



Increasing EHR System Usability Through Standards

As One Approach to Reducing Clinician Burden

HL7 EHR-S Usability Work Group

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EHRs' Unfulfilled Promises

- Decreased efficiency: EHRs add 1-2 hours to the average MD workday
- Disconnect from patients: providers spending 50% or more of their time in the EHR
- Disruption of clinician work-life balance and an epidemic of burnout
- Modest improvement in care process metrics and guideline adherence
- No significant change in large scale health outcomes
- Annual US healthcare expenditures increased from \$2 trillion in 2005 to over \$3.5 trillion in 2017

Why Do So Many Promises Remain Unfulfilled?



- Poor usability and poor support for clinical workflow are major factors—*possibly the most important factors*—preventing health IT from achieving its goals
- Suboptimal human factors engineering and a challenging user experience have a strong, often direct connection to decreased clinical productivity, increased cognitive load, increased error rates, increased user fatigue, and decreased user satisfaction—i.e. a connection to clinician burden

Physician Burnout



Burnout is a syndrome characterized by

- Emotional exhaustion
- Feelings of cynicism and detachment from work
- Sense of low personal accomplishment

- 54-68% of US physicians report at least one symptom of burnout (twice the rate of the general population)
- 70 % of US physicians report symptoms of health IT-related stress
- 53% of self-reported physician stress and burnout is correlated with EHRs and clinical process design highly impacted by EHRs

1. Gardner, RL et al. (2019) Physician stress and burnout: the impact of health IT. *JAMIA* 26(2): 106-114.
2. Kroth, PJ et al. (2019) Association of EHR design and use factors with clinician stress and burnout. *JAMA Network Open* 2(8):e199609

EHR Design and Use Factors Associated with High Clinician Stress

- Information overload (poor interface design)
- Excessive, inefficient data entry
- Slow, confusing system navigation
- Interference with patient-clinician relationship

Kroth, PJ et al. (2019) Association of EHR design and use factors with clinician stress and burnout. JAMA Network Open 2(8):e199609

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

HL7 EHR-S Usability WG: 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)

Conformance Criteria

EHR-S Functional Model

What systems must do to be considered an EHR
(Functions)



Measurable aspects of conformance to function
(Conformance Criteria)

Usability Functional Profile

What EHR systems must do to be usable
(Usability Functions)



Measurable aspects of conformance to function
(Conformance Criteria)

Usability Functional Profile 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							1		The system SHALL 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							1		The system SHOULD provide the ability to label each icon (e.g., by showing an explanation of the icon when the mouse is hovered over the 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 enter 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 enter 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



RCB Project Analysis Worksheet

A	B	C
1	Clinician Burden (the current situation)*	Recommendations
5	Light Green (Column A): Findings, strategies and recommendations from US Office of National Coordinator for Health Information Technology (ONC), DRAFT Strategy on Reducing Regulatory Burden Organized by Burden Topic --- (Ix.Sx.Rx) designates ONC Initiative[I], Strategy[S], Recommendation[R]	
6	Light Orange (Column A): RCB Success Stories of Note	
7	Project Focus - Our current analysis is focused on Root Causes, broken down by RCB topic. See Topics (10th Tab) and Root Causes (5th Tab) below. Please review and offer your comments.	
8	We are also seeking "Reducing Clinician Burden" Success Stories. If you have one (or more) to share, please use this template: http://wiki.hl7.org/images/0/0a/Reducing_Clinician_Burden-Success_Story_Template.docx	
8	Clinician Burden - In General [1.1]	
9	<ul style="list-style-type: none"> • "3 out of 4 physicians believe that EHRs increase practice costs, outweighing any efficiency savings." (26) • "7 out of 10 physicians think that EHRs reduce their productivity." (26) • "Four in 10 primary care physicians (40%) believe there are more challenges with EHRs than benefits." (30) • "Seven out of 10 physicians (71%) agree that EHRs greatly contribute to physician burnout" (30) • "Six out of 10 physicians (59%) think EHRs need a complete overhaul" (30) • "Only 8% say the primary value of their EHR is clinically related" (30) • "[Physicians express that EHR] systems had detracted from professional satisfaction (54%) as well as from their clinical effectiveness (49%)." (60) • "Poll results... showed that few physicians and nurses were involved in the decision-making process of which EHR to implement in their workplace. Of physician participants, 66 percent said they had no input, 28 percent had input and 7 percent did not use an EHR. Of nurse and APRN participants, 80 percent said they had no input, 18 percent had input and 2 percent did not use an EHR." (63) • "Of the physician and nurse/APRN participants who had input in choosing their workplace's EHR system, just 2 percent said the system they wanted was chosen." (63) • "A recent... report revealed that almost 40 percent of surveyed outpatient providers are looking to replace their EHR and other IT tools with solutions that offer better ease of use, more functionality and increased interoperability with other IT systems." (69) 	<ul style="list-style-type: none"> • "Nearly three out of four primary care physicians (72%) think that improving EHRs' user interfaces could best address EHR challenges in the immediate future" (30) • "Seven out of 10 primary care physicians (67%) think solving interoperability deficiencies should be the top priority for EHRs in the next decade—and 43% want improved predictive analytics to support disease diagnosis, prevention, and population health management" (30) • "One out of four primary care physicians (27%) think 'developing Artificial Intelligence (AI) assistants to support physicians with patient care' should be a priority." (30) • "Many doctors do recognize the value in the technology: 60% of participants... said EHRs had led to improved patient care." (60) • "When asked what changes they would like to see be made to the EHR, 44 percent of physician participants said to make the systems more intuitive or user-friendly and 30 percent said enhancing interoperability and record sharing." (63)
9	<ul style="list-style-type: none"> • "EHR human/computer interface continues to follow the paper based model of filing records hence the EHR is visually complex. Human factors designed for healthcare must be infused into this interaction as well... We are lacking this expertise across the board." (1) • "No other industry... has been under a universal mandate to adopt a new technology before its effects are fully understood, and before the technology has reached a level of usability that is acceptable to its users." (3) 	<ul style="list-style-type: none"> • "The primary goal of EHR-generated documentation should be concise, history-rich notes that reflect the information gathered and are used to develop an impression, a diagnostic and/or treatment plan, and recommended follow-up. Technology should facilitate attainment of these goals in the most efficient manner possible without losing the humanistic elements of the record that support ongoing relationships between patients and their physicians." (3)

RCB Project Burden Descriptions as “Function Statements”

RCB Project Burden Statement	Usability FP Conformance Criterion
<p>Cell B 69</p> <ul style="list-style-type: none">• "Improve presentation of clinical data within EHRs. EHRs contain vast quantities of clinical data and are capable of sending and receiving incredible amounts of patient information with a keystroke. This can present a challenge for the end user trying to locate one critical piece of information; a needle in the proverbial haystack. Various modes of information storage also complicate finding desired data—some information is stored as structured data, while other data are contained in scanned images files..." (50, I2.S1.R4) <p><u>NISTIR 7804 Heuristic:</u> Aesthetic and Minimalist Design</p>	<p>Cell O 31, ID U.1, CC 2</p> <p>The system SHOULD provide the ability to manage the configuration of the representation of data (e.g., by configuring the user interface screen/window layout 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; offering differing representational modes for conveying raw-data information (e.g., pain scale of 1-10 versus frown/smile face)) 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.</p>

RCB Project Burden Descriptions as “Function Statements”

RCB Project Burden Statement	Usability FP Conformance Criteria
<p>Cell B 110</p> <ul style="list-style-type: none">• "Better align EHR system design with real-world clinical workflow. A disconnect exists between real-world clinical workflows and the design of health IT systems. Clinicians and other health care providers often must modify their optimal clinical workflow to satisfy the electronic workflow of the health IT system..." (50, I2.S1.R1) <p><u>NISTIR 7804 Heuristics:</u> Flexibility and efficiency of use Recognition rather than recall</p>	<p>Cell O 46 ID U.2 CC14</p> <p>The system SHOULD present menu choices in a clinically relevant, contextually consistent, and workflow optimized fashion according to user preference, user role, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Recognition Rather than Recall.</p> <p>Cell O 162 - 164, ID U.8, CC 4 - 6</p> <p>The system SHOULD provide the ability to capture various combinations of steps of a workflow into a single command from a user in order to complete a task (e.g., so a novice can perform a complex command in a stepwise fashion versus an expert performing multiple steps with a single command) according to user preference, scope of practice, and/or organizational policy.</p>

RCB Project Burden Descriptions as “Function Statements”

RCB Project Burden Statement	Usability FP Conformance Criteria
<p>Cell B 89</p> <ul style="list-style-type: none"> • "[There is often insufficient capability to] distribute work appropriately across members of the care team" (4) • "[There is a lack of ability to designate] clear role transferability and accountability within the team" (4) • "Routing all communication among team members through the EHR adds layers of inefficiency and distracts the team from higher-quality verbal communication. <p><u>NISTIR 7804 Heuristic:</u> Consistency and standards</p> <p><u>Usability WG Heuristic:</u> Manage workflow communication support</p>	<p>Cell O 54 ID U.2, CC 22</p> <p>The system SHOULD render practitioner names, titles, and roles as expressed in a consistent, minimal, and appropriate fashion according to user preference, scope of practice, organizational policy, and/or jurisdictional law and according to User-Centered Design Heuristics that support Consistency and Standards.</p> <p>Cell O 557 – O 562, CC 1, 2, 6</p> <p>The system MAY provide the ability to capture a request-for-action from another provider(s).</p> <p>The system MAY provide the ability to transmit a request-for-action to another provider(s).</p> <p>The system MAY provide the ability to transmit to another provider an acknowledgement of the receipt of that provider's request-for-action.</p>

RCB Project Burden Descriptions as “Function Statements”

RCB Project Burden Statement	Usability FP Conformance Criteria
<p>Cell B 112</p> <ul style="list-style-type: none">• "Promote and improve user interface design standards specific to health care delivery. <p>There is currently variable adherence to usability best practices among EHR products. This creates greater difficulty for end users to perform common workflow tasks and may increase clinician frustration..." (50, I2.S2.R2)</p> <p><u>NISTIR 7804 Heuristic:</u> Consistency and Standards</p>	<p>Cell O 43, ID U.2, CC 11</p> <p>The system SHOULD present consistent, distinct, easy-to-understand icons with supplemental interpretation capability (e.g., depending on technology-specific capabilities, a mouse-over popup description or a long-press versus a finger-tap on the screen).</p> <p>Cell O44, ID U.2, CC 12</p> <p>The system SHOULD present consistent, semantically self-evident, standards-based iconography that is limited to basic types of icons (e.g., no more than twelve-to-twenty icon types per screen as recommended by industry guidelines).</p>

**Comments
And
Questions?**

