

EHR Usability Test Report of AdvancedMD Version 12.5

Report based on ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports

AdvancedMD Version 12.5

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Report Prepared by:	Trent Peterson (UX Analyst / Designer) 801-643-3288 tpeterson@advancedmd.com

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EXECUTIVE SUMMARY

A usability test of AdvancedMD AdvancedEHR was conducted between September 1st and September 14th 2018 in South Jordan Utah via a real-time screen sharing application with participants joining from their own various locations, by Trent Peterson a user experience analyst and designer employed by AdvancedMD . The purpose of this study was to assess 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 clinical healthcare workers matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 39 tasks typically conducted using an EHR:

Table: Tasks and Certification Criteria

Task	Task Description	Criteria
1	Record patient demographics	170.315 (a)(5)
2	Modify patient demographics	170.315 (a)(5)
2.1	Display changed patient demographics	170.315 (a)(5)
3	Select a patient	---
4.1	Trigger, attend and interpret CDS intervention for Age/Gender	170.315 (a)(9)
4.2	Trigger, attend and interpret CDS for laboratory tests	170.315 (a)(9)
4.3	Trigger, attend and interpret CDS intervention for vital signs	170.315 (a)(9)
5	Review active / historic problems	170.315 (a)(6)
6	Change a problem to historic	170.315 (a)(6)
7	Display current and historical medication orders	170.315 (a)(1)
8	Make medication historical	170.315 (a)(1)
8.1	Display changed CPOE medication order	170.315 (a)(1)
9	Review Active / Inactive medication allergies.	170.315 (a)(8)
10	Record medication allergy	170.315 (a)(8)
11	Change a medication allergy to inactive.	170.315 (a)(8)
12	Modify medication allergy	170.315 (a)(8)
13	Record medication via CPOE	170.315 (a)(7)
14	Trigger, attend and interpret CDS intervention for drug-drug interaction, and access information.	170.315 (a)(4)
15	Modify medication via CPOE	170.315 (a)(7)
15.1	Display inactive medication list	170.315 (a)(7)
15.2	Display active medication list	170.315 (a)(7)
16	Create Lab order	170.315 (a)(2)
17	Modify Lab order	170.315 (a)(2)
17.1	Display Modified Lab order	170.315 (a)(2)

18	Modify problem	170.315 (a)(6)
19	Record problem	170.315 (a)(6)
20	Trigger, attend and interpret CDS intervention for problem list, and access information.	170.315 (a)(9)
21	and access patient educational information.	170.315 (a)(9)
22	Create imaging order	170.315 (a)(3)
23	Modify imaging order	170.315 (a)(3)
23.1	Display changed CPOE imaging Order	170.315 (a)(3)
24	Prescribe medication	170.315 (a)(1)
25	Trigger, attend and interpret CDS intervention for drug-allergy interaction, and access information.	170.315 (a)(9)
26	Modify prescription	170.315 (a)(1)
27	Trigger, attend and interpret CDS intervention for medication list, diagnostic and therapeutic reference resources	170.315 (a)(9)
28	Create new ePrescribed liquid medication (metric only)	170.315 (b)(3)
29	Cancel ePrescribed medication	170.315 (b)(3)
30	View cancellation response for a canceled ePrescribed medication	170.315 (b)(3)
31	Request and receive medication history information	170.315 (b)(3)
31.1	Trigger, attend and interpret CDS upon incorporation of summary care	170.315 (a)(9)
32	Review and approve eRefill medication request, approve and allow refills	170.315 (b)(3)
33	Review and respond to pharmacy change request: Approve a Therapeutic Change	170.315 (b)(3)
34	Review and respond to pharmacy change request: Approve/Deny a Generic Change	170.315 (b)(3)
35	Review and respond to pharmacy change request: Approve/Deny Prior Authorization	170.315 (b)(3)
36	Receive fill status notification	170.315 (b)(3)

During the 60 minute 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 2); they were instructed that they could withdraw at any time. Participants had prior experience with the EHRUT, but not with the version of the EHRUT being tested. Participants were provided an eight minute pre-recorded training session prior to the study session. This training session introduced the concept of pharmacy requests and demonstrated the user interface constructs for manipulating these requests. The training video was sent to the participants in the weeks before the study. Some participants elected not to watch the video.

At the time of the study, the administrator described the purpose of the study, asked the participant to complete a background questionnaire, and instructed the participant to complete a series of tasks using the EHRUT. During the study, the administrator timed the tasks and recorded path deviations and errors, along with significant verbalization regarding the user experience. The administrator did not give the participant assistance in how to complete the task. Participant screens, and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

- The number of tasks successfully completed within the allotted time without assistance.
- Time to complete the tasks
- Number and type of errors
- Path deviations
- Participant verbalizations
- Participant satisfaction ratings for each task and for the system

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated with a \$50 gift certificate for their time. 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. Following is a summary of the performance and rating data collected on the EHRUT with tasks grouped by certification criteria and averaged within each group. (For a task by task breakdown of the data, see the Section 4.1 DATA ANALYSIS AND REPORTING).

Table: Results Overview

Task Category	Success (%)		Errors	Deviations	Task Rating	Tasks
	Total	Within Target	Mean	Mean	Mean	
170.315 (a)(1)	100	94	0	0.04	4.64	7, 8, 8.1, 24, 26
170.315 (a)(2)	100	97	0	0	4.63	16, 17, 17.1
170.315 (a)(3)	80	77	0	0.34	4.13	22, 23, 23.1
170.315 (a)(4)	100	100	0	0	4.4	14
170.315 (a)(5)	90	87	0	0.07	4.53	1, 2, 2.1
170.315 (a)(6)	98	90	0	0.11	4.75	5, 6, 18, 19
170.315 (a)(7)	100	90	0.03	0.08	4.15	13, 15, 15.1, 15.2
170.315 (a)(8)	100	95	0	0.05	4.85	9, 10, 11, 12
170.315 (a)(9)	99	98	0	0.01	4.49	4.1, 4.2, 4.3, 20, 21, 25, 27, 31.1
170.315 (b)(3)	92	79	0	0.2	4.18	28, 29, 30, 31, 32, 33, 34, 35, 36

The results from the System Usability Scale (SUS) scored the subjective satisfaction with the system based on performance with these tasks to be 84.5. A SUS score of 68 is considered average.

In addition to the performance data, the following qualitative observations were made (see section 4.3.5 for a full list and more in depth discussion of MAJOR FINDINGS):

MAJOR FINDINGS

- Participants rated the tasks between “Easy” and “Very Easy” (4.47) on average. Showing that the UI has achieved a high degree of usability.
- Tasks marked as ‘High Risk’ were rated between “Easy” and “Very Easy” (4.37) on average.
- In several places in the system, the user is editing a item type, and the title in the panel header is “Edit XXXX”. Several participants were temporarily confused by this title, thinking that it was a link that they needed to click in order to initiate editing.
- Participants were confused about which functions were to be found within the patient record, and which were outside of the individual patient record in the ‘Tools’. For example, refill requests are grouped together in tools, but several participants expects to find it in the patient record.
- Several actions are hidden from the user under a generic “Actions” menu. Several participants were unable to find these actions on their first attempt. Most were able to find the hidden actions after searching for a short time.
- One task required the participants to select a ‘test set’ from a popup dialog which contained a scrollable list of options. Most participants failed to recognize that the list was scrollable. Instead, they assumed that the options they saw in initial list were all the options available.
- In the ‘Tools’ area, in the Pharmacy Requests, in some cases there will be a large number of items for the user to process. Participants were given a large list of items to simulate this circumstance. Participants scrolled through this long list instead of noticing and invoking the filter for the list which is shown constantly at the top of the page.
- In the ‘Tools’ area, in the Pharmacy Requests, when there are a larger number of request, they push the title bar that divides and categorizes the types of requests off the bottom of the page. Users therefore didn’t know that the contents of the page were divided into different types.

AREAS FOR IMPROVEMENT

- Help users understand when to go to the individual patient record and when to go to the tools area for required functions. Or, cross link the functionality, so the use can get to the pharmacy requests for a patient through the patient record.
- Move important actions out from under the “Actions” menu, into their own reserved space so that users will more easily find them.
- Provide a visual indicator in scrollable pop-up lists that there are more options than what is initially showing in the list.

INTRODUCTION

The EHRUT tested for this study was AdvancedMD AdvancedEHR version 12.5. Designed to present medical information to healthcare providers in ambulatory care setting, the EHRUT consists of features that include but are not limited to:

- Patient demographics
- Patient problem, medication and medication allergy lists
- Patient encounter chart notes
- Patient clinical summary documents
- Lab order creation (sending & results may be printed and entered manually, or using an HL7)
- Growth Charting
- Immunization recording
- Electronic Prescribing
- Drug-drug, drug-allergy, and drug-problem interaction checking
- Clinical Quality reporting
- Clinical Decision Support and patient condition monitoring (HealthWatcher)

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, such as successful task completion rate, time on task, number and types of errors, and participant perception of learnability, and satisfaction were captured during the usability testing.

METHOD

3.1 PARTICIPANTS

A total of 10 participants were recruited for the test.

Participants in the test were Physicians and Clinical Staff members including Physicians Assistants, Nurses, and other clinical assistants who are normally responsible for data entry during a patient visit. Five Office Managers with significant clinical experience also participated. Participants were recruited by AdvancedMD Employees and were compensated with a \$50 gift certificate for their time. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received. For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; an example of a screener is provided in APPENDIX 1: Sample Recruiting Screener.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Table: Participant Demographics.

ID	Gender	Age	Patient Education	Occupation / Role	Professional Experience *	Computer Experience *	AdvancedMD Experience *
1	Female	20 - 29	Associate degree	Clinical Staff	120	180	48
2	Male	60 - 69	Associate degree	Clinical Staff	48	228	18
3	Female	40 - 49	Bachelor's degree	Office Manager	240	300	36
4	Male	60 - 69	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Provider	408	408	6
5	Male	30 - 39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Office Manager	36	360	24
6	Male	30 - 39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Provider	96	240	36
7	Female	50 - 59	Some college credit, no degree	Office Manager	360	360	60
8	Male	30 - 39	Bachelor's degree	Office Manager	156	180	48
9	Female	30 - 39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	Provider	120	240	24
10	Male	20 - 29	Some college credit, no degree	Office Manager	48	96	12

* Experience is reported as the number of months.

Note: None of the participants required assistive technologies.

3.2 STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with high 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 EHRUT in their preferred location and were monitored and recorded remotely using GoToMeeting conferencing software. Each participant in the two groups was provided with the same tasks and instructions as others in their group. The system was evaluated for effectiveness, efficiency, learnability, and satisfaction as defined by measures collected and analyzed for each participant:

- The number of tasks successfully completed within the allotted time without assistance.
- Time to complete the tasks successfully.
- Number of errors
- Path deviations
- Participant's verbalizations
- Participant's ratings of task difficulty
- Participant satisfaction ratings for the system

Additional information about the various measures can be found in Section 3.9 on Usability Metrics.

3.3 TASKS

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

A risk level category was assigned to each task prior to the test based on an assessment of risk involved in the task. 'Risk' was operationally defined for the purposes of this test as "The potential for negative patient outcomes due to 1. the inability of a user to complete the task, 2. the inability of a user to complete the task in a timely manner, 3. the inability of a user to complete the task without major errors." A discussion of the test results in relation to this risk assessment follows (see section 4.3.4 Risk Evaluation).

The tasks, their certification criteria category, and the assigned risk level category are specified below:

Table: Tasks and Related Certification Criteria and Risk Level Category.

Task	Task Description	Criteria	Risk
1	Record patient demographics	170.315 (a)(5)	Low
2	Modify patient demographics	170.315 (a)(5)	Low
2.1	Display changed patient demographics	170.315 (a)(5)	Low
3	Select a patient	---	
4.1	Trigger, attend and interpret CDS intervention for Age/Gender	170.315 (a)(9)	High
4.2	Trigger, attend and interpret CDS for laboratory tests	170.315 (a)(9)	High
4.3	Trigger, attend and interpret CDS intervention for vital signs	170.315 (a)(9)	High
5	Review active / historic problems	170.315 (a)(6)	Low
6	Change a problem to historic	170.315 (a)(6)	Low
7	Display current and historical medication orders	170.315 (a)(1)	Low
8	Make medication historical	170.315 (a)(1)	Low
8.1	Display changed CPOE medication order	170.315 (a)(1)	Low
9	Review Active / Inactive medication allergies.	170.315 (a)(8)	Low
10	Record medication allergy	170.315 (a)(8)	High
11	Change a medication allergy to inactive.	170.315 (a)(8)	Medium
12	Modify medication allergy	170.315 (a)(8)	Medium
13	Record medication via CPOE	170.315 (a)(7)	High
14	Trigger, attend and interpret CDS intervention for drug-drug interaction, and access information.	170.315 (a)(4)	High
15	Modify medication via CPOE	170.315 (a)(7)	High
15.1	Display inactive medication list	170.315 (a)(7)	Low
15.2	Display active medication list	170.315 (a)(7)	Low
16	Create Lab order	170.315 (a)(2)	Medium

17	Modify Lab order	170.315 (a)(2)	Medium
17.1	Display Modified Lab order	170.315 (a)(2)	Medium
18	Modify problem	170.315 (a)(6)	Low
19	Record problem	170.315 (a)(6)	High
20	Trigger, attend and interpret CDS intervention for problem list, and access information.	170.315 (a)(9)	High
21	and access patient educational information.	170.315 (a)(9)	Medium
22	Create imaging order	170.315 (a)(3)	Medium
23	Modify imaging order	170.315 (a)(3)	Medium
23.1	Display changed CPOE imaging Order	170.315 (a)(3)	Low
24	Prescribe medication	170.315 (a)(1)	High
25	Trigger, attend and interpret CDS intervention for drug-allergy interaction.	170.315 (a)(4)	High
25.1	Trigger, attend and interpret CDS intervention for drug-allergy interaction, and access information.	170.315 (a)(9)	High
26	Modify prescription	170.315 (a)(1)	High
27	Trigger, attend and interpret CDS intervention for medication list, diagnostic and therapeutic reference resources	170.315 (a)(9)	High
28	Create new ePrescribed liquid medication (metric only)	170.315 (b)(3)	High
29	Cancel ePrescribed medication	170.315 (b)(3)	High
30	View cancellation response for a canceled ePrescribed medication	170.315 (b)(3)	Low
31	Request and receive medication history information	170.315 (b)(3)	Medium
31.1	Trigger, attend and interpret CDS upon incorporation of summary care	170.315 (a)(9)	Medium
32	Review and approve eRefill medication request, approve and allow refills	170.315 (b)(3)	High
33	Review and respond to pharmacy change request: Approve a Therapeutic Change	170.315 (b)(3)	High
34	Review and respond to pharmacy change request: Approve/Deny a Generic Change	170.315 (b)(3)	High
35	Review and respond to pharmacy change request: Approve/Deny Prior Authorization	170.315 (b)(3)	High
36	Receive fill status notification	170.315 (b)(3)	Medium

The full text of each task is included in APPENDIX 5: Test Questions / Tasks.

3.4 PROCEDURES

After the participants were scheduled, they were sent a confirmation email with the testing date and time, as well as a link for joining the scheduled GoToMeeting session. This email also contained a link to a short training video. This video described the new functionality of the EHRUT at a high level, and was meant to mirror the introduction to the new material that the user would normally receive upon purchasing the software.

At the start of each test session, the administrator greeted the participant as he/she joined the GoToMeeting session and informed the participant of who was in the room and observing the session.

The participant was then directed to read and sign an online form which contained a statement of Informed consent for participating in the usability test, and consent to record the test session (See APPENDIX 2).

After gaining participant consent, the administrator started recording the session.

The usability test administrator conducting the test was an experienced usability practitioner with 18 years of experience in user experience design and usability evaluation, and a Ph. D. in a field related to user experience design and evaluation.

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 task success, path deviations, and the number and type of errors. The administrator also took notes on the participant's verbalizations. A custom spreadsheet was created to serve as a test template and a data gathering tool. This enabled the administrator to both take notes and track task times, success, etc.

The administrator gave the participants the following instructions regarding the test:

- Read each task out loud when directed.
- Complete each task as quickly as possible while making as few errors and deviations as possible.
- The test administrator will not answer questions about how to complete the task, but may answer questions to clarify the tasks.
- Say "Finished" or "Done" when you have successfully completed each task.
- Rate the difficulty of completing each task on the 5 point scale that is provided.

Participants were then instructed to login to the EHRUT using credentials provided by the test administrator.

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

Following the test session, the administrator gave the participant the post-test questionnaire and thanked the individual for their participation.

Participants' task success rate, time on task, errors, deviations, pertinent verbalizations and post-test questionnaire responses were recorded into a spreadsheet for compilation and analysis.

3.5 TEST LOCATION

The test was conducted remotely with the use of the screen sharing feature in the video conferencing software GoToMeeting, thus the actual test location was at the discretion of the test participants. The test administrator was located together in the South Jordan, UT AdvancedMD Software corporate office.

3.6 TEST ENVIRONMENT

The EHRUT would typically be used on a mobile device in the healthcare office or facility, either to document patient encounters during the encounter or for post-encounter documentation.

For testing, the participants were logged into an 'emulator' version of the mobile software, on the administrator's desktop, via the GoToMeeting software. This emulator showed an exact copy of the software that the participant would encounter on the mobile software. This substitution was done in order that the administrator could view the interactions of the participant with the software.

The administrator set up the data within the EHRUT prior to each test session. The data consisted of fabricated patient records representative of real patient records. The system was set up with the usual default settings and user preferences.

The application is a cloud-based SAAS (Software as a Service) application, and was running in a production environment, though with fabricated data. The performance (i.e response time) of the system was representative to what users would experience in a field implementation.

3.7 TEST FORMS AND TOOLS

During the usability test, various documents and instruments were used including:

- Informed Consent / Release Form
- Background and Demographics Questionnaire
- Test Instructions
- Test Questions / Tasks
- System Usability Survey (SUS) questionnaire.

Examples of these documents can be found in APPENDICES 2–6.

Participants' interactions with the EHRUT were captured and recorded using the screen recording capability of the GoToMeeting software. A spreadsheet was used to capture task times, path deviations and errors.

3.8 PARTICIPANT INSTRUCTIONS

The Administrator reads the following instructions aloud to each participant.

“Thank you for volunteering to participate in our usability study today. Your input is very important to AdvancedMD.

Today’s session is a test of our Mobile EHR, how easy or how difficult it is to use. It is not a test of you or your skills or abilities. So, if some tasks seems more difficult, remember it is the fault of the system, and it is the purpose of this test to identify those faults.

I am going to give you a series of tasks to complete. You may ask me questions during the test, however, I may be unable to answer all of them.

Examples of questions I can answer are spelling of names, medications, conditions etc., clarification of task instructions, to repeat things that I have said, or you may ask me to provide ICD codes if that it helpful to you.

An example of questions I cannot answer are “what should I click?” or “where should I go to find this?”

Do you have any questions about these instructions before we begin?”

Following these verbal instructions, the participant was given written Test Instructions (APPENDIX 4)

3.9 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 and efficiently, with an acceptable level of satisfaction. Metrics for effectiveness, efficiency, and satisfaction were captured during the usability testing. The goals were to assess:

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

Data Scoring

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

Measures	Rationale and Scoring
Effectiveness Task Success	<p>A task was counted as a “Success” if the participant was able to achieve the correct outcome, without assistance. Successes were then further divided for analysis as whether or not it was completed within the time allotted (*) on a per task basis.</p> <p><i>(*) In the time calculation, administrators took into account irrelevant time spent correcting user typos (as repeated typing mistakes are not considered a UX issue) and time spent by some participants pausing the task to try to comment right away on the feature; even though instructed not to, some participants eager to share comments would sometimes forget this instruction and needed to be reminded to wait until after the task to share their thoughts.</i></p> <p>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.</p> <p>Task times were recorded for successes only.</p> <p>Optimal task performance time under realistic conditions is estimated and recorded when constructing tasks. Target task times are operationally defined by taking measures of optimal performance and multiplying by a factor (1.25 for 60+ second tasks and 1.5 for less than 60 second tasks to allow a buffer because the participants are presumably not trained to expert performance). For instance, if expert optimal performance for a task is 120 seconds, adjusted target task time is 150 (120 x 1.25) seconds and if optimal performance for a task is 10 seconds, adjusted target task time is 15 (10 x 1.5) seconds.</p>
Effectiveness Task Failures	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, the task was counted as a “Failure.” No task times were taken for errors.</p> <p>The total number of errors, average and standard deviation were calculated for each task. Not all deviations would be counted as errors.</p>

Efficiency Task Time	<p>The participant's path (i.e., steps) through the application was recorded. A deviation is recorded 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.</p> <p>A deviation is qualified as minor, for instance:</p> <ul style="list-style-type: none"> ● If the path followed leads to a success without errors but requires more steps. ● If the user notices after the step that it is not the right path and returns easily to the previous step and is able to continue and return on the optimal path without patient safety concerns. ● In all cases, a deviation can only be minor if there are no errors, if patient safety is not compromised or if user shows awareness that he/she requires making a correction to pursue the task. <p>A deviation is qualified as major, for instance:</p> <ul style="list-style-type: none"> ● If the participant cannot return to the optimal path and/or cannot complete the task. ● If the participant believes he/she completed the task successfully but did not. ● If through the workflow, data captured or not captured could potentially affect patient safety. <p>Typically, a major deviation would lead to documentation of an error for the task, unless users realizes the error and makes the required correction so no patient safety issues result once task is completed.</p> <p>Optimal paths (i.e. steps) were recorded when constructing tasks and task deviations are reported. The total number of deviations, average and standard deviation were calculated for each task.</p>
Efficiency Task Time	<p>Each task is timed from when the administrator said "Begin" until the participant indicates they are "Done" whether they have completed the task, think they have completed the task or abandon the task. The time is then stopped.</p> <p>Only task times for tasks that are successfully completed are included in the average task time analysis. Average time per task is calculated for each task.</p> <p>Variance measures (weighted average and standard deviation) are also calculated.</p>
Satisfaction Task Rating	<p>Participant's subjective impression of the ease of use of the application is measured by asking the participant after each task to rate the task "Overall" from 1 (very difficult) to 5 (Very Easy). These data are averaged across participants. Common convention is that average ratings for systems judged easy to use should be 3.3 or above.</p> <p>To measure participants' confidence in and likeability of Hello Health overall, participants are also asked to complete 2 post-test questionnaires (Final questions and System Usability Scale).</p>

RESULTS

4.1 DATA ANALYSIS AND REPORTING

The usability testing results are detailed in the tables below. The results should be seen in light of the objectives and goals outlined in the Study Design section. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Failures, deviations and errors are commented as annotations below each table.

Table: Results Summary

Task	N	Success	Success within Target	Errors		Path Deviations		Task Time		Task Rating
	#	# / (%)	# / (%)	#	Mean (SD)	#	Mean (SD)	Mean (SD)	Target *	Mean **
1	10	9 (90)	8 (80)	1	0.1 (0.32)	3	0.3 (0.67)	160 (51.76)	250	4.2
2	10	9 (90)	9 (90)	0	0 (0)	1	0.1 (0.32)	60.8 (33.24)	150	4.7
2.1	10	9 (90)	9 (90)	0	0 (0)	0	0 (0)	1.5 (0.71)	150	4.7
3	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	20.3 (9.52)	60	4.9
4.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	13.3 (5.36)	45	4.3
4.2	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	13.3 (5.36)	45	4.3
4.3	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	13.3 (5.36)	45	4.3
5	10	10 (100)	9 (90)	0	0 (0)	0	0 (0)	35.5 (34.33)	60	4.7
6	10	9 (90)	8 (80)	0	0 (0)	4	0.4 (0.52)	11.9 (7.38)	23	4.8
7	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	16.9 (13.62)	60	4.8
8	10	10 (100)	9 (90)	0	0 (0)	1	0.1 (0.32)	29.5 (30.86)	45	4.6
8.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	1.8 (1.03)	45	4.6
9	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	24.5 (20.33)	125	4.7
10	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	22.1 (19.93)	75	5
11	10	10 (100)	9 (90)	0	0 (0)	1	0.1 (0.32)	19.9 (33.83)	75	4.9
12	10	10 (100)	9 (90)	0	0 (0)	1	0.1 (0.32)	38.7 (21.66)	94	4.8
13	10	10 (100)	8 (80)	1	0.1 (0.32)	3	0.3 (0.48)	131.6 (107.79)	150	4
14	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	10.7 (5.54)	119	4.4
15	10	10 (100)	8 (80)	0	0 (0)	0	0 (0)	94.5 (61.28)	113	4.2
15.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	2 (0)	113	4.2

15.2	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	1.6 (0.84)	113	4.2
16	10	10 (100)	9 (90)	0	0 (0)	0	0 (0)	45.3 (29.44)	75	4.5
17	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	20.7 (20.03)	75	4.7
17.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	2.7 (1.42)	75	4.7
18	10	10 (100)	10 (100)	0	0 (0)	1	0.1 (0.32)	28.2 (17.19)	138	4.7
19	10	10 (100)	9 (90)	0	0 (0)	0	0 (0)	27.4 (15.96)	45	4.8
20	10	9 (90)	9 (90)	0	0 (0)	0	0 (0)	6.7 (10.44)	75	4.6
21	10	10 (100)	10 (100)	0	0 (0)	1	0.1 (0.32)	27.3 (25.61)	75	4.6
22	10	8 (80)	7 (70)	2	0.2 (0.42)	5	0.5 (0.71)	92.9 (97.23)	150	4.2
23	10	8 (80)	8 (80)	0	0 (0)	3	0.3 (0.48)	24.1 (28.56)	94	4.1
23.1	10	8 (80)	8 (80)	0	0 (0)	0	0 (0)	1.6 (0.93)	94	4.1
24	10	10 (100)	9 (90)	0	0 (0)	1	0.1 (0.32)	77.1 (20.43)	113	4.6
25	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	10.3 (5.23)	75	4.7
25.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	10.3 (5.23)	75	4.7
26	10	10 (100)	9 (90)	0	0 (0)	0	0 (0)	52.9 (48.86)	75	4.6
27	10	10 (100)	9 (90)	0	0 (0)	0	0 (0)	20.2 (17)	38	4.7
28	10	10 (100)	10 (100)	0	0 (0)	1	0.1 (0.32)	112.3 (55.18)	263	4.2
29	10	8 (80)	5 (50)	2	0.2 (0.42)	3	0.3 (0.67)	48.5 (38.88)	75	4.3
30	10	9 (90)	9 (90)	1	0.1 (0.32)	0	0 (0)	44.5 (17.8)	150	4.2
31	10	8 (80)	8 (80)	2	0.2 (0.42)	4	0.4 (0.52)	60.2 (24.12)	125	4.4
31.1	10	10 (100)	10 (100)	0	0 (0)	0	0 (0)	21.4 (10.9)	125	4.4
32	10	9 (90)	8 (80)	0	0 (0)	3	0.3 (0.48)	75.3 (45.26)	150	4
33	10	10 (100)	7 (70)	0	0 (0)	8	0.8 (0.79)	161.9 (99.45)	150	3.4
34	10	10 (100)	9 (90)	0	0 (0)	1	0.1 (0.32)	43.3 (31.16)	75	4.1
35	10	9 (90)	6 (60)	1	0.1 (0.32)	0	0 (0)	47.7 (41.86)	75	4.6
36	10	10 (100)	9 (90)	0	0 (0)	2	0.2 (0.42)	69.8 (51.87)	150	4.4

* Task times are reported in seconds.

** 5 = Very Easy, 1 = Very Difficult

The results from the System Usability Scale (SUS) scored the subjective satisfaction with the system based on performance with these tasks to be 84.5. The average rating of 'ease of use' across all task was 4.47, on a 5 point scale (5 = 'Very Easy')

Task: 1 - Record patient demographics

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	145	5	
2	Y	0	0	152	2	
3	Y	0	0	210	4	
4	Y	0	0	218	4	
5	Y	0	0	273	4	
6	N	1	2	---	4	#1
7	Y	0	0	168	5	
8	Y	0	0	103	5	
9	Y	0	0	134	5	
10	Y	0	1	197	4	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 1</i>	<i>Σ: 3</i>			
		<i>x̄: 0.1</i>	<i>x̄: 0.3</i>	<i>x̄: 177.78</i>	<i>x̄: 4.2</i>	

#1 - The participant first searched for the patient. Upon initiating the search, the "+" button is hidden, and remains hidden until the user explicitly cancels the search. For this reason, the participant was unable to locate the "+" button in order to add the patient.

Task: 2 - Modify patient demographics

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	89	5	
2	Y	0	0	33	5	
3	Y	0	0	41	4	
4	Y	0	1	65	4	
5	Y	0	0	45	5	
6	N	0	0	---	5	#1
7	Y	0	0	81	5	
8	Y	0	0	48	5	
9	Y	0	0	65	5	
10	Y	0	0	141	4	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 67.56</i>	<i>x: 4.7</i>	

#1 - Because the participant had failed to add the patient in task 1, he was unable to modify the patient in this task.

Task: 2.1 - Display changed patient demographics

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	2	5	
2	Y	0	0	1	5	
3	Y	0	0	1	4	
4	Y	0	0	1	4	
5	Y	0	0	1	5	
6	N	0	0	---	5	
7	Y	0	0	2	5	
8	Y	0	0	3	5	
9	Y	0	0	2	5	
10	Y	0	0	2	4	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 1.67</i>	<i>x: 4.7</i>	

Task: 3 - Select a patient

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	30	5	
2	Y	0	0	15	5	
3	Y	0	0	21	5	
4	Y	0	0	33	4	
5	Y	0	0	32	5	
6	Y	0	0	26	5	
7	Y	0	0	12	5	
8	Y	0	0	7	5	
9	Y	0	0	17	5	
10	Y	0	0	10	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 20.3</i>	<i>x: 4.9</i>	

This task was completed by all participants without errors or path deviations.

Task: 4.1 - Trigger, attend and interpret CDS intervention for Age/Gender

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	5	5	
2	Y	0	0	7	4	
3	Y	0	0	10	5	
4	Y	0	0	15	4	
5	Y	0	0	9	5	
6	Y	0	0	15	3	
7	Y	0	0	21	5	
8	Y	0	0	16	5	
9	Y	0	0	15	5	
10	Y	0	0	20	2	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 13.3</i>	<i>x: 4.3</i>	

This task was completed by all participants without errors or path deviations. Participant 10 expressed a desire to have more complete information “up front” without having to click into the details.

Task: 4.2 - Trigger, attend and interpret CDS for laboratory tests

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	5	5	
2	Y	0	0	7	4	
3	Y	0	0	10	5	
4	Y	0	0	15	4	
5	Y	0	0	9	5	
6	Y	0	0	15	3	
7	Y	0	0	21	5	
8	Y	0	0	16	5	
9	Y	0	0	15	5	
10	Y	0	0	20	2	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 13.3</i>	<i>x: 4.3</i>	

This task was completed at the same time as tasks 4.1. That is, the same alert pop-up window contained prompts for multiple CDS conditions.

Task: 4.3 - Trigger, attend and interpret CDS intervention for vital signs

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	5	5	
2	Y	0	0	7	4	
3	Y	0	0	10	5	
4	Y	0	0	15	4	
5	Y	0	0	9	5	
6	Y	0	0	15	3	
7	Y	0	0	21	5	
8	Y	0	0	16	5	
9	Y	0	0	15	5	
10	Y	0	0	20	2	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 13.3</i>	<i>x: 4.3</i>	

This task was completed at the same time as tasks 4.1. That is, the same alert pop-up window contained prompts for multiple CDS conditions.

Task: 5 - Review active / historic problems

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	33	5	
2	Y	0	0	4	4	
3	Y	0	0	19	5	
4	Y	0	0	30	4	
5	Y	0	0	15	5	
6	Y	0	0	126	5	
7	Y	0	0	17	5	
8	Y	0	0	23	5	
9	Y	0	0	39	5	
10	Y	0	0	49	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 35.5</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 6 - Change a problem to historic

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	1	15	5	#1
2	Y	0	0	5	5	
3	Y	0	0	5	5	
4	Y	0	0	21	4	
5	Y	0	1	21	5	#1
6	N	0	1	---	4	#2
7	Y	0	1	23	5	#1
8	Y	0	0	15	5	
9	Y	0	0	7	5	
10	Y	0	0	7	5	
<i>N: 10</i>	Σ Success: 9	Σ : 0	Σ : 4			
		\bar{x} : 0	\bar{x} : 0.4	\bar{x} : 13.22	\bar{x} : 4.8	

#1 - The participant was temporarily confused by the title of the window "Edit Patient". It was misunderstood to be a link that must first be clicked before editing could begin.

#2 - The participant attempted to edit the problem from the patient facesheet which contains a short / condensed version of the problem list.

Task: 7 - Review Current / Historical medications

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	10	5	
2	Y	0	0	7	5	
3	Y	0	0	21	5	
4	Y	0	0	18	5	
5	Y	0	0	3	5	
6	Y	0	0	5	5	
7	Y	0	0	25	5	
8	Y	0	0	16	5	
9	Y	0	0	14	5	
10	Y	0	0	50	3	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 16.9</i>	<i>x: 4.8</i>	

This task was completed by all participants without errors or path deviations.

Task: 8 - Make medication historical

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	22	5	
2	Y	0	0	14	3	
3	Y	0	0	21	4	
4	Y	0	0	6	5	
5	Y	0	0	16	5	
6	Y	0	1	114	4	#1
7	Y	0	0	15	5	
8	Y	0	0	37	5	
9	Y	0	0	22	5	
10	Y	0	0	28	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 29.5</i>	<i>x: 4.6</i>	

#1 - Participant was not able to locate the "Current" checkbox on the medication in order to un-check it.

Task: 8.1 - Display changed CPOE medication order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	2	5	
2	Y	0	0	2	3	
3	Y	0	0	1	4	
4	Y	0	0	3	5	
5	Y	0	0	1	5	
6	Y	0	0	1	4	
7	Y	0	0	4	5	
8	Y	0	0	2	5	
9	Y	0	0	1	5	
10	Y	0	0	1	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 1.8</i>	<i>x: 4.6</i>	

Task: 9 - Review Active / Inactive medication allergies.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	28	5	
2	Y	0	0	19	4	
3	Y	0	0	58	4	
4	Y	0	0	8	5	
5	Y	0	0	7	5	
6	Y	0	0	62	5	
7	Y	0	0	7	5	
8	Y	0	0	14	5	
9	Y	0	0	13	5	
10	Y	0	0	29	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 24.5</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 10 - Record medication allergy

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	7	5	
2	Y	0	0	11	5	
3	Y	0	0	70	5	
4	Y	0	0	10	5	
5	Y	0	0	7	5	
6	Y	0	0	29	5	
7	Y	0	0	13	5	
8	Y	0	0	15	5	
9	Y	0	0	18	5	
10	Y	0	0	41	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 22.1</i>	<i>x: 5</i>	

This task was completed by all participants without errors or path deviations.

Task: 11 - Change a medication allergy to inactive.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	7	5	
2	Y	0	0	11	5	
3	Y	0	0	7	5	
4	Y	0	0	7	5	
5	Y	0	0	13	4	
6	Y	0	1	116	5	#1
7	Y	0	0	10	5	
8	Y	0	0	11	5	
9	Y	0	0	9	5	
10	Y	0	0	8	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 19.9</i>	<i>x: 4.9</i>	

#1 - The participant was temporarily confused by the title of the window "Edit Patient". It was misunderstood to be a link that must first be clicked before editing could begin.

Task: 12 - Modify medication allergy

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	1	53	5	#1
2	Y	0	0	17	4	
3	Y	0	0	40	4	
4	Y	0	0	23	5	
5	Y	0	0	30	5	
6	Y	0	0	94	5	
7	Y	0	0	32	5	
8	Y	0	0	34	5	
9	Y	0	0	34	5	
10	Y	0	0	30	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 38.7</i>	<i>x: 4.8</i>	

#1 - The participant clicked on the "Today" button at the bottom of the date/time dialog, instead of clicking "done" at the top right of the dialog.

Task: 13 - Record medication via CPOE

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	1	140	5	#1
2	Y	0	0	73	4	
3	Y	0	0	107	4	
4	Y	0	0	70	4	
5	Y	0	0	64	2	
6	Y	1	1	412	4	#2
7	Y	0	1	91	4	#3
8	Y	0	0	66	5	
9	Y	0	0	87	5	
10	Y	0	0	206	3	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 1</i>	<i>Σ: 3</i>			
		<i>x̄: 0.1</i>	<i>x̄: 0.3</i>	<i>x̄: 131.6</i>	<i>x̄: 4</i>	

#1 - The participant successfully searched for the drug but didn't click on "Select Drug" to continue.

#2 - The participant thought that she had successfully prescribed the drug upon seeing the drug-drug interaction CDS pop-up.

#3 - The participant canceled the drug-drug interaction CDS pop-up without providing override reason. She was prompted by the system to provide a reason for the override.

Task: 14 - Trigger, attend and interpret CDS intervention for drug-drug interaction, and access information.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	5	5	
2	Y	0	0	10	4	
3	Y	0	0	14	5	
4	Y	0	0	20	4	
5	Y	0	0	14	5	
6	Y	0	0	14	2	
7	Y	0	0	3	4	
8	Y	0	0	5	5	
9	Y	0	0	7	5	
10	Y	0	0	15	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 10.7</i>	<i>x: 4.4</i>	

This task was completed by all participants without errors or path deviations.

Task: 15 - Modify medication via CPOE

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	121	5	
2	Y	0	0	50	4	
3	Y	0	0	100	3	
4	Y	0	0	78	4	
5	Y	0	0	51	4	
6	Y	0	0	81	4	
7	Y	0	0	252	4	
8	Y	0	0	55	5	
9	Y	0	0	48	5	
10	Y	0	0	109	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 94.5</i>	<i>x: 4.2</i>	

This task was completed by all participants without errors or path deviations.

Task: 15.1 - Display inactive medication list

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	2	5	
2	Y	0	0	2	4	
3	Y	0	0	2	3	
4	Y	0	0	2	4	
5	Y	0	0	2	4	
6	Y	0	0	2	4	
7	Y	0	0	2	4	
8	Y	0	0	2	5	
9	Y	0	0	2	5	
10	Y	0	0	2	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 2</i>	<i>x: 4.2</i>	

Task: 15.2 - Display active medication list

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	1	5	
2	Y	0	0	2	4	
3	Y	0	0	3	3	
4	Y	0	0	1	4	
5	Y	0	0	2	4	
6	Y	0	0	1	4	
7	Y	0	0	3	4	
8	Y	0	0	1	5	
9	Y	0	0	1	5	
10	Y	0	0	1	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 1.6</i>	<i>x: 4.2</i>	

Task: 16 - Create Lab order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	1	5	
2	Y	0	0	59	3	
3	Y	0	0	58	4	
4	Y	0	0	34	4	
5	Y	0	0	22	5	
6	Y	0	0	113	4	
7	Y	0	0	38	5	
8	Y	0	0	34	5	
9	Y	0	0	42	5	
10	Y	0	0	52	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 45.3</i>	<i>x: 4.5</i>	

This task was completed by all participants without errors or path deviations.

Task: 17 - Modify Lab order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	10	5	
2	Y	0	0	21	4	
3	Y	0	0	5	5	
4	Y	0	0	14	4	
5	Y	0	0	11	5	
6	Y	0	0	52	4	
7	Y	0	0	13	5	
8	Y	0	0	7	5	
9	Y	0	0	11	5	
10	Y	0	0	63	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 20.7</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 17.1 - Display Modified Lab order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	3	5	
2	Y	0	0	1	4	
3	Y	0	0	2	5	
4	Y	0	0	4	4	
5	Y	0	0	2	5	
6	Y	0	0	2	4	
7	Y	0	0	6	5	
8	Y	0	0	2	5	
9	Y	0	0	2	5	
10	Y	0	0	3	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 2.7</i>	<i>x: 4.7</i>	

Task: 18 - Modify problem

ID	Effectiveness		Efficiency		Satisfaction	
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	1	33	5	#1
2	Y	0	0	29	3	
3	Y	0	0	6	5	
4	Y	0	0	34	5	
5	Y	0	0	32	5	
6	Y	0	0	70	4	
7	Y	0	0	21	5	
8	Y	0	0	15	5	
9	Y	0	0	24	5	
10	Y	0	0	18	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 28.2</i>	<i>x: 4.7</i>	

#1 - The participant was temporarily confused by the title of the window "Edit Problem". It was misunderstood to be a link that must first be clicked before editing could begin.

Task: 19 - Record problem

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	30	5	
2	Y	0	0	16	4	
3	Y	0	0	33	5	
4	Y	0	0	17	4	
5	Y	0	0	12	5	
6	Y	0	0	68	5	
7	Y	0	0	22	5	
8	Y	0	0	18	5	
9	Y	0	0	27	5	
10	Y	0	0	31	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 27.4</i>	<i>x: 4.8</i>	

This task was completed by all participants without errors or path deviations.

Task: 20 - Trigger, attend and interpret CDS intervention for problem list, and access information.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	1	5	
2	Y	0	0	7	4	
3	Y	0	0	7	4	
4	Y	0	0	15	4	
5	Y	0	0	14	5	
6	N	0	0	---	5	#1
7	Y	0	0	30	5	
8	Y	0	0	14	5	
9	Y	0	0	19	5	
10	Y	0	0	10	4	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 13</i>	<i>x: 4.6</i>	

#1 - Participant failed to see, recognize, or understand the CDS alert.

Task: 21 - and access patient educational information.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	66	5	
2	Y	0	0	13	4	
3	Y	0	0	30	4	
4	Y	0	0	7	4	
5	Y	0	0	26	5	
6	Y	0	1	68	4	#1
7	Y	0	0	3	5	
8	Y	0	0	33	5	
9	Y	0	0	9	5	
10	Y	0	0	48	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 30.3</i>	<i>x: 4.6</i>	

#1 - Participant experienced difficulty locating the patient educational materials.

Task: 22 - Create imaging order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	N	1	0	---	3	#1
2	Y	0	0	73	4	
3	Y	0	1	132	2	#1
4	Y	0	0	58	4	
5	Y	0	0	36	5	
6	Y	0	2	340	5	#1
7	N	1	0	---	5	#2
8	Y	0	0	52	5	
9	Y	0	1	116	4	
10	Y	0	1	122	5	#1
<i>N: 10</i>	<i>Σ Success: 8</i>	<i>Σ: 2</i>	<i>Σ: 5</i>			
		<i>x̄: 0.2</i>	<i>x̄: 0.5</i>	<i>x̄: 116.13</i>	<i>x̄: 4.2</i>	

#1 - Participant clicked on 'order sets' and viewed the pop-up dialog containing order sets but didn't recognize that it was a scrollable list and therefore did not see the order set containing the imaging order.

#2 - Participant didn't know to click on "labs" icon to create an imaging order.

Task: 23 - Modify imaging order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	N	0	0	---	3	#1
2	Y	0	0	2	4	
3	Y	0	0	89	1	
4	Y	0	0	17	4	
5	Y	0	0	12	5	
6	Y	0	0	15	5	
7	N	0	0	---	5	#1
8	Y	0	1	31	5	#2
9	Y	0	1	55	5	#2
10	Y	0	1	20	4	#2
<i>N: 10</i>	Σ Success: 8	Σ : 0	Σ : 3			
		\bar{x} : 0	\bar{x} : 0.3	\bar{x} : 30.13	\bar{x} : 4.1	

#1 - Participant did not complete the previous task, "Create imaging order" and so was unable to modify the order in this task.

#2 - Participant had difficulty removing a test from the order. Instead of tapping again on the imaging order to deselect, he/she went to the line below representing the order, and looked for a way to delete it. However, in each case the participant quickly recovered and deleted the imaging order by tapping again.

Task: 23.1 - Display changed CPOE imaging Order

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	N	0	0	---	3	
2	Y	0	0	4	4	
3	Y	0	0	1	1	
4	Y	0	0	2	4	
5	Y	0	0	2	5	
6	Y	0	0	2	5	
7	N	0	0	---	5	
8	Y	0	0	1	5	
9	Y	0	0	2	5	
10	Y	0	0	2	4	
<i>N: 10</i>	<i>Σ Success: 8</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 2</i>	<i>x: 4.1</i>	

Task: 24 - Prescribe medication

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	70	5	
2	Y	0	0	55	4	
3	Y	0	0	116	4	
4	Y	0	0	78	4	
5	Y	0	0	59	5	
6	Y	0	0	93	4	
7	Y	0	0	89	5	
8	Y	0	0	53	5	
9	Y	0	0	65	5	
10	Y	0	1	93	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 77.1</i>	<i>x: 4.6</i>	

This task was completed by all participants without errors or path deviations.

Task: 25 - Trigger, attend and interpret CDS intervention for drug-allergy interaction.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	8	5	
2	Y	0	0	6	5	
3	Y	0	0	15	4	
4	Y	0	0	3	4	
5	Y	0	0	15	4	
6	Y	0	0	13	5	
7	Y	0	0	7	5	
8	Y	0	0	17	5	
9	Y	0	0	4	5	
10	Y	0	0	15	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 10.3</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 25.1 - Trigger, attend and interpret CDS intervention for drug-allergy interaction, and access information.

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	8	5	
2	Y	0	0	6	5	
3	Y	0	0	15	4	
4	Y	0	0	3	4	
5	Y	0	0	15	4	
6	Y	0	0	13	5	
7	Y	0	0	7	5	
8	Y	0	0	17	5	
9	Y	0	0	4	5	
10	Y	0	0	15	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 10.3</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 26 - Modify prescription

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	48	5	
2	Y	0	0	30	4	
3	Y	0	0	185	3	
4	Y	0	0	67	4	
5	Y	0	0	27	5	
6	Y	0	0	60	5	
7	Y	0	0	35	5	
8	Y	0	0	22	5	
9	Y	0	0	28	5	
10	Y	0	0	27	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 52.9</i>	<i>x: 4.6</i>	

This task was completed by all participants without errors or path deviations.

Task: 27 - Trigger, attend and interpret CDS intervention for medication list, diagnostic and therapeutic reference resources

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	66	5	
2	Y	0	0	23	4	
3	Y	0	0	3	5	
4	Y	0	0	14	3	
5	Y	0	0	17	5	
6	Y	0	0	20	5	
7	Y	0	0	10	5	
8	Y	0	0	16	5	
9	Y	0	0	16	5	
10	Y	0	0	17	5	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 20.2</i>	<i>x: 4.7</i>	

This task was completed by all participants without errors or path deviations.

Task: 28 - Create new ePrescribed liquid medication (metric only)

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	62	5	
2	Y	0	0	127	3	
3	Y	0	1	239	2	#1
4	Y	0	0	164	4	
5	Y	0	0	94	5	
6	Y	0	0	105	4	
7	Y	0	0	100	5	
8	Y	0	0	57	5	
9	Y	0	0	64	5	
10	Y	0	0	111	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 112.3</i>	<i>x: 4.2</i>	

#1 - Participant experienced difficulty selecting the correct dosage.

Task: 29 - Cancel ePrescribed medication

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	44	5	
2	Y	0	0	28	4	
3	Y	0	0	98	5	
4	Y	0	0	13	4	
5	Y	0	0	108	5	
6	Y	0	0	47	2	
7	N	1	2	---	4	#1
8	Y	0	1	111	4	
9	Y	0	0	36	5	
10	N	1	0	---	5	#1
<i>N: 10</i>	<i>Σ Success: 8</i>	<i>Σ: 2</i>	<i>Σ: 3</i>			
		<i>x̄: 0.2</i>	<i>x̄: 0.3</i>	<i>x̄: 60.63</i>	<i>x̄: 4.3</i>	

#1 - Participant was not able to locate the "Cancel" menu option under the action menu icon.

Task: 30 - View cancellation response for a canceled ePrescribed medication

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	36	5	
2	N	1	0	---	2	#1
3	Y	0	0	39	5	
4	Y	0	0	44	4	
5	Y	0	0	63	5	
6	Y	0	0	43	2	
7	Y	0	0	87	4	
8	Y	0	0	27	5	
9	Y	0	0	58	5	
10	Y	0	0	48	5	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 1</i>	<i>Σ: 0</i>			
		<i>x̄: 0.1</i>	<i>x̄: 0</i>	<i>x̄: 49.44</i>	<i>x̄: 4.2</i>	

#1 - Participant was not able to locate the "Prescription History" menu option under the action menu icon.

Task: 31 - Request and receive medication history information

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	N	1	1	---	2	#1
2	Y	0	0	56	5	
3	N	1	1	---	4	#1
4	Y	0	0	58	4	
5	Y	0	0	106	5	
6	Y	0	0	56	4	
7	Y	0	0	96	5	
8	Y	0	0	44	5	
9	Y	0	1	88	5	#1
10	Y	0	1	98	5	#1
<i>N: 10</i>	<i>Σ Success: 8</i>	<i>Σ: 2</i>	<i>Σ: 4</i>			
		<i>x̄: 0.2</i>	<i>x̄: 0.4</i>	<i>x̄: 75.25</i>	<i>x̄: 4.4</i>	

#1 - Participant looked for medication history import in Medications page / list instead of on patient face sheet.

Task: 31.1 - Trigger, attend and interpret CDS upon incorporation of summary care

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	31	4	
2	Y	0	0	15	4	
3	Y	0	0	1	5	
4	Y	0	0	24	4	
5	Y	0	0	31	4	
6	Y	0	0	33	4	
7	Y	0	0	9	5	
8	Y	0	0	17	5	
9	Y	0	0	32	5	
10	Y	0	0	21	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 0</i>			
		<i>x: 0</i>	<i>x: 0</i>	<i>x: 21.4</i>	<i>x: 4.4</i>	

This task was completed by all participants without errors or path deviations.

Task: 32 - Review and approve eRefill medication request, approve and allow refills

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	1	185	4	#1
2	Y	0	0	48	4	
3	Y	0	0	115	4	
4	Y	0	0	77	4	
5	Y	0	0	38	4	
6	Y	0	0	75	4	
7	N	0	1	---	2	#1
8	Y	0	0	61	5	
9	Y	0	0	100	5	
10	Y	0	1	54	4	#1
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 0</i>	<i>Σ: 3</i>			
		<i>x: 0</i>	<i>x: 0.3</i>	<i>x: 83.67</i>	<i>x: 4</i>	

#1 - Participant went first to the named patient instead of to "tools".

Task: 33 - Review and respond to pharmacy change request: Approve a Therapeutic Change

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	88	2	
2	Y	0	2	433	1	#1
3	Y	0	0	95	4	
4	Y	0	1	188	4	#1
5	Y	0	2	143	4	#1
6	Y	0	0	156	4	
7	Y	0	1	133	2	#1
8	Y	0	0	138	5	
9	Y	0	1	122	4	#1
10	Y	0	1	123	4	#1
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 8</i>			
		<i>x: 0</i>	<i>x: 0.8</i>	<i>x: 161.9</i>	<i>x: 3.4</i>	

#1 - Participant was unable to locate the Therapeutic Change request. This is at least partly due to the fact that there were many refill requests listed above the Therapeutic Change requests which pushed them down, requiring the user to scroll to find them.

Task: 34 - Review and respond to pharmacy change request: Approve/Deny a Generic Change

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	35	4	
2	Y	0	0	14	4	
3	Y	0	0	22	5	
4	Y	0	0	13	4	
5	Y	0	0	63	5	
6	Y	0	0	36	3	
7	Y	0	0	50	3	#1
8	Y	0	0	35	5	
9	Y	0	1	120	4	#2
10	Y	0	0	45	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 1</i>			
		<i>x: 0</i>	<i>x: 0.1</i>	<i>x: 43.3</i>	<i>x: 4.1</i>	

#1 - Participant was unable to locate the Therapeutic Change request.

#2 - Participant forgot that she had previously filtered out Generic Change request from the list.

Task: 35 - Review and respond to pharmacy change request: Approve/Deny Prior Authorization

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	12	5	
2	Y	0	0	88	4	
3	Y	0	0	36	4	
4	Y	0	0	5	4	
5	Y	0	0	75	5	
6	Y	0	0	67	5	
7	N	1	0	---	5	
8	Y	0	0	27	5	
9	Y	0	0	32	5	
10	Y	0	0	135	4	
<i>N: 10</i>	<i>Σ Success: 9</i>	<i>Σ: 1</i>	<i>Σ: 0</i>			
		<i>x̄: 0.1</i>	<i>x̄: 0</i>	<i>x̄: 53</i>	<i>x̄: 4.6</i>	

This task was completed by all participants without errors or path deviations.

Task: 36 - Receive fill status notification

ID	Effectiveness		Efficiency		Satisfaction	Notes
	Task Success	Errors #	Path Deviations #	Task Time (Seconds)	Task Ratings (5-Very Easy)	
1	Y	0	0	7	5	
2	Y	0	0	14	4	
3	Y	0	0	14	5	
4	Y	0	1	106	4	#1
5	Y	0	1	75	5	#1
6	Y	0	0	73	4	
7	Y	0	0	104	5	
8	Y	0	0	169	3	
9	Y	0	0	97	5	
10	Y	0	0	39	4	
<i>N: 10</i>	<i>Σ Success: 10</i>	<i>Σ: 0</i>	<i>Σ: 2</i>			
		<i>x: 0</i>	<i>x: 0.2</i>	<i>x: 69.8</i>	<i>x: 4.4</i>	

#1 - Participant looked for Fill Status under eSend Status.

4.2 DISCUSSION OF FINDINGS

4.2.1 EFFECTIVENESS

The EHRUT tested well overall, with 41 of the 46 tasks having a 90% or greater success rate (46 of 46 at 80%), success being defined as task completion with no critical errors. Additionally in nearly all cases, participants were performing the tasks for the first time.

4.2.2 EFFICIENCY

Tasks success decreased slightly when the definition of success was constrained to accomplishing the task within a prespecified target time. 34 of the 46 tasks had a 90% or better average rate of 'Success within target time' (42 of 46 tasks at 80%).

Target task times were determined based on optimal task times (See Section 3.9 USABILITY METRICS). 'Optimal task time' is operationally defined as the expected average time required for a practiced expert to accomplish the task, which is a measure of the efficiency of the system over time. So the lower the optimal task time, or the more efficient the system is in the long run, the lower is the target time and the lower is the chance that the new user will achieve that time on their first attempt at the task.

4.3.3 SATISFACTION

On average, on the Ease of Use rating scale (1 = very difficult, 5 = very easy), participants rated the tasks between "Easy" and "Very Easy" (4.47). Only task 33 was rated below 4 on the same scale (3.4).

The results from the System Usability Scale (SUS) scored the subjective satisfaction for all tasks as 84.54.

4.3.4 RISK EVALUATION

An average of the success rates for tasks within Task Risk Categories shows that tasks across all risk levels had a greater than 90% chance of success on the first attempt. A mean Ease of Use rating between 4 and 5 in each category shows that participant satisfaction was high for the most critical tasks, as well as for less critical tasks (High Risk 4.37, Medium Risk 4.5, Low risk 4.5).

The number and severity of critical errors and minor path deviations varied widely between tasks, but averaged out across the tasks within each Task Risk Category, so that mean errors and deviations were near 0 in each category.

Tasks with the lowest subjective satisfaction rates were in the Low risk category.

Table: Results by Task Risk Category.

Task Risk	Success (%)		Errors	Deviations	Task Rating	Tasks
	Total	Within Target	Mean	Mean	Mean	
High	97	87	0.02	0.09	4.37	4.1, 4.2, 4.3, 10, 13, 14, 15, 19, 20, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35
Medium	95	90	0.04	0.16	4.52	11, 12, 16, 17, 17.1, 21, 22, 23, 31, 31.1, 36
Low	95	92	0.01	0.05	4.51	1, 2, 2.1, 5, 6, 7, 8, 8.1, 9, 15.1, 15.2, 18, 23.1, 30

4.3.5 MAJOR FINDINGS

- Participants rated the tasks between “Easy” and “Very Easy” (4.47) on average. Showing that the UI has achieved a high degree of usability.
- Tasks marked as ‘High Risk’ were rated between “Easy” and “Very Easy” (4.37) on average.
- In several places in the system, the user is editing a item type, and the title in the panel header is “Edit XXXX”. Several participants were temporarily confused by this title, thinking that it was a link that they needed to click in order to initiate editing.
- Participants were confused about which functions were to be found within the patient record, and which were outside of the individual patient record in the ‘Tools’. For example, refill requests are grouped together in tools, but several participants expects to find it in the patient record.
- Several actions are hidden from the user under a generic “Actions” menu. Several participants were unable to find these actions on their first attempt. Most were able to find the hidden actions after searching for a short time.
- One task required the participants to select a ‘test set’ from a popup dialog which contained a scrollable list of options. Most participants failed to recognize that the list was scrollable. Instead, they assumed that the options they saw in initial list were all the options available.
- In the ‘Tools’ area, in the Pharmacy Requests, in some cases there will be a large number of items for the user to process. Participants were given a large list of items to simulate this circumstance. Participants scrolled through this long list instead of noticing and invoking the filter for the list which is shown constantly at the top of the page.
- In the ‘Tools’ area, in the Pharmacy Requests, when there are a larger number of request, they push the title bar that divides and categorizes the types of requests off the bottom of the page. Users therefore didn’t know that the contents of the page were divided into different types.

4.3.6 AREAS FOR IMPROVEMENT

- Help users understand when to go to the individual patient record and when to go to the tools area for required functions. Or, cross link the functionality, so the use can get to the pharmacy requests for a patient through the patient record.
- Move important actions out from under the “Actions” menu, into their own reserved space so that users will more easily find them.
- Provide a visual indicator in scrollable pop-up lists that there are more options than what is initially showing in the list.

APPENDICES

APPENDIX 1: Sample Recruiting Screener

Hello, my name is ___. AdvancedMD is seeking doctors and clinicians who are users of AdvancedMD MobileDoc EHR. This study will assist us in designing and developing a solution that meets your needs. Your experiences in using this particular design will greatly help our designers and developers. The testing of our design will take place in your office using remote meeting technology, requiring only your time, thoughts, and suggestions. We expect the session to last approximately 60 minutes. Does this sound like something that interests you?

No constraints were placed on the age, gender, or software experience of the users being recruited. Demographic information was collected during testing session.

APPENDIX 2: Informed Consent / Release Form

The usability testing process can be stressful and frustrating for the participant (you). For this reason, before we begin, I want to inform you that you are free and entitled to end the test at any time, for any reason, with or without explaining why. Ending this test is in no way a reflection on you, and will have no impact on your relationship with AdvancedMD.

Do you understand that your participation is completely optional, and you can stop at any time, and do you now agree to participate in this usability study?

APPENDIX 3: Background and Demographics questionnaire

AdvancedMD Pre-Study Questionnaire

Age

- 10 - 19
- 20 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- 70 - 79
- 80 - 89
- 89 - 90

Gender

- Female
- Male
- Prefer not to say
- Other: _____

Level of Education

- No high school degree
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade / Technical / Vocational training
- Associate degree
- Bachelor's degree
- Master's degree
- Doctorate degree (e.g. MD, DNP, DMD, PhD)

Years of Professional Experience

Your answer _____

Years of Experience Using AdvancedMD

Your answer _____

Years of Experience Using Other EHRs

Your answer _____

Years of Computer Experience

Your answer _____

What is your role title?

Your answer _____

How would you categorize your Role?

- Provider
- Biller
- Billing Service Manager
- Office Manager
- Clinical Staff
- Office Staff
- Other: _____

Specialty

APPENDIX 4: Test Instructions

Read each task out loud as you come to it. When you believe you have completed the task, say "Finished".

Complete each task as quickly as you can, then rate the level of difficulty. Please hold your comments and questions regarding the User Interface until after all of the tasks are complete.

If the tasks are unclear, please ask for clarification. Because of the nature of this study, the moderator will not be able to answer questions about the user interface or how you should complete the tasks.

APPENDIX 5: Test Questions / Tasks

1	Add patient Jan Brown - PREFERRED LANGUAGE: english, DOB: 12/1/2006, SEX: Female, RACE: White, ETHNICITY: Not hispanic / Latino , SEXUAL ORIENTATION: Straight , GENDER IDENTITY: Female ... SAVE
2	Change Jan Brown's language to Spanish and her ethnicity to Hispanic / Latino
2.1	View the edited patient demographics
3	Select Patient Maxine Pressure
4.1	Describe what was communicated in the alert. How difficult was it to see, read and understand this information. (Age / Gender)
4.2	Describe what was communicated in the alert. How difficult was it to see, read and understand this information. (Laboratory tests)
4.3	Describe what was communicated in the alert. How difficult was it to see, read and understand this information. (Vital signs)
5	Review the Maxine's current and historical problem list.
6	Change Viral Pneumonia to historic.
7	Review Current and Historical Medications list.
8	Maxine tells you that she no longer takes Omeprazole. Change Omeprazole to Historic (not Current).
8.1	Show the modified medication order.
9	Review Current and Historical Medication allergies list.
10	Maxine tell you she has an allergy to Penicillins. Add it to her list of allergies.
11	Change the medication allergy for antihistamines to historic
12	Change the onset date for Maxines allergy to Carbamazepine to June 29 of 2008.
13	Maxine says she is also currently taking Prednisolone. Add Prednisolone 15 mg/5 mL oral solution to her list of medications.
14	Describe what was communicated in the alert. How difficult was it to see, read and understand this information.

15	The patient remembers that her previous doc changed her Cefuroxime to Cipro (ciprofloxacin). Make the change in her record.
15.1	Show the inactive medication list.
15.2	Show the active medication list.
16	Add an Order for Cholesterol LDL.
17	Make the collection date for the order set to now (date and time).
17.1	Show the modified lab order.
18	Change 'Acute Bronchitis Unspecified' to chronic.
19	Add Asthma to the patient's Problem List (use ICD code: J44.9)
20	Describe what was communicated in the alert. How difficult was it to see, read and understand this information.
21	Display patient education for Allergies to review with Maxine
22	Add an Order for Chest Xray 2 views.
23	Change the Order to Chest Xray4 views.
23.1	Show the modified imaging order.
24	Write a new prescription for Maxine for Amoxicillin 500 mg oral tablet
25	Describe what was communicated in the alert. How difficult was it to see, read and understand this information. (Drug-allergy interaction)
26	Change the prescription to Amoxicillin 125 mg oral capsule
27	Review clinical research on Albuterol , and share patient educational material for Albuterol with patient.
28	Write a new prescription for Maxine for 220 mg / 5 mL (milliliters) oral liquid ferrous sulfate once per day for 3 months.
29	For patient Maxine, there is a prescription for Ibuprofen, that has already been eSent. Cancel the prescription with the pharmacy because it causes her stomach pain.
30	Earlier you canceled Maxine's prescription for Symbicort. Check the Prescription history to see if the prescription was canceled at the pharmacy.
31	Request the medication history information for patient "Whiteside, Kara"
31.1	Describe what was communicated in the alert. How difficult was it to see, read and understand this information. (Summary of Care)
32	Find the refill request for "PATIENT, TESTx", and approve the refill for transderm-Scop 1 mg, and allow two refills
33	Find the pharmacy therapeutic change request for patient "PATIENT, TESTx" Lisinopril and verbally describe to me what it appears the pharmacy is requesting. Approve the request.
34	Find the pharmacy request for generic on patient "PATIENT, TESTx" Lisinopril and approve the request.
35	Find and deny the prior authorization request for patient "PATIENT, TESTx" Levalbuterol.
36	Check for a fill status on the drug levalbuterol HCl for "PATIENT, TEXTx"
37	Check for a fill status on the drug levalbuterol HCl for "PATIENT, TEXTx"
38	Request the medication history information for patient "Whiteside, Kara"
39	Adjust the severity level of CDS interventions for drug-drug interaction checks to Medium

APPENDIX 6: System Usability Scale (SUS) questions

Strongly disagree 1 – 5 Strongly agree

- 1) I think that I would like to use this system frequently
- 2) I found the system unnecessarily complex
- 3) I thought the system was easy to use
- 4) I think that I would need the support of a technical person to be able to use this system
- 5) I found the various functions in this system were well integrated
- 6) I thought there was too much inconsistency in this system
- 7) I would imagine that most people would learn to use this system very quickly
- 8) I found the system very cumbersome to use
- 9) I felt very confident using the system
- 10) I needed to learn a lot of things before I could get going with this system