

Safety-enhanced design

Usability Report

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Executive Summary

A usability test of HealUs EHR version 1.0, an ambulatory EHRUT was conducted on between January 10th, 2024 and January 20th, 2024 by Medicare MSO support team. 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), that includes 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)(5) Demographics
- 170.315 (a)(9) Clinical decision support
- 170.315 (a)(14) Implantable device list
- 170.315 (b)(2) Clinical information reconciliation and incorporation

During the usability test, a total of 15 users including physicians, nurses and administrative staff members matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 21 individual tasks typically conducted on an EHRUT:

- Record Medication Order
- Modify Medication Order
- View Medication Order
- Record Lab Order
- Modify Lab Order
- View Lab Order
- Record Imaging Order
- Modify Imaging Order
- View Imaging Order
- Add Patient Demographics
- Modify Patient Demographics
- View Patient Demographics
- Configure the CDS rule
- View the triggered CDS rules for the patient
- Turn off clinical support reminders for Rare Diseases for all providers of the practice
- Record Implantable Device
- Inactivate Implantable Device
- View Implantable Device
- Import CCDA
- Perform reconciliation of Medications, Allergies and Problems

- Generate a new CCDA with reconciled data

During the 60 minutes one to one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent (included in Appendix 1); they were instructed that they could withdraw at any time. Most of the participants had prior experience with the software. 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 recorded user performance data electronically. The administrator did not give assistance to participants in how to complete the task. Participant screens and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant's verbalizations
- Participant'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. None of the participants were compensated for their participation. 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.

Task ID	Task	Number	Task Success		Path Deviation	Task Time			Errors	Task Ratings 5 = Very Easy
			Mean	SD		Mean	SD	Deviations (Observed / Optimal)		
	#				Deviations (Observed / Optimal)					
a1.1	Record Medication Order	15	100%	0.00	1.21	64.67	7.77	1.07	1 (6.25%)	4.67 (0.12)
a1.2	Modify Medication Order	15	100%	0.00	1.07	34.00	5.84	1.13	0	4.58 (0.28)
a1.3	View Medication Order	15	100%	0.00	1.03	32.76	4.23	1.09	0	4.66 (0.26)
a2.1	Record Lab Order	15	100%	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)
a2.2	Modify Lab Order	15	100%	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
a2.3	View Lab Order	15	100%	0.00	1.06	47.00	3.05	1.04	0	4.64 (0.30)
a3.1	Record Imaging Order	15	100%	0.00	1.28	64.67	15.26	1.07	0	4.60 (0.32)
a3.2	Modify Imaging Order	15	100%	0.00	1.12	46.67	2.58	1.03	0	4.65 (0.27)
a3.3	View Imaging Order	15	100%	0.00	1.06	32.33	5.18	1.07	0	4.82 (0.13)
a5.1	Add Patient Demographics	15	100%	0.00	1.2	128.00	11.66	1.42	0	4.9 (0.03)
a5.2	Modify Patient Demographics	15	100%	0.00	1.04	48.00	5.1	1.06	0	4.88 (0.05)
a5.3	View Patient Demographics	15	100%	0.00	1.03	51.00	6.63	1.13	0	4.95 (0.05)
a9.1	Configure the CDS rule.	15	100%	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
a9.2	View the triggered CDS rules for the patient.	15	100%	0.00	1.48	45.33	7.08	1.51	0	4.29 (0.22)
a9.3	Turn off clinical support reminders for Rare Diseases for all providers of the practice.	15	100%	0.00	1.26	85.33	7.20	1.42	0	4.34 (0.18)
a14.1	Record Implantable Device.	15	100%	0.00	1.24	49.00	2.00	1.08	1 (21.05%)	4.78 (0.04)
a14.2	Inactivate Implantable Device.	15	100%	0.00	1.17	45.33	1.25	1.00	0	4.85 (0.20)
a14.3	View Implantable Device.	15	100%	0.00	1.05	32.00	4.00	1.06	0	4.82 (0.25)
b2.1	Import CCDA.	15	100%	0.00	1.48	54.00	6.63	1.2	0	4.28 (0.34)
b2.2	Perform reconciliation of Medications, Allergies and Problems.	15	100%	0.00	1.78	79.33	11.82	1.31	1 (16.67%)	4.14 (0.32)
b2.3	Generate a new CCD with reconciled data.	15	100%	0.00	1.28	78.67	11.75	1.31	2 (11.76%)	4.10 (0.26)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 91.4%

Introduction

The EHRUT tested for this study was HealUs EHR v1.0. HealUs EHR is a comprehensive ambulatory EHR system, designed to serve as an all-in-one solution for various areas such as Electronic Health Record management, CPOE, Referral Management, Patient Portal, and Appointment Scheduling. 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, number of tasks successfully completed within the allotted time, time to complete the tasks, number and types of errors, path deviations etc. were captured during the usability testing.

The goal of testing this product was to assess its current interface, design, and functionalities, aligning with the **NISTIR 7741** usability standard. We considered product efficiency, user satisfaction, and system effectiveness throughout the evaluation process. Our endeavor was to conduct a fair experiment, ensuring that the results are both realistic and valid.

Name	NISTIR 7741
Description	NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records
Citation	NIST Interagency/Internal Report (NISTIR) - 7741 Schumacher, R. and Lowry, S. (2010), (NISTIR 7741) NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, NIST Interagency/Internal Report (NISTIR), National Institute of Standards and Technology, Gaithersburg, MD, [online], https://doi.org/10.6028/NIST.IR.7741 https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=907313

Method

Participants

Fifteen participants, including 10 physicians, 3 nurses, and 2 administrative staff members, were involved in testing the EHRUT(s). The physicians came from diverse specialties. Participant selection was managed by Medicare MSO, and all individuals volunteered for testing without compensation. Each participant received the same level of orientation and training as anticipated for actual end users.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the participant screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology. Participant names were replaced with Participant IDs so that an individual’s data cannot be tied back to individual identities.

#	Participant ID	Gender	Age	Education	Occupation/role	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
1	HU001	M	46	MD	Physician	20	22	4	None
2	HU002	M	36	MD	Physician	10	17	3	None
3	HU003	M	40	MD	Physician	14	19	5	None
4	HU004	M	43	MD	Physician	17	16	1	None
5	HU005	F	32	MD	Physician	8	10	6	None
6	HU006	M	55	MD	Physician	30	25	7	None
7	HU007	M	50	MD	Physician	25	24	1	None
8	HU008	M	53	MD	Physician	27	23	3	None
9	HU009	M	38	MD	Physician	13	10	2	None
10	HU010	F	31	MD	Physician	6	13	3	None
11	HU011	F	30	Master's Degree	Nurse Practitioner	15	9	2	None
12	HU012	F	42	Master's Degree	Licensed Practice Nurse (LPN)	19	18	1	None
13	HU013	F	32	Master's Degree	Licensed Practice Nurse (LPN)	7	10	3	None
14	HU014	M	30	Bachelor's Degree	Office Manager	5	8	1	None
15	HU015	M	36	Bachelor's Degree	Assistant Manager	12	12	5	None

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 an EHR, that is, with EHRUT. 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 (Average)

- Participant’s satisfaction ratings of the system

Tasks

The tasks provided were chosen to match the routine actions users perform within the EHR system. They were selected based on how often they're used, their criticality, and how challenging they may be for users.

Task ID #	Description	Reference
a1.1	Record Medication Order	§170.315(a)(1)
a1.2	Modify Medication Order	§170.315(a)(1)
a1.3	View Medication Order	§170.315(a)(1)
a2.1	Record Lab Order	§170.315(a)(2)
a2.2	Modify Lab Order	§170.315(a)(2)
a2.3	View Lab Order	§170.315(a)(2)
a3.1	Record Imaging Order	§170.315(a)(3)
a3.2	Modify Imaging Order	§170.315(a)(3)
a3.3	View Imaging Order	§170.315(a)(3)
a5.1	Add Patient Demographics	§170.315(a)(5)
a5.2	Modify Patient Demographics	§170.315(a)(5)
a5.3	View Patient Demographics	§170.315(a)(5)
a9.1	Configure the CDS rule	§170.315(a)(9)
a9.2	View the triggered CDS rules for the patient	§170.315(a)(9)
a9.3	Turn off clinical support reminders for Rare Diseases for all providers of the practice	§170.315(a)(9)
a14.1	Record Implantable Device	§170.315(a)(14)
a14.2	Inactivate Implantable Device	§170.315(a)(14)
a14.3	View Implantable Device	§170.315(a)(14)
b2.1	Import CCDA	§170.315(b)(2)
b2.2	Perform reconciliation of Medications, Allergies and Problems	§170.315(b)(2)
b2.3	Generate a new CCD with reconciled data	§170.315(b)(2)

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 a Non-Disclosure Agreement and Informed Consent form (Appendix 1).

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. 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 the task success, path deviations, number and type of errors, and comments.

Participants were given these general instructions before performing the tasks:

- Complete all the tasks as quickly as possible, making as few errors and deviations as possible.
- Complete all the tasks without assistance; administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use.
- Complete all the tasks 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.

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

Following the session, the administrator gave the participant the post-test questionnaire and System Usability Scale (Appendix 4 and Appendix 5) and thanked each individual for their participation.

Test Location

The testing facility comprised a waiting area and a dedicated quiet testing room equipped with a table for the participant, a computer, and a separate recording computer for the administrator. Only the participant and administrator were present in the test room. Meanwhile, all observers and the data logger operated from a separate room with a clear view of the participant's screen. To ensure user comfort, noise levels were carefully controlled to a minimum, and the ambient temperature was maintained within a comfortable range. Additionally, all safety instructions and evacuation procedures were prominently displayed and readily accessible to participants.

Test Environment

The EHRUT would be typically be used in a healthcare office or facility. For testing purposes, participants utilized a Desktop PC equipped with the Windows operating system. Interactions with the System Under Test (SUT) were facilitated using a mouse and keyboard. During the HealUs EHR usability testing, a 19-inch display monitor with a screen resolution ranging from 1280 to 1600 was employed. The application was setup by the HealUs EHR Development Team to align with the requirements of each task. The application ran seamlessly on the Chrome web browser, leveraging a high-speed internet connection. The system's performance, notably its response time, accurately mirrored what real users would encounter during field implementation. Additionally, participants were instructed not to alter any default system settings.

Test Forms and Tools

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

- Informed Consent & Non-Disclosure Agreement
- Demographic Information Form
- Usability Testing Scenarios and Moderator's Guide

- Post Test Questionnaire
- System Usability Scale Questionnaire
- Excel Spreadsheet (Data Logging)
- SLI SED checklist validator

Examples of these documents can be found in Appendices 1-5 respectively.

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

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

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

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

Participants were given 21 tasks to complete.

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 this test were to assess:

- Effectiveness of HealUs EHR v1.0 by measuring participant success rates and errors.
- Efficiency of HealUs EHR v1.0 by measuring the average task time and path deviations.
- Satisfaction with HealUs EHR v1.0 by measuring ease of use ratings.

Data Scoring

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

Measures	Rationale and Scoring
<p>Effectiveness: Task Success</p>	<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 some factor that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 'x' seconds then allotted task time performance was x* some factor seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</p>
<p>Effectiveness: Task Failures</p>	<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 a “Failure.”</p> <p>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. This should also be expressed as the mean number of failed tasks per participant.</p> <p>On a qualitative level, an enumeration of errors and error types should be collected.</p>
<p>Efficiency: Task Deviations</p>	<p>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.</p> <p>It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.</p>

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 the tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	Participant’s subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate “Overall, this task was:” on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants. A common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants’ confidence in and likeability of the HealUS EHR v1.0 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.”

Results

Data Analysis and Reporting

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above.

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

Task ID	Task	Number	Task Success		Path Deviation	Task Time			Errors	Task Ratings 5 = Very Easy
			Mean	SD		Mean	SD	Deviations (Observed / Optimal)		
	#				Deviations (Observed / Optimal)					
a1.1	Record Medication Order	15	100%	0.00	1.21	64.67	7.77	1.07	1 (6.25%)	4.67 (0.12)
a1.2	Modify Medication Order	15	100%	0.00	1.07	34.00	5.84	1.13	0	4.58 (0.28)
a1.3	View Medication Order	15	100%	0.00	1.03	32.76	4.23	1.09	0	4.66 (0.26)
a2.1	Record Lab Order	15	100%	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)
a2.2	Modify Lab Order	15	100%	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
a2.3	View Lab Order	15	100%	0.00	1.06	47.00	3.05	1.04	0	4.64 (0.30)
a3.1	Record Imaging Order	15	100%	0.00	1.28	64.67	15.26	1.07	0	4.60 (0.32)
a3.2	Modify Imaging Order	15	100%	0.00	1.12	46.67	2.58	1.03	0	4.65 (0.27)
a3.3	View Imaging Order	15	100%	0.00	1.06	32.33	5.18	1.07	0	4.82 (0.13)

a5.1	Add Patient Demographics	15	100%	0.00	1.2	128.00	11.66	1.42	0	4.9 (0.03)
a5.2	Modify Patient Demographics	15	100%	0.00	1.04	48.00	5.1	1.06	0	4.88 (0.05)
a5.3	View Patient Demographics	15	100%	0.00	1.03	51.00	6.63	1.13	0	4.95 (0.05)
a9.1	Configure the CDS rule.	15	100%	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
a9.2	View the triggered CDS rules for the patient.	15	100%	0.00	1.48	45.33	7.08	1.51	0	4.29 (0.22)
a9.3	Turn off clinical support reminders for Rare Diseases for all providers of the practice.	15	100%	0.00	1.26	85.33	7.20	1.42	0	4.34 (0.18)
a14.1	Record Implantable Device.	15	100%	0.00	1.24	49.00	2.00	1.08	1 (21.05%)	4.78 (0.04)
a14.2	Inactivate Implantable Device.	15	100%	0.00	1.17	45.33	1.25	1.00	0	4.85 (0.20)
a14.3	View Implantable Device.	15	100%	0.00	1.05	32.00	4.00	1.06	0	4.82 (0.25)
b2.1	Import CCDA.	15	100%	0.00	1.48	54.00	6.63	1.2	0	4.28 (0.34)
b2.2	Perform reconciliation of Medications, Allergies and Problems.	15	100%	0.00	1.78	79.33	11.82	1.31	1 (16.67%)	4.14 (0.32)
b2.3	Generate a new CCD with reconciled data.	15	100%	0.00	1.28	78.67	11.75	1.31	2 (11.76%)	4.10 (0.26)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 91.4%. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Discussion of the Findings

The participants actively engaged in the tests, demonstrating a clear understanding of the underlying objectives. Their primary emphasis was on assessing the performance and usability of the HealUs EHR product and its associated workflows. Additionally, participants conducted comparative evaluations between the HealUs EHR system and their prior experiences with other EHR systems. All test results were recorded, and the methods specified in the Usability Metric sections were applied for the calculation of the test results.

Major Findings

Some users took a little extra time on Clinical Information Reconciliation during the import of the CCDA file. Overall, participants found the system to be user-friendly with seamless navigation within the tested workflows. They added how various approaches, such as the use of hovering to view details and the clear indication of mandatory fields, enhanced their experience by simplifying the tested workflows. The design and well-organized structure of different modules within the HealUs EHR system received praise and commendation from the participants.

Areas for Improvement

While participants expressed satisfaction with the usability of HealUs EHR design and workflow during the testing sessions, they also identified areas for improvement. Specifically, participants highlighted the need for increased information density within the interface to enhance productivity. Decreasing the size of widgets and fonts would enable more information to be displayed in a single view, thereby improving the user's ability to access relevant data quickly. This optimization would streamline workflows and reduce the need for scrolling or navigation, ultimately leading to a more efficient user experience.

Effectiveness

Based on the success, failure and path deviation data, users found the HealUs EHR v1.0 system to be very effective. Knowing that most of the participants were experienced EHR users, the workflows seemed very familiar, marked by well-organized sections that facilitated each process with commendable efficiency. The less experienced participants admired how guidelines within the system was provided for any missing information during the addition of the Medication and Demographic Information. This resulted in minimal path deviation for all participants.

Efficiency

Based on the observations of the task time and deviation data, all participants were able to complete most of the tasks within time. Participants added how the user interface was easy to use and the processes were clearly understood by them. As a result, smooth navigation for adding/viewing and retrieving information was attained. Participants noted that the Imaging Order, Lab Order and Medication processes were relatively time-consuming due to various mandatory fields that were needed to be filled. The participants were then informed that the fields had been made mandatory in order to ensure complete information is saved and any potential discrepancies are avoided in the future.

Satisfaction

Overall, the EHRUT demonstrated exceptional performance during the usability testing. Participants efficiently and effectively completed most tasks, reporting a high level of satisfaction. The System Usability Scale (SUS) results yielded a score of 91.4%, indicating favorable subjective satisfaction with the system's performance across these tasks.

Participant Identifier	Overall Task Rating – Scale Type	Task Rating
HU001	System Usability Scale	90
HU002	System Usability Scale	92
HU003	System Usability Scale	96
HU004	System Usability Scale	90
HU005	System Usability Scale	90
HU006	System Usability Scale	100

HU007	System Usability Scale	89
HU008	System Usability Scale	87
HU009	System Usability Scale	92
HU010	System Usability Scale	94
HU011	System Usability Scale	82
HU012	System Usability Scale	85
HU013	System Usability Scale	80
HU014	System Usability Scale	84
HU015	System Usability Scale	89
Average:		91.4%

Appendices

Appendix 1: Non- Disclosure Agreement and Informed Consent Form

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of January 10, 2024, between (“the Participant”) and the testing organization, Medicare MSO located at 150 Washington Avenue Suite 201, Santa Fe, NM 87501.

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

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

Any information the Participant acquires relating to this product during this study is confidential and proprietary to Medicare MSO and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study. By signing this form, the Participant acknowledges that s/he will not disclose this confidential information obtained today to anyone else or any other organizations.

Participant’s Name: _____

Signature: _____

Date: _____

Informed Consent

MedcareMSO would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about 60 minutes.

Agreement

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

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

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

I understand and agree that the data collected from this study may be shared with outside of Medcare MSO and Medcare MSO’s client. I understand and agree that data confidentiality is assured, because only deidentified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

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

Please check one of the following:

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

Signature: _____

Date: _____

Appendix 2: Participant Demographics

Gender	
Men	10
Women	5
Total Participants	15
Occupation / Role	
Medical Doctor	10
Nurse Practitioner	1
Licensed Practical Nurse (LPN)	2
Administrative Staff	2
Total Participants:	15
Years of Professional Experience	
0-5	1
6-10	4
11-20	7
20+	3
Total Participants:	15
Years of Technology Experience	
0-5	0
6-10	5
10+	10
Total Participants:	15
Facility Use of EHR	
All Paper	0
All Electronic	15
Some Paper, Some Electronic	0
Total Participants:	15

Appendix 3: Usability Testing Scenarios and Moderator’s Guide

Administrator: _____
 Data Logger: _____
 Date Time: _____
 Participant #: _____
 Location: _____

Prior to Testing

The timing schedule for the testing process was confirmed with the participants as well as the testing team. The testing environment was made sure to comply with the environment guidelines specified in the previous (Test Environment) section.

Prior to each Participant

The application was reset before the session. All recording tools were set to record once the participant joined.

Prior to each Task

The application was reset to the starting point for the relevant task.

After all Testing

All of the recorded videos and data files were stored as back up.

Orientation

Thank you for participating in this study. Our session today will last about an hour. During that time, you will take a look at an electronic health record system i.e. HealUs EHR V1.0

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

I did not have any involvement in its development, so please be honest with your opinions. We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?”

Preliminary Questions:

The following questions were asked for every participant

- What is your job title / appointment?
- How long have you been working in this role?
- What are some of your main responsibilities?
- Tell me about your experience with electronic health records.

Task a1.1: Record Medication Order

Prescribe a medication with the below details:

Drug Name: Fareston tablet

Strength: 60 mg

Quantity: 1

Unit: Tablet

Route: Oral

Frequency: Once a day

Days Supply: 1

Refill: 0

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Medications>Click on Add Prescription Widget > Select mentioned medication with the provided details> Click on Review button> Click on Add Prescription button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a1.2: Modify Medication Order

Once the medication is prescribed, change the frequency from ‘Once a day’ to ‘at bedtime’.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Medications> Click on Prescribed Medication > Change frequency from ‘Once a day’ to ‘at bedtime’ > Click on Review button> Click on Update Prescription button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a1.3: View Medication Order

View Patient’s updated prescribed medicatio.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Medications

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a2.1: Record Lab Order

Record Lab Order for the patient with the below details:

Test: CBC With Differential/Platelet

Priority: Routine

Fasting: Yes

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Laboratory>Click on Add Lab Order button > Select mentioned test with the provided details> Click on Save button

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a2.2: Modify Lab Order

After recording the lab order, associate ‘Diabetes’ as the diagnosis with the ordered test.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Laboratory > Click on Ordered lab test > Select Diabetes in the Diagnosis field> Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a2.3: View Lab Order

View the updated lab order.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Select Patient> Click on Laboratory

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a3.1: Record Imaging Order

Record Imaging Order for the patient with the below details:

Test: CHEST X-RAY, 2 Views Chest

Reason: The patient is suffering from a persistent cough with accompanying chest congestion.

Priority: Urgent

Fasting: No

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Imaging>Click on Add Imaging Order button > Select mentioned test with the provided details> Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a3.2: Modify Imaging Order

After recording the Imaging order, associate ‘Cough’ as the diagnosis with the ordered test.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Imaging > Click on Ordered Imaging test > Select ‘Cough’ in the diagnosis field> Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a3.3: View Imaging Order

View the updated Imaging order.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Select Patient> Click on Imaging.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a5.1: Add Patient Demographics

Add a new patient with the below details:

First Name: John

Last Name: Doe

Date of Birth: 01/01/2000

Gender: Male

Gender Identity: Male

Sexual Orientation: Straight

Race: Black or African American

Ethnicity: Not Hispanic or Latino

Preferred Language: English

a. Task Success:

Easily Completed

Completed with difficulty or help (Describe: _____)

Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Click on Add Patient> Provide all the mentioned information in the relevant fields > Click on Save button.

Correct

Minor Deviations (Describe: _____)

Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a5.2: Modify Patient Demographics

Update the below demographic details of the added patient:

Sexual Orientation: Choose not to disclose

Race: White

Ethnicity: Hispanic or Latino

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Added Patient > Update the mentioned information in the relevant fields > Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a5.3: View Patient Demographics

View the updated demographics details of the newly added patient.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Click on the Patients > Click on the Added Patient

Correct

Minor Deviations (Describe: _____)

Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

Very Easy

Easy

Fair

Difficult

Very Difficult

e. Administrator Comments:

Task a9.1: Configure the CDS Rule.

Configure the rule with the below information:

Title: Diabetes Management Reminder

Effective From: 01/01/2024

Effective To: 12/31/2024

Frequency: Every 6 months

Demographics: Age > 18 - 75 years

Problem: Code > E11.0 - Diabetes Mellitus

Intervention Type: Medications

Intervention Note: Check medication adherence and adjust dosage if necessary.

Bibliographic Citation: American Diabetes Association Guidelines

Developer: HealUS EHR

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Settings > Click on the Clinical Decision Support> Click on the Add Rule> Provide all the above-mentioned information in the relevant fields> Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a9.2: View the triggered CDS rule for the patient.

After adding the problem E11.0 - Diabetes Mellitus for the 21 years old patient, navigate to the patient's summary, and review triggered CDS Rule: Diabetes Management Reminder.

Check if sources and reference material is available for sharing with the patient.

Mark the alert as completed by selecting the 'Completed' radio button.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Patients > Click on the Patient with the age 18 to 75 years > Click on the Problems> Click on Add button> Search and Select E11.0 - Diabetes Mellitus> Click on Save button> Click on the Summary> Click on the triggered CDS Alert.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a9.3: Turn off clinical support reminders for Rare Diseases for all providers of the practice.

Deactivate the Rare Diseases clinical support reminder for the practice.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)

Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Click on the Settings > Click on the Clinical Decision Support> Click on the Rare Diseases clinical support reminder> Click on the Deactivate button.

Correct

Minor Deviations (Describe: _____)

Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

Very Easy

Easy

Fair

Difficult

Very Difficult

e. Administrator Comments:

Task a14.1: Record Implantable Device

Add an implantable device for the patient during cardiac surgery procedure.

UDI: (01)00643169007222(17)160128(21)BLC200461H

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Patients > Select Patient > Click on the Implantable Devices > Click on the Add Device button > Provide UDI in the relevant field > Click on the Device Details button > Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a14.2: Inactivate Implantable Device.

Inactivate the newly added implantable device for the patient.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Patients > Select Patient > Click on the Implantable Devices > Click on the newly Added Implantable Device > Uncheck the Active checkbox > Click on Save button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task a14.3: View Implantable Device

View the inactivated implantable device.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Click on the Patients > Select Patient > Click on the Implantable Devices > Click on the Inactive Tab.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task b2.1: Import CCDA.

Import received Transition of Care Summary for a patient as a CCDA file.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Import Patient quick link > Select Location > Select Provider > Attach CCDA file > Click on Upload Button > Click on Import button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task b2.2: Perform reconciliation of Medications, Allergies and Problems.

Reconcile and incorporate all the imported allergies, problems, and medications from the C-CDA file to the patient record.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on the Patient > Click on the Transition of Care node > Click on the Reconcile button of the Imported CCDAs > Click on Approve All checkbox > Click on Sign button.

- Correct
- Minor Deviations (Describe: _____)
- Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

- Very Easy
- Easy
- Fair
- Difficult
- Very Difficult

e. Administrator Comments:

Task b2.3: Generate a new CCD with reconciled data.

Generate a new Continuity of Care Document after reconciling and incorporating the imported data.

a. Task Success:

- Easily Completed
- Completed with difficulty or help (Describe: _____)
- Not Completed

Comments:

b. Task Time:

_____ Seconds

c. Optimal Path:

Click on the Patient > Click on the Transition of Care node > Click on the Outgoing tab > Click on the Export CCDA button > Click on the CCD option > Click on Export button.

Correct

Minor Deviations (Describe: _____)

Major Deviations (Describe: _____)

Comments:

d. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

Very Easy

Easy

Fair

Difficult

Very Difficult

e. Administrator Comments:

Appendix 4: Post Test Questionnaire

After completing the test, the participants were asked the following questions:

- What was your overall impression of this system?
- What aspects of the system did you like most?
- What aspects of the system did you like least?
- Were there any features that you were surprised to see?
- What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?
- Compare this system to other systems you have used. Would you recommend this system to your colleagues?

Appendix 5: System Usability Scale Questionnaire

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