



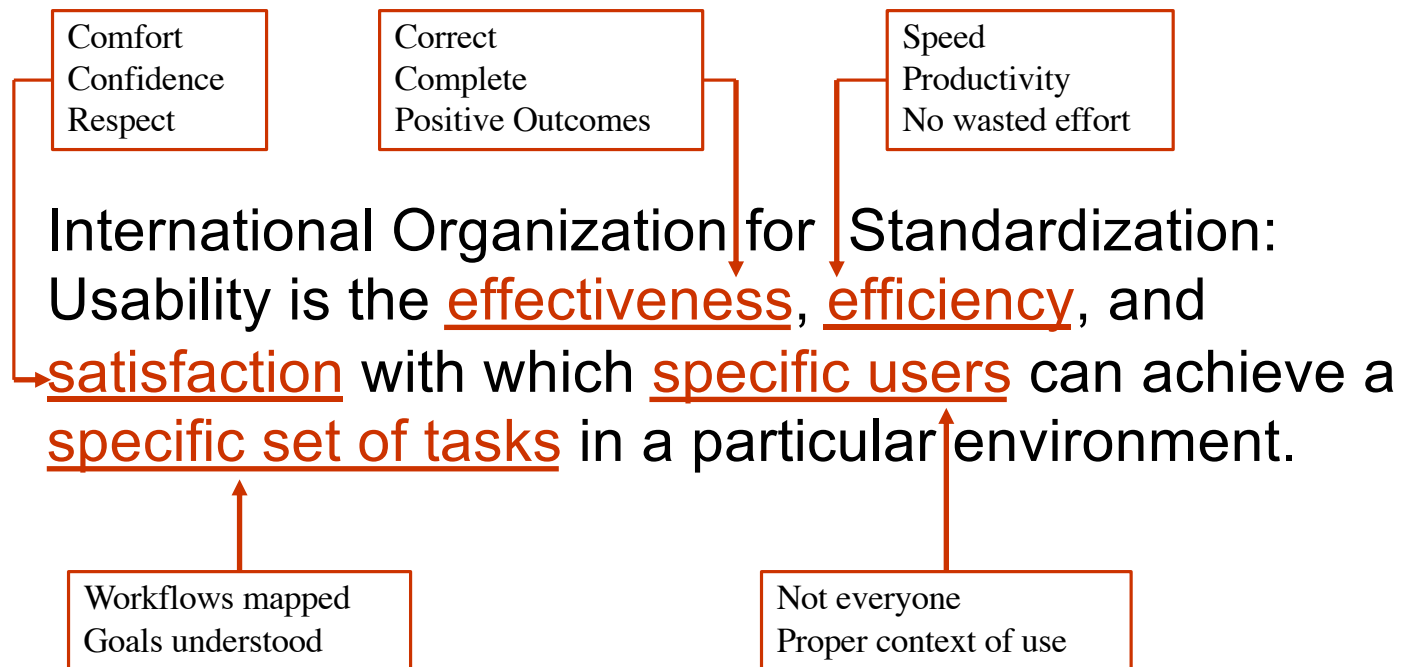
HL7 EHR-S Usability Work Group

Increasing EHR System Usability Through Standards

John Ritter, David Schlossman, Gary Dickinson, et al.

06-17-2019

An Iconic Definition of Usability



HL7 EHR-S Usability WG: Goals

- Increase EHR system usability through standards
- Translate well established usability guidelines (heuristics) into functional conformance criteria for the HL7 EHR-system Functional Model Release 2 (EHR-S FM)
 - Well defined function statements and descriptions
 - Criteria to evaluate conformance to the function
- Develop two companion functional profiles for the EHR-S FM
 - User-centered design functional profile
 - System infrastructure design functional profile

Examples of Usability-Oriented Conformance Criteria in the EHR-S FM

Section/ID#: Care provision support Conformance criteria
Type: Function
Name: Manage user help

Statement: Support the ability to manage the configuration and/or customization of appropriate user help that is context-sensitive and may include the exchange of live online chat

Description: Throughout the system it is necessary to provide configurable, context-sensitive and/or searchable user help to assist in the use of the system. User help levels should be configurable based on user requirements, scope of practice, organizational policy and/or jurisdictional law. User Help may include the live online chat support

1. The system **SHOULD** provide the ability to manage the configuration and customization of User Help in accordance with user requirements, and according to scope of practice, organizational policy and/or jurisdictional law
 2. The system **SHOULD** receive queries and render responses for data entry and system navigation assistance (User Help)
 3. The system **MAY** exchange User Help queries and responses via live online chat
 4. The system **SHOULD** render context-sensitive invocable help to guide users through activities in the system (e.g. charting steps, menu navigation)
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Meehan, R., Mon, D., Kelly, K., et al. (2016). Increasing EHR system usability through standards: Conformance criteria in the HL7 EHR-system functional model. *J. Biomed. Inform.* 63: 169-173.

Methods

- Recruit and engage clinicians, vendors, academicians specializing in usability and human factors research, implementers, SDOs, etc.
- Collect and perform an analysis of
 - Targeted literature reviews, environmental scans, and other academic sources
 - Government publications (AHRQ, NIST) and others from governments outside the US)
 - Technical materials (e.g., the UK's Common User Interface specification, Australia's usability specification)
 - Work items on usability from professional associations (e.g., the HIMSS EHR Usability Task Force)
 - Work items from SDOs (HL7, ISO/TC 215, ...)
 - ONC Standards coordination efforts and ongoing projects (ex; SHARP-C and UTH NCCD)

Heuristics

What are heuristics?

- General principles of interaction design
- Arise from validated studies of human computer interaction
- More broad rules of thumb than specific design guidelines

Sets of heuristics

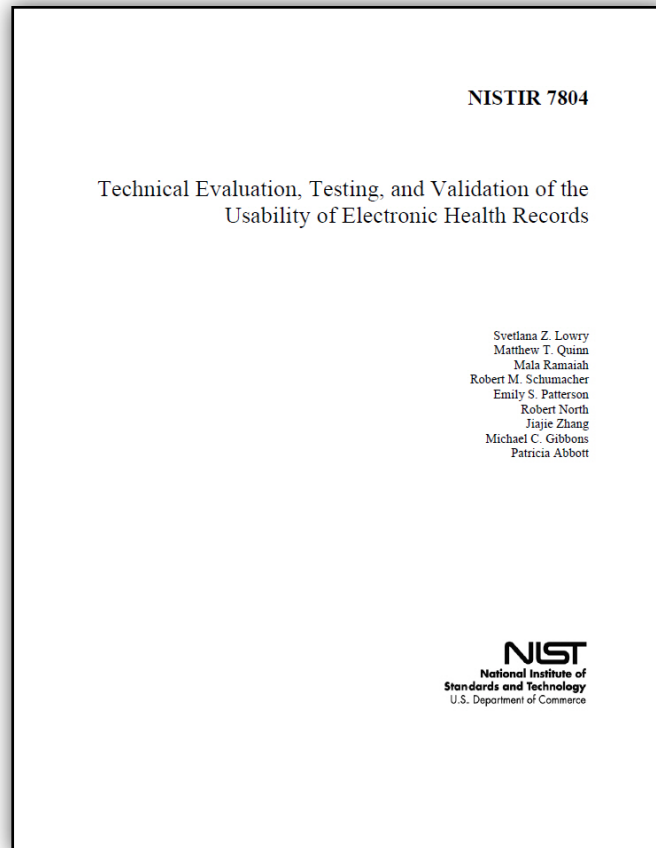
- Ben Shneiderman's Eight Golden Rules of Interface Design:
<https://www.designprinciplesftw.com/collections/shneidermans-eight-golden-rules-of-interface-design>
- Jiajie Zhang's General Design Principles for EHRs:
<https://sbmi.uth.edu/nccd/ehrusability/design/guidelines/Principles/index.htm>
- Nielsen's 10 Heuristics for User Interface Design:
<https://www.nngroup.com/articles/ten-usability-heuristics/>

Nielsen's Heuristics

1. Visibility of the system status
 - What's going on...
2. Match between the system and the real world
 - Natural, logical, clear
3. User control and freedom
 - Cancel, undo, redo
4. Consistency and standards
 - Words, actions, locations
5. Error prevention
 - Avoid errors, confirm before committing
6. Recognition, not recall
 - Objects, actions visible
7. Flexibility and efficiency of use
 - Accelerators, personalization
8. Aesthetic and minimalist design
 - Only relevant, commonly needed information
9. Help users recognize, diagnose, recover from errors
 - Clear error messages with constructive solutions
10. System help and documentation
 - Easy to search, concise, context sensitive, step-by-step

Nielsen, J. (1995). <http://www.nngroup.com/articles/ten-usability-heuristics/>

Consensus Heuristics



Developed function descriptions and conformance criteria based on NISTIR 7804: Technical Evaluation, Testing and Validation of the Usability of Electronic Health Records

NISTIR 7804 Heuristics (1)

NISTIR 7804	Patient identification error	Actions are performed for one patient (or are documented in one patient's record) that were intended for another patient.
	Mode Error	Actions are performed in one mode that were intended for another mode.
	Data Accuracy Error	Displayed data are not accurate
	Data Availability Error	Decisions are based on incomplete information because related information requires additional navigation, access to another provider's note, taking actions to update the status, or is not updated within a reasonable time.

NISTIR 7804 Heuristics (2)

NISTIR 7804	Interpretation Error	Differences in measurement systems, conventions and terms contribute to erroneous assumptions about the meaning of information
	Recall Error	Decisions are based on incorrect assumptions because appropriate actions require users to remember information rather than recognize it.
	Feedback Error	Decisions are based on insufficient information because lack of system feedback about automated actions makes it difficult to identify when the actions are not appropriate for the context.

NISTIR 7804 Heuristics (3)

NISTIR 7804	Data Integrity Error	Decisions are based on stored data that are corrupted or deleted.
	Visibility of System Status	The system should always keep the user informed about what is going on, through appropriate feedback within reasonable time.
	Match Between System and the Real World	The system should follow the user's language, with words, phrases and concepts familiar to the user, rather than system-oriented terms.
	User Control and Freedom	Users should be free to select and sequence tasks (when appropriate), rather than having the system do this for them.

NISTIR 7804 Heuristics (4)

NISTIR 7804	Consistency and Standards	Users should not have to wonder whether different words, situations or actions mean the same thing
	Help Users Recognize, Diagnose and Recover From Errors	Error messages should be expressed in plain language (NO CODES).
	Error Prevention	Even better than good error messages is a careful design
	Recognition Rather Than Recall	Make objects, actions and options visible.
	Flexibility and Minimalist Design	Allow users to tailor frequent actions.
	Aesthetic and Minimalist Design	Dialogues should not contain information that is irrelevant or rarely needed

NISTIR 7804 Heuristics (5)

NISTIR 7804	Help and Documentation	Help and documentation should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.
	Pleasurable and Respectful Interaction with the User	The user's interactions with the system should enhance the quality of her or his work-life.
	Privacy	The system should help the user to protect personal or private information belonging to the user or his/her patients.
	Synchronization Error	The system should help ensure that all members of the patient's care team are offered the latest and most accurate information.

Conformance Criteria

EHR System Usability Functional Profile												upf
2018 Ballot-Comment Item Number	Source of the item	ID	TYPE	NAME	STATEMENT	DESCRIPTION	CC#	CONFORMANCE CRITERIA (Clean)	CONFORMANCE CRITERIA (Tracked-Changes)	Usability Heuristics	Notes	
13	The following usability-related items are based on concepts that are mentioned in the											
14	NISTIR 7804	U.1	F	Aesthetic and Minimalist Design		Dialogues should not contain information that is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.						
15			C				1		The system SHOULD render the title for each screen.			
16			C				2	The system SHOULD provide the ability to manage configuration of user interface dialogue prompts (e.g., to promote the use of prompts that are specific, relevant and concise) according to user preference, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Aesthetic and Minimalist Design.	The system SHOULD provide the ability to manage configuration of user interface dialogue prompts (e.g., to promote the use of prompts that are specific, relevant and concise) according to user preference, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Aesthetic and Minimalist Design.			
17			C				3	The system SHOULD provide the ability to manage the configuration of user interface screen/window layout (e.g., to promote clean, efficient, uncluttered human-computer interfaces, with minimal expression of a screen's title, identification fields, logos, banners, dialog boxes, prompts, alerts, reminders, pictures, graphics, and/or icons) according to user preference, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Aesthetic and Minimalist Design.	The system SHOULD provide the ability to manage the configuration of user interface screen/window layout (e.g., to promote clean, efficient, uncluttered human-computer interfaces, with minimal expression of a screen's title, identification fields, logos, banners, dialog boxes, prompts, alerts, reminders, pictures, graphics, and/or icons) according to user preference, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Aesthetic and Minimalist Design.			
18	NISTIR 7804	U.2	F	Consistency and Standards		Users should not have to wonder whether different words, situations or actions mean the same thing. Follow platform conventions.						
19			C				1		The system SHOULD provide the ability to label each icon (e.g., by offering an explanation of the icon when the mouse is hovered over that icon).			
20			C				2	The system SHOULD provide the ability for a user to maintain selected user-generated text by transforming the selected text from one case to another case (e.g., transforming UPPERCASE to Sentence Case).	The system MAY SHOULD provide the ability for a user to maintain selected user-generated text by transforming the selected text from one case to another case (e.g., transforming UPPERCASE to Sentence Case).			
21			C				3	The system SHALL render computer-interface text elements according to User-Centered Design Heuristics that balance the use of UPPERCASE text versus other case text according to scope of practice, organizational policy, and/or jurisdictional law.	The system SHALL render computer-interface text elements according to User-Centered Design Heuristics that balance the use of UPPERCASE text versus other case text according to scope of practice, organizational policy, and/or jurisdictional law.			
22			C				4	The system MAY provide the ability for a provider to capture and render a "self-generated, temporary, free-form note" for later entry as formal, definitive documentation (e.g., using raw, original, abbreviated, temporary, shorthand note that may use marks) according to user-role, user-preference, scope of practice, organizational policy, and/or jurisdictional law. Note: The raw, original, abbreviated, shorthand marks are not typically needed by the author after they have been reformatted into formal, longhand notes and are typically discarded by the author.	The system MAY provide the ability for a provider to capture and render a "self-generated, temporary, free-form note" for later entry as formal, definitive documentation (e.g., using raw, original, abbreviated, temporary, shorthand note that may use marks) according to user-role, user-preference, scope of practice, organizational policy, and/or jurisdictional law. Note: The raw, original, abbreviated, shorthand marks are not typically needed by the author after they have been reformatted into formal, longhand notes and are typically discarded by the author.			

Background

Usability_FP

Usability Glossary



Ballot Comments by Category

- NISTIR 7804

The NIST 7804 document provides some very well-defined heuristics for usability that must be evaluated with respect to each use case to assure patient safety, efficient workflow and effective output from an EHR.

- 1) The heuristics need to be applied to specific use cases and workflows within the EHR.
- 2) Assigning specific value to individual heuristics across an EHR as a whole seem inconsistent with the intent of the 7804 document.
- 3) To indicate that one heuristic is a "should" and another a "shall" is more of a tradeoff when considering an individual workflow and cannot be applied to the EHR as a whole. Each is important to some degree to the EHR as a whole and a blanket "all or none" for any individual heuristic is inconsistent with the spirit of the 7804 document.

Ballot Comments by Category

- Speed was left out in the ballot
- There are many components. Response time is one. Systems really have to field responses (including pre-calculations or pulling of menus) on the order of 100 milliseconds speed. Faster would be even better. Without such speedy response time, users get stuck in type-ahead problem and they loose their mental flow.

Functionality vs. Usability

- Make sure that this functional profile is not defining functionalities.

“This guide confuses functionality with usability throughout. Even some of the examples in the overview, such as receiving a drug alert, get it wrong. Retrieving an alert is a function. How well or poorly the system implements that function is usability.”

Revising Conformance Criteria

2018 Ballot-Comment Item Number	Source of the Item	ID	TYPE	2019 NAME	2018 NAME	2018 STATEMENT	2019 STATEMENT	2019 DESCRIPTION	2018 DESCRIPTION	2019 CC#	2019 CONFORMANCE CRITERIA (Clean)	2019 CONFORMANCE CRITERIA (Tracked-Changes)
3		OV.1	F	Overarching Section	Overarching Section	Overarching criteria are those that apply to all EHR Systems.		The Overarching Section contains Conformance Criteria that apply to all EHR Systems and consequently must be included in all EHR-S FM compliant profiles. These criteria are grouped under a single Function.				
4		OV.1	C							1	The system SHOULD provide the ability for an authorized user to manage the configuration parameters for indications regarding relevant types of contexts for the information being presented (e.g., PATIENT-CONTEXT, TIME-CONTEXT, SCREEN-CONFIGURATION-CONTEXT, WORKSTATION-CONTEXT, SESSION-CONTEXT, or PROVENANCE-CONTEXT as defined in the Usability Glossary). For example, the system could offer a visual cue that enables the user to readily comprehend that the user is currently signed on to multiple workstations; or that the most recent picture of a patient's laceration is framed in a thick border; or that the current session will time out in 60 seconds if not refreshed.	The system SHOULD provide the ability for an authorized user to manage the configuration parameters for effects of indications regarding all the different relevant types of contexts for the information being presented (e.g., PATIENT-CONTEXT, TIME-CONTEXT, SCREEN-CONFIGURATION-CONTEXT, WORKSTATION-CONTEXT, SESSION-CONTEXT, or PROVENANCE-CONTEXT as defined in the Usability Glossary). For example, the system could offer a visual cue that enables the user to readily comprehend that the user is currently signed on to multiple workstations; or that the most recent picture of a patient's laceration is framed in a thick border; or that the current session will time out in 60 seconds if not refreshed.
5		OV.1	C							2	The system SHOULD render (in real time or asynchronously) indications of the user's location within the system's information architecture (IA) using established user interface guidelines and according to user preference, scope of practice, organizational policy, and/or jurisdictional law. For example, a user might receive an asynchronous notification that the user has successfully changed to a different computer terminal or workstation context. NOTE: Industry standards suggest that a system is intrinsically more usable when it enables users to readily maintain situational awareness (e.g., by the use of relevant types of visible cues) and understand where they are within the system.	The system SHOULD render (in real time or asynchronously) indications of the user's location within the system's information architecture (IA) on indication (e.g., alerts, reminders, notifications) regarding different relevant types of contexts (e.g., PATIENT-CONTEXT, TIME-CONTEXT, SCREEN-CONFIGURATION-CONTEXT, WORKSTATION-CONTEXT, SESSION-CONTEXT, or PROVENANCE-CONTEXT) using established user interface guidelines and according to user preference, scope of practice, organizational policy, and/or jurisdictional law. For example, a user might receive an asynchronous notification that the user has successfully changed to a different computer terminal or workstation context. NOTE: Industry standards suggest that a system is intrinsically more usable when it enables users to readily maintain situational awareness (e.g., by the use of relevant types of visible cues) and understand where they are within the system.
6		OV.1	C							3	The system SHOULD conform to T16 (Business Rules Management) to auto-populate fields via facilitate smart key entry using reference lists (e.g., ASA = Aspirin; DNR = Do Not Resuscitate; UK = United Kingdom).	The system SHOULD conform to T16 (Business Rules Management) to auto-populate fields via facilitate smart key entry using reference lists (e.g., ASA = Aspirin; DNR = Do Not Resuscitate; UK = United Kingdom).
7		OV.1	C							4	The system MAY render an indication regarding the sort order of a list according to scope of practice, organizational policy, and/or jurisdictional law. Note: Since the user's assumptions regarding the sort order of a given list might be a patient safety issue, and since there are many lists that could be presented in various sort orders within an EHR system, an indicator can be presented for any list whose sort order could result in a troublesome interpretation of that list.	The system MAY render an indication regarding the sort order of a list according to scope of practice, organizational policy, and/or jurisdictional law. Note: Since the user's assumptions regarding the sort order of a given list might be a patient safety issue, and since there are many lists that could be presented in various sort orders within an EHR system, an indicator can be presented for any list whose sort order could result in a troublesome interpretation of that list.
8		OV.1	C							5	The system SHOULD provide the ability for authorized users to configure a default sort order for given lists (e.g., to reduce the confusion when the same list is sorted by severity one day and then by date-of-onset the next day) according to scope of practice, organizational policy, and/or jurisdictional law.	The system MAY SHOULD provide the ability for authorized users to configure a default sort order for given lists (e.g., to reduce the confusion when the same list is sorted by severity one day and then by date-of-onset the next day) according to scope of practice, organizational policy, and/or jurisdictional law.
9		OV.1	C							6	The system MAY provide the ability to render lists in an ad hoc (dynamic, real-time) user-selected sort order (e.g., to reduce the confusion when the same list is sorted by severity one day and then by date-of-onset the next day by a different user) according to scope of practice, organizational policy, and/or jurisdictional law.	The system MAY provide the ability to render lists in an ad hoc (dynamic, real-time) user-selected sort order (e.g., to reduce the confusion when the same list is sorted by severity one day and then by date-of-onset the next day by a different user) according to scope of practice, organizational policy, and/or jurisdictional law.

Background

Usability_FP

Usability Glossary

Setup



CMS Request for Information



CMS announces new RFI on Patients over Paperwork

DEPARTMENT OF HEALTH AND
HUMAN SERVICES

Centers for Medicare & Medicaid
Services

42 CFR Ch. IV

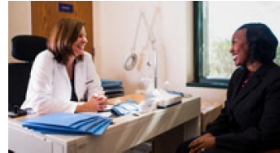
[CMS-6082-NC]

RIN 0938-ZB54

**Request for Information; Reducing
Administrative Burden To Put Patients
Over Paperwork**

AGENCY: Centers for Medicare &
Medicaid Services (CMS), HHS;
Department of the Treasury.

ACTION: Request for information.



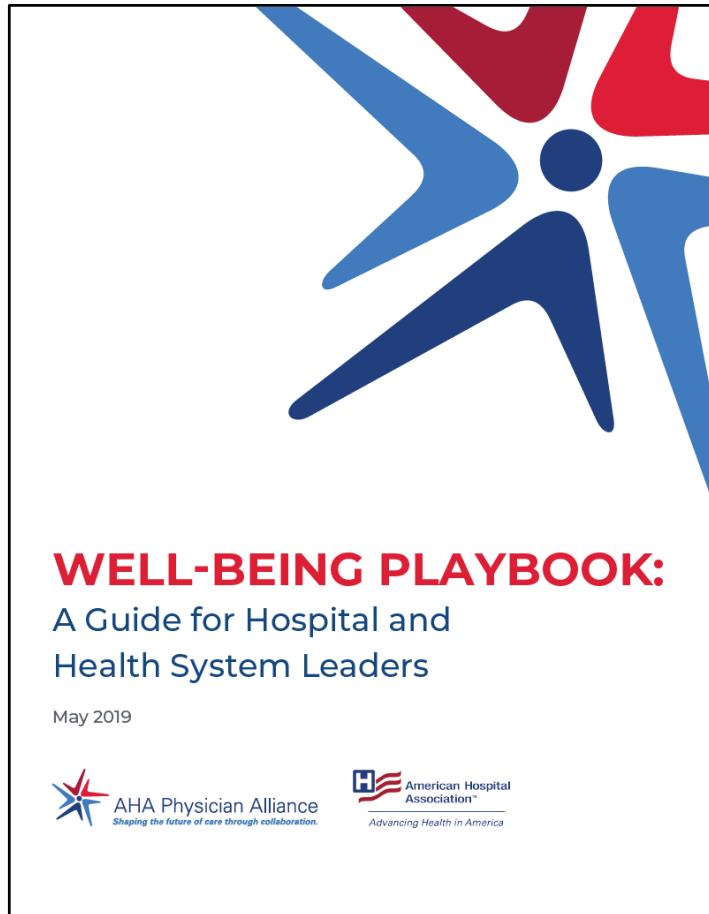
**PATIENTS
OVER PAPERWORK**

- Reporting and documentation requirements
- Coding and documentation requirements for Medicare or Medicaid payment
- Prior authorization procedures
- Policies and requirements for rural providers, clinicians, and beneficiaries
- Policies and requirements for dually enrolled (i.e., Medicare and Medicaid) beneficiaries
- Beneficiary enrollment and eligibility determination

AHA Well Being Playbook



AHA Well-Being Playbook



SEVEN STEPS TO ORGANIZATIONAL WELL-BEING

The potential for positive impact on those who work in health care and those who we care for when we focus on organizational well-being is boundless. Seven key steps will help you address burnout and transform your health system to a culture of well-being:

-  **Create infrastructure for well-being**
-  **Engage your team**
-  **Measure well-being**
-  **Design interventions**
-  **Implement programs**
-  **Evaluate program impact**
-  **Create a sustainable culture**

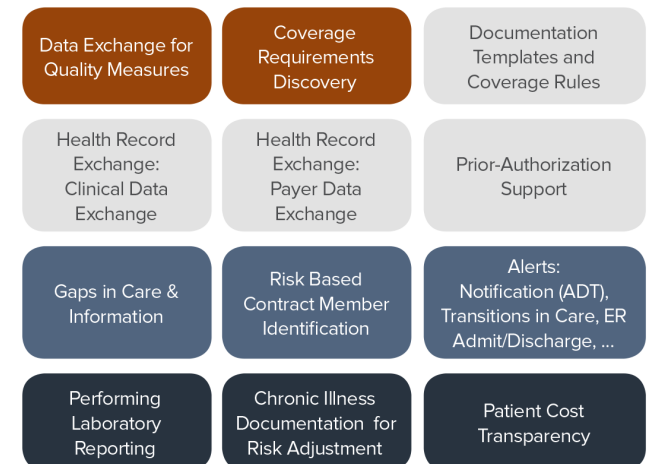
HL7 Da Vinci Project



HL7 Da Vinci Project

- Automate workflows that collect/exchange data related to provider-payer interactions
- Focus on high volume use cases
 - Coverage requirements discovery
 - Prior authorization support
 - Templates and coverage rules
 - eHealth clinical data exchange
 - ADT notifications/care transitions
 - Risk attribution and adjustment
 - Gaps in care and information
 - Several other topics

2019 USE CASE INVENTORY & STATUS



PROJECT PROCESS

Define requirements (technical, business and testing)







- Create Implementation Guide
- Create and test Reference Implementation (prove the guide works)
- Pilot the solution
- Deploy the solution

- In HL7 ballot reconciliation as draft standard
- Under active development
- Planned 2019 Use Cases
- Use Cases in Discovery

<http://www.hl7.org/about/davinci/use-cases.cfm>

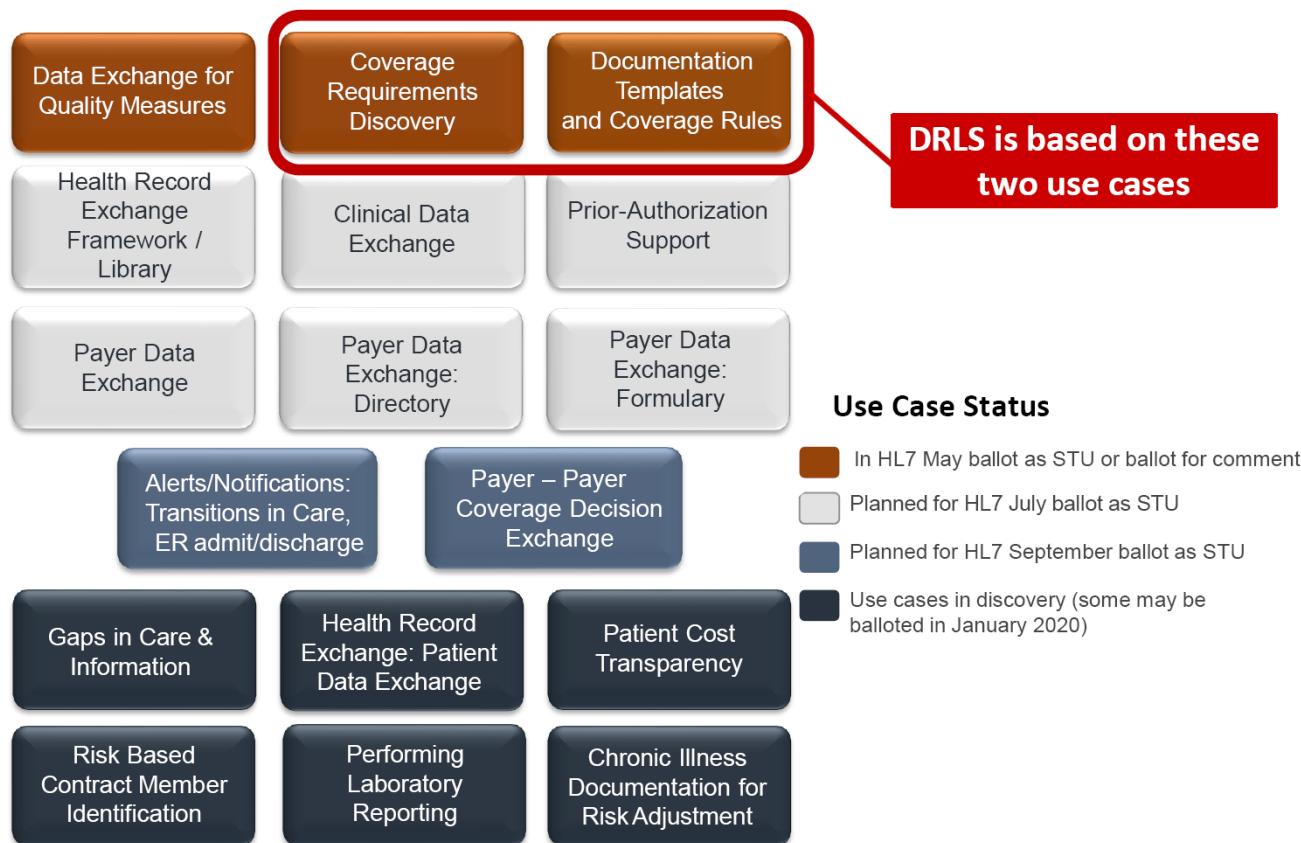
CMS Documentation Requirements Lookup Service (DRLS)

DRLS Goals:

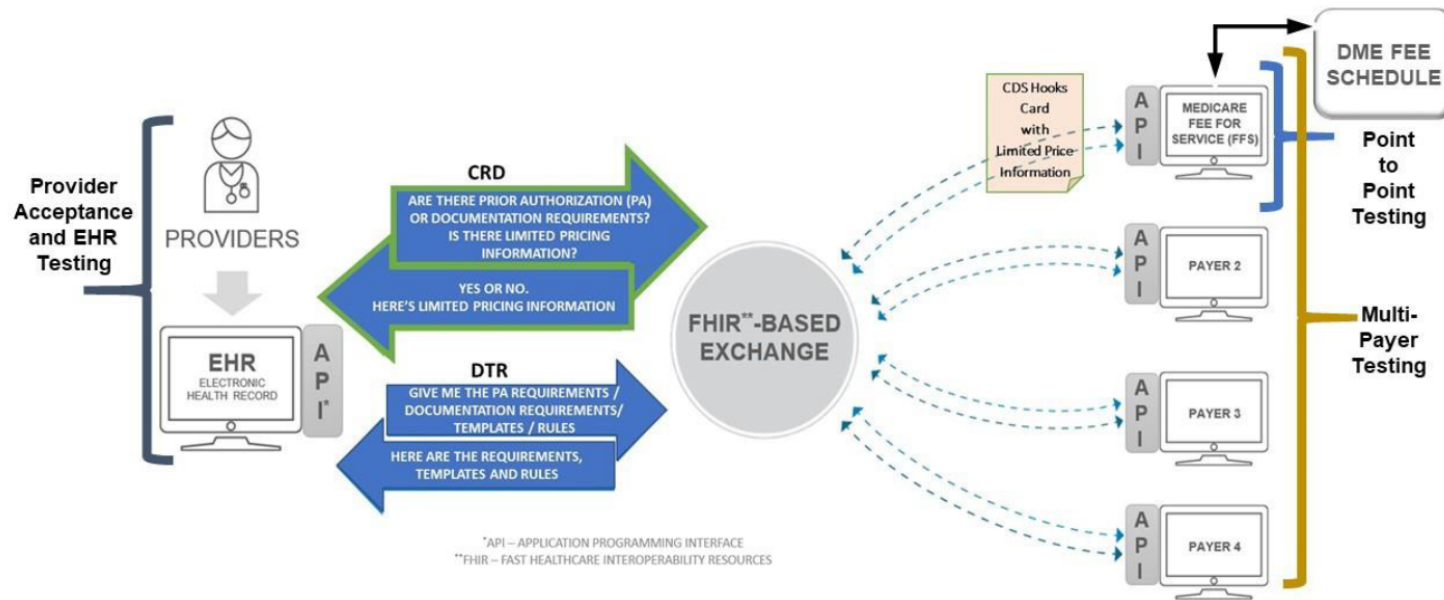
		Reduce provider burden
		Reduce improper payments and appeals
		Improve “provider to payer” information exchange

Discover prior authorization and documentation requirements in the EHR at the time of service through electronic data exchange with payer systems.

HL7 Da Vinci Use Cases in DRLS



How DRLS Works



- Developed CRD Implementation Guide which passed initial HL7 ballot (re-ballot in May), and CRD Reference Implementation

Clinical Workflow and Documentation Focus Team



Clinical Workflow and Documentation Focus Team Activities

- The AMDIS presentation is scheduled for Wednesday, June 19 at 1:45 - 2:15 PM
- Work is in progress to divide and condense our draft manuscript for publication

Sociotechnical Imbalance

