

# Interoperability – What’s in a word?

*W. Ed Hammond,*

*Director, Duke Center for Health Informatics*

*Professor, Department of Community and Family Medicine*

*Adjunct Professor, Fuqua School of Business*

*Duke University*

*Durham, North Carolina USA*

Almost every paper, report, or media release about the use of information technology in healthcare mentions the word interoperability. Even the President of the United States has used this word in his speeches. Yet, the word does not appear in Webster’s or the Oxford Standard Dictionary. When using this word, most publications first define what is meant by interoperability. From a technical perspective, the definition put forth by the Institute of Electrical and Electronic Engineers (IEEE) in 1994 is the most frequently used. This definition addresses only functional and semantic interoperability. The increased importance of interoperability is the perceived requirement to aggregate all data for a patient from all sites of care – the patient-centric record. Complete information about a person provides for high quality, safe, effective, efficient, and lower cost care. Dr. David Blumenthal, National Coordinator for Health Information Technology in the United States recently stated “We need electronic health records to talk to electronic health records.” That’s what interoperability is all about.

The papers in this special issue of electronic Journal of Health Informatics discuss some of the requirements for interoperability. Although most of the papers recognize that there are

many areas for interoperability to be realized, all of the papers largely address the topic from the technical perspective – semantic and functional requirements.

The paper by Atalag, et.al, provides an excellent view of some of the standards important to interoperability. Unfortunately, there are competing standards, or at least a choice of standards, to meet the same business requirement. The authors make a balanced presentation of the key standards for messaging, documents, templates and archetypes, and information models. The arguments for and against each of these standards is most informative and should provide a work list for the standards developing organizations creating the standards. This paper also provides a valuable view of what standards a number of countries are adopting. This paper suggests that semantic interoperability is not an all or nothing paradigm. Depending on how you interpret this comment, I agree or disagree. If the comment means that we can move ahead in steps, then I agree. If it is a matter of scope, then I agree. We can achieve semantic interoperability within our own institution by adopting the same set of data elements, terminology, syntax and comments. We can next move to the enterprise level, and then to the

regional level, to a national level, and finally to a global level. The difficulties increase as the scope grows. However, as long as data is exchanged that is not understood by the receiver, then interoperability has failed. It is important that semantic interoperability from the health care perspective is bi-directional. Data exchange is bidirectional. Not only do we send data to build the contents of the EHR, but the real value comes when we need to find and extract data from the EHR for multiple-purpose use. That is the real test for interoperability and the most difficult.

The paper by Hovenga and Garde also acknowledges that there are many factors that contribute to interoperability, but again addresses primarily the technical components. The paper provides some useful statistics on the cost of health care in different countries and touches on requirements for sustainable health systems. The paper then discusses semantic interoperability and standards including the relationship between the EHR and health data standards. The authors include eleven levels of semantic interoperability from Elkin that I find not useful. I think the fundamental question that needs to be addressed is what we are trying to accomplish. If the definition of interoperability is the basis for under-

standing what we are trying to accomplish, then what is required goes well beyond these eleven items. Semantic interoperability requires what, when and how in a completely understandable way. However, the list is useful in understanding some aspects of what is required. A fundamental requirement for semantic interoperability begins with data elements and the structures that are built on those basic concepts. Two related but different reference models are available for choice: HL7's Reference Information Model and CEN's EN 13606. The differences in these two models impact the binding of ontology to the model, as well as other minor differences. The choice of archetypes, HL7 templates, HL7 CMETs, and Detailed Clinical Models is not as difficult, since the knowledge content of all of these constructs could be easily harmonized into a single set. The attributes of the data elements must include all items necessary to guarantee uniqueness, consistency, and understanding. Finally, the paper discusses the need for unique identifiers to permit error-free aggregation of data. This paper does an excellent job of discussing national strategies and decision making in Australia and the United Kingdom. The importance of political initiatives is well made.

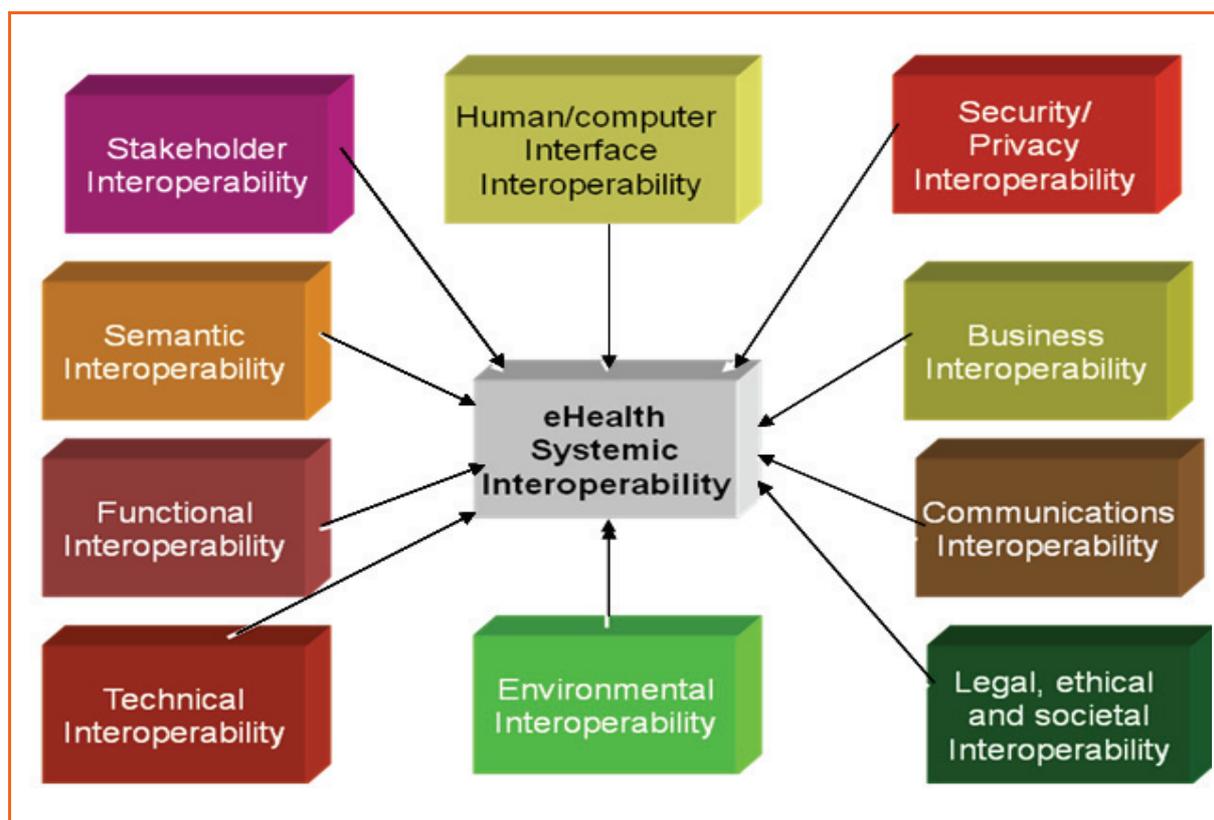
The paper by Heard provides an excellent overview of openEHR Framework and archetypes and their contribution to interoperability. The paper presents a clear relationship and pathway starting with the clinical process and using clinical archetypes and templates to achieve interoperability for shared clinical content. Heard defines how many of the standards fit together to support the patient-centric EHR.

Heidenreich and Angelidis present domain models to support semantic interoperability among connected systems. Again, the perspective is technical and includes the standards that are discussed in most of these papers. In addition to discussion of reference models, data structures, and terminology requirements, the authors introduce a new issue relating to language. In the European Union, more than a dozen languages are spoken. If interoperability is to be supported seamlessly across all of those countries' boundaries, we must develop multilingual clinical understanding across all clinical domains. A key point is made that, in a recent EU report, five different definitions of semantic interoperability were identified at the EU level. Obviously, the challenge increases significantly when what is required is unclear. The authors also make the point that the meaning of any term is not absolute. I think the meaning of a term must be absolute and context independent, if that data is to be reused for multiple purposes. Data should be defined to the level of context independence; i.e., if weight is taken just after a meal, then definition should so state and the assigned attributes support that requirement. I agree that there are important qualifying data that is useful. Examples include date and time collected and collected by whom. Domain models are an important method for understanding the data elements required, the information flow and the work flow – all factors for interoperability. Domain models may be static or active (sometimes referred to as an Activity Diagram).

The last paper by Hieb addresses the need for a unique patient identifier (UPID). Although most countries have a unique identifier system in

place, a few developed countries do not, including Australia and the U.S. At least in the U.S., two factors complicated the problem. The first is the assumed cost for developing and deploying a system to support the unique identifier, and the other relates to privacy and confidentiality. There is strong evidence that errors occur in the absence of a UPID. In five recent pilot projects for ePrescribing, a reliable medication history could not be aggregated for a patient because of errors in patient identification. Although this paper applies most to the U.S., the arguments made have general validity. The paper is based on a number of assumptions, some of which may be questioned.

These papers bring to light many of the standards required for interoperability and barriers that must be overcome. Unfortunately, there are many more standards and issues that must be considered. Considered as a universe, any person or any thing that is concerned with or related to interoperability must be addressed. Figure 1 below illustrates some of the kinds of interoperability required to achieve systemic interoperability. In an ideal world, the scope for interoperability would start with the source of the data object and follow through to the use. For a drug, for example, this means that the code/identifier and other attributes would be defined/assigned at the point and time of manufacture and follow through until used or consumed by the patient. For a lab test, the data item identity would be assigned by the device that performed the test and be retained throughout its use. We need the ability for traceability, accountability, and responsibility throughout the entire system.



**Figure 1:** Categories of Interoperability.

The seemingly unsolvable problem in interoperability is our tendency to avoid the difficult problems. Much of the documentation in health care is in the form of unconstrained and unstructured narrative. Rather than try to move towards structured content, we develop Natural Language Processing tools. Instead of working toward a single (perhaps integrated) terminology or ontology, we spend time and money mapping between multiple terminologies. Instead of working toward one reference information model or one document standard or one messaging standard, we map and harmonize among the various standards. We need error free identifiers – for patients, providers,

employers, sites of care, and for health plans. We need to define what we need to exchange and when. We need to build systems that can adopt to change and new requirements.

As new technology comes into use, and new concepts must be supported, the need for standards continues. Of equal importance is developing tools to make the use of standards easier at all levels – developer, implementer, and user. We need to move from a reactive to proactive response. What are the next steps that will make clinical data more useful to both patients and providers? What standards will support these new functions? Examples include personal health devices, smart phones, and human sensors. What dashboard standards do we

need? We have access to new and unbelievably powerful technology. We need to think progressively and innovatively forward to use this technology appropriately to solve the problems we need to solve.

We have made considerable progress in learning to work together. We still have a ways to go. These papers contribute to a better understanding of the challenges.

## Correspondence

W. Ed Hammond, Ph.D., FACMI  
P.O. Box 17969  
Durham NC 27715  
919-668-2408  
hammo001@mc.duke.edu