

“Show me Your CDA”: Public Health Laboratory Reports

S. R. Renly, S. E. Knoop, R. Ram

srrenly@us.ibm.com, seknoop@us.ibm.com, roni@il.ibm.com

IBM Almaden Research Center, 650 Harry Rd, San Jose, CA 95120 USA

IBM Haifa Research Lab, University of Haifa, Mount Carmel, Haifa, 31905 Israel

Summary-

IBM delivered a successful Nationwide Health Information Network (NHIN) prototype to the U.S. Department of Health and Human Services (HHS), Office of the National Coordinator for Health Information Technology (ONCIT) relying heavily on HL7 standards and Integrating the Healthcare Enterprise (IHE) interoperability specifications. IBM Research asked how this significant infrastructure transformation could be used to improve the often poor bi-directional communication with public health agencies and our ability to build better tools for early disease detection and prevention. IBM Research partnered with the Middle East Consortium for Infectious Disease Surveillance (MECIDS) to enhance reporting of their notifiable food borne illnesses within and across the partner governments. Our Public Health Information Affinity Domain (PHIAD) research prototype provides a web-based end user application and central IHE XDS repositories in the Israel, Jordan, and Palestine Ministries of Health (MOH). A fourth repository for shared laboratory reports will reside in the Cooperative Monitoring Center (CMC) in Amman Jordan. This prototype provides transformation of data to the HL7 CDA R2 IHE XD-Lab document, policy controls for sharing documents with the CMC, and new tools for document-based analysis, visualization, and reporting (AVR). We worked closely with the IHE Lab domain to incorporate new public health data requirements into the existing IHE XD-Lab profile specification which is now in Final Text. The HL7 CDA R2 schema easily supported many of our identified needs. We identified several outstanding issues for future work in our 2008 IHIC paper. This collaborative project is currently in deployment phase.

I. Introduction – Business Case

Population health is an important universal government function. Population health covers many types of programs, each collecting large amounts of population data to identify trends in their particular field. We focus here on infectious disease surveillance and outbreak detection, particularly with respect to food borne illnesses. Food safety involves regular testing at food production sites as well as detecting and investigating outbreaks in the human population that result from a single source contaminant, i.e. an outbreak. Governments receive clinical laboratory results when patients test positive for organisms such as Salmonella, Shigella, or Escherichia coli O157:H7. Public health laboratories receive these isolates and complete epidemiological testing for serotyping and potentially pulse field gel electrophoresis analysis to confirm single source contamination. The government’s ability to quickly aggregate and analyze incoming data is often stymied by inconsistent formats of data and the expensive resources needed to pre-process data prior to being able to analyze, visualize, and report on the current situation. The population is better served by a robust standardized reporting technology that simplifies data collection and automates detection processing so that epidemiologists can devote their time to investigation and prevention. Adopting Healthcare Information Exchanges (HIE) with public health goals in mind is a potential entry point for building a nationwide infrastructure for traditional clinical Healthcare Information Exchanges.

The HL7 Clinical Document Architecture provides several benefits for resource poor governments seeking solutions to improving their population health programs. First, documents closely mirror traditional paper-based reporting workflows still commonly in use. Second, simple style sheets provide for much improved report appearance and documents are easily printed. Third, documents are not locked into a particular system or proprietary vendor solution. Future system implementations can import standardized content from the machine readable document section. Fourth, simple sharing policies can implement nullFlavor masking enabling politically feasible data sharing.

MECIDS provided us with a unique opportunity to work with three government’s food borne illness programs plus a regional collaboration sharing reports with the goal of identifying and investigating cross-border outbreaks. This project encompasses the deployment of three separate government installations and a fourth collaborative installation for regional surveillance. Users of these systems include sentinel clinical laboratories performing initial microbiology isolations, public health laboratories performing epidemiological typing, Ministry of Health staff and epidemiologists analyzing the data and investigating outbreaks, and MECIDS coordinators dedicated to collaborative sharing of data and regional analysis.

II. Implementation, Methodology and Tools

The Israel, Jordan, and Palestine Ministries of Health locally collect food borne laboratory reports isolating Salmonella and Shigella strains to detect outbreaks and identify sources of improper food handling and food contamination. The governments each work closely with their sentinel clinical laboratories and public health laboratories to collect confirmed patient cases and organism isolate information. The processes and system capabilities in place vary greatly from location to location, adding significant overhead at the MOH in aggregating and processing the incoming data. Sharing public health data regionally is increasingly a priority as these countries share food, water, and exchange goods.

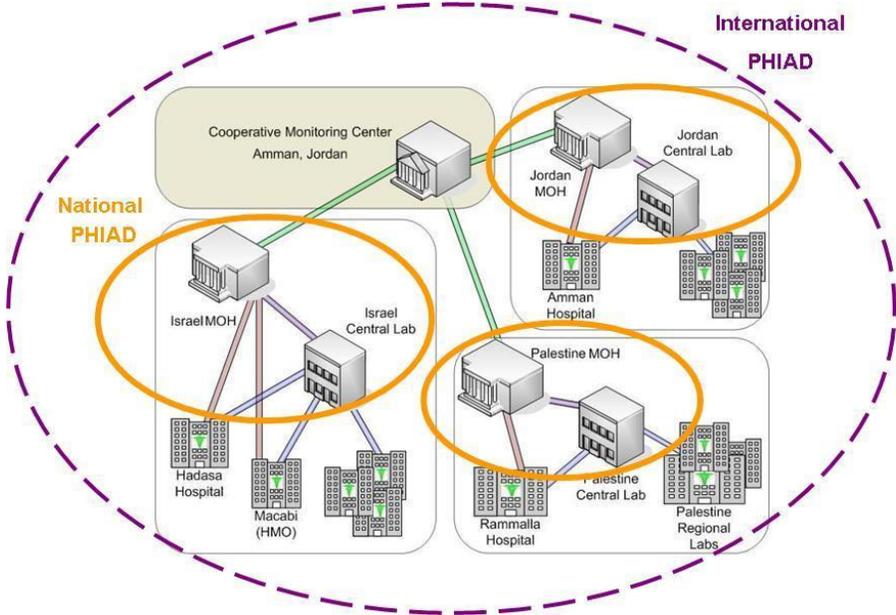


Figure 1: MECIDS Architecture and Deployment Environment

Since public health data gathering is hierarchical in nature, PHIAID was developed as a hierarchical solution. Data is automatically propagated from one layer to another by using the same communication mechanism and the same technology (IHE-XDS). Sharing and privacy policies define who has access to the data, which data is to be shared, and when to

share the data. The MECIDS participants share limited case data within their collaboration to identify and investigate cross-border outbreaks. Collaborative system build ensures consistent LOINC and SNOMED-CT coding of data such as specimen type, test code, and organism identification. CDA nullFlavor masking is a critical piece to enabling document sharing politically.

PHIAD leverages three open source technologies. The PHIAD web application is built atop the open source software for XDS provided by the Eclipse Open Health Framework (OHF) project. OHF provides plugin implementation to support the client side of IHE IT Infrastructure Technical Framework Cross Enterprise Document Sharing (XDS) Profile. Second, PHIAD uses the Eclipse Business Intelligent Reporting Tool (BIRT) to produce table, bar chart, and pie chart reports. Additionally, PHIAD uses the Eclipse OHF Spatio-temporal Epidemiological Modeler (STEM) tool to help epidemiologists and public health officials create and use spatial and temporal models of emerging infectious diseases. These models could aid in understanding, and potentially preventing, the spread of such diseases.

III. CDA in Use

Within each national PHIAD system, reports of Salmonella and Shigella notifiable conditions are a combination of clinical findings and epidemiological findings. Clinical findings include patient information, early organism identification, and often susceptibility interpretations. The isolates are then forwarded to a public health laboratory for identification confirmation, serotyping, susceptibility interpretations, and potentially genetic analysis to compare the strains for a genetic match in the case of an outbreak.

PHIAD provides the laboratories and monitoring Ministry of Health the ability to continue their internal process workflows while coordinating reporting with new efficiency. Early clinical reports are now available electronically allowing both the Ministry of Health and public health laboratories to see real-time incoming cases. Early recognition of a number of new cases can jump start an investigation prior to serotype and genetic confirmation from the public health laboratories. Public health laboratories benefit as more complete reports are received and duplicate data entry is no longer needed because the information from the clinical report is simply pulled forward. Public health laboratories add their epidemiological data to the report and this creates a new document replacing the original clinical report.

Much thought was needed regarding how to handle report edits/updates/retractions. While more work needs to be done for improved handling of these cases, our approach to date has been to allow edits from the clinical laboratories until a report has been submitted by the public health laboratories. After that point any edits must be communicated and performed by the public health laboratories. This ensures consistency within the combined report.

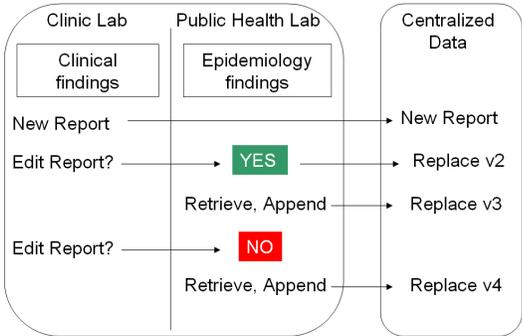


Figure 2: PHIAD Document Exchange Workflows

IV. Evaluation/Assessment

The HL7 CDA R2 provides benefits to resource poor agencies over HL7 electronic laboratory messaging. Today, laboratory information management systems (LIMS) have highly complex and expensive software for the determination of report copies, report routing, report preferences, report rendering, and report archival. Once installed, feature extension incurs additional fees and can sometimes be technologically infeasible. The introduction of HL7 CDA R2 laboratory reports allows for one-time-generation of archival reports, additional flexibility for add-on technologies that can then be responsible for the importing, transforming, routing, rendering, and auditing function as well as providing closer approximation to current paper-based reporting methods and human readability via XML usage.

With these advantages in mind, IBM Research analyzed the IHE XD-Lab Profile, a document format based on HL7 CDA R2 and additional domain specific constraints, for suitability in meeting the expectations of the MECIDS participants and the technical deliverables in our PHIAD system. Two key additions resulted from our public health needs analysis, neither requiring schema extensions in CDA. The first is our ability to represent laboratory reports for human only, subject only, and human/subject use cases. The second is our ability to document public health notifications which can include a notifiable condition, a case number, and an outbreak number. We elaborate on these in greater detail in our full paper.

We also made note of several desirable enhancements that we plan to recommend for CDA R3 that are also described in greater detail in our full paper.

- Adding an id (type II) to the SubjectType
- Modifying the type of the code element on RelatedSubjectType from CE to CD to enable the use of the qualifier sub-element
- Adding a new enumeration value of 'obsolete' on the statusCode on ObservationType and OrganizerType
- Adding a statusCode sub-element to the ServiceEventType to enable flagging of a laboratory report as preliminary.

Having implemented a working prototype that is going into deployment, we are eager to begin the evaluation process. We will consider the system and underlying technology successful when the users feel the system has provided new value. This can be defined in terms of user eagerness to stay with the system, improved data collection and timeliness, and improved situational awareness and communication.

V. Future Plans

Our future plans are heavily invested in making the PHIAD deployments a valuable asset to the MECIDS partners. We are committed to systems that deliver new value to the users and the population served. We are interested in extending the epidemiologist's document-based toolkit for improved analysis, visualization, and reporting. New work will likely include the addition of other communicable diseases. This work is likely to uncover new public health requirements where we work with HL7 and IHE to fill the gaps. With demonstrated success, we will engage additional governments to help them evaluate the benefits to implementing Healthcare Information Exchanges incorporating public health goals.

VI. Conclusions and Lessons Learned

We are very encouraged that HL7 CDA R2 met the majority of implementation requirements for our prototype PHIAD system now in the deployment stage. It is equally noteworthy that our implementation of IHE XD-Lab, initially focused only on the clinical laboratory setting, needed minimal refinements to encompass our public health use cases. There are still additional public health and general laboratory requirements that remain

outstanding which we are continuing to address within the IHE and HL7 communities. The process to transform current clinical and public health data exchange requirements into HL7 CDA R2 is a long but rewarding path.

References

We refer the reader to our IHIC 2008 paper “Creating CDA R2 Laboratory Reports to Meet Public Health Surveillance Requirements” for more details and a list of recommended references.