NISTIR 7742

Customized Common Industry Format Template for Electronic Health Record Usability Testing

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15-Nov-10

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Customized Common Industry Format Report for mdTimeline EHR Usability Testing

Date of Report: June 5th 2019

Report Prepared By: Dennis Bonilla
Product Owner
mdTimeline EHR

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INTENDED AUDIENCE

This document provides a template for the modified version of *Software engineering — Software product Quality Requirements and Evaluation(SQuaRE) — Common Industry Format (CIF) for usability test reports* (ISO/IEC 25062:2006(E)), the Common Industry Format (CIF) usability test report. This version of the CIF has been customized for use in usability testing of Electronic Health Records (EHRs) by usability administrator(s) and data logger(s). The template enables usability engineers to effectively communicate the results of EHR usability testing.

INTENDED PURPOSE

The intention of the CIF is to help vendors demonstrate evidence of usability in their final product in a format that allows both independent evaluation of a single product and comparison across multiple products. This document has been prepared as a template to guide EHR usability test administrators meet the usability processes approach put forth by the National Institute of Standards and Technology (NIST). The following customized CIF template is intended to assist EHR vendors, healthcare providers, and researchers in reporting the results of usability testing for each system tested.

USING THIS DOCUMENT

This document is not intended to be a tutorial on usability or usability testing.[1] To work with this document you should have expertise with common usability industry practices

[1] Excellent starting points for information are www.usability.gov and www.upassoc.org as well as Dumas, J., Redish, J. (1994) *A Practical Guide to Usability Testing.* Norwood, NJ: Ablex.
Dana Chisnell & Jeffrey Rubin *Handbook of Usability Testing: How to Plan, Design, and Conduct*

and with standard ISO/IEC 25062:2006.[2] The ISO document is intended for the reporting of summative (i.e., quantitative) studies. The modifications here allow for the reporting of qualitative findings (i.e., formative) but strongly recommend and encourage the collection of quantitative measures of user performance.

Reports delivered using this template should conform to the major headings and content areas outlined below. Minor deviations from the outline and format are acceptable, but the reports should follow the template in all material aspects. This template includes the following sections:[3]

- Executive Summary
- Introduction
- Method
- Results
- Appendices

In addition to these sections, the modified CIF must also include a title page; a sample title page is included in the template example.

When completing the modified CIF template, it is highly recommended that EHR usability test administrator(s) and their data logger(s) refer to the instructions and guidance in order to properly complete this template.

The sample data provided in this template is an example or placeholder of the types of content that may be useful in completing the modified CIF template. Gray background text (bounded in square brackets) needs to be replaced by the EHRs' supplied information. It is important to note that this sample content is not to be taken literally or as a starting point.

Effective Tests (2nd ed.) Wiley, 2008.
Schumacher (2009). *Handbook of Global User Research*. Burlington, MA: Morgan Kaufman.

[2] This document can be purchased from:
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43046.

[3] Each of these sections has a corresponding section in the ISO/IEC 25062.

EHR Usability Test Report of mdTimeline Ver. 2.0

Report based on ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports
***mdTimeline** Version 2.0 Ambulatory EHR*

Date of Report: June 5th 2019

Report Prepared By: Dennis Bonilla
Product Owner
mdTimeline EHR

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EXECUTIVE SUMMARY

A usability test of **mdTimeline Ver. 2.0 Ambulatory EHR** was

conducted. The purpose of this test was to test and validate the usability of the current user interface and provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, [10] healthcare providers and other intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on [40] tasks typically conducted on an EHR:

• A detailed list of the tasks can be found in SED Checklist document

During the one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/ release form (included in Appendix 3); they were instructed that they could withdraw at any time. Participants had prior experience with the EHR.[4]

The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

[4] If training or help materials were provided, describe the nature of it. The recommendation is that all participants be given the opportunity to complete training similar to what a real end user would receive prior to participating in the usability test.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant's verbalizations
- Participant's satisfaction ratings of the system

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT.

A summary of the performance and rating data collected on the EHRUT can be found in the SED Checklist document.

INTRODUCTION

The EHRUT tested for this study was **mdTimeline Version 2.0 Ambulatory EHR**. Designed to present medical information to healthcare providers in ambulatory care settings. The usability testing attempted to represent realistic exercises and conditions.

The purpose of this study was to test and validate the usability of the current user interface and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency and user satisfaction were captured during the usability testing.

METHOD

PARTICIPANTS

A total of [10] participants were tested on the EHRUT(s). Participants voluntarily participated in this test. In addition, participants had no direct connection to the development of or organization producing the EHRUT.

Participants had a mix of backgrounds and demographic characteristics. A table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology can be found in the SED Checklist document. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

10 participants participated in the usability test.
Participants were scheduled for sessions with time in between each session for debrief by the administrator. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting firm.

STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with satisfaction – and areas where the application failed to meet the needs of the participants. The data from this test may serve as a baseline for future tests with an updated version of the same EHR and/or comparison with other EHRs provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability, but also to identify areas where improvements must be made.

Each participant used the system in the same location, and was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant's verbalizations (comments)
- Participant's satisfaction ratings of the system

TASKS

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might do with this EHR.

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users.[6] Tasks should always be constructed in light of the study objectives.

TASK SUMMARY TABLE

Tasks were prioritized in accordance with the risk associated with user errors.

Task Identifier	Task Description
a.1.1	Change Medication Order
a.1.2	Access Medication Order
a.1.3	Record Medication Order
a.2.1	Record Laboratory Order
a.2.2	Change Laboratory Order
a.2.3	Access Laboratory Order
a.3.1	Record Radiology/imaging Order
a.3.2	Access Radiology/imaging Order
a.3.3	Change Radiology/imaging Order
a.4.1	Adjustment of severity level of drug-drug interventions
a.4.2	Create drug-drug and drug-allergy interventions prior to CPOE completion
a.5.1	Record Demographics (Recorded patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity)
a.5.2	Access Demographics (Accessed recorded patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity)
a.5.3	Change Demographics (Changed patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity)
a.6.1	Change Problem List
a.6.2	Record Problem List
a.6.3	Access Problem List
a.6.4	Access historical problem list
a.7.1	Record Medication List
a.7.2	Access Medication List
a.7.3	Change Medication List
a.7.4	Access historical medication list
a.8.1	Record Medication Allergy List
a.8.2	Change Medication Allergy List
a.8.3	Access Medication Allergy List
a.8.4	Access historical medication allergy list
a.9.1	Activate, trigger and configure clinical decision support intervention with problem list
a.9.2	Activate, trigger and configure clinical decision support intervention with Demographics
a.9.3	Activate, trigger and configure clinical decision support intervention with Medication Allergy List
a.9.4	Activate, trigger and configure clinical decision support intervention with Lab Tests and Results
a.9.5	Log into the system with the various users provided and verify the limitations identified for each
a.9.6	Activate, trigger and configure clinical decision support intervention with Vital Signs
a.9.7	Activate, trigger and configure clinical decision support intervention with medication List
a.9.8	Activate, trigger and configure clinical decision support intervention with Medication & Medication Allergies
a.9.9	Infobutton test for problem list
a.9.10	Infobutton test for medication list
a.9.11	Activate, trigger for CPOE problem list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)
a.9.12	Activate, trigger for CPOE medication list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)
a.9.13	Activate, trigger for CPOE medication allergy list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)
a.14.1	Access Implantable Devices List (Active & Inactive)
a.14.2	Change Implantable Device Status
a.14.3	Record Implantable Devices
b.2.1	Review, validate and reconcile the active medication list, allergy list and problem list with data from an external source
b.2.2	Generate CCDA with reconciled data

b.3.1	Receive Fill Status Notification
b.3.2	E-prescribe New Prescription
b.3.3	Cancel Prescription
b.3.4	Refill Prescription
b.3.5	Change Prescription (dosage or duration)
b.3.6	Request & receive medication history information

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID.[7] Each participant reviewed and signed an informed consent and release form. A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, the administrator assisted the participants.

The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. Participants were instructed to perform the tasks (see specific instructions below):

- As quickly as possible making as few errors and deviations as possible.
- Without assistance; administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use.
- Without using a think aloud technique.

[6] Constructing appropriate tasks is of critical importance to the validity of a usability test. These are the actual functions, but most tasks contain larger and more fleshed out context that aligns with the sample data sets available in the tested EHR. Please consult usability references for guidance on how to construct appropriate tasks.
[7] All participant data must be de-identified and kept confidential.

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task.

Participants' demographic information, task success rate, time on task, errors, deviations and verbal responses recorded into a spreadsheet.

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room.

To ensure that the environment was comfortable for users, noise level were kept to a minimum with the ambient temperature within a normal range.

TEST ENVIRONMENT

The EHRUT was tested in each participants work place using equipment normally used when working. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to the each participant:

Thank you for participating in this study. Your input is very important. During your test session you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. I did not have any involvement in its creation, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.

Following the procedural instructions, participants were shown the EHR and as their first task, were given time to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description to you and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you

not *talk aloud or verbalize while you are doing the tasks.* [9] *I will ask you your impressions about the task once you are done.*

[8] There are a variety of tools that record screens and transmit those recordings across a local area network for remote observations.

USABILITY METRICS

According to the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, EHRs should support a process that provides a high level of usability for all users. The goal is for users to interact with the system effectively, efficiently, and with an acceptable level of satisfaction. To this end, metrics for effectiveness, efficiency and user satisfaction were captured during the usability testing. The goals of the test were to assess:

1. Effectiveness of mdTimeline EHR by measuring participant success rates and errors
2. Efficiency of mdTimeline EHR by measuring the average task time and path deviations
3. Satisfaction with mdTimeline EHR by measuring ease of use ratings

[9] Participants should not use a think-aloud protocol during the testing. Excessive verbalization or attempts to converse with the moderator during task performance should be strongly discouraged. Participants will naturally provide commentary, but they should do so, ideally, after the testing. Some verbal commentary may be acceptable between tasks, but again should be minimized by the moderator.

DATA SCORING

The following table details how tasks were scored, errors evaluated , and the time data analyzed.[10]

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor that allows some time buffer because the participants are presumably not trained to expert performance.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an "Failures." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors.[11] This should also be expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types should be collected.

Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.

[10] An excellent resource is Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman. Also see www.measuringusability.com

[11] Errors have to be operationally defined by the test team prior to testing.

	It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. [12] Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of the mdTimeline EHR overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly."

Table [x]. Details of how observed data were scored.

RESULTS

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above.

The results in the following pages should be seen in light of the objectives and goals. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

[12] See Tedesco and Tullis (2006) for a comparison of post-task ratings for usability tests. Tedesco, D. & Tullis, T. (2006) A comparison of methods for eliciting post-task subjective ratings in usability testing. *Usability Professionals association Conference*, June 12 – 16, Broomfield, CO.

RESULTS TABLE

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors Mean(%)	Task Errors - Std Dev %)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifier	UCD Process Selected	UCD Process Details
a.1.1	Change Medication Order	0.8911	0.08	10	9	44	3	3	22	0.1089	0.09	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.1.2	Access Medication Order	1	0	3	3	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.1.3	Record Medication Order	0.9231	0.05	7	6	90	1	1	45	0.09	0.06	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.2.1	Record Laboratory Order	0.9459	0.04	7	7	92	3	3	46	0.09	0.04	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.2.2	Change Laboratory Order	0.7895	0.15	15	12	120	7	7	60	0.25	0.19	Likert	3.5	1.06	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.2.3	Access Laboratory Order	1	0	3	3	40	1	1	20	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.3.1	Record Radiology/Imaging Order	0.9722	0.02	7	7	90	2	2	45	0.05	0.02	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.3.2	Access Radiology/Imaging Order	1	0	3	3	40	1	1	20	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.3.3	Change Radiology/Imaging Order	0.8633	0.1	14	12	120	6	6	60	0.15	0.11	Likert	3.5	1.06	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.4.1	Adjustment of severity level of drug-drug interventions	0.9735	0.02	11	11	140	3	3	70	0.05	0.02	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

RESULTS TABLE (Cont.)

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors Mean(%)	Task Errors - Std Dev %)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifier	UCD Process Selected	UCD Process Details
a.4.2	Create drug-drug and drug-allergy interventions prior to CPOE completion	0.9244	0.05	12	11	160	4	4	80	0.10	0.06	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.5.1	Record Demographics (Recorded patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity)	0.7143	0.2	3	2	200	6	6	100	0.35	0.28	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.5.2	Access Demographics	1	0	2	2	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.5.3	Change Demographics (Changed patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity)	0.8824	0.08	3	3	120	3	3	60	0.17	0.09	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.6.1	Change Problem List	0.8889	0.08	9	8	80	4	4	40	0.15	0.09	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.6.2	Record Problem List	0.9524	0.03	4	4	110	2	2	105	0.10	0.04	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.6.3	Access Problem List	1	0	1	1	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.7.1	Record Medication List	0.9375	0.04	6	6	60	3	3	30	0.09	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.7.2	Access Medication List	1	0	1	1	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.7.3	Change Medication List	0.8696	0.09	9	8	72	3	3	36	0.18	0.11	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, LICOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

RESULTS TABLE (Cont.)

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors Mean(%)	Task Errors - Std Dev %)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifier	UCD Process Selected	UCD Process Details
a.8.1	Record Medication Allergy List	0.9286	0.05	14	13	140	4	4	70	0.12	0.05	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.8.2	Change Medication Allergy List	0.9565	0.03	12	11	72	2	2	36	0.09	0.03	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.8.3	Access Medication Allergy List	1	0	1	1	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.1	Activate, trigger and configure clinical decision support intervention with problem list	0.8333	0.12	17	14	80	6	6	40	0.25	0.14	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.2	Activate, trigger and configure clinical decision support intervention with Demographics	0.7895	0.15	8	6	80	5	5	40	0.20	0.19	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.3	Activate, trigger and configure clinical decision support intervention with Medication Allergy List	0.8511	0.11	14	12	136	5	5	68	0.45	0.12	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.4	Activate, trigger and configure clinical decision support intervention with Lab Tests and Results	0.8589	0.1	16	14	120	7	7	60	0.45	0.12	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.5	Log into the system with the various users provided and verify the limitations identified for each	0.8032	0.14	25	20	240	7	7	120	0.23	0.17	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.6	Activate, trigger and configure clinical decision support intervention with Vital Signs	0.916	0.06	13	12	100	4	4	50	0.40	0.06	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.7	Activate, trigger and configure clinical decision support intervention with medication List	0.8276	0.12	15	12	130	6	6	65	0.25	0.15	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.8	Activate, trigger and configure clinical decision support intervention with Medication & Medication Allergies	0.916	0.06	13	12	100	4	4	50	0.40	0.06	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJACW, NAZOW, LETOW, UCDW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

RESULTS TABLE (Cont.)

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors Mean(%)	Task Errors - Std Dev %)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifier	UCD Process Selected	UCD Process Details
a.9.9	Infobutton test for problem list	1	0	3	3	40	1	1	20	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.10	Infobutton test for medication list	1	0	3	3	40	1	1	20	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.11	Activate, trigger for CPOE problem list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)	0.9375	0.04	6	6	70	2	2	35	0.25	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.12	Activate, trigger for CPOE medication list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)	1	0	10	10	80	1	1	40	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.9.13	Activate, trigger for CPOE medication allergy list by incorporating CCDA (Bibliographic citation, developer, funding source, & revision date attributes were inspected)	0.9375	0.04	6	6	70	2	2	35	0.25	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.14.1	Access Implatable Devices List (Active & Inactive)	1	0	2	2	12	0	0	6	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.14.2	Change Implantable Device Status	0.9375	0.04	3	3	20	0	0	10	0.10	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
a.14.3	Record Implantable Devices	1	0	10	10	80	1	1	40	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.2.1	Review, validate and reconcile the active medication list, allergy list and problem list with data from an external source	0.8046	0.14	9	7	140	5	5	70	0.24	0.17	Likert	4.5	0.35	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SUAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

RESULTS TABLE (Cont.)

Task Identifier	Task Description	Task Success - Mean (%)	Task Success - Std Dev (%)	Task Path Deviation - Observed #	Task Path Deviation - Optimal #	Task Time - Mean (seconds)	Task Time - Standard Deviation (seconds)	Task Time Deviation - Mean Observed Seconds	Task Time Deviation - Mean Optimal Seconds	Task Errors Mean(%)	Task Errors - Std Dev %)	Task Rating - Scale Type	Task Rating	Task Rating - Standard Deviation	Participant Identifier	UCD Process Selected	UCD Process Details
b.2.2	Generate CCDA with reconciled data	1	0	2	2	20	0	0	15	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.1	Receive Fill Status Notification	1	0	3	3	20	0	0	10	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.2	E-prescribe New Prescription	0.9375	0.04	6	6	70	2	2	35	0.25	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.3	Cancel Prescription	0.8333	0.12	2	2	10	0	0	5	0.07	0.14	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.4	Refill Prescription	1	0	4	4	30	1	1	20	0	0	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.5	Change Prescription (dosage or duration)	0.9722	0.02	14	14	110	3	3	55	0.50	0.02	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
b.3.6	Request & receive medication history information	0.9375	0.04	3	3	20	0	0	10	0.10	0.05	Likert	5	0	JAS, MARIAS, PCMO, PLMO, AZMO, RALMO,SJAOW, NAZOW, LETOW, UCOW	ISO 9241-11	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

mdTimeline EHR should protect the user and patient from potential use errors, all results were analyzed and as product of this analysis we were able to identify the following areas that might engender use errors:

1A. Potential Patient Identification Errors:

#	Review	Severity Rating
1A.1	All display windows should have a title or header with two patient identifiers	Medium

1B. Mode Errors:

#	Review	Severity Rating
1B.1	Include warning for unusual medication dose	High
1B.2	Include alert for viewing data from a previous date	Medium

1C. Data Availability Errors:

#	Review	Severity Rating
1C.1	Identify unsigned notes clearly as “Notes in progress”	Low

1D. Interpretation Errors:

#	Review	Severity Rating
1D.1	Measurement system should be assigned as an administrative function	Medium

1E. Error Prevention:

#	Review	Severity Rating
1E.1	All data entry fields should include data format when appropriate	Low

APPENDICES

The following appendices include supplemental data for this usability test report. Following is a list of the appendices provided:

1: Consent Forms