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Electronic Health Record Usability Testing

OMNIWOUND LLC

U.S. Department of Commerce
Gary Locke, Secretary

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EHR Usability Test Report of OmniEHR v1

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

OmniEHR v1

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Table of Contents

1 EXECUTIVE SUMMARY 7
2 INTRODUCTION 10
3 METHOD 10
3.1 PARTICIPANTS 10
3.2 STUDY DESIGN 11
3.3 TASKS 12
3.4 PROCEDURE 13
3.5 TEST LOCATION 14
3.6 TEST ENVIRONMENT 15
3.7 TEST FORMS AND TOOLS 15
3.8 PARTICIPANT INSTRUCTIONS 16
3.9 USABILITY METRICS 17
4 RESULTS 19
4.1 DATA ANALYSIS AND REPORTING 19
4.2 DISCUSSION OF THE FINDINGS 20

EXECUTIVE SUMMARY

A usability test of OmniEHR v1 was conducted on September 10-16th, 2022 at 1590 Anderson Ave 18A by Omniwound. 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, five healthcare providers and six other medical billing departments (matching the target demographic criteria) served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 7 tasks typically conducted on an EHR:

1. Input Laboratory: (a2)
2. Input Image :(a3)
3. Input Patient Demographic: (a5)
4. Input Clinical Decision Support: (a9)
5. Input Implantable Device: (a14)
6. Input Medication: (a1)
7. Input Drug-Drug Allergy interaction: (a4)

During the 60–90-minute one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form; they were instructed that they could withdraw at any time. All participants did 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 a program called TaskWatch, which was built for recording purposes to be exported to Microsoft Excel. The administrator did not give the participant assistance in how to complete the task.

Participant screens and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

- 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 satisfaction ratings of the system

All participant data was de-identified – no correspondence could be made between the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a posttest questionnaire and were compensated with a gift certificate for their time. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is **a summary of the performance and rating data collected on the EHRUT.**

Meaure / Task	N	Task Success	Path Deviation	Task Time		Errors	Task Rating 5=Easy
	#	Mean (SD)	Deviations (Observed/ Optimal)	Mean(SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
a2	21	0.50	23.40	44.98	59.30%	50.45%	0.82
a3	18	0.30	18.55	35.51	66.58%	30.15%	0.40
a5	19	0.40	24.22	50.70	79.50%	40.45%	0.65
a4	17	0.60	8.69	36.04	95.23%	60.30%	1.27
a9	14	0.50	24.53	46.90	58.09%	50.45%	1.57
a1	17	17	52.28	56.50	11.08%	0.00	5.00
a14	17	0	19.57	20.32	36.79%	0.00	0.40

The results from the Likert Scale scored subjective satisfaction with the system based on performance with these tasks to be: 4/5 on average

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

Major Findings:

- Clinical Decision Support button could not be located by the participant. The CDS (Clinical Decision Support) button used to identify alerts and tasks were not recognized by most of the users. Tasks were not intuitive for the users.

- Many of the users had difficulty locating the Drug-Drug Allergy button due to the confusion of two names (drug and allergy) since it is in two different sections.
    - Areas for improvement
- Allow application to be in full screen in desktop mode.
- All button menu to be aligned left side along with other buttons instead of right side.
- Create a short instruction video of each section input.
- Open sections based on initial patient consultation (previous input)
- Search history displayed along with pre-populated value base on previous input.

INTRODUCTION

The EHRUT test for this study was OmniEMR version 1, which is designed to present medical information to healthcare providers in wound care facilities. The EHRUT consists of a specialized EMR for wound care providers to easily access and input patient information. 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 time on task, number of errors, visual tasks deviations, and numerical ratings, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of eleven participants were tested on the EHRUT(s). Participants in the test were providers from Integrated Wound Care. Participants were recruited by Omniwound LLC and were compensated with a gift certificate for their time. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

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 cannot be tied back to individual identities (Appendix 2).

PartID	Gender	Age	Education	Occupation/role	Professional Experience	Computer Experience	Product Experience	Assitive Technology Needs
1000	Female	20-29	Bachelor's degree	Medical Biller	36	60	12	No
1001	Female	20-29	Bachelor's degree	Medical Biller	24	65	8	No
1002	Female	30-39	MD	Medical Director	120	180	36	No
1003	Female	20-29	Bachelor's degree	Nurse	12	60	6	No
1004	Female	60-69	Bachelor's degree	Nurse/Scribe	20	300	36	No
1005	Female	60-69	Bachelor's degree	Nurese/Scribe	20	324	36	No
1006	Male	40-49	Bachelor's degree	Scribe Manager	24	120	3	No
1007	Female	40-49	Bachelor's degree	Scheduler	24	120	12	No
1008	Female	20-29	Bachelor's degree	Billing	12	60	6	No
1009	Female	40-49	Bachelor's degree	Nurrse	24	324	24	No
1010	Female	40-49	Bachelor's degree	Medical Biller	36	180	24	No

Eleven participants (matching the demographics in the section on Participants) were recruited and all participated in the usability test. None of the participants failed to show up for the study.

Participants were scheduled for 60-90 min sessions by the administrator(s) and data logger(s), and were given the time they needed 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.

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 one EHR. Each participant used the system remotely, and was provided with the same instructions.

The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

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

TASKS

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

1. Laboratory (a2)
2. Imaging (a3)
3. Patient Demographics (a5)
4. CDS (a9)
5. Implantable Device (a14)
6. Medication (a1)
7. Drug Allergy (a4)

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

PROCEDURES

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

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test were experienced usability practitioners with less than a year with bachelor degrees.

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 (the Likert 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 the acknowledgement form (See Appendix 6) indicating that they had received the compensation.

TEST LOCATION

The testing was performed fully remotely (recorded) through Microsoft Teams with the participant and two observers. One observer was responsible for being available to the participant for any guidance needed (without helping with the actual task) and the other observer was gathering data based on the participant’s performance. The participants and observers made sure that the noise levels were kept to a minimum to ensure comfortability.

TEST ENVIRONMENT

The EHRUT would typically be used in a healthcare office or facility. In this instance, the testing was conducted remotely. The participants used their laptops when interacting with the EHRUT.

The EHRUT used Microsoft Teams to record and share screens of the participants. This way, the observers were able to see all actions made by the participants. All participants used the same user ID and password to ensure that they are all using the same setting. Technically, the system performance (i.e., response time) was representative of what actual users would experience in a field implementation due to the system being used electronically.

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. 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 with Microsoft Team video conference. Screen-recording was enabled to capture mouse/keyboard use and verbal comments were recorded with a microphone.

PARTICIPANT INSTRUCTIONS

Task 1 - (a)(2) Laboratory:

Step 1: Log in process

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: Task execution

Step 13: Find and Click on "**Lab & Images**" section

Step 14: Click on "**Open Lab**"

Step 15: On "**Lab Orders**" click "**Add new**" button

Step 16: Only fill the **Required fields**:

Step 17: On "**Date**" select any date (Today's date by default)

Step 18: On "**Type**" select "**Liver panel**"

Step 19: On "**Comments**" feel free to write down any other comment

Step 20: Click on "**Save**" button

Task 2 - (a)(3) Imaging:

Step 1: Log in process

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: Task execution

Step 13: Find and Click on "**Lab & Images**" section

Step 14: Click on "**Open Images**"

Step 15: On "**Diagnostic imaging**" click "**Add new**" button

Step 16: Only fill the **Required fields**:

Step 17: On "**Date**" select any date (Today's date by default)

Step 18: On "**Type**" select "**Bone scan**"

Step 19: On "**Comments**" feel free to write down any other comment

Step 20: Click on "**Save**" button

Task 3 - (a)(5) Demographics:

Step 1: Log in process:

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: Task execution

Step 13: Find and Click on "**Edit Patient Demographics**" button

Step 14: On "**Patient Information**" Make the following changes:

Step 15: **Middle name:** Change to "**Anne**"

Step 16: **Ethnicity**: Change to "**Hispanic or Latino**"

Step 17: **Race**: Change to "**Black or African American**"

Step 18: **Preferred Language**: Change to "**Spanish**"

Step 19: Click on "**Save**" button

Task 4- (a)(9) Clinical decision support:

Step 1: Log in process

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Username: **eblackwell**

Password: **eblackwell**

Step 4: Find CDS button

Step 5: In the "Provider Encounters" view, click on the CDS button. Search and click "add CDS" button.

Step 6: Wait until it is fully loaded to add a CDS.

Step 7: Select a facility from the list

Step 8: Add one of the patients displayed on the list.

Step 9: Select from the list one of the rules you want the CDS to be associated with.

Step 10: Keep the fields: Clinical Widget, Clinical Popup and Patient Widget, which are active by default.

Step 11: If necessary, change the dates and set the duration period of your preference.

Step 12: Add a message to have more information about the reminder.

Step 13: Select a time interval to display the reminder.

Step 14: Press the save button to add the reminder.

Task 5- (a)(14) Implantable device list:

Step 1: Log in process

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: Task execution

Step 13: Find and Click on "**Device**" section

Step 14: Click on "**Add new**"

Step 15: On "**Device Identifier**" please type in this code: **08717648200274**

Step 16: Click on "**Device search**" button and wait until the results are loaded

Step 17: Click on "**Save**" button

Task 6 - (a)(1) Medications:

Step 1: Log in process

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/iwc-pcc/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: (Task execution)

Step 13: Find and Click on "**Medication**" section

Step 14: Click the input for "**Medication Search**"

Step 15: Search and select any medication (e.g., **Codeine**)

Step 16: On the table below, add some comments (e.g., **Take daily**)

Step 17: Task done!

Task 7 - (a)(4) Drug-drug, drug-allergy interaction checks for CPOE:

Step 1 (Log in process)

Step 2: Go to **OmniEMR** using this link: https://omniwound.com/john/iwc%2012-09-22/telemedicine2/login.php

Step 3: Use the following credentials to log in:

Step 4: Username: **eblackwell**

Step 5: Password: **eblackwell**

Step 6: Find patient and Open encounter chart

Step 7: Find the left side bar on "**Provider encounters**" menu, and search for:

Step 8: Facility: **ZTestFacility'6**

Step 9: Date: **08/30/2022**

Step 10: Click on patient's name link "**Salamanca, Freddy**"

Step 11: Wait while the patient's chart fully loads

Step 12: Task execution

Step 13: Find and Click on "**Medication**" section

Step 14: Click on "**Add New Drug Allergy**" green button

Step 15: Click the input for "**Select Medication**"

Step 16: Search and select any medication (e.g., **Codeine**)

Step 17: Click on "**Add**" button

The administrator reads the following instructions aloud to each participant (also see the full moderator's guide in Appendix [4]):

Thank you for participating in this study. Your input is very important. Our session today will last about 60-90 min. 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 (10 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. I will ask you your impressions about the task once you are done.*

Participants were then given 7 tasks to complete. Tasks are listed in the moderator's guide.

USABILITY METRICS

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

The goals of the test were to assess:

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

DATA SCORING

DATA SCORING

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

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 [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+x*0.25] 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 a "Failures." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors.[11] This should also be expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations		The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.

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

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

		It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
Efficiency: Task Time		Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.

Satisfaction: Task Rating		Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. [12] Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of the [EHRUT] overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 5.[13]

Table Above Details of how observed data were scored.

The following app was built record scored, errors evaluated, and the time data analyzed.

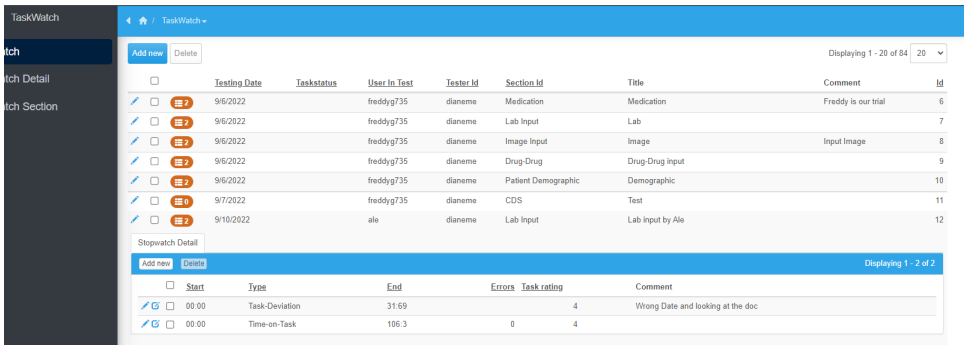

Fig1

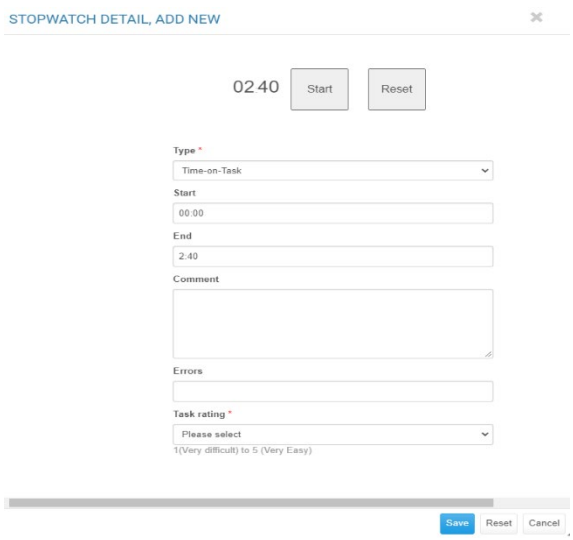

Fig 2

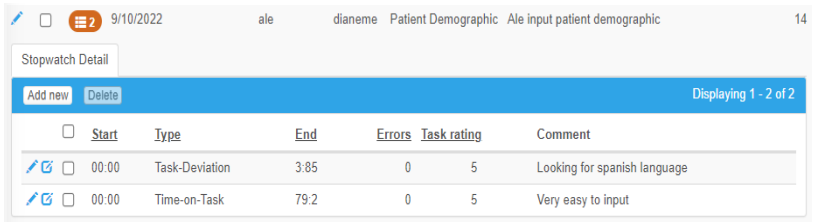

Fig3

Taskwatch is built into OmniEMR to record type of task, start-time, end-time, errors by simple click along with task rating. When the user is ready to begin the task, the start button is used to start the timer and end when with same button when user finishes the task. Second timer of Fig2 can be launch to record time deviation as task type. Fig3 illustrate data being recording during the test.

Task admin and proctor will record this information using Microsoft Team/Google Meet to record video and interact with the tester. Each meeting was recorded independently and saved with consent of the tester.

Lab: (a2)

Name			Task Success		Time on Task		Task Deviation Observered		Path to Deviation from Optimal	Path Deviation Observerd/Optimal	Deviations (Observed/Optimal)		Errors		Task Rating
1000			Compeleted	21	106.3		31.69		74.61	1.482	62.94%		0		4
1001			Compeleted	20	203.89		76.9		126.99	2.522	152.73%		1		3
1002			Compeleted	21	50.35		9.46		40.89	0.812	18.79%		0		5
1003			Compeleted	21	96.19		11.73		84.46	1.677	23.30%		0		3
1004			Compeleted	20	132.95		32.11		100.84	2.003	63.77%		1		5
1005			Compeleted	21	71.16		0		71.16	1.413	0.00%		0		5
1006			Compeleted	20	152.52		48.61		103.91	2.064	96.54%		1		5
1007			Compeleted	20	142.96		49.16		93.8	1.863	97.64%		1		5
1008			Compeleted	21	104.45		9.41		95.04	1.888	18.69%		0		5
1009			Compeleted	21	156.4		45.66		110.74	2.199	90.69%		0		5
1010			Compeleted	21	167.55		95.2		72.35	1.437	189.08%		0		5
			SD:	0.50	44.98		SD:	29.86	SD:	23.40		59.30%	SD:	50.45%	SD:	0.82
	Steps:	21					Optimal	0	Optimal:	50.35					

Image: (a3)

Name		Task Success			Time on Task	Task Deviation Observered		Path to Deviation from Optimal		Deviations (Observed/Optimal)		Errors			Task Rating
1000		Completed	18.00		40.36	0		40.36		0.00%		0			4
1001		Completed	18.00		78.63	19.62		59.01		64.90%		0			5
1002		Completed	18.00		30.23	0		30.23		0.00%		0			5
1003		Completed	18.00		74.6	10.31		64.29		34.11%		0			5
1004		Completed	18.00		81.12	7.93		73.19		26.23%		0			5
1005		Completed	18.00		75.14	2.15		72.99		7.11%		0			5
1006		Completed	18.00		117.7	29.3		88.4		96.92%		0			5
1007		Completed	18.00		62.27	6.3		55.97		20.84%		0			5
1008		Completed	18.00		50.54	0		50.54		0.00%		0			5
1009		Completed	17.00		157.42	67.3		90.12		222.63%		1			4
1010		Completed	18.00		80.18	25.12		55.06		83.10%		0			5
										50.53%	Mean:	9.09%		Mean:	4.82
		SD	0.30		35.51	SD	20.13	SD	18.55	66.58%	SD	30.15%		SD	0.40
	Steps:	18.00				Optimal	0.00	Optimal	30.23						

Patient Demographics:(a5)

Name		Task Success			Time on Task	Task Deviation Observered		Path to Deviation from Optimal		Deviations (Observed/Optimal)		Errors			Task Rating
1000		Completed	19.00		79.2	3.85		75.35		9.60%		0			5
1001		Completed	18.00		165.67	49.72		115.95		123.99%		1			3
1002		Completed	19.00		40.1	1.2		38.90		2.99%		0			5
1003		Completed	19.00		104.8	23.5		81.30		58.60%		0			5
1004		Completed	19.00		84.39	25.86		58.53		64.49%		0			5
1005		Completed	19.00		88.7	6.32		82.38		15.76%		0			5
1006		Completed	19.00		159.72	52.96		106.76		132.07%		0			5
1007		Completed	19.00		52.21	0		52.21		0.00%		0			5
1008		Completed	19.00		65.37	3.77		61.60		9.40%		0			5
1009		Completed	18.00		196.72	104.79		91.93		261.32%		1			4
1010		Completed	19.00		131.7	30.63		101.07		76.38%		0			5
									Mean:	68.60%		18.18%		Mean:	4.73
		SD	0.40		50.70	SD	31.88	SD	24.22	SD	79.50%	40.45%		SD	0.65
	Steps:	19.00				Optimal	0.00	Optimal	40.10						

CDS: (a9)

Name		Task Success			Time on Task	Task Deviation Observered		Path to Deviation from Optimal		Deviations (Observed/Optimal)		Errors			Task Rating
1000		Completed	14.00		69.66	5.21		64.45		8.78%		0			4
1001		Completed	14.00		95.51	0		95.51		0.00%		0			1
1002		Completed	14.00		65.36	15.27		50.09		25.74%		0			4
1003		Completed	14.00		75.71	18.59		57.12		31.33%		0			5
1004		Completed	13.00		189.42	73.72		115.7		124.25%		1			3
1005		Completed	14.00		102.37	70.29		32.08		118.47%		0			1
1006		Completed	13.00		156.58	84.4		72.18		142.26%		1			5
1007		Completed	13.00		142.58	76.75		65.83		129.36%		1			2
1008		Completed	14.00		59.33	11.93		47.4		20.11%		0			5
1009		Completed	13.00		180.29	83.89		96.4		141.40%		1			3
1010		Completed	14.00		109.4	35.36		74.04		59.60%		0			5
		Mean:	13.64		113.29	Mean:	43.22	Mean:	70.07	Mean:	72.85%	36.36%		Mean:	3.45
		SD	0.50		46.90	SD	34.47	SD	24.53	SD	58.09%	50.45%		SD	1.57
	Steps:	14.00				Optimal	0.00	Optimal	59.33						

Implantable Device: (a14)

Name		Task Success			Time on Task	Task Deviation Observered		Path to Deviation from Optimal		Deviations (Observed/Optimal)		Errors			Task Rating
1000		Completed	17.00		41.28	0		41.28		0.00%		0			4
1001		Completed	17.00		61.2	5.8		55.4		18.22%		0			5
1002		Completed	17.00		31.84	0		31.84		0.00%		0			5
1003		Completed	17.00		73.82	2.27		71.55		7.13%		0			5
1004		Completed	17.00		98.48	22.57		75.91		70.89%		0			5
1005		Completed	17.00		89.73	0		89.73		0.00%		0			5
1006		Completed	17.00		88.26	8.72		79.54		27.39%		0			5
1007		Completed	17.00		62.87	5.8		57.07		18.22%		0			4
1008		Completed	17.00		63.3	34.16		29.14		107.29%		0			5
1009		Completed	17.00		81.47	23.63		57.84		74.21%		0			5
1010		Completed	17.00		68.48	17.65		50.83		55.43%		0			5
		Mean:	17.00		69.16	Mean:	10.96	Mean:	58.19	Mean:	34.43%	0.00		Mean:	4.82
		SD	0		20.32	SD	11.72	SD	19.57	SD	36.79%	0.00		SD	0.40
	Steps:	17.00				Optimal	0.00	Optimal	31.84						

Drug Allergy: (a4)

Name		Task Success			Time on Task	Task Deviation Observered		Path to Deviation from Optimal		Deviations (Observed/Optimal)		Errors			Task Rating
1000		Compeleted	17		55.89	0		55.89		0.00%		0			4
1001		Compeleted	15		172.97	127.86		45.11		338.43%		2			1
1002		Compeleted	17		65.36	15.27		50.09		40.42%		0			4
1003		Compeleted	17		37.78	0		37.78		0.00%		0			5
1004		Compeleted	17		74.23	13.8		60.43		36.53%		0			5
1005		Compeleted	17		76.6	22.2		54.4		58.76%		0			5
1006		Compeleted	17		52.42	13.27		39.15		35.12%		0			5
1007		Compeleted	17		71.23	12.92		58.31		34.20%		0			3
1008		Compeleted	17		46.76	0		46.76		0.00%		0			5
1009		Compeleted	17		57.2	18.76		38.44		49.66%		0			5
1010		Compeleted	17		79.12	19.69		59.43		52.12%		0			5
		Mean:	16.82		71.78	Mean:	22.16	Mean:	49.62	Mean:	58.66%	18.18%		Mean:	4.27
		SD	0.60		36.04	SD	35.98	SD	8.69	SD	95.23%	60.30%		SD	1.27
	Steps:	17				Optimal	0.00	Optimal	37.78						

RESULTS

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.

The usability testing results for the EHRUT are detailed below. 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.

Task / Meaure	N	Task Success	Path Deviation	Task Time		Errors	Task Rating 5=Easy
	#	Mean (SD)	Deviations (Observed/ Optimal)	Mean(SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
a2	21	0.50	23.40	44.98	59.30%	50.45%	0.82
a3	18	0.30	18.55	35.51	66.58%	30.15%	0.40
a5	19	0.40	24.22	50.70	79.50%	40.45%	0.65
a4	17	0.60	8.69	36.04	95.23%	60.30%	1.27
a9	14	0.50	24.53	46.90	58.09%	50.45%	1.57
a1	17	17	52.28	56.50	11.08%	0.00	5.00
a14	17	0	19.57	20.32	36.79%	0.00	0.40

The results from the SUS (Likert Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 4/5 on average.

Discussion of Findings

The results of the usability testing provided several areas for improvements in efficiency and learnability. Screen use, search methods, clinical decision support, Drug-Drug Allergy input, and navigation resulted in several opportunities for improvement.

Effectiveness

The following tasks caused some confusion and hesitation on behalf of the users:

- Clinical Decision Support should be much easier to locate on the screen. The CDS (Clinical Decision Support) button used to identify alerts and tasks was not recognized by most of the users. Tasks were not intuitive for the users.
- Many of the users had difficulty locating the Drug-Drug Allergy button, which is in the medication section. Having a button display of Drug-Drug Allergy to go here, which will navigate to the bottom of medication will help a lot.

Efficiency

Below is a summary of improvements that would increase efficiency:

- Most of the test participants had difficulty locating the patient's CDS button. We have decided to move the button to the left corner near the menu, since everyone was looking for it from top to bottom.
- The Drug-Drug Allergy located in the bottom of the medication caused confusion because half of the users went to the allergy section and then navigated to medication section. Simple navigation to medication for allergies will improve to fix the confusion.
- Providing a help video that includes visual instructions will improve efficiency due to users not wanting to read help files.
- After initial patient setup is accomplished, the menu (from top to bottom) can be pre-opened for areas to concentrate on for following visits.

Satisfaction

Some comments from the customers and suggested opportunities to improve OmniEHR user satisfaction:

- User comment "Cannot find the CDS button!!!"
- User comment "Allergy section does not navigate to medication"
- Short video vs help documentation for quicker learning.

Major Findings

- Application would benefit from using the top-down viewport size. This would allow improvements to workflows by allowing users to go up and down only.
- Navigation confusion due to sections not being linked.
- Search history will be stored to improve user experience along with pre-displayed terms.
- Clinical decision support is not intuitive for the user and needs to be relocated.
- The allergy section will navigate to the medication section and vice versa instead of being separate sections.

Areas for Improvement

- Allow application to be in full screen in desktop mode.
- Create a short instruction video of each section input.
- Open sections based on initial patient consultation
  - Search history displayed along with pre-populated value base on previous input.

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

Appendix 1: SAMPLE RECRUITING SCREENER

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

Recruiting Script for Recruiting Firm

Hello, my name is _____, calling from [Insert name of recruiting firm]. 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 to participate. Can I ask you a few questions?

1. Are you male or female?

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.]?

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]

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]_____

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 Customize this to reflect what you know about your EHR's audience

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 [amount].

Would you be able to participate on [date, time]? [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 virtually. I will confirm your appointment a couple of days before your session and provide you with directions. What time is the best time to reach you?

Appendix 2: PARTICIPANT DEMOGRAPHICS

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

Gender

Men [X]

Women [X]

Total (participants) [X]

Occupation/Role

RN/BSN [X]

Physician [X]

Admin Staff [X]

Total (participants) [X]

Years of Experience

Years of experience [X]

Facility Use of EHR

All paper [X]

Some paper, some electronic [X]

All electronic [X]

Total (participants) [X]

Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT FORM

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of _ _, 2010, between _____ ("the Participant") and the testing organization Omniwound.

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 Omniwound, 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 Omniwound 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

Omniwound 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 Omniwound. 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 Omniwound.

I understand and consent to the use and release of the videotape by Omniwound. 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 Omniwound 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 Omniwound and Omniwound's client. I understand and agree that data confidentiality is assured, because only deidentified 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: _____

Appendix 4: EXAMPLE MODERATOR'S GUIDE

EHRUT Usability Test Moderator's Guide

Administrator _____

Data Logger _____

Date _____

Time _____

Participant # _____

Orientation

Thank you for participating in this study. Our session today will last 60-90 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 describe the state of the application, i.e., production version, early prototype, etc. Some of the data may not make sense as it is placeholder data. 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?

Task 1: First Impressions

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: Laboratory

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 3: Imaging

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 4: Demographics

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 5: Clinical Decision Support

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 6: Implantable Device List

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 7: Medication

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Task 8: Drug-Drug Allergy

Take the participant to the starting point for the task.

Success:

□ Easily completed

□ Completed with difficulty or help: Describe below

□ Not completed Comments:

Task Time: _____ Seconds

Optimal Path: Screen A → Screen B → Drop Down B1→ “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 Easy” (1) to “Very Difficult” (5)

Administrator / Notetaker Comments:

Final Questions

What was your overall impression of this system?

What aspects of the system did you like most?

What aspects of the system did you like least?

Were there any features that you were surprised to see?

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

Compare this system to other systems you have used.

Would you recommend this system to your colleagues?

Appendix 5: SYSTEM USABILITY SCALE QUESTIONNAIRE

Circle the number you would rate the system with one being strongly disagree and 5 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 (1–5)

   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

Appendix 6: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Acknowledgement of Receipt

I hereby acknowledge receipt of $_____ for my participation in a research study run by Test Company.

Printed Name: _____
Address: _____
_____

Signature: _____

Date: _____

Usability Researcher: _____

Signature of Usability Researcher: _____

Date: _____

Witness: _____

Witness Signature: _____

Date: _____