EHR Usability Test Report for ehrTHOMAS, version 3.0

Report based on NISTIR 7742 Customized Common Industry Format Template for Electronic Health Record Usability Testing

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1. EXECUTIVE SUMMARY

A usability test of ehrTHOMAS version 3.0, complete ambulatory electronic health record (EHR), was conducted on December 15th, 2017 through January 9th, 2018, in various medical offices by Genius Solutions Inc. The purpose of this test was to examine and validate the usability of the current user interface, and to provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, 11 healthcare providers, medical staff, and office staff matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 26 tasks typically conducted on an EHR:

1. Open a patient chart and update patient demographics.
2. Add and edit the medication allergies list.
3. Review and complete CDS recommendations based on the medication allergies.
4. Add and edit the medication list.
5. Look up the patient's medication history.
6. Access and update the implantable device list, and record a new device.
7. View all active and inactive implantable devices for the patient.
8. Access the diagnostic orders list and create a new order.
9. Change the diagnostic order.
10. Create a medication order and review the drug-drug interaction check.
11. Change a medication order.
12. Refill a medication prescription.
13. Enter in new patient demographics and review and complete CDS recommendations based on demographics.
14. Record vitals and review and complete CDS recommendations based on vitals.
15. Access and update problem list.
16. Record new condition and review and complete CDS recommendations based on problem list and the combination of problem and demographics.
17. Access the laboratory orders list, enter in laboratory results, and review and complete CDS recommendations based on laboratory results.
18. Create a laboratory order.
19. Update the laboratory order.
20. Electronically prescribe a medication and review the drug-allergy interaction check.
21. Cancel and update an electronic prescription.
22. Review and complete CDS recommendation based on the medication list and check the prescription fill status.
23. Reconcile a clinical care document.
24. Configure a CDS recommendation.
25. Review CDS recommendation attributes.
26. Configure drug-drug interactions.

During the 60 minute one-on-one usability test, each participant was greeted by the test administrator and asked to review and sign an informed consent/release form (included in Appendix 3); they were instructed that they could withdraw at any time. Participants either had prior experience with the EHR. Training was provided to newer functionalities of the system. 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 as well as a Microsoft Windows program called Steps Recorder was used to time the test. The administrator also recorded the user performance data on paper. The administrator did not give the participant assistance in how to complete any task. Participant screens were recorded for subsequent analysis.

The following types of data were collected for each participant:

- Number of tasks successfully completed 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 post-test questionnaire and were compensated with a $15 gift certificate to Speedway and their choice of one, five hour block of training for Genius Solutions' electronic healthcare record program, one, five hour block of training for Genius Solutions' practice management system, or one, registration to Genius Solution's focus group seminar for their time. Various recommended metrics, in accordance with the examples set forth in the *NIST guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Table 1: Task Results							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
Task 1: Open a patient chart and update patient demographics.							
1.1 Access Demographic Data	90.91	144.70 (52.74)	144.70/90	3 (2)	3/1	9.09	4.36 (0.77)
1.2 Change Demographic Data	80			9 (1)	9/7	0	
Task 2: Add and edit the medication allergies list.							
2.1: Access Medication Allergy List	100	138.10 (59.92)	138.10/78	3 (1)	3/2	0	4.25 (1.01)
2.2: Record New Medication Allergy	91.67			5 (2)	5/3	8.33	

Task / Subtask							
2.3: Modify Medication Allergy List	91.67			4 (1)	4/3	8.33	

Task 3: Review and complete CDS recommendations based on the medication allergies.							
3.1: Review and Complete CDS Intervention: Medication Allergy List	100	37.91 (16.98)	37.91/34	4 (1)	4/4	0	5 (0)
Task 4: Add and edit the medication list.							
4.1: Access Medication List	100	107.50 (40.85)	107.50/78	2 (0)	2/2	0	4.82 (0.39)
4.2: Record New Medication	100			4 (1)	4/3	0	
4.3: Modify Medication List	100			3 (1)	3/3	0	
Task 5: Look up the patient's medication history.							
5.1: Obtain Medication History	83.33	27.89 (22.37)	27.89/26	5 (2)	5/3	16.67	4.73 (0.62)
Task 6: Access and update the implantable device list, and record a new device.							
6.1: Access Device List	100	162.91 (71.68)	162.91/92	1 (0)	1/1	0	3.83 (0.90)
6.2: Change Status of UDI Recorded	66.67			5 (1)	5/4	33.33	
6.3: Record New UDI	66.67			7 (2)	7/4	33.33	
Task 7: View all active and inactive implantable devices for the patient.							
7.1: View All Active and Inactive Devices	91.67	26.18 (22.21)	26.18/10	2 (2)	2/1	8.33	4.50 (0.96)
Task 8: Access the diagnostic orders list and create a new order.							
8.1: Access Diagnostic Order List	91.67	107.82 (28.76)	107.82/94	2 (2)	2/1	8.33	4.50 (0.87)
8.2: Create Diagnostic Imaging Order	100			7 (1)	7/6	0	
Task 9: Change the diagnostic order.							
9.1: Change the Diagnostic Order	100	36.91 (17.18)	36.91/26	5 (1)	5/4	0	4.64 (0.64)
Task 10: Create a medication order and review the drug-drug interaction check.							
10.1: Order a Medication	100	116.27 (42.49)	116.27/ 111	11 (2)	11/10	0	4.18 (0.94)
10.2: Review Attributes for the Drug-Drug Interaction	81.82			1 (0)	1/1	18.18	
Task 11: Change a medication order.							
11.1 Access and Change Medication Order	90.91	121 (80.42)	121/84	9 (4)	9/7	9.09	4.27 (0.75)
Task 12: Refill a medication prescription.							
12.1: Refill a Medication	100	58.18 (50.23)	58.18/22	5 (5)	5/1	0	4.73 (0.45)
Task 13: Enter in new patient demographics and review and complete CDS recommendations based on demographics.							
13.1: Record Demographics	81.82	185.40 (37.94)	185.40/ 114	10 (1)	10/9	18.18	4.09 (0.67)
13.2: Review and Complete CDS Intervention: Demographics	100			2 (0)	2/2	0	

Task							
Task 14: Record vitals and review and complete CDS recommendations based on vitals.							
14.1: Record Vitals and Review and Complete CDS Intervention: Vital Signs	100	35.17 (10.98)	35.17/32	6 (0)	6/6	0	4.75 (0.60)
Task 15: Access and update problem list.							
15.1: Access Problem List	75	55.09 (24.90)	55.09/16	3 (2)	3/1	25	4.18 (1.11)
15.2: Resolve Condition from Problem List	83.33			2 (2)	2/1	16.67	
Task 16: Record new condition and review and complete CDS recommendations based on problem list and the combination of problem and demographics.							
16.1: Add New Condition to Problem List	100	61.33 (31.69)	61.33/64	8 (2)	8/6	0	4.33 (0.85)
16.2: Review and Complete CDS Intervention: Problem List	100			2 (0)	2/2	0	
16.3: Review and Complete CDS Intervention: Demographics and Problem List	100			2 (0)	2/2	0	
Task 17: Access the laboratory orders list, enter in laboratory results, and review and complete CDS recommendations based on laboratory results.							
17.1: Access Laboratory Orders	100	82.17 (23.73)	82.17/56	2 (1)	2/2	0	4.50 (0.65)
17.2: Review and Complete CDS Intervention: Lab Results	100			9 (1)	9/9	0	
Task 18: Create a laboratory order.							
18.1: Record Laboratory Order	100	40.17 (12.99)	40.17/34	5 (1)	5/4	0	4.75 (0.43)
Task 19: Updatethe laboratory order.							
19.1: Change a Laboratory Order	81.82	54.90 (40.58)	54.9/22	4 (1)	4/3	18.18	4.60 (0.49)
Task 20: Electronically prescribe a medication and review the drug-allergy interaction check							
20.1: Electronically Prescribe a Medication	100	92.45 (17.04)	92.45/98	15 (2)	15/14	0	4.73 (0.44)
20.2: Review Attributes for the Drug-Allergy Intervention	81.82			1 (0)	1/1	18.18	
Task 21: Cancel and update an electronic prescription.							
21.1: Cancel/Change a Medication	90.91	130 (56.31)	130/110	14 (3)	14/13	9.09	4.18 (1.03)
Task 22: Review and complete CDS recommendation based on the medication list and check the prescription fill status.							
22.1: Review and Complete CDS Intervention: Medication List	100	21.27 (11.83)	21.27/20	4 (0)	4/4	0	5 (0)
22.2. Check Prescription Fill Status	100			2 (1)	2/1	0	
Task 23: Reconcile a clinical care document.							
23.1: Reconcile and Incorporate Clinical Information	66.67	278.88 (118.53)	278.88/174	27 (4)	27/18	33.33	2.83 (1.07)
Task 24: Configure a CDS recommendation.							
24.1: Enable CDS Rule	81.82	84.18 (33.01)	84.18/32	6 (2)	6/4	18.18	4.09 (0.79)
24.2: Configure CDS Intervention by User	100			6 (1)	6/6	0	
Task 25: Review CDS recommendation attributes.							

25.1: Review Source Attributes for CDS Alerts	75	51 (24.36)	51/24	5 (2)	5/3	25	3.90 (0.94)

Task 26: Configure drug-drug interactions.							
26.1: Change Drug-Drug Interaction Severity Levels.	83.33	105.20 (12.50)	105.20/40	2 (1)	2/2	16.67	3.83 (0.80)

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 69%

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

Major Findings

- The tasks associated with the Computer Provider Order Entry – Medications were considered easy and had success rate over 90%.
- The tasks associated with the Computer Provider Order Entry – Laboratory were considered to be very easy and had success rate over 81%.
- The tasks associated with the Computer Provider Order Entry –Diagnostic Orders were considered to be very easy to perform and had success rate over 91%.
- The tasks associated with the Drug-Drug, Drug-Allergy Interaction Checks were considered to be easy to perform and had success rate over 81%.
- The tasks associated with the Demographics were considered to be easy and had success rate over 80%.
- The tasks associated with the Problem List were considered to be easy and had success rate over 75%.
- All the tasks associated with the Medication List were considered to be very easy and had a success rate of 100%.
- The tasks associated with the Medication Allergy List were considered to be easy and had success rate over 91%.
- The tasks associated with the Clinical Decision Support were considered to be easy and had success rate over 75%.
- The tasks associated with the Implantable Device List were considered to be easy and had success rate over 66%.
- The task associated with the Clinical Information Reconciliation and Incorporation were considered to be neither easy nor difficult and had success rate over 66%.
- The tasks associated with the Electronic Prescribing were considered to be easy and had success rate over 83%.
- Familiarization of the organization of data would increase the efficiency of tasks.
- Some participants do not use the laboratory and diagnostic imaging ordering functionality in the EHR. Most labs and imaging facilities have their own forms that they prefer to use.
- Tasks regarding the new features in the EHR were expected to less efficient and effective compared to other tasks on existing features.

- Some participants found the feature to reconcile information from a CCDA to be very useful, but impractical. During the open discuss of the task, participants admitted that their office are not exchange patient health information electronically. They state that most providers are still faxing over the patient's health information to their office.

Areas for improvement

- Participants suggested that the DrFirst functionality needs to be embedded into the EHR program.
- Additional service integrations with laboratory and diagnostic companies would minimize extra work for users.
- Certain icons and wording in the EHR needs to be changed since some participants interpreted them differently than its purpose.
- The dropdown options inside the demographic fields needs to be re-organized to increase efficiency.
- The functionality of the 'Calendar' button needs to be improved to be more user-friendly. Additional research regarding the best option would be needed.
- Having the ability to tab through text input fields would increase the efficiency of entering data.
- The search functionality when adding the diagnoses needs to be improved to increase user efficiency.
- Some participants suggested to have a larger screen size so larger text can be used in the system.
- When adding a device to the device list, the system should have the ability to record both DI and UDI from the 'Add' button.
- When reconciling the CCDA information, keeping the headers on both the CCDA file list and the patient's reconcile list expanded so the user does not have to open each header to view the information inside.
- Participants suggested the ability to record and reconcile medication and allergies directly from that screen without having to go out of the EHR.
- The workflow on how the problem list is reconciled should be review and modified to prevent additional problems from the CCDA to be added to the patient's chart.

2. INTRODUCTION

The EHRUT tested for this study was ehrTHOMAS version 3.0, a complete EHR designed for ambulatory settings. The program was designed to create, present and store medical information for healthcare providers in podiatry, chiropractic internal medicine, obstetrics, gynecology, mental health, pediatric and surgical facilities. This 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 pertaining to certification requirements from of the Office of the National Coordinator of Health Information Technology Certification Program in the EHR Under Test (EHRUT).

This study will measure the program's level of effectiveness, efficiency and user satisfaction, such as, time spent on a task, number of errors and user rating, were captured during the usability testing.

3. METHOD

3.1 PARTICIPANTS

A total of elevenparticipants were tested on the EHRUT. Participants in the test were actual users of the ehrTHOMAS program including physicians, medical or clinical assistants, and office managers. Participants were recruited through Genius Solutions and were compensated with their choice of one free five hour training block of the ehrTHOMAS system, one free five hour training block of our practice management system, eTHOMAS, or one free registration to our company's focus group for their time.Participants were given the same amount of training and the same type of training that other ehrTHOMAS end users would receive. In addition, these participants had no direct connection to the development of the software.

The following is a table of participants by characteristics, including demographics, professional experience and computer usage. Participants' names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Table 2:									
Patient Demographics									
Participant ID	Gender	Age (years)	Highest Level of Education	Occupation or Role	Professional Experience (months)	Hours/Week on Computer	Product Experience (months)	Hours/Week using EHR	Assistive Technology Needs
1257	Male	45-54	Doctorate	Physician	192	31-40	3	31-40	No
1874	Female	45-54	High school/GED	Medical Assistant	240	31-40	72	31-40	No
2168	Female	35-44	Doctorate	Physician	216	31-40	54	31-40	No
3210	Male	55-64	Doctorate	Physician	420	21-30	72	11-20	No
3676	Male	55-64	Doctorate	Physician	504	21-30	84	11-20	No
4247	Female	45-54	Some college credit	Office Manager/ Medical Assistant	252	41+	72	11-20	No
4865	Male	55-64	Doctorate	Physician	456	41+	60	41+	No
5912	Male	55-64	Doctorate	Physician	360	41+	60	31-40	No
6124	Female	25-34	Some college credit	Medical Assistant	48	31-40	24	21-30	No
7953	Female	35-44	High school/GED	Medical Assistant	120	41+	24	31-40	No
8791	Female	65+	Bachelor's Degree	Receptionist	558	21-30	72	< 10	No
9856	Female	55-64	Some college credit	Office Manager/ Medical Assistant	432	41+	84	41+	No

20participants (matching the demographics in the section of participants) were recruited and 12people participated in the usability test. Oneparticipant failed to show for the study.

Participants were scheduled for 60 minute sessions with five to ten minutes in between each session for debrief by the administrator and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participants and each participant's demographic characteristics.

3.2 STUDY DESIGN

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

During the usability test, participants interacted with one EHR. Each participant used the software on the same testing computer at his/her location, and was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by data collected and analyzed for each participant:

- Number of tasks successfully completed without assistance
- Time to complete the tasks
- Number of clicks 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 can be found in Section 3.9 on Usability Metrics.

3.3 TASKS

The tasks used were constructed to be realistic and representative of the kinds of activities a user might do with this EHR while incorporating test procedures for capabilities noted inthe 2015 Edition Health IT Certification criteria §170.315(g)(3), Safety-Enhanced Design. §170.315(g)(3), specifies that a summative usability testing was conducted and results were recorded for each of the following certification criteria:

- § 170.315(a)(1) Computerized Provider Order Entry (CPOE)– Medications
- § 170.315(a)(2) Computerized Provider Order Entry (CPOE)– Laboratory
- § 170.315(a)(3) Computerized Provider Order Entry (CPOE)– Diagnostic Imaging
- § 170.315(a)(4) Drug-Drug, Drug-Allergy Interaction Checks
- § 170.315(a)(5) Demographics
- § 170.315(a)(6) Problem List
- § 170.315(a)(7) Medication List
- § 170.315(a)(8) Medication Allergy List
- § 170.315(a)(9) Clinical Decision Support
- § 170.315(a)(14) Implantable Device List
- § 170.315(b)(2) Clinical Information Reconciliation and Incorporation

- § 170.315(b)(3) Electronic Prescribing

The task was selected based on their frequency of use, criticality of function, and those that may be most troublesome for users. Some tasks were divided into subtasks to provide additional data for further analysis.The organization of the taskswere presented to the participant in a manner that follows a typical patient flow through the office. See the Moderator's guide in Appendix 4 for the full task wording.

Table 3: Task List		
Scenario 1		
Task 1: Open a patient chart and update the demographics.		
Task #	**Task Goal**	**Certification Criteria**
1.1	Access Demographic Data	§ 170.315(a)(5) Demographics
1.2	Change Demographic Data	
Task 2: Add a medication to the medication allergy list and modify an existing allergy.		
Task #	**Task Goal**	**Certification Criteria**
2.1	Access Medication Allergy List	§ 170.315(a)(8) Medication Allergy List
2.2	Record New Medication Allergy	
2.3	Modify Medication Allergy List	
Task 3: Update the allergy list and review and complete any CDS recommendations.		
Task #	**Task Goal**	**Certification Criteria**
3.1	Review and Complete CDS Intervention: Medication Allergy List	§ 170.315(a)(9) Clinical Decision Support
Task 4: Record a new medication and update a medication on the patient's medication list.		
Task #	**Task Goal**	**Certification Criteria**
4.1	Access Medication List	§ 170.315(a)(7) Medication List
4.2	Record New Medication	
4.3	Modify Medication List	
Task 5: Look up the patient's medication history.		
Task #	**Task Goal**	**Certification Criteria**
5.1	Obtain Medication History	§ 170.315(b)(3) Electronic Prescribing
Task 6: Update information for an implantable device and record a new device.		
Task #	**Task Goal**	**Certification Criteria**
6.1	Access Device List	§ 170.315(a)(14) Implantable Device List
6.2	Change Status of UDI Recorded	
6.3	Record New UDI	
Task 7: View all active and inactive implantable devices for the patient.		
Task #	**Task Goal**	**Certification Criteria**
7.1	View All Active and Inactive Devices	§ 170.315(a)(14) Implantable Device List
Task 8: Order a MRI diagnostic test.		
Task #	**Task Goal**	**Certification Criteria**
8.1	Create Diagnostic Imaging Order	§ 170.315(a)(3) Computerized Provider Order Entry (CPOE) – Diagnostic Imaging
Task 9: Change the created diagnostic order.		
Task #	**Task Goal**	**Certification Criteria**
9.1	Access a Diagnostic Order	§ 170.315(a)(3) Computerized Provider Order Entry (CPOE) – Diagnostic Imaging
9.2	Change a Diagnostic Order	
Task 10: Create a medication order and review any interaction checks.		
Task #	**Task Goal**	**Certification Criteria**
10.1	Order a Medication	§ 170.315(a)(1) Computerized Provider Order Entry

	10.2	Review Attributes for the Drug-Drug Interaction	(CPOE) – Medications § 170.315(a)(4) Drug-Drug, Drug-Allergy Interaction Checks

Task 11: Change the newly created medication order.		
Task #	**Task Goal**	**Certification Criteria**
11.1	Access a Medication Order	§ 170.315(a)(1) Computerized Provider Order Entry
11.2	Modify a Medication Order	(CPOE) – Medications

Task 12: Refill an existing medication prescription.		
Task #	**Task Goal**	**Certification Criteria**
12.1	Refill a Medication Prescription	§ 170.315(b)(3) Electronic Prescribing

Scenario 2		

Task 13: Enter in new patient demographics and review and complete any CDS recommendations.		
Task #	**Task Goal**	**Certification Criteria**
13.1	Record Demographics	§ 170.315(a)(5) Demographics
13.2	Review and Complete CDS Intervention: Demographics	§ 170.315(a)(9) Clinical Decision Support

Task 14: Record vitals and review and complete CDS any recommendations.		
Task #	**Task Goal**	**Certification Criteria**
14.1	Record Vitals and Review and Complete CDS Intervention: Vital Signs	§ 170.315(a)(9) Clinical Decision Support

Task 15: Access condition list and resolve condition.		
Task #	**Task Goal**	**Certification Criteria**
15.1	Access Problem List	§ 170.315(a)(6) Problem List
15.2	Resolve Condition from Problem List	

Task 16: Add new conditions and review and complete and CDS recommendations.		
Task #	**Task Goal**	**Certification Criteria**
16.1	Record New Conditions	§ 170.315(a)(6) Problem List
16.2	Review and Complete CDS Intervention: Problem List	§ 170.315(a)(9) Clinical Decision Support
16.3	Review and Complete CDS Intervention: Demographics and Problem List	

Task 17: Enter in laboratory results and review and complete any CDS recommendations.		
Task #	**Task Goal**	**Certification Criteria**
17.1	Review and Complete CDS Intervention: Lab Results	§ 170.315(a)(9) Clinical Decision Support

Task 18: Create a laboratory order.		
Task #	**Task Goal**	**Certification Criteria**
18.1	Record Laboratory Order	§ 170.315(a)(2) Computerized Provider Order Entry (CPOE) – Laboratory

Task 19: Updating the laboratory order.		
Task #	**Task Goal**	**Certification Criteria**
19.1	Access Laboratory Order	§ 170.315(a)(2) Computerized Provider Order Entry
19.2	Change a Laboratory Order	(CPOE) – Laboratory

Scenario 3		

Task 20: Electronically prescribe a medication and review any interaction checks.		
Task #	**Task Goal**	**Certification Criteria**
20.1	Electronically Prescribe a Medication	§ 170.315(b)(3) Electronic Prescribing
20.2	Review Attributes for the Drug-Allergy Interaction	§ 170.315(a)(4) Drug-Drug, Drug-Allergy Interaction Checks

Task 21: Cancel and update an electronic prescription.		

Task #	Task Goal	Certification Criteria
21.1	Cancel/Change a Medication	§ 170.315(b)(3) Electronic Prescribing

Task 22: Review and complete CDS recommendation based on the medication list and review fill status.		
Task #	**Task Goal**	**Certification Criteria**
22.1	Review and Complete CDS Intervention: Medication List	§ 170.315(a)(9) Clinical Decision Support
22.2	Review Fill Status Notifications	§ 170.315(b)(3) Electronic Prescribing
Scenario 4		
Task 23: Reconcile a clinical care document and review and complete any CDS recommendations.		
Task #	**Task Goal**	**Certification Criteria**
23.1	Reconcile and Incorporate Clinical Information	§ 170.315(b)(2) Clinical Information Reconciliation and Incorporation
23.2	Review and Complete CDS Intervention: From Care Document	§ 170.315(a)(9) Clinical Decision Support
Scenario 5		
Task 24: Configure a CDS recommendation.		
Task #	**Task Goal**	**Certification Criteria**
24.1	Enable CDS Rule	§ 170.315(a)(9) Clinical Decision Support
24.2	Configure User CDS Intervention	
Task 25: Review CDS recommendation attributes.		
Task #	**Task Goal**	**Certification Criteria**
25.1	Review Source Attributes for CDS Alerts	§ 170.315(a)(9) Clinical Decision Support
Task 26: Configure drug-drug and drug-allergy interactions.		
Task #	**Task Goal**	**Certification Criteria**
26.1	Change Drug-Drug Interaction Severity Levels	§ 170.315(a)(4) Drug-Drug, Drug-Allergy Interaction Checks

3.4 PROCEDURES

The test administrator went to the participants' medical offices and introduced herself to the office. Each participant was greeted and their identity was verified and matched with the corresponding name on the participant schedule. Participants were then assigned a participant ID. When each participant was brought into the testing area where he/she reviewed the information statement and signed an informed consent form (See Appendix 3). The test administrator witnessed the participant's signature.

The usability test was administered by one individual. This administrator had one year of software usability experience, one year of research experience in microscopy imaging analysis software and graduated from Michigan State University with a bachelor's degree.

The test administrator moderated the session including the administration of instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A screen recording program ran on the computer to record the participant's mouse-clicks.

Before starting the test, each participant were introduced to the testing and trained on how to use the new features of the EHRUT.

Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the task was read aloud by the administrator and the participant was given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated he/she had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the post-test questionnaire (see Appendix 5) and a System Usability Scalequestionnaire (see Appendix 6), compensated them for their time, and thanked each individual for their participation.

Videos created from the screen recording software were analyzed afterwards for task success rate, time on task, errors, deviations, and number of clicks. Participant demographic information, task success rate, time on task, errors, deviations, verbal responses, number of clicks and post-test questionnaire wereentered into a spreadsheet for analysis.

3.5 TEST LOCATION

Testing sessions were conducted at various locations based on the participant. Each of the participant's locationprovided an isolated testing area, such as an exam room, work room, or a break area, with a desk or table and two chairs for the participant and the test administrator. To ensure the environment was comfortable for the users, noise levels were kept to a minimum with the temperature kept at a comfortable level.

3.6 TEST ENVIRONMENT

The ehrTHOMAS software is typically used in the healthcare clinic. Testing was conducted at the participant's office where area for testing was provided.

All participants used aHP Pavilion laptop with anIntel Core i7-8550U (1.80GHz) and12GBof RAM running Windows 10 Professional,64-bit for testing. Every participant used the laptop's onboard keyboard and a Dell MS111-L optical USB wired mouse when interacting with the EHRUT. The application was displayed on a 15.6 inch screenusing a screen resolution of 1920 by 1080 with the system's default color setting.

The software was installed on the testing computer by Genius Solutions according to the vendor's documentation describing system set-up and preparation. The data content for the EHRUT was specifically designed for this test. The system performance was representative of what actual users would experience in field implementation. Additionally, participants were instructed not to change any of the default system settings (e.g., font size).

3.7 TEST FORMS AND TOOLS

During the usability test, various documents were used including:

1. Participant Background Questionnaire
2. Research Participant Information Statement
3. Informed Consent Form
4. Moderator's Guide
5. Post-test Questionnaire
6. System Usability Scale Questionnaire

Example of these documents can be found in Appendices 2-6 respectively. The Moderator's Guide was devised to be able to capture required data.

The participant's interaction with the EHRUT and verbal comments were captured and recorded digitally with OBS Studio Version 20.1.3 running on the test computer. The recordings were saved for further analysis.

3.8 PARTICIPANT INSTRUCTIONS

The test administrator read the following introductory statement and instructions aloud to each participant before conducting the test (also see the full moderator's guide in Appendix 4):

Thank you for participating in Genius Solutions' usability study of ehrTHOMAS. The testing session today should last around 1 hour. You will be performing a series tasks using ehrTHOMAS to help us evaluate the effectiveness and efficiency of the program. You are to complete each task as quickly as possible without making any errors or deviating from the task. Our goal is to assess the difficulty utilizing the program and evaluate areas that require improvement.

The data contained on this EHR environment is used for testing purposes only. Additionally, you may find that some of the data does not make sense while performing the tasks. This data is used as placeholders for testing purposes.

I would like to remind you that you are able to withdraw at any time, and for any reason, from the testing.

At the end of the session, we will have an open discussion about the tasks and your opinions of the program. You will also be given two post-test questionnaires to fill out. I do not have any involvement in the development of the program, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

When you leave this room, please do not discuss the tasks you have performed during this session.

Do you have any questions regarding the study?

You will be performing 26 task. A task sheet will be provided to you containing information regarding each task. I will read the description of the task and say, "Begin."

At that point, perform the task as accurately and quickly as possible. Try your best to complete the task even though you may not know how to do it. I will be here provide specific help, such as explanation of the task, however, I am not able to help or instruct you on how to use the software. Keep in mind that we

are testing the software, not you or your abilities. Any difficulty you face while performing a task means something needs to be improved in the software.

Once you think you have completed the task, say "I'm done." You may also say, "I'm done" if you made a full-hearted attempt and believe you cannot complete the task with the information you have been given.

At the end of each task I will ask you to rate the difficulty of the task and allow you to provide any comments or concerns.

Do you have any questions or concerns regarding the test procedures?

Participants were given the opportunity to ask any questions or raise any concerns about the test being conducted. Once all issues were addressed the participants were trained on the new features of ehrTHOMAS.Participants were then given 26 tasks to complete. A Task Sheet was provided for every task for reference. Tasks are listed in the moderator's guide in Appendix 4.

3.8 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:

- Effectiveness of ehrTHOMAS 3.0 by measuring participant success rates and errors.
- Efficiency of ehrTHOMAS 3.0 by measuring the average task time and path deviations.
- Satisfaction with ehrTHOMAS 3.0 by measuring ease of use ratings.

3.9 DATA SCORING

The following table(Table 4)details how tasks were scored, errors evaluated and the time data analyzed.

Table 4: Data Scoring	
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.

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 were provided as a percentage.

Task times were recorded for the completion of a task. Observed task times divided by the optimal time for each task is measured of optimal efficiency.

Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the moderator's guide must be operationally defined by taking multiple measures of optimal performance and multiplying by a factor of 2 that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance was 17 seconds then allotted task time performance was 34 seconds. This ratio should be aggregated across tasks and reported with mean and variance scores. |
| **Effectiveness:** Task Failures | If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, the task was counted as a "Failures". No task times were taken for errors.

The total number of errors was calculated for each task 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 error and error types should be collected. |
| **Efficiency:** Task Deviations | The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviations. Optimal paths (i.e., procedural steps) was recorded when constructing paths. |

Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average time analysis. Average time per task was calculated for each task. Variance measures (standard deviations) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 5 (very easy) to 1 (very difficult). This data are averaged across participants and a standard deviation was calculated.
	Common convention is that average ratings for systems judged easy should be 3.3 or below.
	To measure participants' confidence in and likeability of the ehrTHOMAS overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 6.

4. RESULTS AND FINDINGS

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses.

The research participants has different levels of experience in different areas of the software depending on their role in the office. For instance, those who were medical or clinical assistants may only have experience in updating and entering patient allergies and medication or ordering laboratory tests and radiological tests, while physicians have more experience in charting diagnoses. Due to these ranges of system experience, it was apparent in the data that participants in certain roles would outperform participants in other roles in specific tasks.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 69%.Broadly interpreted, scores under 60% represent a system with poor usability; scores over 80% would be considered above average.

The results of the testing is organized and analyzed by each certification criteria.

§ 170.315(A)(1) COMPUTERIZED PROVIDER ORDER ENTRY (CPOE)– MEDICATIONS

This certification criteria requires that the EHRUT enables a user to record, change, and access medication orders. Task 10.1 tests the user's ability to order a medication and Task 11.1 tests the user's ability to access and change the medication order.

DATA RESULTS

For Task 10.1 and Task 11.1, eleven participants attempted the tasks. One participant refused to complete the task as he believed the testing tasks were not applicable to him. His data was excluded from the analysis.

Table 5: Task Results for Computer Provider Order Entry - Medication							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
10.1: Order a Medication	100	116.27[a] (42.49)	116.27[a]/ 111	111 (2)	11/10	0	4.18[a] (0.94)
11.1: Access and Change a Medication	90.91	121 (80.42)	121/84	9 (4)	9/7	9.09	4.27 (0.75)
[a] Thepresented data is the Time and the Rating for the whole task.							

Eleven participants were able complete Task 10.1: Order a Medication. Ten participants were able to complete Task 11.1: Access and Change a Medication. The participant who was unable to complete Task 11.1 was not included in the data set for observed time.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to order a medication was 11 with a standard deviation of 2 which was close to the optimal number. Ordering a medication presents no efficiency issues.

Users accessing and changing a medication took an average of 121 seconds to complete which is higher than the optimal time. However the average number of steps was 9 with a standard deviation of 4 compared to the optimal 7 steps. Participants that took the most time and took the most steps were not as experienced with EHRUT's functionality.They were uncertain of the options presented to change the medication order. A lot of time was spent idling deciding what to do and exploring the different options to find the best one.

EFFECTIVENESS

The success rate for order a medication was 100%. Accessing and changing a medication had a 90.91% success rate. One user was unable to complete Task 11.1.

Some participants added the medication into the patient's medication list screen rather than creating a medication order. One user quickly corrected this by creating prescription from her patient's medication

list. While this was not the optimal step to create a medication order, the outcome was the same. Another user deleted the medication that was added from the list and then created the order.

The user that did not successfully complete the access and change a medication task did not cancel the order of the medication and created another medication order.

SATISFACTION

Ordering a medication and reviewing the interaction check had an average task rating of 4.18 with a standard deviation of 0.94, indicating that it was easy to perform. Accessing and changing a medication had an average task rating of 4.27 with a standard deviation of 0.75, indicating that it was easy to perform.

MAJOR FINDINGS

- All tasks related to the CPOE for medication had a high success rate and satisfaction rating. Participants with more familiarity with the functionality of the system were more efficient with the presented tasks.
- Most offices would directly electronically prescribe their medications rather than queuing orders.

AREAS FOR IMPROVEMENT

- Additional education on the functionality would increase the efficiency of the tasks.
- A participant suggested that embedding the ordering functionality into the EHR rather than bringing up another software or window to complete the CPOE tasks would make the program more efficient.
- More research should be done to increase the efficiency and effectiveness of the system.

§ 170.315(A)(2) COMPUTERIZED PROVIDER ORDER ENTRY (CPOE)– LABORATORY

This certification criteria requires that the EHRUT enables a user to record, change, and access laboratory orders. Task 17.1 tests the user's ability to access a laboratory order, task 18.1 tests the ability to order a laboratory and task 19.1 tests the change of a laboratory order.

DATA RESULTS

Twelve participants attempted Task 17.1 and Task 18.1. Eleven participants attempted Task 19.1. One participant did not want to perform the task. His data was excluded from the analysis.

Table 6: Task Results for Computer Provider Order Entry - Laboratory							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
17.1: Access Laboratory Orders	100	82.17[a] (23.73)	82.17[a]/ 56	2 (1)	2/2	0	4.50[a] (0.65)

18.1: Record Laboratory Order	100	40.17 (12.99)	40.17/34	5 (1)	5/4	0	4.75 (0.43)
19.1: Change a Laboratory Order	81.82	54.90 (40.58)	54.9/22	4 (1)	4/3	18.18	4.60 (0.49)
[a] The presented data is the Time and the Rating for the whole task.							

All twelve participants were able to access a laboratory order and record an order. Nine participants were able to change a laboratory order. Two participants did not successfully complete Task 19.1 and their data was excluded from the data set for observed time.

DISCUSSION OF FINDINGS

EFFICIENCY

Average number of observed steps to access a laboratory order was 2, with a standard deviation of 1. Some users were able to complete the task in less than the optimal steps. They were able to access the laboratory order directly from the patient's chart without having to go through the patient's laboratory order list. Accessing a lab order presents no efficiency issues.

To record a laboratory order took an average of 40.17 seconds and 5 steps, with a standard deviation of 1, to complete. Many users spent time scrolling through the lab tests to locate the correct one.

On average users took about 54.9 seconds and 4 steps, with a standard deviation of 1, to change a laboratory order. Many users spent a lot of time looking at the organization of the fields to locate the area they needed to change.

EFFECTIVENESS

Task 17.1 and Task 18.1 had a success rate of 100%. Accessing and ordering a laboratory test presents no effectiveness issues.

Changing a laboratory order had a success rate of 81.82%. One user was unable to locate the area to update the order status. Another user deleted the attached test on the order rather than updating the order status. Additional steps were taken within the order the user would try to cancel the order by clicking the 'Cancel' button at the bottom of the order edit. This would just close out of the order edit screen.

SATISFACTION

The task to access a laboratory order, enter lab results and review and complete CDS intervention had an average rating of 4.50 with a standard deviation of 0.65, indicating that it was very easy to perform. Recording a laboratory order had an average task rating of 4.75 with a standard deviation of 0.43, indicating it was very easy to perform. Changing a laboratory order had an average task rating of 4.60 with a standard deviation of 0.49, indicating that it was very easy to use.

MAJOR FINDINGS

- Many users found it easy to create a lab order inside of ehrTHOMAS. However, they do not use the functionality. They expressed that many lab companies have their own forms that they use.

Most users will notate in the patient note that a lab was ordered and then fill out the appropriate lab form.
- A participant noted that the organization of the category tabs for the laboratory orders in the testing database is not the same as her database. She would have found the lab test faster if the organization was the same.
- It seemed like the organization of the fields inside of the lab order edit screen was somewhat difficult to navigate.
- Users assume that an icon that looks like a trash bin or an 'X' is used to cancel orders.

AREAS FOR IMPROVEMENT
- An interface between the EHRUT and a lab company to directly send a lab would prevent unnecessary work for clinician and their staff.
- One user suggested that a printable lab requisition form should automatically appear on the screen.
- One user suggested that every laboratory order should have an edit and a cancel order button.
- Additional research on organization of the laboratory order edit screen and the use of images for buttons should be done.

§ 170.315(A)(3) COMPUTERIZED PROVIDER ORDER ENTRY (CPOE)– DIAGNOSTIC IMAGING

This certification criteria requires that the EHRUT enables the user to electronically record, change and access diagnostic imaging orders. Task 8.1 tests the user's ability to access an order, task 8.2 tests the ordering of a diagnostic test and task 9.1 tests changing the diagnostic order.

DATA RESULTS
Twelve participants attempted Task 8.1. Eleven participants attempted Task 8.2 and 9.1. One participant was unable to complete Task 8.1 which prevented him to reach Task 8.2 and provided insufficient data in the system to complete Task 9.1. The user's data was excluded from the analysis for Task 8.2 and 9.1.

Table 7: Task Results for Computer Provider Order Entry – Diagnostic Imaging							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
8.1: Access Diagnostic Order List	91.67	107.82 (28.76)	107.82/94	2 (2)	2/1	8.33	4.50 (0.87)
8.2: Create Diagnostic Imaging Order	100			7 (1)	7/6	0	
9.1: Change the Diagnostic Order	100	36.91 (17.18)	36.91/26	5 (1)	5/4	0	4.64 (0.64)

Eleven participants completed all of the tasks that tested the functionality of CPOE – Diagnostic Imaging. One participant was unable to successfully complete Task 8.1. His data was excluded from the data set for observed time for Task 8 and observed steps in Task 8.2.

DISCUSSION OF FINDINGS

EFFICIENCY

Accessing a diagnostic order list and creating an order took the user an average of 107.82 seconds to complete. The average number of observed steps to access the patient's diagnostic order list was 2, with a standard deviation of 2. There are no efficiency issues with accessing a diagnostic order.

Creating a diagnostic order took an average of 7 steps, with a standard deviation of 1, to complete. Most users would scroll through the list of procedure codes to locate the right one rather than using the searching functionality. One participant wanted to search through the categories of codes, but ultimately could not find the code she was looking for since it wasn't organized the same way as her system.

It took an average of 36.91 seconds and 5 steps, with a standard deviation of 1, to change a diagnostic order. No efficiency issues were present to change a diagnostic order.

EFFECTIVENESS

Task 8.1 success rate of 91.67%. One participant did not successfully complete the task. He attempted to write his order on an exam template rather than using the designated area for diagnostic orders. He stated in the open discussion of the tasks that he normally writes his orders in the exams and fills out a specific imaging order form for his patient.

Creating and changing a diagnostic order both had a success rate of 100%. These tasks presented no effectiveness issues.

SATISFACTION

Accessing the diagnostic order list and creating a diagnostic imaging order had an average task rating of 4.50 with a standard deviation of 0.87, indicating that the task was easy to perform. The task to change diagnostic order had an average rating of 4.64 with a standard deviation of 0.64, indicating that it was easy to perform.

MAJOR FINDINGS

- Most users chose to locate the diagnostic test by clicking and scrolling rather than searching by typing.
- Some users expressed that diagnostic imaging facilities have their own forms that they use so sometimes using this functionality in the system is creating more work for them.

AREAS FOR IMPROVEMENT

- The able to create categories and orders specific to the diagnostic imaging ordering screen.
- A participant suggested order templates where it would default the facility and the order to the most common ones that they use.

- Creating an interface with imaging facilities to send orders would prevent extra work for the users.

§ 170.315(A)(4) DRUG-DRUG, DRUG-ALLERGY INTERACTION CHECKS

The certification criteria requires that before a medication order is completed and acted upon during computerized provider order entry, interventions must automatically indicate to a user drug-drug and drug-allergy contraindications based on a patient's medication list and medication allergy list. It also requires the EHRUT to enable the severity levels of interventions provided for the drug-drug interactions checks to be adjusted. Task 10 tests the system's ability to prompt a Drug-Drug Interaction Check when creating a medication order. Task 20 tests the Drug-Allergy Interaction Check during electronic prescribing medications. Task 26.1 tests the ability that the severity levels of the interactions can be adjusted.

DATA RESULTS

Eleven participants attempted to complete Task 10.2 and 20.2. One user opted out in attempting the tasks because he believed it was not applicable to him. Twelve participants attempted Task 26.1.

Table 8: Task Results for Drug-Drug, Drug-Allergy Interaction Checks							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
10.2: Review Attributes for the Drug-Drug Interaction	81.82	116.27 [a] (42.49)	116.27 [a]/ 111	1 (0)	1/1	18.18	4.18 [a] (0.94)
20.2: Review Attributes for the Drug-Allergy Intervention	81.82	92.45 [a] (17.04)	92.45 [a]/98	1 (0)	1/1	18.18	4.73 [a] (0.44)
26.1: Change Drug-Drug Interaction Severity Levels.	83.33	105.20 (12.50)	105.20/40	2 (1)	2/2	16.67	3.83 (0.80)
[a] The presented data is the Time and the Rating for the whole task.							

Nine participants were able to complete Task 10.2 and Task 20.2. Ten participants successfully completed Task 26.1. Two participants were unsuccessful in completing the task. Their observed time was not included in the data set for that task.

DISCUSSION OF FINDINGS

EFFICIENCY

Reviewing the attributes for both drug-drug and drug-allergy interactions had an average number of steps of 1. There were no efficiency issues for reviewing the attributes tasks.

Changing the severity levels of the drug-drug interactions had an average task time of 105.20 seconds and took an average of 2 steps, with a standard deviation of 1, to complete. Most participants spent a lot of time reading each question in the settings to determine which one needed to be changed.

EFFECTIVENESS

Task 10.2 and 20.2 both had a success rate of 81.82%. The task ask the participant to read the intervention attributes out loud. Two participants did not read the attribute out loud, but they did see the intervention appear on their screen. There are no efficiency issues present with the interventions.

Changing the drug-drug interaction severity levels had a success rate of 83.33%. Most participants took their time to locate the correct one. Two participants gave up looking for the specific setting to change.

SATISFACTION

Creating a medication order and reviewing the attributes to a drug-drug interaction check had an average task rating of 4.18, with a standard deviation of 0.94, indicating that the task was easy to perform. The task to electronically prescribe a medication and reviewing the attributes to a drug-allergy interaction check had an average task rating of 4.73, with a standard deviation of 0.44, indicating that the task was very easy. The average task rating to change the drug-drug interaction severity level was 3.83, with a standard deviation of 0.80, indicating that it was easy to perform.

MAJOR FINDINGS

- Searching for the appropriate setting to change the severity levels of the interaction check was overwhelming for a lot of users. They thought the settings showed too much information.
- No issue with the interactions.

AREAS FOR IMPROVEMENT

- Organization of the different settings would increase efficiency. Additionally, having a search function within the settings would be helpful to narrow down what the user is looking for.

§ 170.315(A)(5) DEMOGRAPHICS

This certification criteria requires that the EHRUT enables the user to record, change, and access patient demographic data including races, ethnicity, preferred language, sex, sexual orientation, gender identity, and date of birth. Task 1 tests the user's ability to access and change the patient's demographic information and task 13 tests the ability to record new demographic information.

DATA RESULTS

Eleven participants attempted Task 1.1, 1.2 and 13.1. One participant opted to not attempt the task since it is performed by other staff members in his clinic.

Table 9: Task Results for Demographics							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	**Mean (SD)**	**Observed/ Optimal**	**Mean (SD)**	**Observed/ Optimal**	**Mean**	**Mean (SD)**
1.1 Access Demographic Data	90.91	144.70 (52.74)	144.70/90	3 (2)	3/1	9.09	4.36 (0.77)

1.2 Change Demographic Data	80			9 (1)	9/7	0	
13.1: Record Demographics	81.82	185.40 [a] (37.94)	185.40 [a]/ 114	10 (2)	10/9	18.18	4.09 [a] (0.67)
[a] The presented data is the Time and the Rating for the whole task.							

Ten participants were able to complete Task 1.1. One participant was unable to access the demographic data in Task 1.1 which prevented them from changing the data in Task 1.2. Their data was not included in the data set for observed time for Task 1 and success rate and observed steps in 1.2. In Task 13.1, nine participants were able to successfully complete Task 13.1. Two participants did not successfully record demographics. Their data was excluded from the observed task time.

DISCUSSION OF FINDINGS

EFFICIENCY

Accessing and changing the patient's demographics had an average task time of 144.70 seconds to complete. Accessing the demographics took an average of 3 steps, with a standard deviation of 2, to complete. Some of the users were not familiar with accessing the patient's demographics and spent time in other areas of the program to search for the appropriate area.

The average number of steps to change the demographic information took was 9, with a standard deviation of 1.To record demographics it took users an average of 10 steps, with a standard deviation of 2, to complete the task. Many users spent a lot of time looking at the screen looking for the input fields. The information that needed to be changed were not in the same area of the screen. Some users did not know that there were additional fields that could be shown by expanding the headers. The dropdowns that contain information were long and required the user to scroll through the options. Many users instead of typing in a birthday into the input field, they clicked the 'Calendar' button. This caused the user to click through different months and years to enter in the birthday. This added a significant amount of time spent on the task. When users attempted to change the selection for Race from 'Unknown' to another race, they would attempt to click directly on the other race, without unchecking the 'Unknown' option. The program does not uncheck the 'Unknown' option and select the other race which causes the user an extra click.

EFFECTIVENESS

Task 1.1 had a success rate of 90.91%. The participant that failed the task was unable to locate the appropriate area to input data and abandoned the task.Many users went to different areas of the program to locate the fields for demographics.

Task 1.2 had a success rate of 80% and Task 13.1 had a success rate of 81.82%. Users that did not successfully complete the task were unable to find one or two fields in the demographic screen. The titles of the fields were not specific enough for users to understand where to put the data.

SATISFACTION

The average task rating for accessing and changing demographic data was 4.36, with a standard deviation of 0.77, indicating that the task was easy to perform. The record demographics and review and

complete CDS intervention task had an average rating of 4.09, with a standard deviation of 0.67, indicating that the task was easy to perform.

MAJOR FINDINGS

- Many physicians do not fill out demographic information for the patient. Usually a receptionist or a medical assistant is responsible for completing this task.
- Many users went into the patient's medical history to locate the demographic information.
- Most users wanted to use the mouse to input data into the demographic area.
- Many participants stated that being more familiar with the screen and fields would increase their efficiency in entering data.

AREAS FOR IMPROVEMENT

- Additional training in the area would improve both the efficiency and the effectiveness of recording and changing demographics.
- More research should be done regarding the organization of the demographic fields.
- A participant suggested to have the important fields to be highlighted to make inputting demographics a lot easier.
- A participant suggested to have the ability to use keyboard shortcuts to help enter data. For example, allow the ability to tab through fields or when in a drop down, typing the first character of the word you are looking for would bring you to an option that starts with that character.
- Alphabetizing the dropdowns options for language would improve efficiency.
- A participant suggested adding a demographic wizards which would help a user to fill out the appropriate information.
- Improving the functionality of the 'Calendar' button. Instead of the user selecting the month, day and year by going back in time on a calendar, include a dropdown or number selecting option.

§ 170.315(A)(6) PROBLEM LIST

The certification criteria requires the EHRUT enables the user to record, change, and access a patient's active problem list. Task 15 tests the user's ability to access and change the patient's problem list. Task 16.1 tests the user's ability to record diagnoses to the patient's problem list.

DATA RESULTS

Twelve participants attempted to perform all of the tasks to test the functionality of the patient's problem list.

Table 10: Task Results for Problem List					
Task	**Task Success Rate (%)**	**Time (s)**	**# of Steps**	**Errors (%)**	**Task Rating 5 = Easy**

	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
15.1: Access Problem List	75	55.09 (24.90)	55.09/16	3 (2)	3/1	25	4.18 (1.11)
15.2: Resolve Condition from Problem List	83.33			2 (2)	2/1	16.67	
16.1: Add New Condition to Problem List	100	61.33 [a] (31.69)	61.33 [a]/64	8 (2)	8/6	0	4.33 [a] (0.85)
[a] The presented data is the Time and the Rating for the whole task.							

Nine participants were able to complete Task 15.1. Ten participants were able to successfully complete Task 15.2.One participant could not successfully access the problem list in Task 15.1, which was required to start Task 15.2. The data for this participant was not included in the data set for observed task time for Task 15 and for the success rate and observed steps taken. For Task 16.1, all twelve participants successfully completed the task.

DISCUSSION OF FINDINGS

EFFICIENCY

It took users an average of 55.09 seconds to access and resolve a condition from the problem list. Most of the time spent on the task was users trying to locate the problem list. Users took an average of 3 steps, with a standard deviation of 2, to access the problem list. Some participants did not access the list in the most optimal way. One participantnavigated to the summary screen to access the problem list.

The task to resolve a condition took an average of 2 steps, with a standard deviation of 1, to complete. Participants that did not know how to resolve a condition spent additional time and steps in the locating the right button to resolve the condition.

Adding a new condition to the patient's problem list had an average number of steps of 8, with a standard deviation of 2. Some users added each condition to the list separately rather than all together. This added an additional 2 steps to completing the task. One participant did not search for the diagnosis through the search bar, but scrolled through the list of diagnoses. Another participant attempted to use the diagnosis categories to find the condition she was looking for. For multiple participants they would enter their search criteria in the search bar and then instead of hitting enter or allowing the system to automatically filter the diagnosis, they would hit the 'Find' button, which causes the search criteria to disappear in the search. The user spent more time and clicks to search for the diagnosis again.

EFFECTIVENESS

Task 15.1 had a success rate of 75%. Participants that were unable to successfully complete this task struggled to locate the patient's problem list and proceeded on to the next task.During the open discussion of task many admitted that they do not do this on a regular basis and have had limited training on the area.

Task 15.2 had a success rate of 83.33%. This task had a higher rating than the access problem list since there are ways for a user to resolve a condition without having to access the problem list. One of the

participants that did not successfully complete this task opened up the additional diagnosis options and clicked an 'X' that inactivated the diagnosis.

Adding a new condition to the problem list had a success rate of 100%. This task did not present any effectiveness issues.

SATISFACTION

The average task rating to access the problem list and resolve a condition was 4.18, with a standard deviation of 1.11, indicating that the task was easy to perform. The add new condition to the problem list task had an average rating of 4.33, with a standard deviation of 0.85, indicating that it was easy to perform.

MAJOR FINDINGS

- Users with roles that diagnose patients performed better than other roles.
- Participants stated that with more experience with that specific area of the problem they would be more efficient in completing the tasks.
- Some users did not interpret the green checkmark icon as a button to resolve a condition.

AREAS FOR IMPROVEMENT

- More research should be done on the choice of words or icons when labeling buttons.
- Improve the search functionality when adding a new condition to the patient's problem list.

§ 170.315(A)(7) MEDICATION LIST

This certification criteria requires the EHRUT enables the user to record, change, and access a patient's active medication list. Task 4 and its subtasks focuses on testing this criteria.

DATA RESULTS

Eleven participants attempted all the tasks that pertained to the mediation list. One participant chose not to attempt the tasks because he believed that recording the list of medications, their dosage, and frequency that the patient provides could be completely different than what their other providers directed them to take.

Table 11: Task Results for Medication List							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors**	**Task Rating 5 = Easy**
	Mean	**Mean (SD)**	**Observed/ Optimal**	**Mean (SD)**	**Observed/ Optimal**	**Mean**	**Mean (SD)**
4.1: Access Medication List	100	107.50 (40.85)	107.50/78	2 (0)	2/2	0	4.82 (0.39)
4.2: Record New Medication	100			4 (1)	4/3	0	
4.3: Modify Medication List	100			3 (1)	3/3	0	

All eleven participants were able to successfully complete Task 4.1, 4.2, and 4.3.

DISCUSSION OF FINDINGS

EFFICIENCY

On average it took users 107.50 seconds to access, record, and modify the patient's medication list. It took an average of 2 steps to access the medication list. Users took an average of 4 steps, with a standard deviation of 1, to record a new medication.Some users had issues searching for their medication due to a spelling mistakes. Extra step were taken to correct this mistake. One participant wanted to include more information than what was presented on the task sheet.

Modifying a medication on the list took, on average, 3 steps, with a standard deviation of 1. One participant wanted to deleted a medication on the list and re-added the medication again rather than modifying the existing medication.

EFFECTIVENESS

All tasks on had a success rate of 100%. These tasks did not present any effectiveness issues.

SATISFACTION

Accessing the medication list, recording a medication, and modifying the medication list had a task average of 4.82 with a standard deviation of 0.39, indicating that they were very easy to perform.

MAJOR FINDINGS

- All participants were familiar and experience in adding medications to the list.

AREAS FOR IMPROVEMENT

- DrFirst integration directly with the EHR would improve the effectiveness with the EHR.

§ 170.315(A)(8) MEDICATION ALLERGY LIST

This certification criteria requires the EHRUT enables the user to record, change, and access a patient's active medication allergy list as well as medication history. Task 2 focuses on testing this criteria.

DATA RESULTS

Twelve participants attempted all of the tasks that tests the medication allergy list.

Table 12:							
Task Results for Medication Allergy List							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
2.1: Access Medication Allergy List	100	138.10 (59.92)	138.10/78	3 (1)	3/2	0	4.25 (1.01)
2.2: Record New Medication Allergy	91.67			5 (2)	5/3	8.33	

2.3: Modify Medication Allergy List	91.67			4 (1)	4/3	8.33	

Twelve participants successfully completed Task 2.1. Eleven participants were able to complete Task 2.2 and 2.3. One participant was unable to complete both Task 2.2 and 2.3. Their data was excluded from the data set for observed time.

DISCUSSION OF FINDINGS

EFFICIENCY

The average time taken to complete all the tasks was 138.10 seconds. Accessing medication allergy list took users on average 3 steps, with a standard deviation of 1, to complete. A couple of the participants chose to access the medication allergy list by going through the Medications module rather than Allergy module. This added an extra step for these user to access the appropriate area.

The average number of steps to record a new allergy was 5, with a standard deviation of 2. The most common method was typing the allergy into the search bar. The more optimal route was to search for the allergy in the common allergy list which would have save the user an extra step.

To modify the patient's allergy list took an average of 4 steps, with a standard deviation of 1, to complete. A few participants deleted the patient's allergy rather than modifying the reaction. By deleting the allergy, this caused the participants to re-add the allergy which took time and 3 additional steps.

EFFECTIVENESS

The success rate for Task 2.1 was 100%. While many deviated from the optimal path, the participants were still able to reach the intended target.

Task 2.2 and 2.3 had a success rate of 91.67%. The participant who did not complete the task successfully, spent a lot of time searching for the allergy. The user would type into the allergy search bar, but would click on 'Add Common Allergy' rather than clicking on 'Find'. Searching for the allergy was attempted 6 times before he ultimately gave up on the task. At the open discussion, the user admitted that he was not very familiar utilizing the area.

SATISFACTION

The average rating for all of the medication allergy task was 4.25, with a standard deviation of 1.01, indicating that the tasks were easy to perform.

MAJOR FINDINGS

- Efficiency was dependent on experience on the use of the screen. Many of the participants that used the medication allergy list on a regular basis had a faster time completing tasks compared to those that don't.
- Some participants expressed that medication allergy reactions were not important and to enter that information to the EHR is extra work for the user.

AREAS FOR IMPROVEMENT

- Education on the areas would increase the efficiency of the feature.
- Participants suggested that the allergy list should be embedded into the EHR rather than having it take you to another program or window.

§ 170.315(A)(9) CLINICAL DECISION SUPPORT

This certification criteria requires the EHRUT to provide interactions when the user is interacting with the technology and enable the user to configure the interventions. Additionally, the user must be able to review the source attributes of the intervention. Task 3.1, 13.2, 14.1, 16.2, 16.3, 17.2, Task 22.1 tests the system ability to provide interactions based on the user's interactions with the medication allergy list, vital signs, the problem list, a combination of demographics and problem list, laboratory orders, and the medication list, respectively. Task 24 tests the user's ability to enable and configure interventions. Lastly, Task 25 tests the user's ability to review the source attributes of an intervention.

DATA RESULTS

Eleven participants attempted Task 3.1. One participant was unable to fully complete Task 2 which provided insufficient data for Task 3.1. Eleven participants attempted Task 13.2. One participant does not enter demographics in the EHR and chose not to attempt the task. Twelve participants attempted Task 14.1, 16.1, 16.2, and 17.2. Eleven participants attempted Task 22.1. One participant was unable to fully complete Task 21 which provided insufficient data for Task 22.1. Eleven participants attempted Task 24.1 and 24.2. Twelve participants attempted Task 25.1.

Table 13: Task Results for Clinical Decision Support						
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
3.1: Review and Complete CDS Intervention: Medication Allergy List	100	37.91 (16.98)	37.91/34	4 (1)	4/4	0	5 (0)
13.2: Review and Complete CDS Intervention: Demographics	100	185.40 [a] (37.94)	185.40 [a]/ 114	2 (0)	2/2	0	4.09 [a] (0.67)
14.1: Record Vitals and Review and Complete CDS Intervention: Vital Signs	100	35.17 (10.98)	35.17/32	6 (0)	6/6	0	4.75 (0.60)
16.2: Review and Complete CDS Intervention: Problem List	100	61.33 [a] (31.69)	61.33 [a]/64	2 (0)	2/2	0	4.33 [a] (0.85)
16.3: Review and Complete CDS Intervention: Demographics and Problem List	100			2 (0)	2/2	0	
17.2: Review and Complete CDS Intervention: Lab Results	100	82.17 [a] (23.73)	82.17 [a]/56	9 (1)	9/9	0	4.50 [a] (0.65)
22.1: Review and Complete CDS Intervention: Medication List	100	21.27 (11.83)	21.27/20	4 (0)	4/4	0	5 (0)
24.1: Enable CDS Rule	81.82	84.18 (33.01)	84.18/32	6 (2)	6/4	18.18	4.09 (0.79)
24.2: Configure CDS Intervention by User	100			6 (1)	6/6	0	

25.1: Review Source Attributes for CDS Alerts	75	51 (24.36)	51/24	5 (2)	5/3	25	3.90 (0.94)

^a The presented data is the Time and the Rating for the whole task.

Eleven participants successfully completed Task 3.1 and 13.2. Twelve participants successfully completed Task 14.1, 16.1, 16.2, and 17.2. Eleven participants was able to complete Task 22.1 successfully. Nine participants completed Task 24.1 successfully. Eleven participants were able to complete Task 24.2. Nine participants successfully completed Task 25.1.

DISCUSSION OF FINDINGS

EFFICIENCY

All tasks to Review and Complete CDS Interventions had observed number of steps that match the optimal number of steps. No efficiency issues were present in these tasks.

Enabling CDS and configuring CDS intervention tasks took users about 84.18 seconds to complete. On average it took users 6 steps, with a standard deviation of 2, to enable a CDS rule. Configuring the CDS Intervention by User took users an average of 6 steps, with a standard deviation of 1, to complete. Many participants spent the most time looking for the 'Enable' check box. A few participants closed and opened the intervention setting to see if the enable feature was on the list of all the interventions. This added extra steps and time to the participant's data.

It took users on average 51 seconds and 5 steps, with a standard deviation of 2 to review the source attributes for CDS alerts. Users spent time searching for the information within the CDS rule details and going to the CDS intervention list to locate the appropriate information for the alert.

EFFECTIVENESS

All tasks to Review and Complete CDS Interventions had a success rate of 100%. There are no effectiveness issues with this tasks.

Enabling a CDS Rule had a success rate of 81.82%. Participants that did not successfully complete this task was unable to locate and click the 'Enable' checkbox. Three participants had clicked on 'Add Group' to see if that would give them the ability to enable to the intervention.During the open discussion, many participants agreed that the checkbox was very difficult to locate.

Configuring the CDS Intervention by user had a task success rate of 100%. No effectiveness issues were present in this task.

Task 25.1 had a success rate of 75%. Most participants that was unable to successfully complete the task was not able to locate the attributes in the CDS Rule Edit screen. A couple of participants stated that icon to access the attributes in the EHR was not a good image to indicate that more information could be shown.

SATISFACTION

The tasks to review and complete CDS interventions all had a task rating between 5 and 4.09, indicating that the tasks were easy. Enabling the CDS rule and configuring the intervention by user had a task

rating of 4.09, with a standard deviation of 0.79, indicating that it was easy to perform. Reviewing the source attributes had a task rating of 3.90, with a standard deviation of 0.94, indicating that was easy to perform.

MAJOR FINDINGS

- Many participants admitted during the open discussion that it is very rare that they would access the CDS Alert Edits. All CDS interventions are completed during the implementation of the EHRUT and are rarely updated after the system is up and running. This could cause the tasks to be less effective and efficient
- Participants found that some of the information that is provided on the clinical decision support edit screen was unnecessary.

AREAS FOR IMPROVEMENT

- Educational resources on how to interact with the Clinical Decision Support configurations would help users that were struggling with this area.
- More research should be done on the image icons used to show more information. Participants suggested having an 'i' icon to show more information would be better. Another participant suggested to have an addition button at the bottom of the edit screen that would show the attributes for the intervention

§ 170.315(A)(14) IMPLANTABLE DEVICE LIST

The certification criteria requires the EHRUT is able to record Unique Device Identifiers (UDI) associated with the patient's Implantable Devices. It also requires that the system display the patient's implantable device list, allows the user to access each device, and change the status for a device. Task 6 and 7 tests the system's ability to access, record and change the patient's device list.

DATA RESULTS

Twelve participants attempted to complete all tasks that correspond with the certification criteria.

Table 14: Task Results for Implantable Device List						
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
6.1: Access Device List	100	162.91 (71.68)	162.91/92	1 (0)	1/1	0	3.83 (0.90)
6.2: Change Status of UDI Recorded	66.67			5 (1)	5/4	33.33	
6.3: Record New UDI	66.67			7 (2)	7/4	33.33	
7.1: View All Active and Inactive Devices	91.67	26.18 (22.21)	26.18/10	2 (2)	2/1	8.33	4.50 (0.96)

Twelve participants successfully accessed the patient's device list in Task 6.1. Eight participants successfully completed Task 6.2 and 6.3. Eleven participants were able to successfully complete Task 7.1.

DISCUSSION OF FINDINGS

EFFICIENCY

The average time to complete accessing the patient's device list, change a status of the UDI recorded and record a new UDI, was 162.91. All participants were able to access the device list in the optimal amount of steps.

It took an average of 5 steps, with a standard deviation of 1, to change the status of the UDI recorded. Users spent a lot of time reviewing the contents of the UDI details and was unable to locate the 'No longer used' check box quickly. Some participants closed out of the device details to see if there was a inactivate button on the listing which caused them to take extra steps to complete the task.

Users took an average of 7 steps, with a standard deviation of 2, to record a new UDI. Many users clicked on the 'Add' button which would cause a blank device edit screen to appear. Upon seeing this screen some users closed out and picked another option causing additional observed steps.

To view the list of all active and inactive devices, users spent an average of 26.18 seconds and 2 steps, with a standard deviation of 1, to complete. This task did not present any efficiency issues.

EFFECTIVENESS

Accessing a device list had a 100% success rate. No effectiveness issues were present in this task.

Task 6.2 had a success rate of 66.67%. Participants that were not able to successfully complete this task, deleted the device from the list instead of marking the device 'No longer used.'

The success rate of task 6.3 was 66.67%. The 'Add' button was the most common first selection to record a new UDI. One participant assumed that one of the fields in the device details was where a UDI number could be added. Three participants clicked the 'Add DI #' assuming that the UDI number and the DI number was the same.

Task 7.1 had a success rate of 91.67%. One user could not find the 'Show all' checkbox because the font was very small and hard to read.

SATISFACTION

The task to access the device list, change the status of the UDI, and record a UDI had an average task rating of 3.83, with a standard deviation of 0.90, indicating that it was easy to perform. The task to view all active and inactive devices had an average task rating of 4.50, with a standard deviation of 4.50, indicating that the task was very easy to perform.

MAJOR FINDINGS

- As this is a new feature in ehrTHOMAS, the efficiency, effectiveness and success rate were expected to be low. Over time, these measures are expected to increase with additional education and use of the new functions.

- Deviations in the tasks were attempting to add a new device to the patient's device list.
- Upon adding a device by the UDI #, the system automatically saves the information onto the device list and greys out the 'Save' button. Some users instinctively tried to click the 'Save' button to save the device and close rather than just closing out of the device details.
- Participants thought the phrase 'No longer used' was not a very good choice as an indication to inactivate a device.
- Many participants would not use this feature in their office. They state that patients do not carry a UDI number or card with them.

AREAS FOR IMPROVEMENT

- Additional education is required for all users to increase the efficiency and effectiveness of these tasks.
- A participant suggested that a larger button compared to a checkbox would be more effective to indicate 'Show All' to a user.
- A participant suggested to increase the size of the window. He also said the text on the screen was small and larger fonts were needed to get people to find certain areas of the system.
- The system should have the ability to record DI and UDI from the 'Add' button. The screen already includes record DI so record UDI should also be added to stay consistent.

§ 170.315(B)(2) CLINICAL INFORMATION RECONCILIATION AND INCORPORATION

This certification criteria requires the EHRUT enables the user to reconcile the data from clinical care document from another setting of care. Task 23 tests this specific criteria.

DATA RESULTS

Twelve participants attempted to complete Task 23.1.

Table 15: Task Results for Clinical Information Reconciliation						
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
23.1: Reconcile and Incorporate Clinical Information	66.67	278.88 (118.53)	278.88/ 174	27 (4)	27/18	33.33	2.83 (1.07)

Eight participants were able to complete the task to reconcile and incorporate clinical information.

DISCUSSION OF FINDINGS

EFFICIENCY

To reconcile and incorporate clinical information, it took users an average of 278.88 seconds and 27 steps, with a standard deviation of 4, to complete. Many users had a hard time trying to see all of the

information that was located in the CCDA. Users would attempt to expand the information under the Allergies, Medication, and Problem headers but the system would not allow them to expand with a single click. Some participants used the 'View CCDA' button to see the patient's allergy, medication and conditions.

Participants had a lot of issues when trying to reconcile the allergies and medications through DrFirst. Majority of the time the DrFirst screen would appear in full screen and hide the EHR behind the window. Many users would forget what medications and allergies the patient had and would close DrFirst to see what was in CCDA and then go back into DrFirst. This added more time and steps to the participant's data. At times, participants would enter in the allergy information into the medication list and then correct their mistakes causing them to have extra time and steps in their data.

EFFECTIVENESS
The success rate for this task was 66.67%. Participants that did not complete the task had issues adding the correct allergy and medications to the appropriate list or was unable to reconcile the correct problem.

The medication list is the first list that appears when DrFirst is launched. A few participants were able to understand the medication list appeared and reconcile the patient's medication to the medication list. Other participants would add the allergy information from the CCDA to the medication list in DrFirst, assuming that the allergy list was the first list to appear. Most participants that made this error was able to correct it after they went back to the CCDA to review the medication list again.

Reconciling the problem list caused participants to accidentally add additional problems to the patient's condition list. A few participants were able to move one problem from the CCDA to the patient's reconcile list by clicking the arrow button next to the problem. A few users left the checkboxes next to all the problems checked off. When importing the reconcile list to the patient's chart, the system would also pull all checked off problems in to the chart, regardless of what the participant moved over from the CCDA file.

SATISFACTION
The average task rating for this task was 2.83, with a standard deviation of 1.07, indicating that it was neither easy nor difficult to perform.

MAJOR FINDINGS
- Considering that this is a new feature of the EHR, efficiency and effectiveness of the tasks pertaining to the certification criteria were expected to be low.
- Some participants found this feature to be very useful, but impractical. During the open discuss of the task, participants admitted that their office are not exchange patient health information electronically. They state that most providers are still faxing over the patient's health information to their office.

AREAS FOR IMPROVEMENT
- Training on the screens would increase the efficiency of the system.

- A participant suggested to have the ability to drag and drop what they want from the CCDA to their reconcile list.
- Many users found that it's hard to remember the patient's medication and allergies from the CCDA file. Training on how to see two windows side-by-side would prevent issues like this.
- Keeping the headers on both the CCDA file list and the patient's reconcile list expanded so the user does not have to open each header to view the information inside.
- Participants suggested the ability to record and reconcile medication and allergies directly from that screen without having to go out of the EHR.
- The workflow on how the problem list is reconciled should be review and modified to prevent additional problems from the CCDA to be added to the patient's chart.

§ 170.315(B)(3) ELECTRONIC PRESCRIBING

This certification criteria requires that the EHRUT is able to create new prescriptions, change prescriptions, cancel prescriptions, refill prescriptions, receive fill status notifications and request and receive medication history information. Task 5.1 tests the ability to obtain medication history. Task 12 tests the ability to refill a medication. Task 20 tests the ability to electronically prescribe a medication. Task 21 tests the ability to cancel and change a medication. Task 22.2 tests the user's ability to receive a fill status notification.

DATA RESULTS

Twelve participants attempted Task 5.1. Eleven participants attempted Task 12.1. One participant does not handle patient refills and chose not to attempt the task. Eleven participants attempted Task 20.1, 21.1 and 22.2. One participant does not prescribe prescriptions and opted out in attempting these tasks.

Table 16: Task Results for Electronic Prescribing							
Task	**Task Success Rate (%)**	**Time (s)**		**# of Steps**		**Errors (%)**	**Task Rating 5 = Easy**
	Mean	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean	Mean (SD)
5.1: Obtain Medication History	83.33	27.89 (22.37)	27.89/26	5 (2)	5/3	16.67	4.73 (0.62)
12.1: Refill a Medication	100	58.18 (50.23)	58.18/22	5 (5)	5/1	0	4.73 (0.45)
20.1: Electronically Prescribe a Medication	100	92.45 [a] (17.04)	92.45 [a]/98	15 (2)	15/14	0	4.73 [a] (0.44)
21.1: Cancel/Change a Medication	90.91	130 (56.31)	130/110	14 (3)	14/13	9.09	4.18 (1.03)
22.2: Check Prescription Fill Status	100	21.27 [a] (11.83)	21.27 [a]/20	2 (1)	2/1	0	5 [a] (0)
[a] The presented data is the Time and the Rating for the whole task.							

Ten participants were able to complete Task 5.1. The data for the participants that did not successfully complete the task was excluded from the data set for observed time. Eleven participants were able to complete Task 12.1. Eleven participants were able to complete Task 20.1. Ten participants successfully completed Task 21.1. Eleven participants completed Task 22.2 successfully.

Discussion of Findings

Efficiency

User spent on average 27.89 seconds and 5 steps, with a standard deviation of 2, to obtain medication history for the patient. Participants with a high observed step number admitted that they did not know where to the find the history information. Many of them clicked on the 'Show Medication History' under the medication list for the patient. They expressed that if they had more training on the feature they would be able to complete the task faster.

Refilling a medication took users an average of 58.18 seconds and 5 steps, with a standard deviation of 5, to complete. Users with a high observed time and steps prescribed the medication again rather than renewing the existing medication.

On average it took users 15 steps, with a standard deviation of 2, to electronically prescribe a medication. Path deviations occurred when the user was unable to find the correct medication while searching and adding in the wrong signature password to send the prescription to the pharmacy.

To cancel and change the medication, users spent an average of 130 seconds and 14 steps, with a standard deviation of 3, to complete. A lot of time was spent on how to cancel a medication that was sent the pharmacy. Participants stated they never used this feature of the system before.

The average number of steps to check the prescription fill status was 2, with a standard deviation of 1. A couple of participants clicked on the first 'Medline Plus' icon or a 'View Prescription Delivery History' before clicking the arrow icon to see the prescription status.

Effectiveness

Task 5.1 had a success rating of 83.33%. Participants who were unable to complete task successfully did not know where to retrieve the information and ultimately gave up searching for the area. Many of them clicked on the 'Show Medication History' under the medication list for the patient. During the open discussion of the tasks, participants admitted that they did not know that medication history function existed and would have been able to complete the task easily.

Task 12.1 and 20.1 had success rate of 100%. No effectiveness issues were present in this task.

Task 21.1 had a success rate of 90.91%. The participant that was unable to successfully complete the task was able to find the area where the medication could be stopped, but did not cancel the last prescription that was written for the medication.

Checking a prescription fill status had a success rate of 100%. There are no effectiveness issues with this task.

SATISFACTION

The average task rating to obtain the medication history was 4.73, with a standard deviation of 0.62, indicating that the task was very easy to complete. Refilling a medication had an average task rating of 4.73, with a standard deviation of 0.45, indicating the task was very easy to perform. The tasks to electronically prescribe a medication and reviewing the interactions had an average task rating of 4.73, with a standard deviation of 0.44, indicating the task was very easy to perform. Canceling and changing a medication had 4.18, with a standard deviation of 1.03, average task rating indicating that it was easy to perform. The task to review and complete CDS interactions and to check the prescription fill status had an average task rating of 5, indicating it was very easy to perform.

MAJOR FINDINGS

- All participants that attempted the task pertaining to electronic prescribing were familiar with the workflow and features that exist in the program.
- Many participants were under the impression that to cancel a medication they have to call the pharmacy. They were pleased to find out that a prescription could be stopped through DrFirst.
- A participant complained that the system requires the user to go through the manage medications before allowing the user to prescribe a medication. On a more regular basis, the provider will just review the medications then prescribe a medication. Launching DrFirst directly to the 'Manage Meds' section shows redundant information.

AREAS FOR IMPROVEMENT

- A participant would like to have the electronic prescriptions to be embedded directly through the EHR program rather than going to a 3rd party site.

5. APPENDICES

APPENDIX 1: PATIENT DEMOGRAPHICS

Following is a high-level overview of the participants in this study.

Gender		Count
Men		5
Women		7
	Total (Participants)	12

Age Range		Count
25-34		1
35-44		2
45-54		3
55-64		5
65+		1
	Total (Participants)	12

Education		Count
High School/GED		2
Some College Credit		3
Bachelor's Degree		1
Doctorate Degree		6
	Total (Participants)	12

Occupation/Role		Count
Medical Assistants		3
Office Managers/Medical Assistants		2
Physicians		6
Receptionist		1
	Total (Participants)	12

Months of Experience	Mean	Range
Professional Experience	316.5	48-558
Computer Experience	216	120-360
Experience with ehrTHOMAS	56.75	3-84
Experience with EHRs	844.36	54-108

Assistive Technology Needs		Count
Yes		0
No		12

Total (Participants)   12

APPENDIX 2: PARTICIPANT BACKGROUND QUESTIONNAIRE

Please answer the following questions below.

Gender: ☐Male ☐Female ☐No response

Which of the following best describes your age?

☐18-24 ☐35-44 ☐55-64
☐25-34 ☐45-54 ☐65 or over ☐No response

Which of the following best describes your highest degree or level of school you have completed?

☐Some high school, no diploma ☐Associate's Degree
☐High School diploma/GED ☐Bachelor's Degree
☐Some college credit, no degree ☐Master's Degree
☐Trade/technical/vocational ☐Doctorate

Which of the following best describes your ethnic group?

☐Asian/Pacific Islander ☐Native American/Alaskan Native
☐Black/African American ☐White/Caucasian
☐Hispanic/Latino ☐Multi Race/Other
☐No Response

How long have you been working in the medical field? _____

Which of the following best describes your position in the office?

☐Receptionist ☐Nurse
☐Medical Biller ☐Clinician/Provider
☐Office Manager ☐Other: _____
☐Medical/Clinical Assistant ☐No Response

How long have you held this position? _____

What are your main responsibilities?

_____
_____
_____
_____
_____

How long have you been working with computers? _____

How many hours per week do you spend on the computer?

☐ 10 or less hrs   ☐ 21-30 hrs   ☐ 41+ hrs

☐ 11-20 hrs   ☐ 31-40 hrs   ☐ No Response

What computer platform do you usually use? *Please select one.*   ☐ Mac   ☐ Unsure

☐ Windows   ☐ Other: _____

☐ No Response

Do you require any additional technology to help you use a computer?   ☐ NO   ☐ No Response

☐ YES

How many EHR programs are you familiar with?   _____

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

How long have you been working with ehrTHOMAS?   _____

How many hours per week do you spend using an EHR?

☐ 10 or less hrs   ☐ 21-30 hrs   ☐ 41+ hrs

☐ 11-20 hrs   ☐ 31-40 hrs   ☐ No Response

Describe your experience with electronic health records:

_____
_____
_____
_____
_____

APPENDIX 3: RESEARCH PARTICIPANT INFORMATION STATEMENT AND INFORMED CONSENT

RESEARCH PARTICIPANT INFORMATION STATEMENT

Genius Solutions would like to thank you for your interest in participating in ehrTHOMAS's usability study. This form provides you with information about this study and the researcher(s).

If you have any questions about the study you can reach Melissa at (586)751-9080, option 7. Please read the information below and ask any questions you might have before deciding whether or not to take part.

TITLE OF PROJECT: EHR Usability Test of ehrTHOMAS Version 3.0.

PURPOSE OF RESEARCH: To comply with the 2015 Edition EHR Certification Criteria, released by the Secretary of Health and Human Services, the ehrTHOMAS software must undergo a user-centered design process and document the findings. The purpose of this study is to evaluate the ehrTHOMAS program for effectiveness, efficiency, and user satisfaction.

SPECIFIC PROCEDURES: If you decide to participate, you will be asked several background questions, perform several tasks using our EHR, and provide feedback. Your use of the EHR will be recorded to time the completion of each task. Patient data will not be used in data gathering and your personal information will also be confidential.

DURATION OF PARTICIPATION: The study will take about one hour of your time.

COMPENSATION: Your office will receive a non-expiring certificate for one (1) free five hour training day **or** one (1) free Genius Solution focus group registration for one person, and a gift certificate per individual who participates.

INFORMED CONSENT FORM

Agreement:

I agree to participate in the study conducted by Genius Solutions Inc. I understand that participation in this usability study is voluntary and I am free to withdraw consent or discontinue my participation, without any penalty, at any time.

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

I understand and agree that the data collected from this study may be shared outside of Genius Solutions within the scope of this testing. I understand that data confidentiality is assured and anonymous data (e.g. identification numbers instead of names) will be used in analysis and reporting of the results insofar as is possible.

I agree to raise any concerns or areas of discomfort during the session with the study administrator.

I have read the above statement and agree to be a participant.

Participant's Signature: _____   Date: _____

Participant's Name (printed): _____

APPENDIX 4: MODERATOR GUIDE

Moderator's Guide

Administrator: _____   Date: _____
Location: _____   Time: _____
Participant ID: _____

Before Testing Session

- ☐ Ensure ehrTHOMAS has sample information pre-programed in.
- ☐ Ensure testing equipment is running properly.
    - o Laptop is set up.
    - o Peripherals are in place.
- ☐ Open ehrTHOMAS with username Thomas and one with username Genius
- ☐ Open OBS Studio

Prior to Participant Testing

- ☐ Ensure Patient Accounts are usable.
    - o 1st Patient Acct: _____
    - o 2nd Patient Acct: _____
    - o 3rd Patient Acct: _____
    - o 4th Patient Acct: _____
- ☐ Open OBS Studio and Click Start Recording.
    - o Time Started: _____

After each Participant

- ☐ Gather all documents.
    - o Consent Form
    - o Participant Background
    - o Post-Test Questionnaire
    - o System Usability Scale
- ☐ Disable "Obtain influenza immunization status" and enable all users.
- ☐ Reset DrFirst options > Preference

After Testing

- ☐ Move all files onto a USB.

Please read aloud to the participant regarding the procedures of the test:

Thank you for participating in Genius Solutions' usability study of ehrTHOMAS. The testing session today should last around 1 hour. You will be performing a series tasks using ehrTHOMAS to help us evaluate the effectiveness and efficiency of the program. You are to complete each task as quickly as possible without making any errors or deviating from the task. Our goal is to assess the difficulty utilizing the program and evaluate areas that require improvement.

The data contained on this EHR environment is used for testing purposes only. Additionally, you may find that some of the data does not make sense while performing the tasks. This data is used as placeholders for testing purposes.

I would like to remind you that you are able to withdraw at any time, and for any reason, from the testing.

At the end of the session, we will have an open discussion about the tasks and your opinions of the program. You will also be given two post-test questionnaires to fill out. I do not have any involvement in the development of the program, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

When you leave this room, please do not discuss the tasks you have performed during this session.

Do you have any questions or concerns at this time?

[Allow the participant to ask any questions.]

You will be performing 26 task. A task sheet will be provided to you containing information regarding each task. I will read the description of the task and say, "Begin."

At that point, perform the task as accurately and quickly as possible. Try your best to complete the task even though you may not know how to do it. I will be here provide specific help, such as explanation of the task, however, I am not able to help or instruct you on how to use the software. Keep in mind that we are testing the software, not you or your abilities. Any difficulty you face while performing a task means something needs to be improved in the software.

Once you think you have completed the task, say "I'm done." You may also say, "I'm done" if you made a full-hearted attempt and believe you cannot complete the task with the information you have been given.

At the end of each task I will ask you to rate the difficulty of the task and allow you to provide any comments or concerns.

Do you have any questions or concerns regarding the test procedures?

[Allow the participant to ask any questions. Once questions have been answered begin task series.]

Scenario 1

Task 1

Pre-task(s):
1. Select patient account #: _____
2. Open a new encounter for today
3. Take to Menu tab

Task:

You recently received some new demographic information for your patient. Record or update her demographics using the following data:
- *Gender Identity: Female*
- *Ethnicity: Declined*
- *Race: Decline to answer*
- *Preferred Language: English*
- *Sexual Orientation: Straight/Heterosexual*

Observed Errors and Verbalizations:

Results:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

Post Task Questions:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 1.1: Access Demographics	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 1.2: **Change Demographics**	**# of Clicks**	**Comments**
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

TASK 2

Pre-task(s):
- Take to Menu tab

TASK:

You are in the room with the patient reviewing medication allergies. The patient noticed that a few weeks ago she was getting abdominal pain while taking aspirin. She also claims that taking Zithromax Z-Pak was making her nauseous, but it's now causing her to vomit.
Perform the following: 1.) Add aspirin to the patient's allergy list and 2.) Change her Zithromax Z-Pak medication allergy information. Once completed, don't go back to the EHR yet. Stay on the DrFirst screen.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 2.1: Access Medication Allergy List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Task 2.2: Record New Medication Allergy	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Task 2.3: Modify Medication Allergy List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

TASK 3

Pre-task(s):

- None

TASK:

Now go back to the EHR to update the allergies. Review and complete any CDS rules that appears.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 3.1: Review and Complete CDS Intervention: Medication Allergy List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

TASK 4

PRE-TASK(S):
- Take to Menu tab

TASK:

You are now reviewing the patient's medication list. The patient has been seeing a gastroenterologist and was prescribed omeprazole 20 mg capsule, delayed release. The patient reported that she is taking 10mg instead of the 20mg. She also states that she has been taking Targadox, 50 mg, for her acne.
Perform the following: 1) Update her omeprazole medication from 20mg to 10mg and 2) add Targadox, 50mg to her medication list. Once completed, don't go back to the EHR. Stay on the DrFirst screen.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 4.1: Access Medication List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 4.2: **Record New Medication**	**# of Clicks**	**Comments**
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 4.3: **Change Medication**	**# of Clicks**	**Comments**
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

TASK 5

Pre-task(s):
- Ensure that the user is on the DrFirst screen.

Task:
     Look up the patient's medication history for the past 30 days.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 5.1: Obtain Medication History	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 6

PRE-TASK(S):

- Take to different EHR.

TASK:

The patient also wanted to let you know that there were some changes to her implantable devices. She recently had her knee insert replaced with a new insert on 02/09/2017. She presents to you her new Unique Device Identifier (UDI) for her insert:
(01)00841153100250(17)190203(11)100102(10)ABYZ(21)X99213.
Perform the following: 1) Access her device list, 2) inactivate her old knee insert, and 3) add the new device to her device list by UDI.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 6.1: Access Device List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Task 6.2: Change Status of UDI Recorded	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Task 6.3: Record New UDI	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

A<small>DMINISTRATOR</small> C<small>OMMENTS</small>:

Task 7

PRE-TASK(S):

- None

TASK:

View the list of all active and inactive devices this patient has.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 7.1: Review active and inactive devices.	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 8

Pre-task(s):
- Take back to original EHR
- Take to Menu tab

Task:
Order a lower extremity MRI with contrast diagnostic test at Henry Ford Health Systems for your patient.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 8.1: Access Diagnostic Order List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 8.2: Create Diagnostic Imaging Order	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 9

Pre-task(s):

- None

Task:

After you ordered the MRI, you realized that you are sending the patient to the wrong facility. Change the facility from Henry Ford Health System to Beaumont.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 9.1: Change Diagnostic Order	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 10

Pre-task(s):

- Take to Menu tab

Task:

Order Fioricet tablets for the patient to take 1 tablet every 8-12 hours as needed for pain for 7 days with no refills. This medication must be printed on paper. If any interactions appear read off the source of the alert out loud before finishing the order.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 10.1: Order a Medication	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 10.2: Review the attributes for the interaction	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 11

Pre-task(s):

- None

Task:

You determined that Fioricet is not the best medication to give to your patient after reviewing the interactions. Perform the following: 1) Cancel your previous Fioricet medication order and 2) Order Norco 7.5-375mg tablets with the sig of take 1 tablet every 8-12 hours as needed for pain for 7 days with no refills. If any interactions appears read of the source of the alert out loud before finishing the order.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 11.1: Change Medication Order	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 12

Pre-task(s):

- None

Task:

The patient asks if you can also refill her Lipitor prescription for her. Refill her medication.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 12.1: Refill a medication	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

SCENARIO 2:

Task 13

Pre-task(s):
1. Select patient account #: _____
2. Open a new encounter for today
3. Take to Menu Tab

Task:

This patient never had demographic information recorded in his chart. Record his demographics using the following data:
   Birthday: 12/5/1962
   Sex: Male
   Gender Identity: Choose not to disclose.
   Ethnicity: Non-Hispanic or Latino
   Race: American Indian and White
   Preferred Language: Declined to Answer
   Sexual Orientation: Choose not to disclose.
Review and complete any CDS alerts that appears.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 13.1: Record demographics	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 13.2: Review and Complete CDS Intervention: Demographics	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 14

Pre-task(s):
- Take to Menu tab

Task:

Enter in the patient's height and weight.
    Height - 5'8"/68in
    Weight – 200lb
Review and complete the CDS alert that appears.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 14.1: Review and Complete CDS Intervention: Vital Signs	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 15

Pre-task(s):

- Take to Menu tab

Task:

You are ready to diagnose this patient. You see that he has an old influenza diagnosis that is no longer relevant. Perform the following: 1) Access his condition list and 2) resolve the influenza condition.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 15.1: Access Problem List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 15.2: **Resolve Condition from Problem List**	**# of Clicks**	**Comments**
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 16

Pre-task(s):

- None

Task:

Add Type 2 Diabetes (E11.9) and Essential Hypertension (I10) to the condition list. Review and complete any CDS alert that appears.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 16.1: Add New Condition to Problem List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 16.2: Review and Complete CDS Intervention: Problem List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 16.3: Review and Complete CDS Intervention: Demographics and Problem List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 17

Pre-task(s):

- Take to Menu tab

Task:

Enter in the following lab results for a previously ordered lipid panel.
    Cholesterol, Total – 210 mg/dL
    Triglycerides – 150mg/dL
    HDL – 50 mg/dL
    LDL – 130 mg/dL
    Non-HDL – 160 mg/dL
Review and complete any CDS alert that appears.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 17.1: **Access Lab Orders**	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 17.1: **Review and Complete CDS Intervention: Lab Results**	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 18

Pre-task(s):

- None

Task:

Order a complete blood count lab to be fulfilled at Quest for your patient.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 18.1: Record a Laboratory Order	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 19

Pre-task(s):

- None

Task:

> *After you created the CBC order, you realized it was for the wrong patient. Void the lab order you just made.*

Observed Errors and Verbalizations:

Results:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

Post Task Questions:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 19.1: Change a Laboratory Order	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Administrator Comments:

SCENARIO 3

Task 20

Pre-task(s):
1. Select patient account #: _____
2. Open a new encounter for today
3. Take to Menu tab

Task:

Electronically prescribe Warfarin 4mg for this patient. Take 1 tablet by mouth once a day as directed for 30 days with two refills. If any interactions appear, read off the source of the alert out loud before finishing the order. Use the following signature password: XXXXXXX. Once completed, don't go back to the EHR. Stay on the DrFirst screen.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 20.1: Electronically Prescribe a Medication	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 21

Pre-task(s):

- None

Task:

You realized that you sent the wrong medication dosage to the pharmacy. Preform the following: 1) Cancel the previously prescribed medication and 2) change the dosage of the Warfarin medication from 4mg to 3mg with the sign 'Take 1 tablet by mouth once a day as directed for 30 days (qty 30) with two refills.' If any interactions appear read off the source of the alert out loud before finishing the order. Use the following signature password: XXXXXXXX. Once completed, don't go back to the EHR. Stay on the DrFirst screen.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 21.1: Cancel/Change a Medication	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 22

Pre-task(s):

- None

Task:

Go back to the EHR. Review and complete any CDS rules. Check the prescription fill status.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 22.1: Review and Complete CDS Intervention: Medication List	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 22.2: Check Prescription Fill Status	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Scenario 4

Task 23

Pre-task(s):
- Go to Messages, CCDA Import.
- Explain new screen.

Task:

You have received a patient's clinical document from one of your referring providers and need to reconcile it into your EHR. Perform the following: 1) Open the Document that is located on the desktop 2) reconcile any medications and/or allergies inside of DrFirst, 3) add only hypertension from the clinical document, and then 4) import the patient's information into a new encounter for today.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 23.1: Reconcile and Incorporate Clinical Information	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Scenario 5

Task 24

Pre-task(s):
- Go to Code Files, CDS Rules.
- Explain new features.

Task:

Enable the CDS rule, "Obtain influenza immunization status" for the system and prevent the following users from completing the intervention.

Users: Sarah, Jodie, Chris, Alex

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 24.1: Enable CDS Rule	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		
Task 24.2: Configure CDS Intervention by User	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 25

Pre-task(s):

- None

Task:

Read the aloud the release date of the CDS rule "Patient has hypertension. Record blood pressure."

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Task 25.1: Review Source Attributes for CDS Alerts	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

ADMINISTRATOR COMMENTS:

Task 26

Pre-task(s):

- Go to DrFirst > Additional Options

Task:

Change the drug-drug interactions for your practice from showing "all interactions" to "severe and contraindicated" only.

Observed Errors and Verbalizations:

Results:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

Post Task Questions:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____

What type of improvements would you like to see to make this task easier?

Task 26.1: Change Drug-Drug Interaction Severity Level	# of Clicks	Comments
☐ Correct path ☐ Some deviations ☐ Major deviations		

Administrator Comments:

APPENDIX 5: POST-TEST QUESTIONNAIRE

POST-TEST QUESTIONS

1. What was your initial impression of the system?

2. After getting acquainted to the program did your impression change?

3. What do you like most about ehrTHOMAS?

4. What do you like the least about ehrTHOMAS?

5. What changes or improvements would you like to see in ehrTHOMAS?

6. If applicable, compare ehrTHOMAS to other EHR programs you have used.

7. Would you recommend this product to your colleagues?

APPENDIX 6: SYSTEM USABILITY SCALE QUESTIONNAIRE

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

Final Score:

_____

This questionnaire is based off John Brooke's System Usability Scale (1986).

EHR Usability Test Report for ehrTHOMAS, version 3

Report based on NISTIR 7741 Customized Common Industry Format Template for Electronic Health Record Usability Testing
https://doi.org/10.6028/NIST.IR.7741

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6. EXECUTIVE SUMMARY

An updated usability test of ehrTHOMAS version 3, complete ambulatory electronic health record (EHR), was conducted on February 1, 2025 through February 20, 2025. The purpose of this test was to examine and validate the usability of the current user interface, and to provide evidence of usability in the EHR Under Test (EHRUT). During the usability test, 10 healthcare providers, medical staff, and office staff matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 5 tasks typically conducted on an EHR:

1. **Create CDS Rule-**Confirm users can record and store the source attributes of Evidence-based DSIs.
2. **Modify CDS Rule-** Ensure that users can modify the source attributes for a configured DSI.
3. **Trigger CDS Alert**- Ensure that users can trigger CDS Alerts.
4. **Record Feedback**- Verify that users can provide feedback on CDS rule.
5. **Export Feedback**- Verify that feedback data can be exported with the required field and in a computable format.

 During the 60 minute (or less) one-on-one usability test, each participant was greeted by the test administrator and asked to review and sign an informed consent/release form (included in Appendix 3); they were instructed that they could withdraw at any time. Participants either had prior experience with the EHR. Training was provided to newer functionalities of the system. 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 as well as a Microsoft Windows program called Steps Recorder was used to time the test. The administrator also recorded the user performance data on paper. The administrator did not give the participant assistance in how to complete any task. Participant screens were recorded for subsequent analysis.

The following types of data were collected for each participant:

* Number of tasks successfully completed 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 post-test questionnaire and were compensated with a $20 gift. Various recommended metrics, in accordance with the examples set forth in the "*NISTIR-(7741) Guide to the Processes Approach for Improving the Usability of Electronic Health Records (*NIST Interagency/Internal Report (NISTIR) – 7741)" https://doi.org/10.6028/NIST.IR.7741 were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Table 1: _Task Result_							
Measure **Tasks**	**N**	**Task Success**	**Path Deviation**	**Task Time**		**Errors**	**Task Ratings 5 = Easy**
§ 170.315(b)(11) Decision Support Intervention	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Task 1-Create CDS Rule	10	99 (3)	0/0	34 (3)	7/1	0 (0)	4.90 (0.30)
Task 2- Modify CDS Rule	10	100 (0)	0/0	31 (3)	11/1	0 (0)	5 (0)
Task 3- Trigger CDS Alert	10	100 (0)	0/0	13 (6)	40/2	0 (0)	5 (0)
Task 4- Record Feedback	10	97 (4.58)	0/0	27 (7)	45/2	0 (0)	4.70 (0.50)
Task 5-Export Feedback	10	93 (4.58)	0/0	41 (5)	24/2	0 (0)	4.40 (0.50)

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 97.8%

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

Major Findings

The task associated with the: Create CDS Rule-Confirm users can record and store the source attributes of Evidence-based DSIs was considered very easy and had success rate of 99%.

The task associated with: Modify CDS Rule- Ensure that users can modify the source attributes for a configured DSI was considered to be very easy and had success rate of 100%.

The task associated with: Trigger CDS Alerts-Ensures that user can trigger CDS Alerts was considered to be very easy to perform and had success rate 100%.

The tasks associated with: Record Feedback -Verify that users can record feedback on CDS rules was considered to be very easy to perform and had success rate of 97%.

The tasks associated with: Export Feedback - Verify that feedback data can be exported with the required field and in a computable format was considered to be easy and had success rate of 93%.

Areas for improvement

- Each user wants a clear description of their access level or access level change upon using the system. (This will be up to the office to provide access level and/or description.)

7. INTRODUCTION

The EHRUT tested for this study was ehrTHOMAS version 3, a complete EHR designed for ambulatory settings. The program was designed to create, present and store medical information for healthcare providers in podiatry, chiropractic internal medicine, obstetrics, gynecology, mental health, pediatric and surgical facilities. This usability testing attempted to represent realistic exercises and conditions.

The purpose of this study was to test and validate the updated usability of the current user interface, and provide evidence of usability pertaining to certification requirements from of the Office of the National Coordinator of Health Information Technology Certification Program in the EHR Under Test (EHRUT). This study will measure the program's level of effectiveness, efficiency and user satisfaction, such as, time spent on a task; number of errors and user rating were captured during the usability testing.

8. METHOD

3.1 PARTICIPANTS

A total of ten participants were tested on the EHRUT. Participants in the test were actual users of the ehrTHOMAS program including physicians, medical or clinical assistants, and office managers. Participants were recruited through Genius Solutions and were compensated with a $20 gift card.

The following is a table of participants by characteristics, including demographics, professional experience and computer usage. Participants' names were replaced with Participant IDs so that an individual's data cannot be tied back to individual identities.

Participant ID	Gender	Age (years)	Highest Level of Education	Occupation or Role	Professional Experience (months)	Computer Experience (months)	Product Experience (months)	Assistive Technology Needs
P1	Female	30-39	Some college credit	Medical Assistant	12	264	9	No
P2	Female	40-49	Doctorate	Physician	72	300	13	No
P3	Female	40-49	High School	Office Manager/ Receptionist	60	228	24	No
P4	Male	50-59	Doctorate	Physician	120	120	5	No
P5	Female	30-39	Trade/Technical/Vocational	Medical Assistant	36	348	11	No
P6	Male	40-49	Associate Degree	Medical Assistant	42	468	26	No
P7	Male	30-39	Doctorate	Physician	62	384	8	No
P8	Female	20-29	High School	Receptionist	16	216	17	No
P9	Male	30-39	GED/High School	Medical Assistant	96	372	20	No
P10	Female	60-69	Doctorate	Physician	300	60	12	No

10 participants (matching the demographics in the section of participants) were recruited and 10 people participated in the usability test.

Participants were scheduled for 60 minutes (or less) sessions with five to ten minutes in between each session (if needed)   for debrief by the administrator and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participants and each participant's demographic characteristics.

3.2 STUDY DESIGN

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

During the usability test, participants interacted with one EHR. Each participant used the software on the same testing computer at his/her location, and was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by data collected and analyzed for each participant:

- Number of tasks successfully completed without assistance
- Time to complete the tasks
- Number of steps to complete the tasks
- Number and types of errors
- Path deviations

- Participant's satisfaction ratings of the system

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

3.3 TASKS

The tasks used were constructed to be realistic and representative of the kinds of activities a user might do with this EHR while incorporating test procedures for capabilities noted in the Health IT Certification criteria §170.315(b)(11), Decision Support Intervention. §170.315(b)(11), specifies that a summative usability testing was conducted and results were recorded for each of the following certification criteria:

- § 170.315(b)(11) Decision Support Intervention

The task was selected based on the added update (§170.315(b)(11) being added and §170.315(a)(9) being removed). The organization of the tasks was presented to the participant in a manner that follows a typical patient flow through the office. See the Moderator's guide in Appendix 4 for the full task wording.

Table 3: Task List			
Task 1: Create CDS Rules			
	Task #	**Task Goal**	**Certification Criteria**
	1.	Confirm that users can record and store the source attributes of DSI.	§ 170.315(b)(11) Decision Support Intervention
Task 2: Modify CDS Rule			
	Task #	**Task Goal**	**Certification Criteria**
	2.	Ensure that users can modify the source attributes for a configured DSI.	§ 170.315(b)(11) Decision Support Intervention
Task 3: Trigger CDS Alert			
	Task #	**Task Goal**	**Certification Criteria**
	3.	Ensure that users can trigger CDS Alerts.	§ 170.315(b)(11) Decision Support Intervention
Task 4: Record Feedback			
	Task #	**Task Goal**	**Certification Criteria**
	4.	Verify that users can record feedback on CDS rules	§ 170.315(b)(11) Decision Support Intervention
Task 5: Export Feedback			
	Task #	**Task Goal**	**Certification Criteria**
	5.	Verify that feedback data can be exported with the required field and in a computable format.	§ 170.315(b)(11) Decision Support Intervention

3.4 PROCEDURES

The test administrator went to the participants' medical offices and introduced herself to the office. Each participant was greeted and their identity was verified and matched with the corresponding name on the participant schedule. Participants were then assigned a participant ID. When each participant was brought into the testing area where he/she reviewed the information statement and signed an informed consent form (See Appendix 3). The test administrator witnessed the participant's signature.

The usability test was administered by one individual. This administrator had one year of software usability experience, one year of research experience in microscopy imaging analysis software and graduated from Michigan State University with a bachelor's degree.

The test administrator moderated the session including the administration of instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A screen recording program ran on the computer to record the participant's mouse-clicks.

Before starting the test, each participant were introduced to the testing and trained on how to use the new features of the EHRUT.

Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the task was read aloud by the administrator and the participant was given a written copy of the task. Task timing began once the administrator finished reading the question. The task time was stopped once the participant indicated he/she had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the post-test questionnaire (see Appendix 5) and a System Usability Scale questionnaire (see Appendix 6), compensated them for their time, and thanked each individual for their participation.

Videos created from the screen recording software were analyzed afterwards for task success rate, time on task, errors, deviations, and number of clicks. Participant demographic information, task success rate, time on task, errors, deviations, verbal responses, number of steps and post-test questionnaire were entered into a spreadsheet for analysis.

3.5 TEST LOCATION

Testing sessions were conducted at various locations based on the participant. Each of the participant's location provided an isolated testing area. To ensure the environment was comfortable for the users, noise levels were kept to a minimum with the temperature kept at a comfortable level.

3.6 TEST ENVIRONMENT

The ehrTHOMAS software is typically used in the healthcare clinic. Testing was conducted at the participant's office where area for testing was provided.

All participants used a HP Pavilion laptop with an Intel Core i7-8550U (1.80GHz) and12GBof RAM running Windows 10 Professional, 64-bit for testing. Every participant used the laptop's onboard keyboard and a Dell MS111-L optical USB wired mouse when interacting with the EHRUT. The application was displayed on a 17.3 inch screen using a screen resolution of 1920 by 1080 with the system's default color setting.

The software was installed on the testing computer by Genius Solutions according to the vendor's documentation describing system set-up and preparation. The data content for the EHRUT was specifically designed for this test. The system performance was representative of what actual users would experience in field implementation. Additionally, participants were instructed not to change any of the default system settings (e.g., font size).

3.7 TEST FORMS AND TOOLS

During the usability test, various documents were used including:

1. Participant Background Questionnaire
2. Research Participant Information Statement
3. Informed Consent Form
4. Moderator's Guide
5. Post-test Questionnaire
6. System Usability Scale Questionnaire

Example of these documents can be found in Appendices 2-6 respectively. The Moderator's Guide was devised to be able to capture required data.

The participant's interaction with the EHRUT and verbal comments were captured and recorded digitally with OBS Studio Version 20.1.3 running on the test computer. The recordings were saved for further analysis.

3.8 PARTICIPANT INSTRUCTIONS

The test administrator read the following introductory statement and instructions aloud to each participant before conducting the test (also see the full moderator's guide in Appendix 4):

Thank you for participating in Genius Solutions' usability study of ehrTHOMAS. The testing session today should last around 1 hour. You will be performing a series tasks using ehrTHOMAS to help us evaluate the effectiveness and efficiency of the program. You are to complete each task as quickly as possible without making any errors or deviating from the task. Our goal is to assess the difficulty utilizing the program and evaluate areas that require improvement.

The data contained on this EHR environment is used for testing purposes only. Additionally, you may find that some of the data does not make sense while performing the tasks. This data is used as placeholders for testing purposes.

I would like to remind you that you are able to withdraw at any time, and for any reason, from the testing.

At the end of the session, we will have an open discussion about the tasks and your opinions of the program. You will also be given two post-test questionnaires to fill out. I do not have any involvement in the development of the program, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

When you leave this room, please do not discuss the tasks you have performed during this session.

Do you have any questions regarding the study?

You will be performing 5 tasks. A task sheet will be provided to you containing information regarding each task. I will read the description of the task and say, "Begin."

At that point, perform the task as accurately and quickly as possible. Try your best to complete the task even though you may not know how to do it. I will be here to provide specific help, such as explanation of the task, however, I am not able to help or instruct you on how to use the software. Keep in mind that we are testing the software, not you or your abilities. Any difficulty you face while performing a task means something needs to be improved in the software.

Once you think you have completed the task, say "I'm done." You may also say, "I'm done" if you made a full-hearted attempt and believe you cannot complete the task with the information you have been given.

At the end of each task I will ask you to rate the difficulty of the task and allow you to provide any comments or concerns.

Do you have any questions or concerns regarding the test procedures?

Participants were given the opportunity to ask any questions or raise any concerns about the test being conducted. Once all issues were addressed the participants were trained on the new features of ehrTHOMAS. Participants were then given 5 tasks to complete. A Task Sheet was provided for every task for reference. Tasks are listed in the moderator's guide in Appendix 4.

3.8 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:

- Effectiveness of ehrTHOMAS 3, by measuring participant success rates and errors.
- Efficiency of ehrTHOMAS 3, by measuring the average task time and path deviations.
- Satisfaction with ehrTHOMAS 3, by measuring ease of use ratings.

3.9 DATA SCORING

The following table (Table 4) details how tasks were scored, errors evaluated and the time data analyzed.

Table 4: Data Scoring	
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. 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 were provided as a percentage. Task times were recorded for the completion of a task. Observed task times divided by the optimal time for each task is measured of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the moderator's guide must be operationally defined by taking multiple measures of optimal performance and multiplying by a factor of 2 that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance was 15 seconds then allotted task time performance was 30 seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, the task was counted as a "Failures". No task times were taken for errors. The total number of errors was calculated for each task 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 error and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviations. Optimal paths (i.e., procedural steps) were recorded when constructing paths.

Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average time analysis. Average time per task was calculated for each task. Variance measures (standard deviations) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 5 (very easy) to 1 (very difficult). This data are averaged across participants and a standard deviation was calculated. Common convention is that average ratings for systems judged easy should be 3.3 or below. To measure participants' confidence in and likeability of the ehrTHOMAS overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in Appendix 6.

9. RESULTS AND FINDINGS

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses.

The research participants have different levels of experience in different areas of the software depending on their role in the office. For instance, those who were medical or clinical assistants may only have experience in updating and entering patient allergies and medication or ordering laboratory tests and radiological tests, while physicians have more experience in charting diagnoses. Due to these ranges of system experience, it was apparent in the data that participants in certain roles would outperform participants in other roles in specific tasks.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 97.8%. Broadly interpreted, scores under 60% represent a system with poor usability; scores over 80% would be considered above average.

The results of the testing is organized and analyzed by each certification criteria.

§ 170.315(B)(11) DECISION SUPPORT INTERVENTION

This certification criterion requires that the EHRUT enables users Create CDS Rules. Task 1 test the user's ability to Create CDS Rules and confirm that users can record and store the source attributes of DSI.

DATA RESULTS

For Task 1, ten participants attempted the tasks. No data was excluded from the analysis.

Table 5: Task results for Create CDS Rules.						
Measure / **Tasks**	**N**	**Task Success**	**Path Deviation**	**Task Time**	**Errors**	**Task Ratings 5 = Easy**
Task 1-Create CDS Rule	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Confirm that users can record and store the source attributes of DSI.	10	99 (3)	0/0	34 (3)	7/1	0 (0)	4.90 (0.30)
The presented data is the Time and the Rating for the whole task.						

All Ten participants were able complete Task 1: Create CDS Rules.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to Create a CDS Rule was 6 with a standard deviation of 0 which was close to the optimal number. Creating CDS Rules presented no efficiency issues.

Users creating a CDS rule took an average of 34 seconds to complete which is higher than the optimal time. However the average number of steps was 6 with a standard deviation of 0 compared to the optimal 0 steps. Participants that took the most time and took the most steps were not as experienced with EHRUT's functionality.

EFFECTIVENESS

The success rate for Creating CDS Rules was 99%. All user s were able to complete Task 1.

SATISFACTION

Creating CDS Rules had an average task rating of 4.90 with a standard deviation of 0.30, indicating that it was very easy to perform.

MAJOR FINDINGS

- Task 1, Creating CDS Rules had a high success rate and satisfaction rating. Participants found this task to be very easy.

- None

§ 170.315(B)(11) DECISION SUPPORT INTERVENTION

This certification criterion requires that the EHRUT enables users to Modify CDs Rules..   Tasks 2 test the user's ability to Modify CDS Rules and ensure that users can modify the source attributes for a configured DSI.

Data Results

For Task 2, ten participants attempted the tasks. No data was excluded from the analysis.

Table 6: Task results for Modify CDS Rules.							
Measure / Tasks	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
Task 2- Modify CDS Rules	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Ensure that users can modify the source attributes for a configured DSI.	10	100 (0)	0/0	31 (3)	11/1	0 (0)	5 (0)
The presented data is the Time and the Rating for the whole task.							

All Ten participants were able complete Task 2: Modify CDS Rules.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to Modify CDS Rules was 6 with a standard deviation of 0 which was close to the optimal number. Modifying CDS Rules presented no efficiency issues.

Users Modifying CDS Rules took an average of 31 seconds to complete which is higher than the optimal time. However the average number of steps was 6 with a standard deviation of 0 compared to the optimal 0 steps. Participants that took the most time and took the most steps were not as experienced with EHRUT's functionality.

EFFECTIVENESS

The success rate for Modifying CDS Rules was 100%. All users were able to complete Task 2.

SATISFACTION

Modifying CDS Rules had an average task rating of 45 with a standard deviation of 0, indicating that it was very easy to perform.

MAJOR FINDINGS

- Task 2, Modifying CDS Rules had a high success rate and satisfaction rating. Participants found this task to be very easy.

AREAS FOR IMPROVEMENT

- None.

§ 170.315(B)(11) DECISION SUPPORT INTERVENTION

This certification criterion requires that the EHRUT enable Trigger CDS Rules. Users will be able to Trigger CDS Alerts.

DATA RESULTS

For Task 3, ten participants attempted the tasks. No data was excluded from the analysis.

Table 7: Task results for Trigger CDS Alerts.							
Measure / Tasks	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
Task 3- Trigger CDS Alerts	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Ensure that users can trigger CDS Alerts.	10	100 (0)	0/0	13 (6)	40/2	0 (0)	5 (0)
The presented data is the Time and the Rating for the whole task.							

All Ten participants were able complete Task 3: Trigger CDS Alerts.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to Trigger CDS Alerts was 3 with a standard deviation of 0 which was close to the optimal number. Triggering CDS Alerts presented no efficiency issues.

Users triggering CDS Alerts took an average of 13 seconds to complete which is higher than the optimal time. However the average number of steps was 3 with a standard deviation of 0 compared to the optimal 0 steps. Participants that took the most time and took the most steps were not as experienced with EHRUT's functionality.

EFFECTIVENESS

The success rate for Triggering CDS Alerts was over 100%. All user s were able to complete Task 3.

SATISFACTION

Triggering CDS Alerts had an average task rating of 5 with a standard deviation of 0, indicating that it was easy very to perform.

MAJOR FINDINGS

- Task 3, Triggering CDS Alerts had a high success rate and satisfaction rating. Participants found this task to be very easy.

AREAS FOR IMPROVEMENT

- None

§ 170.315(B)(11) DECISION SUPPORT INTERVENTION

This certification criterion requires that the EHRUT enable users to record feedback. Task 4 tests the user's ability to record feedback and verify that users can provide feedback on CDS Rules.

DATA RESULTS

For Task 4, ten participants attempted the tasks. No data was excluded from the analysis.

Table 8:
Task Results for Record Feedback

Measure / Tasks	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
Task 4- Record Feedback	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Verify that users can record feedback on CDS rule.	10	97 (4.58)	0/0	27 (7)	45/2	0 (0)	4.70 (0.50)
The presented data is the Time and the Rating for the whole task.							

All Ten participants were able complete Task 4: Record feedback.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to record feedback was 4 with a standard deviation of 0 which was close to the optimal number. Recording feedback presented no efficiency issues.

Users recording feedback took an average of 27 seconds to complete which is higher than the optimal time. However the average number of steps was 4 with a standard deviation of 0 compared to the optimal 0 steps.

EFFECTIVENESS

The success rate for Recording Feedback was 97%. All user s were able to complete Task 4.

SATISFACTION

Recording Feedback had an average task rating of 4.70 with a standard deviation of 0.50, indicating that it was very easy to perform.

MAJOR FINDINGS

- Task 4, for Record Feedback had a high success rate and satisfaction rating. Participants found this task to be very easy.

AREAS FOR IMPROVEMENT

- None.

§ 170.315(B)(11) DECISION SUPPORT INTERVENTION

This certification criterion requires that the EHRUT exporting feedback in a computable format and export with specific fields. Task 5 tests user's ability to EHRUT Export feedback in a computable format and export with specific fields Data Results

For Task 5, ten participants attempted the tasks. No data was excluded from the analysis.

Table 9:
Task Results for Export Feedback

Measure / Tasks	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5 = Easy
Task 5- Export Feedback	#	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Deviations (Observed/Optimal)	Mean (SD)	Mean (SD)
Verify that users can export feedback on CDS rule.	10	93 (4.58)	0/0	41 (5)	24/2	0 (0)	4.40 (0.50)

All Ten participants were able complete Task 5: Export Feedback.

DISCUSSION OF FINDINGS

EFFICIENCY

The average observed steps taken to export feedback was 4 with a standard deviation of 0 which was close to the optimal number. Exporting feedback presented no efficiency issues.

Users exporting feedback took an average of 24 seconds to complete which is higher than the optimal time. However the average number of steps was 4 with a standard deviation of 0 compared to the optimal 0 steps. Participants that took the most time and took the most steps were not as experienced with EHRUT's functionality.

EFFECTIVENESS

Exporting feedback was 93%. All user s were able to complete Task 5.

SATISFACTION

Exporting Feedback had an average task rating of 4.40 with a standard deviation of 0.50, indicating that it was very easy to perform.

MAJOR FINDINGS

- Task 5, for Export feedback had a high success rate and satisfaction rating. Participants found this task to be easy.

AREAS FOR IMPROVEMENT

- None.

10. APPENDICES

APPENDIX 1: PATIENT DEMOGRAPHICS

Following is a high-level overview of the participants in this study.

Gender		Count
Men		4
Women		6
	Total (Participants)	10

Age Range	Count
20-29	1
30-39	4
40-49	3

50-59	1
60-69	1
Total (Participants)	10

Education	Count
High School/GED	4
Some College Credit	1
Bachelor's Degree	1
Doctorate Degree	4
Total (Participants)	10

Occupation/Role	Count
Medical Assistants	4
Office Managers/Medical Assistants	1
Physicians	4
Receptionist	1
Total (Participants)	10

Months of Experience	Mean	Range
Professional Experience	81.6	12-300
Computer Experience	276	60-468
Experience with ehrTHOMAS	14.5	5-26
Experience with EHRs	18	19-30

Assistive Technology Needs	Count
Yes	0
No	10
Total (Participants)	10

APPENDIX 2: PARTICIPANT BACKGROUND QUESTIONNAIRE

Please answer the following questions below.

Gender: ☐Male   ☐Female   ☐No response

Which of the following best describes your age?

☐18-24   ☐35-44   ☐55-64
☐25-34   ☐45-54   ☐65 or over   ☐No response

Which of the following best describes your highest degree or level of school you have completed?

☐Some high school, no diploma   ☐Associate's Degree
☐High School diploma/GED   ☐Bachelor's Degree
☐Some college credit, no degree   ☐Master's Degree
☐Trade/technical/vocational   ☐Doctorate

Which of the following best describes your ethnic group?

☐Asian/Pacific Islander   ☐Native American/Alaskan Native
☐Black/African American   ☐White/Caucasian
☐Hispanic/Latino   ☐Multi Race/Other
                               ☐No Response

How long have you been working in the medical field?   _____

Which of the following best describes your position in the office?

☐Receptionist   ☐Nurse
☐Medical Biller   ☐Clinician/Provider
☐Office Manager   ☐Other: _____
☐Medical/Clinical Assistant   ☐No Response

How long have you held this position?   _____

What are your main responsibilities?

_____
_____
_____
_____
_____

How long have you been working with computers?   _____

How many hours per week do you spend on the computer?
- ☐ 10 or less hrs   ☐ 21-30 hrs   ☐ 41+ hrs
- ☐ 11-20 hrs   ☐ 31-40 hrs   ☐ No Response

What computer platform do you usually use? *Please select one.*   ☐ Mac   ☐ Unsure
☐ Windows   ☐ Other: _____
☐ No Response

Do you require any additional technology to help you use a computer?   ☐ NO   ☐ No Response
☐ YES

How many EHR programs are you familiar with?   _____

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

How long have you been working with ehrTHOMAS?   _____

How many hours per week do you spend using an EHR?
- ☐ 10 or less hrs   ☐ 21-30 hrs   ☐ 41+ hrs
- ☐ 11-20 hrs   ☐ 31-40 hrs   ☐ No Response

Describe your experience with electronic health records:
_____
_____
_____
_____
_____

APPENDIX 3: RESEARCH PARTICIPANT INFORMATION STATEMENT AND INFORMED CONSENT

RESEARCH PARTICIPANT INFORMATION STATEMENT

Genius Solutions would like to thank you for your interest in participating in ehrTHOMAS's usability study. This form provides you with information about this updated study and the researcher(s).

If you have any questions about the study you can reach Kim at (586)751-9080, option 7. Please read the information below and ask any questions you might have before deciding whether or not to take part.

TITLE OF PROJECT: (Updated) EHR Usability Test of ehrTHOMAS Version 3.

PURPOSE OF RESEARCH: To comply with the Certification Criteria, released by the Secretary of Health and Human Services, the ehrTHOMAS software must undergo a user-centered design process and document the findings. The purpose of this study is to evaluate the ehrTHOMAS program for effectiveness, efficiency, and user satisfaction.

SPECIFIC PROCEDURES: If you decide to participate, you will be asked several background questions, perform several tasks using our EHR, and provide feedback. Your use of the EHR will be recorded to time the completion of each task. Patient data will not be used in data gathering and your personal information will also be confidential.

DURATION OF PARTICIPATION: The study will take less than an hour of your time.

COMPENSATION: Your office will receive a gift card per individual who participates.

INFORMED CONSENT FORM

Agreement:

I agree to participate in the study conducted by Genius Solutions Inc. I understand that participation in this usability study is voluntary and I am free to withdraw consent or discontinue my participation, without any penalty, at any time.

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

I understand and agree that the data collected from this study may be shared outside of Genius Solutions within the scope of this testing. I understand that data confidentiality is assured and anonymous data (e.g. identification numbers instead of names) will be used in analysis and reporting of the results insofar as is possible.

I agree to raise any concerns or areas of discomfort during the session with the study administrator.

I have read the above statement and agree to be a participant.

Participant's Signature: _____   Date: _____

Participant's Name (printed): _____

Moderator's Guide

Administrator: _____   Date: _____
Location: _____   Time: _____
Participant ID: _____

Before Testing Session

- ☐ Ensure ehrTHOMAS has sample information pre-programmed in.
- ☐ Ensure testing equipment is running properly.
  - o Laptop is set up.
  - o Peripherals are in place.
- ☐ Open ehrTHOMAS with username Thomas and one with username Genius
- ☐ Open OBS Studio

Prior to Participant Testing

- ☐ Ensure Patient Accounts are usable.
  - o 1st Patient Acct: _____
  - o 2nd Patient Acct: _____
  - o 3rd Patient Acct: _____
  - o 4th Patient Acct: _____
- ☐ Open OBS Studio and Click Start Recording.
  - o Time Started: _____

After each Participant

- ☐ Gather all documents.
  - o Consent Form
  - o Participant Background
  - o Post-Test Questionnaire
  - o System Usability Scale
- ☐ Disable "Obtain influenza immunization status" and enable all users.
- ☐ Reset DrFirst options > Preference

After Testing

- ☐ Move all files onto a USB.

Please read aloud to the participant regarding the procedures of the test:

Thank you for participating in Genius Solutions' usability study of ehrTHOMAS. The testing session today should last around 1 hour. You will be performing a series tasks using ehrTHOMAS to help us evaluate the effectiveness and efficiency of the program. You are to complete each task as quickly as possible without making any errors or deviating from the task. Our goal is to assess the difficulty utilizing the program and evaluate areas that require improvement.

The data contained on this EHR environment is used for testing purposes only. Additionally, you may find that some of the data does not make sense while performing the tasks. This data is used as placeholders for testing purposes.

I would like to remind you that you are able to withdraw at any time, and for any reason, from the testing.

At the end of the session, we will have an open discussion about the tasks and your opinions of the program. You will also be given two post-test questionnaires to fill out. I do not have any involvement in the development of the program, so please be honest with your opinions. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

When you leave this room, please do not discuss the tasks you have performed during this session.

Do you have any questions or concerns at this time?

[Allow the participant to ask any questions.]

You will be performing 5 tasks. A task sheet will be provided to you containing information regarding each task. I will read the description of the task and say, "Begin."

At that point, perform the task as accurately and quickly as possible. Try your best to complete the task even though you may not know how to do it. I will be here providing specific help, such as explanation of the task, however, I am not able to help or instruct you on how to use the software. Keep in mind that we are testing the software, not you or your abilities. Any difficulty you face while performing a task means something needs to be improved in the software.

Once you think you have completed the task, say "I'm done." You may also say, "I'm done" if you made a full-hearted attempt and believe you cannot complete the task with the information you have been given.

At the end of each task I will ask you to rate the difficulty of the task and allow you to provide any comments or concerns.

Do you have any questions or concerns regarding the test procedures?

[Allow the participant to ask any questions. Once questions have been answered begin task series.]

Scenario 1

Task 1

Pre-task(s):

- None

Task:

- *Create CDS Rule-Confirm users can record and store the source attributes of an Evidence-based DSI.*

Observed Errors and Verbalizations:

Results:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

Post Task Questions:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

Administrator Comments:

TASK 2

Pre-task(s):

- None

TASK:

- Modify CDS Rule-Ensure users can modify the source attributes for a configured DSI.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

ADMINISTRATOR COMMENTS:

TASK 3

Pre-task(s):

- None

TASK:

- *Trigger CDS Alerts-Ensure that user can trigger CDS Rules.*

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

ADMINISTRATOR COMMENTS:

TASK 4

PRE-TASK(S):
- None

TASK:
- *Record Feedback*- Verify that users can provide feedback on CDS rules.

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:
From 5, being very easy to 1 being very difficult, how would you rate this task? _____
What type of improvements would you like to see to make this task easier?

ADMINISTRATOR COMMENTS:

TASK 5

Pre-task(s):

- None

Task:

- *Export feedback.-Verify that feedback data can be exported with the required fields and in a computable format.*

OBSERVED ERRORS AND VERBALIZATIONS:

RESULTS:

	Comments	Time Taken
☐ Completed with no help ☐ Completed with difficulty or help (Describe) ☐ Did not complete (Describe)		

POST TASK QUESTIONS:

From 5, being very easy to 1 being very difficult, how would you rate this task? _____

What type of improvements would you like to see to make this task easier?

ADMINISTRATOR COMMENTS:

APPENDIX 5: POST-TEST QUESTIONNAIRE

POST-TEST QUESTIONS

1. What was your initial impression of the system?

2. After getting acquainted to the program did your impression change?

3. What do you like most about ehrTHOMAS?

4. What do you like the least about ehrTHOMAS?

5. What changes or improvements would you like to see in ehrTHOMAS?

6. If applicable, compare ehrTHOMAS to other EHR programs you have used.

7. Would you recommend this product to your colleagues?

APPENDIX 6: SYSTEM USABILITY SCALE QUESTIONNAIRE

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

Final Score:

_____

This questionnaire is based off John Brooke's System Usability Scale (1986).