

Safety-enhanced design

Usability Report

Report Based On:
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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)
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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.” 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>
<p>Efficiency: Task Time</p>	<p>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.</p>
<p>Satisfaction: Task Rating</p>	<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. 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.”</p>

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

MedicareMSO 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 Medicare 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 Medicare MSO.

I understand and consent to the use and release of the videotape by Medicare 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 Medicare 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 Medicare MSO and Medicare 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 CCDA > 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.					

Safety-enhanced design

Usability Report

- 170.315 (a)(4) Drug-drug, drug-allergy interaction checks for CPOE
- 170.315 (b)(3) Electronic prescribing

Report Based On:
ISO/IEC 25062 : 2006 Common Industry Format
for Usability Test Reports



Date of Usability Test:
January 15, 2025 - January 17, 2025

Date of Report:
January 18, 2025

Report Prepared By:
Medcare MSO



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Executive Summary

A usability test for HealUs EHR Version 1.0, an ambulatory Electronic Health Record (EHR) System, was conducted by the Medicare MSO Support Team from January 15, 2025, to January 17, 2025. The objective of this test was to assess and validate the usability of the current user interface and to provide evidence of usability for the EHR Under Test (EHRUT). The test specifically focused on evaluating the system's compliance with the following certification criteria:

- 170.315 (a)(4) Drug-drug, drug-allergy interaction checks for CPOE
- 170.315 (b)(3) Electronic Prescribing

During the usability test, a total of 15 participants, including physicians, nurses, and administrative staff, all of whom matched the target demographic criteria, engaged with the EHR Under Test (EHRUT). They completed a series of simulated tasks that were representative of typical real-world usage.

The study focused on collecting performance data for 9 core tasks commonly performed in an EHRUT:

- Evaluate and Address Drug-Allergy interaction alert for Aspirin and Ibuprofen
- Evaluate and Address Drug-Drug interaction alert for Azithromycin and Digoxin
- Generate new prescription
- Cancel Prescribed Medication
- Review Pending Prescriptions
- Review and Respond to Renewal Request
- Review and Respond to Change Request
- Request and review fill status
- Request Medication History

During the 60-minute, one-on-one usability test, each participant was greeted by the administrator and asked to review and sign the informed consent form (see Appendix 1). They were also informed that participation was voluntary, and they could withdraw at any time. Most participants had prior experience with the software.

The administrator provided an introduction to the test and instructed participants to complete a series of tasks, presented one at a time, using the EHR Under Test (EHRUT). Throughout the session, the administrator timed the test and electronically recorded user performance data. No assistance was provided in completing the tasks. To ensure accurate analysis, participant screens and audio were recorded for later review.

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, ensuring that no personal identifying information could be linked to the collected data. Upon completing the testing, participants were asked to fill out a post-test questionnaire. None of the participants received compensation for their involvement. To evaluate the usability of the EHR Under Test (EHRUT), various recommended metrics were applied, in line with the guidelines outlined in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records. Below is a summary of the performance and rating data collected during the test.

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)					
a4.1	Evaluate and Address Drug-Allergy interaction alert for Aspirin and Ibuprofen	15	100 %	0.00	1.28	64.67	15.26	1.07	0	4.60 (0.32)
a4.2	Evaluate and Address Drug-Drug interaction alert for Azithromycin and Digoxin	15	100 %	0.00	1.78	79.33	11.82	1.31	1 (16.67 %)	4.14 (0.32)
b3.1	Generate new prescription	15	100 %	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)
b3.2	Cancel Prescribed Medication	15	100 %	0.00	1.03	51.00	6.63	1.13	0	4.95 (0.05)
b3.3	Review Pending Prescriptions	15	100 %	0.00	1.04	48.00	5.1	1.06	0	4.88 (0.05)
b3.4	Review and Respond to Renewal Request	15	100 %	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
b3.5	Review and Respond to Change Request	15	100 %	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
b3.6	Request and review fill status	15	100 %	0.00	1.12	46.67	2.58	1.03	0	4.65 (0.27)
b3.7	Request Medication History	15	100 %	0.00	1.06	32.33	5.18	1.07	0	4.82 (0.13)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 90.2%

Introduction

The EHR Under Test (EHRUT) for this study was HealUs EHR v1.0, a comprehensive ambulatory Electronic Health Record system designed to provide an all-in-one solution for areas such as Electronic Health Record management, CPOE, Referral Management, Patient Portal, and Appointment Scheduling. The usability testing was designed to simulate realistic tasks and conditions.

The purpose of this study was to evaluate and validate the usability of the current user interface and to provide evidence of its usability. To achieve this, we measured effectiveness, efficiency, and user satisfaction through metrics including the number of tasks successfully completed within the allotted time, time taken to complete tasks, error frequency and types, and any path deviations observed during the testing.

The primary goal of this evaluation was to assess the system’s current interface, design, and functionality, in accordance with the **NISTIR 7741 usability standards**. Throughout the testing, we focused on evaluating product efficiency, user satisfaction, and overall system effectiveness. Our aim was to conduct a fair and objective experiment, ensuring that the results were 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

A total of 15 participants took part in testing the EHR Under Test (EHRUT), including 9 physicians, 4 nurses, and 2 administrative staff members. The physicians represented a range of specialties. Participant recruitment was managed by Medicare MSO, and all participants volunteered without compensation. Each participant received an orientation and training session tailored to the level of support expected for actual end users.

The recruited participants had diverse backgrounds and demographic characteristics, in line with the criteria outlined in the participant screener. Below is a table detailing the participants' characteristics, including demographics, professional experience, computing proficiency, and any

needs for assistive technology. To ensure confidentiality, participant names were replaced with Participant IDs, ensuring that no individual data could be traced back to their identities.

#	Participant ID	Gender	Age	Education	Occupation/role	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
1	U001	M	46	MD	Physician	18	22	4	None
2	U002	M	36	MD	Physician	8	17	3	None
3	U003	M	42	MD	Physician	16	19	5	None
4	U004	M	43	MD	Physician	17	16	1	None
5	U005	F	32	MD	Physician	8	10	6	None
6	U006	M	57	MD	Physician	32	25	7	None
7	U007	F	50	MD	Physician	25	24	1	None
8	U008	M	53	MD	Physician	27	23	3	None
9	U009	M	32	MD	Physician	11	10	2	None
10	U010	F	31	Master’s Degree	Nurse Practitioner	6	4	3	None
11	U011	F	30	Master’s Degree	Nurse Practitioner	15	9	2	None
12	U012	F	40	Master’s Degree	Licensed Practice Nurse (LPN)	19	18	1	None
13	U013	F	32	Master’s Degree	Licensed Practice Nurse (LPN)	7	10	3	None
14	U014	M	28	Bachelor’s Degree	Office Manager	5	5	1	None
15	U015	M	33	Bachelor’s Degree	Assistant Manager	10	8	5	None

Study Design

The primary objective of this test was to identify areas where the application excelled—specifically in terms of effectiveness, efficiency, and user satisfaction—and areas where it fell short of meeting the participants' needs. The data collected from this test can serve as a baseline for future assessments of updated versions of the same EHR, or for comparisons with other EHR systems, provided the same tasks are used. In essence, this testing serves both to establish a benchmark for current usability and to pinpoint areas where improvements are needed.

Throughout the usability test, participants interacted with the EHR Under Test (EHRUT). Each participant used the system in a consistent environment and received the same set of instructions. The system was evaluated based on effectiveness, efficiency, and satisfaction, as measured by specific metrics that were 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 selected for the test were designed to reflect the routine actions that users typically perform within the EHR system. These tasks were chosen based on their frequency of use, their importance to the system's core functionality, and the potential challenges they may present to users.

Task ID #	Description	Reference
a4.1	Evaluate and Address Drug-Allergy interaction alert for Aspirin and Ibuprofen	§170.315(a)(4)
a4.2	Evaluate and Address Drug-Drug interaction alert for Azithromycin and Digoxin	§170.315(a)(4)
b3.1	Generate new prescription	§170.315(b)(3)
b3.2	Cancel Prescribed Medication	§170.315(b)(3)
b3.3	Review Pending Prescriptions	§170.315(b)(3)
b3.4	Review and Respond to Renewal Request	§170.315(b)(3)
b3.5	Review and Respond to Change Request	§170.315(b)(3)
b3.6	Request and review fill status	§170.315(b)(3)
b3.7	Request Medication History	§170.315(b)(3)

Procedures

Upon arrival, participants were greeted, and their identities were verified against the participant schedule. Each participant was then assigned a unique participant ID. Participants reviewed and signed the Non-Disclosure Agreement and Informed Consent forms (Appendix 1).

To ensure the test ran smoothly, two staff members were involved: the usability administrator and the data logger. The administrator moderated the session, providing instructions and overseeing

task execution. Additionally, the administrator tracked task times, collected post-task rating data, and took notes on participant comments. The data logger, on the other hand, recorded task success rates, path deviations, error types and counts, as well as participant feedback.

Before starting the tasks, participants were given the following general instructions:

- Complete all tasks as quickly as possible, minimizing errors and deviations.
- Perform all tasks independently; the administrator could offer minimal guidance or clarification but not instructions on how to use the system.
- Do not use the think-aloud technique during the tasks.

For each task, participants were provided with a written copy of the task instructions. Task timing began once the administrator finished reading the task and was stopped when the participant indicated they had successfully completed it.

Data collected during the test included participants' demographic information, task success rates, task completion times, errors, deviations, verbal responses, and post-test questionnaire responses, all of which were recorded in a spreadsheet.

At the end of the session, the administrator provided participants with the post-test questionnaire and the System Usability Scale (Appendix 4 and Appendix 5) and thanked them for their participation.

Test Location

The testing facility consisted of a waiting area and a dedicated, quiet testing room. The test room was equipped with a table for the participant, a computer for task completion, and a separate recording computer for the administrator. Only the participant and administrator were present in the testing room, while observers and the data logger operated from a separate room that offered a clear view of the participant's screen.

To ensure a comfortable environment, noise levels were minimized, and the ambient temperature was maintained at a comfortable level. Additionally, all safety instructions and evacuation procedures were clearly displayed and easily accessible to participants.

Test Environment

The EHR Under Test (EHRUT) is typically used in a healthcare office or facility. For the purpose of this testing, participants interacted with a desktop PC running the Windows operating system. Interactions with the system 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 used. The application was configured by the HealUs EHR Development Team to meet the specific requirements of each task. The system ran smoothly on the Chrome web browser, supported by a high-speed internet connection. The system's performance, particularly its response time, accurately reflected the experience real users would encounter during field deployment. Participants were also instructed not to modify 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 9 tasks to complete.

Usability Metrics

According to the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, EHRs should be designed to support processes that ensure a high level of usability for all users. The goal is for users to interact with the system in a way that is effective, efficient, and provides an acceptable level of satisfaction. To achieve this, metrics related to effectiveness, efficiency, and user satisfaction were collected 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.” 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>
<p>Efficiency: Task Time</p>	<p>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.</p>
<p>Satisfaction: Task Rating</p>	<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. 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.”</p>

Results

Data Analysis and Reporting

The results of the usability test were calculated using the methods outlined in the Usability Metrics section above. The findings for the EHR Under Test (EHRUT) are presented below. These results should be interpreted in the context of the objectives and goals outlined in the Study Design section. The data provides actionable insights that, if addressed, could lead to significant improvements in 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)		
	#		Mean	SD	Deviations (Observed / Optimal)	Mean	SD	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)
a4.1	Evaluate and Address Drug-Allergy interaction alert for Aspirin and Penicillin	15	100 %	0.00	1.28	64.67	15.26	1.07	0	4.60 (0.32)

a4.2	Evaluate and Address Drug-Drug interaction alert for Azithromycin and Digoxin	15	100 %	0.00	1.28	64.67	15.26	1.07	0	4.60 (0.32)
b3.1	Generate new prescription	15	100 %	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)
b3.2	Cancel Prescribed Medication	15	100 %	0.00	1.03	51.00	6.63	1.13	0	4.95 (0.05)
b3.3	Review Pending Prescriptions	15	100 %	0.00	1.04	48.00	5.1	1.06	0	4.88 (0.05)
b3.4	Review and Respond to Renewal Request	15	100 %	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
b3.5	Review and Respond to Change Request	15	100 %	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
b3.6	Request and review fill status	15	100 %	0.00	1.12	46.67	2.58	1.03	0	4.65 (0.27)
b3.7	Request Medication History	15	100 %	0.00	1.06	32.33	5.18	1.07	0	4.82 (0.13)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 90.2%. 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 strong understanding of the objectives. Their primary focus was on evaluating the performance and usability of the HealUs EHR system and its associated workflows. In addition, participants performed comparative evaluations, contrasting their experience with HealUs EHR against prior encounters with other EHR systems. All test results were meticulously recorded, and the methods outlined in the Usability Metrics section were applied to calculate the final results.

Major Findings

During the usability testing, participants found the system to be user-friendly, with easy navigation between prescribing tasks and interaction checks. The real-time alerts for drug-drug and drug-allergy interactions were praised for enhancing patient safety, although users suggested adding more context to the alerts to improve understanding.

Areas for Improvement

While participants praised the overall usability and design of the Electronic Prescribing and Interaction checks, they also identified areas for improvement. One key suggestion was to enhance the detail provided in the interaction alerts, as participants felt that more context within the alerts would help them make more informed decisions. Additionally, some users experienced delays

when processing multiple prescriptions, indicating that optimizing system speed for larger data sets would improve efficiency.

Effectiveness

Based on the success, failure, and path deviation data, users found the HealUs EHR v1.0 system to be highly effective in terms of UCD principles. Most participants, being experienced EHR users, appreciated the system's workflows, which closely aligned with familiar practices. This organization promoted efficiency, reducing the likelihood of errors.

For less experienced users, the safety features were particularly beneficial. The system's built-in guidelines during prescription entry ensured missing or incorrect information was flagged immediately. Additionally, the integrated drug allergy and drug-drug interaction checks provided real-time alerts, preventing potential adverse events. These features reduced cognitive load, guiding users through the process and preventing critical mistakes. As a result, path deviation remained minimal for all users.

Efficiency

Based on the observations of task time and deviation data, all participants were able to complete most of the tasks within the expected time frame. Participants mentioned that the user interface was intuitive, and the processes were easy to understand. As a result, smooth navigation for managing the prescriptions was achieved. However, some participants noted that the additional checks for drug allergies and drug-drug interactions took a bit more time for adding the prescriptions. While these checks were seen as important for patient safety, they added a step to the process. Participants were informed that these safety features were incorporated deliberately to ensure that potential adverse events or drug interactions were flagged in real time, ultimately improving the safety and accuracy of the prescription. Despite the added time for these checks, participants acknowledged that the trade-off between efficiency and safety was valuable for avoiding future discrepancies or harmful interactions.

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 90.2%, indicating favorable subjective satisfaction with the system's performance across these tasks.

Participant Identifier	Overall Task Rating – Scale Type	Task Rating
U001	System Usability Scale	93
U002	System Usability Scale	91
U003	System Usability Scale	89
U004	System Usability Scale	92

U005	System Usability Scale	98
U006	System Usability Scale	94
U007	System Usability Scale	86
U008	System Usability Scale	87
U009	System Usability Scale	91
U010	System Usability Scale	96
U011	System Usability Scale	86
U012	System Usability Scale	93
U013	System Usability Scale	84
U014	System Usability Scale	89
U015	System Usability Scale	85
Average:		90.2%

Appendices

Appendix 1: Non- Disclosure Agreement and Informed Consent Form

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of January 15, 2025, 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

MedicareMSO 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 Medicare 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 Medicare MSO.

I understand and consent to the use and release of the videotape by Medicare 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 Medicare 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 Medicare MSO and Medicare 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	9
Women	6
Total Participants	15
Occupation / Role	
Medical Doctor	9
Nurse Practitioner	2
Licensed Practical Nurse (LPN)	2
Administrative Staff	2
Total Participants:	15
Years of Professional Experience	
0-5	1
6-10	5
11-20	6
20+	3
Total Participants:	15
Years of Technology Experience	
0-5	2
6-10	5
10+	8
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 testing schedule was confirmed with both the participants and the testing team. Additionally, the testing environment was carefully set up to comply with the guidelines outlined in the 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 prior to the session, and all recording tools were activated once the participant joined.

After all Testing

All recorded videos and data files were securely stored as backups.

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 a4.1: Evaluate and Address Drug-Allergy interaction alert for Aspirin and Ibuprofen

Evaluate and address drug-allergy alerts for Aspirin and Ibuprofen to ensure patient safety.

Drug Name: Ibuprofen tablet

Strength: 200 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 with the Aspirin allergy> Click on Medication > Click on Manage button > Click on Create New Rx button > Select mentioned medication with the provided details> Click on Review button> Click on Acknowledge Alerts button after evaluating the interaction 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 a4.2: Evaluate and Address Drug-Drug interaction alert for Azithromycin and Digoxin

Evaluate and address Drug-Drug alerts for Azithromycin and Digoxin to ensure patient safety.

Prescription#1:

Drug Name: Azithromycin tablet

Strength: 250 mg

Quantity: 1

Unit: Tablet

Route: Oral

Frequency: Once a day

Days Supply: 1

Refill: 0

Prescription#2:

Drug Name: Digoxin tablet

Strength: 0.25 mg

Quantity: 1

Unit: Tablet

Route: Oral

Frequency: Once a day

Days Supply: 1

Refill: 0

c. Task Success:

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

Comments:

d. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Medications>Click on Manage button > Click on Create New Rx button > Select mentioned medication with the provided details> Click on Review button> Click on Save and Add Rx button > Click on Prescription Summary link> Provide Signature Password > Click on Send button.

Click on Create New Rx button again > Select mentioned medication with the provided details> Click on Review button> Click on Acknowledge Alerts button after evaluating the drug-drug interaction 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 b3.1: Generate new prescription

Prescribe a medication with the below details:

Drug Name: Azithromycin tablet

Strength: 500 mg

Quantity: 1

Unit: Tablet

Route: Oral

Frequency: Once a day

Days Supply: 1

Refill: 0

c. Task Success:

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

Comments:

d. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient> Click on Medications>Click on Manage button > Click on Create New Rx button> Select mentioned medication with the provided details> Click on Review button> Click on Save and Add Rx button > Click on Prescription Summary link> Provide Signature Password > Click on Send button.

- Correct

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

Comments:

f. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

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

g. Administrator Comments:

Task b3.2: Cancel Prescribed Medication

Once the medication is prescribed, cancel the prescription.

c. Task Success:

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

Comments:

d. Task Time:

_____ Seconds

c. Optimal Path:

Select Patient> Click on Medications>Click on Manage button > Click on Cancel Prescription button of the generated prescription > Select reason for cancellation> > Click on Cancel Prescription button.

Correct

Minor Deviations (Describe: _____)

Major Deviations (Describe: _____)

Comments:

f. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

Very Easy

Easy

Fair

Difficult

Very Difficult

g. Administrator Comments:

Task b3.3: Review Pending Prescriptions

Review pending prescriptions of the patient.

c. Task Success:

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

Comments:

d. Task Time:

- _____ Seconds

c. Optimal Path:

Click on eRx Management link > Click on Pending Requests tab > Search and Select the patient from the Patient filter > Click on Search 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 b3.4: Review and Respond to Renewal Request

Review the renewal request and respond by approving or denying.

Patient: John Doe

Prescribed Medication: Lisinopril 20 Mg Tablet for 30 days

Requested Renewal: Lisinopril 20 Mg Tablet for another 30 days

c. Task Success:

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

Comments:

d. Task Time:

- _____ Seconds

c. Optimal Path:

Click on eRx Management link> Click on Refill Requests tab> Click on the View button of the received request> Select 'Deny' from the Action drop down menu> Select 'Reason' from the Denial Reason> Provide Response Notes> Click on Send 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 b3.5: Review and Respond to Change Request

Review the change request and respond by approving or denying.

c. Task Success:

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

Comments:

d. Task Time:

_____ Seconds

c. Optimal Path:

Click on eRx Management link> Click on Change Requests tab> Click on the View button of the received request> Select 'Deny' from the Action drop down menu> Select 'Reason' from the Denial Reason> Provide Response Notes> Click on Send 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 b3.6: Request and Review Fill Status

Request the fill status while prescribing and review the status of a prescription fill.

Task Success:

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

Comments:

c. Task Time:

- _____ Seconds

d. Optimal Path:

Request Fill Status: Select Patient> Click on Medications>Click on Manage button > Click on Create New Rx button > Select mentioned medication with the provided details> Click on Review button> Click on Save and Add Rx button > Click on Prescription Summary link> Provide Signature Password > Click on Send button.

Review Fill Status: Select Patient> Click on Medications> Review the fill status displayed with the prescription record

- 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 b3.7: Request Medication History

Request Medication History to review patient's previous medication prescriptions.

Patient: John Doe

Time Period: 1 year

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 Manage button > Click on Show Medication History > Select Time Period '1 year' from the drop down

- 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
11. I think that I would like to use this system frequently.	1	2	3	4	5
12. I found the system unnecessarily complex.					
13. I thought the system was easy to use.					
14. I think that I would need the support of a technical person to be able to use this system.					
15. I found the various functions in this system were well integrated.					
16. I thought there was too much inconsistency in this system					
17. I would imagine that most people would learn to use this system very quickly.					
18. I found the system very cumbersome to use.					
19. I felt very confident using the system.					
20. I needed to learn a lot of things before I could get going with this system.					

Safety-enhanced design

Usability Report

- 170.315 (b)(11) Decision Support Interventions

Report Based On:
ISO/IEC 25062 : 2006 Common Industry Format
for Usability Test Reports



Date of Usability Test:
January 25, 2025 – January 27, 2025

Date of Report:
January 28, 2025

Report Prepared By:
Medcare MSO



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Executive Summary

A usability test for HealUs EHR Version 1.0, an ambulatory Electronic Health Record (EHR) system, was conducted by the Medicare MSO Support Team from January 25, 2025, to January 27, 2025. The primary objective of the test was to evaluate and validate the usability of the system's user interface, ensuring it meets the necessary criteria for certification. Specifically, the test focused on assessing the system's compliance with the following certification standard:

- 170.315 (b)(11) Decision Support Interventions

During the test, 15 participants, including physicians, nurses, and administrative staff, all selected to match the target demographic, engaged with the HealUs EHR system. The participants completed a series of simulated tasks designed to replicate typical, real-world usage scenarios. The study focused on gathering performance data for 9 core tasks commonly performed within the EHR, enabling an in-depth assessment of the system's usability and functionality.

- Configure Evidence – Based DSI
- Configure Predictive DSI
- Modify Source Attributes of Configured Evidence-Based DSI
- Modify Source Attributes of Configured Predictive DSI
- Evaluate and Address Triggered DSI
- Provide feedback on the triggered DSI
- Export feedback of the triggered DSI

During the 60-minute, one-on-one usability test, each participant was welcomed by the test administrator and asked to review and sign the informed consent form (refer to Appendix 1). Participants were informed that their involvement was entirely voluntary, and they were free to withdraw from the test at any point. The majority of participants had prior experience using the software.

The administrator provided a brief overview of the test, then instructed participants to complete a series of tasks, presented individually, using the EHR Under Test (EHRUT). Throughout the session, the administrator monitored the time and electronically recorded participant performance data. No assistance was given during task completion to maintain the integrity of the test. To ensure accurate and thorough analysis, both the participant's screen and audio were recorded for subsequent review.

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 to ensure that no personally identifiable information could be linked to the collected data. Upon completing the testing, participants were asked to fill out a post-test questionnaire. None of the participants received compensation for their involvement. To evaluate the usability of the EHR Under Test (EHRUT), various recommended metrics were applied, in accordance with the guidelines outlined in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records. Below is a summary of the performance and rating data collected during the test.

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)					
b11.1	Configure Evidence – Based DSI	15	100 %	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)
b11.2	Configure Predictive DSI	15	100 %	0.00	1.48	45.33	7.08	1.51	0	4.29 (0.22)
b11.3	Modify Source Attributes of Configured Evidence-Based DSI	15	100 %	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
b11.4	Modify Source Attributes of Configured Predictive DSI	15	100 %	0.00	1.17	45.33	1.25	1.00	0	4.85 (0.20)
b11.5	Evaluate and Address triggered DSI	15	100 %	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
b11.6	Provide feedback on the triggered DSI	15	100 %	0.00	1.05	32.00	4.00	1.06	0	4.82 (0.25)
b11.7	Export feedback of the triggered DSI	15	100 %	0.00	1.07	34.00	5.84	1.13	0	4.58 (0.28)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 88.66%

Introduction

The EHR Under Test (EHRUT) for this study was HealUs EHR v1.0, a comprehensive ambulatory Electronic Health Record system designed to offer an all-in-one solution for key areas such as Electronic Health Record management, CPOE, Referral Management, Patient Portal, and Appointment Scheduling. The usability testing was structured to simulate real-world tasks and conditions.

The primary objective of this study was to evaluate and validate the usability of the system's current user interface and to provide concrete evidence of its usability. To achieve this, we assessed effectiveness, efficiency, and user satisfaction through various metrics, including the number of tasks successfully completed within the allotted time, time taken to complete tasks, error frequency and types, and any deviations in task paths observed during the testing.

The main goal of this evaluation was to assess the system's interface, design, and functionality in line with the **NISTIR 7741** usability standards. Throughout the testing process, we focused on evaluating the system's efficiency, user satisfaction, and overall effectiveness. Our aim was to conduct a fair and objective evaluation to ensure that the results were 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

A total of 15 participants took part in testing the EHR Under Test (EHRUT), including 10 physicians, 3 nurses, and 2 administrative staff members. The physicians represented a range of specialties. Participant recruitment was managed by Medicare MSO, and all participants volunteered without compensation. Each participant received an orientation and training session tailored to the level of support expected for actual end users.

The recruited participants had diverse backgrounds and demographic characteristics, in line with the criteria outlined in the participant screener. Below is a table detailing the participants' characteristics, including demographics, professional experience, computing proficiency, and any needs for assistive technology. To ensure confidentiality, participant names were replaced with Participant IDs, ensuring that no individual data could be traced back to their identities.

#	Participant ID	Gender	Age	Education	Occupation/role	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
1	P001	M	48	MD	Physician	20	24	6	None
2	P002	M	38	MD	Physician	10	12	4	None
3	P003	M	40	MD	Physician	18	19	6	None
4	P004	M	43	MD	Physician	19	18	3	None
5	P005	F	32	MD	Physician	10	12	8	None
6	P006	M	57	MD	Physician	32	25	7	None
7	P007	F	50	MD	Physician	25	24	1	None
8	P008	M	53	MD	Physician	27	23	3	None
9	P009	M	32	MD	Physician	13	11	3	None
10	P010	F	31	MD	Physician	7	5	4	None
11	P011	F	30	Master's Degree	Nurse Practitioner	13	8	3	None
12	P012	F	40	Master's Degree	Licensed Practice Nurse (LPN)	20	19	1	None
13	P013	F	32	Master's Degree	Licensed Practice Nurse (LPN)	7	10	3	None
14	P014	M	28	Bachelor's Degree	Office Manager	7	6	2	None
15	P015	M	33	Bachelor's Degree	Assistant Manager	11	9	6	None

Study Design

The primary objective of this test was to identify the strengths and weaknesses of the application, specifically in terms of effectiveness, efficiency, and user satisfaction. The goal was to pinpoint areas where the system excelled and where it fell short of meeting participants' needs. The data collected serves as a baseline for future evaluations of updated versions of this EHR system, or for comparisons with other EHR systems, provided the same tasks are utilized. In essence, this testing establishes a benchmark for current usability and highlights areas that require improvement.

Throughout the usability test, participants interacted with the EHR Under Test (EHRUT) in a consistent environment, receiving the same set of instructions. The system was evaluated based on effectiveness, efficiency, and user satisfaction, using specific metrics 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 selected for the test were carefully designed to mirror the routine actions that users typically perform within the EHR system. These tasks were chosen based on their frequency of use, their significance to the system’s core functionality, and the potential challenges they may pose to users.

Task ID #	Description	Reference
b11.1	Configure Evidence – Based DSI	§170.315(b)(11)
b11.2	Configure Predictive DSI	§170.315(b)(11)
b11.3	Modify Source Attributes of Configured Evidence-Based DSI	§170.315(b)(11)
b11.4	Modify Source Attributes of Configured Predictive DSI	§170.315(b)(11)
b11.5	Evaluate and Address triggered DSI	§170.315(b)(11)
b11.6	Provide feedback on the triggered DSI	§170.315(b)(11)
b11.7	Export feedback of the triggered DSI	§170.315(b)(11)

Procedures

Upon arrival, participants were greeted, and their identities were verified against the participant schedule. Each participant was then assigned a unique participant ID. They were provided with and asked to review and sign the Non-Disclosure Agreement and Informed Consent forms (Appendix 1).

To ensure the smooth execution of the test, two staff members were involved: the usability administrator and the data logger. The administrator facilitated the session, providing instructions and overseeing task execution. Additionally, the administrator tracked task completion times, gathered post-task rating data, and documented participant comments. The data logger, meanwhile, recorded key metrics such as task success rates, path deviations, error types and counts, and participant feedback.

Before starting the tasks, participants were given the following general instructions:

- Complete all tasks as quickly as possible, minimizing errors and deviations.
- Perform all tasks independently; the administrator could offer minimal guidance or clarification but not instructions on how to use the system.
- Do not use the think-aloud technique during the tasks.

For each task, participants were provided with a written copy of the task instructions. Task timing began once the administrator finished reading the instructions and was stopped when the participant indicated they had successfully completed the task.

Data collected during the test included participants' demographic information, task success rates, completion times, error occurrences, path deviations, verbal responses, and post-test questionnaire answers. All data were recorded in a spreadsheet for later analysis.

At the conclusion of the session, the administrator distributed the post-test questionnaire and the System Usability Scale (Appendices 4 and 5) and expressed appreciation for the participants' involvement.

Test Location

The testing facility included a waiting area and a dedicated, quiet testing room. The test room was equipped with a table for the participant, a computer for completing tasks, and a separate recording computer for the administrator. Only the participant and the administrator were present in the testing room, while observers and the data logger operated from an adjacent room with a clear view of the participant's screen.

To ensure a comfortable environment, noise levels were minimized, and the room's temperature was maintained at a comfortable level. Additionally, safety instructions and evacuation procedures were prominently displayed and easily accessible to participants.

Test Environment

The EHR Under Test (EHRUT) is typically used in healthcare offices or facilities. For the purpose of this testing, participants interacted with a desktop PC running the Windows operating system, using a mouse and keyboard to navigate the system.

During the HealUs EHR usability testing, a 19-inch display monitor with a screen resolution ranging from 1280 to 1600 was used. The application was configured by the HealUs EHR Development Team to align with the specific requirements of each task. The system ran seamlessly on the Chrome web browser, supported by a high-speed internet connection. The system's performance, particularly its response time, accurately mirrored the experience real users would have during field deployment. Participants were instructed not to modify any default system settings during the test.

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 7 tasks to complete.

Usability Metrics

In accordance with the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, EHR systems should be designed to support processes that ensure optimal usability for all users. The aim is for users to interact with the system in a manner that is both effective, efficient, and provides an acceptable level of satisfaction. To assess this, key metrics related to effectiveness, efficiency, and user satisfaction were collected 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.” 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>
<p>Efficiency: Task Time</p>	<p>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.</p>
<p>Satisfaction: Task Rating</p>	<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. 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.”</p>

Results

Data Analysis and Reporting

The results of the usability test were analyzed using the methods outlined in the Usability Metrics section above. The findings for the EHR Under Test (EHRUT) are presented below. These results should be viewed in the context of the objectives and goals established in the Study Design section. The data offers valuable insights that, if acted upon, could lead to meaningful improvements in 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)		
	#		Mean	SD	Deviations (Observed / Optimal)	Mean	SD	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)
b11.1	Configure Evidence – Based DSI	15	100 %	0.00	1.45	84.00	9.52	1.12	0	4.49 (0.37)

b11.2	Configure Predictive DSI	15	100 %	0.00	1.48	45.33	7.08	1.51	0	4.29 (0.22)
b11.3	Modify Source Attributes of Configured Evidence-Based DSI	15	100 %	0.00	1.41	83.33	16.73	1.10	0	4.23 (0.18)
b11.4	Modify Source Attributes of Configured Predictive DSI	15	100 %	0.00	1.17	45.33	1.25	1.00	0	4.85 (0.20)
b11.5	Evaluate and Address triggered DSI	15	100 %	0.00	1.37	64.00	6.11	1.06	0	4.51 (0.35)
b11.6	Provide feedback on the triggered DSI	15	100 %	0.00	1.05	32.00	4.00	1.06	0	4.82 (0.25)
b11.7	Export feedback of the triggered DSI	15	100 %	0.00	1.07	34.00	5.84	1.13	0	4.58 (0.28)

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 88.66%. 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, showcasing a clear understanding of the objectives. Their primary focus was on assessing the performance and usability of the HealUs EHR system and its associated workflows. Additionally, participants conducted comparative evaluations, contrasting their experience with HealUs EHR against previous encounters with other EHR systems. All test results were carefully recorded, and the methods detailed in the Usability Metrics section were used to calculate the final outcomes.

Major Findings

During the usability testing, participants found the system to be user-friendly, with easy navigation through the Decision Support Interventions (DSI) workflows, including activating or deactivating DSIs from the settings, marking decisions as complete, excluding intervention from DSI alerts, and providing feedback on triggered DSIs. The process of exporting feedback for activated and triggered DSIs was also appreciated.

Areas for Improvement

While participants were generally satisfied with the Decision Support Interventions (DSI) workflows, one area for improvement was identified. The users recommended adding more real-time guidance or tooltips within the workflow, especially during the steps to exclude or complete decisions, to reduce uncertainty.

Effectiveness

Based on the success, failure, and path deviation data, users found the HealUs EHR v1.0 system to be highly effective in managing Decision Support Interventions (DSIs). Experienced users appreciated the straightforward process of activating and deactivating DSIs, with minimal disruptions to their workflow. The ability to configure DSIs and provide timely feedback enhanced user satisfaction and contributed to smoother task execution, aligning well with established EHR practices.

For less experienced users, the clear alerts and intervention actions were particularly helpful. Users noted that the feedback export feature provided valuable insights for improving future interventions. Overall, the streamlined DSI workflow led to fewer errors and path deviations, ensuring both efficiency and safety throughout the task execution.

Efficiency

Participants completed most tasks involving Decision Support Interventions (DSIs) within the expected time frame, indicating the system's efficiency. The ability to easily activate or deactivate DSIs and provide feedback was seen as seamless and minimally disruptive to their workflow. Some participants mentioned that while the feedback export process added additional time to completing certain tasks, it provided valuable information for future system improvements. Despite the slight increase in task time, users recognized the importance of providing feedback and exporting it to enhance the system's decision-making support. Overall, the DSI workflow was efficient, providing timely and relevant interventions without significantly hindering task completion.

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 88.66%, indicating favorable subjective satisfaction with the system's performance across these tasks.

Participant Identifier	Overall Task Rating – Scale Type	Task Rating
P001	System Usability Scale	95
P002	System Usability Scale	96
P003	System Usability Scale	89
P004	System Usability Scale	90
P005	System Usability Scale	87
P006	System Usability Scale	85
P007	System Usability Scale	92
P008	System Usability Scale	96

P009	System Usability Scale	84
P010	System Usability Scale	87
P011	System Usability Scale	89
P012	System Usability Scale	93
P013	System Usability Scale	80
P014	System Usability Scale	82
P015	System Usability Scale	85
Average:		88.66%

Appendices

Appendix 1: Non- Disclosure Agreement and Informed Consent Form

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of January 25, 2025, 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	9
Women	6
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	0
6-10	5
11-20	7
20+	3
Total Participants:	15
Years of Technology Experience	
0-5	1
6-10	4
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 testing schedule was confirmed with both the participants and the testing team. Additionally, the testing environment was carefully set up to comply with the guidelines outlined in the 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 prior to the session, and all recording tools were activated once the participant joined.

After all Testing

All recorded videos and data files were securely stored as backups.

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 b11.1: Configure Evidence – Based DSI

Configure evidence-based Decision Support Interventions to enhance clinical decision-making and ensure patient safety.

DSI: Hypertension Management

a. Task Success:

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

Comments:

b. Task Time:

- _____ Seconds

c. Optimal Path:

Click on Setting Module> Click on Decision Support Intervention link >Select the above-mentioned Evidence-Based DSI> Click on Activate 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 b11.2: Configure Predictive DSI

Configure evidence-based Decision Support Interventions to enhance clinical decision-making and ensure patient safety.

DSI: Diabetes Complication Risk Prediction

e. Task Success:

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

Comments:

f. Task Time:

- _____ Seconds

c. Optimal Path:

Click on Setting Module> Click on Decision Support Intervention link > Select the above-mentioned Predictive DSI> Click on Activate 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 b11.3: Modify Source Attributes of Configured Evidence-Based DSI

DSI: Hypertension Management

e. Task Success:

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

Comments:

f. Task Time:

- _____ Seconds

c. Optimal Path:

Click on Setting Module > Click on Decision Support Intervention link > Select the above-mentioned Evidence-Based DSI > Update the source attributes > Click on Save button

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

Comments:

h. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

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

i. Administrator Comments:

Task b11.4: Modify Source Attributes of Configured Predictive DSI

DSI: Diabetes Complication Risk Prediction

e. Task Success:

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

Comments:

f. Task Time:

- _____ Seconds

c. Optimal Path:

Click on Setting Module> Click on Decision Support Intervention link > Select the above-mentioned Predictive DSI> Update the source attributes > Click on Save button

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

Comments:

h. Observed Errors and Verbalizations

Comments:

Rating: Overall, this task was:

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

i. Administrator Comments:

Task b11.5: Evaluate and Address Triggered DSI

Assess and respond to triggered decision support interventions (DSI) to ensure appropriate clinical actions are taken and patient safety is maintained.

e. Task Success:

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

Comments:

f. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient > Click on Summary > Click on DSI Alerts > Click on the triggered DSI > Evaluate and Mark the Decision as Completed or Excluded > 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 b11.6: Provide feedback on the triggered DSI

Provide feedback on triggered decision support interventions to enhance future recommendations.

e. Task Success:

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

Comments:

f. Task Time:

- _____ Seconds

c. Optimal Path:

Select Patient > Click on Summary > Click on DSI Alerts > Click on the triggered DSI > Evaluate and Mark the Decision as Completed or Excluded > Provide the Feedback in the relevant section > 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 b11.7: Export feedback of the triggered DSI

Export feedback on triggered decision support interventions for further analysis and improvement of the system.

e. Task Success:

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

Comments:

f. Task Time:

- ____ Seconds

c. Optimal Path:

Click on Settings Module> Click on Decision Support Intervention link > Click on Export Feedback button> Provide From and To Dates for the export duration> 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	2	3	4	5
21. I think that I would like to use this system frequently.					
22. I found the system unnecessarily complex.					
23. I thought the system was easy to use.					
24. I think that I would need the support of a technical person to be able to use this system.					
25. I found the various functions in this system were well integrated.					
26. I thought there was too much inconsistency in this system					
27. I would imagine that most people would learn to use this system very quickly.					
28. I found the system very cumbersome to use.					
29. I felt very confident using the system.					
30. I needed to learn a lot of things before I could get going with this system.					