EHR Usability Test Report of Freedom Medical Systems® EHR v5.0 r3

UCD Process Used: *NISTIR 7741*

Schumacher, Robert M., and Svetlana Z. Lowry. (NISTIR 7741) NIST, Guide to the Processes Approach for Improving the Usability of Electronic Health Records. NIST, 29 Nov. 2010. Web. http://www.nist.gov/customcf/get_pdf.cfm?pub_id=907313

Report Based On: *NISTIR 7742*

Schumacher, Robert M., and Svetlana Z. Lowry. (NISTIR 7742) NIST, Customized Common Industry Format Template for Electronic Health Record Usability Testing. NIST, 16 Nov. 2010. Web. http://www.nist.gov/customcf/get_pdf.cfm?pub_id=907312

Freedom Medical Systems® EHR v5.0 r3

Date of Usability Test: 8/4/17 – 9/8/17

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EXECUTIVE SUMMARY

A usability test of Freedom Medical Systems® EHR v5.0 r3 was conducted on 8/4/17 - 9/8/17 in Omaha, NE by Custom Computing Corporation. The purpose of this test was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, 10 participants 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:

- TASK 1 (A) – CPOE MEDICAITON: ORDER MEDICATION

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- TASK 11 (C) – CLINICAL INFORMATION RECONCILIATION: INCORPORATE

- TASK 12 (A) – E-PRESCRIBING: PRESCRIBE MEDICATION

During the 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 (included in Appendix 3); they were instructed that they could withdraw from the test at any time. Participants had prior experience with the EHR. The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the UCD Testing Application, recorded user performance data electronically. The administrator did not give the participant assistance on 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

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 questionnaire and were compensated $200 for their time. Various recommended metrics, in accordance with the examples set forth in the *(NISTIR 7741) NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. The following is a summary of the performance and rating data collected on the EHRUT.

Table 1 - Results

Measure / Task	N	Task Success	Path Deviation	Task Time (seconds)		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Task 1 A	10	70% (0.48)	(15.9 / 16.0)	57.33 (1.53)	(55.57 / 86.00)	0.4 (0.84)	4.8 (0.42)
Task 1 B	10	70% (0.48)	(5.7 / 5.0)	16.67 (3.21)	(19.57 / 25.05)	0.6 (1.58)	4.9 (0.32)
Task 2 A	10	60% (0.52)	(3.4 / 3.0)	18.00 (4.58)	(14.50 / 27.00)	0.4 (0.70)	5.0 (0)
Task 2 B	10	100% (0)	(5.4 / 5.0)	14.33 (1.53)	(17.90 / 21.50)	0 (0)	5.0 (0)
Task 3 A	10	90% (0.32)	(3.7 / 4.0)	16.33 (1.53)	(16.78 / 24.49)	0.1 (0.32)	5.0 (0)
Task 3 B	10	100% (0)	(6.7 / 6.0)	18.67 (2.52)	(19.30 / 28.01)	0 (0)	5.0 (0)
Task 4 A	10	80% (0.42)	(8.0 / 7.0)	35.33 (12.86)	(38.89 / 53.00)	0.8 (1.03)	4.9 (0.32)
Task 4 B	10	90% (0.32)	(7.3 / 7.0)	27.00 (10.44)	(28.22 / 40.50)	0.3 (0.67)	4.9 (0.32)
Task 5 A	10	80% (0.42)	(8.3 / 7.0)	25.00 (2.00)	(29.38 / 37.50)	1.3 (2.67)	4.9 (0.32)
Task 5 B	10	60% (0.52)	(11.2 / 9.0)	31.67 (2.08)	(37.67 / 47.50)	2.0 (1.56)	4.4 (0.97)
Task 5 C	10	100% (0)	(2.8 / 3.0)	12.67 (3.51)	(11.30 / 19.00)	0.2 (0.42)	5.0 (0)
Task 6 A	10	90% (0.32)	(2.2 / 2.0)	11.67 (3.06)	(11.56 / 17.51)	0.2 (0.63)	5.0 (0)
Task 6 B	10	90% (0.32)	(4.7 / 4.0)	11.67 (3.06)	(12.78 / 17.51)	0.1 (0.32)	5.0 (0)
Task 6 C	10	80% (0.42)	(8.9 / 7.0)	29.33 (7.51)	(32.88 / 44.00)	0.2 (0.63)	4.9 (0.32)
Task 7 A	10	100% (0)	(2.0 / 2.0)	11.00 (2.00)	(10.70 / 16.50)	0 (0)	5.0 (0)
Task 7 B	10	80% (0.42)	(5.1 / 5.0)	19.00 (2.00)	(21.88 / 28.50)	0.1 (0.32)	5.0 (0)
Task 7 C	10	60% (0.52)	(15.4 / 15.0)	33.33 (7.51)	(40.33 / 49.99)	3.0 (5.44)	4.9 (0.32)
Task 8 A	10	100% (0)	(2.0 / 2.0)	8.33 (2.52)	(8.30 / 12.49)	0 (0)	5.0 (0)
Task 8 B	10	100% (0)	(2.1 / 2.0)	11.00 (1.73)	(13.00 / 16.50)	0 (0)	5.0 (0)
Task 8 C	10	60% (0.52)	(13.1 / 12.0)	12.00 (4.04)	(26.83 / 49.01)	3.4 (5.66)	5.0 (0)
Task 9 A	10	100% (0)	(2.1 / 2.0)	8.67 (1.15)	(9.40 / 13.01)	0 (0)	5.0 (0)
Task 9 B	10	50% (0.53)	(3.3 / 2.0)	10.00 (4.36)	(9.00 / 15.00)	0.6 (1.26)	4.6 (0.7)
Task 9 C	10	90% (0.32)	(6.1 / 5.0)	17.00 (4.58)	(18.00 / 25.50)	0.3 (1.11)	4.8 (0.42)
Task 10 A	10	100% (0)	(2.0 / 2.0)	11.33 (4.04)	(10.10 / 17.00)	0 (0)	5.0 (0)

Measure / Task	N #	Task Success Mean (SD)	Path Deviation Deviations (Observed / Optimal)	Task Time (seconds) Mean (SD)	Deviations (Observed/Optimal)	Errors Mean (SD)	Task Ratings 5=Easy Mean (SD)
Task 10 B	10	70% (0.48)	(5.1 / 4.0)	11.33 (2.52)	(9.14 / 17.00)	0.2 (0.42)	4.8 (0.42)
Task 10 C	10	70% (0.48)	(5.8 / 4.0)	17.67 (1.53)	(21.00 / 26.51)	0.3 (0.48)	4.7 (0.48)
Task 11 A	10	70% (0.48)	(3.2 / 3.0)	9.67 (2.08)	(9.43 / 14.51)	0.2 (0.42)	5.0 (0)
Task 11 B	10	70% (0.48)	(25.0 / 24.0)	55.33 (2.08)	(61.71 / 83.00)	0.7 (1.89)	4.6 (0.97)
Task 11 C	10	100% (0)	(3.2 / 3.0)	9.33 (2.08)	(10.20 / 14.00)	0 (0)	4.9 (0.32)
Task 12 A	10	90% (0.32)	(18.9 / 19.0)	60.33 (5.13)	(65.33 / 90.50)	0.4 (0.84)	4.9 (0.32)

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be 90.6.

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

Major findings:

Task 1 (A) – CPOE Medication: Order Medication

- Task Failures: A total of three participants failed to complete the task. Two participants performed missed step errors when documenting the sig details and associated reason. One participant failed to complete the task in the allotted time.

Task 1 (B) – CPOE Medication: Modify Medication

- Task Failures: A total of three participants failed to complete the task within the optimal time allotted for the task. Two participants completed the task using the optimal path but took extra time double-checking their work. One participant initially performed major path deviations by ordering the medication again before self-correcting and modifying the existing order using the optimal path.

TASK 2 (A) – CPOE Lab: Review Lab Results

- Task Failures: A total of four participants failed to complete the task.
    - Two participants failed to complete the task within the optimal time allotted:
        - One participant used the optimal path and identified the correct lipid panel but verbalized every result element within the lipid panel before completing the task.
        - One participant performed major deviations by initially selecting the Orders tab, then the Note tab before correctly selecting the results tab and identifying the correct LDL result. The participants role within the practice would have traditionally selected the Orders tab to process the lab and was determined the cause of the deviations.
    - Two participants failed to identify the correct LDL result:
        - Further analysis determined that the participants did not use the result date column within the result grid. Both participants selected the last result even though the system displays results in descending order (most recent to oldest).

Task 2 (B) – CPOE Lab: Enter Lab Order

- Notable Deviations: Two participants single clicked vs double-clicking the diagnosis code when associating the diagnosis code with the lab order. These were determined minor path deviations and considered a consistency design flaw within the system as most screens allow users to single click to select an item.

Task 3 (A) – CPOE Radiology: Review Radiology Results

- Task Failures: One participant failed to identify the most recent mammogram result. Participant appeared to have reviewed the dates listed and verbalized looking for the most recent mammogram but then selected the wrong mammogram result.

Task 3 (B) – CPOE Radiology: Enter Radiology Order

- Notable Deviations: Several participants single clicked vs double-clicking the diagnosis code when associating the diagnosis code with the radiology order. These were determined minor path deviations and considered a consistency design flaw within the system as most screens allow users to single click to select an item.

Task 4 (A) – CPOE Medication: Drug-Drug Interaction Check(s)

- Task Failures: Two participants failed to complete the task.
  - One participant failed to document an override reason and continued to prescribe anyways. This was considered a major deviation resulting in a task failure.
  - One participant failed to complete the task in within the optimal time allotted. The participant also failed to document the correct override reason as outlined in the task instructions.
- Notable Deviations: Several participants initially searched the pre-defined list of drug-drug override reason before self-correcting and manually entering the over-ride reason. Participants appeared to be un-aware that the field just below the pre-defined list was for manual entry. These deviations were determined to be caused by the user interface not having proper labels next to each field describing the field purpose.

Task 4 (B) – CPOE Medication: Drug-Allergy Interaction Check(s)

- Task Failures: One participant failed to complete the task within the optimal time allotted as the participant initially attempted to manually enter the override reason before self-correcting and selecting the correct pre-defined override reason.

Task 5 (A) – Demographics: Sexual Orientation & Gender Identity

- Task Failures: Two participants failed to complete the task within the optimal time allotted. Both participants performed major path deviations going in and out of screens looking for the correct fields. Once identified, both participants successfully documented the sexual orientation and gender identity. Failures were attributed to the fact that neither participant were familiar with the new fields and do not update demographic data within the practice workflow.

Task 5 (B) – Demographics: Race & Ethnicity

- Task Failures: Four participants failed to complete the task within the optimal time allotted. The following major findings were determined the causes of the task failures:
    - Participants initially attempted to scroll through the list of CDC race codes looking for the correct race but realized that is was not the most efficient method.
    - When participants located the keyword search field, most participants attempted to enter the CDC Race code vs. searching by description.
    - Participants who attempted to use the OMB standard filter found it of no value and moved back to the keyword search field to search by race description where they could complete the task.

Task 6 (A) – Problem List: Review Active Problems

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant initially selected the modify option resulting in a minor deviation before self-correcting and completing the task.
- Notable Deviations: Several participants used an alternative route which required no extra time or steps when reviewing the problem list and resulted in no errors. This alternative route was not the optimal path and was declared an acceptable route based on user preference when reviewing active problems.

Task 6 (B) – Problem List: Modify Problem

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant performed major deviations before selecting the correct status but failed to save the update resulting in a missed step error.

Task 6 (C) – Problem List: Add Problem

- Task Failures: Two participants failed to complete the task within the optimal time allotted.
    - Both participants performed major path deviations which resulted in task time overruns. Post analysis determined most of the path deviations could have been avoided with improvements to the user interface and were noted in areas for improvement.
- Notable Deviations: Several participants performed minor deviations that were determined to be areas for improvement:
    - Participants selecting the new button even though the system was already in new problem mode.
    - Participants single clicking diagnosis codes in diagnosis search grid vs double-clicking.
    - Participants were slow to identify the keyword search field located in the lower left corner.
    - Participants initially selected the ICD-9 search vs the ICD-10 search.

Task 7 (B) – Medication List: Modify Medication(s)

- Task Failures: Two participants failed to complete the task.
    - One participant failed to complete the task within the optimal time allotted by initially wandering the screen looking for the manage medication link. Participant performed a minor deviation when selecting the drug dosage drop-down before completing the task. Task failure was attributed to the participant being unfamiliar with the screen.
    - One participant failed to complete the task by performing a missed step error. Task failure was attributed to the participant pressing F9 before completing the task.

Task 7 (C) - Medication List: Add Medication(s)

- Task Failures: Four participants failed to complete the task.
    - Two participants performed missed step errors when documenting the sig details. Failures were attributed to the system not warning users of required sig elements and are noted in areas of improvement.
    - One participant used the free-text feature to add the medication to the active medication list. System displays warning as free-text entry is not recommended. Participant was presented with structured medications, but participant failed to select. Further training will be conducted to remind participant to always use structured medications vs free-text.
    - One participant failed to complete the task within the optimal time allotted. Participant performed several major deviations while looking for the manage medications link before eventually finding it and completing the task without errors. Task failure was attributed to the screens being busy with little spacing between various actions participants can perform. Areas for improvement were noted.

Task 8 (C) – Medication Allergy List: Add Allergy

- Task Failures: Four participants failed to complete the task.
    - Three participants failed to complete the task within the optimal time allotted.
        - One participant wandered the screen looking for the Add Allergy field. Participant eventually found it and proceeded to complete the task without errors. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.
        - One participant performed major deviations by initially entering free-text allergy vs using the coded allergies. Participant self-corrected and completed the task without errors. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.
        - One participant performed major deviations by initially documenting the reaction as a free-text allergy entry. Participant self-corrected and documented the correct medication allergy but failed to document the reaction and onset date. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.

  o One participant failed to complete the task when participant performed missed step errors. Participant failed to document both the reaction and onset date before pressing F9 to complete the task. Task failure was attributed to the system failing to warn user that onset and reaction are recommended when documenting medication allergies.

Task 9 (B) – Clinical Decision Support: Review Attributes

- Task Failures: Five participants failed to complete the task within the optimal time allotted. Further review attributed the task failures to the user interface where the participant(s) were required to navigate way from the CDS intervention grid to manually select a button to view CDS attributes.

Task 9 (C) - Clinical Decision Support: Take Action

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant was puzzled by an encounter date pop-up that required the user to assign the action to a previous encounter date. The failure was attributed to the test case scenario setup where a previous date encounter was used. Future UCD test scenario setup will require administrator to modify the encounter date so that participants experience a more realistic scenario before starting a task.

Task 10 (B) – Implantable Device List: Modify

- Task Failures: Three participants failed to complete the task within the optimal time allotted. All three participants performed minor deviations by selecting various grid cells for the medical device while looking for the status field. Participants were not aware that the system immediately selected the medical device and loaded the details upon selecting the first grid cell. Failures were attributed to the difficulty in understanding which column to select within the medical device list and lack of system message notifying participants that they were updating an existing medical device.

Task 10 (C) - Implantable Device List: Add

- Task Failures: Three participants failed to follow the optimal path while performing major deviations. All three participants selected the save button before the system could finish processing the UDI number. Failures were attributed to the users not being aware the system was still processing in the background and inadvertently failed to save the device to the chart before processing was completed. Areas for improvements were noted.

Task 11 (A) – Clinical Information Reconciliation: Identify

- Task Failures: Three participants failed to complete the task:
    - One participant failed to complete the task within the optimal time allotted. Participant performed a path deviation by initially selecting the upload button resulting in two additional clicks before self-correcting and proceeding on optimal path to complete the task.
    - Two participants failed to complete the task by not selecting the reconcile link before pressing F9 to end the task. Participant deviations were noted as missed step errors and attributed to participants rushing to complete the task.

Task 11 (B) – Clinical Information Reconciliation: Reconcile

- Task Failures: Three participants failed to complete the task:
    - Two participants failed to complete the task within the optimal time allotted. Both participants struggled knowing which items were added to the reconciled list resulting participants spending time double-checking their work. Task failure was attributed to the user interface not updating the record selection indicator with a green check mark to inform the participant the item was added to the reconciled list. Areas for improvement were noted.
    - One participant failed to add three problems to the reconciled list resulting in six missed step errors. After further review, participant excluded codes which did not have a description. Task failure was attributed to the interface not displaying alternative code descriptions when SNOMED CT code and description were missing. Areas for improvements were noted.

Task 12 (A) – E-Prescribing: Prescribe Medication

- Task Failures: One participant failed to complete the task within the optimal time allotted. Task failure was attributed to the user taking their time while performing the task as the participant completed the task on the optimal path without errors.
- Notable Deviations: Minor path deviations were observed where users missed clicking within the drop-downs resulting in additional clicks. Areas for improvement were noted.

Areas for improvement:

- When entering medication orders, consider adding system edit warnings that inform user of missing information.
- When reviewing results, consider the following enhancements:
  - Adding a label above result grid(s) indicating that results are listed in descending order by date.
  - Consider the potential use of color coding to assist users in quickly identifying the most recent data being displayed within a grid.
- When associating diagnosis codes with orders, consider updating the system interface with a check-mark column on the Associate Diagnosis screen so that users can single click vs. double-clicking.
- When documenting drug-drug / drug-allergy override reasons, consider adding field labels to the pre-defined list drop-down field and "Free-text" field(s).
- When documenting Race, consider the following enhancements:
  - Update the keyword search so that CDC Race codes are recognized by the system.
  - Move the keyword search field above the grid to draw user focus to the field.
  - Make the keyword search field the cursor focus on entering the screen.
  - Add instructions above the keyword field instructing the user to enter either a race description or CDC race code.
  - Further evaluate the use of the OMB standard filter to determine if it should be removed or if instructions should be included explaining how to use it.
- When documenting new problems, consider the following enhancements:
  - Displaying a warning messaging reminding the user to Save, Discard or Cancel.
  - Hiding the ICD-9 code, search button and description field if the date diagnosed is after the ICD-10 transition period to direct users to the correct ICD-10 search.
  - Hiding the New Problem button if the system is already in the new problem mode upon user entering the screen.
  - Updating the Diagnosis Search screen so that the Keyword field, Search button and Match filter fields are above the grid.

- When managing medications, consider the following enhancements:
    - Adding error messages / warnings when users fail to document each element of a structured sig.
    - Creating a single action drop-down where users can choose which actions to perform.
- When managing allergies, consider the following enhancements:
    - Creating a single action drop-down where users can choose which actions to perform.
    - Create more separation between the common allergy drop-down and allergy search fields.
    - Add a border to group the text entry search field and find button.
    - Add field labels / instructions such as "Select Common Allergies" or "Search for Drug Allergies".
- When displaying clinical decision attributes, consider the following enhancements:
    - Consider adding an expand function to the grid that would allow users to individually display the CDS attributes related to each CDS intervention under its title.
- When modifying medical device list, consider the following enhancements:
    - Add new edit column to the UDI device list grid making the edit column the only selectable grid cell.
    - Add a label above the medical device list grid indicating the system is in update mode upon user selecting the edit action.
    - Consider using alternative text color for fields that are not updatable.
- When adding medical devices, consider the following enhancements:
    - Disable the "Process UDI" button if no UDI number is loaded in the field. Enable upon UDI number being loaded.
    - Change the process button from a green go to a labeled button "Process UDI".
    - Disable all fields and buttons when the "Process UDI" button is selected.
    - Display pop-up messaging informing users the system is processing the UDI.
    - Upon processing UDI, re-enable the fields and buttons:
- When reconciling clinical data received via C-CDA, consider the following enhancements:
    - Add green check-mark to indicate the data element was added to the reconciled list.
    - In absence of SNOMED CT descriptions consider displaying alternative codes and descriptions such as ICD-9/10.

- When creating prescriptions, consider the following enhancements:
    - Adding system edit warnings that inform user of missing information in the sig detail.
    - Creating larger fields so that users can easily select drop-down lists as the current user interface field size is small.

INTRODUCTION

The EHRUT tested for this study was Freedom Medical Systems® EHR v5.0 r3. Designed to present medical information to healthcare providers in an ambulatory setting, the EHRUT consists of a Graphical User Interface (GUI) that stores and retrieves data from a database server through application service provider systems architecture. 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 of access, number of mouse clicks, time on task and number of errors were captured during the usability testing.

METHOD

PARTICIPANTS

A Total of 10 participants were tested on the EHRUT. Participants in the test were physicians, nurses and medical assistants. Participants were recruited by Custom Computing Corporation and were compensated $200 for their time. In addition, participants had no direct connection to the development of our organization producing the EHRUT. 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 cannot be tied back to individual identities.

Table 2 – Participant Demographics

	Part ID	Gender	Age	Education	Occupation / Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
1	001	Male	50-59	Doctorate Degree	Physician	240 mos.	216 mos.	18 mos.	None
2	002	Female	30-39	Bachelor's Degree	Medical Assistant	216 mos.	240 mos.	18 mos.	None
3	003	Male	60-69	Doctorate Degree	Physician	468 mos.	240 mos.	60 mos.	None
4	004	Female	20-29	Master's Degree	Nurse Practitioner	50 mos.	96 mos.	8 mos.	None
5	005	Female	30-39	Technical / Trade	Medical Assistant	168 mos.	240 mos.	72 mos.	None
6	006	Female	30-39	Bachelor's Degree	Radiology Tech	78 mos.	264 mos.	78 mos.	None
7	007	Female	40-49	Technical / Trade	Medical Assistant	204 mos.	300 mos.	24 mos.	None
8	008	Female	30-39	Bachelor's Degree	Nurse	156 mos.	240 mos.	36 mos.	None
9	009	Male	60-69	Doctorate Degree	Physician	420 mos.	360 mos.	72 mos.	None
10	010	Female	40-49	Bachelor's Degree	Nurse	288 mos.	384 mos.	0 mos.	None

Ten participants (matching the demographics in the section on Participants) were recruited and 10 participated in the usability test. No participants failed to show for the study.

Participants were scheduled for 60 minute sessions with 30 minutes following each session for debrief by the administrator, and to reset the systems to proper test conditions. An administrator binder was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiter.

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 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 can be made.

During the usability test, participants interacted with 1 EHR. Each participant used the system in the same location, and was provided the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

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

Additional information about the various measures used can be found in Table 3, Page 28 in Data Scoring.

TASKS

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

- TASK 1 (A) – CPOE MEDICATION: ORDER MEDICATION
- TASK 1 (B) – CPOE MEDICATION: MODIFY MEDICATION ORDER
- TASK 2 (A) – CPOE LAB: REVIEW LAB RESULTS
- TASK 2 (B) – CPOE LAB: ENTER LAB ORDER(S)
- TASK 3 (A) – CPOE RADIOLOGY: REVIEW RADIOLOGY RESULT(S)
- TASK 3 (B) – CPOE RADIOLOGY: ENTER RADIOLOGY ORDER(S)
- TASK 4 (A) – CPOE MEDICATION: DRUG-DRUG INTERACTION CHECK(S)
- TASK 4 (B) – CPOE MEDICATION: DRUG-ALLERGY INTERACTION
- TASK 5 (A) – DEMOGRAPHICS: SEXUAL ORIENTATION & GENDER IDENTITY
- TASK 5 (B) – DEMOGRAPHICS: RACE & ETHNICITY
- TASK 5 (C) – DEMOGRAPHICS: LANGUAGE PREFERENCE
- TASK 6 (A) – PROBLEM LIST: REVIEW ACTIVE PROBLEMS
- TASK 6 (B) – PROBLEM LIST: MODIFY PROBLEM
- TASK 6 (C) – PROBLEM LIST: ADD PROBLEM
- TASK 7 (A) – MEDICATION LIST: VIEW ACTIVE MEDICATION(S)
- TASK 7 (B) – MEDICATION LIST: MODIFY MEDICATION(S)
- TASK 7 (C) – MEDICATION LIST: ADD MEDICATION(S)
- TASK 8 (A) – MEDICATION ALLERGY LIST: REVIEW ALLERGIES
- TASK 8 (B) – MEDICATION ALLERGY LIST: MODIFY ALLERGY
- TASK 8 (C) – MEDICATION ALLERGY LIST: ADD ALLERGY
- TASK 9 (A) – CLINICAL DECISION SUPPORT: IDENTIFY INTERVENTION(S)
- TASK 9 (B) – CLINICAL DECISION SUPPORT: REVIEW ATTRIBUTES
- TASK 9 (C) – CLINICAL DECISION SUPPORT: TAKE ACTION
- TASK 10 (A) – IMPLANTABLE DEVICE LIST: REVIEW
- TASK 10 (B) – IMPLANTABLE DEVICE LIST: MODIFY
- TASK 10 (C) – IMPLANTABLE DEVICE LIST: ADD

- TASK 11 (A) – CLINICAL INFORMATION RECONCILIATION: IDENTIFY

- TASK 11 (B) – CLINICAL INFORMATION RECONCILIATION: RECONCILE

- TASK 11 (C) – CLINICAL INFORMATION RECONCILIATION: INCORPORATE

- TASK 12 (A) – E-PRESCRIBING: PRESCRIBE MEDICATION

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users.

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were assigned a participant ID. Each participant reviewed and signed a non-disclosure agreement and informed consent forms (See Appendix 3 & 4). The usability administrator witnessed the participant's signature.

To ensure that the test ran smoothly, one staff member participated in this test, the usability administrator. The usability testing staff member was an experienced usability practitioner with 16 years of experience.

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 UCD testing application was used as the data logger and allowed the administrator to take 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 instruction on use.

- Without using a think aloud technique.

For each task, the participants were provided a written copy of the task. Task timing began once the participant pressed [F9]. The task time was stopped once the participant indicated they had successfully completed the task or pressed [F9]. Data Scoring is discussed below in Table 3, Page 28.

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 user for their participation. Participants were thanked for their time and compensated.

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

Participants signed a receipt and acknowledgement from (See Appendix 6) indicating that they had received the compensation.

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, a computer for the participant, and a computer for the administrator. Only the participant and administrator were present in the testing room. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. Site safety instruction and evacuation procedures were current, in place, and visible to the participants.

TEST ENVIRONMENT

The EHRUT would typically be used in an ambulatory practice setting. However, efforts were made to perform these tests in an environment like the ambulatory practice setting. In this instance, the testing was conducted in the main training room at Custom Computing Corporation. For testing, the computer used was a Dell Vostro running Windows 7 Professional operating system. The participants used a keyboard and mouse when interacting with the EHRUT.

The EHRUT used a 17 inch (17") computer monitor display set at 32-bit color and 1366x768 screen resolutions. The application was setup by the Custom Computing Corporation IT department personnel according to the vendor's documentation describing the system setup and preparation. The application itself was running on a Linux server platform using a Test Data Base on a LAN connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience

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

TEST FORMS AND TOOLS

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

1. Sample Recruiting Screener
2. Participant Demographics
3. Non-Disclosure Agreement (NDA)
4. Informed Consent
5. Moderator's Guide
6. System Usability Score Questionnaire
7. Incentive Receipt and Acknowledgment Form

Examples of these documents can be found in Appendices 1-7 respectively. The Moderator's Guide was devised to allow required data capture.

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. An integrated web camera recorded each participant's facial expressions simultaneous with the screen capture, and verbal comments were recorded with a microphone. The test sessions were electronically recorded to the local machine for review and evaluation by the testing team.

PARTICIPANT INSTRUCTIONS

The administrator reads the following introduction aloud to each participant (also see the full moderator's guide in Appendix 5):

Thank you for participating in today's study. My name is [Administrator Name], and I'll be working with you today.

In this study, we're evaluating the usability of an electronic health record system. To do this, you will be asked to complete some surveys and perform 7 tasks. We will be watching and recording how the EHR supports the execution of these tasks. This will include us taking notes, as well as recording screenshots and audio of your feedback. All recordings and information that you provide will be kept confidential, and you will in no way be identified in any of our records.

Each task will include a scenario to explain why you are doing the task. As you work, feel free to perform whatever steps you feel are necessary to complete the task. I can try to answer questions about information that you might feel is missing, but I cannot provide you with directions on how to complete the task.

You are free to stop or take a break at any time, and that will not affect any consideration we will be providing. Please let me know if you need anything to make yourself more comfortable.

Before we begin, I will need you to read over these documents and sign them. The first describes the study and your rights as a participant and the other is a non-disclosure agreement. When you have read and signed them, you may give them to me.

Do you have any questions?

Following the introduction, participants were provided an overview of the UCD testing application and were given 5 minutes to explore the EHRUT system. Once complete, the administrator gave the following instructions:

> *Here are the instructions for the first task. Each set of instructions provides you with a brief scenario explaining the task that you are to accomplish using Freedom Medical Systems EHR. In some cases, you will be required to input data into the EHR system to complete the task. You may refer to these instructions at any time. I will provide the next set of instructions when you finish the task.*

> *Once you click on the NEXT button, the UCD Testing software will minimize and I will take control of the computer for a moment to prepare the task. I will then hand control back over to you for the task. Once you feel that you have accomplished the task, please verbally indicate that you have finished, and then press the F9 key on the keyboard to pause the recording as we prepare for the next task. After pressing F9, I will again briefly take control of the computer to prepare the next task. If you forget which key to press to pause the recording, you can reference the lower left corner of the instruction page.*

> *In this study we are interested in how well the EHR design facilitates your ability to complete the tasks, not about your medical decision-making skills or ability to catch a mistake in the record, so please do not spend time reviewing the patient's histories in detail. Assume that everything in the record is accurate unless otherwise specified in the task instructions. Work as quickly as possible, but focus on completing the task rather than worry about how long it might be taking.*

> *Do you have any questions?*

Participants were then given 30 tasks to complete. Tasks are listed in Appendix 5 of 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 Freedom Medical Systems® EHR v5.0 r3 by measuring participant success rates and errors.
2. Efficiency of Freedom Medical Systems® EHR v5.0 r3 by measuring the average task time and path deviations.
3. Satisfaction with Freedom Medical Systems® EHR v5.0 r3 by measuring ease of use ratings.

DATA SCORING

The following table (Table 3) details how tasks were scored, errors evaluated, and the time data analyzed.

Table 3 – Details of how observed data were scored.

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. 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 of 1.5 that allows a time buffer since participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 00:10 seconds then allotted task time performance was 00:15 seconds. This ratio was aggregated across all tasks and reported with mean and standard deviation scores.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer, performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a "Error". No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e. steps) through the application was recorded. Deviations occur if the participant, for example, went to an improper screen, clicked on an inappropriate menu item, followed an incorrect link, or interacted erroneously 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 the 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 participant selected "F9" to begin the recording session until the participant said "Done" and pressed "F9" to end the recording session. If he or she failed to say "Done" or select the "F9" key, 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:	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). This data was then averaged across participants.
Task Rating	Common convention is that average ratings for systems judged easy to use should be 3.3 or above.
	To measure participants' confidence in the likeability of the Freedom Medical Systems® EHR v5.0 r3 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 the Appendix 6.

RESULTS

DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Data Scoring 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 the Study Design. The data should yield actionable results that, if corrected, yield a positive impact on user performance.

Table 4 - Results

Measure / Task	N	Task Success	Path Deviation	Task Time (seconds)		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Task 1 A	10	70% (0.48)	(15.9 / 16.0)	57.33 (1.53)	(55.57 / 86.00)	0.4 (0.84)	4.8 (0.42)
Task 1 B	10	70% (0.48)	(5.7 / 5.0)	16.67 (3.21)	(19.57 / 25.05)	0.6 (1.58)	4.9 (0.32)
Task 2 A	10	60% (0.52)	(3.4 / 3.0)	18.00 (4.58)	(14.50 / 27.00)	0.4 (0.70)	5.0 (0)
Task 2 B	10	100% (0)	(5.4 / 5.0)	14.33 (1.53)	(17.90 / 21.50)	0 (0)	5.0 (0)
Task 3 A	10	90% (0.32)	(3.7 / 4.0)	16.33 (1.53)	(16.78 / 24.49)	0.1 (0.32)	5.0 (0)
Task 3 B	10	100% (0)	(6.7 / 6.0)	18.67 (2.52)	(19.30 / 28.01)	0 (0)	5.0 (0)
Task 4 A	10	80% (0.42)	(8.0 / 7.0)	35.33 (12.86)	(38.89 / 53.00)	0.8 (1.03)	4.9 (0.32)
Task 4 B	10	90% (0.32)	(7.3 / 7.0)	27.00 (10.44)	(28.22 / 40.50)	0.3 (0.67)	4.9 (0.32)
Task 5 A	10	80% (0.42)	(8.3 / 7.0)	25.00 (2.00)	(29.38 / 37.50)	1.3 (2.67)	4.9 (0.32)
Task 5 B	10	60% (0.52)	(11.2 / 9.0)	31.67 (2.08)	(37.67 / 47.50)	2.0 (1.56)	4.4 (0.97)
Task 5 C	10	100% (0)	(2.8 / 3.0)	12.67 (3.51)	(11.30 / 19.00)	0.2 (0.42)	5.0 (0)
Task 6 A	10	90% (0.32)	(2.2 / 2.0)	11.67 (3.06)	(11.56 / 17.51)	0.2 (0.63)	5.0 (0)
Task 6 B	10	90% (0.32)	(4.7 / 4.0)	11.67 (3.06)	(12.78 / 17.51)	0.1 (0.32)	5.0 (0)

Measure / Task	N #	Task Success Mean (SD)	Path Deviation Deviations (Observed / Optimal)	Task Time (seconds) Mean (SD)	Deviations (Observed/Optimal)	Errors Mean (SD)	Task Ratings 5=Easy Mean (SD)
Task 6 C	10	80% (0.42)	(8.9 / 7.0)	29.33 (7.51)	(32.88 / 44.00)	0.2 (0.63)	4.9 (0.32)
Task 7 A	10	100% (0)	(2.0 / 2.0)	11.00 (2.00)	(10.70 / 16.50)	0 (0)	5.0 (0)
Task 7 B	10	80% (0.42)	(5.1 / 5.0)	19.00 (2.00)	(21.88 / 28.50)	0.1 (0.32)	5.0 (0)
Task 7 C	10	60% (0.52)	(15.4 / 15.0)	33.33 (7.51)	(40.33 / 49.99)	3.0 (5.44)	4.9 (0.32)
Task 8 A	10	100% (0)	(2.0 / 2.0)	8.33 (2.52)	(8.30 / 12.49)	0 (0)	5.0 (0)
Task 8 B	10	100% (0)	(2.1 / 2.0)	11.00 (1.73)	(13.00 / 16.50)	0 (0)	5.0 (0)
Task 8 C	10	60% (0.52)	(13.1 / 12.0)	12.00 (4.04)	(26.83 / 49.01)	3.4 (5.66)	5.0 (0)
Task 9 A	10	100% (0)	(2.1 / 2.0)	8.67 (1.15)	(9.40 / 13.01)	0 (0)	5.0 (0)
Task 9 B	10	50% (0.53)	(3.3 / 2.0)	10.00 (4.36)	(9.00 / 15.00)	0.6 (1.26)	4.6 (0.7)
Task 9 C	10	90% (0.32)	(6.1 / 5.0)	17.00 (4.58)	(18.00 / 25.50)	0.3 (1.11)	4.8 (0.42)
Task 10 A	10	100% (0)	(2.0 / 2.0)	11.33 (4.04)	(10.10 / 17.00)	0 (0)	5.0 (0)
Task 10 B	10	70% (0.48)	(5.1 / 4.0)	11.33 (2.52)	(9.14 / 17.00)	0.2 (0.42)	4.8 (0.42)
Task 10 C	10	70% (0.48)	(5.8 / 4.0)	17.67 (1.53)	(21.00 / 26.51)	0.3 (0.48)	4.7 (0.48)
Task 11 A	10	70% (0.48)	(3.2 / 3.0)	9.67 (2.08)	(9.43 / 14.51)	0.2 (0.42)	5.0 (0)
Task 11 B	10	70% (0.48)	(25.0 / 24.0)	55.33 (2.08)	(61.71 / 83.00)	0.7 (1.89)	4.6 (0.97)
Task 11 C	10	100% (0)	(3.2 / 3.0)	9.33 (2.08)	(10.20 / 14.00)	0 (0)	4.9 (0.32)
Task 12 A	10	90% (0.32)	(18.9 / 19.0)	60.33 (5.13)	(65.33 / 90.50)	0.4 (0.84)	4.9 (0.32)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 90.6. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

DISCUSSION OF THE FINDINGS

Major findings and Areas for Improvement are indicated below and were gathered using participant verbalizations, debrief notes and data analysis of the UCD study. Overall, most participants demonstrated that the preferred path was acceptable when performing the task. Most participants could complete the task in the time allowed without major deviations or errors.

EFFECTIVENESS

Freedom Medical Systems® EHR v5.0 r3 measures of effectiveness:

- The average task success rate for all 30 tasks was 82%.
  - o The average per task failure rate was 1.8 participants out of 10.
    - Task Time Failures averaged 1.2 per task.
    - Task Error Failures averaged 0.6 per task.
- The average per task error rate for all 30 tasks was 0.53.
  - o Task errors ranged from (0 to 3.4) where Task 8 (C) – Medication Allergy List – Add Allergy had the most errors.

When task failures occurred, the majority were attributed to usability issues identified within the user interface and noted as areas of improvement.

EFFICIENCY

Freedom Medical Systems® EHR v5.0 r3 measures of efficiency:

- Percentage of completed task 82%.
  - o Percentage of tasks achieved per unit of time 88%.
  - o Average time per task 00:23.02 seconds.
- Average percentage of deviations per task 11.4%.

SATISFACTION

Participant's subjective impression of the ease of use of the EHRUT was measured by administering both the post-task question as well as a post-session (SUS) questionnaire.

- Participant's post-task question was computed for all tasks to be a Mean value of 4.9 with a Standard Deviation of 0.15.
- The System Usability Score (SUS) questionnaire scored a Mean value of 90.6 with a Standard Deviation of 3.53.

MAJOR FINDINGS

Task 1 (A) – CPOE Medication: Order Medication

- Task Failures: A total of three participants failed to complete the task. Two participants performed missed step errors when documenting the sig details and associated reason. One participant failed to complete the task in the allotted time.

Task 1 (B) – CPOE Medication: Modify Medication

- Task Failures: A total of three participants failed to complete the task within the optimal time allotted for the task. Two participants completed the task using the optimal path but took extra time double-checking their work. One participant initially performed major path deviations by ordering the medication again before self-correcting and modifying the existing order using the optimal path.

TASK 2 (A) – CPOE Lab: Review Lab Results

- Task Failures: A total of four participants failed to complete the task.
  - Two participants failed to complete the task within the optimal time allotted:
    - One participant used the optimal path and identified the correct lipid panel but verbalized every result element within the lipid panel before completing the task.
    - One participant performed major deviations by initially selecting the Orders tab, then the Note tab before correctly selecting the results tab and identifying the correct LDL result. The participants role within the practice would have traditionally selected the Orders tab to process the lab and was determined the cause of the deviations.
  - Two participants failed to identify the correct LDL result:
    - Further analysis determined that the participants did not use the result date column within the result grid. Both participants selected the last result even though the system displays results in descending order (most recent to oldest).

Task 2 (B) – CPOE Lab: Enter Lab Order

- Notable Deviations: Two participants single clicked vs double-clicking the diagnosis code when associating the diagnosis code with the lab order. These were determined minor path deviations and considered a consistency design flaw within the system as most screens allow users to single click to select an item.

Task 3 (A) – CPOE Radiology: Review Radiology Results

- Task Failures: One participant failed to identify the most recent mammogram result. Participant appeared to have reviewed the dates listed and verbalized looking for the most recent mammogram but then selected the wrong mammogram result.

Task 3 (B) – CPOE Radiology: Enter Radiology Order

- Notable Deviations: Several participants single clicked vs double-clicking the diagnosis code when associating the diagnosis code with the radiology order. These were determined minor path deviations and considered a consistency design flaw within the system as most screens allow users to single click to select an item.

Task 4 (A) – CPOE Medication: Drug-Drug Interaction Check(s)

- Task Failures: Two participants failed to complete the task.
  - One participant failed to document an override reason and continued to prescribe anyways. This was considered a major deviation resulting in a task failure.
  - One participant failed to complete the task in within the optimal time allotted. The participant also failed to document the correct override reason as outlined in the task instructions.
- Notable Deviations: Several participants initially searched the pre-defined list of drug-drug override reason before self-correcting and manually entering the over-ride reason. Participants appeared to be un-aware that the field just below the pre-defined list was for manual entry. These deviations were determined to be caused by the user interface not having proper labels next to each field describing the field purpose.

Task 4 (B) – CPOE Medication: Drug-Allergy Interaction Check(s)

- Task Failures: One participant failed to complete the task within the optimal time allotted as the participant initially attempted to manually enter the override reason before self-correcting and selecting the correct pre-defined override reason.

Task 5 (A) – Demographics: Sexual Orientation & Gender Identity

- Task Failures: Two participants failed to complete the task within the optimal time allotted. Both participants performed major path deviations going in and out of screens looking for the correct fields. Once identified, both participants successfully documented the sexual orientation and gender identity. Failures were attributed to the fact that neither participant were familiar with the new fields and do not update demographic data within the practice workflow.

Task 5 (B) – Demographics: Race & Ethnicity

- Task Failures: Four participants failed to complete the task within the optimal time allotted. The following major findings were determined the causes of the task failures:
    - Participants initially attempted to scroll through the list of CDC race codes looking for the correct race but realized that is was not the most efficient method.
    - When participants located the keyword search field, most participants attempted to enter the CDC Race code vs. searching by description.
    - Participants who attempted to use the OMB standard filter found it of no value and moved back to the keyword search field to search by race description where they could complete the task.

Task 6 (A) – Problem List: Review Active Problems

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant initially selected the modify option resulting in a minor deviation before self-correcting and completing the task.
- Notable Deviations: Several participants used an alternative route which required no extra time or steps when reviewing the problem list and resulted in no errors. This alternative route was not the optimal path and was declared an acceptable route based on user preference when reviewing active problems.

Task 6 (B) – Problem List: Modify Problem

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant performed major deviations before selecting the correct status but failed to save the update resulting in a missed step error.

Task 6 (C) – Problem List: Add Problem

- Task Failures: Two participants failed to complete the task within the optimal time allotted.
    - o Both participants performed major path deviations which resulted in task time overruns. Post analysis determined most of the path deviations could have been avoided with improvements to the user interface and were noted in areas for improvement.
- Notable Deviations: Several participants performed minor deviations that were determined to be areas for improvement:
    - o Participants selecting the new button even though the system was already in new problem mode.
    - o Participants single clicking diagnosis codes in diagnosis search grid vs double-clicking.
    - o Participants were slow to identify the keyword search field located in the lower left corner.
    - o Participants initially selected the ICD-9 search vs the ICD-10 search.

Task 7 (B) – Medication List: Modify Medication(s)

- Task Failures: Two participants failed to complete the task.
    - o One participant failed to complete the task within the optimal time allotted by initially wandering the screen looking for the manage medication link. Participant performed a minor deviation when selecting the drug dosage drop-down before completing the task. Task failure was attributed to the participant being unfamiliar with the screen.
    - o One participant failed to complete the task by performing a missed step error. Task failure was attributed to the participant pressing F9 before completing the task.

Task 7 (C) - Medication List: Add Medication(s)

- Task Failures: Four participants failed to complete the task.
    - o Two participants performed missed step errors when documenting the sig details. Failures were attributed to the system not warning users of required sig elements and are noted in areas of improvement.
    - o One participant used the free-text feature to add the medication to the active medication list. System displays warning as free-text entry is not recommended. Participant was presented with structured medications, but participant failed to select. Further training will be conducted to remind participant to always use structured medications vs free-text.
    - o One participant failed to complete the task within the optimal time allotted. Participant performed several major deviations while looking for the manage medications link before eventually finding it and completing the task without errors. Task failure was attributed to the screens being busy with little spacing between various actions participants can perform. Areas for improvement were noted.

Task 8 (C) – Medication Allergy List: Add Allergy

- Task Failures: Four participants failed to complete the task.
    - o Three participants failed to complete the task within the optimal time allotted.
        - One participant wandered the screen looking for the Add Allergy field. Participant eventually found it and proceeded to complete the task without errors. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.
        - One participant performed major deviations by initially entering free-text allergy vs using the coded allergies. Participant self-corrected and completed the task without errors. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.
        - One participant performed major deviations by initially documenting the reaction as a free-text allergy entry. Participant self-corrected and documented the correct medication allergy but failed to document the reaction and onset date. Task failure was attributed to the user interface lacking field labels and noted as areas for improvement.

o One participant failed to complete the task when participant performed missed step errors. Participant failed to document both the reaction and onset date before pressing F9 to complete the task. Task failure was attributed to the system failing to warn user that onset and reaction are recommended when documenting medication allergies.

Task 9 (B) – Clinical Decision Support: Review Attributes

- Task Failures: Five participants failed to complete the task within the optimal time allotted. Further review attributed the task failures to the user interface where the participant(s) were required to navigate way from the CDS intervention grid to manually select a button to view CDS attributes.

Task 9 (C) - Clinical Decision Support: Take Action

- Task Failures: One participant failed to complete the task within the optimal time allotted. Participant was puzzled by an encounter date pop-up that required the user to assign the action to a previous encounter date. The failure was attributed to the test case scenario setup where a previous date encounter was used. Future UCD test scenario setup will require administrator to modify the encounter date so that participants experience a more realistic scenario before starting a task.

Task 10 (B) – Implantable Device List: Modify

- Task Failures: Three participants failed to complete the task within the optimal time allotted. All three participants performed minor deviations by selecting various grid cells for the medical device while looking for the status field. Participants were not aware that the system immediately selected the medical device and loaded the details upon selecting the first grid cell. Failures were attributed to the difficulty in understanding which column to select within the medical device list and lack of system message notifying participants that they were updating an existing medical device.

Task 10 (C) - Implantable Device List: Add

- Task Failures: Three participants failed to follow the optimal path while performing major deviations. All three participants selected the save button before the system could finish processing the UDI number. Failures were attributed to the users not being aware the system was still processing in the background and inadvertently failed to save the device to the chart before processing was completed. Areas for improvements were noted.

Task 11 (A) – Clinical Information Reconciliation: Identify

- Task Failures: Three participants failed to complete the task:
    - One participant failed to complete the task within the optimal time allotted. Participant performed a path deviation by initially selecting the upload button resulting in two additional clicks before self-correcting and proceeding on optimal path to complete the task.
    - Two participants failed to complete the task by not selecting the reconcile link before pressing F9 to end the task. Participant deviations were noted as missed step errors and attributed to participants rushing to complete the task.

Task 11 (B) – Clinical Information Reconciliation: Reconcile

- Task Failures: Three participants failed to complete the task:
    - Two participants failed to complete the task within the optimal time allotted. Both participants struggled knowing which items were added to the reconciled list resulting participants spending time double-checking their work. Task failure was attributed to the user interface not updating the record selection indicator with a green check mark to inform the participant the item was added to the reconciled list. Areas for improvement were noted.
    - One participant failed to add three problems to the reconciled list resulting in six missed step errors. After further review, participant excluded codes which did not have a description. Task failure was attributed to the interface not displaying alternative code descriptions when SNOMED CT code and description were missing. Areas for improvements were noted.

Task 12 (A) – E-Prescribing: Prescribe Medication

- Task Failures: One participant failed to complete the task within the optimal time allotted. Task failure was attributed to the user taking their time while performing the task as the participant completed the task on the optimal path without errors.
- Notable Deviations: Minor path deviations were observed where users missed clicking within the drop-downs resulting in additional clicks. Areas for improvement were noted.

AREAS FOR IMPROVEMENT

- When entering medication orders, consider adding system edit warnings that inform user of missing information.
- When reviewing results, consider the following enhancements:
    - Adding a label above result grid(s) indicating that results are listed in descending order by date.
    - Consider the potential use of color coding to assist users in quickly identifying the most recent data being displayed within a grid.
- When associating diagnosis codes with orders, consider updating the system interface with a check-mark column on the Associate Diagnosis screen so that users can single click vs. double-clicking.
- When documenting drug-drug / drug-allergy override reasons, consider adding field labels to the pre-defined list drop-down field and "Free-text" field(s).
- When documenting Race, consider the following enhancements:
    - Update the keyword search so that CDC Race codes are recognized by the system.
    - Move the keyword search field above the grid to draw user focus to the field.
    - Make the keyword search field the cursor focus on entering the screen.
    - Add instructions above the keyword field instructing the user to enter either a race description or CDC race code.
    - Further evaluate the use of the OMB standard filter to determine if it should be removed or if instructions should be included explaining how to use it.
- When documenting new problems, consider the following enhancements:
    - Displaying a warning messaging reminding the user to Save, Discard or Cancel.
    - Hiding the ICD-9 code, search button and description field if the date diagnosed is after the ICD-10 transition period to direct users to the correct ICD-10 search.
    - Hiding the New Problem button if the system is already in the new problem mode upon user entering the screen.
    - Updating the Diagnosis Search screen so that the Keyword field, Search button and Match filter fields are above the grid.

- When managing medications, consider the following enhancements:
  - Adding error messages / warnings when users fail to document each element of a structured sig.
  - Creating a single action drop-down where users can choose which actions to perform.
- When managing allergies, consider the following enhancements:
  - Creating a single action drop-down where users can choose which actions to perform.
  - Create more separation between the common allergy drop-down and allergy search fields.
  - Add a border to group the text entry search field and find button.
  - Add field labels / instructions such as "Select Common Allergies" or "Search for Drug Allergies".
- When displaying clinical decision attributes, consider the following enhancements:
  - Consider adding an expand function to the grid that would allow users to individually display the CDS attributes related to each CDS intervention under its title.
- When modifying medical device list, consider the following enhancements:
  - Add new edit column to the UDI device list grid making the edit column the only selectable grid cell.
  - Add a label above the medical device list grid indicating the system is in update mode upon user selecting the edit action.
  - Consider using alternative text color for fields that are not updatable.
- When adding medical devices, consider the following enhancements:
  - Disable the "Process UDI" button if no UDI number is loaded in the field. Enable upon UDI number being loaded.
  - Change the process button from a green go to a labeled button "Process UDI".
  - Disable all fields and buttons when the "Process UDI" button is selected.
  - Display pop-up messaging informing users the system is processing the UDI.
  - Upon processing UDI, re-enable the fields and buttons:
  - When reconciling clinical data received via C-CDA, consider the following enhancements:
    - Add green check-mark to indicate the data element was added to the reconciled list.
    - In absence of SNOMED CT descriptions consider displaying alternative codes and descriptions such as ICD-9/10.

- When creating prescriptions, consider the following enhancements:
  - o Adding system edit warnings that inform user of missing information in the sig detail.
  - o Creating larger fields so that users can easily select drop-down lists as the current user interface field size is small.

APPENDICES

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

Appendix 1: Sample Recruiting Screener

Appendix 2: Participant Demographics

Appendix 3: Non-Disclosure Agreement (NDA)

Appendix 4: Informed Consent

Appendix 5: Moderator's Guide

Appendix 6: System Usability Score Questionnaire

Appendix 7: Incentive Receipt and Acknowledgment Form

APPENDIX 1: SAMPLE RECRUITING SCREENER

The purpose of a screen is 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 Custom Computing 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 you 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. [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 12 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? [23-39; 40-59; 60-74; 75 and older][Recruit Mix]
6. Do you require any assistive technologies to use a computer? [If so, please describe]

   _____

Professional Demographics:

7. What is your current position?

   ☐ Nurse: Specialty   _____

   ☐ Physician: Specialty   _____

   ☐ Medical Assistant

   ☐ Administrative Staff

8. How long have you held this position?   _____

9. Do you practice in a private practice setting? [If no, Terminate]

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

    ☐ High School Graduate / GED

    ☐ Some College

    ☐ College Graduate (RN, BSN)

    ☐ Post Graduate (MD, DO, PA, NP, PhD)

    ☐ Other: _____

Computer Skills:

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

    ☐ Accessing EHR   ☐ Online Banking   ☐ No computer Use [Terminate]

    ☐ Research   ☐ Digital Pictures

    ☐ Reading News   ☐ Programming

    ☐ Shopping   ☐ Word Processing

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

    ☐ 0 – 10 Hours   ☐ 11 – 25 Hours   ☐ 26+ Hours

13. What computer platform do you usually use?

    ☐ Windows   ☐ Macintosh   ☐ Other: _____

14. What Internet browser(s) do you usually use?

    ☐ IE   ☐ FireFox   ☐ Chrome   ☐ Other: _____

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

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

17. How does your practice store patient records?

    ☐ On Paper   ☐ Mixed   ☐ All Electronic

Contact Information

Those are all the questions I have for you. Your background matches the people we're looking for. For your participation, you will be paid $200.00.

Would you be able to participate on xx/xx/xx date at xx:xx time? If yes, complete contact information below:

May I get your contact information?

Name: _____

Address: _____

City: _____   State: _____   Zip: _____

Phone: _____

E-mail: _____

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?   ☐ Yes   ☐ No

This study will take place at 11135 Mill Valley Road, Omaha, NE 68154. I will confirm your appointment a couple days before your session and provide you with directions to our office. What time is the best time to reach you? _____ - _____

APPENDIX 2: PARTICIPANT DEMOGRAPHICS

The following is an overview of the participants in this study:

#	Part ID	Gender	Age	Education	Occupation / Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
1	001	Male	50-59	Doctorate Degree	Physician	240 mos.	216 mos.	18 mos.	None
2	002	Female	30-39	Bachelor's Degree	Medical Assistant	216 mos.	240 mos.	18 mos.	None
3	003	Male	60-69	Doctorate Degree	Physician	468 mos.	240 mos.	60 mos.	None
4	004	Female	20-29	Master's Degree	Nurse Practitioner	50 mos.	96 mos.	8 mos.	None
5	005	Female	30-39	Technical / Trade	Medical Assistant	168 mos.	240 mos.	72 mos.	None
6	006	Female	30-39	Bachelor's Degree	Radiology Tech	78 mos.	264 mos.	78 mos.	None
7	007	Female	40-49	Technical / Trade	Medical Assistant	204 mos.	300 mos.	24 mos.	None
8	008	Female	30-39	Bachelor's Degree	Nurse	156 mos.	240 mos.	36 mos.	None
9	009	Male	60-69	Doctorate Degree	Physician	420 mos.	360 mos.	72 mos.	None
10	010	Female	40-49	Bachelor's Degree	Nurse	288 mos.	384 mos.	0 mos.	None

APPENDIX 3: NON-DISCLOSURE AGREEMENT

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of _____, 2017, between _____ ("the Participant") and the testing organization *Custom Computing Corporation* located at *11135 Mill Valley RD, Omaha, NE 68154*.

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 *Custom Computing Corporation*, 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 *Custom Computing Corporation* and is being disclosed solely for the purposes of the Participant's participation in today's study. By signing this form the Participant acknowledges that he/she will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Participants printed name: _____

Signature: _____   **Date: _____**

APPENDIX 4: INFORMED CONSENT

Informed Consent

Custom Computing Corporation (CCC) would like to thank you for your 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 Electronic Health Record Under Test (EHRUT) and give your feedback. The study will last about 90 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 (CCC) 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 (CCC).

I understand and consent to the use and release of the videotape by (CCC). 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 (CCC) 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 (CCC) and its client's. 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.

Participants printed name: _____

Signature: _____   **Date:** _____

APPENDIX 5: MODERATOR'S GUIDE

Moderator's Guide

System: Freedom Medical Systems® EHR v5.0 r3   Data Base: TST

Administrator: Samantha Waldmann   Date: 8/4/17 – 9/8/17

Data Logger: UCD Application   Time: Scheduled

Participant IDs: 001-010

Location: 11135 Mill Valley Road, Omaha, NE 68154

PRIOR TO TESTING SESSION:
- ☐ Confirm with participant test date and time

DAY OF TESTING:
- ☐ Verify EHRUT lab environment is setup and configured properly
- ☐ Verify data recording equipment and tools are running properly

UPON PARTICIPANT ARRIVAL:
- ☐ Read Orientation
- ☐ Obtain NDA and Informed Consent forms
- ☐ Introduce TURF Application to Participant
- ☐ Introduce Freedom | EHR Application to Participant
- ☐ Have Participant Complete Preliminary Questions

DURING THE TESTING SESSION
- ☐ Provide Task Instructions

UPON TEST COMPLETION
- ☐ Read Post-Test Message
- ☐ Administer post-test Usability Scale Questionnaire
- ☐ End TURF Application
- ☐ Read Participant Debrief Message
- ☐ Obtain Acknowledgement of Receipt Form

Orientation [10 Minutes]

ADMINISTRATOR INSTRUCTIONS: Read the following to the participant.

Thank you for participating in today's study. My name is Administrator Name and I'll be working with you today.

In this study, we're evaluating the usability of an electronic health record system. To do this, you will be asked to complete some surveys and perform 7 tasks. We will be watching and recording how the EHR supports the execution of these tasks. This will include us taking notes, as well as recording screenshots and audio of your feedback. All recordings and information that you provide will be kept confidential, and you will in no way be identified in any of our records.

Each task will include a scenario to explain why you are doing the task. As you work, feel free to perform whatever steps you feel are necessary to complete the task. I can try to answer questions about information that you might feel is missing, but I cannot provide you with directions on how to complete the task."

You are free to stop or take a break at any time, and that will not affect any consideration we will be providing. Please let me know if you need anything to make yourself more comfortable.

Before we begin, I will need you to read over these documents and sign them. The first describes the study and your rights as a participant and the other is a non-disclosure agreement. When you have read and signed them, you may give them to me.

Do you have any questions?

- ☐ **Obtain NDA form**
- ☐ **Obtain Informed Consent form**

Introduce TURF Application [5 Minutes]

ADMINISTRATOR INSTURCTIONS: Read the following to the participant and provide an overview of the TURF application.

We will be using the TURF software to record your answers to a few surveys and to record your interactions with the EHR system. You will navigate through TURF with the NEXT button located here POINT TO NEXT BUTTON*. Note that there is no BACK button, so please be sure to carefully read the instructions and answer the questions before moving on.*

Introduce EHR Application [5 Minutes]

ADMINISTRATOR INSTRUCTIONS: Read the following to the participant and allow the participant 5 minutes to get familiar with the EHR application.

We will be using Freedom Medical Systems EHR v5.0 r3 for today's test. Freedom EHR is a complete ambulatory EHR system designed for private practices. Please take a moment to familiarize yourself with the application. When you are ready please let me know.

Demographics Survey [5 Minutes]

ADMINISTRATOR INSTRUCTIONS: Navigate to the Demographics Survey in TURF and have the participant complete the questions.

☐ Demographics Survey Completed

Task Instructions [5 Minutes]

ADMINISTRATOR INSTRUCTIONS: Provide the participant with the Task 1(A) – CPOE MEDICATION: PRESCRIBE MEDICATION" participant instructions.

Read the following to the participant.

Here are the instructions for the first task. Each set of instructions provides you with a brief scenario explaining the task that you are to accomplish using Freedom Medical Systems EHR. In some cases, you will be required to input data into the EHR system to complete the task. You may refer to these instructions at any time. I will provide the next set of instructions when you finish the task.

*Once you click on the **NEXT** button, the TURF software will minimize, and I will take control of the computer for a moment to prepare the task. I will then hand control back over to you for the task. Once you feel that you have accomplished the task, please verbally indicate that you have finished, and then press the **F9** key on the keyboard to stop the recording as we prepare for the next task. After pressing **F9**, I will again briefly take control of the computer to prepare the next task. If you forget which key to press to stop the recording, you can reference the lower left corner of the instruction page.*

In this study we are interested in how well the EHR design facilitates your ability to complete the tasks, not about your medical decision-making skills or ability to catch a mistake in the record, so please do not spend time reviewing the patient's histories in detail. Assume that everything in the record is accurate unless otherwise specified in the task instructions. Work as quickly as possible, but focus on completing the task rather than worrying about how long it might be taking.

Do you have any questions?

ADMINISTRATOR INSTRUCTIONS:
- When the participant presses **F9** and ends the current task, provide the next task set of instructions.
- Ensure that the participant presses the **NEXT** button to begin each new task.
- Briefly take control of the testing machine and navigate to the starting point of the next task as outlined in the Moderator's guide and onscreen instructions.
- Allow the participant to review the next task instructions.
- Fill in the performance evaluation forms as instructed after each task.
- You may use printed copies of the performance evaluation form to take notes before filling in the onscreen performance evaluation form that appear after each task.
- When the participant finishes each task, ensure they press **F9**.
- Repeat this process until all tasks have been completed.

TASK 1 (A) – CPOE MEDICAITON: ORDER MEDICATION	MARTHA SMITH, #1050
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX> Patient Summary Screen

End Point: Participant successfully enters Albuterol Sulfate and selects the Find button. Then selects Albuterol Sulfate 8mg Tablet Extended Release 12 hr from the list of available medications. Participant continues filling out the SIG information and selects the Continue button. On the Prescription Preview screen, participant selects the Ok button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 1 (B) – CPOE MEDICAITON: MODIFY MEDICATION ORDER	MARTHA SMITH, #1050
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX> Patient Summary Screen

End Point: Under pending prescriptions, participant selects Modify. Participant selects the dosage drop-down, selects 4 mg tablet extended release 12 hr and selects the Continue button. On the Prescription Preview screen, participant selects the Ok button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 2 (A) – CPOE LAB: REVIEW LAB RESULTS	RORY SMITH, #1010
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom EHR > Patient Chart **>** Note Tab > Encounter 06/26/2017

End Point: Participant successfully navigates to the Results Tab > Lab Tab > and selects the Review Status hyper-link Pend Provider to open the Result Summary Tab and verbally states the LDL Cholesterol level from the most recent (5/26/17) Lipid Panel - LDL Cholesterol result of 129.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 2 (B) – CPOE LAB: ENTER LAB ORDER(S)	RORY SMITH, #1010
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom EHR > Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant navigates to the Orders > Lab Orders and selects the Fasting Glucose lab test from the In-House (CLIA) Labs column and appropriately associates the diagnosis code with the order before selecting the Exit button on the Associate DX pop-up screen.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 3 (A) – CPOE RADIOLOGY: REVIEW RADIOLOGY RESULT(S)	KAREN SMITH, #1020
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom EHR > Patient Chart **>** Note Tab > Encounter 06/26/2017

End Point: Participant successfully navigates to the Results Tab > Radiology Tab and selects the Status hyper-link Pend Review to open the Result Summary Tab and verbally states the overall result flag of "Normal" for the most recent mammogram screening ordered on (05/15/17).

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 3 (B) – CPOE RADIOLOGY: ENTER RADIOLOGY ORDER(S)	KAREN SMITH, #1020
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom EHR > Patient Chart **>** Note Tab > Encounter 06/26/2017

End Point: Participant successfully navigates to the Orders > Radiology Orders > Common X-Ray(s)
                    category and orders a Chest; 2 views – Frontal & Lateral x-ray study and appropriately
                    associates the diagnosis code with the order before selecting the Exit button of the
                    Associate Dx pop-up screen.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 4 (A) – CPOE MEDICATION: DRUG-DRUG INTERACTION CHECK(S)	TOM SMITH, #1030
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX > Patient Summary Screen

End Point: Participant successfully searches for Tramadol using the prescribe a medication search field. Participant selects Tramadol [Ultram] 50 mg tablet from the list of available medications. Participant enters the Drug-Drug Interaction warning override reason "Will monitor and follow-up" and selects the Prescribe Anyway button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 4 (B) – CPOE MEDICATION: DRUG-ALLERGY INTERACTION	JOHN SMITH, #1040
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX > Patient Summary Screen

End Point: Participant successfully searches for Bactrim using the prescribe a medication search field. Participant selects Bactrim 400-80 mg tablet from the list of available medications. Participant enters the Drug-Allergy Interaction warning override reason Patient tolerates medication pair currently or in past and selects the Prescribe Anyway button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 5 (A) – PATIENT DEMOGRAPHICS: SEXUAL ORIENTATION & GENDER IDENTITY	PATIENT DEMO, #1090
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant selects the View Demographics hyper-link or Demographic button to open the EHR Demographics screen. Participant locates and selects the Sexual Orientation Search button, selects the Straight or Heterosexual option and then the Exit button. Participant locates and selects the Gender Identity Search button, selects the Identifies as Male option and then the Exit button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 5 (B) – PATIENT DEMOGRAPHICS: RACE & ETHNICITY	PATIENT DEMO, #1090
	ENCOUNTER DATE: 06/26/2017

Start Point: EHR Demos Screen

End Point: Participant locates and selects the Ethnicity Search button, selects the Hispanic or Latino option and then the Exit button. Participant locates and selects the Race Search button, selects the Mexican American Indian option and then the Exit button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 5 (C) – PATIENT DEMOGRAPHICS: LANGUAGE PREFERENCE	PATIENT DEMO, #1090
	ENCOUNTER DATE: 06/26/2017

Start Point: <u>EHR Demos</u> Screen

End Point: Participant locates and selects the Race <u>Drop-Down</u>, selects the <u>Spanish; Castilian</u> option
                       and selects the <u>Save</u> button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 6 (A) – PROBLEM LIST: REVIEW ACTIVE PROBLEMS	DOUG SMITH, #1110
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant navigates to the note menu and selects the Review Problem List option.
                        User verbally indicates three active problems.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 6 (B) – PROBLEM LIST: MODIFY PROBLEM	DOUG SMITH, #1110
	ENCOUNTER DATE: 06/26/2017

Start Point: Note Tab > Encounter 06/26/2017 > Review Problem List Screen

End Point: Participant selects the Edit Hyper-link for "Acute sinusitis, unspecified". From the Problem Screen, the participant selects the Status Drop-down, selects the Inactive option and then selects the Save button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	□ Easily Completed □ Completed w/ Difficulty □ Not Completed
Path Deviation	□ Yes □ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	□ 1 "Very Difficult" □ 2 □ 3 □ 4 □ 5 "Very Easy"

TASK 6 (C) – PROBLEM LIST: ADD PROBLEM	DOUG SMITH, #1110
	ENCOUNTER DATE: 06/26/2017

Start Point: Note Tab > Encounter 06/26/2017 > Review Problem List Screen

End Point: Participant selects New Problem button. From the Problem Screen, participant selects
the ICD-10 Search button, then enters keyword search criteria and selects the Go
button. Participant chooses the Z91.81 – History of Falling ICD code that appears and
then selects the Add button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 7 (A) – MEDICATION LIST: VIEW ACTIVE MEDICATION(S)	JULIE SMITH, #1000
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant successfully navigates to the Review Allergy/Meds menu option on the note tab and verbally states "Lipitor Tablet 20 mg" on the patient's active medication list.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 7 (B) – MEDICATION LIST: MODIFY MEDICATION(S)	JULIE SMITH, #1000
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX > Patient Summary Screen

End Point: Participant selects the Manage Medication then Modify option for the drug Lipitor, selects the 40 mg tablet from the drop-down menu next to the medication name and then selects the Continue button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 7 (C) – MEDICATION LIST: ADD MEDICATION(S)	JULIE SMITH, #1000
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom | ERX > Manage Medication Screen

End Point: Participant successfully uses the Add a Medication field, selects the Find button, selects the Ibuprofen 400 mg Tablet from the list of medications that appears and continues to fill out the Sig Information before selecting the Continue button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 8 (A) – MEDICATION ALLERGY LIST: REVIEW ALLERGIES	AMANDA SMITH, #1060
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant successfully selects the Review Allergy/Meds menu option and confirms the patient's active allergies as Sulfa and Penicillins Group.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 8 (B) – MEDICATION ALLERGY LIST: MODIFY ALLERGY	AMANDA SMITH, #1060
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom |ERX > Patient Summary Screen

End Point: Participant successfully selects the Manage Allergies hyper-link. Participant selects the
                        Delete option to the right of the Penicillin allergy.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	□ Easily Completed □ Completed w/ Difficulty □ Not Completed
Path Deviation	□ Yes □ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	□ 1 "Very Difficult" □ 2 □ 3 □ 4 □ 5 "Very Easy"

TASK 8 (C) – MEDICATION ALLERGY LIST: ADD ALLERGY	AMANDA SMITH, #1060
	ENCOUNTER DATE: 06/26/2017

Start Point: Freedom |ERX > Manage Allergies Screen

End Point: Participant successfully selects Codeine from the Common Allergies drop-down and then selects the Add Common Allergy button. Participant selects Rash from the Reaction drop-down and enters 06/27/2017 as the Onset Date and selects the Add button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 9 (A) – CLINICAL DECISION SUPPORT: IDENTIFY INTERVENTION(S)	STEVEN SMITH, #1070
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant successfully selects either the View CDS Alerts hyper-link or View CDS button. Participant successfully identifies the "Noncompliant" Diabetes: Urine Protein Screening CDS alert rule listed.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 9 (B) – CLINICAL DECISION SUPPORT: REVIEW ATTRIBUTES	STEVEN SMITH, #1070
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > CDS Notification Screen

End Point: Participant successfully selects the View Recommendation Statement button, locates
                        and verbally identifies the Recommendation Statement before pressing [F9].

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 9 (C) – CLINICAL DECISION SUPPORT: TAKE ACTION	STEVEN SMITH, #1070
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > CDS Notification Screen

End Point: Participant successfully selects the Order Diabetes Urine Protein Screening action link. Participant chooses the 06/26/2017 Encounter, then the Microalbumin/Creatinine Ratio lab study, and appropriately associates the diagnosis code with the order before selecting the Exit button on the Associate DX pop-up screen.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 10 (A) – IMPLANTABLE DEVICE LIST: REVIEW	BOB SMITH, #1100
	ENCOUNTER DATE: 06/26/2017

Start Point: Patient Chart > Note Tab > Encounter 06/26/2017

End Point: Participant successfully navigates to the Devices tab and verbally indicates 2 active
                        medical devices.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	□ Easily Completed □ Completed w/ Difficulty □ Not Completed
Path Deviation	□ Yes □ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	□ 1 "Very Difficult" □ 2 □ 3 □ 4 □ 5 "Very Easy"

TASK 10 (B) – IMPLANTABLE DEVICE LIST: MODIFY	BOB SMITH, #1100
	ENCOUNTER DATE: 06/26/2017

Start Point: <u>Patient Chart</u> > <u>Devices Tab</u>

End Point: Participant successfully locates and selects the <u>B066000325011NS1 – Cardiopulmonary bypass system filter, arterial blood line</u> device. Participant proceeds to select the Status <u>Drop-down</u>, <u>Inactive</u> before selecting the <u>Save</u> button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 10 (C) – IMPLANTABLE DEVICE LIST: ADD	BOB SMITH, #1100

ENCOUNTER DATE: 06/26/2017

Start Point: <u>Patient Chart</u> > <u>Devices Tab</u>

End Point: Participant successfully <u>Types</u> the UDI Number in the UDI Field, selects the <u>Go</u> button to process the UDI number. After the system Parses UDI, Obtains GUDID and Obtains CT Description, the participant selects the <u>Save</u> button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 11 (A) – CLINICAL INFORMATION RECONCILIATION: IDENTIFY	DONALD SMITH, #1080
	ENCOUNTER DATE: 06/26/2017

Start Point: <u>EHR Dashboard</u>

End Point: Participant successfully navigates to the <u>3rd Party Recs</u> link and selects it on the EHR
                        Dashboard. Participant correctly identifies <u>Donald Smith's</u> record listed on the 3rd Party
                        Records screen and then selects the <u>Reconcile</u> hyper-link.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 11 (B) – CLINICAL INFORMATION RECONCILIATION: RECONCILE	DONALD SMITH, #1080
	ENCOUNTER DATE: 06/26/2017

Start Point: Clinical Information Reconciliation > Medications Tab

End Point: Participant successfully Reconciles the incoming Medications and then selects the
                        Submit button. Participant successfully Reconciles the incoming Medication Allergies
                        and then selects the Submit button. Participant successfully Reconciles the incoming
                        Problems and then selects the Submit button.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	□ Easily Completed □ Completed w/ Difficulty □ Not Completed
Path Deviation	□ Yes □ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	□ 1 "Very Difficult" □ 2 □ 3 □ 4 □ 5 "Very Easy"

TASK 11 (C) – CLINICAL INFORMATION RECONCILIATION: INCORPORATE	DONALD SMITH, #1080
	ENCOUNTER DATE: 06/26/2017

Start Point: Clinical Information Reconciliation > Review/Complete Tab

End Point: Participant successfully selects the Complete Reconciliation button, enters the workflow password and then selects save.

TASK PERFORMANCE EVALUATION	
Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

TASK 12 (A) – E-PRESCRIBING: PRESCRIBE MEDICATION	MARTHA SMITH, #1050
	ENCOUNTER DATE: 06/26/2017

Start Point: <u>Freedom | ERX</u>> <u>Patient Summary</u> Screen

End Point: Participant successfully enters <u>Albuterol Sulfate</u> and selects the <u>Find</u> button. Then selects <u>Albuterol Sulfate 8 mg Tablet Extended Release 12 hr</u> from the list of available medications. Participant continues filling out the <u>SIG</u> information and selects the <u>Continue</u> button. On the Prescription Preview screen, participant selects the <u>Ok</u> button. Under pending prescriptions, participant enters <u>Signature Password</u> and then selects <u>Send</u>.

TASK PERFORMANCE EVALUATION

Attempt Number	
Task Time (mm:ss)	
Task Success	☐ Easily Completed ☐ Completed w/ Difficulty ☐ Not Completed
Path Deviation	☐ Yes ☐ No
Observed # of Steps	
Number of Errors	
Participants Verbalizations	
Major Findings	
Satisfactory Rating "On a scale from 1 to 5, 1 being very difficult and 5 being very easy, how would you rate this task?"	☐ 1 "Very Difficult" ☐ 2 ☐ 3 ☐ 4 ☐ 5 "Very Easy"

Post Test Message

ADMINISTRATOR INSTRUCTIONS: Read the following to the participant.

Great, now we have a final survey for you to complete. Please fill it out to the best of your ability and let me know when you have finished.

Post Test Survey

ADMINISTRATOR INSTRUCTIONS: Provide participant with the System Usability Scale Questionnaire.

☐ Obtain System Usability Scale Questionnaire

Debrief Participant

ADMINISTRATOR INSTRUCTIONS: Read the following to the participant.

Great! That completes our study. I want to thank you for taking the time to complete this study. As you know, the purpose of this study is to allow us to assess the usability of an EHR system and your input has been very valuable.

Do you have any questions before you go?

Thanks again!

☐ Provide Participant with "UCD Receipt Form"
☐ Obtain signed UCD Receipt Form
☐ Provide participant with compensation check
☐ Select the END SESSION button

Reset UCD Study Test Environment

ADMINISTRATOR INSTRUCTIONS: After the participant has left, perform the following steps to reset the UCD Test Environment:

1. Notify Programming to reset the "UCD" data base to the restore point.
2. After programming has reset the "UCD" data base environment, verify that all test cases are ready for next participant.

APPENDIX 6: SYSTEM USABILITY SURVEY QUESTIONAIRRE

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

APPENDIX 7: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Receipt Form: Participant UCD Study Compensation

Thank you for taking the time out of your busy schedule to participate in our UCD study. Please sign below to indicate that you have received the promised compensation for your participation in today's study.

Date:

Amount received:

Please print your name:

Please sign your name:

Thank you!

Custom Computing Corporation appreciates your participation in today's UCD study.