PCP to stop medication, or prompt patient to report current medication status</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>New medication not listed</td>
<td>Medication omission; patient harm</td>
<td>Manual reconciliation required</td>
<td>Patient review of medication list</td>
<td>Cross-EHR communication, standard terminology, MA enters prescription</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Medication incorrect dosage</td>
<td>Incorrect dosage; patient harm</td>
<td>Manual reconciliation required</td>
<td>Patient review of medication list</td>
<td>Cross-EHR communication, standard terminology, MA enters prescription</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>EHR stores patient's input</td>
<td>List not updated</td>
<td>Incorrect medication list</td>
<td>Disconnect between patient's entries and EHR's medication list</td>
<td>?</td>
<td>Lists of prescribed vs. taken medications; dynamic list showing status of each medication</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Patient’s input not readily accessible to clinicians from medication list</td>
<td>Missing information for clinicians</td>
<td>Disconnect between patient's entries and EHR's medication list</td>
<td>Patient updates are available, but require effort to find</td>
<td>Lists of prescribed vs. taken medications; dynamic list showing status of each medication</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
Incremental Lessons Learned - 1

• Impactful clinical information captured by current systems may be functionally inaccessible, easier to re-do (over and over) than to find. Invested cognitive effort is often lost.

• “Re-work” is a huge drag on clinician uncertainty and morale, both rarely recognized or measured thus rendering these burdens partially invisible while also expanding risk

• The fact that correct information exists (ex: reconciliation notes) but un-accessed is readily discoverable and elevates institutional risk.

• Commitment to “Closed Loop” modeling and execution is critical, effective
  • An information requirement identified must be methodically managed to closure
  • “Truth” is dynamic, continuously maintained. Revalidation is required to assure continuous trust
  • Usability science can help capture these requirements, renders them actionable
Incremental Lessons Learned - 2

• Deep-dive reveals additional levels of complexity
  • What to do about non-Rx/OTC medications
  • Suboptimal interoperability; conflicting or inaccessible med lists
  • Integration of outpatient medication data into workflows
    • Universal all-state queries re controlled substances
    • Medication possession ratios
    • “Rx never picked up by patient” messages
Next Steps

1. High fidelity interactive prototype for usability testing
   a. API-capable and supporting workflow and exchange for demonstration purposes

2. A FHIR 4.0 implementation guide (conformance testable)
   a. Normalized for exchange incorporating conformance testing (with agreement on a validated reference universal trust specification)
   b. Enablement of exchange infrastructure for validating conformance (yes/no acceptance or conditional acceptance similar to CLIA for lab results)
Primary Contacts are Lisa Masson and Reed Gelzer
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HL7 Facilitator: R.Gelzer@TrustworthyEHR.com

RCB Project Webpage: https://confluence.hl7.org/pages/viewpage.action?pageId=104568480

Source: https://www.pinterest.com/pin/137219738483858967/