Creating Rules to Automatically Map Electronic Lab Reports Imported into the Sexually Transmitted Diseases Surveillance System

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Background

Upon adoption of PRISM for STD surveillance and case management in April 2010, TDH made significant changes to the application and databases to meet state-specific programmatic needs. This included a module for mapping ELR to a set of tables based on 15 data elements common in a lab message.

In 2016, TDH completed an in-depth analysis of the ELR mapping module and identified several areas for improvement. The STD program also began a major effort to modify PRISM to take advantage of additional system features and ELR enhancements. One of the main changes was to import ELR from HL7 messages and lab results from an internal patient tracking and billing system (PTBMIS) in a single XML file format. All previous mappings were re-evaluated to address changes to file format and inaccuracies discovered during the in-depth analysis.

Methods

New labs were required to match the ELR Mapping table based on the following 15 data elements:

- SendingApplication
- OrderCode
- OrderDescription
- OrderAlternate Description
- ObservationName
- OrderAlternateCode
- ObservationCode
- ObservationAlternate Code
- ObservationAlternate Name
- ResultType
- ResultCode
- ResultDescription
- AlternateResultCode
- AlternateResult Description
- ResultNumeric Number2

Unmatched labs were sent to a Mapping Hold table so that SQL rules could be written to automatically map them.

Examples of rules for each data element include:

- If ObservationName LIKE '%GONORRHEA%'
  then DS_DiseaseCategory = 'Gonorrhea'
- If AlternateResultCode = '<20' AND DS_DiseaseCategory = 'HIV'
  then DS_QualitativeResult = 'T' [Undetected]
- If ObservationName = 'TREPONEMA PALLIDUM AB' AND ObservationAlternateName = 'T pallidum Ab(TP-PA)'
  then DS_Test = 'T. Pallidum Antibody'

Methods

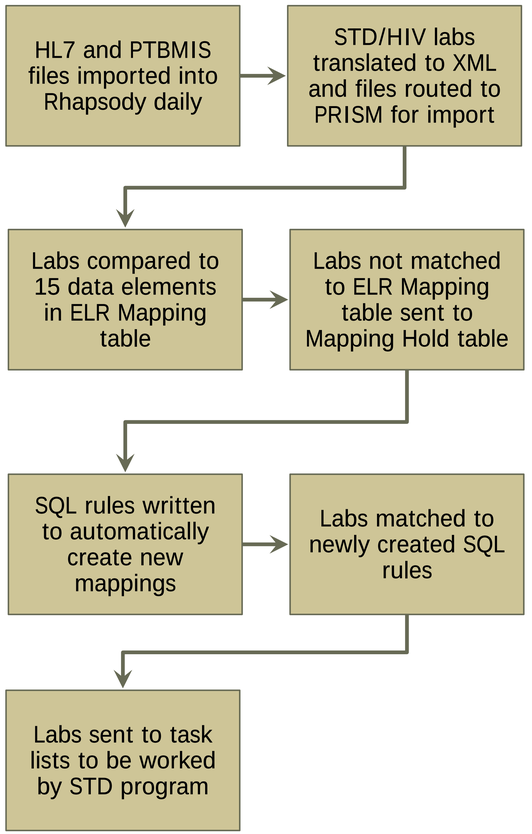

Figure 1. Mapping process for HL7 and PTBMIS labs into PRISM. ELR testing of the PRISM Replacement application took place between October 27 and December 9, 2016.

Results

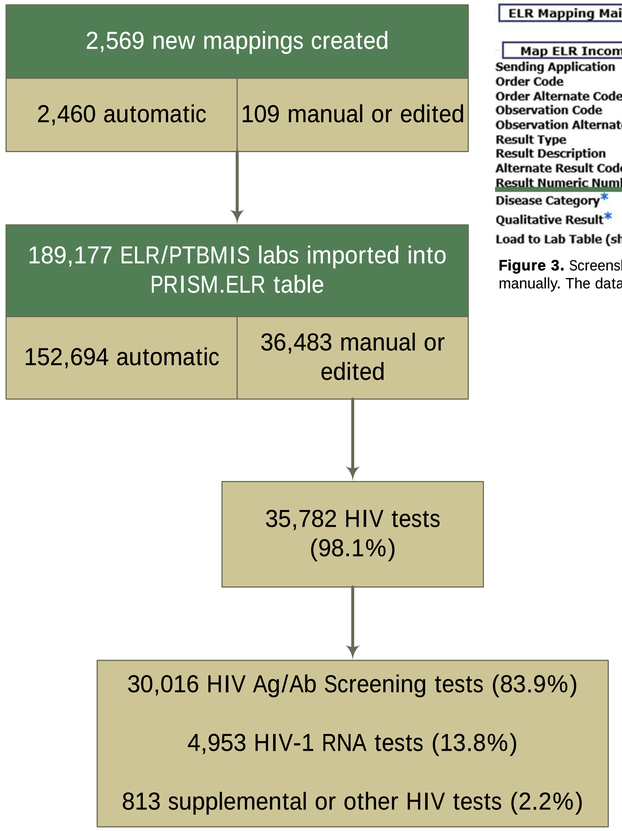

Figure 2. Total number of mappings that were created or edited and a breakdown of the electronic labs that were effected by these mappings. Results were calculated between December 12, 2016 and April 30, 2017.

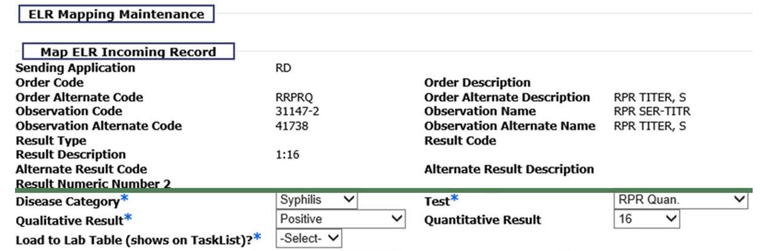

Figure 3. Screenshot of the ELR Mapping module in PRISM, where all incoming labs were previously mapped manually. The data elements below the green line are mapped based on the inbound data above the line.

Conclusions

Advantages of auto mapping:

- Positive step towards standardization of lab results.
- Reduction in human error – new unmapped labs no longer require human intervention (manual mapping) in order to be imported and sent to a user's task list.
- Time saved – users are able to see results in their task lists almost immediately instead of waiting for them to be mapped.

Disadvantages of auto mapping:

- Requires maintenance and updates, but this should decrease over time.
  - The most frequently edited rules were for HIV. This is not surprising since the HIV diagnostic testing algorithm is very complex and many laboratories send results in different formats.
  - The mapping module in Figure 3 still exists as a way to track incoming labs and write new SQL rules based on those labs.
- No audit mechanism is currently in place to determine how mappings were updated.
  - Addition of an audit mechanism has been requested because understanding why some rules don't work will only help to improve them.

Contact

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Acronyms & Abbreviations

ELR: electronic lab reporting
HL7: Health Level 7
PRISM: Patient Reporting Investigation Surveillance Manager
PTBMIS: Patient Tracking Billing Management Information System
SQL: structured query language
STD: sexually transmitted disease/infection
TDH: Tennessee Department of Health
XML: extensible markup language

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Advantages and Disadvantages of Auto Mapping: A Closer Look

- Positive step towards standardization of lab results. Our analysis of the previous method of manually mapping labs showed errors and inconsistencies in the mappings of test names and test results that will be avoided by an automated process.
- Reduction in human error—new unmapped labs no longer require human intervention (manual mapping) in order to be imported and sent to the user's task list.
- Time saved—users are able to see results in their task lists almost immediately instead of waiting for them to be mapped. PRISM imports HL7 and PTBMIS labs three times per day. Previously, unmapped labs would wait to be manually mapped twice a week by program staff. They can now be auto mapped as soon as they are imported.

- Requires maintenance and updates. On its first day in production, PRISM automatically created 464 new mappings based on the SQL rules. Since then, the daily number of new mappings created has been<30, with the numbers decreasing over time.
    - The most frequently edited rules are for HIV-related tests. This is not surprising since the HIV diagnostic testing algorithm is very complex and many laboratories send results in different formats.
    - Any time a new lab is onboarded, or a current lab changes test methods, new rules will need to be written.
    - The mapping module in Figure 3 still exists as a way to track unmapped labs and write new SQL rules based on those labs.
- No audit mechanism is currently in place to determine how mappings are updated.
    - Addition of an audit mechanism has been requested because understanding why some rules don't work will only help to improve them.

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