Enhancing Health Information Exchange with the FHIM

Introduction, Evaluation, Suggestions, and Next Steps

A White Paper by:

The Open Group Healthcare Forum

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Boundaryless Information Flow™
achieved through global interoperability
in a secure, reliable, and timely manner

Executive Summary

The efficient and effective flow of secure healthcare information through healthcare systems has been an elusive business and social goal for decades. No country, no healthcare industrial complex, has yet produced a scalable solution to the interoperability problem. As a result, patients continue to have limited access to information about their own health. Clinicians continue to provide care without comprehensive pre- and post-care knowledge about their patients. Healthcare quality suffers and healthcare costs continue to spiral upward. Why is healthcare so far behind other industries in the efficient and effective exchange of critical information?

We acknowledge that healthcare systems are highly complex and the magnitude and scope of common healthcare interoperability is, though daunting, eminently achievable. We recognize that key stakeholders (e.g., providers, payers, vendors) often disagree about how to exchange patient-relevant healthcare information. However, we believe the essential barrier to interoperability is rooted in the fact that the healthcare industry lacks a common, shared language. Fundamentally, a standardized vocabulary is necessary to share healthcare information in ways that consistently and reliably help patients. Thus, for instance, information about a patient's blood pressure should mean the same among all healthcare stakeholders regardless of the trusted source, and it should flow freely but securely among all people, places, and things integral to a patient's care.

This lack of effective standardization in healthcare has several inter-related underpinnings: sometimes there are too many overlapping standards, sometimes standards conflict, sometimes there are gaps in available standards, and sometimes there is lack of consensus about best available standards. This problem is not limited to the US. The need to agree on health and healthcare information standards for interoperability has global appeal and begs for solutions that can be implemented globally. The diverse ways nations organize their healthcare systems does not overshadow the international need to develop common standards.

The US federal government has been working on the interoperability problem for many years. There has been a great deal of attention and money focused on encouraging the adoption of electronic medical records to achieve "meaningful use" since passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009.[1] Another key activity for interoperability, far less well known, is the significant work dedicated to creation of the Federal Health Information Model (FHIM). The FHIM is under the direction of the US Federal Health Architecture (FHA) program managed by the Office of the National Coordinator for Health IT (ONC). Late in the summer of 2014, the FHA asked The Open Group Healthcare Forum to perform an evaluation of the FHIM. The FHA wanted to know how *good* is the FHIM and how *useful* is it?

The Open Group Healthcare Forum is well qualified to address these questions. The Open Group is a global consortium that enables the achievement of business objectives through IT standards. With more than 475 member organizations, we have a diverse membership that spans all sectors of the IT community – customers, systems and solution suppliers, tool vendors, integrators and consultants, as well as academics and researchers. Our vision is Boundaryless Information Flow™ through global interoperability in a secure, reliable, and timely manner. The goal of our work in the healthcare sector is to enhance access to integrated information to improve health outcomes and to support business process improvements.

The Open Group Healthcare Forum evaluated the FHIM using widely accepted program evaluation methods to conduct focused workshops and detailed dialogs with global private and public sector health and Enterprise Architecture experts. We presented our core findings in a December 9, 2014 presentation to the FHA Managing Board in Washington, DC at the offices of the ONC.

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[1] Refer to: www.healthit.gov/policy-researchers-implementers/health-it-legislation-and-regulations.

Enhancing Health Information Exchange with the FHIM

As a result of its evaluation The Open Group Healthcare Forum commends the FHIM for five main reasons:

1. The FHIM catalogs a large number of key shared information exchange needs …

2. … based on actual scenarios provided by 20 federal partners …

3. … in a structured model populated with consensus-based industry standards.

4. The FHIM documents the model building processes, which is key to building understanding, confidence, and support.

5. The FHIM enhances automation of healthcare data exchange, thus promoting higher quality and efficiency.

The Open Group Healthcare Forum may help unlock immense advantages made possible by increased healthcare interoperability. For this to become a reality, however, federal agencies with healthcare information exchange needs and their private sector collaborators will have to adopt the FHIM, adapt it to their particular exchange needs, and implement it in their core interoperability systems.

Identifying examples of FHIM adoption, understanding barriers to its adoption, and relating the FHIM to other major efforts to achieve healthcare interoperability can be an important step in helping to enabling The Open Group vision of Boundaryless Information Flow. The Healthcare Forum is engaged in this work and expects to publish new insights in the second White Paper in this series, planned for late 2015.

Background

Too often the flow of information about the most important life events we experience – births, deaths, and illnesses – becomes congested at critical junctures in the delivery of healthcare services. In such cases, clinicians and caretakers, the people who can help most, do not have ready access to the health data required to provide appropriate care to patients. Compared to other industries in developed economies (e.g., finance, commerce, transportation, and manufacturing), healthcare is stuck in something akin to the "middle ages". Many people the world over are extremely concerned with this state of affairs and want to see it improved.

So much of what we do today is dependent on the exchange of information between various parties and organizations. Information exchange is pervasive and necessary to provide seemingly simple services we take for granted. Consider what happens when you order something from an online retailer. First, you browse the website and place your order. The options presented are the result of an information exchange between the website and the logistics system. You place your order and can pay with a credit card or check. This is possible through an information exchange between you, the online retailer and your bank. The online retailer sends information to the warehouse where robots use barcodes to pick the items in your order. This is made possible through information exchange between the online retailer, the logistics system, and the robot-controller. It is shipped using your choice of shipping options, and you can track your order from the online retailer through all its intermediary stops until it is delivered on your doorstep. This is dependent on information exchange between the online retailer and the service delivery agent(s).

In the retail industry, data exchange is facilitated by standards and interoperability. In the healthcare industry, critical information does not flow freely between participants in the ecosystem due to a lack of agreed, useful, and ubiquitously deployed standards. Applying the retail model to healthcare, the entire sequence of inter-dependent steps is contingent on one fundamental building block: agreed standards for healthcare information exchange. This is the aim of the FHIM: to create and maintain a set of agreed standards to drive healthcare information exchange.

The FHA Mandate

The Clinger-Cohen Act of 1996 provides general authority for a Federal Enterprise Architecture (FEA). In 1999, the US Office of Management and Budget's (OMB) Federal CIO Council created the FEA to direct each federal agency to manage its work according to best business practices to foster interoperability, consistency, efficiency, data utility, and transparency.

In 2004, the OMB established a Federal Health Architecture (FHA) program to produce a common way to represent exchanged healthcare information.[2] More specifically, the FHA was initiated to bring together the decision-makers in federal health IT for inter-agency collaboration – resulting in effective healthcare information exchange, enhanced interoperability among federal health IT systems, and efficient coordination of shared services. The FHA supports federal agency adoption of nationally-recognized standards and

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[2] ONC/FHA PMO: FHA Federal Health Information Model (FHIM) Information Modeling Process Guide, Version 1.0, September 2014; available at: www.fhims.org.

policies for efficient, secure healthcare information exchange. Currently, the FHA is funded by the Veterans' Administration (VA), Department of Defense (DoD), Health and Human Services (HHS), and the Social Security Administration (SSA) to reach out to more than 20 federal agencies to advance the national agenda for health IT.[3]

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[3] Refer to http://healthit.gov/policy-researchers-implementers/federal-health-architecture-fha, accessed March 30, 2015.

The Federal Health Information Model

The goal of the FHIM (www.fhims.org), which the FHA describes as a "model of healthcare information", is to "support semantic interoperability and harmonize information requirements from federal partners and standards organizations". Its scope is far-reaching; it includes "all healthcare information" with the exception of billing and resource planning".[4] To create the FHIM, modelers work with federal partners to understand their agencies' key information exchange needs. A central part of their work is the creation of a common terminology framework based on standards issued, endorsed, or profiled by SDOs, including HL7, IHE, HITSP, and the ONC's Standards and Interoperability (S&I) Framework for achieving Meaningful Use. To remain current, the FHIM must continuously evolve to meet federal partners' changing semantic interoperability needs, including those that arise in collaboration with private sector entities.[5]

The FHIM is like a 3-D visual map of information. If you flattened it out to expose all of its detail, you would see that it contains the "categories" of information needed to improve the efficiency and effectiveness of healthcare collaboration between the agencies of the US Government. Using a filing cabinet as an analogy, at the highest level of generality, the map is simply a set of approximately 40 labeled folders; for example, one for lab, one for surgery, one for provider, and one for person. Moving to the next level, each folder is a grouping of related concepts that divide the healthcare ecosystem into manageable "domains". And on and on it goes until you get to a level of detail that calls for a standard terminology for representing the most basic information.

For instance, "vital sign" is a domain. A vital sign is "observed" by a "provider" in a "person" who is a "patient". In the preceding sentence each word in quotes can be qualified using multiple levels of information – all specified in the FHIM. Going on, suppose the observation is blood pressure. Here too there are many healthcare delivery-relevant classes of information: the size of the cuff, the body position of the patient, whether the patient was awake or asleep at the time of measurement, the method of measurement (e.g., automated or manual), and the physical measures of systolic and diastolic pressure. At or near the "bottom" or most detailed level of the model, an observation such as body position has several values, including: prone, sitting, recumbent, and standing.

Granted, the FHIM is intricate and complex (as is the healthcare ecosystem). But like a map of the stations of the London Tube or the New York subway, it contains only necessary information and users do not "see" the map as a whole. They use it for a specific purpose. Remaining with this analogy, reading a map to navigate from Piccadilly Circus to Heathrow stations is akin to using only those FHIM domains that are relevant to diagnosing a patient presenting with shortness of breath and numbness in an extremity.

As of this writing, FHIM modelers and their collaborators had completed half of the domains and more than half of the first full iteration of the model, including over 85% of the most frequently exchanged healthcare

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[4] Refer to www.fhims.org, accessed January 14, 2015.

[5] Technically, the FHIM is an information reference model based on the principles of Model-Driven Architecture (MDA). It produces a platform-independent higher-level specification. Agency partners and their collaborators use the FHIM to produce distinctive data models by using formal model-to-model transformations to generate a Platform-Specific Model (PSM). In short, federal agencies and their exchange partners can use the FHIM to implement healthcare information exchanges and concrete software applications.

information.[6] The model can be used today to support exchange of healthcare information in the completed domains. We believe that with some relatively small course corrections (discussed in Areas for Improvement below) and a concerted public and private effort to ensure adoption and implementation of the FHIM, this model has the potential to meet the objectives of the authorizers and the needs of patients, provider, payers, and other stakeholders.

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[6] It should be noted that the VHA Health Information Model (VHIM, now VIM) provided the underpinnings on which the FHIM is built.

Purpose and Approach

In this White Paper we aim to achieve four main purposes. First, we provide a plain language introduction to the FHIM, whose existence is not widely known and whose purpose is not well understood. Second, we present core findings from our evaluation of the model. Third, we describe areas for model improvement (intended primarily for FHIM modelers and the FHA program at ONC). Fourth and finally, we draw conclusions and describe next steps for this important program of work.

The Open Group Healthcare Forum conducted the following evaluation and consensus development activities:

- Content review of FHIM program documents and other FHIM-related documents available on the FHA website[7]

- FHIM workshop provided by FHA Enterprise Architects for The Open Group Healthcare Forum

- Model review by 30 healthcare and Enterprise Architecture experts from over 15 organizations in the US, UK, Germany, and Norway

- Two three-day FHIM Evaluation Workshops: The Open Group Conference, London (October 2014)[8] and The Open Group Conference, San Diego (February 2015)[9]

- Consensus development, resulting in observations and questions submitted to the FHA

- Evaluation of written responses provided by the FHA

- Feedback on December 9, 2014 presentation of findings at the ONC

- Ongoing Healthcare Forum evaluation of the FHIM during the process of writing the White Paper

- Internal review of the White Paper by The Open Group Executive leadership

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[7] Refer to: www.fhims.org.
[8] Refer to: www.opengroup.org/london2014.
[9] Refer to: www.opengroup.org/sandiego2015.

Findings

The evaluation questions are qualitative by nature. The Open Group Healthcare Forum developed an evaluation approach that answered the questions by uncovering facts, applying our knowledge of best practice, and offering our members' collective opinion. In summary, the FHIM is a very good information model that can drive great value to stakeholders through its adoption and can be an enabler to building an interoperable healthcare system. It provides a common vocabulary and a well-defined set of model elements to make the federal healthcare system more understandable and healthcare information more readily exchanged. It synthesizes recognized industry standards into a single model and is validated using a "bottom-up" approach to its construction by agency representatives. The FHIM identifies shared information needs across two or more agencies and helps build mutual understanding and consensus on data sharing and documents. It helps automate key aspects of information exchange protocols.

How Good is the FHIM?

The FHIM assembles an essential and necessary structure (conceptual model). It provides a logical/reality-based map of the professional and business needs of healthcare information exchange. It "binds" terminology – reflecting a common vocabulary of consensus-based industry standards – to the conceptual elements of the map. In so doing, it creates a structure for navigating the practical rigors of exchanging critical healthcare information among people, places, and (increasingly) things.

The Open Group Healthcare Forum derived five main findings from its evaluation of the FHIM:

1. The FHIM identifies information that is shared, or needs to be shared, by two or more federal agencies.

The detailed process of defining a baseline of common and shared attributes is a "once and done" method that is in place for future data exchanges, thus greatly reducing the effort to share healthcare information. An essential "first step" to streamlining information exchange, this should help reduce costs and improve quality over time. The process is, of course, iterative, as models of the real world must change to reflect real change.

2. The FHIM establishes information exchange requirements through "real-world" use-case scenarios.

The process of building the FHIM establishes understanding of agencies' information exchange requirements through opportunities for practical data exchange based on actual healthcare scenarios. These real-world exchange scenarios serve as validation criteria for inclusion in the model.

3. The FHIM leverages industry standard data identifiers and format.

The Open Group Healthcare Forum gained an appreciation for the FHIM modeling approach, which synthesizes best available industry domain standards into a single information model for healthcare. The process produces an information model that is based on internationally recognized industry standards. Moreover, it informs the public and private sectors, in the US and abroad, about the current state of standards development, including where gaps exist and further work is needed.

4. The FHIM provides an audit trail of decisions made throughout construction.

The process for building the FHIM documents embodies and audits agreements made over time. This is key. Producing and building an information model requires that decisions made throughout the process can be

revisited to ensure that new users understand why specific direction was taken and who participated in setting that direction or decision. This builds trust in the use of the model, and more importantly in the process for producing/maintaining the model over time.

   5. The FHIM automates the production of implementation tools and artifacts.

The FHIM is not just an information reference model. It can help to enable the generation of tools such as implementation guides and validation schemas that facilitate the more timely and cost-effective implementation of conformant information exchange. [10]

How Useful is the FHIM?

At this time, we have only anecdotal evidence that the FHIM can be highly useful as an integral part of the roadmap to interoperability. For example, it was reported that the VA and DoD have used the FHIM in their initiatives to streamline the exchange of healthcare information, achieve productivity gains, reduce inefficiencies, and improve quality. In the private sector, one of the largest kidney care companies in the US is using the FHIM. It is difficult to know how many organizations have adopted some part of the FHIM because it is an openly available and free resource. Nevertheless, further adoption will bring greater evidence of the model's usefulness in enabling global interoperability in a secure, reliable, and timely manner. Success breeds success and fuels adoption. We encourage higher involvement from partner agencies as the investment of completed work can yield high dividends. The shortest path to obtaining the vision of interoperability among agencies is to agree to support and leverage the construction of this information model. It represents the blueprint for building exchanges that can be fully understood and implemented by all participating agencies.

The gauge of usefulness is directly correlated to the adoption of the FHIM, both with federal agencies and the private sector. We were told that the VA and DoD provide proof of concept: they have used the FHIM to support initiatives to streamline exchange of healthcare information. We believe that if adoption and implementation can be promoted effectively the potential usefulness of the FHIM is very high.

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[10] Refer to www.projects.openhealthtools.org/sf/projects/mdht, accessed March 30, 2015.

Areas for Improvement

In this section we offer ideas for improvement that we identified through our evaluation process. We grouped these opportunities into the four categories discussed below.

Model Structure

Definition

The structure of an information model focuses on significant model elements, the relations between them, and the properties of both elements and relations. This viewpoint considers aspects such as cohesiveness of model elements; separation of concerns, consistency of modeling concepts, elements used to aid in representation of domain, and fitness of the model to model transformation capabilities to aid in the development of concrete data models.

Recommendations

Establish and communicate a clear vision for the FHIM and the value it offers federal agencies, the private sector, and the overall healthcare ecosystem. Ensure consistency of communication across the various model elements and related work products. Consider extending the information model by healthcare system-specific "plug-in" capabilities to enhance international participation and model adoption.

Capture and document Business Scenarios – end-to-end – to demonstrate quality and usefulness of the model.[11] Provide metrics on the use-cases the model applies to and design Business Scenarios for testability of the overall model and individual model elements. Provide clear guidance for the usage of model elements in information exchange scenarios and for platform-specific software implementations.

Model Life Cycle Management

Definition

Lifecycle management includes the definition and documentation of the intended lifetime of the model and individual model elements and the supporting governance and change management capabilities to maintain the model and individual elements over their intended lifetime.

Recommendations

Establish, document, and maintain periodic reviews and revisions of the FHIM. Develop a documented release model with clear release cycles and deliverables to encourage model usage across federal agencies and the private sector. Consider establishing a process to review "finished" and effective model elements over time to determine portions of the model that require rework. Strengthen cohesiveness and consistency of

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[11] Refer to the Manager's Guide to Business Scenarios, by Terry Blevins, John Spencer, and The Open Group Architecture Forum (2002), available at www.opengroup.org/bookstore/catalog/g261.htm.

concepts applied to model elements to ensure usability of the model for concrete implementations in software applications.

Standards Management

Definition

This viewpoint focuses on standards used to both model the healthcare domain space as well as standards used to facilitate model creation, maintenance, and most importantly usage.

Recommendations

Strive to be more transparent and clear about the standards selection, rejection, and adoption process. Engage and collaborate with international organizations to identify appropriate standards, influence the enhancement of standards where required, and advance widespread adoption of the healthcare information model. Avoid development of unique model elements that lack support by SDOs.

Standards Conformance

Definition

Standards conformance is the two-step practice of adhering to published standard specifications. First, within the specification a standard should fully document how an implementation shows adherence to that standard. Second, standards compliance procedures outline how an implementer attests to their adherence to the standard.

Recommendations

To realize interoperability after standards are in place it is necessary to ensure that the standards are followed as they were intended. Standards compliance procedures must be put in place for the implementations to prove that exchanges faithfully pass along the right information in the right format. Where tools automate or facilitate information exchange generation is a great place to ensure standards compliance. In reality, implementations need to comply with the standards, so it is critical to have a standards compliance strategy, plan, and procedures that will improve the usefulness of the FHIM.

Governance

Definition

Governance is the discipline of monitoring, managing, and steering an IT product (here, the FHIM) to deliver the intended outcome.[12]

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[12] Based on the TOGAF® Version 9 standard.

Recommendations

While the current governance framework for the FHIM may suffice in a federal context, consider offering it as a framework/foundation for current private sector Electronic Health Record (EHR) collaborations on interoperability, and more generally for increased and even widespread participation by the private sector and potentially an international audience. Adjust current governance processes to meet the needs of all stakeholders.

Engagement Model

Definition

The engagement model defines and maintains supporting processes that allow the various, many times diverse stakeholders to use the model or parts of the model and participate in its lifecycle management.

Recommendations

Establish a process that allows a broad audience, from federal agencies to the private sector, to use the model and to participate in the lifecycle management of model elements from discovery, selection, and modeling to revisioning and retirement. Provide clear communication and documentation to stakeholders on the *modus operandi* for engagement.

Conclusions and Next Steps

The Open Group Healthcare Forum believes the FHIM should be completed and continuously maintained. It should be adopted and implemented (by partner agencies and their collaborators). Take-up of a new technology requires change at many levels and leadership is key to success. Completing and maintaining the model will be a challenge, but one well within the realms of possibility and required to make strides in interoperability in the healthcare ecosystem.

Ensuring adoption and implementation is far more difficult. What can the FHA and ONC do to help? The Open Group recommends a detailed assessment of federal partners' and their private sector collaborators' willingness to adopt the FHIM and barriers to its uptake. The Open Group Healthcare Forum is working with the FHA to conduct this assessment during the second phase of this project. Suggestions from readers are encouraged and can be sent to j.lee@opengroup.org.

The Open Group Healthcare Forum wishes to emphasize that the FHIM does not exist in a vacuum. It is not a "plug and play" or "off the shelf" application. However, the FHIM can play an important enabler role at a critical level in interoperability. The FHIM provides a standardized terminology and mapping of relationships that are key to exchange of healthcare information. What else is needed though? An answer to this question is the key third phase of work in this project. If the FHIM provides the description of the "payload" of healthcare information, how do entities agree to and physically exchange information? What transport is used? What issues does this raise? Will the private sector, will the medical establishment, be highly resistant to or eagerly accepting of a federal, FHIM-based integrated solution to healthcare interoperability? These are large questions but we believe they must be asked and the answers must be made transparent to all of those whose aim is to increase the secure exchange of healthcare information among key stakeholders.

Acronyms and Abbreviations

DoD   Department of Defense (US)

EHR   Electronic Health Record

FEA   Federal Enterprise Architecture

FHA   Federal Health Architecture

FHIM   Federal Health Information Model

HHS   Health and Human Services

HIT   Healthcare Information Technology

HITECH Health Information Technology for Economic and Clinical Health

HITSP   Healthcare Information Technology Standards Panel (www.hitsp.org)

HL7   Health Level Seven International (HL7) (www.hl7.org)

IHE   Integrating the Healthcare Enterprise (www.ihe.net)

MDA   Model-Driven Architecture

OMB   Office of Management and Budget

ONC   Office of the National Coordinator for Health IT

PSM   Platform-Specific Model

SDO   Standards Development Organization

SSA   Social Security Administration

VA   Veterans' Administration (US)

VIM   VHA Health Information Model, formerly VHIM

References

(Please note that the links below are good at the time of writing but cannot be guaranteed for the future.)

- Clinger–Cohen Act (CCA) 1996, formerly the Information Technology Management Reform Act of 1996 (ITMRA).

- Health Information Technology for Economic and Clinical Health (HITECH) Act, 2009; refer to: www.healthit.gov/policy-researchers-implementers/health-it-legislation-and-regulations.

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- ONC/FHA PMO: FHA Federal Health Information Model (FHIM) Information Modeling Process Guide, Version 1.0, September 2014; available at: www.fhims.org/links.html.

- TOGAF® Version 9.1, Enterprise Edition, Open Group Standard (G116), December 2011, published by The Open Group; available at www.opengroup.org/bookstore/catalog/g116.htm.

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The Open Group is a global consortium that enables the achievement of business objectives through IT standards. With more than 475 member organizations, The Open Group has a diverse membership that spans all sectors of the IT community – customers, systems and solutions suppliers, tool vendors, integrators, and consultants, as well as academics and researchers – to:

- Capture, understand, and address current and emerging requirements, and establish policies and share best practices

- Facilitate interoperability, develop consensus, and evolve and integrate specifications and open source technologies

- Offer a comprehensive set of services to enhance the operational efficiency of consortia

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