A Standard (HL7 V3) Based Public Health Information Network for Los Angeles County

Department of Health Services: Public Health – Case Study

By: David Cardenas, Abdul Malik Shakir and Gora Datta, Department of Health Services-Public Health, Los Angeles County, Los Angeles, CA

Challenge

Public Health applications have been previously developed to assist public health programs in meeting individual program's goals and objectives. This has led to the development of systems that collect data only for explicit purposes, without clear efforts to improve the integration, efficiency, and usefulness of public health data. The evolution of these disparate, fragmented public health data systems has led to duplication of effort, and placed limitations on local public health agencies to accomplish the mission of safeguarding and improving the health of the community and to respond effectively to large-scale threats to public health.

The Los Angeles County Department of Health Services has created an initiative to support consolidation of critical clinical and public health data across diverse individual IT systems [4]. The adoption and integration of knowledge-based decision support systems such as Data Warehouse, Business Intelligence toolset, and use of a central master person identifier are promoted. This initiative requires that existing investments in legacy systems be leveraged and merged with standards-based web enabled systems to provide a synchronized view of public health data and resources across all program areas.

Solution

The Los Angeles County (LAC) Operational Data Store (ODS) architecture is based upon the nine elements of the Public Health Information Network initiative (PHIN) published by Center of Disease Control and Prevention (CDC) and influenced by CDC's National Electronic Disease Surveillance System (NEDSS) [2, 3]. Deployment of the ODS and related components introduces an integrated standards-based system in LAC that provides a synchronized view of public health data and resources across all program areas.

The Operational Data Store (ODS), a component of PHIN architecture, will eventually hold all operational data for the public health program areas and include an Operational Data Store Application Program Interface (ODS-API) [5]. The ODS-API provides an interface to store and retrieve data from the ODS using the logical data model and without the detailed knowledge of the underlying relational tables. ODS-API provides an interface to the ODS for all other components of the framework.

Architecture Deployed

ODS is the core component of the PHIN architecture. The strategic objectives of PHIN are: Enhance the ability of Public Health to conduct surveillance for bioterrorism and other communicable diseases; Assist in the control of disease outbreaks and offer critical surge capacity for the tracking of epidemiological information; Broaden the communications capabilities of the public health

system; Implement mechanisms to support broad CDC initiatives while complying with requirements of local jurisdictions; Align the public health system with federal directives and national initiatives.

Key components of the architecture include: 1) Infrastructure & housekeeping services to provide authentication, directory and security services for the system and enable single sign-on. 2) A knowledge management module that manages translation and mapping of data from other systems to the ODS in a standardized format. 3) HASTEN provides the single sign-on portal for authentication & entry into the system. It also incorporates an event alerting mechanism. HASTEN provides the human interface. 4) HEDEX provides an electronic interface to systems that need to send data to and receive data from the ODS. 5) Analysis and Visualization services provide data analysis, reporting and GIS services. 6) Unique Person Identifier is an effort at the LAC to cross-index and assign unique identifiers to individuals who receive care or are referred to LAC facilities. 7) Data Warehouse at LAC is a patient-centric data store that pools data from hospitals, emergency care and public health programs. 8) The Incident Management System is the core component of the PHIN architecture that provides case management and program area support for managing disease specific interactions.

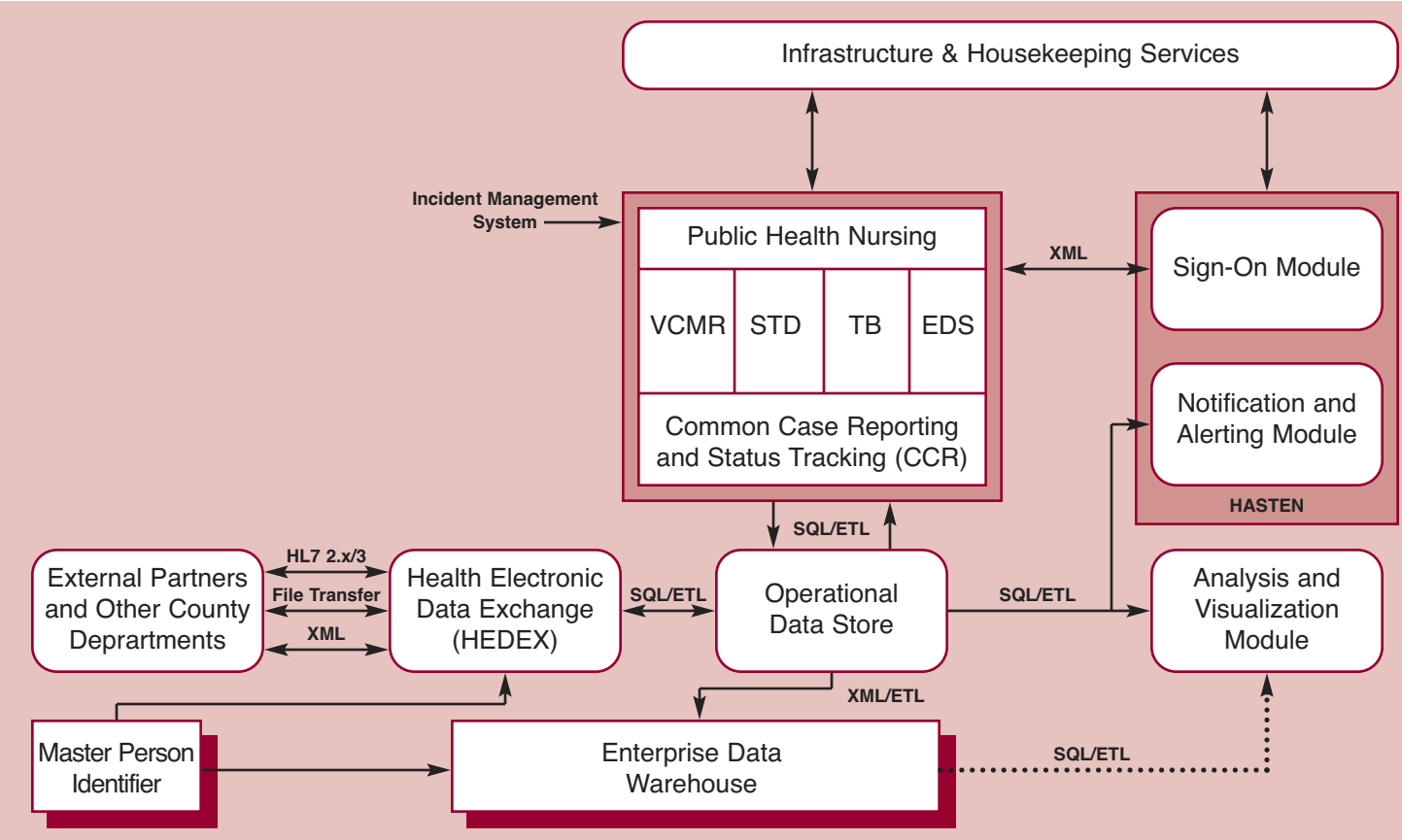

Figure 1: Los Angeles County Public Health Information Network Architecture Overview

ODS: The ODS provides persistent and patient-centric storage for data from multiple public health programs. The ODS is a relational database designed in an abstract-extensible style consistent with the HL7 V3 Reference Information Model (RIM). The database is implemented in three phases. In the first phase, the ODS merely mimics the data currently maintained by existing Program Area Modules (PAMs), such as the EDS [1]. In the second phase, the ODS is expanded to support the expansion of PAM capabilities and the introduction of Common Area Modules (CAMs), such as Knowledge Management System. In the third phase, the ODS replaces PAM specific local databases as the database of record for non-transient PAM-specific data. PAM specific databases are used for transient data only. The ODS also includes a staging area for the temporary storage of data received from external systems and data intended for export to external applications or bulk transport. Structured Query Language/Extract Transform and Load (SQL/ETL) tools are used to transform data to and from the persistent storage areas of the ODS.

ODS-API: The ODS-API handles healthcare transactions by exposing the HL7 V3 RIM objects that can be manipulated by client applications and provides the ability to persist the transaction in a relational database using Object-Relational Mapping technology, freeing the client application from having to deal with the physical data model [6]. Initial scope of this layer is to provide an XML message interface for incoming and outgoing messages from the other components of the PHIN System. As the development matures and the interface stabilizes, the ODS-API, in its final form, will be published as the only interface to the LAC Public Health ODS and all new applications developed internally and externally will be required to use this Interface to store and retrieve data to/from the LAC Public Health ODS.

The final steps will be the implementation of the ODS-API with Reference Information Model (RIM) Interface towards automating the population of ODS. The ODS-API will allow newly developed public health applications to directly store the operational data in the ODS and will remove the need of duplicate data stores. This ODS-API will be built on top of ODS-API layer which consumes the XML messages for healthcare events.

Benefits

The ODS is under deployment and the legacy systems are now being integrated with it. The ODS-API is under development. The Reporting services have been deployed and can report on ODS data. Several systems will be integrated into the infrastructure over the coming years including PAMs to support integrated case management activities for Public Health.

The PHIN compliant systems will specifically address the following [7, 8]: a) The development of a web-based system architecture for Public Health programs and health districts that is capable of supporting electronic data exchange from public health partners using a HL7 based integration hub, b) the development of management tools and applications to assist public health response and c) recovery activities while providing resources to support departmental integration. The PHIN/NEDSS systems will leverage individual system components for the overall improvement of public health information technology infrastructure while contributing to the development of a common enterprise data warehouse that will unify public health and clinical data under a unique person identifier.

There are multiple systems in place that support communications for public health labs, the clinical community, and state and local health departments. However, most of these systems operate in isolation. Numerous benefits will start accruing as parts of the system are built and integrated into the business processes of the local health services. The implementation of a unifying system will further improve access to laboratory data and response protocols, advanced capabilities for rapid notification of public health partners, response agencies, the media, and the general public. There will be an enhanced capability to train public health staff and a uniform data exchange standard for exchanging data between the public health partners.

Real-time collection of data from heterogeneous healthcare systems, program area modules, consolidation and cross-indexing of data, integrated directory infrastructure for public health personnel and identity management, integration of related healthcare and patient data from heterogeneous systems into a common interface, provide access through a ubiquitous web-based portal that will obviate the necessity of client-side implementations of application systems, provide a mechanism to disseminate critical and public-interest information to the community in general are additional benefits.

Conclusion/ Lessons Learned

The primary objectives of this initiative was to enhance the ability to conduct public health surveillance, provide electronic applications to assist in the control of disease outbreaks, develop advanced training tools for public health partners, and broaden the communications capabilities of the public health system in Los Angeles County in order to effectively prepare and respond to bioterrorism and other public health emergencies.

It is expected that the Public Health Information Network System effort will expedite the consolidation of critical clinical and public health data across diverse individual IT systems. It will leverage existing investments in legacy systems and merge them with standards based web enabled systems to provide a synchronized view of public health data and resources across all program areas. The ODS can be queried for a person-centric view of health-related data across all program areas. The visualization services provide a dashboard view and drill-down report capabilities for decision support and alignment of critical public health resources.

The use of a model driven [http://www.omg.org/mda/] Service Oriented Architecture [http://www.service-architecture.com/index.html] has allowed the County to take advantage of state-of-the-art information technologies while at the same time leveraging the investment made in its legacy application system. The use of industry standards positions the system to be interoperable with similar efforts conducted in other jurisdictions such as in neighboring Counties, the state of California, and the CDC.

A difficult issue to overcome was the inertia and tradition of autonomy enjoyed by program area leaders. We were fortunate enough to benefit from the coincidental coming together of three factors. First, the vision expressing the necessity of data sharing and leveraging data as a department wide asset was clearly communicated by the highest level of the County management. Second, CDC's effort to define standards for use in enabling a public health information network had reached a level of maturity that was useful for our purpose. And finally, the national recognition of the vulnerability of our public health system motivated Congress to allocate the funds necessary to underwrite the cost of development. Without these influences, the project would not have achieved the benefits so urgently needed.

Acknowledgements

This work was performed by CAL2CAL Corporation at the LAC-Department of Health Services-Public Health. The ODS and ODS related applications are developed under a grant from the CDC to state and local jurisdictions to support public health preparedness and response to bioterrorism [4]. This work was done in collaboration with Public Health Information Systems and Bio-terrorism Preparedness and Response Initiative, LAC Department of Health Services.

For more information contact David Cardenas at dcardenas@ladhs.org; or Gora Datta at gdatta@ladhs.org, Los Angeles County Public Health. ■

References

[1] Los Angeles County Department of Health Services, Public Health Information Systems, [a] SARS-EDS Software Requirement Specifications v1.0.2, October 2003;

[b] SARS-EDS Functional Document v1.0.2, October 2003

[2] Public Health Information Network: An Overview, published article at http://www.cdc.gov/phin/index.html .

[3] National Electronic Disease Surveillance System, "The Surveillance and Monitoring Component of the Public Health Information Network", published article of http://www.cdc.gov/nedss .

[4] Los Angeles County Department of Health Services, Public Health Information Systems, PHIS Action Plan for Bio-terrorism Preparedness Initiative – The application of NEDSS architecture to Public Health Information systems in Los Angeles County, March 2003

[5] Los Angeles County Department of Health Services, Public Health, Bio-terrorism Preparedness & Response Unit, ODS and ODS-API design and architecture documents, April 2005

[6] Beeler, George W; Huff, Stan; Rishel, Wesley; Shakir, Abdul-Malik; Walker, Mead; Mead, Charlie; and Schadow, Gunther, HL7: Message Development Framework, published article on http://www.hl7.org/library/mdf99/mdf99.pdf .

[7] Health Alert Network: Public Health Information Technology, Functions and Specifications (for Emergency Preparedness and Bioterrorism) February 14, 2002, published article on http://www.cdc.gov/cic/functionsspecs/IT_Functions_Specifications_final_21402.pdf .

[8] Los Angeles County Department of Health Services, Public Health, Bio-terrorism Preparedness & Response Unit, Bio-terrorism Preparedness and Response Initiative – The application of PHIN Standards & NEDSS Architecture towards integrating Pubic Health Information Systems in Los Angeles County – Program Plan, March 2004