

Version 1.0 January 2008

The Health Information Domain, EHR and E-31 Standards

About This Document

This document is intended to provide the various health professional disciplines an overall picture of the E-31 informatics standards for the EHR and how they contribute to full mosaic of informatics standards that support management of information in healthcare. The EHR is THE core document in healthcare because it captures the observations made during Individual Health and these observations are fundamental in relating basic science to the processes of the health of individuals as well as being the source of data for Population Health. The management of the resources that support all aspects of both Individual and Population Health are enabling, including those for information management. Thus, the common conventions that relate patient care observations to those needed for management of resources are interdependent.

Contributors

This ASTM E-31 EHR Standards Training document was created by those E-31 Technical Committee members who developed the profile of informatics standards of the Technical Committee and include:

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Links

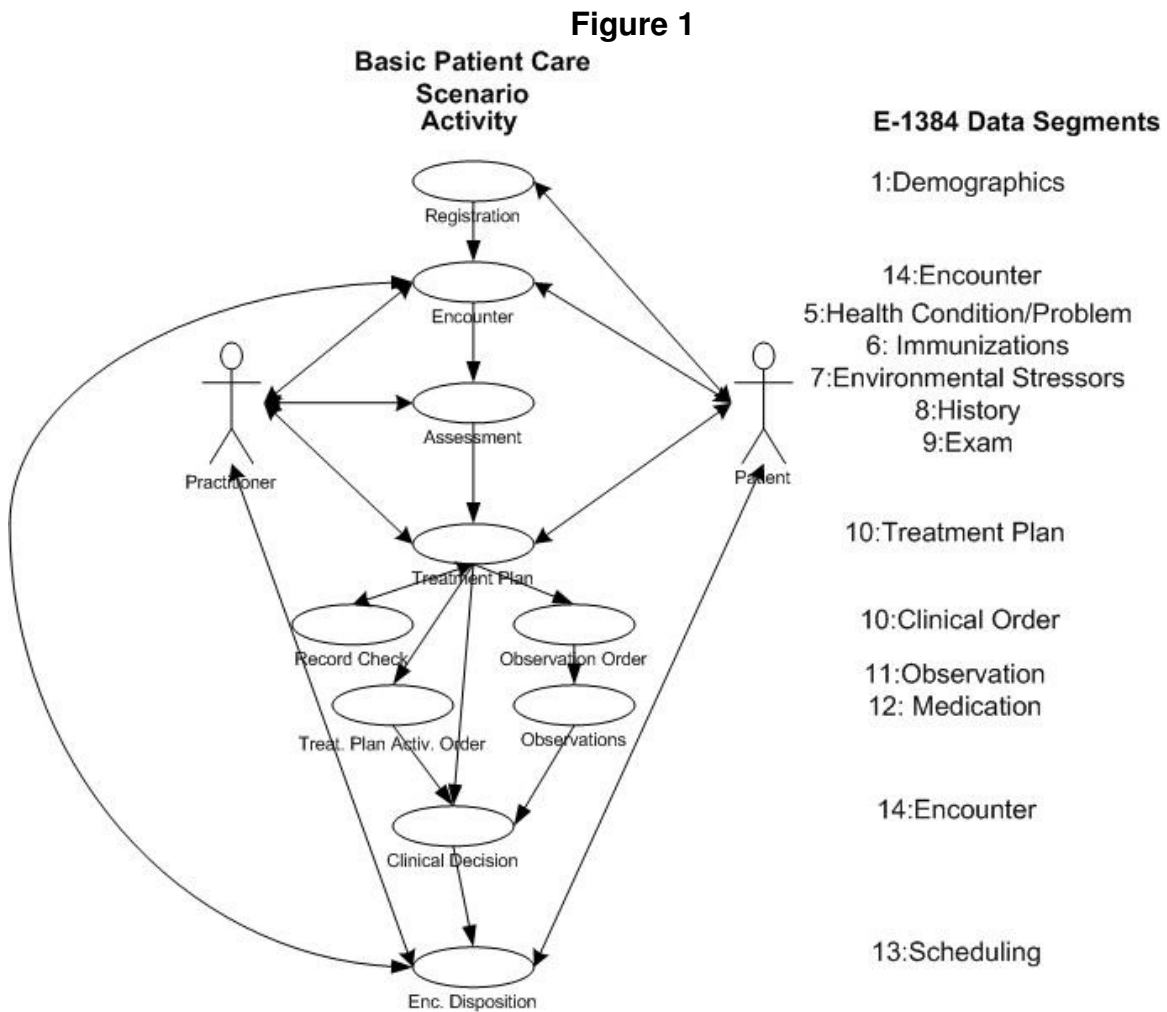
E-31 Standards List (www.astm.org/)
UW EHR Web site (<http://www.ehrweb.org>)
Enterprise Management Document – EMD Link
AHIMA (<http://www.ahima.org>)
AACC LISMID (<http://www.aacc.org/>)
NACB (<http://www.aacc.org/nacb>)
ADA SCDI (<http://www.ada.org/>)
HL7 (<http://www.hl7.org>)
VA VistA website (http://www.va.gov/vista_monograph)
Epic Website (<http://>)

Information Importance in Healthcare

In order to understand the full context of work in informatics standards for use in healthcare, the reader must recognize that the Health Information Domain (HID). See **Figure 3** can be partitioned in one dimension into Patient Care and Resource Management. Orthogonally it can also be partitioned into Conceptual Content and Implementing Technology. Finally, the domain can also be partitioned into Data Structure and Data Representation that is orthogonal to the two other dimensions. These three dimensions enable the variety of perspectives needed to appreciate how Informatics enables the Patient-Centered Care, Multidisciplinary Teams, Quality Management and Evidence-based Practice set of Core Competencies that the IOM 2003 report “Health Professions Education: A Bridge to Quality” gave as the framework for transforming the US Healthcare system. That transformation is critically dependent upon the education process; standards education underpins health professions education. The business model for healthcare is not guided by the commercial (“supermarket”) model and this is why the Patient Care/Resource Management axis is the key starting point. Moreover, Conceptual Content comes before Implementation aspects since it is well understood in Software Engineering that “Requirements” come first – namely know what you want to do and why before starting to deal with implementing technology. Know also that there are a variety of models for the healthcare process but that the iterative process has been the most effective for healthcare because the scientific base of knowledge for Patient Care is continually accreting and growing. Realize also that Resource Management supports and enables Patient Care which is of prime priority. Without Patient Care, Resource Management can be dispensed with. The Basic Care Scenario is shown in **Figure 1**.

With these perspectives in mind, a discussion of the various subject areas for informatics standards can proceed and an appreciation gained of the knowledge areas where E-31 standards apply. Because of the essential aspect of patient care, the Structure and Content of the Health Record is the most relevant starting point. From the events and data captured in this record, the associated resource management (prime example: billing information) data can be derived. From the figure above, the events of healthcare are related to what is stated to be an “Encounter”. One key step that E-31 has done, through its Terminology Subcommittee, is to collect all the terms relevant to the Healthcare “Business Model” into one key Terminology standard (E-2457) that can be a primary resource to all health informatics Standards Developer Organizations (SDOs) in unambiguously discussing the various aspects of the Health Information Domain and creating common conventions (standards) for the capture, storage and exchange of information. This healthcare informatics terminology has been deliberately coordinated with the best ISO recommended practices for terminology work. Ongoing work within E-31 is to see that these terms are consistently used within E-31 health informatics standards at the very least. Such usage will then enable unambiguous descriptions of the various parts of the EHR and all derived concepts and data used by any of the HITSP SDOs in their standards harmonization and consistency. These concepts will be continually

referred to the various health professional disciplines for comparison with their current colloquial usage in order to both refine colloquial usage and the core common vocabulary to be consistent and unambiguous. Such efforts related to the capture of patient care data for the record will also be carried into those terminologies used for resource management and official data exchange. Many of the terms related to the implementation process come from those collections of terms already prepared by the information engineering disciplines so that the definitions used in healthcare are in common with the engineers who must implement the concepts in actual systems.



In addition to the core EHR, the supporting service information subdomains, such as the clinical laboratory, pharmacy and imaging services, will be subjected to the same consistent definitions of data, functions and behavior that has been applied to the EHR. The concepts of Assessment and Intervention through Treatment Plans and Clinical Orders that exist in the EHR will be related to the supporting services. For example, informatics standards for the clinical laboratory, which were originated in an earlier E-31 Subcommittee (CLSI: LIS-8A,

LIS9A), are now provided by the SDO CLSI and integrated with those standards that deal with automation aspects of clinical laboratory operations. The CLSI standards for data communication from the laboratory are coordinated by CLSI collaboration with HL7 messaging standards activities.

One of the aspects of describing common conventions for information is through modeling activities. ASTM E-31 Subcommittee SC E-31.25 is specifically directed at modeling in support of healthcare (E-2145) and it coordinates with modeling groups in the American Dental Association which began defining common informatics issues as they relate to oral health specialty disciplines. These ASTM efforts have not duplicated those of the ADA and both SDOs work to utilize the messaging conventions of HL7 and the Data Interchange Standards Association (DISA) X12N SDOs that focus on commercial transaction-oriented messages.

Another important aspect of the management of healthcare information is its alternative representation as free text and in this the Medical Transcription specialties have been involved because the historic capture of observations in the paper record has been written/dictated text. An important collaborative aspect of this perspective has been to map the contents of identified focal text segments with specifically defined structural elements from models of the EHR documented in E-31 standards such as E-1239, E-1715, E-1384. These EHR standards were developed with major contributions by both the American Health Information Management Association and the Medical Transcription Association. Value sets (including coded values) have been collected in E-1633 and partly harmonized with common data elements used in the messages of HL7. This work continues. In Subcommittee-31.25 the EHR text has been structured for the exchange of EHR information in E-2369 that is consistent with the E-1384 model.

Another important aspect of the E-31 EHR effort has been the development of specific "Views" of the comprehensive record structure which have particular, but cross-disciplinary, relevance. These are: the Emergency Medical Services View (E-1744), the Occupational and Environmental Health View (E-2473) and the Pharmacotherapy View (E-2538) which all use the various EHR record segments but with significant differences in perspective; each standard was created to enlighten a particular perspective for clear understanding of how common segments support the data capture needs of that profile of functions required by a specific care situation. The EMS View standard, for example, draws on other earlier meetings and documents on this subject by CDC but it specifically relates the identified data to defined EHR data segments and data elements appearing in E-1384 and specific codes and terms given in E-1633. The very recent Occupational/Environmental Health View (E-2473) reflects the logical structure of data that comes from Environmental Health activities and agencies but which has not yet appeared in EHR systems and it brings a unified view of these data to both the practitioner and the patient for "Patient-Centered Care". A variety of implementation alternatives may be available but the specific capabilities have already been pointed out and can lead to interoperable implemented systems.

These capabilities are reflected in the draft E-31 E-X Standard Practice on Classification of Clinical Systems Features

Examples of the resource management usage of patient care data include how the data used for the HIPAA messages that are described in Data Interchange Standards Association (DISA) X12N standards are located primarily in the EHR segments that document the attributes of the Encounter Receipt and Disposition Phases described in E-1384. These same data elements are used for the data described in E-1744 for EMS data that are being routed to Trauma Registries and can be transmitted using HL7 message formats.

The above examples of the ways to use the E-31 Standards are intended to develop wide general understanding of the nature and uses of informatics standards for health at different levels of specificity but with common uses of conventions for structuring or representing the concepts involved. These examples also illustrate the complementarity of the different SDOs and how the active positive dialog among them that draws on their differences in ways that can yield the range of standards (common conventions) needed to address the scope of the perspective levels required to create an individual information architecture for a given healthcare enterprise that is tailored to its “business model”.

Finally, as noted in the introductory paragraph, a critical major focus of these ASTM and associated referenced standards is their use in the educational process for the health professional disciplines. It must be recognized that the scientific concepts included in the basic sciences, as well as the succeeding health specialty knowledge areas, will require addressing their appearance in some data attribute or concept representation that is eventually used in a patient care process or the associated resource management functions. The health informatics standards, such as those developed by ASTM E-31, will be applicable to the educational elements used in the health professional educational process – be it either the formal or the continuing professional component. Thus, educators must fully understand these standards and must be able to develop a framework of how they apply from the beginning of health professional education to the curricular subject matter for each professional discipline.

Standards (Common Conventions) Are Essential

The term “Standards” are thought by many to imply mandates but in reality they are just “common conventions” that by consensus are agreed upon to deal with a concept in a mutual fashion; thus common conventions can evolve to accommodate new knowledge in unambiguous ways. “Standards” apply in various areas of the six axes contained in the three dimensions of the Health Information Domain but their common nature is critical to achieving “Interoperability” which implies flow of information among different healthcare

enterprises that operate within the full domain. Thus the “standards process” is important because the health professions have only in recent years begun to operate across organizational boundaries to deal with the health of individuals who have wide geographic locations. While Industry developed “Standards Developer Organizations” – SDOs - for manufactured products early in the Twentieth Century, the health professional disciplines only came face-to-face with this issue in recent years, particularly in the last decade of the century when the technologic explosion occurred. Many of the health informatics standards activities are still in the early phases of the evolutionary curve – but they remain an essential aspect for progress in the application of informatics to healthcare. **Figure 2** illustrates the various roles that different standards play in an enterprise information domain.

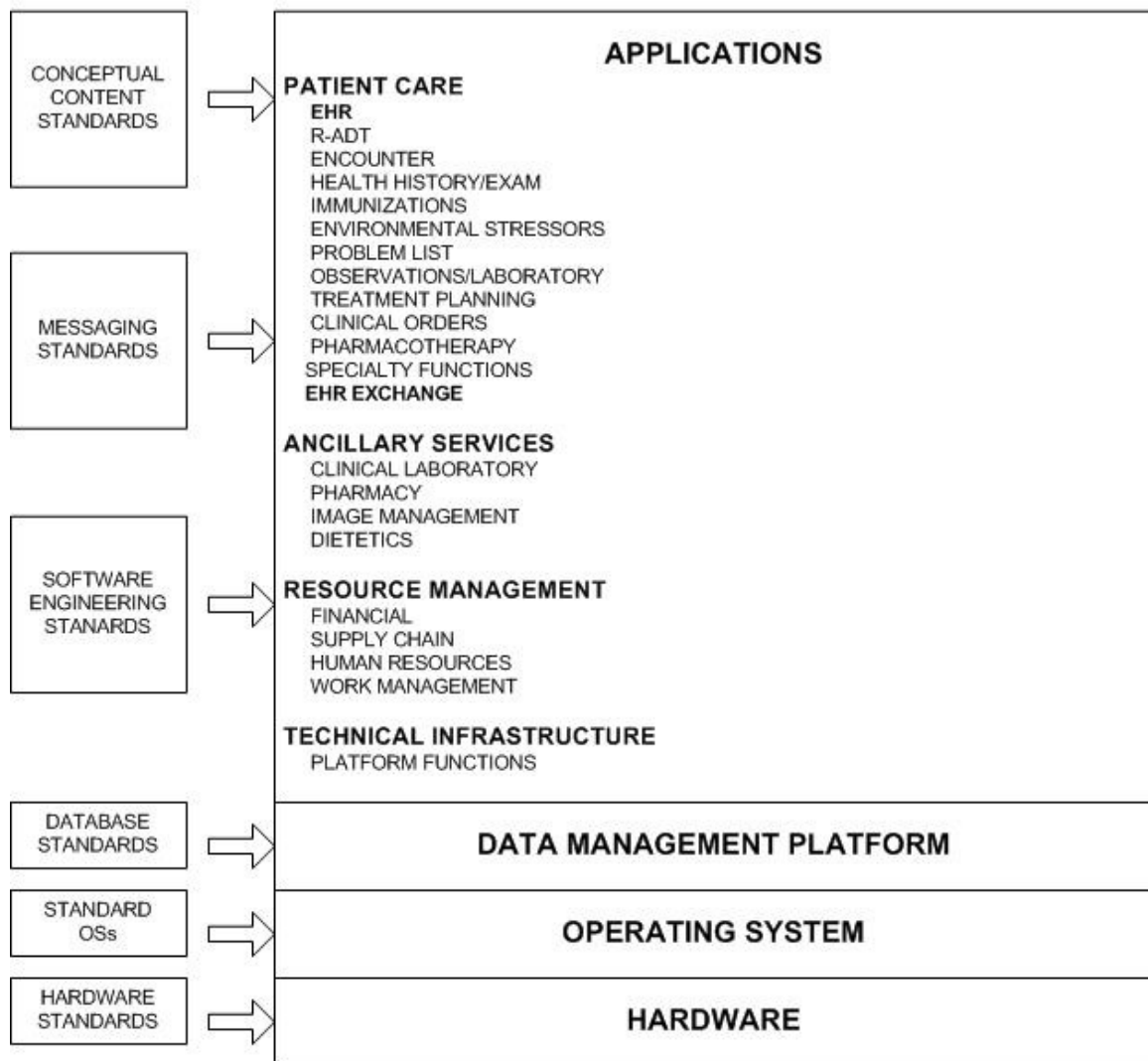
It should be noted that the first formal organization for this health informatics standards purpose was that in which ASTM had a major role and that was organized by the American National Standards Institute – ANSI, the designated national accrediting body for the US for all SDOs, as the Health Informatics Standards Board – HISB in 1996. This body was replaced in 2005 due to the formal efforts of the DHHS in the US government by a new ANSI-accredited body the Health Information Technology Standards Panel – HITSP to which ASTM also belongs. The HITSP works to coordinate and harmonize the work of the SDO members of the Panel so that each of their Standards contributes in a consistent and unambiguous way to the overall effort. The individual health professional discipline participants join the various SDO organizations (such as ASTM E-31) and their standards activity projects that contribute in a specific fashion to the various capabilities in the Health Information Domain. Thus, consideration of the ASTM E-31 standards activities should begin in selecting the location of the particular capability of interest within the E-31 Technical Committee range of activities.

Figure 2

**IMPLEMENTED
HEALTH
INFORMATION
DOMAIN**

INFORMATICS
STANDARDS

IMPLEMENTED
ARCHITECTURE



Activities in Healthcare Informatics Standards and ASTM's Contribution

Work on standards for the EHR in the context of all such standards for the Health Information Domain (HID) began 25 years ago within ASTM's Standards Committee E-31, then named Computerized Systems which primarily focused on data capture in laboratory environments. However, in 1981 the Dept of Veteran's Affairs (DVA) already had underway a project for Electronic Health Record (EHR) components for its facilities and one of those components that is a foundation stone for the information domain in healthcare enterprises was the Registration Module. This module had just been implemented within the DVA architecture. It thus became the subject for one of the first of E-31's EHR standards since this module serves all functions, including those for the clinical laboratory. This present discussion document is directed at informing all of those interested in any aspect informatics standards for healthcare, as well as those individuals who may be participating in the activities of the E-31 Technical Committee, about the significance and implications of the standards documents that have been produced as a result of the work of this Technical Committee. It is critical for all individuals who may be working in the areas of informatics standards for healthcare to appreciate these implications in order for them to continue to participate in the full range of activities that lead to the use and benefits of Information and Communication Technology (ICT) to healthcare. It is critical specifically because there is widespread recognized fragmentation of the activities and perspectives of both standards participants and other responsible individuals outside of standards development activities such that many activities clash and derogate the work of all of these otherwise complementary efforts that should be leading to common benefits.

The E-31 work that led to the definition of the EHR Registration module was directed at being an effort to define the conceptual content basis of what would be one part of a model for the HID and would be useful in implementing working systems (such as the VA's beginning system). At that time, concurrent work also began by the IEEE Computer Society on the basic principles for Life Cycle Management of information systems; that effort eventually became an international effort under the Joint Technical Committee 1 (JTC1) of the ISO and IEC standards bodies. The E-31 efforts were, therefore, carefully conditioned to be complementary to the work of other SDOs but to draw on the synergy, for healthcare, of defining the meaning of the Conceptual Content. A number of leading healthcare professional discipline societies had E-31 members as participants at that time. Among them were: American Health Information Management Association (AHIMA), American Nurses Association (ANA), American Association for Clinical Chemistry (AACC). Links were also established with other SDOs. HL7 was established in the late 1980s and NCCLS (now Clinical Lab Standards Institute – CLSI) was already active in general lab

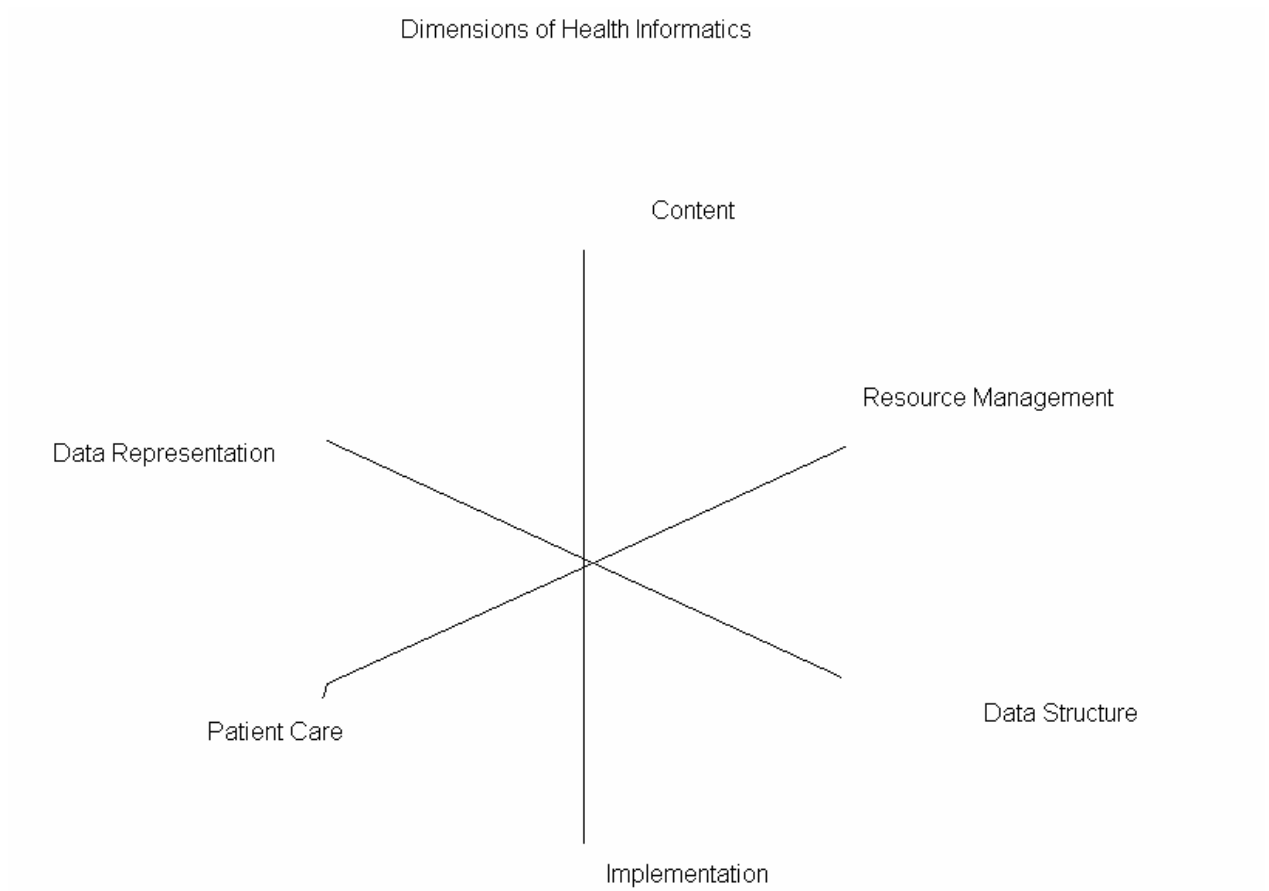
standards. Much early informatics standards work related to messaging standards for clinical laboratory data.

Nevertheless, considerable work continued within E-31 on the core standards that underpin the structure and content of the EHR while associated E-31 work related to issues of Privacy and Confidentiality in the use of the data captured within the EHR. These standards complement the structure and content common conventions in helping to define the associated business processes that generate, and then use, both the Patient Care data that is captured in the EHR and the related Resource Management data that support the care processes. Patient Care is first priority but Resource Management is also essential. The E-31 Standards Catalog also reflects work on conventions that relate a structured approach to EHR data to textual approaches to patient care data. These perspectives must be viewed as complementary and synergistic rather than conflicting. The E-31 standards have been created to establish that relationship for the conceptual content as well as to document clear Requirements for the Implementing Technology. These standards efforts have also been directed at collaborative work with other Standards Developer Organizations (SDOs) and participation in the organizational structure of the US Voluntary Consensus Standards system as well as the International Standards system. The following discussion of the catalog of E-31 standards will seek to explain how each document contributes to this framework. A summary of the E-31 standards profile that is organized with respect to the Basic Care Scenario is given in the document "E-31 EHR and Standards Education in Health Informatics".

Important Dimensions of Healthcare Information

Figure 3

Health Informatics Dimensions



Conceptual Content before Implementing Technology

It is axiomatic in healthcare that the Conceptual Content axis of the Content/Implementation dimension of the Health Information domain shown in **Figure 3** should be the initial focus of understanding how Informatics enables the Core Competencies of all professional disciplines. It should be also clear that in order to have interoperability of healthcare enterprises and the systems that manage each enterprise's information, that there must be common conventions for representing and structuring the concepts that are in common. For over one hundred years industry has recognized this fact with regard to the manufactured

products and services that they make available to society. But ideas and their constituent concepts have always been flexible and reflected in written or spoken language reflecting their originator. As technology began to be applied to information management, particularly for healthcare in the last fifty years, the difficulties due to the significant differences in communicating even basic concepts have become very apparent. Work on informatics common conventions (standards) began largely in the technical side with implementing technology but quickly the need for conventions addressing the concepts arose. Early work began with the bibliographic representations for the scientific literature and international standards bodies for that arose. As part of the business process “code sets”, which were controlled vocabularies for billable items with surrogate representations (“codes”), arose to facilitate financial management functions; these now need to be unambiguously related to concepts observed and recorded by practitioners in the record of patient care which until recently has largely been unstructured text. ASTM Technical Committee E-31 was one of the first to begin work in 1980 in this area. Later, after several additional bodies began work on various concept subject areas in healthcare, a number of these bodies first formed an ad hoc “Health Informatics Standards Coordinating Committee – HISCC” that was the first step in forming an American National Standards Institute – ANSI - accredited Health Informatics Standards Board – HISB in 1996. This body has now been reformed as the Health Informatics Technology Standards Panel – HITSP to coordinate the harmonized library of individual standards that support Information and Communication Technology – ICT applied to healthcare. This organization is still in evolution and is guided by the US Dept of HHS Office of the National Coordinator for Health Information Technology (ONCHIT). This is the formal societal structure for getting in place the ability to agree on US National standards that can be related to the international process. This structure will encourage all health professional disciplines to participate in the activities that will ensure comprehensive, unambiguous common conventions that can support the transparent uses of recorded healthcare data.

Representations of Healthcare Data

A key aspect of developing a common convention for a healthcare concept is to examine it for both structural (including relationships among the sub-concepts in the parent concept) as well as representational (e.g. terminologic such as synonyms etc) for each level of complexity of that concept. One key aspect of the healthcare sector is that most individuals are only cursorily aware of activities that relate to the “Controlled Vocabularies” that contain well-vetted knowledge structures of concepts in healthcare and their terminologic representation. Most people use designated “Code Sets” when directed but have not had an embedded orientation to the nature and uses of well-vetted vocabulary collections in support of the cognitive processes supporting patient care. The lack of formal common conventions about vocabulary that are used from the beginning in their professional education is one prime reason for this situation.

Implementation of Conceptual Framework by Best Engineering Practices

Following the initial description of the conceptual content of the patient care record and its supporting information subdomains, there is a well defined process for using this information to manage the Implementation Life Cycle for components of the implemented defined enterprise information architecture. The principles, as noted above, have been generally defined for all systems but these must be conditioned for use in actual healthcare enterprises. The standard terminology for health informatics terms is given in E-2457 that includes term about the Conceptual Content as well as about the Implementing Technology underpinning healthcare enterprise information architectures. Standard E-1340 describes the Rapid Prototyping organization for the developmental evolution of systems that has been the hallmark of systems in healthcare. The ASTM standard E-2145 on modeling provides solid guidance on methods for clearly understanding the relationships of concepts in healthcare. Model templates that use the key standards have been prepared as guides (See **EMD Link**). In short, they outline how to document the “Concept of Operations” of the host enterprise and then document the formal Requirements for data, functions and behavior of the components of the envisioned information architecture. Finally, a Project Management Plan/Plans (using IEEE-CS and JTC1 Standards noted above) can be created to define who will do what, when and how. The model templates are a basic beginning and must be extended and refined in order to create systematic documentation targeted for the various parties who will be involved. Modeling is one aspect of documenting the functions and data that will be included. ASTM E-2145 is a general modeling standard carefully describing the particular issues needed in healthcare enterprises.

Healthcare Professional Specialty Perspectives

One issue that must be addressed by each individual working to understand the presentation of the E-31 standards given in this document is how the more generally worded standards apply to each individual’s healthcare specialty area. The following sections will briefly outline some aspects that must be considered. The grouping of E-31 standards with respect to the Basic Care Scenario shown above is given in the following **EMD Link**. Nevertheless, the following outline of different perspectives of several specialties will need to be appreciated in considering just the general Conceptual Content as well the special considerations of the content of aspects of various care settings.

Primary Care Physicians/Dentists

Primary care practitioners such as general practice physicians and dentists will need to know only generally how the informatics common conventions present in the E-31 standards profile translate into systems that behave in support of their thought processes used in patient care. One standard that will be most familiar

will be the E-2369 CCR standard which is a structured textual representation of the structured data described in both E-1384 and E-1633 that details both the data structures and vocabularies of the EHR. Not all of the details in those standards are regularly used in daily thought processes of practitioners but these details underpin the implemented Clinical Decision Support components that will, in due time, be included in systems for these practitioners and that will aid in the networking of general and specialist practitioners into “Multidisciplinary Teams” focused on “Patient Centered Care” using “Evidenced Based Practice”. In both formal and Continuing Professional Education (CPE) there will need to be ongoing descriptions about how the basic common convention concepts, as well as the implementing technology, provide the system behavior that must complement the business processes that are also described in the E-31 standards profile. General practitioners will depend upon joint work between the membership of the E-31 Technical Committee and those member’s professional organizations to translate the language of the standards documents into appropriate descriptive language for both formal and CPE instruction.

Specialty Care Physicians/Dentists

Specialty care practitioners focus on the unique and less frequent attributes of the health conditions within the Individual Health Conditions contained in the EHR. These other attributes require submission of the relevant demographic and Assessment information obtained by the general practitioner during the Assessment Phases of the prior Encounters with the referring Primary Care practitioner. The referred to practitioner will get this information in an interoperable way if those earlier observations have the common conceptual structure and representation that is described in the E-31 standards profile and if it is implemented in a harmonized way within the referring Primary Care Practitioner’s information architecture and its supporting ancillary systems. Likewise, the further detailed assessments made during encounters with the Specialty Care Practitioner that will eventually be sent back to the referring Primary Care Practitioner must be managed by these same common conventions in order to have the intended synergism. This includes, for example, the common privacy/confidentiality business processes that are detailed in the E-31 Standards profile. One example of the needed interoperability is described in E-2473 that describes the Occupational and Environmental Health uses of the EHR and how the Specialist disciplines should use the EHR to promote multidisciplinary use of patient care data; this could include uses of the CCR described in E-2369.

Clinical Laboratory

The perspective of clinical laboratory disciplines with regard to the EHR and the clinical laboratory information subdomains needs to consider the previous E-31 Standards for Clinical Laboratory Information Management Systems (CLIMS) that were transferred in 2002 to the Clinical Laboratory Standards Institute

(CLSI). These are (with their prior ASTM identifiers): LIS-1(E-1381), LIS-2(E1394), LIS3(E792), LIS-4(E-1029), LIS-5(E-1238), LIS-6(E-1246), LIS-7(E1466), LIS-8(E-1639), LIS-9(E-2118). These CLIMS Standards had in common the Registration/Reservation function that is in common with all supporting ancillary Service subdomains that is described in E-1239, E-1715, E-1633. At present there is no official joint work with regard to the common ground between E-31 standards and those of CLSI which currently focuses on the laboratory device/CLIMS interfaces. It should be noted that the patient data privacy and security issues addressed in the E-31 standards for the EHR would apply.

Radiology/Image Processing

An important supporting ancillary discipline in general patient care is image processing that historically was largely X-Ray images but also included visible light Anatomic Pathology images of tissue specimens. Now, with the recent technologic production of electronic images, the production and storage of images in the EHR must be re-examined so that the data structures described in E-1384, and their associated attributes documented in E-1633, provide optimal long term persistent storage that supports both general and specialty cognition regarding the Individual Health information in the EHR. Separate attention must also be given to the image processing specialty disciplines ancillary service support information subdomains. The mutual business processes that guide the privacy and confidentiality across the EHR/ Ancillary information subdomains must draw on the principles in the ASTM E-31 Standards profile.

Oral Health

Oral health specialties include both Dentists and Dental Hygienists who also need to know the areas of commonality with Medical and Nursing specialties that relate to the Basic Care Scenario. The common EHR segments that are also applicable to oral health are the Demographic, Health History, Exam, Problem List, Scheduling, Encounter segments. The Treatment Planning segments for Oral Health will have specialty views and behavior that best support this discipline's cognitive processes. Thus, the ASTM E-1384 general standard must draw also on the ADA Standards Committee on Dental Informatics standards <[ADA SCDI Link](#)>.

Nursing

Nursing practitioners exhibit a wide range of professional competencies that serve a similarly wide range of care settings that utilize the EHR. Nursing specialists have contributed extensively to the E-31 standards profile, particularly E-1384 and E-1744, the basic and EMS Views of the EHR. However, there are also a variety of issues relating to Privacy and Confidentiality of patient data in a

number of care settings that will be relevant to this specialty discipline. E-1869, E-1985, E-1886, E-1987, E-1988 will be particularly relevant. In addition, Nursing insights into the abstraction of data for the E-2369 CCR synopsis will be critical in developing uses of the EHR in the business processes for individual healthcare enterprises.

Pharmacy

The Pharmacy specialty is in the process of being incorporated into Multidisciplinary teams for Patient-Centered Care related to pharmacotherapy (see E- 2538) as a major intervention in treating assessed health conditions in Individual Health. As this role evolves, Pharmacists will work with Clinical Toxicologists located in clinical laboratories that support both Primary Care as well as Specialty Care Practitioners. The ASTM E-31 Standards profile will need to be carefully related to the NCPDP SDO “Script” standards for electronic prescription transmission. The roles of individual pharmacists supporting patients from both Primary Care and Specialty Care Practitioners will need careful definition and relationship to the medication information in the EHR as defined by E-1384 and its roles in all types of pharmacotherapy as identified in E-2536. How this information is summarized and transmitted by the CCR will also need further definition as well as how the Therapeutic Drug Monitoring data requested of the clinical laboratory as part of the EHR Treatment Plan segment will be optimally shared with appropriate pharmacists.

Public Health

Public health agencies utilize a variety of Individual Health care settings in their programs but much of “Public Health” deals with Population Health aggregated data from Individual Health events. While the abstraction of defined data from the Individual Health Data for non-resource management facets of healthcare (including transmission of reportable events such as transmissible diseases) are guided by HL7 messaging standards, the financial management transactions are guided by the Data Interchange Standards Association (DISA) X12 Insurance Subcommittee standards that are used for the HIPAA defined transactions. Nevertheless, the data must be derived from, and be consistent with that recorded in the EHR (E-1239, E-1384, E-1633, E-1715); Table A2.1 in E-1384 gives a partial map of the data correspondence.

Health Information Administration

The historic role of the Health Information Administrator was the management of the physical location and usage of paper record versions of the Patient Care Record. The seminal role of this healthcare discipline as master of the Conceptual Content of Individual Health data is still evolving but health care also has great dependence upon the skills and knowledge of this discipline in linking the practitioners (both primary and specialty care and ancillary support

specialties) to those IT and Software Engineering disciplines who design, implement and maintain the various components of the individual enterprise information architecture. It is this discipline that must help collect, organize and document the required concepts for an individual enterprise (such as a family practice physician or general dentist as well as that for a major resident care facility such as a general or specialty hospital) so that working documentation contains the “Requirements” that can be the basis for either designing/implementing or acquiring the components needed for the information architecture for that enterprise. Thus this discipline will find major value in all of the standards in the E-31 standards profile starting with the Health Information Terminology E-2457 as well as E-1340 and E-2145 that address Life Cycle Principles.

Various “Views” of the Common Model

Another perspective of the E-31 Standards Profile is how the various standards apply to different care settings.

Basic

This view of the E-31 Standards Profile focuses on the non-emergent time frame of establishing the basic EHR framework through initial Registration and then conducting Encounters to first assess any Health Conditions. This is followed by planning and executing interventions to appropriately deal with the assessed conditions in Patient Centered Care while managing the resources to carry out that care. This framework includes transitioning from ambulatory care settings to resident care settings to deal with both emergent and non-emergent acute care. The practitioners must identify the common data elements in the care record structure that enable transparency in moving from ambulatory to resident care settings. One facet of this transition is the complexity of Encounter data capture in the record that is inherent in resident care settings.

Emergency Medical Systems

In spite of the AHIC-stated Use Case for emergency medical services (EMS), the EMS disciplines have not yet recognized how the E-31 standards profile, beginning with E-1384 and E-1744 should be used in support of emergency care that could draw on existing care information in the individual’s EHR as well as how the EHR could produce consistent information about the care provided in the emergency environment that should be useful in followup care settings. Uses of CCR (E-2369) transfer data could be useful in emergency care if the process uses the conventions for structure and terminology defined in E-1384, E-1744 and E-1633.

Occupational/Environmental Health

Integration of Occupational and Environmental aspects of Individual Health that can be coupled with abstraction of data for Population Health is only just emerging. This view will draw on not only the E-1384 and E1633 E-31 standards but also the recent E-2473 Occupational and Environmental Health View of the EHR which outlines the various special perspectives that will help involve the specialties who must be included that are not presently recognized as having a contribution but whose understanding of the E-31 standards profile can facilitate their involvement in a Multidisciplinary Team contribution to Patient-Centered Care. Some of these specialties are Environmental Scientists and Clinical Toxicologists who are presently confined to environmental and clinical laboratories. If these specialties are linked to both Primary Care Practitioners as well as Occupational Health Specialty Practitioners, the full range of potentially adverse health conditions can be assessed and various broadly effective interventions planned and executed.

Pharmacotherapy

The use of pharmacologic agents is a major intervention in treatments for assessed health conditions/problems documented in the EHR. Its use involves several specialty disciplines who share the individual patient's information contained in the EHR. E-31 standard E-2538 extends the basic information in E-1239, E-1715, E1384 and E-1633 with respect to the additional knowledge representations and structures that are related to the data in the individual's record of care. The recent progress in recognizing the genetic aspects of an individual's constitution that control the pharmacodynamics and pharmacokinetics of drug action implies that there are contributions of additional disciplines (such as therapeutic drug-monitoring clinical toxicologists) who are members of the Multidisciplinary Teams in Patient-centered Care. The full range of common conventions supporting the EHR and its communication with the ancillary support information domains will require the interpretation of the implications of the EHR common conventions in terms of best Evidence-based Practice through collaboration with other convention sets developed by other SDOs of the ANSI HITSP (e.g. NCPDP).

Home Healthcare

This care setting is basically an ambulatory practice care setting located in a patient's home but the information is managed as if it were in the ambulatory practice setting. With recent telecommunications technology the information management process can be transparent and the features of EHR systems that use E-31 standards can be invoked and be conformant to the E-31 harmonized conventions. Thus both EHR and the communications conventions use the harmonized conventions for the same concepts regardless of care setting.

Relationship of Patient Care to Resource Management Data

Another historic aspect relates to how the data captured about patient care is related to those data that have historically been primarily oriented to healthcare financing that have a different conceptual granularity to the detail needed for care processes.

Resource Management Supports Patient Care

The historic focus of information management in healthcare has been healthcare financing (e.g. billing) functions but as ICT has been applied in the evolution of Patient Care functions, it has become increasingly clear that much of the data needed for the supporting resource management functions can be derived from the observations captured within the EHR. In fact E-1384 has an outline of these relationships in Annex A2.2 where the DISA X12N data elements that correspond to those of the EHR are indexed. As the harmonization of healthcare standards common conventions proceeds, these standards will explicitly reflect the instances of the data recorded about a given encounter that must be included in X12N and HL7 messages. Moreover, these and other data documented by CLSI relating to attributes captured during Point-of-Care testing for both the EHR and clinical laboratory information subdomains, must be represented, structured and stored as well as transmitted (See CLSI LIS-9 and ASCPT-2 as well as E-2538, E-2473, E-1744).

Informatics Enables Specialty Core Competencies

As noted in the section on Information Importance in Healthcare, it now is, and will increasingly be, critical for all healthcare professional disciplines to relate the informatics common conventions for concepts captured during Individual Health care to be unambiguously related to the identified and documented knowledge areas and skills that underpin the competencies identified by each professional specialty that support the five Core Competencies of the IOM 2003 report. Thus, this E-31 Standards Education website must continually evolve to point out how the E-31 Standards Profile contributes to the common conventions that each discipline will need to identify that contributes to mastery of the knowledge areas for each identified professional competency. The viewer of this site must inform the Contributor Panel for this site of additional material that needs inclusion into this site in order to convey to all other viewers the E-31 standards implications for that viewer's specialty. In addition to the standards education implications, these inputs also point to work items for the E-31 Technical Committee and its Technical Subcommittees that can yield new useful common conventions to be included in the E-31 Standards profile.

Examples of Implementation of Conceptual Content in Uses of Standards

Finally, this discussion of the E-31 Standards Profile must conclude with presentation of several current examples of how these standards have been used in existing system architectures and observations about the success or deficiency that has resulted. These examples are most important since they illustrate the linkage between definition of common conventions for Conceptual Content and their implementation and use in working systems and information architectures

VistA

One currently recognized major example of an implemented enterprise health information architecture is that of the Dept of Veterans Affairs (DVA) Veteran's Information Systems Architecture (VistA) [\[link\]](#) . Participants from the DVA have contributed over many years to the E-31 Standards Profile and those within DVA who were involved in the VistA implementation over the years of its evolution have included conventions into VistA from the E-31 profile. The above links will illustrate documentation of where and how those conventions were included within VistA. Because the above links cover the extensive functional profile for a healthcare enterprise, the linked sites will probe the specific uses of the E-31 standards within that architecture. There will be additional links to the IHS and DoD variants of the VistA basic architecture.

Epic

A major example of a widely used commercial product that will need to be interoperable with a system such as VistA is EpicCare [\[link\]](#), an ambulatory EHR system. The major point to be learned from this particular example is how completely different implemented architectures use the same common conventions for the Conceptual Content; a variety of examples could be given to illustrate this point.