

EHR Usability Test Report for PracticeSuite EHR 18.0.0

*Report based on ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports
NISTIR 7742*

Product: PracticeSuite

Version: EHR 18.0.0

Adopted UCD Standard Name: NISTIR 7741

Adopted UCD Standard Description:

This standard provides NIST guidance for those developing electronic health record (EHR) applications who need to know more about processes of user centered design (UCD). UCD ensures that designed EHRs are efficient, effective, and satisfying to the user. Following the guidance in this document will greatly increase the likelihood of achieving the goal of building a usable user interface and a better user experience.

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Preface

About this Document

This document is based on certification criterion from the Health Information Technology: Standards, Implementation Specifications, and Certification Criteria for Electronic Health Record Technology, 2015 Edition.

This document explains Test procedure for Certification Criteria:

§170.315(g)(3) Safety-enhanced design.

This document focuses on requirements of user-centered design processes that must be applied to each capability an EHR technology includes that is specified in the following certification criteria:

§170.315(a)(1); §170.315(a)(2); §170.315(a)(3); §170.315(a)(4); §170.315(a)(5); §170.315(a)(6); §170.315(a)(7); §170.315(a)(8); §170.315(a)(9); §170.315(a)(14); §170.315(b)(2); and §170.315(b)(3).

Document Owner

PracticeSuite

Target Audience

This guide is intended for users of PracticeSuite EHR 18.0.0

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1 Executive Summary

A usability test of PracticeSuite, version EHR 18.0.0 ambulatory software was conducted between 10/2/2017 - 10/31/2017 by PracticeSuite Inc. The purpose of this test was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT).

During the usability test, 12 healthcare providers matching the target demographic criteria served as participant and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 10 tasks, typically conducted on an EHR:

1. Record Demographics.
2. Clinical information reconciliation and incorporation
3. Record, Review and update Medication allergy list
4. Record, Review and update Problem list
5. Review, create and update patient's Medication list. Assessing a drug-drug interaction and a drug-allergy Interaction warning in an order set.
6. Clinical decision support
7. Record Lab Order
8. Record Radiology Order
9. Review and Record Implantable device.

During the 30-minute one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form; they were instructed that they could withdraw at any time. Participants had prior experience with the EHR.

The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance - 100
- Time to complete the tasks - About 11 minutes
- Number and types of errors - 8
- Path deviations – Average 1.05
- Participant's verbalizations
- Participant's satisfaction ratings of the system – 4.09

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.

Various recommended metrics, in accordance with the examples set forth in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Measure Task	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easiest
	#	# Mean% (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	# Mean% (SD)	Mean (SD)
Create and update patient demographics.	12	12 100% (0.0)	1.06	107.75 (31.82)	1.20	0 0% (0.0)	4.33 (0.44)
Reconcile the Medications, Allergies and Diagnoses of the patient from an outside practice.	12	10 83.33% (0.37)	1.05	129.25 (67.54)	1.85	2 16.67% (0.37)	3.91 (0.45)
Review, create and update patient's Medication Allergy list	12	11 91.66% (0.27)	1.09	52.42 (10.52)	1.31	1 8.34% (0.27)	4.16 (0.55)
Review, create and update patient's Problem list	12	12 100% (0.0)	1.07	74.92 (21.93)	1.25	0 0% (0.0)	4.33 (0.55)
Review, create and update patient's Medication list. Assessing a drug-drug interaction and a drug-allergy Interaction warning in an order set	12	10 83.33% (0.37)	1.01	157 (15.82)	1.14	2 16.67% (0.37)	3.75 (0.62)
Clinical Decision Support	12	9 75% (0.43)	1.05	17.33 (11.76)	1.93	3 25% (0.43)	3.75 (0.5)
Record Lab Order	12	12 100% (0.0)	1.06	45.08 (7.35)	1.16	0 0% (0.0)	4.25 (0.37)
Record Radiology Order	12	12 100% (0.0)	1.05	28.67 (8.08)	1.37	0 0% (0.0)	4.1 (0.41)

Record Implantable Device	12	12 100% (0.0)	1.01	37 (16.73)	1.85	0 0% (0.0)	4.25 (0.37)
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The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 82.5. In addition to the performance data, the following qualitative observations were made:

1.1 Major findings

- Every task tested and measured using summative testing methods, were completed by the participants within the allocated target task time.
- The participants were able to navigate the user interface to accomplish the listed tasks without many erroneous detours or deviations from the optimal path.
- Across all tasks, the most frequent error that occurred was typos, especially when searching medication and lab orders.

1.2 Areas for improvement

- The number of steps needed to create or enter a medication order is still excessive, even though the participants were able to navigate the user interface within the acceptable number of steps.
- Create a “Select All” check box in CCDA import module for quick selection.
- In addition, we will re-examine our user testing scenarios to determine if changes are needed to more accurately reflect typical provider workflows.

2 Introduction

The EHRUT tested for this study was PracticeSuite, version EHR 18.0.0 ambulatory software. Designed to present medical information to healthcare providers in private practices, the EHRUT consists of practice management, EHR and medical billing software. The usability testing attempted to represent realistic exercises and conditions.

The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency and user satisfaction, such as time on task, path deviation, errors, were captured during the usability testing.

3 Method

3.1 Participants

A total of 12 participant were tested on the EHRUT(s). Participants in the test were doctors (MD/DO), nurses (RN/LNP), medical assistants (MA), and clinical analyst. Participants were selected by PracticeSuite and since each participant volunteered for test event participation, none of the participants were provided compensation for their time.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to participant screener. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology. Participant names were replaced with Participant IDs so that an individual's data cannot be tied back to individual

	ID	Gender	Age	Education	Occupation/ Role	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
1	U1	M	47	MD	Physician	20	>20	5	None
2	U2	M	37	MD	Physician	10	10-15	6	None
3	U3	M	40	MD	Physician	13	5-10	2	None
4	U4	F	38	Graduate	Nurse	26	>20	5	None
5	U5	F	32	Associate Degree	MA	2.5	5-10	4	None
6	U6	F	37	Graduate	Nurse	5	5-10	5	None
7	U7	F	38	Associate Degree	MA	12	15-20	3	None
8	U8	M	29	Associate Degree	MA	3	10-15	3	None
9	U9	F	29	Graduate	Nurse	2	5-10	1	None
10	U10	M	38	Postgraduate	Analyst	10	15-20	8	None
11	U11	F	49	MD	Physician	22	>20	7	None
12	U12	M	36	Postgraduate	Analyst	8	10-15	6	None

identities.

12 participants were recruited and participated in the usability test. Participants were scheduled for 30-minute sessions with 5 minutes in between each session for debrief by the administrator(s) and data logger(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic.

3.2 Study Design

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

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

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- 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

Scenario 1

Jerry Lamp, a 51-year-old male, comes in for his Annual Physical Exam. This is his first visit to the practice and was referred by Dr. Williams. He has a history of high blood pressure. His current complaints are high Cholesterol and an elevated blood glucose level. Also worried about a persistent cough he recently developed.

Task1: Add the following details to Jerry's Demographics.

(§170.315(a)(5) Demographics)

- a. Race: White
- b. Ethnicity: Not Hispanic or Latino
- c. Preferred Language: English
- d. Sexual Orientation: Heterosexual
- e. Gender Identity: Identifies as Male

Task 2: Import the Summary of Care CCDA file received from Dr. Williams clinic and reconcile the Medications, Allergies and Diagnoses of the patient.

(§170.315(b)(2) Clinical information reconciliation and incorporation)

- Perform medical record reconciliation.

Task 3: Review Jerry's current medication allergy list which contains Sulfa. Remove the Sulfa allergy from the list as the patient confirms that he is not allergic to Sulfa. Update the allergy list with a patient-reported Penicillin allergy.

(§170.315(a)(8) Medication allergy list)

- Penicillin

Task 4: Review Jerry's current problem list which contains Hypertension and Hypokalemia. Resolve Hypertension because current blood pressure is normal. Add the following problem to the patient's current problem list.

(§170.315(a)(6) Problem list)

- R05 – Cough
- E78.00 – Hypercholesterolemia
- R73.9 - Hyperglycemia

Task 5: Review Jerry's current medication list which contains Simvastatin 20 mg and Amiloride 5 Mg. Change the medication to Simvastatin 40 mg. Also, add Metformin and Lisinopril to his medication list. Medication details are given in the tables below:

(§ 170.315 (a)(1) Computerized Provider Order Entry (CPOE) – medications)

(§170.315(a)(7) Medication list)

(§170.315(b)(3) Electronic prescribing)

(§170.315(a)(4) Drug-drug, drug-allergy interaction checks)

Simvastatin	40 Mg Tablet once daily
Metformin	500 mg twice a day
Lisinopril	10 mg orally once a day
Cephalexin	250 mg orally every 6 hours

A Drug – Drug Interaction alert will appear warning you of possible interactions between Lisinopril and Amiloride.

Drug – Allergy interaction alert will appear warning you of possible interactions between Penicillin and Cephalexin.

Task 6: Review the patient's clinical alerts that have been triggered after reconciliation. The first alert is for ordering a Potassium test for patient's Hypokalemia.

(§170.315(a)(9) Clinical decision support)

Task 7: To investigate the elevated blood glucose level and low potassium, create a Lab Order for the following tests:

(§170.315(a)(2) Computerized provider order entry—Laboratory)

- Potassium test
- Urine Microalbumin
- Glucose Fasting

Task 8: Order an imaging procedure to assess for possible infection which could be causing the cough.

(§170.315(a)(3) Computerized provider order entry—Diagnostic imaging)

- Chest X-Ray

Task 9: Check the historical entry on the implantable device and Record the following UDI.

(§170.315(a)(14) Implantable device list)

3.4 Risk Analysis

Tasks in the Usability Tests Scenarios were selected based on requirements to satisfy the Safety-enhanced Design criterion (170.315.g.3) and on good software development practices. Included in the requirements is that ‘User tasks employed in the study are prioritized in accordance with the risk associated with user.’ The assessment of patient safety risk resulting from the software development, and then end-user interaction with the EHR, begins during the design phase, and continues through the development phase of the EHR functionality. The Product Owner and the development scrum team assess the requirements and workflow of the desired enhancement for the potential patient safety and IT risks and actively plan in reducing these risks.

PracticeSuite has defined tasks to be performed in the summative usability tests based on their frequency of use, criticality of function, and those that may be most troublesome for users.

Moderate to High-risk workflows were selected for the user tasks. Risk analysis of the tasks is summarized in the Table below.

Criteria	Likelihood	Risk
Task 1: Create and update patient demographics.		
(§170.315(a)(5) Demographics)	Moderate	Moderate
Task 2: Reconcile the Medications, Allergies and Diagnoses of the patient from an outside practice.		
(§170.315(b)(2) Clinical information reconciliation and incorporation)	Moderate	High
Task 3: Review, create and update patient’s Allergy list		
(§170.315(a)(8) Medication allergy list)	Low	Moderate
Task 4: Review, create and update patient’s Problem list		
(§170.315(a)(6) Problem list)	Moderate	Moderate
Task 5: Review, create and update patient’s Medication list; Assessing a drug-drug interaction and a drug-allergy Interaction warning in an order set		
(§ 170.315 (a)(1) Computerized Provider Order Entry (CPOE) – medications, §170.315(a)(7) Medication list); (§170.315(b)(3) Electronic prescribing); (§170.315(a)(4) Drug-drug, drug-allergy interaction checks)	Moderate	Moderate
Task 6: Clinical Decision Support		
(§170.315(a)(9) Clinical decision support)	Moderate	Moderate
Task 7: Record Lab Order		
(§170.315(a)(2) Computerized provider order entry—Laboratory)	Low	Moderate
Task 8: Record Radiology Order		
(§170.315(a)(3) Computerized provider order entry—Diagnostic imaging)	Moderate	Moderate
Task 9: Record Implantable Device		
(§170.315(a)(14) Implantable device list)	Moderate	Moderate

3.5 Procedures

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

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was experienced usability practitioners.

The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments.

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

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

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

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

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

Participants were thanked for their time.

3.6 Test Location

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room. All observers and the data logger worked from a separate room where they could see the participant's screen. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

3.7 Test Environment

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in PracticeSuite Inc. Headquarters. For testing, the computer used a laptop running Windows 10 operating system. The participants used mouse and keyboard

when interacting with the EHRUT. The PracticeSuite, EHR 18.0.0 used 15" LCD screen with resolution 1600x900 and True Color 32-bit color settings.

The application was set up by the vendor according to the vendor's documentation describing the system set-up and preparation. The application itself was running in the cloud using a test database. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

3.8 Test Forms and Tools

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

1. Informed Consent
2. Moderator's Guide
3. Post-test Questionnaire
4. Task List
5. Acknowledgment Form

The Moderator's Guide was devised so as to be able to capture required data.

3.9 Participant Instructions

The administrator reads the following instructions aloud to each participant:

Thank you for participating in this study. Your input is very important. Our session today will last about 30 minutes. During that time, you will use an instance of an electronic health record.

I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

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

Following the procedural instructions, participants were shown the EHR and as their first task, were given time (10 minutes) to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

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

Participants were then given 9 tasks to complete.

3.10 Usability Metrics

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

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

4 Data Scoring.

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

Measures	Rationale and Scoring
Effectiveness: Task Success	<p>A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis.</p> <p>The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.</p> <p>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency.</p> <p>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 on a task was 30 seconds then allotted task time performance was 60 seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</p>
Effectiveness: Task Failures	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an "Failures." No task times were taken for errors.</p> <p>The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors.¹¹ This should also be expressed as the mean number of failed tasks per participant.</p>

Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.
	It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	<p>Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. 12</p> <p>Common convention is that average ratings for systems judged easy to use should be 3.3 or above.</p> <p>To measure participants' confidence in and likeability of the PracticeSuite, version EHR 18.0.0 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."</p>

Table [x]. Details of how observed data were scored.

5 Results

5.1 Data Analysis and Reporting

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

The usability testing results for the EHRUT are detailed below:

Measure	N	Task Success	Path Deviation	Task Time	Errors	Task Ratings

Task							5=Easy
	#	# Mean% (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	# Mean% (SD)	Mean (SD)
Create and update patient demographics.	12	12 100% (0.0)	1.06	107.75 (31.82)	1.20	0 0% (0.0)	4.33 (0.44)
Reconcile the Medications, Allergies and Diagnoses of the patient from an outside practice.	12	10 83.33% (0.37)	1.05	129.25 (67.54)	1.85	2 16.67% (0.37)	3.91 (0.45)
Review, create and update patient's Medication Allergy list	12	11 91.66% (0.27)	1.09	52.42 (10.52)	1.31	1 8.34% (0.27)	4.16 (0.55)
Review, create and update patient's Problem list	12	12 100% (0.0)	1.07	74.92 (21.93)	1.25	0 0% (0.0)	4.33 (0.55)
Review, create and update patient's Medication list. Assessing a drug-drug interaction and a drug-allergy Interaction warning in an order set	12	10 83.33% (0.37)	1.01	157 (15.82)	1.14	2 16.67% (0.37)	3.75 (0.62)
Clinical Decision Support	12	9 75% (0.43)	1.05	17.33 (11.76)	1.93	3 25% (0.43)	3.75 (0.5)
Record Lab Order	12	12 100% (0.0)	1.06	45.08 (7.35)	1.16	0 0% (0.0)	4.25 (0.37)
Record Radiology Order	12	12 100% (0.0)	1.05	28.67 (8.08)	1.37	0 0% (0.0)	4.1 (0.41)
Record Implantable Device	12	12 100% (0.0)	1.01	37 (16.73)	1.85	0 0% (0.0)	4.25 (0.37)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 82.5.

5.2 Effectiveness

PracticeSuite EHR proved to be very effective based on overall success reported on all 9 tasks. Effective calculation is around 92.59%. Task failures were infrequent, and when occurred, they were often due to non-safety related usability issues.

5.3 Efficiency

Based on observations of the task time and deviation data, most of the participants were able to complete task ahead of target time. For all tasks, the deviation rate was relatively low with a range of 1.01 – 1.09 (the closer to 1 the better), with few participants drastically deviating from the optimal path. Efficiency calculation: Average path deviation recorded as 1.05. Average Time deviation recorded as 1.45.

5.4 Satisfaction

The majority of participants rated the tasks as Very Easy. Overall post-task rating scales scored over 4 points (on a scale of 1 to 5, 5 being “very easy”) for 6/9 tasks. The overall SUS score was 82.5 which is considered above average.

5.5 MAJOR FINDINGS

- Every task tested and measured using summative testing methods, were completed by the participants within the allocated target task time.
- The participants were able to navigate the user interface to accomplish the listed tasks without many erroneous detours or deviations from the optimal path.
- Across all tasks, the most frequent error that occurred was typos, especially when searching medication and lab orders.

5.6 AREAS OF IMPROVEMENT

- The number of steps needed to create or enter a medication order is still excessive, even though the participants were able to navigate the user interface within the acceptable number of steps.
- Create a “Select All” check box in CCDA import module for quick selection.
- In addition, we will re-examine our user testing scenarios to determine if changes are needed to more accurately reflect typical provider workflows.

6 Appendix: SYSTEM USABILITY SCALE QUESTIONNAIRE

In 1996, Brooke published a “low-cost usability scale that can be used for global assessments of systems usability” known as the System Usability Scale or SUS.¹⁶ Lewis and Sauro (2009) and others have elaborated on the SUS over the years. Computation of the SUS score can be found in Brooke’s paper, in at <http://www.usabilitynet.org/trump/documents/Suschart.doc> or in Tullis and Albert (2008).

1. I think that I would like to use this system frequently

1	2	3	4	5

2. I found the system unnecessarily complex

1	2	3	4	5

3. I thought the system was easy to use

1	2	3	4	5

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5

5. I found the various functions in this system were well integrated

1	2	3	4	5

6. I thought there was too much inconsistency in this system

1	2	3	4	5

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5

8. I found the system very cumbersome to use

1	2	3	4	5

9. I felt very confident using the system

1	2	3	4	5

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5