HealthLine
Integrated Healthcare Information Management System

PHOENIX© INTEGRATED ELECTRONIC HEALTH RECORDS
ISIS© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM

Preserving Life's Most Valuable Asset...
OUR HEALTH

170.315(G)(3) SAFETY-ENHANCED DESIGN

EHR USABILITY TEST REPORT

PHOENIX© INTEGRATED ELECTRONIC HEALTH RECORDS
ISIS© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM
VERSION 10

Report based on* NISTIR 7742 *Common Industry Format for Usability Test Reports

Presented To

INFOGARD

Meaningful Use 2015-2017, Stage 3

Stage 3

Date: June 11, 2016

Standards
Report based on NISTIR 7742 *Common Industry Format for Usability Test Reports*

Full Name of Product and Version Tested

1. **PHOENIX© INTEGRATED ELECTRONIC HEALTH RECORDS VERSION 10**
2. **ISIS© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM VERSION 10**

Date of Usability Test Was Conducted: May 4, 2016
Date of Report Was Prepared: June 17, 2016
Report Prepared By:
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1 EXECUTIVE SUMMARY

A usability test of Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System, Version 10 ("E*HealthLine EHR") practice and hospital was conducted on May 4, 2016 in 11408 S. King Dr. Chicago IL 60615 by Roseland Technologies Corporation.

Phoenix Integrated Health Records, Version 10 and ISIS Integrated Hospital Information Management System Version 10 ("E*HealthLine EHR") will henceforth be described as the "EHR Under Test (EHRUT)"

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, 25 healthcare providers and other intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 12 tasks typically conducted on an EHR:

1. § 170.315 (a)(1) Computerized Provider Order Entry (CPOE) – medications
2. § 170.315 (a)(2) CPOE – laboratory
3. § 170.315 (a)(3) CPOE – diagnostic imaging
4. § 170.315 (a)(4) Drug-drug, Drug-allergy Interaction Checks for CPOE
5. § 170.315 (a)(5) Demographics
6. § 170.315 (a)(6) Problem List
7. § 170.315 (a)(7) Medication List
8. § 170.315 (a)(8) Medication Allergy List
9. § 170.315 (a)(9) Clinical Decision Support
10. § 170.315 (a)(14) Implantable Device List
11. § 170.315 (b)(2) Clinical Information Reconciliation and Incorporation
12. § 170.315 (b)(3) Electronic Prescribing

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 3); they were instructed that they could withdraw at any time. Participants did not have prior experience with the EHR. [1] The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

Participant screens, head shots and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

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

The principle guideline used in the process of the design of Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System; Version 10 was the ISO 9241-11 Standard, with emphasis on Efficiency, Effectiveness and Satisfaction of user experience.

[1] Training and help materials were provided. all participants be given the opportunity to complete training similar to what a real end user would receive prior to participating in the usability test

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 [insert dollar amount or other incentive] 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.

Measure/ Task	*N*	Task Success	Task Success	Path Deviation	Task Time (Sec)		Errors		Task Ratings 5=Easy
	#	(%)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	%	Mean (SD)	Mean (SD)
1. §170.315(a)(1)Computerized Provider Order Entry (CPOE) – medications	25	100	0.1101	4/4	0.1608	53/31	0	0.3648	4 (0.8)
2. §170.315 (a)(2) CPOE – laboratory	25	100	0.1101	4/4	0.1608	53/31	0	0.3648	4 (0.8)
3. §170.315 (a)(3) CPOE – diagnostic imaging	25	100	0.1572	7/6	0.1499	49/35	0	0.3648	4 (0.8)
4. §170.315 (a)(4) Drug-drug, Drug-allergy Interaction Checks for CPOE	25	96	0.1201	5/5	0.1499	32/35	4	0.3162	5 (0.6)
5. §170.315(a)(5) Demographics	25	100	0.1201	5/5	0.1499	32/30	0	0.3162	5 (0.6)
6. § 170.315 (a)(6) Problem List	25	100	0.1201	5/6	0.1499	225/180	0	0.3162	5 (0.6)
7. § 170.315 (a)(7) Medication List	25	100	0.1201	5/5	0.1499	200/180	0	0.3162	5 (0.6)
8. §170.315(a)(8) Medication Allergy List	25	99	0.1201	5/5	0.1372	40/35	1	0.3162	5 (0.6)
9. §170.315(a)(9)Clinical Decision Support	25	98	0.1572	4/6	0.1372	225/180	2	0.3648	4 (0.8)
10. §170.315 (a)(14) Implantable Device List	25	100	0.1201	5/5	0.1608	53/40	0	0.3162	5 (0.6)
11. §170.315(b)(2)Clinical Information Reconciliation and Incorporation	25	100	0.1201	9/6	0.1608	53/40	0	0.3162	5 (0.6)
12. §170.315(b)(3) Electronic Prescribing	25	99	0.1572	4/4	0.1499	35/35	1	0.3648	4 (0.8)

Confidence Level =99%

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be 99.[2]

Verbal feedback as well as task ratings conclude that there is a high level of comfort and overall satisfaction with the system. Specifically, users stated that the system is "simple and intuitive," "user friendly," and "organized logically." These statements, along with other participant verbalizations, suggest a high level of usability within the system.

[2] See Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 149). Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

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

MAJOR FINDINGS

- Task Completion Rates: 99.69% completion rates
- Task Failure Rates: 0.31%

Participant	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10	Task 11	Task 12	Task 13
1	√	√	√	√	√	√	√	√	√	√	√	√	√
2	√	√	√	√	√	√	√	√	√	√	√	√	√
3	√	√	√	√	√	√	√	√	√	√	√	√	√
4	√	√	√	√	√	√	√	√	√	√	√	√	√
5	√	√	√	√	√	√	√	√	√	√	√	√	√
6	√	√	√	√	√	√	√	√	√	√	√	√	√
7	√	√	√	√	√	√	√	√	√	√	√	√	√
8	√	√	√	√	√	√	√	√	√	√	√	√	√
9	√	√	√	√	√	√	√	√	√	√	√	√	√
10	√	√	√	√	√	√	√	√	√	√	√	√	√
11	√	√	√	√	√	√	√	√	√	√	√	√	√
12	√	√	√	√	√	√	√	√	√	√	√	√	√
13	√	√	√	√	√	√	√	√	√	√	√	√	√
14	√	√	√	√	√	√	√	√	√	√	√	√	√
15	√	√	√	X	√	√	√	√	√	√	√	√	√
16	√	√	√	√	√	√	√	√	√	√	√	√	√
17	√	√	√	√	√	√	√	√	√	√	√	√	√
18	√	√	√	√	√	√	√	√	√	√	√	√	√
19	√	√	√	√	√	√	√	√	√	√	√	√	√
20	√	√	√	√	√	√	√	√	√	√	√	√	√
21	√	√	√	√	√	√	√	√	√	√	√	√	√
22	√	√	√	√	√	√	√	√	√	√	√	√	√
23	√	√	√	√	√	√	√	√	√	√	√	√	√
24	√	√	√	√	√	√	√	√	√	√	√	√	√
25	√	√	√	√	√	√	√	√	√	√	√	√	√
Success	**25**	**25**	**25**	**24**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
Failure	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Completion Rates	**100%**	**100%**	**100%**	**96%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Failure Rates	**0%**	**0%**	**0%**	**4%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**

After the completion of each task, participants rated the ease or difficult of completing the task for three factors:

1. It was easy to find my way to this information from the homepage.
2. As I was searching for this information, I was able to keep track of where I was in the website.
3. Was able to accurately predict which section of the website contained this information.

TASK RATINGS

The 5-point rating scale ranged from 1 (Strongly disagree) to 5 (Strongly agree). Agree ratings are the agree and strongly agree ratings combined with a mean agreement ratings of > 4.0 considered as the user agrees that the information was easy to find, that they could keep track of their location and predict the section to find the information.

- ***Ease in Finding Information***

All participants agreed it was easy to find treatment information (mean agreement rating = 4.7)

- ***Keeping Track of Location in Site***

All the participants found it easy to keep track of their location in the site while finding treatment

information (mean agreement rating = 4.7)

- ***Time on Task***

  The testing software recorded the time on task for each participant. Some tasks were inherently more difficult to complete than others and is reflected by the average time on task.
  Task 12 required participants to find prescription refill and took the longest time to complete (mean = 210 records).

- ***Overall** Metrics*

Overall Ratings

After task session completion, participants rated the site for eight overall measures These measures include:

- Ease of use
- Frequency of use
- Difficulty of keeping track of where they were in the site
- How quickly most people would learn to use the site
- Getting information quickly
- Homepage's content facilities exploration
- Relevancy of site content
- Site organization

Post-Task Overall Questionnaire

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Percent Agree
Thought Website was easy to use					25	100%
Would use website frequently				6	19	100%
Found it difficult to keep track of where they were in website			2	1	22	92%
Thought most people would learn to use website quickly				8	17	100%
Can get information quickly			1	8	16	92%
Homepage's content makes me want to explore site				2	23	100%
Site's content would keep me coming back			2	6	17	92%
Website is well organized				6	19	100%

**Percent Agree (%) = Agree & Strongly Agree Responses combined*

AREAS FOR IMPROVEMENT

Recommendations:

The recommendations section provides recommended changes and justifications driven by the participant success rate, behaviors, and comments. Each recommendation includes a severity rating. The following recommendations will improve the overall ease of use and address the areas

Change	Justification	Severity
Background color	Four participants had suggested minor background color changes, making these enhancements will improve the overall all user experience of the system.	Low
Add categories to Medication List	Medication history list was too long	Low

Most of the participants found Phoenix© Integrated Electronic Health Records and ISIS© Integrated Hospital Information Management System EHR to be well-organized, comprehensive, clean and uncluttered, very useful, and easy to use.

Having a centralized site to find information is key to many if not all of the participants. Implementing the recommendations and continuing to work with users (i.e., real lay persons) will ensure a continued user-centered Phoenix© Integrated Electronic Health Records and ISIS© Integrated Hospital Information Management System **(**E*HealthLine) EHR.

2 INTRODUCTION

The EHRUT(s) tested for this study were Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System, Version 10. Designed to present medical information to healthcare providers in clinical and hospital, the EHRUT consists of Integrated Electronic Health Records.

The principle guideline used in the process of the design of Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System; Version 10 was the ISO 9241-11 Standard, with emphasis on Efficiency, Effectiveness and Satisfaction of user experience.

PHOENIX© Electronic Medical Record provides lifelong clinical information to care providers whenever and wherever this information is needed. **PHOENIX©** EMR obtains vital information from all points throughout the enterprise (hospitals, physician offices, and clinics) and displays it in integrated views at the point of care. With E*HealthLine's integrated, web-based technology, the EMR is updated in "real time".
Features Include:

1. Streamline patient visits
2. Enhance patient care
   E*HealthLine's offers a broad range of embedded clinical content, plus the flexibility to customize / design encounter forms, add content, and adapt the program to suit specific needs
3. Intelligent decision support tools integrated within the workflow, bring critical information to the point of care, facilitating informed treatment Decisions.
4. Automatic reminders alert - Automated orders and results.
5. Provides a secure, complete view of the patient's clinical data across the care continuum
6. Clinical orders and results are electronically sent and received
7. Online Electronic prescription writer and medication history manager that automatically checks for formulary compliance, drug/drug, drug/disease and drug/allergy interactions.
8. Electronic Prescribing
9. Powerful E&M advisor assists with coding accuracy
10. Security allows user-defined, restricted access to patient records.
11. Provides audit trails documenting every chart action.

ISIS© is a comprehensive "award winning" integrated solution providing hospitals with dynamic paperless information management technology that synchronizes not only the workflow, but also the process flow across the entire enterprise. ISIS© functions as an intuitive workflow process, enabling the management of patient care, patient safety, administrative transactions and financial transactions to facilitate the healthcare enterprise in making accurate and faster decisions and to eliminate medical errors and improve patient safety and outcomes.

ISIS© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM
Features include:

- Patient Admission, Discharge, Transfer
- Scheduling
- Bed Management
- Patient Care
- Department Ordering
- Materials Management
- Patient Accounting

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 Ease in Finding Information, Time on Task, Ease of use, Frequency of use, Site organization, were captured during the usability testing.

3 METHOD

3-1 PARTICIPANTS

Twenty five participants were scheduled over the two testing dates. Twenty five of the Twenty five participants completed the test. Seventeen participants were involved in testing on May 21st and eight on May 22nd. Of the Twenty five participants, eighteen were male and seven were female.

A total of Twenty five participants were tested on the EHRUT(s). Participants in the test were physicians, nurses and Medical assistant. Participants were recruited by Roseland technology and were compensated $100.00 for their time. In addition, participants had no direct connection to the development of or organization producing the EHRUT(s). Participants were not from the testing or supplier organization. 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].

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

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience (M)	Computer Experience (M)	Product Experience (M)	Assistive Technology Needs
1	12455	Male	44	MD	MD	60	288	0	NO
2	12456	Female	36	MD	MD	72	144	0	NO
3	12457	Female	51	MD	MD	132	252	0	NO
4	12458	Male	49	MD	MD	108	228	0	NO
5	12459	Female	35	MD	MD	48	180	0	NO
6	12460	Female	31	MD	MD	36	132	0	NO
7	12461	Female	33	MD	MD	48	156	0	NO
8	12462	Female	39	RN	RN	36	228	0	No
9	12463	Female	38	RN	RN	72	216	0	No
10	12464	Male	42	RN	RN	168	144	0	No
11	12465	Female	28	RN	RN	36	144	0	No
12	12466	Female	26	RN	RN	24	108	0	No
13	12467	Male	34	RN	RN	72	120	0	No
14	12468	Female	38	RN	RN	108	132	0	No
15	12469	Female	31	RN	RN	36	132	0	No
16	12470	Female	36	RN	RN	72	180	0	No
17	12471	Male	37	RN	RN	48	192	0	No
18	12472	Male	46	RN	RN	180	252	0	No
19	12473	Male	29	RN	RN	36	108	0	No
20	12474	Male	30	RN	RN	24	108	0	No
21	12475	Male	42	RN	RN	120	132	0	No
22	12476	Male	34	RN	RN	60	156	0	No
23	12477	Male	24	MA	MA	36	96	0	No
24	12478	Male	24	MA	MA	24	84	0	No
25	12479	Male	24	MA	MA	48	108	0	No
N		25							

Twenty five participants (matching the demographics in the section on Participants) were recruited and Twenty five, i.e., total number of participants who showed participated showed in the usability test. no participants failed to show for the study.

Participants were scheduled for 60 minutes sessions with 30 minutes at the beginning of the session for debrief by the administrator(s) and data logger(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting firm.

3-2 STUDY DESIGN

STUDY DESIGN

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

During the usability test, participants interacted with two EHR(s).

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:

25	Number of tasks successfully completed within the allotted time without assistance
60 min	Time to complete the tasks
1	Number and types of errors
0.1201	Path deviations
25	Participant's verbalizations (comments)
92-100	Participant's satisfaction ratings of the system

3-3 TASKS

TASKS

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

Task 1-4: Computerized Provider Order Entry (CPOE)

1. CPOE – Medications
2. CPOE – laboratory
3. CPOE – diagnostic imaging
4. CPOE – Drug-drug, Drug-allergy Interaction Checks for CPOE

Task 5-11: Patient Summary Screen

5. Demographics
6. Problem List
7. Medication List
8. Medication Allergy List
9. Clinical Decision Support
10. Implantable Device List
11. Clinical Information Reconciliation and Incorporation

Task 12: Electronic Prescribing

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users. [3] Tasks should always be constructed in light of the study objectives.

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

3-4 PROCEDURE

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. [4] Each participant reviewed and signed an informed consent and release form (See Appendix 3). A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was experienced usability practitioners with 3-5 years of experience as usability specialist, and usability analyst. Educational backgrounds: Bachelor's degree in design, human-computer interaction (HCI), or equivalent professional experience as an interactive/user experience designer
Qualifications: Ability to define patterns and advocate for consistency, without repressing inspiration or inhibiting innovation, Proficiency in a variety of design tools, Excellent communication, presentation, interpersonal and analytical skills including the ability to communicate complex, interactive design concepts clearly and persuasively across different audiences and varying levels of the organization, Experience driving user research/usability tests and interpreting usability test data

Administrator(s) and data logger(s)].

The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments.
Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (e.g., the System Usability Scale, see Appendix 5), compensated them for their time, and thanked each individual for their participation.

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

Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form (See Appendix 6) indicating that they had received the compensation.

[4] All participant data must be de-identified and kept confidential.

3-5 TEST LOCATION

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room. All observers and the data logger worked from a separate room where they could see the participant's screen and face shot, and listen to the audio of the session. 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 visible to the participants.

3-6 TEST ENVIRONMENT

TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in larger usability lab is a large three-room suite designed to accommodate focus groups, eyetracking as well as individual or multi-user usability testing The three-room suite can comfortably seat up to 30 observers, Real time remote observations via a live video stream and Wifi is available for clients.[5] For testing, the computer used is a HP 251-a123wb Desktop PC with Intel Pentium J2900 Processor, 4GB Memory, 21.5" Monitor, 1TB Hard Drive and running Windows 10 operating system . The participants used mouse and keyboard when interacting with the EHRUT.

The EHRUT used 21.5" Monitor. The application was set up by the test laboratory according to the E*HealthLine's documentation describing the system set-up and preparation. The application itself was running on a Windows 10 operating system utilizing Microsoft SQL Enterprise Database on a WAN connection. Technically, the system performance response time (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

3-7 TEST FORMS AND TOOLS

TEST FORMS AND TOOLS

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

1. Informed Consent
2. Moderator's Guide
3. Post-test Questionnaire
4. Incentive Receipt and Acknowledgment Form
5. Post-test Questionnaire
6. Incentive Receipt and Acknowledgment Form

Examples of these documents can be found in Appendices 3-6 respectively. The Moderator's Guide was devised so as to be able to capture required data.

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. A video and web camera recorded each participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone.

[5] The test session were electronically transmitted to a nearby observation room where the data logger observed the test session.
[6] There are a variety of tools that record screens and transmit those recordings across a local area network for remote observations.

3-8 PARTICIPANT INSTRUCTIONS

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to the each participant (also see the full moderator's guide in Appendix [B4]):

Thank you for participating in this study. Your input is very important. Our session today will last about 60 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

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

Following the procedural instructions, participants were shown the EHR and as their first task, were given time 15 minutes to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description to you and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not talk aloud or verbalize while you are doing the tasks. [7] I will ask you your impressions about the task once you are done.

Participants were then given Four (4) tasks to complete. Tasks are listed in the moderator's guide in Appendix [B4].

3-9 USABILITY METRICS

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

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

DATA SCORING

The following table (Table [x]) details how tasks were scored, errors evaluated, and the time data analyzed. [8]

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor [e.g., 1.25] that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was [x] seconds then allotted task time performance was [x * 1.25] seconds. This ratio should be 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 an "Failures." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors.[9]This should also be expressed as the On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation. It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. [10] 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 E*HealthLine EHR overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 5.[11]

Table 1. Details of how observed data were scored.

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

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

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

[11] The SUS survey yields a single number that represents a composite measure of the overall perceived usability of the system. SUS scores have a range of 0 to 100 and the score is a relative benchmark that is used against other iterations of the system.

3 RESULTS

3-1 DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses for this test there were not any data exclusions and there were not testing irregularities or issues that affected data collection or interpretation of the results.

The usability testing results for the EHRUT are detailed below (see Table 2 [14]. The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Measure/ Task	*N*	Task Success	Task Success	Path Deviation	Task Time (Sec)		Errors		Task Ratings 5=Easy
	#	(%)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	%	Mean (SD)	Mean (SD)
1. §170.315(a)(1)Computerized Provider Order Entry (CPOE) – medications	25	100	0.1101	4/4	0.1608	53/31	0	0.3648	4 (0.8)
2. §170.315 (a)(2) CPOE – laboratory	25	100	0.1101	4/4	0.1608	53/31	0	0.3648	4 (0.8)
3. §170.315 (a)(3) CPOE – diagnostic imaging	25	100	0.1572	7/6	0.1499	49/35	0	0.3648	4 (0.8)
4. §170.315 (a)(4) Drug-drug, Drug-allergy Interaction Checks for CPOE	25	96	0.1201	5/5	0.1499	32/35	4	0.3162	5 (0.6)
5. §170.315(a)(5) Demographics	25	100	0.1201	5/5	0.1499	32/30	0	0.3162	5 (0.6)
6. § 170.315 (a)(6) Problem List	25	100	0.1201	5/6	0.1499	225/180	0	0.3162	5 (0.6)
7. § 170.315 (a)(7) Medication List	25	100	0.1201	5/5	0.1499	200/180	0	0.3162	5 (0.6)
8. §170.315(a)(8) Medication Allergy List	25	99	0.1201	5/5	0.1372	40/35	1	0.3162	5 (0.6)
9. §170.315(a)(9)Clinical Decision Support	25	98	0.1572	4/6	0.1372	225/180	2	0.3648	4 (0.8)
10. §170.315 (a)(14) Implantable Device List	25	100	0.1201	5/5	0.1608	53/40	0	0.3162	5 (0.6)
11. §170.315(b)(2)Clinical Information Reconciliation and Incorporation	25	100	0.1201	9/6	0.1608	53/40	0	0.3162	5 (0.6)
12. §170.315(b)(3) Electronic Prescribing	25	99	0.1572	4/4	0.1499	35/35	1	0.3648	4 (0.8)

Table 2. The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 95 Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.[15]

Verbal feedback as well as task ratings conclude that there is a high level of comfort and overall satisfaction with the system. Specifically, users stated that the system is "simple and intuitive," "user friendly," and "organized logically." These statements, along with other participant verbalizations, suggest a high level of usability within the system.

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14 [12] Note that this table is an example. You will need to adapt it to report the actual data collected.
15 [13] See Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 149).

3-2 DISCUSSION OF THE FINDINGS

Most of the participants found Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System, Version 10 (E*HealthLine EHR) to be well-organized, comprehensive, clean and uncluttered, very useful, and easy to use. Having a centralized site to find information is key to many if not all of the participants. Implementing the recommendations and continuing to work with users (i.e., real lay persons) will ensure a continued user-centered E*HealthLine EHR.

DISCUSSION OF THE FINDINGS

Measures	Findings
EFFECTIVENESS	The effectiveness of the EHRUT in light of the findings and based on the participants successfully completing the tasks without any path deviation, the mean successful task competition rate was at 99.69%, and Task Failure Percent was at 0.31%. This rate indicated that the participants had very little difficulty with the tasks. Even with no prior experience with an EHR system the tasks was successful performed.
EFFICIENCY	The efficiency of the EHRUT in light of the findings and based on the observations of the task time, most of the participants successfully completed tasks within an acceptable time. Some tasks were complete more quickly than the calculated optimal time; many were almost equal to this timing.
SATISFACTION	The satisfaction data of the EHRUT in light of the findings, based on the task ratings and SUS (System Usability Scale) results data the participants were generally satisfied with Phoenix© Integrated Electronic Health Records and ISIS© Integrated Hospital Information Management System. The results from the SUS scored the subjective satisfaction with the system based on performance with these tasks to be at 95%. Broadly interpreted, scores over 80% would be considered above average, suggesting that the system was easy to adapt to. Individual task satisfaction ratings were related to individual user performance.
MAJOR FINDINGS	The interpretation of the quantitative findings, verbal report of the participants, and observations from the administrators and data loggers, demonstrated considerably more positive attitudes indicating, that the system is very user friendly, comfortable navigating and managing within unfamiliar's system.
AREAS FOR IMPROVEMENT	The interpretation of the quantitative findings, verbal report of the participants, and observations from the administrators and data loggers, demonstrated that the system is easily adaptable, usable system with a relatively short learning curve. Four participants had suggested minor background color changes, making these enhancements will improve the overall all user experience of the system.

Conclusion

Most of the participants found Phoenix© Integrated Electronic Health Records, Version 10 and ISIS© Integrated Hospital Information Management System, Version 10 (E*HealthLine EHR) to be well-organized, comprehensive, clean and uncluttered, and easy to use. Having a centralized site to find information is key to all of the participants. Implementing the recommendations and

continuing to work with users (i.e., real lay persons) will ensure a continued user-centered E*HealthLine EHR.

4 APPENDICES

APPENDICES

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

1: Sample Recruiting screener

2: Participant demographics

3: Non-Disclosure Agreement (NDA) and Informed Consent Form

4: Example Moderator's Guide

5: System Usability Scale Questionnaire

6: Incentive receipt and acknowledgment form

4-1 APPENDIX 1: SAMPLE RECRUITING SCREENER

Appendix 1: SAMPLE RECRUITING SCREENER

Recruiting Script for Recruiting Firm

Hello, my name is John Scott, calling from Roseland Technologies Corporation. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid $100.00 to participate. Can I ask you a few questions?

1. [If not obvious] Are you male or female? [Recruit a mix of participants]
2. Have you participated in a focus group or usability test in the past *xx* months? [If yes, Terminate]
3. Do you, or does anyone in your home, work in marketing research, usability research, web design […etc.]? [If yes, Terminate]
4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
5. Which of the following best describes your age? [23 to 39; 40 to 59; 60 - to 74; 75 and older] [Recruit Mix]
6. Which of the following best describes your race or ethnic group? [e.g., Caucasian, Asian, Black/African-American, Latino/a or Hispanic, etc.]
7. Do you require any assistive technologies to use a computer? [if so, please describe]

Professional Demographics

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

    - ☐ RN: Specialty
    - ☐ Physician: Specialty
    - ☐ Resident: Specialty
    - ☐ Administrative Staff
    - ☐ Other [Terminate]

9. How long have you held this position?
10. Describe your work location (or affiliation) and environment? (Recruit according to the intended users of the application) [e.g., private practice, health system, government clinic, etc.]
11. Which of the following describes your highest level of education? [e.g., high school graduate/GED, some college, college graduate (RN, BSN), postgraduate (MD/PhD), other (explain)]

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? [e.g., access EHR, research; reading news; shopping/banking; digital pictures; programming/word processing, etc.] [If no computer use at all, Terminate]
13. About how many hours per week do you spend on the computer? [Recruit according to the demographics of the intended users, e.g., 0 to 10, 11 to 25, 26+ hours per week]
14. What computer platform do you usually use? [e.g., Mac, Windows, etc.]
15. What Internet browser(s) do you usually use? [e.g., Firefox, IE, AOL, etc.]
16. In the last month, how often have you used an electronic health record?
17. How many years have you used an electronic health record?
18. How many EHRs do you use or are you familiar with?
19. How does your work environment patient records? [Recruit according to the demographics of the intended users]

    - On paper
    - Some paper, some electronic
    - All electronic

Contact Information *If the person matches your qualifications, ask*

Those are all the questions I have for you. Your background matches the people we're looking for. [If you are paying participants or offering some form of compensation, mention] For your participation, you will be paid [$100.0].

Would you be able to participate on May 4, 2016? [If so collect contact information]

May I get your contact information?

- Name of participant:
- Address:
- City, State, Zip:
- Daytime phone number:
- Evening phone number:
- Alternate [cell] phone number:
- Email address:

Before your session starts, we will ask you to sign a release form allowing us to videotape your session. The videotape will only be used internally for further study if needed. Will you consent to be videotaped?

This study will take place at Roseland Technologies Corporation . I will confirm your appointment a couple of days before your session and provide you with directions to our office. What time is the best time to reach you?

4-2 Appendix 2: PARTICIPANT DEMOGRAPHICS

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	13
Women	12
Total (participants)	25
Occupation/Role	
RN/BSN	15
Physician	7
Admin Staff	3
Total (participants)	25
Years of Experience	
Years experience	3 -10
Facility Use of EHR	No
All paper	Yes
Some paper, some electronic	No
All electronic	No
Total (participants)	25

As an appendix to the report, below the full participant breakdown (de-identified)

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience (M)	Computer Experience (M)	Product Experience (M)	Assistive Technology Needs
1	12455	Male	44	MD	MD	60	288	0	NO
2	12456	Female	36	MD	MD	72	144	0	NO
3	12457	Female	51	MD	MD	132	252	0	NO
4	12458	Male	49	MD	MD	108	228	0	NO
5	12459	Female	35	MD	MD	48	180	0	NO
6	12460	Female	31	MD	MD	36	132	0	NO
7	12461	Female	33	MD	MD	48	156	0	NO
8	12462	Female	39	RN	RN	36	228	0	No
9	12463	Female	38	RN	RN	72	216	0	No
10	12464	Male	42	RN	RN	168	144	0	No
11	12465	Female	28	RN	RN	36	144	0	No
12	12466	Female	26	RN	RN	24	108	0	No
13	12467	Male	34	RN	RN	72	120	0	No
14	12468	Female	38	RN	RN	108	132	0	No
15	12469	Female	31	RN	RN	36	132	0	No
16	12470	Female	36	RN	RN	72	180	0	No
17	12471	Male	37	RN	RN	48	192	0	No
18	12472	Male	46	RN	RN	180	252	0	No
19	12473	Male	29	RN	RN	36	108	0	No
20	12474	Male	30	RN	RN	24	108	0	No
21	12475	Male	42	RN	RN	120	132	0	No
22	12476	Male	34	RN	RN	60	156	0	No
23	12477	Male	24	MA	MA	36	96	0	No
24	12478	Male	24	MA	MA	24	84	0	No
25	12479	Male	24	MA	MA	48	108	0	No
N		25							

4-3 Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT

Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT FORM

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of April 5, *2016*, between E*HealthLine com, Inc. ("the Participant") and the testing organization Roseland Technologies Corporation (*Test Company)* located at 1408 S. King Dr. Chicago IL 60615.

The Participant acknowledges his or her voluntary participation in today's usability study may bring the Participant into possession of Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by *Test Company*, or otherwise acquired by the Participant, in the course of today's study.

By way of illustration, but not limitation, Confidential Information includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided design files and other computer files, computer software, ideas, improvements, inventions, training methods and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts.

Any information the Participant acquires relating to this product during this study is confidential and proprietary to *Test Company* and is being disclosed solely for the purposes of the Participant's participation in today's usability study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Participant's printed name: _____

Signature: _____ **Date:** _____

Informed Consent

Roseland Technologies Corporation (*Test Company)* would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about *60* minutes. At the conclusion of the test, you will be compensated for your time.

Agreement

I understand and agree that as a voluntary participant in the present study conducted by *Test Company* I am free to withdraw consent or discontinue participation at any time. I understand and agree to participate in the study conducted and videotaped by the *Test Company*.

I understand and consent to the use and release of the videotape by *Test Company*. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research. I relinquish any rights to the videotape and understand the videotape may be copied and used by *Test Company* without further permission.

I understand and agree that the purpose of this study is to make software applications more useful and usable in the future.

I understand and agree that the data collected from this study may be shared with outside of *Test Company* and *Test Company's* client. I understand and agree that data confidentiality is assured, because only de-identified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

I agree to immediately raise any concerns or areas of discomfort with the study administrator. I understand that I can leave at any time.

Please check one of the following:

- ☐ YES, I have read the above statement and agree to be a participant.
- ☐ NO, I choose not to participate in this study.

Signature: _____

Date: _____

4-4 Appendix 4: MODERATOR'S GUIDE

Appendix A4: MODERATOR'S GUIDE

EHRUT Usability Test
Moderator's Guide

Administrator JOSPH GARACIA

Data Logger: 05-04-2016

Date: 05-04-2016 Time 10:00 AM

Participant # 25

Location: Chicago Illinois

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
- Start session recordings with *tool*

Prior to each task:
- Reset application to starting point for next task

After each participant:
- End session recordings with *tool*

After all testing
- Back up all video and data files

Orientation 15 minutes

Thank you for participating in this study. Our session today will last 60 **minutes**. During that time you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

I did not have any involvement in its creation, so please be honest with your opinions.

The product you will be using today is Phoenix© Integrated Electronic Health Records, Version 10, and ISIS© Integrated Hospital Information Management System, Version 10.

We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?

Preliminary Questions 15 minutes

What is your job title / appointment?

How long have you been working in this role?

What are some of your main responsibilities?

Tell me about your experience with electronic health records.

Task 1: First Impressions 5 Minutes

This is the application you will be working with. Have you heard of it? Yes No
If so, tell me what you know about it.

- *Show test participant the EHRUT.*
- Please don't click on anything just yet. What do you notice? What are you able to do here? Please be specific.

Notes / Comments:

Task 2: Computerized Provider Order Entry (CPOE) - Medication 5 Minutes

Take the participant to the starting point for the task.

On her last visit, you order *Patient* the following prescriptions (do not e-prescribe or send to pharmacy in this task).
Rx :

Hydrochlorothiazide 50 mg tablet. (Generic Name: Hydrochlorothiazide, Trade Name-Aldactazide). Take1 tablet orally, once a day, for 30 days. 1 Refill, dispense: 30, substitution allowed.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time: 300 Seconds

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 3: Computerized Provider Order Entry (CPOE) - laboratory 5 Minutes

Take the participant to the starting point for the task.

On her last visit, you sent *Patient* to get the following laboratory tests

- Creatinine 24 H Urine Panel
- Cholesterol in HDL in serum or plasma
- Fasting Blood Glucose in serum or plasma

Locate these results and review the notes from the specialist.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time:___300___Seconds

Optimal Path: *Screen A → Screen B → Drop Down B[1] → "OK" Button → Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 4: Computerized Provider Order Entry (CPOE) – Diagnostic Imaging 5 Minutes

Take the participant to the starting point for the task.

On her last visit, you sent *Patient* to get a colonscopy. Locate these results and review the notes from the specialist.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time: 300 Seconds

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X...*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 5: Computerized Provider Order Entry (CPOE) – Drug-drug, Drug-allergy Interaction 2 Minutes

Take the participant to the starting point for the task.

Drug-drug Interaction**:**
Prescribe the drug below to patient and notice the drug-drug interaction notification:
ibuprofen 200 mg oral tablet (Trade Name: Motrin IB), OTC Branded**, 1 tablet twice a day, for 30 days. Refills: 1**

Drug-allergy Interaction
Prescribe another drug (below) for patient and notice the drug-allergy interaction notification.
Penicillin V potassium 500 mg oral tablet (Penicillin V Potassium), Rx Generic, 1 tablet once a day, for 5 days. No refills.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time:___2_____Minutes

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 6: Patient Summary Screen - Demographics 1 Minutes

Take the participant to the starting point for the task.

Before going into the exam room and you want to review *Patient's* demographics and chief complaint, history, and vitals. Find this information.

Success:

- ☐ Easily completed
- ☐ Completed with difficulty or help :: Describe below
- ☐ Not completed

Comments:

Task Time:___60_____Seconds

Optimal Path: *Screen A → Screen B → Drop Down B[1] → "OK" Button → Screen X…*

- ☐ Correct
- ☐ Minor Deviations / Cycles :: Describe below
- ☐ Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 7: Patient Summary Screen - Problem List 2 Minutes

Take the participant to the starting point for the task.

Before going into the exam room and you want to review *Patient's* chief complaint, history, ,vitals and problem list. Find this information.

Success:

- ☐ Easily completed
- ☐ Completed with difficulty or help :: Describe below
- ☐ Not completed

Comments:

Task Time: 120 Seconds

Optimal Path: *Screen A → Screen B → Drop Down B[1] → "OK" Button → Screen X...*

- ☐ Correct
- ☐ Minor Deviations / Cycles :: Describe below
- ☐ Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 8: Patient Summary Screen - Medication List 2 Minutes

Take the participant to the starting point for the task.

Your patient has told you that he is taking certain medications currently. Record the current medication list below for the patient:

- Klor-Con 10 mEq Extended Release Tablet (Generic: Potassium Chloride 10 mq oral tablet). one tablet, by oral route, two times a day for 10 days

Make a change to the above medication list by changing the dose from one tablet to **two tablets**.

• Klor-Con 10 mEq Extended Release Tablet, **two tablets**, by oral route, two times a day for 10 days.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time:___120___Seconds

Optimal Path: *Screen A Screen B Drop Down B*[1] *"OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 9: Patient Summary Screen - Medication Allergy List 2 Minutes

Take the participant to the starting point for the task.

Enter the following Allergies for patient:

Type: Medication
Allergen: Ampicillin
Severity: Severe
Observed On: (enter today's date)
Status: Active
Reaction: Diarrhea

Type: Medication
Allergen: Ibuprofen
Severity: Severe
Observed On: (enter today's date)
Status: Active
Reaction: Respiratory distress
Reopen and **deactivate** the 'Ibuprofen' allergy

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time: 120 Seconds

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 10: Patient Summary Screen - Clinical Decision Support 4 Minutes

Take the participant to the starting point for the task.

Before going into the exam room and you want to review *Patient's* chart. Find this information.

Perform the actions below and notice the CDS interventions.
Open a new chart note for patient 'Patient1 C1' and prescribe the antibiotic below.
• Cefprozil 250 MG Oral Tablet, orally, 1 tablet once a day, 10 days, no refills. Dispense: 10.

Success:

- ☐ Easily completed
- ☐ Completed with difficulty or help :: Describe below
- ☐ Not completed

Comments:

Task Time: 240 Seconds

Optimal Path: *Screen A → Screen B → Drop Down B[1] → "OK" Button → Screen X…*

- ☐ Correct
- ☐ Minor Deviations / Cycles :: Describe below
- ☐ Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 11: Patient Summary Screen - Implantable Device List 2 Minutes

Take the participant to the starting point for the task.

Before going into the exam room and you want to review *Patient's* chart for implantable device list and problem list. Find this information.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time:___120___Seconds

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 12: Patient Summary Screen - Clinical Information Reconciliation 5 Minutes

Take the participant to the starting point for the task.

Before going into the exam room and you want to review and reconcile *Patient's* clinical information to include, medication list, laboratory order list, and problem list. Find this information.

Success:

- Easily completed
- Completed with difficulty or help :: Describe below
- Not completed

Comments:

Task Time: 300 Seconds

Optimal Path: *Screen A Screen B Drop Down B[1] "OK" Button Screen X…*

- Correct
- Minor Deviations / Cycles :: Describe below
- Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Task 13: Electronic Prescribing 5 Minutes

Take the participant to the starting point for the task. Ensure that this patient has a drug-drug and a drug-food allergy to the drug chosen. This will put force the participant to find other drugs and use other elements of the application.

After examining *Patient,* you have decided to put this patient on a Statin – *drug name*. Check for any interactions and place an order for this medication.

Success:

- ☐ Easily completed
- ☐ Completed with difficulty or help :: Describe below
- ☐ Not completed

Comments:

Task Time:___300____Seconds

Optimal Path: *Screen A → Screen B → Drop Down B[1] → "OK" Button → Screen X…*

- ☐ Correct
- ☐ Minor Deviations / Cycles :: Describe below
- ☐ Major Deviations :: Describe below

Comments:

Observed Errors and Verbalizations:
Comments:

Rating:

Overall, this task was:_____

Show participant written scale: "Very Difficult" (1) to "Very Easy" (5)

Administrator / Notetaker Comments:

Final Questions 5 Minutes

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?

Administer the SUS

Appendix 5: SYSTEM USABILITY SCALE QUESTIONNAIRE

*In 1996, Brooke published a "*low-cost usability scale that can be used for global assessments of systems usability*" known as the System Usability Scale or SUS.* [14] *Lewis and Sauro (2009) and others have elaborated on the SUS over the years. Computation of the SUS score can be found in Brooke's paper, in at* http://www.usabilitynet.org/trump/documents/Suschapt.doc *or in Tullis and Albert (2008).* [15]

	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

[14] Brooke, J.: SUS: A "quick and dirty" usability scale. In: Jordan, P. W., Thomas, B., Weerdmeester, B. A., McClelland (eds.) *Usability Evaluation in Industry* pp. 189--194. Taylor & Francis, London, UK (1996). SUS is copyrighted to Digital Equipment Corporation, 1986.

[15] Lewis, J R & Sauro, J. (2009) "The Factor Structure Of The System Usability Scale." in *Proceedings of the Human Computer Interaction International Conference (HCII 2009), San Diego CA, USA*

4-6 APPENDIX 6: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Appendix 6: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Acknowledgement of Receipt

I hereby acknowledge receipt of $100.00 for my participation in a research study run by Roseland Technologies Corporation (Test Company).

Printed Name: _____

Address:_____

Signature: _____ Date: _____

Usability Researcher: _____

Signature of Usability Researcher: _____

Date: _____

Witness: _____

Witness Signature: _____

Date: _____

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170.315(b)(11)

EHR Usability Test Report

PHOENIX© INTEGRATED ELECTRONIC HEALTH RECORDS

CARE© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM
VERSION 10.0.0

170.315(b)(11)

Decision Support Intervention
Report based on NISTIR 7742 Common Industry Format for Usability Test Reports

Dates of Usability Testing: September 23, 2024 to September 25, 2024

Date of Report: September 27, 2024

Table of Contents

1 EXECUTIVE SUMMARY

A usability test of Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System, Version 10.0.0 ("E*HealthLine EHR")

From September 23 to September 25,2024, E*HealthLine conducted a summative usability test of the Phoenix-CARE 170.315(b)(11) Decision Support Intervention (DSI) module. The test was conducted via virtual sessions with participants. The purpose was to test and validate the usability of the current user interface and provide evidence of the usability of the Phoenix-CARE 170.315(b)(11) DSI as the Electronic Module Under Test (EMUT).Twenty Five (25) healthcare providers matching the target demographic criteria participated in the usability test using the EMUT in simulated, but representative DSI-related tasks.

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, 25 healthcare providers and other intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

UCD STANDARD USED

Name; NISTIR 7741
Description; NISTIR 7741 - NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, Robert M. Schumacher, User Centric, Inc., Svetlana Z. Lowry, Information Access division, Information Technology Laboratory, National Institute of Standards and Technology, U.S. Department of Commerce, National Institute of Standards and Technology, Version 0.2, 15- Nov.2010.
Citation (URL and/or publication citation) https://www.nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records

The study focused on measuring the effectiveness and efficiency of and satisfaction (NISTIR 7741) with the Phoenix-CARE DSI solution among a sample of potential application users.
Performance data was collected on two scenarios:

1. DSI configuration with two (2)tasks
2. DSI alerts with seven (7)tasks

These tasks are typically performed with in the DSI module. The tasks created were ordered based on their potential risk levels for causing patient harm. Additionally, the criteria for evaluating conformance to DSI functionality within an Electronic Health Record (EHR) were based on the test procedure structure. This structure aligns with the certification criteria defined by the ONC Health IT Certification Program Test Method, identified in § 170.315(b)(11).

This study collected performance data on 9 tasks typically conducted on an EHR:

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 3); they were instructed that they could withdraw at any time. Participants did not have 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, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

Participant screens, head shots and audio were recorded for subsequent analysis.
The following types of data were collected for each participant:

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

The principle guideline used in the process of the design of Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System; Version 10.0.0 was the NISTIR 7741 Standard, with emphasis on Efficiency, Effectiveness and Satisfaction of user experience.

The study results showed that the Phoenix-CARE DSI module performed well in both effectiveness and efficiency, and the participants were satisfied with its performance.

Introduction

The Electronic Module Under Test (EMUT) tested for this study, the DSI module of E*HealthLine' Phoenix-CARE 2.0 ("Phoenix-CARE DSI"), was specifically designed to present medical information to healthcare providers using electronic technology in typical healthcare settings. This study tested and validated the usability of Phoenix-CARE DSI user interface and provided evidence with representative exercises in realistic user conditions. As a result, measures of effectiveness and efficiency, such as time on task, number of errors made, and completion rates were captured during usability testing .Satisfaction was assessed, and user comments were collected using two industry-standard questionnaires:

- System Usability Scale (SUS)/ Likert Scale
- Computer System Usability Questionnaire (CSUQ)

Task Success - Mean (%) and Task Success - SD %.

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 fifty (50) USD 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.

Measure/ Task	*N*	Task Success	Task Success	Path Deviation		Task Time (Sec)				Errors		Task Ratings 5=Easy
	#	Mean (%)	SD (%)	Deviations Observed	Deviations Optimal	Mean	SD	Deviations Observed	Deviations Optimal	Mean (%)	SD (%)	Mean (SD)
C-CDA Incorporation	10	79	0.1201	6	20	79	66	66	38	0	0.3162	5 (0.8)
Configuration Evidence Based DSI	10	100	0.1572	11	2	9	11	11	2	4	0.3162	5 (0.8)
Configuration Predictive DSI	10	100	0.1572	11	2	9	11	11	2	4	0.3162	5 (0.8)
Demographics - Alert, Access, Edit & Feedback	10	97	0.1572	7	9	97	71	71	51	4	0.3162	5 (0.8)
Drug x Allergy Alert, Access, Edit & Feedback	10	97	0.1572	7	9	97	71	71	51	4	0.3162	5 (0.8)
Drug x Drug - Alert, Access, Edit & Feedback	10	100	0.1201	21	7	28	13	21	7	1	0.3648	4 (0.8)
Labs -Alert, Access, Edit & Feedback	10	100	0.1201	21	7	28	13	21	7	1	0.3648	4 (0.8)
Problems - Alert, Access, Edit & Feedback	10	100	0.1201	26	20	46	21	26	20	0	0.3162	4 (0.8)
Vitals -Alert, Access, Edit & Feedback	10	100	0.1572	26	20	46	21	26	20	0	0.3162	4 (0.8)

Confidence Level =99%

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be 99.[2]

Verbal feedback as well as task ratings conclude that there is a high level of comfort and overall satisfaction with the system. Specifically, users stated that the system is "simple and intuitive," "user friendly," and "organized logically." These statements, along with other participant verbalizations, suggest a high level of usability within the system.

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

MAJOR FINDINGS

- Task Completion Rates: 99.33% completion rates
- Task Failure Rates: 0.67%

Participant	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9
1	√	√	√	√	√	√	√	√	√
2	√	√	√	√	√	√	√	√	√
3	√	√	√	√	√	√	√	√	√
4	√	√	√	√	√	√	√	√	√
5	√	√	√	√	√	√	√	√	√
6	√	√	√	√	√	√	√	√	√
7	√	√	√	√	√	√	√	√	√
8	√	√	√	√	√	√	√	√	√
9	√	√	√	√	√	√	√	√	√
10	√	√	√	√	√	√	√	√	√
11	√	√	√	√	√	√	√	√	√
12	√	√	√	√	√	√	√	√	√
13	√	√	√	√	√	√	√	√	√
14	√	√	√	√	√	√	√	√	√
15	√	√	√	√	√	√	√	√	√
16	√	√	√	√	√	√	√	√	√
17	√	√	√	√	√	√	√	√	√
18	√	√	√	√	√	√	√	√	√
19	√	√	√	√	√	√	√	√	√
20	√	√	√	√	√	√	√	√	√
21	√	√	√	√	√	√	√	√	√
22	√	√	√	√	√	√	√	√	√
23	√	√	√	√	√	√	√	√	√
24	√	√	√	√	√	√	√	√	√
25	√	√	√	√	√	√	√	√	√
Success	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Failure	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Completion Rates	**100%**	**100%**	**100%**	**96%**	**100%**	**100%**	**100%**	**99%**	**98%**
Failure Rates	**0%**	**0%**	**0%**	**4%**	**0%**	**0%**	**0%**	**1%**	**2%**

After the completion of each task, participants rated the ease or difficult of completing the task for three factors:

1. It was easy to find my way to this information from the homepage.
2. As I was searching for this information, I was able to keep track of where I was in the website.
3. Was able to accurately predict which section of the website contained this information.

TASK RATINGS

The 5-point rating scale ranged from 1 (Strongly disagree) to 5 (Strongly agree). Agree ratings are the agree and strongly agree ratings combined with a mean agreement ratings of > 4.0 considered as the user agrees that the information was easy to find, that they could keep track of their location and predict the section to find the information.

- ***Ease in Finding Information***

All participants agreed it was easy to find treatment information (mean agreement rating = 4.7)

- ***Keeping Track of Location in Site***

All the participants found it easy to keep track of their location in the site while finding treatment information (mean

agreement rating = 4.7)

- ***Time on Task***

  The testing software recorded the time on task for each participant. Some tasks were inherently more difficult to complete than others and is reflected by the average time on task.
  Task 9 required participants to find prescription refill and took the longest time to complete (mean = 210 records).

- ***Overall** Metrics*

Overall Ratings

After task session completion, participants rated the site for eight overall measures These measures include:

- Ease of use
- Frequency of use
- Difficulty of keeping track of where they were in the site
- How quickly most people would learn to use the site
- Getting information quickly
- Homepage's content facilities exploration
- Relevancy of site content
- Site organization

Post-Task Overall Questionnaire

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Percent Agree
Thought Website was easy to use					25	100%
Would use website frequently				6	19	100%
Found it difficult to keep track of where they were in website			2	1	22	92%
Thought most people would learn to use website quickly				8	17	100%
Can get information quickly			1	8	16	92%
Homepage's content makes me want to explore site				2	23	100%
Site's content would keep me coming back			2	6	17	92%
Website is well organized				6	19	100%

**Percent Agree (%) = Agree & Strongly Agree Responses combined*

AREAS FOR IMPROVEMENT

Recommendations:

The recommendations section provides recommended changes and justifications driven by the participant success rate, behaviors, and comments. Each recommendation includes a severity rating. The following recommendations will improve the overall ease of use and address the areas

Change	Justification	Severity
Background color	Four participants had suggested minor background color changes, making these enhancements will improve the overall all user experience of the system.	Low
Add categories to Medication List	Medication history list was too long	Low

Most of the participants found Phoenix© Integrated Electronic Health Records and CARE© Integrated Hospital Information Management System EHR to be well-organized, comprehensive, clean and uncluttered, very useful, and easy to use.

Having a centralized site to find information is key to many if not all of the participants. Implementing the recommendations and continuing to work with users (i.e., real lay persons) will ensure a continued user-centered Phoenix© Integrated Electronic Health Records and CARE© Integrated Hospital Information Management System **(**E*HealthLine) EHR.

2 INTRODUCTION

The EHRUT(s) tested for this study were Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System, Version 10.0.0. Designed to present medical information to healthcare providers in clinical and hospital, the EHRUT consists of Integrated Electronic Health Records.

The principle guideline used in the process of the design of Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System; Version 10.0.0 was the NISTIR 7741 Standard, with emphasis on Efficiency, Effectiveness and Satisfaction of user experience.

PHOENIX© Electronic Medical Record provides lifelong clinical information to care providers whenever and wherever this information is needed. **PHOENIX©** EMR obtains vital information from all points throughout the enterprise (hospitals, physician offices, and clinics) and displays it in integrated views at the point of care. With E*HealthLine's integrated, web-based technology, the EMR is updated in "real time".
Features Include:

1. Streamline patient visits
2. Enhance patient care
   E*HealthLine's offers a broad range of embedded clinical content, plus the flexibility to customize / design encounter forms, add content, and adapt the program to suit specific needs
3. Intelligent decision support tools integrated within the workflow, bring critical information to the point of care, facilitating informed treatment Decisions.
4. Automatic reminders alert - Automated orders and results.
5. Provides a secure, complete view of the patient's clinical data across the care continuum
6. Clinical orders and results are electronically sent and received
7. Online Electronic prescription writer and medication history manager that automatically checks for formulary compliance, drug/drug, drug/disease and drug/allergy interactions.
8. Electronic Prescribing
9. Powerful E&M advisor assists with coding accuracy
10. Security allows user-defined, restricted access to patient records.
11. Provides audit trails documenting every chart action.

CARE© is a comprehensive "award winning" integrated solution providing hospitals with dynamic paperless information management technology that synchronizes not only the workflow, but also the process flow across the entire enterprise. CARE© functions as an intuitive workflow process, enabling the management of patient care, patient safety, administrative transactions and financial transactions to facilitate the healthcare enterprise in making accurate and faster decisions and to eliminate medical errors and improve patient safety and outcomes.

CARE© INTEGRATED HOSPITAL INFORMATION MANAGEMENT SYSTEM
Features include:

- Patient Admission, Discharge, Transfer
- Scheduling
- Bed Management
- Patient Care
- Department Ordering
- Materials Management
- Patient Accounting

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 Ease in Finding Information, Time on Task, Ease of use, Frequency of use, Site organization, were captured during the usability testing.

3 METHOD

3-1 PARTICIPANTS

Twenty Five (25) individuals (12 men and 13 women) participated in the EMUT using the Phoenix-CARE DSI. Participants were various specialty physicians recruited from users of distinct EHRs. Those who responded to the invitation to take part in the study were directed to an online questionnaire that served as the participant screener. (The screening questionnaire is provided as Appendix A.) Respondents meeting the criteria for participation in the study were contacted and scheduled via telephone and email.

Participants in the usability test of the Phoenix-CARE DSI had a variety of healthcare backgrounds and demographic characteristics. Table 1 presents participant characteristics, including demographics, professional experience, computing experience, and previous EHR experience. Participant characteristics reflect the audience of current and future users and meet the criteria designated in the ONC Certification Companion Guide for Safety-enhanced design - 170.315(g)(3). None of the participants were from or affiliated with E*HealthLine. Participants were not compensated for their time.

For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants.

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

Participant Identifier	Participant Gender	Participant Age	Participant Education	Participant Occupation/Role	Participant Professional Experience	Participant Computer Experience	Participant Product Experience	Participant Assistive Technology Needs
1000	Female	20-29	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	60	60	60	No
1001	Male	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	240	11	240	No
1002	Male	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	336	120	336	No
1003	Male	60-69	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	480	36	480	No
1004	Female	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	132	96	132	No
1005	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	300	132	300	No
1006	Female	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	360	72	360	No
1007	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	180	120	180	No
1008	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	360	132	360	No
1009	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	384	240	384	No
1010	Male	40-49	Master's degree	RN	228	36	228	No
1011	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	192	192	192	No
1012	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	156	204	156	No
1013	Male	50-59	Bachelor's degree	Biologics coordinator/Front desk	240	360	240	No
1014	Female	50-59	High school graduate, diploma or the equivalent (for example: GED)	CSS	12	144	12	No
1015	Female	20-29	Bachelor's degree	Clinical Associate	24	204	24	No
1016	Female	30-39	Bachelor's degree	Manager of Patient Access	120	300	120	No

1017	Female	30-39	Associate degree	Office Supervisor	36	312	36	No
1018	Female	50-59	Some college credit, no degree	Outreach Specialist	84	120	84	No
1019	Female	20-29	Bachelor's degree	Patient Services Specialist	72	72	72	No
1020	Female	40-49	Trade/technical/vocational training	Patient access representative	120	120	120	No
1021	Male	50-59	Bachelor's degree	Practice Administrator	180	360	180	No
1022	Female	40-49	Bachelor's degree	Surgery Scheduler	96	336	96	No
1023	Female	40-49	Some college credit, no degree	Receptionist / Scheduler	30	468	30	No
1024	Female	50-59	Trade/technical/vocational training	Clinical Assistant	192	360	192	No

Participants were scheduled for 60 minutes sessions with 30 minutes at the beginning of the session for debrief by the administrator(s) and data logger(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting firm.

3-2 STUDY DESIGN

STUDY DESIGN

The overall objective of this usability test was to uncover areas where the Phoenix-CARE DSI application performed well – effectively, efficiently, and satisfactorily. Data from this test may be used as a baseline for future tests of updated versions of Phoenix-CARE DSI and/or for comparing the Phoenix-CARE DSI application with other DSI modules presenting the same tasks. In short, this testing serves as both a means to record or benchmark current usability and to identify areas where improvements can or should be deployed.

Participants had a range of experience with EHRs in general, but none had any prior experience with the Phoenix-CARE DSI since it is brand new to the market to address the new 170.315(b)(11) criterion. Participants completed the Phoenix-CARE DSI usability study during individual 30-40-minute remote video conference sessions. During the test, each participant had the opportunity to review, interact, and provide feedback on various components of Phoenix-CARE DSI. Each participant was provided with the same set of instructions.

During the usability test, participants interacted with two EHR(s).

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:

25	Number of tasks successfully completed within the allotted time without assistance
60 min	Time to complete the tasks
1	Number and types of errors
0.1201	Path deviations
25	Participant's verbalizations (comments)
92-100	Participant's satisfaction ratings of the system

3-3 TASKS

TASKS

E*HealthLine constructed seven (7) Alert Tasks and two (2) Configuration Tasks to realistically represent activities a user might engage in while using Phoenix-CARE DSI in actual medical settings. The tasks were created based upon the criteria specified in the test procedure structure for evaluating conformance to the ONC Health IT Certification Program Test Method criteria identified in § 170.315(b)(11).

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

Configuration Tasks

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users. [3] Tasks should always be constructed in light of the study objectives.

Task 1 (T101): The user configures evidence-based DSI based on the required elements - alone or in combination.

- User searches evidence-based DSIs from a list of available DSIs
- User views source attributes for evidence-based DSI – (based on the 13 source attributes)
- User enables evidence-based DSI
- User changes source attributes for evidence-based DSI
- User accesses updated source attributes for evidence-based DSI

Task 2 (T102): User demonstrates the configuration of access to a third-party Predictive Decision Support Intervention (PDSI) based on USCDI data elements. As Phoenix-CARE DSI is not a supplier of PDSI, a demo app was configured to allow users to understand how they will be able to search, view source attributes and activate third-party Predictive DSI.

- User searches Predictive DSIs from a list of available DSIs
- User views source attributes for Predictive DSI – (based on the 31 source attributes)
- User enables Predictive DSI
- User changes source attributes for Predictive DSI
- User accesses updated source attributes for Predictive DSI

Alerts Tasks

Alerts tasks involved configuring specific alerts and then viewing them from the patient chart.

Task 1 (T105): **Drug x Drug**

- Enable Alert
- Access Source Attributes
- View Alert
- Submit Feedback

Task 2 (T104): **Drug x Allergy**

- Enable Alert
- Access Source Attributes
- View Alert
- Submit Feedback

Task 3 (T103): Demographic (Age/Gender)

- Enable Alert
- View Alert
- Submit Feedback

Task 4 (T108): **Vitals**

- Enable Alert
- View Alert
- Submit Feedback

Task 5 (T106): **Labs**

- Enable Alert
- View Alert
- Submit Feedback

Task 6 (T107): **Problem**

- Enable Alert
- View Alert
- Submit Feedback

Task 7 (T100): **C-CDA incorporation**

- Import CCDA
- View Alerts

3-4 PROCEDURE

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. [4] Each participant reviewed and signed an informed consent and release form (See Appendix 3). A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was experienced usability practitioners with 3-5 years of experience as usability specialist, and usability analyst. Educational backgrounds: Bachelor's degree in design, human-computer interaction (HCI), or equivalent professional experience as an interactive/user experience designer

Qualifications: Ability to define patterns and advocate for consistency, without repressing inspiration or inhibiting innovation, Proficiency in a variety of design tools, Excellent communication, presentation, interpersonal and analytical skills including the ability to communicate complex, interactive design concepts clearly and persuasively across different audiences and varying levels of the organization, Experience driving user research/usability tests and interpreting usability test data

Administrator(s) and data logger(s)].

The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments.
Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (e.g., the System Usability Scale, see Appendix 5), compensated them for their time, and thanked each individual for their participation.

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

Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form (See Appendix 6) indicating that they had received the compensation.

3-5 TEST LOCATION

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room. All observers and the data logger worked from a separate room where they could see the participant's screen and face shot, and listen to the audio of the session. 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 visible to the participants.

3-6 TEST ENVIRONMENT

TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in larger usability lab is a large three-room suite designed to accommodate focus groups, eye tracking as well as individual or multi-user usability testing The three-room suite can comfortably seat up to 30 observers, Real time remote observations via a live video stream and Wifi is available for clients.[5] For testing, the computer used is a HP 251-a123wb Desktop PC with Intel Pentium J2900 Processor, 4GB Memory, 21.5" Monitor, 1TB Hard Drive and running Windows 10 operating system . The participants used mouse and keyboard when interacting with the EHRUT.

The EHRUT used 21.5" Monitor. The application was set up by the test laboratory according to the E*HealthLine's documentation describing the system set-up and preparation. The application itself was running on a Windows 10 operating system utilizing Microsoft SQL Enterprise Database on a WAN connection. Technically, the system performance response time (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

3-7 TEST FORMS AND TOOLS

TEST FORMS AND TOOLS

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

1. Informed Consent
2. Moderator's Guide
3. Post-test Questionnaire
4. Incentive Receipt and Acknowledgment Form
5. Post-test Questionnaire
6. Incentive Receipt and Acknowledgment Form

Examples of these documents can be found in Appendices 3-6 respectively. The Moderator's Guide was devised so as to be able to capture required data.

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. A video and web camera recorded each participant's
facial expressions synced with the screen capture, and verbal comments were recorded with a microphone.

3-8 PARTICIPANT INSTRUCTIONS

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to the each participant (also see the full moderator's guide in Appendix [B4]):

Thank you for participating in this study. Your input is very important. Our session today will last about 60 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

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

Following the procedural instructions, participants were shown the EHR and as their first task, were given time 15 minutes to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

For each task, I will read the description to you and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not talk aloud or verbalize while you are doing the tasks. [7] I will ask you your impressions about the task once you are done.

Participants were then given Four (4) tasks to complete. Tasks are listed in the moderator's guide in Appendix [B4].

3-9 USABILITY METRICS

USABILITY METRICS

According to the *NIST Guide* (NIST IR 7741) *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 E*HealthLine EHR by measuring participant success rates and errors
2. Efficiency of E*HealthLine EHR by measuring the average task time and path deviations
3. Satisfaction with E*HealthLine EHR 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. [8]

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor [e.g., 1.25] that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was [x] seconds then allotted task time performance was [x * 1.25] seconds. This ratio should be 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 an "Failures." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors.[9]This should also be expressed as the On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation. It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants.

3 RESULTS

3-1 DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses for this test there were not any data exclusions and there were not testing irregularities or issues that affected data collection or interpretation of the results.

The usability testing results for the EHRUT are detailed below (see Table 2 [14]. The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Measure/ Task	N	Task Success	Task Success	Path Deviation		Task Time (Sec)				Errors		Task Ratings 5=Easy
	#	Mean (%)	SD (%)	Deviations Observed	Deviations Optimal	Mean	SD	Deviations Observed	Deviations Optimal	Mean (%)	SD (%)	Mean (SD)
C-CDA Incorporation	10	79	0.1201	6	20	79	66	66	38	0	0.3162	5 (0.8)
Configuration Evidence Based DSI	10	100	0.1572	11	2	9	11	11	2	4	0.3162	5 (0.8)
Configuration Predictive DSI	10	100	0.1572	11	2	9	11	11	2	4	0.3162	5 (0.8)
Demographics - Alert, Access, Edit & Feedback	10	97	0.1572	7	9	97	71	71	51	4	0.3162	5 (0.8)
Drug x Allergy Alert, Access, Edit & Feedback	10	97	0.1572	7	9	97	71	71	51	4	0.3162	5 (0.8)
Drug x Drug - Alert, Access, Edit & Feedback	10	100	0.1201	21	7	28	13	21	7	1	0.3648	4 (0.8)
Labs -Alert, Access, Edit & Feedback	10	100	0.1201	21	7	28	13	21	7	1	0.3648	4 (0.8)
Problems - Alert, Access, Edit & Feedback	10	100	0.1201	26	20	46	21	26	20	0	0.3162	4 (0.8)
Vitals -Alert, Access, Edit & Feedback	10	100	0.1572	26	20	46	21	26	20	0	0.3162	4 (0.8)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 95 Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.[15]

Verbal feedback as well as task ratings conclude that there is a high level of comfort and overall satisfaction with the system. Specifically, users stated that the system is "simple and intuitive," "user friendly," and "organized logically." These statements, along with other participant verbalizations, suggest a high level of usability within the system.

3-2 DISCUSSION OF THE FINDINGS

Most of the participants found Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System, Version 10.0.0 (E*HealthLine EHR) to be well-organized, comprehensive, clean and uncluttered, very useful, and easy to use. Having a centralized site to find information is key to many if not all of the participants. Implementing the recommendations and continuing to work with users (i.e., real lay persons) will ensure a continued user-centered E*HealthLine EHR.

In general, the participants performed well and were satisfied with the Phoenix-CARE DSI application.

Some participants struggled with some portions of a few tasks, but in general, most were able to successfully complete most of the tasks with little or no difficulty. The very new feature of accessing the Predictive DSI application to configure and edit the source attributes was the most difficult. This is partly because none of the participants were exposed to these types of tasks within their current use of the EHRs. Given that no participants had any prior experience with the application, this shows that the Phoenix-CARE DSI application is an easy-to-learn module. Participants were mostly able to perform all tasks successfully on their own with no assistance or external documentation. Based on the participant's high average performance rate, the Phoenix-CARE DSI application appears to be a highly usable DSI module.

Effectiveness
All the tasks presented were successfully completed by all the participants. The participants' mean successful task completion rate was high, with an overall average rate of 100 percent. This high score is an indicator that the participants had little difficulty completing the tasks.

The amount of prior experience with EHR systems was related to successful task performance and error rates. Participants with more prior experience were more likely to successfully complete tasks with fewer errors than those with less prior experience.

Efficiency
Participants who successfully completed tasks mostly completed those tasks within an acceptable time. Some tasks were completed more quickly than others when compared to the calculated optimal time. Some unfamiliar tasks (configuring source attributes) took slightly longer than expected but were finished within the optimal time assigned. The tasks that took the longest required the participants to navigate to an unfamiliar portion of the application, interact with a new workflow, and locate and select specific actions. Those tasks may be performed more quickly with a minor set of updates to the user interface and/or the user experience.

Some participants almost made errors when attempting to navigate toward solving their assigned tasks. These errors were avoided by following the easily accessible selection tabs. These potential errors can be associated with participants' lack of familiarity with the features and the unique input functions of the Phoenix-CARE DSI application. As noted above, prior experience with EHR systems was related to successful task completion.

Satisfaction
Participants were satisfied with the Phoenix-CARE DSI application as indicated by the SUS (mean = 86.5 out of a possible 100) and the CSUQ scores (Overall score = 5.4 out of a possible 7.0). These high scores demonstrate a high degree of satisfaction with the application.

On the CSUQ, participants ranked the scale "(System Usefulness)" highest of the three scales, suggesting that users felt that the Phoenix-CARE DSI application would likely solve their tasks in an effective and efficient manner. Individual task satisfaction ratings were related to individual user performance. The participants who were able to successfully complete tasks were also more likely to rank those tasks as satisfying, while those participants who did poorly or were not able to complete a task ranked those tasks as less satisfying.

DISCUSSION OF THE FINDINGS

Measures	Findings
EFFECTIVENESS	The effectiveness of the EHRUT in light of the findings and based on the participants successfully completing the tasks without any path deviation, the mean successful task competition rate was at 99.33%, and Task Failure Percent was at 0.67%. This rate indicated that the participants had very little difficulty with the tasks. Even with no prior experience with an EHR system the tasks was successful performed.
EFFICIENCY	The efficiency of the EHRUT in light of the findings and based on the observations of the task time, most of the participants successfully completed tasks within an acceptable time. Some tasks were complete more quickly than the calculated optimal time; many were almost equal to this timing.
SATISFACTION	The satisfaction data of the EHRUT in light of the findings, based on the task ratings and SUS (System Usability Scale) results data the participants were generally satisfied with Phoenix© Integrated Electronic Health Records and CARE© Integrated Hospital Information Management System. The results from the SUS scored the subjective satisfaction with the system based on performance with these tasks to be at 95%. Broadly interpreted, scores over 80% would be considered above average, suggesting that the system was easy to adapt to. Individual task satisfaction ratings were related to individual user performance.
MAJOR FINDINGS	The interpretation of the quantitative findings, verbal report of the participants, and observations from the administrators and data loggers, demonstrated considerably more positive attitudes indicating, that the system is very user friendly, comfortable navigating and managing within unfamiliar's system.
AREAS FOR IMPROVEMENT	The interpretation of the quantitative findings, verbal report of the participants, and observations from the administrators and data loggers, demonstrated that the system is easily adaptable, usable system with a relatively short learning curve. Four participants had suggested minor background color changes, making these enhancements will improve the overall all user experience of the system.

Conclusion

Most of the participants found Phoenix© Integrated Electronic Health Records, Version 10.0.0 and CARE© Integrated Hospital Information Management System, Version 10.0.0 (E*HealthLine EHR) DSI application to be well-organized, comprehensive, clean and uncluttered, and easy to use. Having a centralized site to find information is key to all of the participants. Implementing the recommendations and continuing to work with users (i.e., real lay persons) will ensure a continued user-centered E*HealthLine EHR.

This evaluation demonstrated that the Phoenix-CARE DSI application is a usable application with a short learning curve. None of the participants had any experience using the Phoenix-CARE DSI application. However, they experienced very little difficulty completing their tasks, even with a limited understanding of the unique navigation. Configuration Task 2 (PDSI Configuration) was the task that participants needed the most time with. This involved simulating the configuration of a demo third-party PDSI application. Participants with more EHR experience completed this task with relatively low difficulty and no errors.

APPENDICES

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

1: Sample Recruiting screener

2: Participant demographics

3: Non-Disclosure Agreement (NDA) and Informed Consent Form

4: Example Moderator's Guide

5: System Usability Scale Questionnaire

6: Incentive receipt and acknowledgment form

4-1 APPENDIX 1: SAMPLE RECRUITING SCREENER

Appendix 1: SAMPLE RECRUITING SCREENER

Recruiting Script for Recruiting Firm

Hello, my name is John Scott, calling from Roseland Technologies Corporation. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid $100.00 to participate. Can I ask you a few questions?

1. [If not obvious] Are you male or female? [Recruit a mix of participants]
2. Have you participated in a focus group or usability test in the past *xx* months? [If yes, Terminate]
3. Do you, or does anyone in your home, work in marketing research, usability research, web design […etc.]? [If yes, Terminate]
4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
5. Which of the following best describes your age? [23 to 39; 40 to 59; 60 - to 74; 75 and older] [Recruit Mix]
6. Which of the following best describes your race or ethnic group? [e.g., Caucasian, Asian, Black/African-American, Latino/a or Hispanic, etc.]
7. Do you require any assistive technologies to use a computer? [if so, please describe]

Professional Demographics

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

    - ☐ RN: Specialty
    - ☐ Physician: Specialty
    - ☐ Resident: Specialty
    - ☐ Administrative Staff
    - ☐ Other [Terminate]

9. How long have you held this position?
10. Describe your work location (or affiliation) and environment? (Recruit according to the intended users of the application) [e.g., private practice, health system, government clinic, etc.]
11. Which of the following describes your highest level of education? [e.g., high school graduate/GED, some college, college graduate (RN, BSN), postgraduate (MD/PhD), other (explain)]

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? [e.g., access EHR, research; reading news; shopping/banking; digital pictures; programming/word processing, etc.] [If no computer use at all, Terminate]
13. About how many hours per week do you spend on the computer? [Recruit according to the demographics of the intended users, e.g., 0 to 10, 11 to 25, 26+ hours per week]
14. What computer platform do you usually use? [e.g., Mac, Windows, etc.]
15. What Internet browser(s) do you usually use? [e.g., Firefox, IE, AOL, etc.]
16. In the last month, how often have you used an electronic health record?
17. How many years have you used an electronic health record?
18. How many EHRs do you use or are you familiar with?
19. How does your work environment patient records? [Recruit according to the demographics of the intended users]

    - On paper
    - Some paper, some electronic
    - All electronic

Contact Information *If the person matches your qualifications, ask*

Those are all the questions I have for you. Your background matches the people we're looking for. [If you are paying participants or offering some form of compensation, mention] For your participation, you will be paid [$100.0].

Would you be able to participate on May 4, 2016? [If so collect contact information]

May I get your contact information?

- Name of participant:
- Address:
- City, State, Zip:
- Daytime phone number:
- Evening phone number:
- Alternate [cell] phone number:
- Email address:

Before your session starts, we will ask you to sign a release form allowing us to videotape your session. The videotape will only be used internally for further study if needed. Will you consent to be videotaped?

This study will take place at Roseland Technologies Corporation . I will confirm your appointment a couple of days before your session and provide you with directions to our office. What time is the best time to reach you?

4-2 Appendix 2: PARTICIPANT DEMOGRAPHICS

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	13
Women	12
Total (participants)	25
Occupation/Role	
RN/BSN	15
Physician	7
Admin Staff	3
Total (participants)	25
Years of Experience	
Years experience	3 -10
Facility Use of EHR	No
All paper	Yes
Some paper, some electronic	No
All electronic	No
Total (participants)	25

As an appendix to the report, below the full participant breakdown (de-identified)

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience (M)	Computer Experience (M)	Product Experience (M)	Assistive Technology Needs
1	1000	Female	20-29	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	60	60	60	No
2	1001	Male	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	240	11	240	No
3	1002	Male	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	336	120	336	No
4	1003	Male	60-69	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	480	36	480	No
5	1004	Female	40-49	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	132	96	132	No
6	1005	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	300	132	300	No
7	1006	Female	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	360	72	360	No
8	1007	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	180	120	180	No
9	1008	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	360	132	360	No
10	1009	Male	50-59	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	384	240	384	No
11	1010	Male	40-49	Master's degree	RN	228	36	228	No
12	1011	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	192	192	192	No
13	1012	Male	30-39	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	156	204	156	No
14	1013	Male	50-59	Bachelor's degree	Biologics coordinator/Front desk	240	360	240	No
15	1014	Female	50-59	High school graduate, diploma or the equivalent (for example: GED)	CSS	12	144	12	No
16	1015	Female	20-29	Bachelor's degree	Clinical Associate	24	204	24	No
17	1016	Female	30-39	Bachelor's degree	Manager of Patient Access	120	300	120	No
18	1017	Female	30-39	Associate degree	Office Supervisor	36	312	36	No
19	1018	Female	50-59	Some college credit, no degree	Outreach Specialist	84	120	84	No
20	1019	Female	20-29	Bachelor's degree	Patient Services Specialist	72	72	72	No
21	1020	Female	40-49	Trade/technical/vocational training	Patient access representative	120	120	120	No
22	1021	Male	50-59	Bachelor's degree	Practice Administrator	180	360	180	No
23	1022	Female	40-49	Bachelor's degree	Surgery Scheduler	96	336	96	No
24	1023	Female	40-49	Some college credit, no degree	Receptionist / Scheduler	30	468	30	No
25	1024	Female	50-59	Trade/technical/vocational training	Clinical Assistant	192	360	192	No
N		25							

4-3 Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT

Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT FORM

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of April 5, *2016*, between E*HealthLine com, Inc. ("the Participant") and the testing organization Roseland Technologies Corporation (*Test Company)* located at 1408 S. King Dr. Chicago IL 60615.

The Participant acknowledges his or her voluntary participation in today's usability study may bring the Participant into possession of Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by *Test Company*, or otherwise acquired by the Participant, in the course of today's study.

By way of illustration, but not limitation, Confidential Information includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided design files and other computer files, computer software, ideas, improvements, inventions, training methods and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts.

Any information the Participant acquires relating to this product during this study is confidential and proprietary to *Test Company* and is being disclosed solely for the purposes of the Participant's participation in today's usability study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Participant's printed name: _____

Signature: _____ **Date:** _____

Informed Consent

Roseland Technologies Corporation (*Test Company)* would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about *60* minutes. At the conclusion of the test, you will be compensated for your time.

Agreement

I understand and agree that as a voluntary participant in the present study conducted by *Test Company* I am free to withdraw consent or discontinue participation at any time. I understand and agree to participate in the study conducted and videotaped by the *Test Company*.

I understand and consent to the use and release of the videotape by *Test Company*. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research. I relinquish any rights to the videotape and understand the videotape may be copied and used by *Test Company* without further permission.

I understand and agree that the purpose of this study is to make software applications more useful and usable in the future.

I understand and agree that the data collected from this study may be shared with outside of *Test Company* and *Test Company's* client. I understand and agree that data confidentiality is assured, because only de-identified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

I agree to immediately raise any concerns or areas of discomfort with the study administrator. I understand that I can leave at any time.

Please check one of the following:

- ☐ YES, I have read the above statement and agree to be a participant.
- ☐ NO, I choose not to participate in this study.

Signature: _____

Date: _____

4-4 Appendix 4: MODERATOR'S GUIDE

Appendix A4: MODERATOR'S GUIDE

EHRUT Usability Test
Moderator's Guide

Administrator JOSPH GARACIA

Data Logger: 05-04-2016

Date: 05-04-2016 Time 10:00 AM

Participant # 25

Location: Chicago Illinois

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
- Start session recordings with *tool*

Prior to each task:
- Reset application to starting point for next task

After each participant:
- End session recordings with *tool*

After all testing
- Back up all video and data files

Orientation 15 minutes

Thank you for participating in this study. Our session today will last 60 **minutes**. During that time you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

I did not have any involvement in its creation, so please be honest with your opinions.

The product you will be using today is Phoenix© Integrated Electronic Health Records, Version 10.0.0, and CARE© Integrated Hospital Information Management System, Version 10.0.0.

We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?

Preliminary Questions 15 minutes

What is your job title / appointment?

How long have you been working in this role?

What are some of your main responsibilities?

Tell me about your experience with electronic health records.

Final Questions 5 Minutes

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?

Administer the SUS

Appendix 5: SYSTEM USABILITY SCALE QUESTIONNAIRE

*In 1996, Brooke published a "*low-cost usability scale that can be used for global assessments of systems usability*" known as the System Usability Scale or SUS.* [14] *Lewis and Sauro (2009) and others have elaborated on the SUS over the years. Computation of the SUS score can be found in Brooke's paper, in at* http://www.usabilitynet.org/trump/documents/Suschapt.doc *or in Tullis and Albert (2008).* [15]

	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

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