

CDC: Moving Public Health IT Interoperability Towards Meaningful Implementation

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The Centers for Disease Control and Prevention (CDC) has continued to provide public health support in conjunction with utilizing the best available practices, policies and technology platforms. This document includes present and merging informatics efforts during 2010 with the inclusion of strategies, success stories, and the adaptability of evolving technology.

Background

CDC is a unique federal government structure with the purpose of protecting the Nations health and equity. CDC also plays a vital role in *“Collaborating to create the expertise, information, and tools that people and communities need to protect their health – through health promotion, prevention of disease, injury and disability, and preparedness for new health threats.”* (<http://www.cdc.gov/about/organization/mission.htm>)

In 2010 CDC continued improvement of informatics initiatives and services that were consistent with the CDC’s Vision for the 21st Century: “Health Protection...Health Equity”. Many of CDC’s activities rely on collaboration between public health and the healthcare community, especially in the areas of:

- Health monitoring;
- Detection and investigation of health problems;
- Conduction of research; and
- Development and implementation of health policies and prevention strategies.

Also in 2010, CDC began a transformation across all centers, including its public health informatics programs. The purpose of this reorganization is to consolidate entities to better serve the public and population health in the United States. This reorganization has restructured programs within the National Center for Public Health Informatics (NCPHI) and incorporated them into the new Office of Surveillance, Epidemiology and Laboratory Services (OSELS), within the Public Health Informatics and Technology Program Office (PHITPO).

The focus areas for this office include:

- Helping public health programs benefit from major changes in health informatics created by the HITECH Act.
- Exploring the use of electronic health records, electronic personal health records and health information exchange for prevention and public health.
- Increasing workforce competence in public health informatics through training, technical assistance and conferences.
- Improving interoperability and reducing cost of public health information systems through shared planning, standards, policies and services (like messaging and directory systems).
- Focusing public health informatics funding, design and acquisition practices on users and their public health objectives
- Applied research and evaluation of public health information technologies.
- More information may be found at: www.cdc.gov/osels/ph_informatics_technology/index.html

Informatics Initiatives

Fundamental developments during this past year at CDC include the Electronic Health Record (EHR) Meaningful Use Advisory Group, CSTE and CDC Electronic Laboratory Reporting (ELR) Taskforce, and release of several key data requirements and guides (e.g., Immunization Messaging Guide, International Society for Disease Surveillance, ISDS/CDC Core EHR Data Requirements for Syndromic Surveillance, Public Health Information Network (PHIN) Vocabulary and Access Distribution System (VADS).

A review of CDC's past interoperability effort may be found at:

http://www.interoperabilityshowcase.org/himss10/docs/himss10presentations/HIMSS10_Showcase_Theater_Presentation_Centers_for_Disease_Control_and_Prevention.pdf

1) EHR Meaningful Use Advisory Group

CDC is making a concerted effort across the Agency to support public health departments seeking to assure that adoption of EHRs results in improved monitoring and delivery of preventative healthcare services. As part of that commitment, OSELS and the Office of State, Tribal, Local and Territorial Support (OSTLTS) has convened an EHR Meaningful Use Advisory Group to ensure the challenge is met by supporting the development of state and local health department capacity for electronic data exchange and assuring the coordination of the resources available. This advisory body of CDC leaders is providing strategic planning to advance the exchange of information from EHRs to include syndromic surveillance, immunization registries, and electronic laboratory reporting between laboratories and the health departments.

The EHR Meaningful Use Advisory Group is comprised of senior leaders and staff with expertise and interest in many different areas to develop a comprehensive CDC plan. Because developing state and local capacity for receipt of electronic health records requires partnering with many stakeholders, the Advisory Group collaborates with CDC programs, federal partners (e.g., Centers for Medicare & Medicaid Services (CMS), Office of the National Coordinator for Health Information Technology (ONC)) and external partners (e.g., Association of State and Territorial Health Officials (ASTHO), Council of State and Territorial Epidemiologists (CSTE), National Association of City and County Health Officials (NACCHO), Association of Public Health Laboratories (APHL), and Joint Public Health Informatics Taskforce (JPHIT)).

2) CSTE and CDC Joint Electronic Laboratory Reporting (ELR) Taskforce

This Taskforce was established to work on the following tasks:

- Building on work with large national labs to ensure full implementation of ELR;
- Working effectively with LIMS and EHR vendors to support the adoption and use of interoperable standards-based systems;
- Addressing legal and policy issues at state and local levels;
- Using effective means to ensure ELR implementation (e.g., resources through CDC cooperative agreements, shaping guidance, providing technical assistance, monitoring progress);
- Identifying additional resources, as needed, for national ELR implementation; and
- Identifying and addressing unresolved issues regarding standards (e.g., message structure, content, vocabulary) and architecture.

3) Release of Several Key Data Requirements and Guides

In May 2010, the CDC National Center for Immunization and Respiratory Diseases (NCIRD) had released the HL7 Version 2.5.1: Implementation Guide for Immunization Messaging, Release 1.1. This messaging guide may be found at: <http://www.cdc.gov/vaccines/programs/iis/stds/downloads/hl7guide-08-2010.pdf>

In September 2010, ISDS and CDC released the *Core EHR Data Requirements for Syndromic Surveillance, Preliminary Recommendations* (http://syndromic.org/uploads/files/ISDSRecommendation-PRELIMINARY_EHRDataReq4SS_vFINALerratum-r3.pdf). Those recommendations included a contemporary model for syndromic surveillance and core EHR data requirements. A final version of this document as well as the PHIN Syndromic surveillance Messaging Guide are planned to be released at the beginning of 2011.

In December 2010, the Public Health Information Network (PHIN) had released a new version of the Vocabulary Access and Distribution System (VADS) that contain a collection of value sets for different objectives of Meaningful use. More information about this topic may be found in the “Meaningful Use Hot Topics” area at:
<http://phinvads.cdc.gov/vads/SearchHome.action>

Also in December 2010, PHIN VADS released a set of value sets (known as a “View”) for Syndromic Surveillance. The main purpose of PHIN VADS is to distribute value sets. PHIN VADS does not allow the users to download the code systems such as LOINC and SNOMED CT and expect the users to download from the SDO or official distribution source. More information may be found at: <http://phinvads.cdc.gov/vads/ViewView.action?id=CFA926B5-4405-E011-9273-00188B39829B>

The goal of CDC public health IT standards and interoperability enterprise service is to advance public health capacity for electronic exchange of health information to support public health surveillance and to improve the preventive care, health promotion and health education by assuring interoperable resources exist in public health practice and informatics. Information related to CDC standards can be found at:http://www.cdc.gov/osels/ph_informatics_technology/standards.html

For more information on CDC-wide informatics efforts contact Nikolay Lipskiy, MD, DrPH, MBA at dgz1@cdc.gov

National Center for Health Statistics (NCHS): Electronic Health Record and Vital Record Systems Information Exchange

The National Vital Statistics System has a long and enduring history that serves to provide essential data on births, deaths, and fetal deaths within the United States (U.S.) and is the oldest and most successful example of intergovernmental data sharing in Public Health¹. Over 6 million vital event records annually, including statistical information (demographic, medical/health, and geographic) are derived from over four million birth certificates and from about 2.4 million death certificates and fetal death reports. These events are registered annually by fifty-seven registration areas: 50 states, two cities (New York and Washington DC), and 5 U.S. territories (American Samoa, Guam, Confederation of Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands). Detailed data on all events are transmitted to the Centers for Disease Control and Prevention/National Center for Health Statistics (CDC/NCHS) for processing and dissemination.

Similar to other areas within healthcare, vital registration systems have not kept pace with e-commerce or other industries in developing interoperable data systems to support quality and timely data capture and transmission. The current registration system has supported the proliferation of silo solutions that have fostered redundancy in data entry and standards not recognized widely. This may result in slow transmission of birth and death certificate data to the federal government which can significantly impact data timeliness and usefulness which is essential for driving key health and healthcare related policy decisions. It may also influence programmatic and policy decisions for state agencies.²

A significant number of data items on birth and death certificates are captured in medical records. Currently, the capturing of these items at the facility or provider level for entry into state electronic systems are occurring through manual processes and stand-alone systems that foster duplicative data entry and a lack of standards. This process can be labor-intensive and lead to errors, adversely affecting the quality of the health and medical information captured on birth and death certificates and increasing hospital labor costs.

Current birth and death registration processes in the U.S. are characterized by:

- Progressively constrained schedules for reporting to federal agencies;
- Higher expectations of data quality and timeliness by stakeholders and the public;
- Separate, costly reengineering projects in various jurisdictions;
- Limited integration among internal vital records systems and with other stakeholder systems;
- A need for a standards-based, uniform, and systematic approach to collecting and exchanging data from vital records.

The CDC/NCHS is providing support for the development of vital records standards to enable interoperable electronic data exchanges among electronic health record systems, U.S. vital records systems and potentially other public information systems for birth, death and fetal death events. NCHS's Division of Vital Statistics (DVS) has initiated several projects that can serve as the foundation for standardizing electronic transmission of vital record events. These initiatives are carried out in conjunction with the Classifications and Public Health Data Standards Staff (CPHDSS) that represents the National Center for Health Statistics at Health Level Seven International (HL7) and Integrating the Healthcare Enterprise (IHE). NCHS has also collaborated on these activities with the National Association for Public Health Statistics and Information Systems (NAPHSIS), state representatives and other vital records stakeholders.

The NCHS and NAPHSIS have long collaborated to promote uniformity and consistency in vital records data collection. NCHS, NAPHSIS and interested state vital records representatives partnered to develop an HL7 Vital Records Domain Analysis Model (VR DAM). The VR DAM identifies and describes the activities and data required for processing birth,

¹ Centers for Disease Control and Prevention/National Center for Health Statistics/National Vital Statistics

System. About the National Vital Statistics System. Retrieved November 16, 2010 from <http://www.cdc.gov/nchs/nvss.htm>.

² Health Level Seven International (HL7). Vital Records Domain Analysis Model. Section 1: Project Overview.

death and fetal death records in compliance with the U.S. Standard Certificates of Birth and Death, and the U.S. Standard Report of Fetal Death. The model shows vital records stakeholders who are involved in exchanging data within the context of each activity. The model also includes descriptions of each of the data elements required for vital registration as defined by the national standard. The VR DAM will serve as a framework to guide future design and implementation efforts to standardize electronic vital records exchange.

Building on this collaborative relationship, NCHS, NAPHSIS and other vital records stakeholders developed an HL7 Electronic Health Record System (EHR-S) Vital Records Functional Profile (VRFP). The VRFP was derived from the HL7 EHR-S Functional Model (FM), which provides a reference list of functions that may be present in an electronic health record system. Functional profiles are a subset of the EHR-S FM that provide a standardized description and common understanding of the functions that are needed or required for a specific care setting or subject area. The VRFP profile defines the functional requirements needed to capture vital records data at the point of contact or care with a patient and supports messaging between EHR systems and states, local registrars, and federal agencies. The VRFP is intended to ultimately serve as the reference for the certification of EHR systems that include functionality to support vital records requirements.

CDC/NCHS also participated in vital records standards activity with the Healthcare Information Technology Standards Panel (HITSP) Populations Perspectives Technical Committee. They collaborated on the development of the C170 Vital Records Pre-Populate Component document to specify data sets that may be pre-populated from an EHR to a vital records system. More recently they have been engaged in the Quality, Research and Public Health (QRPH) Committee within the Integrating the Healthcare Enterprise (IHE). IHE promotes the coordinated use of established standards such as DICOM (**Digital Imaging and Communications in Medicine**) and HL7 to address specific clinical needs in support of optimal patient care.³ CDC/NCHS has been working with IHE/QRPH to align the HITSP C170 component document with the IHE Maternal and Child Health (MCH) Profile. The IHE MCH Profile describes the content to be used in automating the data capture in vital records such as the birth certificate. The aligned profile provides a technical framework for developing interoperable systems that will support transmitting EHR systems data to VR systems while adhering to the *Birth Edit Specifications for the 2003 Revision of the U.S. Standard Certificate of Birth* and the *Fetal Death Edit Specifications for the 2003 Revision of the U.S. Standard Report of Fetal Death*.

Future CDC/NCHS vital records standards activities will be focused on identifying the required vital records data exchanges and the potential for developing technical messaging and document requirements to support vital registration. Work has begun to form a new work group to provide support to develop these new HL7 vital records standards. CDC/NCHS plans to solicit the HL7 Public Health and Emergency Response Work Group to provide support for the development of these standards. It is anticipated that an initial set of standards will be available for balloting at HL7 by fall 2011. Based on fiscal year 2011 funding, NCHS is planning to pilot test in several states interoperability between EHR and Vital Record systems.

³ Integrating the Healthcare Enterprise. Retrieved November 16, 2010 from <http://www.ihe.net/>.

National Center for Health Statistics

CDC/National Center for Health Statistics (NCHS)/Classifications and Public Health Data Standards Staff (CPHDSS) collaborated with the NCHS/Division of Vital Statistics (DVS); the National Association of Public Health Statistics and Information Systems (NAPHSIS); and other vital records stakeholders to develop the:

- Health Level Seven International (HL7) Vital Records Domain Analysis Model (VR DAM) to describe the data content captured for the U.S. Standard Birth and Death Certificates and Fetal Death Report; and the birth and death registration work flow activities and stakeholders. The VR DAM was balloted and approved by HL7 as an Informative component of their Version 3 standard.
- HL7 Vital Records Functional Profile (VRFP) to provide a standardized way to describe the functional requirements needed in an Electronic Health Record (EHR) to support data exchange between EHR systems and states, local registrars and Federal agencies. The VRFP was balloted and approved during the September 2010 HL7 ballot cycle.
- CDC/NCHS/CPHDSS and DVS collaborated with the Healthcare Information Technology Standards Panel (HITSP) Population Perspectives Technical Committee to develop the C170: Vital Records Pre-Populate Component document. HITSP C170 specifies data sets that may be pre-populated from an EHR to assist with providing vital records information to State and Federal agencies.
- CDC/NCHS collaborated with the Integrating the Healthcare Enterprise (IHE)/Quality, Research and Public Health (QRPH) Committee to align the HITSP C170 with the IHE Maternal and Child Health (MCH) Profile. The MCH profile describes the data content that may be used from an electronic health record system in automating the data captured for vital records and for the child growth summary.
- CDC/NCHS provided support for the development of a U.S. extension of the MCH profile to specify a technical framework for developing interoperable systems that will support transmitting EHR system data to vital records systems while adhering to the U.S. Birth Certificate and Fetal Death Edit Specifications.

For more information on this project, contact Michelle Williamson at mwilliamson@cdc.gov or Hetty Khan at hkhan@cdc.gov.

For more information on vital statistics, visit <http://www.cdc.gov/nchs/nvss.htm>.

Early Hearing Detection and Intervention (EHDI)

Introduction

Newborn screening (hearing and bloodspot) is one of the first interactions between clinical care and public health that involves information exchanges. Integrating electronic newborn screening information into the newborn discharge summary of the birthing facility's EHR establishes one of the first meaningful interoperability opportunities in an individual's lifetime and provides an opportunity to lay the foundation for a public health role in EHR information exchanges.

Background

Hearing loss identified in the newborn period has been referred to as a neuro-developmental emergency. Congenital hearing loss affects two to three infants per 1,000 live births. Congenital and delayed onset hearing loss in infants is linked with speech and language delay and lifelong social-emotional and cognitive challenges. For the estimated 5,000 children born each year in the U.S. who have moderate to profound bilateral hearing loss without other disabilities, the calculated year 2007 value of the lifetime educational cost of hearing loss was \$115,600 per child. The identification of infants with permanent hearing loss through newborn hearing screening (diagnosed and intervened) reduces special education costs by an estimated 36% or a reduction of \$44,200 per child, suggesting EHDI programs can potentially save at least \$200 million in additional U.S. educational costs per year.

National goals have been established to ensure: hearing screening for all newborns no later than one (1) month of age; diagnostic audiological evaluation as early as possible, but no later than three (3) months of age for those who do not pass the screening; and enrollment in early intervention services as early as possible, but no later than six (6) months of age for those identified with hearing loss. These three goals are frequently referred to as the "1-3-6" Early Hearing Detection and Intervention (EHDI) plan and reflect recommendations and endorsements of several federal agencies and national organizations.

Since the organized collection of newborn hearing screening data started in 2000 (for year 1999) demonstrated progress has been made in increasing the number of infants screened for hearing loss. Now more than 95% of U.S. infants can be documented as having their hearing screened, yet nearly 50% of infants needing care following screening may not receive it. Some infants might have received follow-up services, but the results were not reported to the EHDI program and their status cannot be determined from available data.

A contributing factor to the lack of documentation of follow-up services exists because information flows among providers (birthing facilities, pediatricians and specialists) and public health agencies concerning EHDI have been inconsistent and unreliable. Screening results are not consistently communicated to health care providers. Many providers at the point of care do not have ready access to timely clinical and diagnostic guidance to assist care coordination for the infant with suspected hearing loss. Currently, the acquisition of much of this information for entry into the public EHDI information systems (EHDI-IS) is occurring through manual processes and multiple systems. This contributes to labor-intensive duplicative data entry and consequently increases the likelihood of errors, time delays, and poorer quality health and medical information. Clinical electronic health record systems (EHR-S) and EHDI-IS are seldom interoperable and do not share information electronically.

Use Case Development and Functional Requirements

In 2008, the Newborn Screening Subgroup of the American Health Information Community (AHIC) published newborn screening high-level and detailed use cases for the Personalized Health Care Workgroup. In 2009 the Integrating the Healthcare Enterprise (IHE) published a newborn screening white paper. The Health Information Technology Standards Panel (HITSP) Newborn Screening Interoperability Specification (IS 92 V:1.0) published in January 2010 further described the information flows, issues, and system capabilities supporting newborn screening reporting and information exchanges among clinical care settings and public health.

Harmonization of Standards and Specifications

The HITSP Population Perspective Technical Committee conducted the selection process of harmonized standards. The U.S. National Library of Medicine (NLM) has published these standards in their Newborn Screening Coding and Terminology guide to promote and facilitate the use of electronic health data standards for the conditions recommended for screening by the HHS Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (ACHDNC). The NLM web site includes standard codes and terminology for newborn hearing screening and coding for the transmission of Joint Committee of Infant Hearing (JCIH) risk indicators as they can be used for clinical surveillance of children at risk for delayed onset or progressive hearing loss within the Medical Home. Additionally these standards are available through the CDC Public Health Information Network Vocabulary Access and Distribution System (PHIN-VADS) vocabulary repository required for messaging and applications.

Implementation Specifications

In September of 2010 the IHE Quality, Research and Public Health (QRPH) Technical Committee published the EHDl Supplement for Trial Implementation that defines the information content and detailed communication specifications in five clinical use cases to facilitate electronic reporting of clinical data to the public health domain with minimal burden on birthing facilities, provider offices, and public health organizations.

The IHE EHDl Profile enables electronic communication between participants of care to reduce the likelihood of procedural failures at birthing facilities, primary care settings, and state EHDl programs, thus advancing public health's ability to assure that all newborns receive recommended care. While addressing these unique needs of a population of children with hearing loss, this Profile establishes one of the first meaningful interoperability opportunities in an individual's entire lifetime, laying the foundation of bi-directional information exchange between clinical care and public health. The IHE EHDl Profile enables the multiple care providers to adopt a uniform method for transmitting data, better manage ongoing care through an Early Hearing Care Plan (EHCP) and report on defined EHDl Quality Measures. The exchange of the EHCP is particularly suited to document sharing enabling multiple care providers engaged in early identification and intervention to better manage ongoing care. The Profile specifies quality measures relevant to the monitoring and measurement of the early screening evaluation and intervention process. These measures may be expressed using the HL7 Health Quality Measures Format supporting an automated machine interpretation and processing of the specified measure which decreases the burden of reporting.

EHDl Quality Measures for Meaningful Use

The Centers for Medicare and Medicaid Services (CMS) has recommended the expansion of the Clinical Quality Measure set to include additional pediatrics measures such as the documentation of both newborn hearing and bloodspot screening. CMS recognizes that quality measures associated with the Stage 1 definition of Meaningful Use presently contain certain gaps in newborn screening and other areas of pediatric care. As part of its final rule for the EHR Incentive Program, CMS agreed, "that newborn screening, both as a clinical quality measure, and from a data standards perspective, is a prime candidate for inclusion in the Stage 2 definition of meaningful use."

The final rule also states that preference is given to the clinical quality measures endorsed by the National Quality Forum (NQF). In response to a NQF Call for Intent to submit candidate standards for Child Health Quality Measures CDC, HRSA, and the National Committee for Quality Assurance (NCQA) submitted newborn bloodspot screening and EHDl candidate standards for consideration of endorsement. The EHDl quality measures submitted by CDC were based upon the criteria published in the IHE EHDl Profile.

During the past year the EHDI has completed the following achievements:

- Health Information Technology Standards Panel (HITSP) published Newborn Screening Interoperability Specification (IS 92 V:1.0) describes the information flows, issues, and system capabilities supporting newborn screening reporting and information exchanges among clinical care settings and public health
- U.S. National Library of Medicine (NLM) published harmonized standards in their Newborn Screening Coding and Terminology Guide promotes and facilitates the use of electronic health data standards for the conditions recommended for screening by the HHS Secretary's Advisory Committee on Heritable Disorders in Newborns and Children (ACHDNC)
- Newborn bloodspot screening and hearing screening quality measures submitted to National Quality Forum (NQF) for consideration of endorsement submissions by CDC, HRSA, and the National Committee for Quality Assurance (NCQA) to Call for Intent for Child Health Quality Measures
- IHE Quality, Research and Public Health (QRPH) Technical Committee published the EHDI Supplement for Trial Implementation defines the information content and detailed communication specifications in five clinical use cases to facilitate electronic reporting of clinical data to the public health domain with minimal burden on birthing facilities, provider offices, and public health organizations
- Towards a commitment to leverage the information technologies offered by EHR-S functionality; data standards, data requirements, and implementation guidance for the interoperability between clinical EHR-S and public EHDI-IS have been developed.

This project was conducted in partnership with the Public Health Data Standards Consortium (PHDSC, www.phdsc.org) with the support from the OZ Systems (<http://www.oz-systems.com/>)

For more information on this project, contact John Eichwald at jeichwald@cdc.gov.

For more information on EHDI, visit <http://www.cdc.gov/ncbddd/hearingloss>.

National Program of Cancer Registries (NPCR):

CDC-NPCR successfully tested the Anatomic Pathology Reporting to a Public Health Repository (ARPH) Profile at the IHE 2010 Connectathon, demonstrating the ability to send electronic pathology laboratory reports from a pathology Laboratory Information System (LIS) to a Central Cancer Registry, using their anatomic pathology reporting software, eMaRC Plus (electronic Mapping, Reporting and Coding) to receive and process the data.

- At the 2010 HIMSS Interoperability Showcase, CDC-NPCR successfully demonstrated the ability to transmit 1) anatomic pathology laboratory reports from an LIS vendor to the public health cancer registry according to the ARPH profile, and 2) cancer case reports from a physician office EMR to the public health cancer registry.
- Through the IHE Quality, Research, and Public Health (QRPH) Technical Committee, published the Physician Office Reporting to Public Health-Cancer Registries (PRPH-Ca) Supplement for Trial Implementation. This profile defines the information content and communication specifications to facilitate electronic reporting of cancer case data to public health cancer registries with minimal burden on physician office and public health organizations.
- CDC-NPCR has implemented live electronic pathology laboratory reporting from three large national laboratories, LabCorp, Bostwick, and CBLPath, to up to 32 state central cancer registries, using the ARPH profile. Please see <http://www.cdc.gov/cancer/npcr/informatics/aerro/activities/epath.htm> for details.

Anatomic Pathology Reporting to Public Health (ARPH)

Public health organizations collect data on diseases (e.g., cancers or premalignant conditions) diagnosed in AP laboratories. The NPCR developed the IHE ARPH integration profile as a way to transmit AP reports from AP laboratories to public health organizations (e.g., cancer registries, CDC, screening organizations) and is intended for international use. The HL7 AP work group worked closely with the NAACCR E-Path Working Group on this update to ensure consistency with the HL7 standards.

Cancer registries in the United States and Canada have extensive experience using an electronic reporting process for using Health Level 7 (HL7) Version 2.x standards and their IHE-ARPH integration profile is based on the *NAACCR Standards for Cancer Registries Volume V: Pathology Laboratory Electronic Reporting*, Version 3.0. It will transmit an HL7 Version 2.5.1 Observation Result (ORU) message from AP laboratories to the appropriate central cancer registries. The NPCR-AERRO project tested the IHE ARPH profile at the 2010 IHE North-American Connectathon and successfully demonstrated its ability to send electronic pathology laboratory reports from a pathology laboratory information system to a central cancer registry. The demonstration used the AP reporting software eMaRC Plus (electronic Mapping, Reporting and Coding) to enable cancer registries to receive and process the data.

The IHE ARPH profile defines the actors and transactions involved in AP reporting to public health organizations. This integration profile will make it easier for AP laboratories, public health agencies, and software vendors to adopt a uniform method to report, transmit, and process data. It will facilitate international electronic reporting of AP data in the public health domain.

Physician Reporting to a Public Health Repository – Cancer Registry (PRPH-Ca)

Until recently, complete and high-quality cancer reporting has been achieved primarily through hospital cancer registries. Historically, cancer patients received diagnostic testing or treatment in hospitals. Advances in medicine now allow some patients to obtain their care outside of hospitals (e.g., in clinics and physician's offices), which makes data collection more challenging and less complete. The result is underreporting of certain types of cancers, typically those now diagnosed and treated outside the hospital setting. For example, both melanomas and prostate cancers have been shown to be underreported when central registries rely only on hospital reporting. Treatments such as chemotherapy that are delivered in the outpatient setting are also underreported.

In many states, these non-hospital data sources are only minimally involved in reporting to central cancer registries, although the numbers are increasing each year. When reporting does occur, it may be through a manual process of identifying reportable cases and submitting copies of the medical record, or the central registry may send certified tumor registrars (CTR) to clinics or physician offices to manually abstract the information from the paper-based medical records. These processes are resource-intensive, time-consuming, and vulnerable to errors in transcription. The need to access

the data contained in clinics and physician offices with only limited resources is driving the effort to develop an automated electronic process to identify and report cancer cases through the EMR systems used in these settings.

The PRPH-Ca profile defines the actors and transactions involved in physician reporting to public health organizations. This HL7 Clinical Document Architecture (CDA) content profile uses several IHE and HITSP constructs to facilitate the secure exchange of clinical data from physician EMRs to state cancer registries. The IHE constructs used to support the PRPH-Ca profile include: 1) IHE Retrieve Form for Data Capture (RFD), which allow the EMRs used in physician offices to automatically populate a standard form with relevant clinical data that can be reported to state cancer registries with no additional burden to the physician; 2) IHE Cross Enterprise Document Sharing (XDS) for direct exchange of the document; and 3) IHE Medical Document Specification, which defines the base set of constraints to be used for this profile.

The IHE Sharing Value Sets (SVS) construct will be used through the implementation of Public Health Information Network Vocabulary Access and Distribution System (PHIN VADS) to map code values from the physician EMRs to national cancer community standards (established by the NAACCR) and to trigger the physician EMR to identify reportable cancer cases to report to the state cancer registry based on a pre-defined set of International Classification of Diseases (ICD-9) codes. The associated HITSP constructs include TP50, C76, and T66.

The PRPH-Ca profile will make it easier for clinics and physician offices, public health organizations, and software vendors to adopt a uniform method for reporting, transmitting, and processing data. It also will facilitate international electronic reporting of clinical data to the public health domain. Figure 2 presents a visual representation of how the ARPH and PRPH-Ca profiles can be used to improve reporting of cancer data.

For more information on this project, contact Wendy Blumenthal at wblumenthal@cdc.gov or Sandy Jones at sft1@cdc.gov.

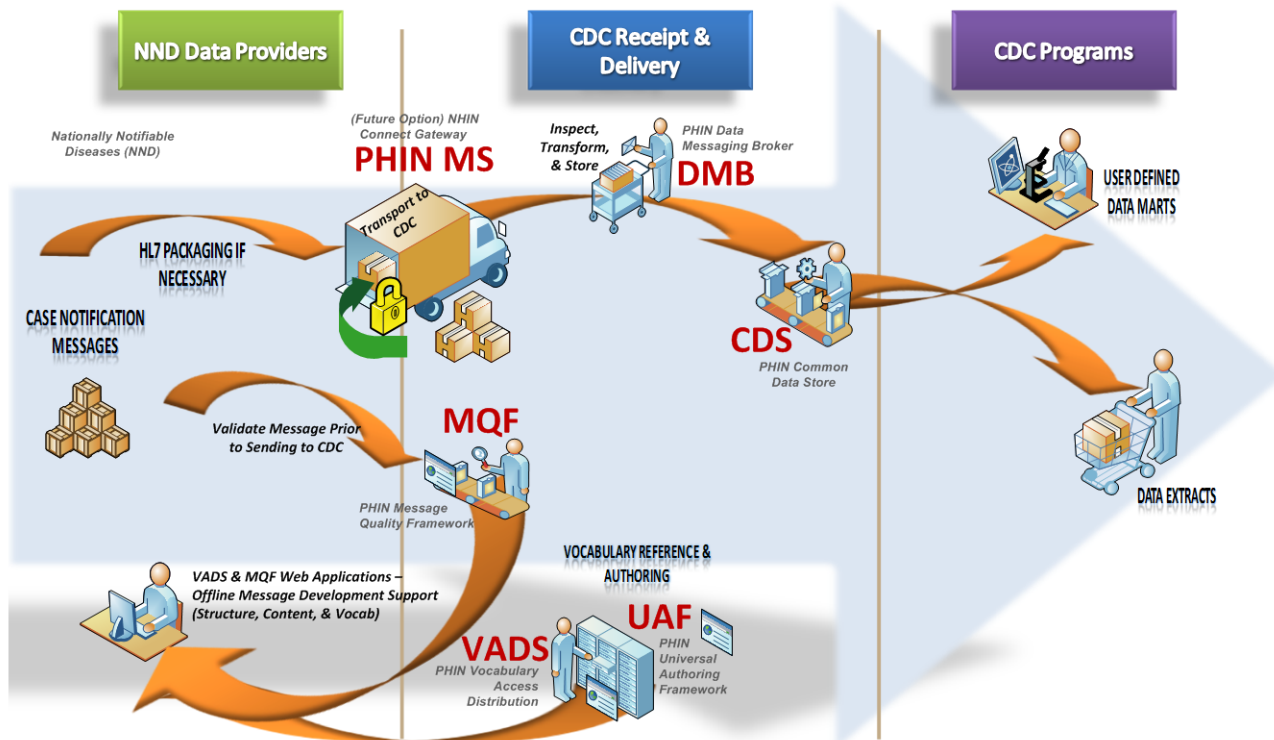
Public Health Information Network (PHIN) Vocabulary Access and Distribution System (VADS) – Making Public Health Vocabulary Interoperable

Background

Coded data using standardized vocabulary in electronic data exchanges plays a crucial role in the following public health activities including: (a) Early Event Detection (b) Emergency Response and Preparedness (c) Data Aggregation and (d) Population Health Measurement.

In 2004, CDC developed a Web-based enterprise vocabulary system called PHIN VADS. CDC developed this system to access, search, and distribute value sets used within PHIN. The CDC Vocabulary and Messaging team manages the PHIN VADS application and content. PHIN VADS is one of many tools in CDC's suite of applications used in Case Notification as depicted in Figure 1.

Figure 1. CDC Interoperability Tools (Case Notification)



Standard vocabulary created by the Standard Development Organization (SDO) is also called a “Code System.” Examples include SNOMED, ICD-9 CM, and LOINC.

Most of the public health data elements or questions usually have answer lists that are created using a few concepts from the SDO code system. “Value Set” is the technical term that is used for the collection of concepts from SDO vocabulary. Example: A microorganism value set created using SNOMED CT.

Using Standards

PHIN VADS values sets are developed based on Whitehouse E-Gov Consolidated Health Informatics (CHI) domain recommendations and Health Informatics Technology Standards Panel (HITSP) C80 value sets content and metadata.

PHIN VADS value set metadata is based on the “HL7 Domain and Value Set definitions and binding” document provided by HL7 vocabulary technical committee. The PHIN VADS application is developed based upon HL7 Common Terminology Services (CTS) and ISO 11179-metadata standard.

ONC Federal HIT Vocabulary Task Force Testimony about PHIN VADS

The CDC vocabulary team provided the testimony to the Office of National Coordinator (ONC) Federal Health IT standards committee vocabulary task force regarding the vocabulary development and PHIN VADS value set distribution.

The CDC PHIN VADS Testimony hyperlinks include:

- One Stop Shop for Meaningful Use Vocabulary - Sept 1st, 2010 ([Written Transcript](#), [Audio](#))
- Best Practices and Lessons Learned: Vocabulary Infrastructure - March 23rd, 2010 ([Written Transcript](#), [Audio](#))

PHIN VADS Content

The main purpose of PHIN VADS is to distribute value sets. PHIN VADS does not allow the users to download the code systems such as LOINC and SNOMED CT and expect the users to download from the SDO or official distribution source.

Value sets developed by CDC are used primarily to support the HL7 message (V2.x, V3). CDA implementation guides are developed for Electronic Laboratory Reporting (ELR), Immunization, Vaccine Adverse Event Reporting System (VAERS), Public Health Case Reporting, Case Notification, Healthcare Associated Infections (HAI), Antibiotic Use and Resistance (AUR) surveillance, BioSense, Non-infectious conditions (Lead Poisoning), chronic condition, and cancer.

PHIN VADS has already published the value sets associated with population health Meaningful Use measures. These value sets include [ELR to Public Health \(HL7, version 2.5.1\)](#) and [Immunization \(HL7, version 2.5.1\)](#).

Currently, PHIN VADS has 592 value sets supporting 60 HL7 and CDA message implementation guides. PHIN VADS hosts both the intrinsic and extrinsic value sets. In addition, PHIN VADS has a robust mechanism to host current and previous versions of value sets and messaging guide vocabulary views.

Besides hosting the value sets, PHIN VADS also hosts 149 SDO code systems including the following CDC-developed code systems: Clinical Vaccine Names (CVX), Manufacturers of Vaccine (MVX), Healthcare Service Location (HSLOC), and CDC Race and Ethnicity (CDCREC).

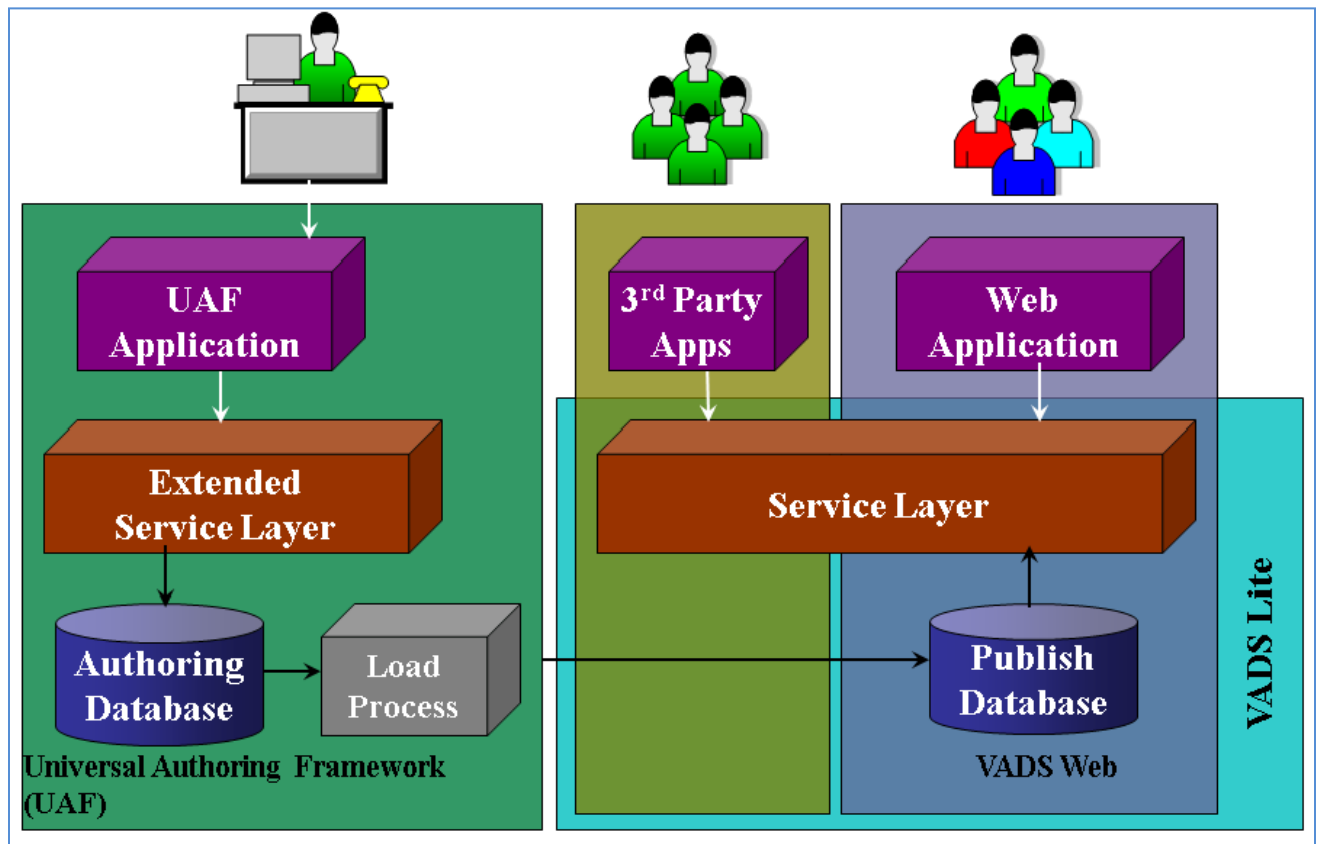
PHIN VADS Distribution Methods

CDC distributes value sets primarily through the vocabulary server, PHIN VADS. The Public health community uses PHIN VADS to obtain the value sets associated with the various HL7 implementation guides based on HL7 2.x, V3 and CDA.

PHIN VADS can be accessed using one of the following methods that have been described in detail below and visually represented in Figure 2:

- PHIN VADS Web Browser
- PHIN VADS Web Service – System-to-System exchange of vocabulary data
- PHIN VADS Lite – Local instance of VADS Web services and database

Figure 2. PHIN VADS Framework



PHIN VADS Web Browser

The PHIN VADS Web browser is the most commonly-used method for browsing, searching and downloading the public health value sets. This browser has been in use since 2004, and can be accessed at <http://phinvads.cdc.gov>. Users have an option to download PHIN VADS value sets using Microsoft Excel or using a tab-delimited text format. The PHIN VADS Web user interface is compliant with Web accessibility, Section 508.

PHIN VADS allows the users to bookmark the value sets, code systems, concepts, vocabulary views and groups. PHIN VADS vocabulary view bookmarks are usually included in the HL7 message implementation guide that allows the implementers to access the messaging vocabulary associated with implementation guide easily.

PHIN VADS Web Service – System-to-System Exchange of Vocabulary Data

- PHIN VADS Web services are based upon the following functional specifications:
 - Health Level 7 Common Terminology Services (HL7 CTS)
 - IHE ESVS and HITSP T66
- Provides a collection of methods that can be invoked by any software application to access the data directly without using the PHIN VADS web browser.
- Can be incorporated into other applications
- Accesses the PHIN VADS database used by the PHIN VADS Web Browser
- The PHIN VADS Web application has a link to the developer toolkit that contains libraries for integrating with the VADS Web service in three popular languages (Java, .Net, and PHP).
- The PHIN VADS developer's tool kit can be obtained from the following link:: <http://phinvads.cdc.gov/vads/developersGuide.action>

PHIN VADS Lite - Implementation of a Local Instance of the PHIN VADS Web Service and Database

- Allows any individual or organization to implement a local instance of the VADS service and database
- The VADS Lite deployment is available for Oracle and Microsoft SQL Server.
- VADS Lite is the same Service and Database that is used by the PHIN VADS Web browser.
- VADS Lite is not deployed with a user interface
- The deployment model requires the users to download, install, and maintain a local installation on their hardware. Vocabulary Server with Application Programming Interface (API) may allow the vendors or implementers to integrate the vocabulary server with their application. e.g., [NEDSS Messaging Subscription Service application](#) includes PHIN VADS vocabulary server and Orion Rhapsody that assists in the validation of HL7 messages and assists mapping between local and standard terminology.

Public Health Information Network (PHIN) Message Quality Framework (MQF)

The beta version of the Public Health Information Network (PHIN) Message Quality Framework (MQF) Application was released in early 2010 and is available through the CDC website.

The MQF application is a flexible framework of services and utilities designed to assist public health partners with preparing and communicating quality standard electronic messages as defined by the applicable messaging, vocabulary, and programmatic standards. The tool is a web interface and middleware system which assists public health partners with preparing and improving the data quality of HL7 messages.

The public health community has a growing need to ensure that the data exchanged across numerous health IT initiatives meets a variety of relevant national messaging, vocabulary and quality standards, including but not limited to HL7 v2.5 PHIN public health case notification message mapping guides. The Health Level 7 (HL7) messaging standard, version 2.x that was implemented by most vendors and public health agencies does not resolve all systems interoperability problems. Many of the current processes associated with ensuring standard compliance in the public health community are time and resource consuming. MQF is an automated testing tool that ensures messages are adhering to standards defined in the messaging guides by: validating the structure of the message, validating that the messages are following the business rules defined for the message, and verifying that the vocabulary defined for the message is utilized.

The following was performed to determine the requirements necessary to support the development effort of the MQF Tool.

1. Analysis of HL7 message structures that support reporting of Nationally Notifiable Conditions (NNC) - Reporting of Nationally Notifiable Conditions (NNC) PHIN HL7 Version 2.5 Messaging Standard National Condition Reporting Case Notification ORU^R01 Message Structure Specification/Profile Version 2.0 October 23, 2008.
<http://www.cdc.gov/phinf/library/documents/pdf/PHIN%20NotificationMessageSpecificationProfile%20v2%200.pdf>
2. Analysis of HL7 message structures that supports reporting of Public Health Lab Interoperability Project (PHLIP) - APHL/CDC PHLIP Messaging Guide for Influenza Test Result Reporting by Public Health Laboratories, ORU R01 HL7 v2.3.1, Document version 1.0.2, Sept. 15, 2009
https://phinmqf.cdc.gov/HL7v2_3_1_APHL_Influenza_Msg_Guide_ORU_v1%200%202.pdf
3. Analysis of best practices on a structural validation of messages.
4. Analysis of capabilities for conformance testing and support rapid implementation of bio-surveillance applications.

MQF facilitates a 50% improvement in the implementation of a new message mapping guide by the public health partners. In the past a public health partner would code the message, submit a test message to the CDC, and await feedback. The CDC resource would test the submitted message and provide issue and error feedback. This process was labor intensive and required prioritization and coordination between many teams to confirm a test message success or failure. Use of this tool allows public health partners the capability to test HL7 messages on their own prior to submitting them to other health partners or the CDC, therefore, decreasing the cost and time to implement integrated systems. The average time for a new message implementation has been significantly decreased from 12 weeks to 6 weeks or less. By placing the testing capability into the hands of the implementer the CDC resource support has been decreased by 75%.

MQF Supported Specifications

MQF supports HL7 structural validation against the following published message standards:

The NND CN Project:

- PHIN HL7 Version 2.5 Messaging Standard National Condition Reporting Case Notification ORU^R01 MESSAGE STRUCTURE SPECIFICATION/PROFILE Version 2.0 October 23, 2008
- Varicella Case Notification Message Mapping Guide, Version 2.0, 01/09/2009
- Tuberculosis Case Notification Message Mapping Guide, Version 2.0, 01/09/2009
- Generic Case Notification Message Mapping Guide, Version.1.0, 06/16/2009
- Arboviral Human Case Notification Message Mapping Guide, Version 1.1, 01/20/2009
- Malaria Case Notification Message Mapping Guide, Version 1.04, 03/10/2010
- Generic Summary Case Notification Message Mapping Guide, Version 1.0, 06/18/2009

The PHLIP Project

- APHL – CDC PHLIP Messaging Guide for Influenza Test Result Reporting by Public Health Laboratories, ORU R01 HL7 v2.3.1, Document version 1.0.2, Sept. 15, 2009

Integration with PHIN VADS

In 2004, the CDC developed a Web-based enterprise vocabulary system called the Public Health Information Network Vocabulary Access and Distribution System (PHIN VADS). CDC developed this system to access, search, and distribute value sets used within PHIN.

MQF introduced vocabulary validation through a real time integration with PHIN VADS by accessing the web services to validate that the vocabulary is valid for the specified message. MQF supports vocabulary validation against the following published message standards:

- Tuberculosis Case Notification Message Mapping Guide, Version 2.0, 01/09/2009
- APHL – CDC PHLIP Messaging Guide for Influenza Test Result Reporting by Public Health Laboratories, ORU R01 HL7 v2.3.1, Document version 1.0.2, Sept. 15, 2009

Benefits

- ✓ Public Health partners can test messages on site reducing dependency on other entities
- ✓ Provides easy reporting of any errors
- ✓ Potential use for testing messages for Meaningful Use objectives
- ✓ Data Quality/Accuracy Improvement
- ✓ Basis for Decision Support (Laboratory Reporting, Healthcare Quality Evaluation, Case Detection)
- ✓ Potential use for Certification Support (e.g. PHIN, CCHIT)
- ✓ Streamlines the testing / validation process
- ✓ Improves
 - time for partner message certification of sending a standard message both to CDC and to other partners
 - cost - provides the capability to validate messages prior to submission
 - quality through reusable/shared components across programs and systems

Future

Future efforts will allow MQF to be used to support and assist HHS candidates to prepare for certification necessary to meet the American Recovery and Reinvestment Act (ARRA) "Meaningful Use". These services will include validation services to support structural, constraint, and vocabulary validation of the

Meaningful use message domain profiles. The initial ARRA message domain profiles which will be supported include:

- ✓ ELR: Supported standard - HL7 2.3.1 ORU R01 and HL7 2.5.1 ORU R0
- ✓ Immunization Registries
- ✓ Syndromic Surveillance

Supported Program User Guides

Public Health laboratory Interoperability Project Guide:

<http://phinmqf.cdc.gov/MQF%20User%20Guide%20%20PHLIP%20Users.pdf>

Case Notification Guide -

<http://phinmqf.cdc.gov/MQF%20User%20Guide%20Case%20Notification%20Users.pdf>

Contact Information for MQF

Email: phinmqfsupport@cdc.gov

PHIN MQF Application URL: <http://phinmqf.cdc.gov>

National Center for Immunization and Respiratory Diseases (NCIRD)

Background

The Immunization Information Systems Support Branch (IISSB) of NCIRD is vital in providing support to Immunization Information Systems (IIS). IIS are confidential, population-based, computerized information systems that attempt to collect vaccination data about all children within a geographic area. IIS are an important tool to increase and sustain high vaccination coverage by consolidating vaccination records of children from multiple providers, generating reminder and recall vaccination notices for each child, and providing official vaccination forms and vaccination coverage assessments

In a population-based IIS, children are entered into the IIS at birth, often through a linkage with electronic birth records. An IIS record also can be initiated by a health care provider at the time of a child's first immunization. If an IIS includes all children in a given geographical area and all providers are reporting immunization information, it can provide a single data source for all community immunization partners. Such a population-based IIS can make it easier to carry out the demonstrably effective immunization strategies (e.g., reminder/recall, AFIX, and WIC linkages) and thereby decrease the resources needed to achieve and maintain high levels of coverage. IIS also can be used to enhance adult immunization services and coverage.

The concept of IIS is not new. Many individual practices and health plans administer immunizations to their patients. Records of these immunizations often are based on computerized information systems designed for other purposes such as billing. There also is a growing movement toward the development of totally computerized patient medical records. Although an IIS includes all immunizations administered by health care providers participating in it, only population-based IIS are capable of providing information on all children and all doses of vaccines administered by all providers.

Standards Development and Interoperability

IISSB has a long history of participating in standards development and implementing these standards. Its first HL7 Implementation Guide was published in 1999 and was based on HL7 V2.3.1. This Guide was soon adopted by many IIS and EHR vendors and became a model of successful interoperability. As a result, thousands of messages are transmitted daily using the Guide.

In May 2010, a new Implementation Guide was published, based on HL7 V2.5.1 and available free via the web and PHIN VADS. While the Meaningful Use Final Rule specifies use of either the 2.3.1 or 2.5.1 Implementation Guide, IISSB recommends use of 2.5.1 because it is more tightly constrained, has improved query capabilities, and improved clarity. Most IIS are eager and ready to move to 2.5.1.

IISB has provided support to the IIS community by awarding ARRA-HITECH grants to 20 states and municipalities to enhance the interoperability of EHR-IIS data exchange. The funds will be used to establish expert panels focused on transport, de-duplication, and support of the HL7 2.5.1 Implementation Guide by improving technical assistance documentation and identifying best practices for local business rules.

Further, IISB has funded an initiative to assist IIS and EHRs in reconciling their decision support functionality and provide a common logic framework for the interpretation of Advisory Committee on Immunization Practices (ACIP) recommendations. An expert panel will be formed to plan, draft, and finalize Clinical Decision Support standards and associated guidance documents.