Augmentation and Automated Reconciliation of External Immunization Information in an Electronic Health Record

S73: Interoperability

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#AMIA2018
Disclosure

I have no relevant relationships with commercial interests to disclose.
Learning Objectives

After participating in this session the learner should be better able to:

• Develop awareness of technical, organizational and legal issues limiting US immunization information systems’ role as a sole source of historical and forecasted immunizations
• Understand differences between immunization data sources
• Describe practical strategies for improving the completeness and accuracy of immunization information in an electronic health record (EHR) while reducing manual effort
Immunization information: before

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Date 1</th>
<th>Date 2</th>
<th>Date 3</th>
<th>Date 4</th>
<th>Date 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPV</td>
<td>5-30-79</td>
<td>8-8-79</td>
<td>10-4-79</td>
<td>11-15-79</td>
<td></td>
</tr>
<tr>
<td>DTP</td>
<td>5-30-79</td>
<td>8-8-79</td>
<td>10-4-79</td>
<td>2-17-81</td>
<td></td>
</tr>
<tr>
<td>MMR</td>
<td>7-1-80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbPV (Haemophilus b Poly saccharides Vaccine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculin</td>
<td>11/6/80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- PCP-centric
- Uncoordinated
- Sharing by mail, fax, humans
Immunization information: IIS-centric ideal

IIS receives immunization administration reports for every patient in its jurisdiction and provides forecasts of immunizations and dates due.

- Data correction
- Manual matching
Immunization information in reality

• Some IISes don’t include adults or are opt-in
• No inter-IIS interchange; clinicians can’t access non-local IIS (legal barriers)
• IIS interfaces are missing and limited
  • EHR → IIS only (MU1/2) — technical/staffing issues limit bidirectional communication
  • EHR ↔ IIS interface is add/query only — can’t merge records or correct data
  • Instead must use IIS Web interface; changes (at least in Ohio) queued for manual review
  • IIS forecasts unreliable, so EHRs/pharmacy information systems must make their own
• Non-IIS sources add information
  • Pharmacy “dispenses”, insurance claims, other EHRs
Pharmacy/workplace administration

- Pharmacy reporting to IIS not required in **many states**
- “Nonmedical places” not required/permitted to report to IIS

**Sources:**
- Walmart, **Collaboration and coordination of complementary access points for adult vaccinations**
- CDC, **Results of November 2017 Influenza Vaccination Coverage Surveys**
An EHR-centric view of immunizations

- Local EHR
- IIS
- Web interface
- eRx network
- Outside EHR/HIE

- Portal/PHR
  - Forecast
  - “I got…”

- Pharmacy

- Data correction
- Manual matching

Provenance not preserved
An EHR-centric view: pros and cons

+ eRx immunization “dispense” data are most consistent
  + Exact date and location, exact product administered, standardized coding

+ Outside EHR data transcends IIS jurisdictions

+ Portal/PHR data can encompass “nonmedical places”

- Outside EHR data may be incomplete, erroneous or unmapped

Pneumococcal Vac Conjugate(#7 thru APRIL 2010 then #13 thereafter)

\[ n \sim 65\ 000 \]
Baseline EHR deduplication

Discard external imms with **same CVX code and date** as local imms

<table>
<thead>
<tr>
<th>CVX Code</th>
<th>CVX Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>135</td>
<td>Influenza, high dose seasonal</td>
</tr>
<tr>
<td>140</td>
<td>Influenza, seasonal, injectable, preservative free</td>
</tr>
<tr>
<td>141</td>
<td>Influenza, seasonal, injectable</td>
</tr>
<tr>
<td>144</td>
<td>influenza, seasonal, intradermal, preservative free</td>
</tr>
<tr>
<td>149</td>
<td>influenza, live, intranasal, quadrivalent</td>
</tr>
<tr>
<td>150</td>
<td>influenza, injectable, quadrivalent, preservative free</td>
</tr>
<tr>
<td>155</td>
<td>influenza, recombinant, injectable, preservative free</td>
</tr>
<tr>
<td>158</td>
<td>influenza, injectable, quadrivalent</td>
</tr>
<tr>
<td>160</td>
<td>Influenza A monovalent (H5N1), ADJUVANTED-2013</td>
</tr>
<tr>
<td>161</td>
<td>Influenza, injectable, quadrivalent, preservative free, pediatric</td>
</tr>
<tr>
<td>166</td>
<td>influenza, intradermal, quadrivalent, preservative free</td>
</tr>
<tr>
<td>168</td>
<td>influenza, trivalent, adjuvanted</td>
</tr>
<tr>
<td>171</td>
<td>Influenza, injectable, MDCK, preservative free, quadrivalent</td>
</tr>
<tr>
<td>185</td>
<td>influenza, recombinant, quadrivalent, injectable, preservative free</td>
</tr>
<tr>
<td>186</td>
<td>Influenza, injectable, MDCK, quadrivalent, preservative</td>
</tr>
</tbody>
</table>
Interventions

1. Augment with pharmacy-administered immunization “dispenses”
   - Fetch dispense data from eRx network for each visit, stored in EHR pending reconciliation
   - Convert unreconciled dispenses to administered immunizations in nightly batch process*

2. Automatically reconcile (import into local EHR) or discard as duplicate
   - Unreconciled data ignored in forecasting/reporting*
   - Match on vaccine groups in addition to CVX codes*
   - Replace MMR, DTAP vaccine groups
     - Example: MMR group contains MMR, M/R, MMRV
     - Instead, use antigen-based groups for M, M, R
   - Match combined vaccines with their components

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<table>
<thead>
<tr>
<th>CVX Code</th>
<th>CVX Short Description</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>135</td>
<td>Influenza, high dose seasonal</td>
<td>FLU</td>
</tr>
<tr>
<td>140</td>
<td>Influenza, seasonal, injectable, preservative free</td>
<td>FLU</td>
</tr>
<tr>
<td>141</td>
<td>Influenza, seasonal, injectable</td>
<td>FLU</td>
</tr>
<tr>
<td>03</td>
<td>MMR</td>
<td>MMR</td>
</tr>
<tr>
<td>04</td>
<td>M/R</td>
<td>MMR</td>
</tr>
<tr>
<td>05</td>
<td>measles</td>
<td>MMR</td>
</tr>
<tr>
<td>06</td>
<td>rubella</td>
<td>MMR</td>
</tr>
<tr>
<td>07</td>
<td>mumps</td>
<td>MMR</td>
</tr>
<tr>
<td>38</td>
<td>rubella/mumps</td>
<td>MMR</td>
</tr>
<tr>
<td>94</td>
<td>MMRV</td>
<td>MMR</td>
</tr>
</tbody>
</table>

* Remedied in versions of our EHR released since submission
Intervention 1: incorporate dispenses

Processing backlog: 93% auto-reconciled or discarded

12/2017: Bidirectional interface to Ohio IIS (ImpactSIIS) established

Minimum age lowered from 21 to 18

~125 000 dispenses of immunizations automatically reconciled or discarded

Seasonal influenza vaccine becomes available

Through 10/28: 94% auto-reconciled or discarded
Intervention 2: auto-reconcile/discard

Bidirectional interface to Ohio IIS (ImpactSIIS) established

8/2017: 40% (305,000/770,000) external imms (<10 years old) unreconciled

~1,800,000 external immunizations automatically reconciled or discarded

As of 10/28: 13% (270,000/2,000,000) external imms (<10 years old) unreconciled
Conclusions

- IIS ↔ EHR becoming more widespread
- Benefits from other immunization sources
- Reduce barriers to use of existing data

Many opportunities for improvement…
Next steps

- **EHR capabilities:** auto-reconciliation, sanity checking; merging imms
- **IIS:** sanity checking/normalization of patient and immunization information
- **IIS-EHR interface:** patient matching; forecasting based on provisional data?
- **Legal framework:** rule harmonization, facilitation of inter-IIS communication
- **CDC:** antigen-based vaccine groups, machine-readable availability
- **Overall:** maintain and propagate provenance and “eventual correctness”
Question

Which external source provides the most consistent and timely immunization information?

A. Another EHR
B. Insurance claims
C. E-prescribing network
D. Immunization information system (IIS)
Answer

A. Another EHR
B. Insurance claims
C. E-prescribing network
D. Immunization information system (IIS)

Explanation:

• “Dispenses” of immunizations include the product administered, the exact dispense date and clear provenance (pharmacy where given)

• IIS/EHR data is mixed historical/manual entry; EHR data may be unmapped; claims data includes no location/provenance and may be delayed
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Thank you!

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