



EHR Usability Test Report of ClinicMax EHR Version 15.0

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

ClinicMax EHR Version 15.0

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EXECUTIVE SUMMARY

A usability test of ClinicMax EHR Version 15.0 was conducted on June 20, 2017 in Waldorf, Maryland and Charlotte Hall, Maryland by ClinicMax, Inc. 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, 16 healthcare providers matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative, tasks. This study collected performance data on 10 tasks typically conducted on an EHR:

1. Updating patient demographics
2. Creating and editing orders such as Laboratory Orders and Imaging Orders
3. Adding and editing a drug allergy in the patient record
4. Adding and editing a problem in the patient record
5. Recording the Universal Device Identifier code into the patient record
6. Creating the current medication list
7. Ordering, composing and editing new medications
8. Reviewing the alerts and contraindications to prescribed medications
9. Creating a new clinical decision alert
10. Reconciling a patient's record with an external CCDA

During the 15-30 minute usability test, each participant was greeted by the administrator. All participants had prior experience with the EHR.

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 recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

A login with password and a "User Manual" consisting of step-by-step instructions and screenshots using a fictitious patient and representative data was provided to each participant, similar to the type of training material provided to any new user of the EHRUT.

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 from optimum path (noted but not counted)
- 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. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire. Participants were not compensated for their time as testing was performed as part of the participants’ workday. 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.

Task	Measure	Task Success	Path Deviation	Task Time		Errors	Task Ratings
				Mean (SD)	Deviations (Observed/Optimal)		
1. Demographics	170.315 a.5	0	0	80 (20)	0.53	0	4.89
2. Computerized Order and Imaging Entry	170.315 a.2, 170.315 a.3 (For 170.315 a.1 - Medication Order, see Task 7)	0	<5	139 (37)	0.95	0	4.52
3. Medication Allergy	170.315 a.8	0	>5	120 (45)	1.04	0	4.15
4. Problem List	170.315 a.6	0	>5	123 (69)	0.92	0	3.96
5. Implantable Device	170.315 a.14	0	>5	99 (0)	0.46	0	3.67
6. Medication List	170.315 a.7	0	<5	106 (23)	0.45	0	4.36
7. Electronic Prescribing	170.315 a.1, 170.315 a.4, 170.315 b.3	0	<5	241 (29)	0.84	0	4.29
8. Drug-drug, Drug-Allergy Interaction	170.315 a.4	0	<5	See Task 7	See Task 7	0	4.14
9. Clinical Decision Support	170.315 a.9	0	>5	227 (59)	1.00	0	4.07
10. Clinical Information Reconciliation	170.315 b.2	0	>5	97 (45)	0.76	0	4.52

In addition to the performance data, the following qualitative observations were made:

Major findings

All participants were at least somewhat familiar with the ClinicMax EHR system. In most cases, users were able to work through the tasks quickly and without assistance. It was noted that there were some components of tasks that were confusing to the user. The administrator felt that most of the confusion lay in the fact that the participant did not perform that task in their regular workflow, as those who did performed well in the exercise.

Some users stated that they routinely zoom in their screens to more than 100% for larger fonts and easier readability.

In regards to deviations, the most difficult task was the addition of an implantable device. There was some comment about the need to enter the procedure first, as their practice would not have implanted the device and was just recording its presence. The screens were unfamiliar to all of the users and actual entry of the data into the screens required their full concentration. Otherwise, deviations were generally within expected ranges.

The administrators noted many small exclamatory comments, most not really relevant to the EHRUT, but to workflow. It was also noted that the participants often did not take time to read the task fully and sometimes were forced to backtrack to reach the required conclusion. These were deemed to be deviations – not errors, as the desired conclusion was eventually reached.

Overall, administrators felt that participant satisfaction with the program and their performance using it was adequate-to-good. The majority of deviations from the optimal path were felt to be the result of user unfamiliarity with the task itself, not from within the program. Participants verified this to us, stating that they “never did this” and “this isn’t my job.”

Areas for improvement

More training and cross-training would make the system more familiar to all users. This would be primarily a function of the office management using materials provided by ClinicMax.

Improvements could be made to the layout and usable screen size of some screens to make them less crowded as well as increasing font size for readability.

Users totally unfamiliar with certain screens showed difficulty finding the appropriate places to enter certain data elements or search for criteria, expecting to find them elsewhere on the screen. These issues could be addressed to make those screens more intuitive.

INTRODUCTION

The EHR Under Test (EHRUT) tested for this study was ClinicMax EHR Version 15.0. Designed to present medical information to healthcare providers in radiation oncology practices, the EHRUT is a secure web browser-based Electronic Health Record system. 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 EHRUT. To this end, measures of effectiveness, efficiency and user satisfaction such as time on task, ease of use and intuitiveness, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 16 participants were tested on the EHRUT. Participants in the test were medical providers and staff of a radiation oncology center. Participants were recruited from within the offices of current users of the EHR and were not compensated for their time. Participants had no direct connection to the development of or organization producing the EHRUT. Participants had the same orientation and level of training as the actual end users 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 the screener is provided in Appendix 1.

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, computing experience and user needs for assistive technology. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

	Part ID	Gender	Age	Education	Organization Role	Computer Experience	Product Experience	Assistive Technology Needs
1	Phys 1	F	40-59	Postgraduate	Physician	Proficient	5 yrs	None
2	Phys 2	M	23-39	Postgraduate	Physician	Proficient	6 yrs	None
3	Phys 3	M	40-59	Postgraduate	Physician	Moderate	6 yrs	None
4	Nurse 1	F	Declined	College Graduate	Nurse	Little	5 yrs	None
5	Nurse 2	F	40-59	College Graduate	Nurse	Proficient	7 yrs	None
6	Nurse 3	F	23-39	Some College	C N A	Proficient	3 yrs	None
7	Nurse 4	F	40-59	College Graduate	C N A	Proficient	7 yrs	None
8	Office 1	F	40-59	High School	Office Staff	Proficient	2 mos	None
9	Office 2	F	40-59	Some College	Office Staff	Moderate	4 yrs	None
10	Office 3	F	40-59	High School	Office Staff	Moderate	1 mo	None
11	Office 4	F	40-59	BS, RTT	Therapist	Moderate	3 mos	None
12	Admin 1	F	23-39	College Graduate	Administrator	Proficient	3 yrs	None
13	Admin 2	F	40-59	Postgraduate	Administrator	Proficient	7 yrs	None
14	Admin 3	F	40-59	College Graduate	Therapist	Moderate	7 yrs	None
15	Admin 4	F	40-59	High School	Administrator	Moderate	4.5 yrs	None
16	Admin 5	F	40-59	Some College	Therapist	Moderate	2 yrs	None

i.e., 16 participants were recruited and participated in the usability test. No participants failed to show for the study. Participants were scheduled for 15-30 minute sessions with at least 10 minutes in between each session for debrief by the administrator(s) to reset systems to proper test conditions.

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 participants reported improvements that could be made to the application to address better workflow and ease of use. 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.

During the usability test, participants interacted with one EHR. 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
- Task deviations from optimal path (noted but not counted)
- Participant’s verbalizations (comments)
- Participant’s satisfaction ratings of the system

testing staff members were experienced with usability testing with significant background in the EHR industry and 5 or more years' experience with ClinicMax EHR specifically.

Participants were instructed to perform the tasks as quickly as possible making as few errors and deviations as possible.

All participant data was de-identified and kept confidential.

For each task, the participants were given a written copy of the task. Administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use. Participants were provided with screenshots guiding them through each task for their use, if unable to perform the task without assistance.

Task timing began once the administrator finished reading the question. The task time was stopped once the participant had successfully completed the task. After each task, the participant was directed to enter a 0-5 score for Viewing, Entering and Editing each task into their individual scorecard. Each individual was thanked for their participation.

Following the session, the administrator distributed the post-test questionnaire (e.g., the System Usability Scale) to the participants.

Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded.

TEST LOCATION

The test facility included a quiet testing room with tables and computers for the participants. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and well-known to the participants.

TEST ENVIRONMENT

The EHRUT would be typically used in a healthcare office or facility. In this instance, the testing was conducted in two (2) ambulatory clinics in southern Maryland. For testing, the computers used were laptops running Windows 10. The participants used a keyboard and mouse when interacting with the EHRUT.

The ClinicMax EHR Version 15 application was set up by the ClinicMax staff. The application itself was running on a Windows platform using a test database accessed with an internet browser. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation.

Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

TEST FORMS AND TOOLS

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

1. Moderator's Guide
2. Testing Scoresheets
3. Post-test Questionnaire

Examples of these documents can be found in Appendices 2-4 respectively.

PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to the each participant (also see the full moderator's guide in Appendix 3).

“The Usability Testing is a test of OUR system, not your performance. We welcome both positive and negative feedback on your experience navigating through the tasks that follow.

A specific task may or may not be included in your manual, according to your assigned role and your typical office workflow. Most of these tasks will already be familiar to you. Please complete them to the best of your ability. If you need help with a task, screenshots are provided to guide you through the process. If you use the screenshots, it is important to follow the numbered steps for each section in order to achieve the expected results. You should be aware that in many cases, problems and contraindications are meant to be generated. This is to test our system for use in real office situations.

A successfully completed task will be indicated by the expected appearance of the entry in the patient record.

To judge the system's ease of use, we ask you to record the time it takes to complete the tasks. When I say “BEGIN”, please start your timer. When you have finished each task, please stop your timer.

If you find you are totally unable to complete the task and don't wish to continue with it, say aloud “QUIT”.

At the end of each task, you will be asked to record your time and to score the task on a provided scorecard. Each task has 3 criteria to rank from 0-5: Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Any score below 3 will trigger a return to the developer for adjustments/corrections. You will also have an opportunity to add comments about each section. These comments will be helpful to us in refining our system.

You have been assigned a specific patient in the system. Sign on using your assigned tester User Name and Password. Choose and open the patient assigned to you. The Patient's Initial visit has already been created in the system.”

Participants were then given 10 tasks to complete. Tasks are listed in the moderator's guide in Appendix 2.

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 EHRUT by measuring participant 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 details how tasks were scored, errors evaluated, and the time data analyzed.

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, was defined by taking a measure of optimal performance and multiplying by 2, thus allowing a time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 100 seconds then allotted task time performance was 200 seconds. This ratio was aggregated across tasks and reported with mean and variance scores.

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 a “Failure.” 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. 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 observed. 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.

Optimal paths were created when constructing the tasks. Because of the limited number of testing staff and participants it was determined that deviations would be observed and noted, but not counted.

Efficiency: Each task was timed from when the administrator said “Begin” until
Task Time 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: Participant’s subjective impression of the ease of use of the
Task Rating application was measured by administering both a simple post-task review on the scoring form 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.

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 EHRUT 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.” See full System Usability Score questionnaire in Appendix 5.

RESULTS

DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. No participants failed to follow session and task instructions resulting in their data excluded from the analyses.

The usability testing results for the EHRUT are detailed below.

Task	Measure	Task Success (%)	Path Deviation	Task Time		Errors	Task Ratings
		Mean (SD)	Deviations	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
1. Demographics	170.315 a.5	0	0	80 (20)	0.53	0	4.89 (0.24)
2. Computerized Order and Imaging Entry	170.315 a.2, 170.315 a.3	0	<5	139 (37)	0.95	0	4.52 (0.53)
3. Medication Allergy	170.315 a.8	0	>5	120 (45)	1.04	0	4.15 (0.96)
4. Problem List	170.315 a.6	0	>5	123 (69)	0.92	0	3.96 (1.09)
5. Implantable Device	170.315 a.14	0	<5	99 (24)	0.46	0	3.67 (1.22)
6. Medication List	170.315 a.7	0	<5	106 (23)	0.45	0	4.36 (0.75)
7. Electronic Prescribing	170.315 a.1, 170.315 b.3	0	<5	241 (29)	0.84	0	4.29 (0.95)
8. Drug-drug, Drug-Allergy Interaction	170.315 a.4	0	See Task 7	See Task 7	See Task 7	0	See Task 7
9. Clinical Decision Support	170.315 a.9	0	>5	227 (59)	1.00	0	4.07 (1.06)
10. Clinical Information Reconciliation	170.315 b.2	0	>5	97 (45)	0.76	0	4.52 (0.50)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 85.13%. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Demographics entries posed no difficulties. New features of Demographics (170.315 a.5) regarding race and gender caused some comment, mostly regarding their actual use in a clinical setting. It was generally felt that the gender requirements could be awkward in actual use and would only be recorded if the patient self-identified.

Computerized Order and Imaging (170.315 a.2, 170.315 a.3), Medication Allergy (170.315 a.8) and Problem List (170.315 a.6) were fundamentally unchanged from previous versions and posed no difficulty to established users and only slight deviations from newer users and engendered little comment.

The Implantable Device entry was new to all users. It was agreed that there was a need to record the presence of the device, but potential entry of long UDI numbers was deemed to be burdensome.

The entering of current medications, Medication List (170.315 a.7) remained the same, as ClinicMax utilizes the 3rd party provider, NewCrop. Using NewCrop, Electronic Prescribing (170.315 a.1, 170.315 b.3) and Drug-Drug Allergy Interaction (170.315 a.4) are combined into one operation and were tested together in Usability Testing. Testers

were familiar with the interface and there was no difficulty with the data entry. The only real comment was that the testing did not accurately reflect real Rx composing because the final result was not transmitted, only saved to Current Medications. Testers considered this to be a shortcoming of the testing design, not the EHR itself.

Clinical Decision Support (170.315 a.9) was familiar to those testing it. There was some confusion as to their generation and use in their own workflow, but not with the system itself.

The reconciliation of CCDAs (170.315 b.2) went well and was clearly understandable to all testers.

EFFECTIVENESS

For the most part, participants were assigned modules to test based on their real-life work duties. This meant that the areas tested were at least somewhat familiar to them and the concepts clear.

Participants generally felt that the system was effective in capturing the necessary data and that it was easy to use and relatively intuitive.

The administrator noted there was some difficulty on some screens in finding the correct button to click to get to a selection screen. The Implantable Device entry process was confusing to participants as it had several steps and the screen looked crowded and had the addition of a new icon not seen in any other screen.

Verbal comments were mostly regarding the usefulness of a particular task in their own workflow.

Participants testing tasks with which they had no familiarity naturally had the most difficulty. There were several relatively new employees included in the 16 testers and their exposure to EHRs and ClinicMax, in particular, was limited. Generally, though, all of the participants were able to perform the tasks easily and relatively quickly.

EFFICIENCY

The EHRUT was generally felt to be efficient in collecting all of the needed data. Some participants felt that a few of the individual tasks were too complicated or confusing and could be streamlined to fewer steps.

SATISFACTION

Average satisfaction scores ranged from a low of 3.67 to a high of 4.89. On the individual scorecards, most tasks were given at least a “3” overall for their ease of viewing, entering and editing. One participant gave consistently low scores across the board, with several tasks scoring a “2.”

After testing, the post-test questionnaire was distributed (see Appendix 4). Each user was asked to rate their satisfaction with the EHRUT by responding to the questions with a number score from 1 (strongly disagree) to 5 (strongly agree). Ten users returned their questionnaires. The following is an overview of the scores returned in the questionnaire.

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

Overview of Final Questions

“What was your overall impression of this system?”

Responses mostly ranged from fair to good, noting it to be easy/user friendly. It was stated that the system might appear complicated at first but would be easy to adapt to.

“What aspects of the system did you like most?”

The ease of patient interface and the ability to import and reconcile CCDAs were the two aspects commented upon.

“What aspects of the system did you like least?”

A few users felt the system could use more integration between their other Healthcare applications.. It was also mentioned that some participants would prefer use of the Chrome browser over Internet Explorer.

“Were there any features that you were surprised to see?”

There were no users who reported being surprised to see anything within the system.

“What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?”

At least one user felt the system was missing some functionality, but no specifics were mentioned. Another wished for the ability to graph laboratory results in the system.

“Compare this system to other systems you have used.”

Most users did not respond to this question at all or entered N/A. Two of these users had not used other systems. Of those who responded, only one compared it unfavorably to another EMR

“Would you recommend this system to your colleagues?”

Recommendations were evenly divided between yes and no.

DISCUSSION OF RESULTS

MAJOR FINDINGS

All users were already familiar with the look and content of the EHRUT. Most of the participants found the interface to be easy to use and had no issues finding the screens and buttons they needed to follow the optimum path. Most difficulties/deviations arose because of individual user unfamiliarity with the specific type of task, in that they did not access those screens on a regular basis and weren't familiar with the exact placement of tabs, buttons, and fields or with specific terminology, codes, etc. Even with those difficulties, the correct path was fairly readily found and accomplished with success.

As expected, demographics and order entry tasks tested well. Although there were some changes to demographics in this version, the interface presented them in a familiar way and, other than discussion of the requirements themselves, no issues were encountered. Also testing well was the new requirement for entry of an Implantable Device. Even with the necessity of adding a Procedure first, the burden of entering the UDI number and the addition of a new type of icon for moving to the next step, users were able to move through the process with few difficulties relatively quickly.

Those tasks involving the use of the NewCrop prescription pharmaceutical system showed few deviations, but were performed slightly slower than anticipated. This may be due to the relatively low familiarity of the selected users or the NewCrop interface, itself.

Clinical Decision Support – the creation of patient “Alerts” – required more time and engendered a few more deviations, probably due to unfamiliarity with the process on the part of most users and the test requirement to type text and link information manually. This was considered to be a logical reason for the added time and deviations.

Unexpectedly, the Problem List and Allergies showed a few more deviations from the optimal path than expected. However, these items still tested well and were performed in good time.

AREAS FOR IMPROVEMENT

The EHRUT provides all of the required elements for successful patient data management.

It is felt that most needed is more training and cross-training to make the system more familiar to all users. Of course, real-time office workflow may make additional training difficult.

Improvements could be made to the layout of some screens to make them less crowded and easier to find the correct field. A few participants commented that the fonts seemed too small and difficult to read and that, in some cases, usable screen size could be enlarged to space out the entry items.

There were some cases where the users showed difficulty finding the appropriate places to enter search criteria, expecting to find them elsewhere on the screen. One screen was remarked upon as having an icon for entry to the next screen unlike any others in the system, causing some confusion.

Users suggested that updates should be made to allow the system to better interface with other systems in the clinic and add the ability to graph patient data. These capabilities are currently under development.

APPENDICES

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

- 1: Recruiting Screener: Stage 3 / Electronic Health Record Survey
- 2: Participant Demographics
- 3: Moderator's Guide
- 4: System Usability Scale Questionnaire

Appendix 1: SAMPLE RECRUITING SCREENER

The purpose of a screener to ensure that the participants selected represent the target user population as closely as possible. (Portions of this sample screener are taken from www.usability.gov/templates/index.html#Usability and adapted for use.)

The Stage 3 Electronic Health Record edition requires your participation in a usability study.

Please fill out the following information required for the study.

Contact Information:

Name of participant: _____

Primary location: Waldorf _____ Charlotte Hall _____ Both _____

Email address: _____

1. Are you male or female? Male _____ Female _____

2. Have you participated in a focus group or usability test in the past 6 months?
 Yes _____ No _____

3. Do you, or does anyone in your home, work in marketing research, usability research, web design, or other computer work? Yes _____ No _____

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? Yes _____ No _____

5. Which of the following best describes your age?
 23 to 39 _____ 40 to 59 _____ 60 to 74 _____
 75 or older _____

6. Which of the following best describes your race or ethnic group?
 Caucasian _____ Asian _____ Black/African American _____
 Latino/a or Hispanic _____ Other _____

7. Do you require any assistive technologies to use a computer? Yes _____ No _____
If Yes, Please Describe: _____

Professional Demographics:

8. What is your current position and title? (Must be healthcare related.)

- Administrative Staff
 Office Staff
 RN
 Physician
 Therapist
 Medical Assistant
 Other Medical Specialty _____

9. How long have you held this position? _____

10. Which of the following describes your highest level of education?

- High School/GED _____ Some College _____
College Graduate (RN/BSN) _____ Postgraduate (MD/PhD) _____
Other: Please Describe: _____

Computer Expertise:

11. Besides reading email, what professional activities do you do on the computer?

- Access EHR _____ Research _____ News _____ Shopping/Banking _____
Digital Pictures _____ Programming _____ Microsoft Office Products _____

12. About how many hours per week do you spend on the computer?

- 0 to 10 _____ 11 to 25 _____ 26 or More _____

13. What computer platform do you usually use? [e.g., Mac, Windows, etc.]

14. What Internet browser(s) do you usually use? [e.g., Firefox, IE, Chrome, etc.]

15. In the last month, how often have you used an electronic health record?

16. How many years have you used an electronic health record?

17. How many EHRs do you use or are you familiar with? _____

18. How does your work environment record/retrieve patient records?

On Paper _____ Some Paper/Some Electronic _____ All Electronic _____

Contact Information

Those are all the questions I have for you.

Would you be able to participate on June 20, 2017?

May I get your contact information?

Name of participant:

Address:

City, State, Zip:

Daytime phone number:

Email address:

This study will take place at CPRCC Waldorf or Charlotte Hall.

Appendix 2: PARTICIPANT DEMOGRAPHICS

The report should contain a breakdown of the key participant demographics. A representative list is shown below.

Following is a high-level overview of the participants in this study.	
Gender	
Men	2
Women	14
Total (participants)	16
Occupation/Role	
RN/BSN/CNA	4
Physician	3
Therapists	2
Office Staff	4
Admin Staff	3
Total (participants)	16
Years of Experience w/EHRUT (Avg)	
Years' experience	4.2
Facility Use of EHR	
All paper	0
Some paper, some electronic	16
All electronic	0
Total (participants)	16

Appendix 3: EXAMPLE MODERATOR'S GUIDE

EHRUT Usability Test

Moderator's Guide

Administrator/Data Logger: Site 1 -- Deborah Dubrosky

Administrator/Data Logger: Site 2 -- Anuj Agarwal

Date: June 20, 2017

Time: 9:00 a.m. - 3:00 p.m.

Prior to testing

- Confirm schedule with Participants
- Ensure EHRUT lab environment is running properly
- Ensure lab and data recording equipment is running properly

Prior to each participant:

- Reset application

After each participant:

- Collect scoring comment sheets

After all testing

- Distribute Questionnaire

Orientation

The Usability Testing is a test of OUR system, not your performance. We welcome both positive and negative feedback on your experience navigating through the tasks that follow.

This exercise focuses on tasks typically conducted on an EHR.

A specific task may or may not be included in your manual, according to your assigned role and your typical office workflow. Most of these tasks will already be familiar to you. Please complete them to the best of your ability. If you need help with a task, screenshots are provided to guide you through the process. If you use the screenshots, it is important to follow the numbered steps for each section in order to achieve the expected results. You should be aware that in many cases, problems and contraindications are meant to be generated. This is to test our system for use in real office situations.

A successfully completed task will be indicated by the expected appearance of the entry in the patient record.

To judge the system's ease of use, we ask you to record the time it takes to complete the tasks. When I say "BEGIN", please start your timer. When you have finished each task, please stop your timer.

If you find you are totally unable to complete the task and don't wish to continue with it, say aloud "QUIT".

At the end of each task, you will be asked to record your time and to score the task on a provided scorecard. Each task has 3 criteria to rank from 0-5:

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult;
Deficient = 0

Any score below 3 will trigger a return to the developer for corrections. You will also have an opportunity to add comments about each section. These comments will be helpful to us in refining our system.

You have been assigned a specific patient in the system. Sign on using your assigned tester **User Name** and **Password**. Choose and open the patient assigned to you. The Patient's Initial visit has already been created in the system.

Now we will begin the Tasks being tested.

Remember, this is a **test of OUR SYSTEM**, not your performance. We are attempting to judge our system's ease of use in an attempt to make it better and more intuitive with each iteration.

- Before each Task, take a moment to read the boxed information at the top. This should contain everything you need to know to perform the task. If necessary, you may consult the screenshots walking you through each task.
- Please use the patient information provided to complete the tasks. The information is found in the Task Box preceding each task and in the Patient Spec Sheet assigned to you.
- Feel free to use your own experience with the system to complete the task in the most efficient way for you.
- Remember to stop your timer when the task is completed.
- If you need assistance, raise your hand. If you absolutely cannot perform the task and do not wish to continue with it, say QUIT.
- Please fill out your scoresheet, including your time, after each Task.

When the group is done with one task, I will allow some time to review the instructions for the next task. Wait for me to say BEGIN to start the actual work.

Task 1. Demographics

While in your patient's record, click PT PROFILE, then DEMOGRAPHICS.

- ① Verify the Birth Sex - **Male**
- ② Select Race from pull-down – **West Indian**. (Selected Race will auto fill with **African American**.) Note: If Patient specifies mixed race, two races may be selected.
- ③ Select Gender Identity from pull-down – **Identifies as Male**
- ④ Select Preferred Language from pull-down - **English**
- ⑤ Select Ethnicity from pull-down – **Not Hispanic or Latino**
- ⑥ Select Sexual Orientation from pull-down – **Lesbian, Gay or Homosexual**

Enter Time, Score and Comments on Scoresheet.

Task 1: Demographics

Goal Task Time: 2:20 Minutes **Actual Average Time:** 1:19 Minutes

Optimal Path: *Patient Profile* *Demographics* *Edit* *Save*

4 Correct

Minor Deviations / Cycles: Describe below

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments: Described as “easy” with some discussion of new requirements.

Average Rating:

Overall, this task was: 4.89

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

All users very familiar with screen. _____

Task 2. Computerized provider order entry

Add a Laboratory Order: **Lipid Panel 57698-3**. Any order date.

Then **edit** the Lab Order by adding the **Indication: Obesity**

Add the Imaging Order: **Chest x-ray, PA and Lateral**

Enter Time, Score and Comments on Scoresheet.

Task 2: Computerized provider order entry

Goal Task Time: 2:26 Minutes **Actual Average Time:** 2:19 Minutes

Optimal Path: Orders Order Form Add Orders Date/Type/Test/Description
 Save

4 Correct

4 Minor Deviations / Cycles: Describe below

A few users had some difficulty finding pull-down to choose what sort of Order.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 4.52

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Generally worked well.

Task 3. Medication allergy list

Allergies can be added on either the MD or from within Nursing. All information is then “carried over” to the other’s screen. For this task, we will enter the information from the MD tab.

Enter an **allergy to Penicillin G beginning 10/1/2005**.

Then go back and **edit the start date** of the allergy **to 10/1/2000**.

Enter Time, Score and Comments on Scoresheet.

Task 3: Medication allergy list

Goal Task Time: 1:55 Minutes **Actual Average Time:** 1:46 Minutes

Optimal Path: MD Tab H&P Allergies “Select” Button In pop-up enter description “Search” Button Check selected result In pull-downs enter Severity/Reaction/Onset Date Check “Active” radio button Save

4 Correct

4 Minor Deviations / Cycles: Describe below

Nurse users initially went to Nursing screen when MD screen was indicated in instructions. A few forgot to enter start date of allergy, as they typically don’t enter it in actual work flow.

Major Deviations: Describe below

Correct

Minor Deviations / Cycles: Describe below

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 4.15

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

All testers were familiar with screen. _____

Task 4. PROBLEM LIST

Add the following Problems:

ICD-9-CM 153.9 Malignant neoplasm of colon, unspecified site

SNOMED 266287006 Hypertensive disease

Description: Elevated cholesterol/high density lipoprotein ratio

Make all Problems Active and use the default date.

Mark malignant neoplasm of colon as a Health Concern.

Enter Time, Score and Comments on Scoresheet.

Task 4: Problem List

Goal Task Time: 2:14 Minutes **Actual Average Time:** 2:03 Minutes

Optimal Path: MD Tab Problem List "Edit" Button Select "Search by" from pull-down Enter Search Parameter "Search" button Select problem Click "Active" radio button Check "Health Concern" box Add additional problems Save

4 Correct

4 Minor Deviations / Cycles: Describe below

A few did not follow instructions about how to search for problems; a few added problems one at a time, rather than in a group, raising their entry time.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 3.96

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Test instructions should have been clearer about the 3 ways to search for problems. _____

Task 5. Implantable Device

Under **Procedures**, enter the **Procedure Concept Code** from Notepad file:

Procedure Concept Code: 440093006

Click the **blue + sign** next to the Procedure to be taken to the UDI entry screen.

From Notepad, **enter the Universal Device Identifier:**

UDI Code = (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234

Enter Time, Score and Comments on Scoresheet.

Task 5: Implantable Device

Goal Task Time: 3:36 Minutes **Actual Average Time:** 1:38 Minutes

Optimal Path: MD Tab □□ Diagnosis □□ On left side, Procedures, “Select” button □□ In pop-up window, in Search by pull-down, select Concept Code □□ Enter Concept Code □□ “Search” button □□ Check selection □□ Enter date □□ Save □□ In Diagnosis screen, Procedures, click blue “+” □□ In new window at bottom, enter UDI code □□ “Search” button □□ In pop-up window, review information □□ Save □□ In new window, check “Add to Procedure” □□ Save

4 Correct

4 Minor Deviations / Cycles: Describe below

Some issues finding the icon to go to the next screen after entering Procedures.

4 Major Deviations: Describe below

After entering UDI, 2nd Save was overlooked.

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 3.67

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

May want to reformat these screens to make more intuitive.

Task 6. Medication list

Add current Medication to record, **Lanoxin 125mcg, 1 tablet once a day.**

Use **any date previous** to current date of service.

Add to Current Medications.

Then **edit** that entry from 1 tablet once a day to **1 tablet 2x daily.**

Enter Time, Score and Comments on Scoresheet.

Task 6: Medication list

Goal Task Time: 3:55 Minutes **Actual Average Time:** 1:46 Minutes

Optimal Path: MEDS Tab "Med Entry" Button Enter Physician/Rx Date
 Enter drug keyword "Drug Search" Button Click on selected med Click
"Edit" Add dosing information "Save Rx" Button Check box next to med
 "Select to Move to Current Meds" Click "Edit" to make required edit
"Save Rx" On upper right, click Exit

4 Correct

4 Minor Deviations / Cycles: Describe below

Physicians had some issues following task instructions as it is usually performed by other staffers.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 4.36

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Generally worked well. Note – this capability is provided by an outside vendor. _____

**Task 7. Electronic prescribing; and
Task 8. Drug-drug, drug-allergy interaction checks**

These two tasks are combined because of the way they interact in the system of our Rx provider, New Crop.

Compose new prescriptions for:

Lasix 20 mg	1 daily
Nitroglycerin 50 mg/10 mL IV	1 daily
Cialis 20 mg	1 daily
Penicillin V Potassium 500mg Tab	1 daily

Close all pop-up alerts and contraindications.

When all are entered, **take the Rxs to the Review Page.**

Delete Cialis.

Add the meds to Current Medications.

From Current Medications, **edit** the previously added **Lanoxin from one BID to 2 BID.**

Enter Time, Score and Comments on Scoresheet.

Task 7 & 8: Electronic prescribing and drug-drug, drug-allergy interaction checks

Goal Task Time:4:46 Minutes **Actual Average Time:** 3:43 Minutes

Optimal Path: *Meds Tab □□Compose Rx □□Enter medication keyword □□ Choose prescribing physician from pull-down □□ “Drug Search” Button □□ Click on desired medication □□ Enter dosing information □□ “Save Rx” Button □□ Add remaining medications in the same way □□ In Pending Rx queue, click “Take Complete Rx to Review Page” □□ Review Alerts and Contraindications □□ Click “X” on far right of Cialis entry □□ Click “Finish/Add to Current Meds” □□ In Current Medications list, next to Lanoxin, click “Edit” □□ Change dosing information as directed □□ “Save Rx” □□ On upper right, click “Exit”*

4 Correct

4 Minor Deviations / Cycles: Describe below

Physicians had some issues following task instructions as it differed from their usual practice.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 4.29

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Generally went well. Note – this capability is provided by an outside vendor. _____

Task 9. Clinical Decision Support

Add new active Alert

Description: (#). Screen for colorectal cancer trial

Text: Screen for possible inclusion in colorectal cancer trial

Select Problem triggering alert: **Malignant neoplasm of colon, unspecified 153.9**
Specify those between ages 40 and 75.

User Roles (who will see the Alerts): Physicians, Nurses, Administrators
Activate.

Add the required reference data:

Link: <https://www.cancer.gov/research/areas/clinical-trials>

Reference Date: **1/11/2017**

Short description: **Colorectal cancer clinical trials**

Funding: **NIH**

Users (who will see the reference info): **physicians, administrators, nurses**

Click Activate and Save.

Edit the Alert to change the age range from 40-75 to 40-80.

Enter Time, Score and Comments on Scoresheet.

Task 9: Clinical Decision Support

Goal Task Time: 3:47 Minutes **Actual Average Time:** 3:46 Minutes

Optimal Path: Admin Tab Click on Clinical Decision Support Alerts “Add”
In text boxes, enter Alert Description and Alert Text Next to Problem click “Select”
Button Enter problem triggering alert Next to Demographics, enter age range
 Next to Activated check box Select users who will see alert by clicking in User
Role box At bottom, enter the link used as reference Enter the date of the
reference Enter short description of reference Enter who funded the reference
 Select the Users who can see the reference Save In Alert list, click “Edit”
button next to alert Make desired change Save

4 Correct

4 Minor Deviations / Cycles: Describe below

Some confusion with 2 instances of User Roles and Activation buttons.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments: Participants wondered how this would fit into their own work flow.

Average Rating:

Overall, this task was: 4.07

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Generally worked well. May require extra training. _____

Task 10. Clinical information reconciliation

Find your Patient's incoming CCDA on the Inbound Messages Dashboard.

Open the incoming message.

Reconcile with your Patient's record by comparing the Incoming information on the right with the current information on the left. **Check missing information** to be moved to current record.

Complete the Reconciliation and Save.

Enter Time, Score and Comments on Scoresheet.

Task 10: Clinical information reconciliation

Goal Task Time: 1:48 Minutes **Actual Average Time:** 1:37 Minutes

Optimal Path: "Dashboard" button Locate Direct Message regarding your Patient
 Click on Patient Name In Message Menu, click "Reconcile" Button Compare
Current information with Incoming External information Check boxes of External
information not seen in Current Save In Message Menu check Completed box
 Save

4 Correct

4 Minor Deviations / Cycles: Describe below

Some slight confusion determining Current from External information.

Major Deviations: Describe below

Observed Errors and Verbalizations:

Comments:

Average Rating:

Overall, this task was: 4.52

Very Easy = 5; Easy = 4; Average = 3; Slightly Difficult = 2; Very Difficult = 1; Deficient = 0

Administrator / Notetaker Comments:

Most felt this task to be very easy and looked forward to using. _____

Appendix 4: SYSTEM USABILITY SCALE QUESTIONNAIRE

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

Final Questions

What was your overall impression of this system?

What aspects of the system did you like most?

What aspects of the system did you like least?

Were there any features that you were surprised to see?

What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?

Compare this system to other systems you have used.

Would you recommend this system to your colleagues?
