Understanding the EHR System Functional Model Standard

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In May 2004 Health Level Seven (HL7), an ANSI-accredited designated standards organization, announced passage of the electronic health record system (EHR-S) draft standard for trial use (DSTU). This draft standard summarizes the functions that may be present in an EHR system and provides a common language for communicating its behaviors and capabilities. The DSTU's scope is limited to functionality and does not address data content for the EHR or endorse the use of specific technology.

HL7 traditionally develops standards around messaging and interoperability. However, in July 2003 it collaborated with public and private healthcare leaders to develop the EHR functional standard. AHIMA was an early supporter and contributor to the HL7 EHR standard and continues to participate fully in the standards development process.

This practice brief summarizes and paraphrases the key functionality in the EHR system DSTU. The complete standard can be viewed at www.hl7.org/ehr.

What Is a DSTU?

For a "draft standard for trial use," HL7 is allowed to solicit and incorporate industry feedback concerning the EHR system standard before it becomes a full-fledged ANSI standard. A draft standard can be in place for up to two years.

How Is an EHR-S Different from an EHR?

The EHR-S could be one system with applicable functionality in the draft standard, or it could be a variety of interoperable systems that combine to meet the functionality of the DSTU. An EHR is the data content contained within the EHR system.

How to Read the EHR-S Standard

There are more than 125 functions in the EHR-S DSTU. They are broken into three main sections:

- Direct care
- Supportive
- Information infrastructure

Each function is assigned an ID and includes a title, a short statement, and a longer narrative describing the functionality. The example below illustrates the format of the EHR-S functional model.

ID	Title	Statement	Description
I.2	Health record information and manage-ment	Manage EHR information across EHR-S applications by ensuring that clinical information entered by providers is a valid representation of clinical notes; and is accurate and complete according to clinical rules and tracking amendments to clinical documents. Ensure that information entered by or on behalf of the patient is accurately represented.	Since EHR information will typically be available on a variety of EHR-S applications, an EHR-S must provide the ability to access, manage, and verify accuracy and completeness of EHR information, and provide the ability to audit the use and access to EHR information.

Functions are outlined in a hierarchical manner; for example:

- DC.1.2—Care plans, guidelines, and protocols (This is the "parent" function. Additional related functions are listed below as "children.")
- DC.1.2.1—Present care plans, guidelines, and protocols (child function)
- DC.1.2.2—Manage guidelines, protocols, and patient-specific care plans (child function)
- DC.1.2.3—Generate and record patient-specific instructions (child function)

In addition to the EHR-S DSTU there are other supporting documents. An HL7 white paper titled "EHR System Functional Model: A Major Development towards Consensus on Electronic Health Record System Functionality" provides an excellent reference on the background and anticipated use of the DSTU.

Direct Care

The direct care section of the functional model addresses functionality related to the care delivery process under three main headings:

- DC.1 Care Management
- DC.2 Clinical Decision Support
- DC.3 Operations Management and Communication

The direct care section is comprised of parent functions, with children functions that provide more detail and granularity. The table identifies the main functions and then summarizes the functionality within the section.

DC.1 Care Management		
ID	**Functionality**	**Summary**
DC.1.1	Health information capture, management, and review	This functionality relates to health information entry (or capturing through a device), management, and review and has a variety of subfunctions that go into more detail. They include maintaining a patient record, maintaining demographic information, managing a variety of lists, managing patient history, managing clinical documents and notes, capturing external documents and patient-originated documentation, and capturing patient or family preferences.
DC.1.2	Care plans, guidelines, and protocols	Functionality in this section relates to care planning such as presenting care plans and guidelines or protocols, tools for building care plans, guidelines, and protocols, and generating patient-specific instructions such as after a procedure or upon discharge.
DC.1.3	Medication ordering and management	This section relates to functionality for medication ordering and medication administration management (e.g., electronic documentation for med pass administration).
DC.1.4	Orders, referrals, and results management	The functions under this heading address managing orders for diagnostic tests, blood products, and other patient care orders.
DC.1.5	Consents, authorizations, and directives	This section addresses functionality and the need to create, maintain, verify, or provide access to consents, authorizations, and advance directives.

DC.2 Clinical Decision Support		
ID	**Functionality**	**Summary**
DC.2.1	Manage health information to enable decision support	The functionality in this section offers prompts and support for clinicians when they complete assessments or enter data at the point of care. This includes pointing out potential problems or risks based on patient-specific

		issues and integrating patient or family preferences into clinical decision support.
DC.2.2	Care plans, guidelines, and protocols	The set of functions in this section relate to decision support for care planning such as providing standard care plans, guidelines, and protocols. It also includes decision support functionality for managing populations or groups (e.g.,related by diagnosis), supporting research protocols, and patient self-support.
DC.2.3	Medication and immunization management	Decision support functions in this section include drug interaction checking, dosing and warnings, and medication recommendations. They also include real-time support during the medication administration process (e.g., wrong patient, wrong drug, wrong dose, wrong time).
DC.2.4	Orders, referrals, results, and care management	Functionality in this section relates to decision support for non-medication orders, result interpretation, and referrals (including recommendations).
DC.2.4.4	Support for care delivery	These functions relate to decision support for safe blood administration and accurate specimen collection.
DC.2.5	Support for health maintenance: preventive care and wellness	Functions in this section relate to providing alerts for preventive services and wellness in clinical decision making or notification of the patient between encounters (such as suggestions, reminders, screening tests, preventive tests, actions).
DC.2.6	Support for population health	This section includes functionality related to monitoring aggregate data for identifying health risks, notifying care providers of the health risks within the population, and monitoring responses and follow-ups.
DC.2.7	Support for knowledge access	Decision support functions relate to providing evidence-based information and knowledge at the point of care and to the patient about their wellness, disease management, and treatment.

DC.3 Operations Management and Communication		
ID	**Functionality**	**Summary**
DC.3.1	Clinical workflow tasking	The functionality in this section relates to workflow, scheduling and managing tasks, assigning tasks and routing to the appropriate party, linking a task to a patient or part of the EHR, tracking the completion of the task, and timeliness of task completion.
DC.3.2	Support clinical communication	This section addresses the functions that support clinical communication such as interprovider communication, pharmacy communication, provider-patient or -family communication, and communication with medical devices. It also includes availability of educational or support resources for the patient, family, or caregiver.

Supportive

The supportive section of the DSTU addresses functionality related to administrative and financial requirements associated with care delivery. It includes support for medical research, public health, and quality improvement. There are three main sections:

- S.1 Clinical Support
- S.2 Measurement, Analysis, Research, Reporting
- S.3 Administrative and Financial

Most but not all of the functions in the supportive section have both parent and child subfunctions.

S.1 Clinical Support		
ID	**Functionality**	**Summary**
S.1.1	Registry notification	This function supports the transfer of information to registries (such as disease or immunization).
S.1.2	Donor management support	This function supports the sharing of information for potential organ or blood donors and recipients.
S.1.3	Provider directory	Functions under this section relate to a provider, including a directory, demographics, on-call location, and general location.
S.1.4	Patient directory	Functions under this section relate to the patient, including a patient directory, demographics, location within a facility, and residence for administration of services. It also includes bed optimization functionality.
S.1.5	De-identified data request management	This function relates to specific functionality to de-identify patient data in accordance with applicable rules.
S.1.6	Scheduling	This function supports interaction with other systems or applications to provide necessary data for scheduling.
S.1.7	Healthcare resource availability	This function supports the identification of available healthcare resources during local or national emergencies (e.g., available beds, providers, support personnel, medical supplies, vaccines).

S.2 Measurement, Analysis, Research, and Reports		
ID	**Functionality**	**Summary**
S.2.1	Measurement, monitoring, and analysis	The functions under this heading support measurement or monitoring such as outcome measurement and analysis and performance and accountability measures.
S.2.2	Report generation	Functions under this section relate to the ability to generate reports (standard and ad hoc) and the ability to allow users to define the records and reports contained in their formal medical record and provide a mechanism for output.

S.3 Administration and Financial		
ID	**Functionality**	**Summary**
S.3.1	Encounter/episode of care management	Includes functions for specialized views based on the encounter, protocols, or business rules; encounter-specific functionality; automatic generation of administrative and financial data from the clinical record; and support for remote healthcare services (telehealth, remote device monitoring and integration of data into the EHR for care management, billing, and public health reporting).
S.3.2	Information access for supplemental use	The functionality in this section supports the use of clinical data for care management, financial, administrative, and public health purposes, and includes functionality such as rules-driven clinical coding assistance, rules-driven financial and administrative coding assistance, and integration of cost-financial information.
S.3.3	Administrative transaction processing	Functions in this section support the interchange of data for processing transactions. It includes enrolling patients, eligibility verification and determination of coverage, service authorizations, service requests and claims, claims and encounter reports for reimbursement, and health service reports at the conclusion of an episode of care.
S.3.4	Manage practitioner/patient relationships	This function addresses the ability to identify relationships between a patient and treating providers.

S.3.5	Subject to subject relationship	This function addresses the ability to capture relationships between a patient and another party (e.g., parent of a child to allow access to medical records). It includes relationships where they are related by genealogy, insurance, living situation, or other means.
S.3.6	Acuity and severity	This function addresses the ability to provide data to support and manage patient acuity and severity of illness or risk adjustment.
S.3.7	Maintenance of supportive functions	The functionality in this section identifies the need to update the EHR supportive content on an automated basis including updates for clinical decision support guidelines, patient education materials, patient reminder updates, and public health updates.

Information Infrastructure

The information infrastructure section of the DSTU addresses functionality related to technical capabilities that are essential to support operations and the direct care functions. There are seven main sections:

- I.1 EHR Security
- I.2 EHR Information and Records Management
- I.3 Unique Identity, Registry, and Directory Services
- I.4 Support for Health Informatics and Terminology Standards
- I.5 Interoperability
- I.6 Manage Business Rules
- I.7 Workflow

Most of the functions in the seven sections include both parent and child functions.

I. Information Infrastructure		
ID	**Functionality**	**Summary**
I.1	Security	The security section addresses a range of functionality including entity authentication, entity authorization, entity access control, patient access management, non-repudiation, secure data exchange, secure data routing, information attestation, and enforcement of confidentiality rules as they apply to various parts of the EHR-S.
I.2	Health record information and management	Functionality in this section includes the ability to retain, ensure availability, and destroy health record information according to organizational standards. Audit trail capabilities is also included which identifies the author and the date/time the record was created, modified, viewed, extracted, or deleted. This section also includes synchronization between components and applications and management of data extraction in accordance with analysis and reporting requirements.
I.3	Unique identity, registry, and directory services	Functionality in this section addresses registry services and directories that are critical to successfully managing the security, interoperability, and the consistency of the health record data across an EHR-S. It also includes functionality for communication with registry services through standardized interfaces.
I.4	Health informatics and terminology standards	Functionality in this section addresses consistent terminologies/vocabularies/standardized transactions, data correctness, and interoperability. Examples include LOINC, SNOMED, CPT, ICD, and messaging standards such as X12 and HL7. It also includes functionality for maintenance and versioning as well as mapping to local terminology, codes, and formats.
I.5	Standards-based interoperability	Functionality in this section refers to the use of interoperability standards to exchange key clinical and administrative information. It also includes standards-based application integration (standard programming interfaces) where applicable in the EHR. This section includes support for interchange agreements.

I.6	Business rules management	This function addresses the ability to create, update, delete, and version business rules including institutional preferences.
I.7	Workflow management	This function supports workflow including both management and set up of work queues, personnel, and system interfaces.

EHR-S Functions that Affect E-HIM

Many functions throughout the EHR-S DSTU have an impact on HIM professionals, depending on their role in an organization. For example, a data analyst will be interested in the functions in direct care that will facilitate the collection of patient information and records. A clinical coder may be interested in supportive and information infrastructure functions related to rules-driven coding assistance, transaction processing, health informatics and terminology standards, and workflow management. An HIM professional responsible for managing health information and health records should have an overall understanding of most of the functions in the DSTU.

One area beginning to get more attention is electronic health records management. The EHR-S draft standard addresses a number of records management functions, recognizing that the EHR must stand as the legal health record in order to eliminate the paper-based record. Electronic health records management can be defined as "the process by which electronic (e.g., digital) health records are created or received and preserved for evidentiary (e.g., legal or business) purposes."[1] This includes issues such as version control, amendment, retention, archiving, destruction, record completion, locking capabilities, and output for disclosure purposes. Many of these functions are found in I.2 (health record information and management), but can also be found in other areas of the DSTU.

Today, many clinical information systems focus on the care delivery process and clinical functions. HIM has been left to purchase unique software applications that do not interface with these systems to address electronic records management. The EHR-S draft standard recognizes the importance of records management functions that could result in vendor awareness of the need to integrate these functions in their clinical and EHR applications to maintain a legal record.

Next Steps for the EHR-S DSTU

The HL7 EHR Technical Committee continues to work on new projects to move EHR functional standards forward. A number of projects are currently under way.

Minimum Function Sets: In order to establish a core set of functions that would comprise an EHR today, the committee is balloting a minimum set of functions by care settings. This work recognizes that not all functions in the EHR-S DSTU apply to all care settings and takes steps to identify the functions applicable to a setting. Work is currently being done in acute care, ambulatory care, and long-term care. In addition to care settings, a minimum set of functions is being identified for an e-prescribing application.

Conformance: The EHR-S DSTU functions are written in fairly generic terms that can be interpreted in a variety of ways. In order to create a common understanding to meet the intent of the standard, conformance statements and criteria are under development for each function. Eventually, each care setting will add to the conformance criteria to tailor the functionality.

Work Groups in the Legal EHR and PHR: The EHR technical committee has created two new work groups to evaluate the functionality in the draft standard to make sure it can stand as a legal record. Another work group has been established to evaluate EHR-S functions related to the personal health record.

Note

1. AHIMA e-HIM Task Force. "The Strategic Importance of Electronic Health Records Management." *Journal of AHIMA* 75, no. 9 (2004): 80A–B.

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