
Interoperability: Semantics

Key Points

- A major challenge in sharing health information is ensuring the information has the same meaning to both the sender and the receiver (which is known as *semantic interoperability*).
- To facilitate interoperability, agencies need to aggressively move to standards-based semantics and coding and away from local, proprietary, or un-coded values.
- The more that data flows *between* systems to meet public health objectives, the more important standardized vocabularies become to ensure meaning is maintained.
- CDC promotes the use of standard vocabularies through PHIN VADS and provides both interactive and web service interfaces to its contents.
- Retrofitting existing systems and semantic mapping are key strategies to enabling semantic interoperability.

Without common understanding, the goals of information sharing cannot be met. A major challenge in sharing health information is ensuring the information has the same meaning to both the sender and the receiver (which is known as *semantic interoperability*). Both in the U.S. and globally, major efforts are underway to standardize how health information is captured, coded, and exchanged so that semantic interoperability can be achieved and healthcare outcomes improved. To achieve meaningful data exchange, both healthcare organizations and public health agencies (PHAs) need to aggressively move to standards-based semantics and coding, and away from local, proprietary, or un-coded values.

Semantic standards also save time and money. They improve understanding and reduce errors at all levels of data interoperability: within programs, across programs within agencies, and between organizations. Healthcare does not stop at jurisdictional lines, so information needs to flow across those boundaries to follow the patient, the exposure, or the case. Semantic standards are inherently a collaborative endeavor. Organizations must agree and work together to everyone's mutual benefit. PHAs must not only show leadership as key data exchange partners, but must also consider the needs, limitations, and capabilities of those partners in defining semantic standard requirements.

In many cases, semantic standards are embedded within the technical standards that use them (for example, many HL7 version 2 messaging implementation guides include code tables for use in the messages). However, many information systems in healthcare, both within and outside of public health, predate the development of these standards and contain local, proprietary codes to represent data values. Just because semantics are defined for interoperability, does not mean that source systems know how to translate proprietary codes into standard codes, or that they can do this consistently. Although some code sets are remarkably stable (for instance, codes used for race, ethnicity, and gender), others expand, contract, and change as medical knowledge evolves over time (like codes that represent symptoms or diseases), requiring constant attention to semantic coding

issues throughout the lifecycle of a system's use. It may also be less clear how to apply semantic standards to less structured data where meaning may in fact be more contextual than predictable.

Through its Public Health Information Network (PHIN) initiative, the CDC promotes the use of standard vocabularies among its own projects as well as the activities of its federal, state, local, and international partners. CDC's vocabulary services strive to promote semantic interoperability by working closely with relevant standards development organizations (SDO) to ensure public health's place at the table, and by taking the results of these SDO activities and ensuring their availability to public health stakeholders through the PHIN Vocabulary Access and Distribution System (PHIN VADS).

PHIN VADS provides standard vocabularies to CDC and its Public Health partners in one place. PHIN VADS is a web-based enterprise vocabulary system for accessing, searching, and distributing vocabularies used in public health and clinical care practice. It promotes the use of standards-based vocabulary to support the exchange of consistent information among Public Health partners.¹

While primarily created to support the semantic interoperability needs of HL7 version 2 messaging, it has been expanded to include support for clinical document architecture (CDA) document standards as well. Access to PHIN VADS data is available both interactively via a public web page² as well as through a system to system, standards-based web service, which allows local systems to draw upon semantic standards represented in PHIN VADS.³

In order to use *vocabulary* correctly, you need to ensure that the data elements represented by the vocabulary are also being used properly. This is critical, as different systems use different names (or terms) for the same data, and the same names for different data. The United States Health Information Knowledgebase (USHIK) was created as a central repository of data elements and their corresponding attributes and meaning.

It allows for query as well as comparison of data elements (or similar data elements). Interestingly, the USHIK database contains not only descriptions of the data elements themselves, but also any relevant vocabulary (called Value Domains in USHIK).

Case Study

As part of its recommendations, the International Society for Disease Surveillance (ISDS) Meaningful Use workgroup created a summary of the core data elements of interest from inpatient and ambulatory clinical settings for syndromic surveillance. Also presented for comparison are the core data elements of interest from the CDC PHIN Messaging Guide for Syndromic Surveillance: Emergency Department and Urgent Care Data (Release 1.1). To ensure that nationally certified EHR technologies can support a reasonable range of variation in data requirements based on state and local laws, ISDS expects that Meaningful Use certification will be required to demonstrate the ability to message all core required (R - Required, RE - Required, but may be sent empty, and C - conditional) and optional elements (O - Optional) defined in the summary.

¹ <http://www.cdc.gov/phinf/tools/PHINVADS/index.html>

² <https://phinvads.cdc.gov/>

³ <https://phinvads.cdc.gov/vads/developersGuide.action>

While adherence to national semantic standards is important, retrofitting an existing system to use these standards can be challenging and time consuming. It has implications not only to system development and maintenance, but also to the data contained within systems, both historic and new. But the more that data flows *between* systems to meet public health objectives, the more important standardized vocabularies become to ensure meaning is maintained.

One useful bridging strategy is semantic mapping, where data encoded using one scheme is mapped to a standard coding scheme before being sent to its destination; for instance, mapping and re-coding proprietary lab result codes to the LOINC standard before sending to public health in an electronic laboratory result (ELR) message. For example, just 15% of eligible hospitals in stage 1 of Meaningful Use attestation conducted a test of reportable lab results submissions to public health.⁴ Given that this measure will move from the menu set to the core set in stage 2, *and* will require use of SNOMED-CT and LOINC, this represents a huge requirement for standards-based semantics in the coming years. The mandated move from ICD-9 to ICD-10 in October 2014 will be equally dramatic. Recoding can take place within the originating system, within an interface engine as data leaves the source organization, at an intermediary (like a health information exchange) as data passes through it, or at the final destination before incorporation into the target system. The challenge is that code value mapping may change over time and require ongoing maintenance to ensure that mapped code sets remain complete.

Action Steps for State and Local PHAs

PHAs need to work proactively to move towards more standard vocabularies through a combination of activities, including:

- Carefully documenting their systems' current data elements, their corresponding vocabularies, and whether it matches a vocabulary required for healthcare organizations/providers by Meaningful Use or other regulation.
- Work with system vendors and developers to ensure all new systems and system enhancements incorporate national vocabulary standards.
- Map local vocabularies-in-use to nationally-defined vocabularies, especially for data involved in health information exchange (both received and sent).
- Consider providing code set translation services to organizations with which you exchange data to facilitate use of standard code sets.

Leadership Steps for National Agencies and Organizations

- Continue to participate in national standards development and harmonization activities and to represent public health interests.
- Continue investments in central resources such as PHIN VADS and USHIK to enhance their effectiveness and use by PHAs and their data trading partners.

⁴ See http://www.healthit.gov/sites/default/files/hitpc_apr2013nn.pdf slide 35.

- Work with other national organizations to encourage the adoption and use of semantic standards that are important to public health, and encourage state and local PHAs to use these standards.

More Information

<http://www.cdc.gov/phinf/tools/PHINvads/index.html>

<http://ushik.ahrq.gov/>

<http://www.hln.com/expertise/hit/hie/hie-standards.php#sem>

This paper is part of a series of information briefs for local and state public health officials and managers, developed by the Joint Public Health Informatics Taskforce in partnership with HLN Consulting, LLC. The full series of seven briefs can be downloaded at no cost from www.jphit.org.