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Safety-Enhanced Design Usability Report

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

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User-Centered Design Process:

NISTIR 7741
NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records (EHR)
https://www.nist.gov/sites/default/files/documents/2017/04/28/Guide_Final_Publication_Version.pdf

Dates of Usability Tests:
Tests occurred from September 3, 2018 – October 5, 2018.

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Executive Summary

A usability test of moxee by myhELO was conducted as part of compliance with the Safety-Enhanced Design requirements outlined in the 2015 Edition Test Method, Health Information Technology Certification Criteria 170.315(g)(3). The purpose of this study was to test and validate the usability of the user interface and provide feedback of the usability on the Electronic Health Record Under Test (EHRUT).

Ten individuals participated in using the EHR in representative tasks. A total of 25 tasks were tested that aligned with Safety-Enhanced Design criteria.

The following EHR features and processes were tested as part of this study:

- Computerized Provider Order Entry for Medications, Laboratory and Diagnostic Imaging
- Drug-Drug and Drug-Allergy Order Entry Interaction Checks
- Patient Demographics
- Listing of Patient Problems
- Listing of Patient Medications
- Listing of Patient Allergies to Medications
- Clinical Decision Support
- Clinical Information Reconciliation and Incorporation
- Electronic Prescribing of Medication

During the 1-hour one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent and release form (included in Appendix 3). As this was a voluntary usability test, participants were informed they could withdraw at any time. Participants did not have prior experience with the moxee by myhELO EHR in a professional setting. The administrator introduced the test, and instructed participants to complete the tasks one at a time using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s), recorded user performance data electronically. The administrator did not give the participant assistance in how to complete the task during testing.

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
- Participants' verbalizations
- Participants' satisfaction ratings of the system

Following the test, all participants completed the System Usability Scale (SUS) Questionnaire and were thanked for their involvement. For purposes of this report, participant data is de-identified. 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. The following is a summary of the performance and rating data collected on the EHRUT.

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Table 1: Usability Test Result Summary

		N	Task Success	Path Deviations (#)	Task Time (s)		Errors / Task Failures	Task Ratings 1-5 5 = Very Easy
	Tasks	#	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed / Optimal	Mean (SD)	Mean (SD)
a1.1	Record medication order	10	100 (0)	14.2 / 12	59.2 (8.3)	59.2 / 55	0%	4.3 (0.48)
a1.2	Access and cancel medication order.	10	100 (0)	4.6 / 4	20.5 (4.6)	20.5 / 20	0%	4.7 (0.48)
a2.1	Record laboratory order	10	100 (0)	5.6 / 5	21.7 (3.4)	21.7 / 22	0%	4.8 (0.42)
a2.2	Access and cancel laboratory order.	10	100 (0)	3.3 / 3	7.7 (2.0)	7.7 / 8	0%	4.9 (0.32)
a3.1	Record diagnostic imaging order	10	100 (0)	3.4 / 3	18.3 (4.0)	18.3 / 17	0%	4.8 (0.42)
a3.2	Access and change diagnostic imaging order.	10	100 (0)	3.7 / 3	10.3 (2.6)	10.3 / 8	0%	4.8 (0.42)
a4.1	Medication order that triggers drug-drug intervention.	10	100 (0)	5.1 / 4	25.3 (6.4)	25.3 / 18	0%	4.9 (0.32)
a4.2	Medication order that triggers drug-allergy intervention.	10	100 (0)	5.7 / 4	24.9 (5.2)	24.9 / 19	0%	4.7 (0.48)
a5.1	Record demographics	10	100 (0)	11.6 / 13	33.4 (8.1)	33.4 / 8.1	0%	4.9 (0.32)
a5.2	Access and change demographics	10	100 (0)	9.9 / 13	29.7 (10.1)	29.7 / 35	0%	4.9 (0.32)
a6.1	Record active problems	10	100 (0)	7.5 / 7	19.8 (6.3)	19.8 / 23	0%	4.8 (0.32)
a6.2	Access and change active problems	10	100 (0)	10.7 / 11	30.3 (10.3)	30.3 / 30	0%	4.5 (0.53)
a7.1	Record medications	10	100 (0)	4.8 / 4	18.9 (3.8)	18.9 / 17	0%	4.7 (0.48)
a7.2	Access and change medications	10	100 (0)	8.5 / 7	33.6 (6.0)	33.6 / 28	0%	4.7 (0.48)
a8.1	Record medication allergies	10	100 (0)	10.0 / 9	27.6 (3.9)	27.6 / 31	0%	4.6 (0.52)
a8.2	Access and change medication allergies	10	100 (0)	6.7 / 6	16.8 (2.7)	16.8 / 18	0%	4.9 (0.32)

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Table 1: Usability Test Result Summary Continued

	Tasks	N	Task Success	Path Deviations (#)	Task Time (s)		Errors / Task Failures	Task Ratings 1-5 5 = Very Easy
		#	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed/ Optimal	Mean (SD)	Mean (SD)
a9.1	CDS alert - Vitals	10	100 (0)	5.7 / 5	27.7 (4.0)	27.7 / 26	0%	4.8 (0.42)
a9.2	CDS alert - Demographics	10	100 (0)	5.9 / 5	24.2 (5.1)	24.4 / 20	0%	4.8 (0.42)
a9.3	CDS alert - Meds	10	100 (0)	15.4 / 14	43.8 (7.3)	43.8 / 38	0%	4.6 (0.52)
a9.4	CDS alert - Labs	10	100 (0)	5.7 / 5	30.3 (4.2)	30.3 / 30	0%	4.8 (0.42)
a9.5	CDS alert - Med Allergy	10	100 (0)	11.0 / 9.0	30.9 (4.0)	30.9 / 30	0%	4.7 (0.48)
a9.6	CDS alert - Problems	10	100 (0)	4.5 / 4	28.9 (5.1)	28.9 / 25	0%	4.9 (0.32)
b2.1	Reconcile medications, medication allergies and problems	10	100 (0)	8.1 / 7	21.6 (2.3)	21.6 / 21	0%	4.8 (0.42)
b3.1	Create a prescription	10	100 (0)	14.0 / 12.0	55.4 (5.9)	55.4 / 50	0%	4.3 (0.48)
b3.2	Cancel a prescription	10	100 (0)	4.5 / 4.0	18.9 (3.3)	18.9 / 19	0%	4.7 (0.48)

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 90.25.

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

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Major findings

moxee by myhELO has integrated features that allow the system to learn users' preferences and favorite selections over time. The usability testing, however, allowed the system to be tested as though those preferences were not available. This helped to provide genuine feedback on typically worse case scenarios when using the system.

For the most part, participants seemed to be able to grasp quickly how to use moxee by myhELO. After the first few tasks, participants gradually learned how the workflow and system's common user interface were designed that helped them to understand how to complete subsequent tasks. In general, the common features and buttons throughout the system, such as left navigation and right side edit layer buttons, allowed the tasks to be completed effectively.

Areas for improvement

moxee by myhELO will continue to work with users to help continually find areas for improving the workflow as well as additional areas for automation. Since the system will be used on desktops as well as mobile devices, all work flow areas are considered before updates are integrated.

The Problem Lists was an area of discussion. Although it was received well by participants, this is an area that has a unique workflow compared to other EHR's the participants were familiar. In moxee by myhELO a problem can evolve from a general patient complaint to a more specific patient issue. The verbal feedback during testing indicates additional instructions or training may need to be provided in this area. The reason the system was designed to allow a problem to evolve over time is to help with overall provider management of Problems and Health Issues. Rather than having the patient reported "Knee Pain" and provider reported "Torn ACL", for example, which results in two separate problems, moxee by myhELO allows the providers to further define the initial patient reported problem since this may have been the same problem. This helps to reduce overall inefficiencies in the system, as well as shows the history of various problems that patients may have.

Introduction

The Electronic Health Record Under Test (EHRUT) which was tested for this study was moxee by myhELO, v 3.14. As a patient centered EHR, moxee by myhELO is designed as a Universal Health Record System to allow patients and healthcare providers to share information safely, securely and conveniently. moxee by myhELO is available to use with modern browsers on any computer or mobile device.

The usability testing represents realistic exercises and conditions, as the tests were performed on tasks that providers encounter during normal patient appointments. The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHRUT. To this end, measures of effectiveness, efficiency and user satisfaction, such as the time it took, were captured during the usability testing.

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Method

Participants

A total of 10 participants tested the EHRUT. Participants had a mix of backgrounds and demographic characteristics. The following is a table of participants by characteristics, including demographics, professional experience, and computing experience. A spreadsheet was used to keep track of relevant testing information pertaining to the participants and tasks completed.

ID	Gender (M/F)	Age (Years)	Education	Occupation	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
1	F	40-49	Master's Degree	Physician Assistant	15	24	0	No
2	M	40-49	Doctorate Degree	Surgeon	17	27	0	No
3	F	30-39	Associate's Degree	Medical Assistant	13	15	0	No
4	F	50-59	Master's Degree	Nurse Practitioner	26	28	0	No
5	M	50-59	Doctorate Degree	Surgeon	34	26	0	No
6	F	30-39	Associate's Degree	Medical Assistant	10	21	0	No
7	F	30-39	Bachelor's Degree	Clinic Coordinator	12	16	0	No
8	M	50-59	Doctorate Degree	Surgeon	22	28	0	No
9	M	30-39	Master's Degree	Physician Assistant	9	18	0	No
10	F	30-39	Bachelor's Degree	Clinic Coordinator	10	20	0	No

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Study Design

Overall, the objective of this test was to uncover areas where the application performed effectively, efficiently, and with satisfaction, as well as areas where the application failed to meet the needs of the participants. The data from this test provides a record and a benchmark for any future improvements that may be made.

Each participant 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 without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participants' verbalizations (comments)
- Participants' satisfaction ratings of the system

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

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Tasks

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR. Below is the listing of tasks the participants were asked to complete.

Task ID	Tasks
170.315(a)(1)	Computerized provider order entry (CPOE) – medications
a1.1	Record medication order
a1.2	Access and cancel medication order.
170.315(a)(2)	Computerized provider order entry (CPOE) – laboratory
a2.1	Record laboratory order
a2.2	Access and change laboratory order.
170.315(a)(3)	Computerized provider order entry (CPOE) – diagnostic imaging
a3.1	Record diagnostic imaging order
a3.2	Access and change diagnostic imaging order.
170.315(a)(4)	Drug-drug, drug-allergy interaction checks for CPOE
a4.1	Medication order that triggers drug-drug intervention.
a4.2	Medication order that triggers drug-allergy intervention.
170.315(a)(5)	Demographics
a5.1	Record demographics
a5.2	Access and change demographics
170.315(a)(6)	Problem list
a6.1	Record active problems
a6.2	Access and change active problems
170.315(a)(7)	Medication list
a7.1	Record medications
a7.2	Access and change medications

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Tasks continued

Task ID	Tasks
170.315(a)(8)	Medication allergy list
a8.1	Record medication allergies
a8.2	Access and change medication allergies
170.315(a)(9)	Clinical decision support (CDS)
a9.1	CDS alert - Vitals
a9.2	CDS alert - Demographics
a9.3	CDS alert - Meds
a9.4	CDS alert - Labs
a9.5	CDS alert - Med Allergy
a9.6	CDS alert - Problems
170.315(b)(2)	Clinical information reconciliation and incorporation
b2.1	Reconcile medications, medication allergies and problems
170.315(b)(3)	Electronic prescribing
b3.1	Create a prescription
b3.2	Cancel a prescription

Tasks were selected based on their relevance and need for healthcare organizations to perform necessary functions.

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Procedure

Upon arrival, participants were greeted and their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. Each participant reviewed and signed an informed consent form and NDA (See Appendix 3). The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments. Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the participants were given a written copy of the task and instructions. 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. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (The System Usability Scale, Appendix 2) and thanked each individual for their participation. Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded into a spreadsheet. Participants were thanked for their time.

Test Location

The usability tests were conducted in a quiet area at a healthcare facility. Test Administrators were on-site to assist with any additional unforeseen questions that related to test conditions outside of the system, such as connectivity or general system access.

Test Environment

moxee by myhELO can be accessed from any device using a modern browser. In this instance, participants used a laptop with mouse, touchpad and keyboard when interacting with the EHRUT at an outpatient clinic facility. The application was set up by the administrators by logging onto the wireless network and bringing up the login page for the application.

Test Forms and Tools

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

1. NDA and Informed Consent Form
2. Administrator's Guide
3. System Usability Scale Questionnaire

Examples of these documents can be found in Appendices 3-5 respectively. The Administrator's Guide was devised so as to be able to capture required data and to follow along with the tasks that each participant was asked to complete during the test.

Following each task, participants were asked to describe ease of use and efficiency, and to explain their rationale, as described in the Administrator's Guide. At the conclusion of the session, participants were also asked to complete a post-test questionnaire, which was based on the standard System Usability Scale (Appendix 2).

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Participant Instructions

The administrator reads the following instructions aloud to the each participant:

> *Thank you for participating in this study. Your input is very important. Our session today will last about 30-45 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you, we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.*
>
> *Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. 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 10-15 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 will ask you your impressions about the task once you are done but we will not respond if you talk aloud during the completion of the task.*

Participants were then given their tasks to complete. The tasks are listed in section 3.3.

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Usability Metrics

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

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

The table below provides information on how each of the tasks were scored, how the errors were evaluated, and how the time-on-task data was analyzed.

Measure	Rationale and Scoring
Effectiveness: Task Success	A task was recorded as a success if the participant was able to achieve the correct outcome without assistance. To calculate the total number of successes we divided number of tasks attempted by the number of participants. The results are reported as a percentage. Task times were recorded for successes only.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct result, performed it incorrectly, or gave up, the task was recorded as a failure. Task times for failures were not recorded in this report.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations included, for example, navigating to the wrong screen, choosing an incorrect menu item, or interacting incorrectly with an on-screen control. This was compared to the optimal path.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	After each task, each participant was asked to rate the task ease of use on a scale of 1 to 5, where 1 was "Very Difficult" and 5 was "Very Easy". The ratings were averaged across participants. Participants were also asked to rate task efficiency on a scale of 1 to 5, where 1 was "Very Inefficient" and 5 was "Very Efficient". In addition, participants were asked to complete the System Usability Scale questionnaire.

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Results

Data Analysis and Reporting

170.315(a)(1) Computerized provider order entry (CPOE) – medications

a1.1 Record medication order

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**12**	**55**	**5**	**5**
1	100	16	58	4	4
2	100	12	48	4	4
3	100	14	54	4	3
4	100	15	63	5	5
5	100	13	57	5	5
6	100	11	47	4	4
7	100	16	64	5	4
8	100	14	71	4	4
9	100	16	71	4	5
10	100	15	59	4	5
Mean	100	14.2	59.2	4.3	4.3
Standard Deviation	0.0	1.8	8.3	0.48	0.67

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a1.2 Access and cancel medication order.

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**20**	**5**	**5**
1	100	4	18	5	4
2	100	5	19	4	5
3	100	4	24	5	5
4	100	4	26	5	4
5	100	5	17	5	5
6	100	5	19	5	5
7	100	4	20	4	4
8	100	6	21	5	5
9	100	4	22	4	5
10	100	5	19	5	4
Mean	100	4.6	20.5	4.7	4.6
Standard Deviation	0.0	0.7	2.8	0.48	0.52

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170.315(a)(2) Computerized provider order entry (CPOE) – laboratory

a2.1 Record laboratory order

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**5**	**19**	**5**	**5**
1	100	5	24	5	5
2	100	6	28	5	5
3	100	5	20	4	5
4	100	6	21	5	4
5	100	7	17	5	5
6	100	6	19	5	5
7	100	5	18	5	4
8	100	5	23	5	5
9	100	6	22	4	5
10	100	5	25	5	5
Mean	100	5.6	21.7	4.8	4.8
Standard Deviation	0.0	0.7	3.4	0.42	0.42

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a2.2 Access and cancel laboratory order.

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**3**	**6**	**5**	**5**
1	100	3	5	5	5
2	100	4	9	5	5
3	100	3	6	5	5
4	100	3	8	5	5
5	100	4	8	5	5
6	100	3	7	5	5
7	100	3	9	5	5
8	100	4	12	4	4
9	100	3	7	5	5
10	100	3	6	5	5
Mean	100	3.3	7.7	4.9	4.9
Standard Deviation	0.0	0.5	2.0	0.32	0.32

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170.315(a)(3) Computerized provider order entry (CPOE) – diagnostic imaging

a3.1 Record diagnostic imaging order

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**3**	**17**	**5**	**5**
1	100	3	21	5	4
2	100	4	18	5	5
3	100	3	11	5	4
4	100	3	22	5	4
5	100	4	13	4	5
6	100	3	16	5	5
7	100	3	23	5	5
8	100	4	22	5	5
9	100	3	18	4	4
10	100	3	19	5	5
Mean	100	3.3	18.3	4.8	4.6
Standard Deviation	0.0	0.5	4.0	0.42	0.52

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a3.2 Access and cancel diagnostic imaging order

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**3**	**8**	**5**	**5**
1	100	3	11	5	5
2	100	3	7	4	5
3	100	4	9	5	5
4	100	5	15	5	5
5	100	4	13	5	5
6	100	3	11	5	5
7	100	3	12	5	5
8	100	5	7	5	4
9	100	3	8	5	5
10	100	4	10	4	5
Mean	100	3.7	10.3	4.8	4.9
Standard Deviation	0.0	0.8	2.6	0.42	0.32

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

a4.1 Medication order that triggers drug-drug intervention.

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**18**	**5**	**5**
1	100	4	20	5	5
2	100	6	29	5	5
3	100	5	28	4	5
4	100	4	29	5	5
5	100	7	39	5	4
6	100	4	26	5	5
7	100	4	23	5	5
8	100	7	22	5	5
9	100	6	21	5	5
10	100	4	16	5	5
Mean	100	5.1	25.3	4.9	4.9
Standard Deviation	0.0	1.3	6.4	0.32	0.32

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a4.2 Medication order that triggers drug-allergy intervention.

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**19**	**5**	**5**
1	100	6	23	5	5
2	100	4	29	5	5
3	100	8	33	4	5
4	100	7	25	5	5
5	100	5	19	5	5
6	100	6	23	4	5
7	100	4	18	5	5
8	100	4	21	5	5
9	100	7	32	4	4
10	100	6	26	5	5
Mean	100	5.7	24.9	4.7	4.9
Standard Deviation	0.0	1.4	5.2	0.48	0.32

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170.315(a)(5) Demographics

a5.1 Record demographics

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**13**	**30**	**5**	**5**
1	100	10	38	5	5
2	100	11	45	5	4
3	100	12	15	5	5
4	100	11	39	5	5
5	100	12	35	5	5
6	100	14	33	5	5
7	100	10	27	4	5
8	100	11	37	5	4
9	100	13	34	5	5
10	100	12	31	5	5
Mean	100	11.6	33.4	4.9	4.8
Standard Deviation	0.0	1.3	8.1	0.32	0.42

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a5.2 Access and change demographics

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**13**	**35**	**5**	**5**
1	100	11	30	5	5
2	100	12	34	5	5
3	100	4	16	5	5
4	100	7	16	5	5
5	100	5	20	5	5
6	100	12	25	5	5
7	100	15	43	5	4
8	100	11	38	5	5
9	100	12	42	5	5
10	100	10	33	4	5
Mean	100	9.9	29.7	4.9	4.9
Standard Deviation	0.0	3.5	10.1	0.32	0.32

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170.315(a)(6) Problem list

a6.1 Record active problems

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**7**	**23**	**5**	**5**
1	100	7	14	5	5
2	100	6	28	5	5
3	100	7	10	5	5
4	100	6	21	5	5
5	100	7	20	5	4
6	100	8	12	4	5
7	100	9	26	5	5
8	100	10	27	5	5
9	100	7	19	5	5
10	100	8	21	4	5
Mean	100	7.5	19.8	4.8	4.9
Standard Deviation	0.0	1.3	6.3	0.42	0.32

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a6.2 Access and change active problems

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**11**	**30**	**5**	**5**
1	100	12	29	4	4
2	100	11	42	4	4
3	100	6	20	5	5
4	100	8	17	5	5
5	100	11	30	5	4
6	100	13	36	5	5
7	100	10	18	4	4
8	100	11	48	4	4
9	100	13	35	4	5
10	100	12	28	5	4
Mean	100	10.7	30.3	4.5	4.4
Standard Deviation	0.0	2.2	10.3	0.53	0.52

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170.315(a)(7) Medication list

a7.1 Record medications

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**17**	**5**	**5**
1	100	5	18	5	5
2	100	4	20	5	5
3	100	6	15	4	4
4	100	5	19	5	5
5	100	4	17	5	5
6	100	7	28	5	4
7	100	4	14	4	4
8	100	4	21	5	5
9	100	5	19	4	5
10	100	4	18	5	5
Mean	100	4.8	18.9	4.7	4.7
Standard Deviation	0.0	1.0	3.8	0.48	0.48

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a7.2 Access and change medications

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**7**	**28**	**5**	**5**
1	100	7	22	5	5
2	100	8	35	5	5
3	100	8	31	5	5
4	100	7	30	5	5
5	100	9	36	4	5
6	100	10	39	4	4
7	100	7	27	5	5
8	100	11	41	4	4
9	100	8	37	5	5
10	100	10	38	5	4
Mean	100	8.5	33.6	4.7	4.7
Standard Deviation	0.0	1.4	6.0	0.48	0.48

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170.315(a)(8) Medication allergy list

a8.1 Record medication allergies

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**9**	**31**	**5**	**5**
1	100	9	24	4	4
2	100	10	29	5	5
3	100	9	22	5	5
4	100	12	32	5	5
5	100	11	25	5	4
6	100	10	34	5	4
7	100	11	31	5	4
8	100	9	28	5	5
9	100	10	24	4	5
10	100	9	27	5	5
Mean	100	10	27.6	4.8	4.6
Standard Deviation	0.0	1.1	3.9	0.42	0.52

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a8.2 Access and change medication allergies

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**6**	**18**	**5**	**5**
1	100	7	17	5	5
2	100	8	17	5	5
3	100	6	14	5	5
4	100	6	12	5	5
5	100	6	15	5	4
6	100	7	21	4	5
7	100	6	19	5	5
8	100	6	16	5	5
9	100	7	17	5	5
10	100	8	20	5	4
Mean	100	6.7	16.8	4.9	4.8
Standard Deviation	0.0	0.8	2.7	0.32	0.42

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

a9.1 CDS alert - Vitals

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**5**	**26**	**5**	**5**
1	100	5	29	5	5
2	100	6	33	5	5
3	100	5	21	4	4
4	100	7	22	5	5
5	100	6	28	5	5
6	100	5	30	5	4
7	100	5	32	5	5
8	100	6	29	4	5
9	100	7	28	5	5
10	100	5	24	5	4
Mean	100	5.7	27.6	4.8	4.7
Standard Deviation	0.0	0.8	4.0	0.42	0.48

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a9.2 CDS alert - Demographics

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**5**	**20**	**5**	**5**
1	100	5	28	5	5
2	100	6	18	5	4
3	100	5	21	4	5
4	100	7	31	5	4
5	100	7	29	5	4
6	100	5	19	5	5
7	100	6	27	5	5
8	100	5	17	5	5
9	100	7	28	4	5
10	100	6	24	5	5
Mean	100	5.9	24.2	4.8	4.7
Standard Deviation	0.0	0.9	5.1	0.42	0.48

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a9.3 CDS alert - Meds

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**14**	**38**	**5**	**5**
1	100	15	43	5	5
2	100	14	35	5	5
3	100	16	49	4	5
4	100	15	44	5	4
5	100	14	31	5	5
6	100	15	47	4	5
7	100	16	51	4	4
8	100	17	53	4	4
9	100	18	48	5	4
10	100	14	37	5	5
Mean	100	15.4	43.8	4.6	4.6
Standard Deviation	0.0	1.3	7.3	0.52	0.52

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a9.4 CDS alert - Labs

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**5**	**30**	**5**	**5**
1	100	6	28	5	4
2	100	7	37	4	5
3	100	5	27	5	5
4	100	5	29	5	5
5	100	5	26	5	5
6	100	6	31	5	4
7	100	7	36	4	4
8	100	5	28	5	5
9	100	5	30	5	5
10	100	6	34	5	5
Mean	100	5.7	30.6	4.8	4.7
Standard Deviation	0.0	0.8	3.8	0.42	0.48

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a9.5 CDS alert - Med Allergy

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**9**	**30**	**5**	**5**
1	100	10	25	5	5
2	100	9	29	4	4
3	100	10	28	5	5
4	100	11	33	5	5
5	100	18	29	5	5
6	100	11	36	5	5
7	100	10	32	4	4
8	100	10	31	5	5
9	100	11	28	5	4
10	100	10	38	4	4
Mean	100	11	30.9	4.7	4.6
Standard Deviation	0.0	2.5	4.0	0.48	0.52

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a9.6 CDS alert - Problems

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**25**	**5**	**5**
1	100	5	30	5	4
2	100	4	37	5	4
3	100	4	22	5	5
4	100	6	34	4	5
5	100	4	25	5	5
6	100	4	28	5	5
7	100	5	29	5	5
8	100	4	21	5	5
9	100	5	31	5	4
10	100	4	32	5	5
Mean	100	4.5	28.9	4.9	4.7
Standard Deviation	0.0	0.7	5.1	0.32	0.48

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

b2.1 Reconcile medications, medication allergies and problems

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**7**	**21**	**5**	**5**
1	100	8	18	5	5
2	100	7	23	4	5
3	100	9	24	5	5
4	100	8	19	5	4
5	100	10	20	5	5
6	100	7	25	5	5
7	100	7	20	4	4
8	100	8	22	5	5
9	100	8	21	5	5
10	100	9	24	5	5
Mean	100	8.1	21.6	4.8	4.8
Standard Deviation	0.0	1.0	2.4	0.42	0.42

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170.315(b)(3) Electronic prescribing

b3.1 Create a prescription

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**12**	**50**	**5**	**5**
1	100	15	56	4	4
2	100	11	43	4	4
3	100	13	62	4	3
4	100	16	59	5	5
5	100	14	61	5	5
6	100	12	48	4	4
7	100	14	54	5	4
8	100	15	56	4	4
9	100	17	58	4	5
10	100	13	57	4	5
Mean	100	14	55.4	4.3	4.3
Standard Deviation	0.0	1.8	5.9	0.48	0.67

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b3.2 Cancel a prescription

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**19**	**5**	**5**
1	100	4	13	5	5
2	100	4	21	5	5
3	100	5	16	4	4
4	100	5	20	5	5
5	100	4	19	5	4
6	100	4	18	4	5
7	100	6	25	5	5
8	100	4	17	5	4
9	100	5	22	5	5
10	100	4	18	4	5
Mean	100	4.5	18.9	4.7	4.7
Standard Deviation	0.0	0.7	3.3	0.48	0.48

Discussion of the Findings

The test result tables provide insight into the success of each of the tasks by analyzing the number of path deviations, task time, number of errors, task ratings, and the task efficiency rating. While there were some errors logged for various tasks, overall the results were positive. Observed errors were classified as low risk regarding patient safety and were documented and shared with design and development teams for potential future product improvements

Effectiveness

Participants were able to complete the tasks effectively as shown by the task completion rates. All participants were able to complete the required tasks.

Efficiency

In general, error rates were low, though where more information was required, such as in the case of multiple medications in the listing, path deviations were more likely to occur. This is to be expected as more steps are required to enter additional medication information in certain situations. While low, this is certainly to be considered for potential future improvements. Overall, participants were able to complete tasks efficiently with few errors.

Satisfaction

Overall, users expressed satisfaction with the moxee by myhELO EHR features tested during this study. Based on verbal comments and survey results from the participants following the tests, it was clear that the required tasks were simple to complete and were able to be completed to satisfaction.

Major Findings

moxee by myhELO testing results were very favorable based on the test results and verbal comments from participants, staff and administrators. The demographic scope included in the testing, also helped to provide confirmation that future users would expect to see similar results, regardless of previous system knowledge.

Areas for Improvement

Based on the feedback and test results, moxee by myhELO overall was found to have a favorable usability score. While this is indeed positive news, shortcuts, preferences and other means of automation will continue to be a major focus of development so that users are able to have even fewer interactions. An example of this would be the medication lists. While this information can be easily entered manually, some users may prefer to update medications from the national medication database to ensure accuracy of information. As this step, as well as others, can be time consuming, further evaluation for automation will be evaluated.

Appendix

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

Appendix 1: Sample Recruiting Screener
Appendix 2: System Usability Scale Questionnaire
Appendix 3: Non-Disclosure Agreement and Informed Consent Form
Appendix 4: Administrator's Guide

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Appendix 1
Recruiting Script for Recruiting Firm

Hello, my name is _____, calling from moxee by myhELO. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid to participate.

Can I ask you a few questions?

1. (If not obvious) Are you male or female? (Recruit a mix of participants)
    a. Male
    b. Female

2. Have you participated in a focus group or usability test in the past xx months?
    a. Yes (Terminate)
    b. No

3. Do you, or does anyone in your home, work in marketing research, usability research, web design or related areas?
    a. Yes (Terminate)
    b. No

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
    a. Yes (Terminate)
    b. No

5. Which of the following best describes your age? (Recruit Mix)
    a. 23 to 39
    b. 40 to 59
    c. 60 - to 74
    d. 75 and older

6. Which of the following best describes your race or ethnic group?
    a. Caucasian
    b. Asian
    c. Black/African-American
    d. Latino/a or Hispanic
    e. Other _____

7. Do you require any assistive technologies to use a computer? (if so, please describe)
    a. Yes, please describe _____
    b. No

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Professional Demographics

8. What is your current position and title? (Must be healthcare provider)
    a. RN: Specialty _____
    b. Physician: Specialty _____
    c. Physician's Assistant: _____
    d. Medical Assistant: _____
    e. Resident: Specialty _____
    f. Administrative Staff
    g. Other _____

9. How long have you held this position? _____

10. Describe your work location (or affiliation) and environment? _____

11. Which of the following describes your highest level of education?
    a. High school graduate/GED
    b. Some college
    c. College graduate (RN, BSN)
    d. Postgraduate (MD/PhD)
    e. Other _____

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? (If no computer use at all, Terminate)
    a. EHR Access
    b. Research
    c. Reading news
    d. Shopping/banking
    e. Digital pictures
    f. Programming/word processing
    g. Other _____

13. About how many hours per week do you spend on the computer?
    a. 0 to 10 hours
    b. 11 to 25 hours
    c. 26+ hours per week

14. What computer platform do you usually use?
    a. Mac
    b. Windows
    c. Other _____

15. What Internet browser(s) do you usually use?
    a. IE
    b. Chrome
    c. Firefox
    d. Safari
    e. Other _____

16. In the last month, how often have you used an electronic health record? _____

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

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

19. How does your work environment maintain patient records?
    a. On paper
    b. Some paper, some electronic
    c. All electronic

Contact Information

(If the person matches your qualifications, continue.)

Those are all the questions I have for you. Your background matches the people we're looking for. Would you be able to participate in the next couple weeks? (Schedule Date and Time)

May I get your contact information?

Name of participant:
Address:
City, State, Zip:
Daytime phone number:
Evening phone number:
Cell phone number:
Email address:

Before your session starts, we will ask you to sign a release form allowing us to record your session. The recording will only be used internally for further study if needed. Will you consent to be recorded?

(Confirm scheduled date, time and location.) I will confirm your appointment again a couple of days before your session and provide you with directions if needed. What time is the best time to reach you?

Thank you.

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Appendix 2

System Usability Scale

	System Usability Scale	Rating Scale 1-5 1 = Strongly Disagree 5 = Strongly Agree				
		1	2	3	4	5
1	I think that I would like to use this system frequently					
2	I found the system unnecessarily complex					
3	I thought the system was easy to use					
4	I think that I would need the support of a technical person to be able to use this system					
5	I found the various functions in this system were 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					

Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 138)

All comments, concerns and questions may be directed to: info@myhelo.com.

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Appendix 3

Non-Disclosure Agreement and Informed Consent Form

I voluntarily agree to participate in an evaluation being conducted by myhelo, Inc., (“myhELO”). This evaluation will test the usability of moxee by myhELO ("moxee").

The purpose of this study is to gather feedback about the effectiveness and efficiency of moxee. By participating in this study, I agree and consent to the following:

I authorize myhELO to keep, preserve, use in any manner and dispose of the findings from this evaluation, including my feedback and suggestions expressed. I relinquish any rights to my feedback and suggestions about moxee. myhELO will not associate my name or organization name with the results of this evaluation.

I give my permission for myhELO to make video and audio records and to take photos of me during this evaluation. I understand that these recordings and photos can be used only for the purpose of evaluating the moxee and showing the results of the evaluations and not for any other purpose.

I understand that during the usability study, I will come into contact with Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by myhELO, or otherwise acquired by the Participant, during the usability study.

Any information I acquire relating to this product during this study is confidential and proprietary to myhELO and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study.

By signing this form, I confirm I will not disclose this confidential information obtained today to anyone else or any other organizations.

I understand that my participation is completely voluntary and I may withdraw my consent and discontinue my participation at any time without penalty.

_____	_____	_____
Name (Please Print)	Signature	Date

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Appendix 4

Administrator's Guide

Thank you for participating in this study. Our session today will last about 1 hour. During that time, you will take a look at an electronic health record system. The product you will be using today is moxee by myhELO.

The system has been set up with a default testing database. Don't worry about making changes or mistakes in this environment, as it is only loaded with test data. We are recording only the screens 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.

I will ask you to complete a few tasks using this system and answer some questions at the end of the session. We are interested in how easy (or how difficult) this system is to use, and how we could improve it. You will be asked to complete these tasks on your own. Do not do anything more than asked. Please save your detailed comments until the end of the session. You can write notes about each task if you choose but it is not required.

Please be honest with your opinions. This is a test of the system and not of your abilities.

Getting started, the process will be as follows. We will provide the steps, and allow time for you to review them. Then you may open and start the task recording. Don't worry if you make errors or don't understand a step, just do your best. We're not allowed to help you once you have begun the recording. Do you have any questions or concerns?

Open your browser of choice, and go to the site: provider.myhelo.com. Enter your username, password and organization ID. Your Participant ID is: __ .

Testing Tasks

Demographics
Task a5.1 – Record patient demographic data including name, race, ethnicity, preferred language, sex, sexual orientation, gender identity, and date of birth. (Please make up a name and other demographics. i.e. "first name, test" and enter additional required fields)
Task a5.2 - Access and change the patient demographic information of the patient just entered. (i.e. change the ethnicity of the patient.)

Problem List
Task a6.1 – Record a patient's active problem list. (i.e. Arm Injury)
Task a6.2 – Access and change a patient's active problem list. (i.e. Change the Problem from "Arm Injury" to "Fracture of forearm".)

Medication List
Task a7.1 – Record a patient's active medication list. (i.e. "Tylennol Acetaminophen Extra Strength")
Task a7.2 – Access and change a patient's active medication list. (i.e. change "Tylennol Acetaminophen Extra Strength" to a different dosage)

Medication Allergy List
Task a8.1 – Record a patient's active medication allergy list. (i.e. "Bactrim")
Task a8.2 – Access and change a patient's active medication list. (i.e. change severity of "Bactrim" reaction to "Severe")

CPOE Diagnostic Imaging
Task a3.1 – Record an order for an x-ray. (i.e. "X-ray Exam of Forearm")
Task a3.2 – Access and cancel order for x-ray. (i.e. cancel "X-Ray Exam of Forearm")

CPOE Lab
Task a2.1 – Record an order for a laboratory test. (i.e. "Urinalysis")
Task a2.2 – Access and cancel order for laboratory test. (i.e. cancel "Urinalysis")

CPOE Medication
Task a1.1 – Record an order for a medication. (i.e. "Advil")
Task a1.2 – Access and cancel order for a medication. (i.e. cancel "Advil")

Electronic Prescribing
Task b3.1 – Create a new prescription. (i.e. create a prescription for "Ibuprofen")
Task b3.2 – Access and cancel prescription. (i.e. cancel "Ibuprofen" prescription)

Drug-Drug, Drug-Allergy Interaction Checks for Computerized Provider Order Entry
Task a4.1 – Enter a medication order that triggers a drug-drug intervention.
Task a4.2 – Enter a medication order that triggers a drug-allergy intervention.

CDS Alerts
Task a9.1 – Trigger a CDS Intervention for Vitals – High BMI
Task a9.2 – Trigger a CDS Intervention for Demographics – Age (i.e. if between 50-75, recommend colonoscopy)
Task a9.3 – Trigger a CDS Intervention for Medications (i.e. Rivaroxaban & Warfarin)
Task a9.4 – Trigger a CDS Intervention for Lab (i.e. if urine pH is outside 4.6 – 8.0)
Task a9.5 – Trigger a CDS Intervention for Medication Allergy (i.e. Penicillin Allergy)
Task a9.6 – Trigger a CDS Intervention for Problems (i.e. Patient is Pregnant)

Clinical Information Reconciliation and Incorporation
Task b3.1 – Reconcile a patient's medications, medication allergies and problems. (Use a provider given file and reconcile the required information with the existing patient.)

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Response Form

Task:
Participant ID:
Were you able to complete the Task?
How many steps did it take?
How long did it take?
How easy was it? (5 = Very Easy)
How efficient was it? (5 = Very Efficient)

Safety-Enhanced Design Usability Report

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

Date: January 7, 2025

Product: myhELO

Version: 3.14

User-Centered Design Process:

NISTIR 7741
NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records (EHR)
https://www.nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records

Dates of Usability Tests:
Tests occurred from September 30, 2024 – January 6, 2025.

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Executive Summary

A usability test of myhELO was conducted as part of compliance with the Safety-Enhanced Design requirements outlined by the ONC Health IT Certification Program Test Method, Health Information Technology Certification Criteria 170.315(g)(3). The purpose of this study was to test and validate the usability of the user interface and provide feedback of the usability on the Electronic Health Record Under Test (EHRUT).

Ten individuals participated in using the EHR in representative tasks. A total of 10 tasks were tested that aligned with Safety-Enhanced Design criteria.

This aspect of testing focused on Decision Support Intervention (DSI) tasks associated with ONC Criterion 170.315(b)(11). Decision Support Interventions for problems, medication, allergies, demographics, lab, vital signs, unique device identifiers and procedures were all tested.

During the usability test, each participant was greeted by the administrator and asked to review and sign an informed consent and release form (included in Appendix 3). As this was a voluntary usability test, participants were informed they could withdraw at any time. Participants had very little or no prior experience with the myhELO EHR in a professional setting. The administrator introduced the test, and instructed participants to complete the tasks one at a time using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s), recorded user performance data electronically. The administrator did not give the participant assistance in how to complete the task during testing.

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
- Participants' verbalizations
- Participants' satisfaction ratings of the system

Following the test, all participants completed the System Usability Scale (SUS) Questionnaire and were thanked for their involvement. For purposes of this report, participant data is de-identified. 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. The following is a summary of the performance and rating data collected on the EHRUT.

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Table 2: Usability Test Result Summary

		N	Task Success	Path Deviations (#)	Task Time (s)		Errors / Task Failures	Task Ratings 1-5 5 = Very Easy
	Tasks	#	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed / Optimal Deviation	Mean (SD)	Mean (SD)
b11.1	Problems - Attempt to schedule cataract surgery for a patient with uncontrolled glaucoma (a contraindicated problem).	10	100 (0)	2 / 2	6 (1)	1 / 0	0%	5 (0.0)
b11.2	Medications - Attempt to prescribe NSAIDs for an orthopedic patient with a history of peptic ulcer disease.	10	100 (0)	2 / 2	5 (1)	0 /0	0%	5 (0.0)
b11.3	Allergies - Attempt to order Prednisolone eye drops for a patient with a documented allergy to corticosteroids.	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)
b11.4	Demographics - Attempt to prescribe a bisphosphonate for osteoporosis in a pediatric orthopedic patient (age under 18, where it's contraindicated).	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)
b11.5	Laboratory - Attempt to schedule an intraocular injection for a patient whose recent lab result shows elevated INR (risk of bleeding).	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)
b11.6	Vital Signs - Attempt to prescribe anesthesia for an orthopedic surgery patient with hypotension (low blood pressure).	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)
b11.7	Unique Device Identifier - Attempt to order an MRI for an orthopedic patient with an implanted knee prosthesis flagged as non-MRI compatible.	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)
b11.8	Procedures - Attempt to schedule a LASIK procedure for a patient with thin corneas (< 480 microns) based on prior diagnostic imaging.	10	100 (0)	2 / 2	5 (0)	0 / 0	0%	5 (0.0)

	Tasks	N	Task Success	Path Deviations (#)	Task Time (s)		Errors / Task Failures	Task Ratings 1-5 5 = Very Easy
		#	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed / Optimal	Mean (SD)	Mean (SD)
b11.9	Update DSI Alert	10	100 (0)	5 / 5	30 (4)	3 / 0	0%	5 (0.0)
b11.10	Provide feedback on DSI	10	100 (0)	4 / 4	15 (2)	2 / 0	0%	5 (0.0)

Major findings

myhELO has integrated features that allow the system to learn users' preferences and favorite selections over time. This helped to provide genuine feedback on scenarios when using the system.

For the most part, participants seemed to be able to grasp quickly how to use myhELO. After the first few tasks, participants gradually learned how the workflow and system's common user interface were designed that helped them to understand how to complete subsequent tasks. In general, the common features and buttons throughout the system, such as left navigation and right side edit layer buttons, allowed the tasks to be completed effectively.

Areas for improvement

myhELO will continue to work with users to help continually find areas for improving the workflow as well as additional areas for automation. Since the system will be used on desktops as well as mobile devices, all work flow areas are considered before updates are integrated.

Introduction

The Electronic Health Record Under Test (EHRUT) which was tested for this study was myhELO, v 3.14. As a patient centered EHR, myhELO is designed as a Universal Health Record System to allow patients and healthcare providers to share information safely, securely and conveniently. myhELO is available to use with modern browsers on any computer or mobile device.

The usability testing represents realistic exercises and conditions, as the tests were performed on tasks that providers encounter during normal patient appointments. The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHRUT. To this end, measures of effectiveness, efficiency and user satisfaction, such as the time it took, were captured during the usability testing.

Intended Users

The intended users of this system include healthcare professionals and administrative staff operating in outpatient specialty practices and ambulatory surgery centers (ASCs). This group primarily comprises physicians, nurse practitioners, and physician assistants who rely on the system for clinical documentation, ordering tests, managing medications, and coordinating care. Additional users include registered nurses and allied health professionals involved in direct patient care, as well as administrative staff such as practice managers, billing specialists, and revenue cycle professionals who manage scheduling, coding, and claims submission. The system is designed to support a wide range of user expertise, from highly experienced clinicians to staff requiring additional training, ensuring usability across diverse workflows and settings.

Method

Participants

A total of 10 participants tested the EHRUT. Participants had a mix of backgrounds and demographic characteristics. The following is a table of participants by characteristics, including demographics, professional experience, and computing experience. A spreadsheet was used to keep track of relevant testing information pertaining to the participants and tasks completed.

ID	Gender (M/F)	Age (Years)	Education	Occupation	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
11	M	50-59	Doctorate degree	Physician	30.5	40.5	0	No
12	F	40-49	Doctorate degree	Physician	7	17	0	No
13	F	30-39	Bachelor's degree	Clinical Assistant	9	24	0	No
14	F	20-29	Associate degree	Clinical Assistant	14	23	0	No
15	M	40-49	Master's degree	COO	18	28	1	No
16	F	30-39	Bachelor's degree	Clinical Assistant	7	18	0	No
17	M	20-29	Associate degree	Clinical Assistant	5	15	0	No
18	F	30-39	Associate degree	Clinical Assistant	8	16	0	No
19	F	50-59	High school graduate	Clinical Assistant	21	26	0	No
20	F	20-29	Vocational Training	Clinical Assistant	5	15	0	No

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Study Design

Overall, the objective of this test was to uncover areas where the application performed effectively, efficiently, and with satisfaction, as well as areas where the application failed to meet the needs of the participants. The data from this test provides a record and a benchmark for any future improvements that may be made.

Each participant 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 without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participants' verbalizations (comments)
- Participants' satisfaction ratings of the system

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

Tasks

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR. Below is the listing of tasks the participants were asked to complete.

Task ID	Tasks
170.315(b)(11)	Decision Support Interventions (DSI)
b11.1	Problems - Attempt to schedule cataract surgery for a patient with uncontrolled glaucoma (a contraindicated problem).
b11.2	Medications - Attempt to prescribe NSAIDs for an orthopedic patient with a history of peptic ulcer disease.
b11.3	Allergies - Attempt to order Prednisolone eye drops for a patient with a documented allergy to corticosteroids.
b11.4	Demographics - Attempt to prescribe a bisphosphonate for osteoporosis in a pediatric orthopedic patient (age under 18, where it's contraindicated).
b11.5	Laboratory - Attempt to schedule an intraocular injection for a patient whose recent lab result shows elevated INR (risk of bleeding).
b11.6	Vital Signs - Attempt to prescribe anesthesia for an orthopedic surgery patient with hypotension (low blood pressure).
b11.7	Unique Device Identifier - Attempt to order an MRI for an orthopedic patient with an implanted knee prosthesis flagged as non-MRI compatible.
b11.8	Procedures - Attempt to schedule a LASIK procedure for a patient with thin corneas (< 480 microns) based on prior diagnostic imaging.
b11.9	Update DSI Alert
b11.10	Provide feedback on DSI

Tasks were selected based on their relevance and need for healthcare organizations to perform necessary functions.

Task Scenarios

Task Scenario b11.1: Contraindicated Surgery Scheduling
Scenario: Attempt to schedule cataract surgery for a patient with uncontrolled glaucoma. The system must trigger a decision support alert identifying the contraindication and provide guidance on resolving the issue.

Task Scenario b11.2: Contraindicated Medication Prescription
Scenario: Attempt to prescribe NSAIDs for an orthopedic patient with a history of peptic ulcer disease. The system must trigger a decision support alert identifying the contraindication and provide guidance on alternative options.

Task Scenario b11.3: Contraindicated Medication Order
Scenario: Attempt to order Prednisolone eye drops for a patient with a documented allergy to corticosteroids. The system must trigger a decision support alert identifying the allergy and provide guidance on alternative treatments.

Task Scenario b11.4: Contraindicated Prescription Based on Demographics
Scenario: Attempt to prescribe a bisphosphonate for osteoporosis in a pediatric orthopedic patient under age 18. The system must trigger a decision support alert indicating the contraindication based on the patient's age and provide guidance on appropriate next steps.

Task Scenario b11.5: Contraindicated Procedure Based on Lab Results
Scenario: Attempt to schedule an intraocular injection for a patient with a recent lab result showing elevated INR, indicating a risk of bleeding. The system must trigger a decision support alert highlighting the lab result contraindication and provide appropriate guidance.

Task Scenario b11.6: Contraindicated Prescription Based on Vital Signs
Scenario: Attempt to prescribe anesthesia for an orthopedic surgery patient with documented hypotension. The system must trigger a decision support alert indicating the contraindication and provide appropriate guidance.

Task Scenario b11.7: Contraindicated Imaging Order Based on Device Information
Scenario: Attempt to order an MRI for an orthopedic patient with an implanted knee prosthesis flagged as non-MRI compatible. The system must trigger a decision support alert identifying the device-related contraindication and provide appropriate guidance.

Task Scenario b11.9: Updating a Decision Support Intervention (DSI) Alert
Scenario: Update the DSI alert for prescribing a bisphosphonate to pediatric patients (Task b11.4) by refining the age criteria to trigger the alert only for patients under 16. The system must allow authorized users to edit the alert, save the changes, and ensure proper functionality.

Task Scenario b11.10: Providing Feedback on a Decision Support Intervention (DSI)
Scenario: Create a "myhELO Task" in the secure internal chat system to provide feedback to the Support team regarding a DSI alert. The feedback should include details about the issue (e.g., incorrect trigger, missing information, or unnecessary alert) and any suggestions for improvement. The system must support task creation with secure message delivery to the appropriate team.

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Procedure

Upon arrival, participants were greeted and their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. Each participant reviewed and signed an informed consent form and NDA (See Appendix 3). The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments. Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the participants were given a written copy of the task and instructions. 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. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (The System Usability Scale, Appendix 2) and thanked each individual for their participation. Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded into a spreadsheet. Participants were thanked for their time.

Test Location

The usability tests were conducted in a quiet area at a healthcare facility. Test Administrators were on-site to assist with any additional unforeseen questions that related to test conditions outside of the system, such as connectivity or general system access.

Test Environment

myhELO can be accessed from any device using a modern browser. In this instance, participants used a laptop with mouse, touchpad and keyboard when interacting with the EHRUT at an outpatient clinic facility. The application was set up by the administrators by logging onto the wireless network and bringing up the login page for the application.

Test Forms and Tools

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

1. NDA and Informed Consent Form
2. Administrator's Guide
3. System Usability Scale Questionnaire

Examples of these documents can be found in Appendices 3-5 respectively. The Administrator's Guide was devised so as to be able to capture required data and to follow along with the tasks that each participant was asked to complete during the test.

Following each task, participants were asked to describe ease of use and efficiency, and to explain their rationale, as described in the Administrator's Guide. At the conclusion of the session, participants were also asked to complete a post-test questionnaire, which was based on the standard System Usability Scale (Appendix 2).

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Participant Instructions

The administrator reads the following instructions aloud to the each participant:

> *Thank you for participating in this study. Your input is very important. Our session today will last about 20-30 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you, we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.*
>
> *Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. 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 10-15 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 will ask you your impressions about the task once you are done but we will not respond if you talk aloud during the completion of the task.*

Participants were then given their tasks to complete. The tasks are listed in section 3.3.

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Usability Metrics

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

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

The table below provides information on how each of the tasks were scored, how the errors were evaluated, and how the time-on-task data was analyzed.

Measure	Rationale and Scoring
Effectiveness: Task Success	A task was recorded as a success if the participant was able to achieve the correct outcome without assistance. To calculate the total number of successes we divided number of tasks attempted by the number of participants. The results are reported as a percentage. Task times were recorded for successes only.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct result, performed it incorrectly, or gave up, the task was recorded as a failure. Task times for failures were not recorded in this report.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations included, for example, navigating to the wrong screen, choosing an incorrect menu item, or interacting incorrectly with an on-screen control. This was compared to the optimal path.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	After each task, each participant was asked to rate the task ease of use on a scale of 1 to 5, where 1 was "Very Difficult" and 5 was "Very Easy". The ratings were averaged across participants. Participants were also asked to rate task efficiency on a scale of 1 to 5, where 1 was "Very Inefficient" and 5 was "Very Efficient". In addition, participants were asked to complete the System Usability Scale questionnaire.

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Results

Data Analysis and Reporting

170.315(b)(11) Decision Support Interventions (DSI)

b11.1 DSI alert – Problems

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	6.4	5	5
12	100	2	5.3	5	5
13	100	2	7.8	5	5
14	100	2	4.7	5	5
15	100	2	5.9	5	5
16	100	2	8.1	5	5
17	100	2	6.3	5	5
18	100	2	6.1	5	5
19	100	2	4.3	5	5
20	100	2	4.8	5	5
Mean	100	2	5.97	5	5
Standard Deviation	0.0	0.0	1.27	0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.2 DSI alert – Medications

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	5.3	5	5
12	100	2	4.8	5	5
13	100	2	6.2	5	5
14	100	2	5.1	5	5
15	100	2	4.9	5	5
16	100	2	5.8	5	5
17	100	2	4.7	5	5
18	100	2	5.9	5	5
19	100	2	5.7	5	5
20	100	2	5.3	5	5
Mean	100	2	5.37	5	5
Standard Deviation	0.0	0.0	0.51	0	0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.3 DSI alert – Allergies

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	5.6	5	5
12	100	2	5.8	5	5
13	100	2	5.3	5	5
14	100	2	4.9	5	5
15	100	2	5.5	5	5
16	100	2	6.4	5	5
17	100	2	4.8	5	5
18	100	2	5.1	5	5
19	100	2	5.5	5	5
20	100	2	5.4	5	5
Mean	100	2	5.43	5	5
Standard Deviation	0.0	0	0.46	0	0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.4 DSI alert – Demographics

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	4.7	5	5
12	100	2	4.8	5	5
13	100	2	4.7	5	5
14	100	2	5.1	5	5
15	100	2	4.9	5	5
16	100	2	5.2	5	5
17	100	2	4.8	5	5
18	100	2	5.6	5	5
19	100	2	4.9	5	5
20	100	2	5.3	5	5
Mean	100	2	5	5	5
Standard Deviation	0.0	0.0	0.29	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.5 DSI alert – Laboratory

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	4.7	5	5
12	100	2	5.1	5	5
13	100	2	4.8	5	5
14	100	2	5.3	5	5
15	100	2	5.2	5	5
16	100	2	4.6	5	5
17	100	2	5.1	5	5
18	100	2	5.8	5	5
19	100	2	5.3	5	5
20	100	2	4.6	5	5
Mean	100	2	5.05	5	5
Standard Deviation	0.0	0.0	0.38	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.6 DSI alert – Vital Signs

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	4.8	5	5
12	100	2	5.4	5	5
13	100	2	4.7	5	5
14	100	2	4.9	5	5
15	100	2	5.3	5	5
16	100	2	4.6	5	5
17	100	2	5.1	5	5
18	100	2	5.3	5	5
19	100	2	4.7	5	5
20	100	2	4.9	5	5
Mean	100	2	4.97	5	5
Standard Deviation	0.0	0.0	0.29	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.7 DSI alert – Unique Device Identifier

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	4.8	5	5
12	100	2	5.4	5	5
13	100	2	4.7	5	5
14	100	2	4.9	5	5
15	100	2	5.3	5	5
16	100	2	4.6	5	5
17	100	2	5.1	5	5
18	100	2	5.3	5	5
19	100	2	4.7	5	5
20	100	2	4.9	5	5
Mean	100	2	4.97	5	5
Standard Deviation	0.0	0.0	0.29	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.8 DSI alert – Procedures

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**2**	**5**	**5**	**5**
11	100	2	5.3	5	5
12	100	2	4.9	5	5
13	100	2	5.2	5	5
14	100	2	5.8	5	5
15	100	2	5.3	5	5
16	100	2	4.6	5	5
17	100	2	4.8	5	5
18	100	2	4.7	5	5
19	100	2	5.3	5	5
20	100	2	4.9	5	5
Mean	100	2	5.08	5	5
Standard Deviation	0.0	0.0	0.36	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.9 – Update DSI alert

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**5**	**28**	**5**	**5**
11	100	5	27.7	5	5
12	100	6	35.1	5	5
13	100	5	33.8	5	5
14	100	5	27.6	5	5
15	100	5	22.1	5	5
16	100	5	32.6	5	5
17	100	5	31.1	5	5
18	100	5	29.3	5	5
19	100	5	28.4	5	5
20	100	5	31.5	5	5
Mean	100	5	29.92	5	5
Standard Deviation	0.0	0	3.76	0.0	0.0

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170.315(b)(11) Decision Support Interventions (DSI)

b11.10 – Provide feedback on DSI

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**4**	**16**	**5**	**5**
11	100	4	10.93	5	5
12	100	4	14.8	5	5
13	100	4	12.3	5	5
14	100	4	17.9	5	5
15	100	4	13.8	5	5
16	100	4	14.9	5	5
17	100	4	15.5	5	5
18	100	4	16.3	5	5
19	100	4	17.5	5	5
20	100	4	14.1	5	5
Mean	100	4	14.8	5	5
Standard Deviation	0.0	0.0	2.17	0.0	0.0

Discussion of the Findings

The test result tables provide insight into the success of each of the tasks by analyzing the number of path deviations, task time, number of errors, task ratings, and the task efficiency rating. While there were some errors logged for various tasks, overall the results were positive. Observed errors were classified as low risk regarding patient safety and were documented and shared with design and development teams for potential future product improvements

Effectiveness

Participants were able to complete the tasks effectively as shown by the task completion rates. All participants were able to complete the required tasks.

Efficiency

In general, error rates were low, though where more information was required, such as in the case of multiple medications in the listing, path deviations were more likely to occur. This is to be expected as more steps are required to enter additional medication information in certain situations. While low, this is certainly to be considered for potential future improvements. Overall, participants were able to complete tasks efficiently with few errors.

Satisfaction

Overall, users expressed satisfaction with the myhELO EHR features tested during this study. Based on verbal comments and survey results from the participants following the tests, it was clear that the required tasks were simple to complete and were able to be completed to satisfaction.

Major Findings

myhELO testing results were very favorable based on the test results and verbal comments from participants, staff and administrators. The demographic scope included in the testing, also helped to provide confirmation that future users would expect to see similar results, regardless of previous system knowledge.

Areas for Improvement

Based on the feedback and test results, myhELO overall was found to have a favorable usability score. While this is indeed positive news, shortcuts, preferences and other means of automation will continue to be a major focus of development so that users are able to have even fewer interactions. An example of this would be the medication lists. While this information can be easily entered manually, some users may prefer to update medications from the national medication database to ensure accuracy of information. As this step, as well as others, can be time consuming, further evaluation for automation will be evaluated.

Appendix

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

Appendix 1: Sample Recruiting Screener
Appendix 2: System Usability Scale Questionnaire
Appendix 3: Non-Disclosure Agreement and Informed Consent Form
Appendix 4: Administrator's Guide

Appendix 1
Recruiting Script for Recruiting Firm

Hello, my name is _____, calling from moxee by myhELO. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid to participate.

Can I ask you a few questions?

1. (If not obvious) Are you male or female? (Recruit a mix of participants)
    a. Male
    b. Female

2. Have you participated in a focus group or usability test in the past xx months?
    a. Yes (Terminate)
    b. No

3. Do you, or does anyone in your home, work in marketing research, usability research, web design or related areas?
    a. Yes (Terminate)
    b. No

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
    a. Yes (Terminate)
    b. No

5. Which of the following best describes your age? (Recruit Mix)
    a. 23 to 39
    b. 40 to 59
    c. 60 - to 74
    d. 75 and older

6. Which of the following best describes your race or ethnic group?
    a. Caucasian
    b. Asian
    c. Black/African-American
    d. Latino/a or Hispanic
    e. Other _____

7. Do you require any assistive technologies to use a computer? (if so, please describe)
    a. Yes, please describe _____
    b. No

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Professional Demographics

8. What is your current position and title? (Must be healthcare provider)
    a. RN: Specialty _____
    b. Physician: Specialty _____
    c. Physician's Assistant: _____
    d. Medical Assistant: _____
    e. Resident: Specialty _____
    f. Administrative Staff
    g. Other _____

9. How long have you held this position? _____

10. Describe your work location (or affiliation) and environment? _____

11. Which of the following describes your highest level of education?
    a. High school graduate/GED
    b. Some college
    c. College graduate (RN, BSN)
    d. Postgraduate (MD/PhD)
    e. Other _____

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? (If no computer use at all, Terminate)
    a. EHR Access
    b. Research
    c. Reading news
    d. Shopping/banking
    e. Digital pictures
    f. Programming/word processing
    g. Other _____

13. About how many hours per week do you spend on the computer?
    a. 0 to 10 hours
    b. 11 to 25 hours
    c. 26+ hours per week

14. What computer platform do you usually use?
    a. Mac
    b. Windows
    c. Other _____

15. What Internet browser(s) do you usually use?
    a. IE
    b. Chrome
    c. Firefox
    d. Safari
    e. Other _____

16. In the last month, how often have you used an electronic health record? _____

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

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

19. How does your work environment maintain patient records?
    a. On paper
    b. Some paper, some electronic
    c. All electronic

Contact Information

(If the person matches your qualifications, continue.)

Those are all the questions I have for you. Your background matches the people we're looking for. Would you be able to participate in the next couple weeks? (Schedule Date and Time)

May I get your contact information?

Name of participant:
Address:
City, State, Zip:
Daytime phone number:
Evening phone number:
Cell phone number:
Email address:

Before your session starts, we will ask you to sign a release form allowing us to record your session. The recording will only be used internally for further study if needed. Will you consent to be recorded?

(Confirm scheduled date, time and location.) I will confirm your appointment again a couple of days before your session and provide you with directions if needed. What time is the best time to reach you?

Thank you.

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Appendix 2

System Usability Scale

	System Usability Scale	Rating Scale 1-5 1 = Strongly Disagree 5 = Strongly Agree				
		1	2	3	4	5
1	I think that I would like to use this system frequently					
2	I found the system unnecessarily complex					
3	I thought the system was easy to use					
4	I think that I would need the support of a technical person to be able to use this system					
5	I found the various functions in this system were 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					

Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 138)

All comments, concerns and questions may be directed to: info@myhelo.com.

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Appendix 3

Non-Disclosure Agreement and Informed Consent Form

I voluntarily agree to participate in an evaluation being conducted by myhelo, Inc., (“myhELO”). This evaluation will test the usability of myhELO ("moxee").

The purpose of this study is to gather feedback about the effectiveness and efficiency of moxee. By participating in this study, I agree and consent to the following:

I authorize myhELO to keep, preserve, use in any manner and dispose of the findings from this evaluation, including my feedback and suggestions expressed. I relinquish any rights to my feedback and suggestions about moxee. myhELO will not associate my name or organization name with the results of this evaluation.

I give my permission for myhELO to make video and audio records and to take photos of me during this evaluation. I understand that these recordings and photos can be used only for the purpose of evaluating the moxee and showing the results of the evaluations and not for any other purpose.

I understand that during the usability study, I will come into contact with Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by myhELO, or otherwise acquired by the Participant, during the usability study.

Any information I acquire relating to this product during this study is confidential and proprietary to myhELO and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study.

By signing this form, I confirm I will not disclose this confidential information obtained today to anyone else or any other organizations.

I understand that my participation is completely voluntary and I may withdraw my consent and discontinue my participation at any time without penalty.

_____	_____	_____
Name (Please Print)	Signature	Date

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Appendix 4

Administrator's Guide

Thank you for participating in this study. Our session today will last about 1 hour. During that time, you will take a look at an electronic health record system. The product you will be using today is myhELO.

The system has been set up with a default testing database. Don't worry about making changes or mistakes in this environment, as it is only loaded with test data. We are recording only the screens 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.

I will ask you to complete a few tasks using this system and answer some questions at the end of the session. We are interested in how easy (or how difficult) this system is to use, and how we could improve it. You will be asked to complete these tasks on your own. Do not do anything more than asked. Please save your detailed comments until the end of the session. You can write notes about each task if you choose but it is not required.

Please be honest with your opinions. This is a test of the system and not of your abilities.

Getting started, the process will be as follows. We will provide the steps, and allow time for you to review them. Then you may open and start the task recording. Don't worry if you make errors or don't understand a step, just do your best. We're not allowed to help you once you have begun the recording. Do you have any questions or concerns?

Open your browser of choice, and go to the site: provider.myhelo.com. Enter your username, password and organization ID. Your Participant ID is: __ .

Testing Tasks

DSI Alerts
Task b11.1 – Problems - Attempt to schedule cataract surgery for a patient with uncontrolled glaucoma (a contraindicated problem).
Task b11.2 – Medications - Attempt to prescribe NSAIDs for an orthopedic patient with a history of peptic ulcer disease.
Task b11.3 – Allergies - Attempt to order Prednisolone eye drops for a patient with a documented allergy to corticosteroids.
Task b11.4 – Demographics - Attempt to prescribe a bisphosphonate for osteoporosis in a pediatric orthopedic patient (age under 18, where it's contraindicated).
Task b11.5 – Laboratory - Attempt to schedule an intraocular injection for a patient whose recent lab result shows elevated INR (risk of bleeding).
Task b11.6 – Vital Signs - Attempt to prescribe anesthesia for an orthopedic surgery patient with hypotension (low blood pressure).
Task b11.7 – Unique Device Identifier - Attempt to order an MRI for an orthopedic patient with an implanted knee prosthesis flagged as non-MRI compatible.
Task b11.8 – Procedures - Attempt to schedule a LASIK procedure for a patient with thin corneas (< 480 microns) based on prior diagnostic imaging.
Task b11.9 – Update DSI Alert
Task 11.10 – Provide feedback on DSI

Response Form

Task:
Participant ID:
Were you able to complete the Task?
How many steps did it take?
How long did it take?
How easy was it? (5 = Very Easy)
How efficient was it? (5 = Very Efficient)

Safety-Enhanced Design Usability Report

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

Date: November 9, 2026

Product: myhELO

Version: 3.14

User-Centered Design Process:

NISTIR 7741
NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records (EHR)
https://www.nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records

Dates of Usability Tests:
Tests occurred October 29 and 30, 2026.

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Executive Summary

A usability test of myhELO was conducted as part of compliance with the Safety-Enhanced Design requirements outlined by the ONC Health IT Certification Program Test Method, Health Information Technology Certification Criteria 170.315(g)(3). The purpose of this study was to test and validate the usability of the user interface and provide feedback of the usability on the Electronic Health Record Under Test (EHRUT).

Ten individuals participated in using the EHR in representative tasks. A total of 3 tasks were tested that aligned with Safety-Enhanced Design criteria.

This aspect of testing focused on Implantable Device List tasks associated with ONC Criterion 170.315(a)(14). Recording a Unique Device Identifier (UDI), accessing the implantable device list and device details, and changing the status of a recorded device were all tested.

During the usability test, each participant was greeted by the administrator and asked to review and sign an informed consent and release form (included in Appendix 3). As this was a voluntary usability test, participants were informed they could withdraw at any time. All participants were existing myhELO users, with 18 to 48 months of experience with the product. The administrator introduced the test, and instructed participants to complete the tasks one at a time using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s), recorded user performance data electronically. The administrator did not give the participant assistance in how to complete the task during testing.

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
- Participants' verbalizations
- Participants' satisfaction ratings of the system

Following the test, all participants completed the System Usability Scale (SUS) Questionnaire and were thanked for their involvement. For purposes of this report, participant data is de-identified. 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. The following is a summary of the performance and rating data collected on the EHRUT.

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Table 2: Usability Test Result Summary

		N	Task Success	Path Deviations (#)	Task Time (s)		Errors / Task Failures	Task Ratings 1-5 5 = Very Easy
	Tasks	#	Mean (SD)	Observed/ Optimal	Mean (SD)	Observed / Optimal Deviation	Mean (SD)	Mean (SD)
a14.1	Record a Unique Device Identifier (UDI) for a patient's implantable device and confirm the parsed identifiers and device description.	10	100 (0)	8 / 8	25 (5)	10 / 0	0%	4.8 (0.4)
a14.2	Access the patient's implantable device list and view the details of an active implantable device.	10	100 (0)	3 / 3	13 (2)	3 / 0	0%	4.9 (0.3)
a14.3	Change the status of a recorded implantable device to inactive and access the list of all implantable devices, including inactive devices.	10	100 (0)	9 / 9	20 (3)	5 / 0	0%	4.7 (0.5)

Major findings

All ten participants completed all three Implantable Device List tasks without assistance, and the mean System Usability Scale score was 94.0. Three minor errors were observed, each an extra step in the task path. None affected the device recorded or its status.

For the most part, participants seemed to be able to grasp quickly how to use myhELO. After the first few tasks, participants gradually learned how the workflow and system's common user interface were designed that helped them to understand how to complete subsequent tasks. In general, the common features and buttons throughout the system, such as left navigation and right side edit layer buttons, allowed the tasks to be completed effectively.

Areas for improvement

The main opportunities identified were faster results from the device search when recording a new device, fewer steps to change a device's status, and brief guidance for first-time users. myhELO will continue to work with users to find areas for improving the workflow as well as additional areas for automation.

Introduction

The Electronic Health Record Under Test (EHRUT) which was tested for this study was myhELO, v 3.14. As a patient centered EHR, myhELO is designed as a Universal Health Record System to allow patients and healthcare providers to share information safely, securely and conveniently. myhELO is available to use with modern browsers on any computer or mobile device.

The usability testing represents realistic exercises and conditions, as the tests were performed on tasks that providers encounter during normal patient appointments. The purpose of this study was to test and validate the usability of the current user interface, and provide evidence of usability in the EHRUT. To this end, measures of effectiveness, efficiency and user satisfaction, such as the time it took, were captured during the usability testing.

Intended Users

The intended users of this system include healthcare professionals and administrative staff operating in outpatient specialty practices and ambulatory surgery centers (ASCs). This group primarily comprises physicians, nurse practitioners, and physician assistants who rely on the system for clinical documentation, ordering tests, managing medications, and coordinating care. Additional users include registered nurses and allied health professionals involved in direct patient care, as well as administrative staff such as practice managers, billing specialists, and revenue cycle professionals who manage scheduling, coding, and claims submission. The system is designed to support a wide range of user expertise, from highly experienced clinicians to staff requiring additional training, ensuring usability across diverse workflows and settings.

Method

Participants

A total of 10 participants tested the EHRUT. Participants had a mix of backgrounds and demographic characteristics. The following is a table of participants by characteristics, including demographics, professional experience, and computing experience. A spreadsheet was used to keep track of relevant testing information pertaining to the participants and tasks completed.

ID	Gender (M/F)	Age (Years)	Education	Occupation	Professional Experience (Years)	Computer Experience (Years)	Product Experience (Years)	Assistive Technology Needs
21	M	40-49	Doctorate degree	MD	17	30	1.7	No
22	M	30-39	Doctorate degree	MD	7	20	1.5	No
23	F	30-39	Master's degree	Physician Assistant	15	21	1.8	No
24	F	30-39	Master's degree	Physician Assistant	11	19	1.8	No
25	M	40-49	Master's degree	Administrator	27	31	2.2	No
26	F	30-39	Associate degree	Clinical Assistant	13	17	4	No
27	M	20-29	Associate degree	Clinical Assistant	6	10	2	No
28	F	30-39	Vocational Training	Clinical Assistant	9	13	1.7	No
29	F	50-59	Vocational Training	Clinical Assistant	32	36	1.7	No
30	F	20-29	Associate degree	Clinical Assistant	6	10	1.8	No

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Study Design

Overall, the objective of this test was to uncover areas where the application performed effectively, efficiently, and with satisfaction, as well as areas where the application failed to meet the needs of the participants. The data from this test provides a record and a benchmark for any future improvements that may be made.

Each participant 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 without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participants' verbalizations (comments)
- Participants' satisfaction ratings of the system

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

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Tasks

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might perform with this EHR. Below is the listing of tasks the participants were asked to complete.

Task ID	Tasks
170.315(a)(14)	Implantable Device List
a14.1	Record a Unique Device Identifier (UDI) for a patient's implantable device and confirm the parsed identifiers and device description.
a14.2	Access the patient's implantable device list and view the details of an active implantable device.
a14.3	Change the status of a recorded implantable device to inactive and access the list of all implantable devices, including inactive devices.

Tasks were selected based on their relevance and need for healthcare organizations to perform necessary functions, and were prioritized according to the risk associated with user errors: incorrectly recording a device, misreading its MRI safety or latex labeling, or leaving a removed device on the active list.

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Task Scenarios

Task Scenario a14.1: Recording an Implantable Device by UDI
Scenario: A patient returns for a post-operative visit following a total knee arthroplasty. Using the implant record from the operative report, record the knee prosthesis on the patient's implantable device list by entering its Unique Device Identifier (UDI): (01)00811767020008(11)250310(17)300310(10)TK25031A(21)KN7730021. Confirm that the system parses the Device Identifier and Production Identifiers (lot or batch, serial number, expiration date, manufacture date and, where present, distinct identification code) and displays the device description, brand name, version or model, company name, MRI safety information and natural rubber latex labeling. Risk addressed: an incorrectly recorded or mis-identified implant can lead to unsafe imaging (MRI) or exposure to latex, so accurate capture is prioritized.
Task Scenario a14.2: Reviewing the Implantable Device List
Scenario: Before ordering imaging, review the patient's implantable device list. Locate the knee prosthesis recorded in Task a14.1, open its details, and identify its UDI, device description, parsed identifiers, and its MRI safety and latex labeling. Risk addressed: clinicians must be able to quickly find and read device safety attributes before ordering procedures.
Task Scenario a14.3: Changing the Status of an Implantable Device
Scenario: The patient reports that a previously recorded device (a forefoot bone screw, UDI (01)00190837019761(10)LS22917) was removed during a prior surgery. Change the status of that device to inactive, then confirm that it no longer appears among the active devices and can still be accessed in the list of all devices recorded for the patient. Risk addressed: an outdated active device list can produce incorrect safety decisions, so status changes must be clear and reversible.

Procedure

Upon arrival, participants were greeted and their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. Each participant reviewed and signed an informed consent form and NDA (See Appendix 3). The administrator moderated the session including administering instructions and tasks. The administrator also monitored task times, obtained post-task rating data, and took notes on participant comments. A second person served as the data logger and took notes on task success, path deviations, number and type of errors, and comments. Participants were instructed to perform the tasks (see specific instructions below):

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

For each task, the participants were given a written copy of the task and instructions. 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. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (The System Usability Scale, Appendix 2) and thanked each individual for their participation. Participants' demographic information,

task success rate, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded into a spreadsheet. Participants were thanked for their time.

Test Location

The usability tests were conducted in a quiet area at a healthcare facility. Test Administrators were on-site to assist with any additional unforeseen questions that related to test conditions outside of the system, such as connectivity or general system access.

Test Environment

myhELO can be accessed from any device using a modern browser. In this instance, participants used a laptop with mouse, touchpad and keyboard when interacting with the EHRUT at an outpatient clinic facility. The application was set up by the administrators by logging onto the wireless network and bringing up the login page for the application.

Test Forms and Tools

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

1. NDA and Informed Consent Form
2. Administrator's Guide
3. System Usability Scale Questionnaire

Examples of these documents can be found in Appendices 3-5 respectively. The Administrator's Guide was devised so as to be able to capture required data and to follow along with the tasks that each participant was asked to complete during the test.

Following each task, participants were asked to describe ease of use and efficiency, and to explain their rationale, as described in the Administrator's Guide. At the conclusion of the session, participants were also asked to complete a post-test questionnaire, which was based on the standard System Usability Scale (Appendix 2).

Participant Instructions

The administrator reads the following instructions aloud to the each participant:

> *Thank you for participating in this study. Your input is very important. Our session today will last about 20-30 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you, we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.*
>
> *Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. 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 10-15 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 will ask you your impressions about the task once you are done but we will not respond if you talk aloud during the completion of the task.*

Participants were then given their tasks to complete. The tasks are listed in section 3.3.

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Usability Metrics

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

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

The table below provides information on how each of the tasks were scored, how the errors were evaluated, and how the time-on-task data was analyzed.

Measure	Rationale and Scoring
Effectiveness: Task Success	A task was recorded as a success if the participant was able to achieve the correct outcome without assistance. To calculate the total number of successes we divided number of tasks attempted by the number of participants. The results are reported as a percentage. Task times were recorded for successes only.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct result, performed it incorrectly, or gave up, the task was recorded as a failure. Task times for failures were not recorded in this report.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations included, for example, navigating to the wrong screen, choosing an incorrect menu item, or interacting incorrectly with an on-screen control. This was compared to the optimal path.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	After each task, each participant was asked to rate the task ease of use on a scale of 1 to 5, where 1 was "Very Difficult" and 5 was "Very Easy". The ratings were averaged across participants. Participants were also asked to rate task efficiency on a scale of 1 to 5, where 1 was "Very Inefficient" and 5 was "Very Efficient". In addition, participants were asked to complete the System Usability Scale questionnaire.

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Results

Data Analysis and Reporting

170.315(a)(14) Implantable Device List

a14.1 – Record UDI

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**8**	**15**	**5**	**5**
21	100	8	19	5	5
22	100	8	25	5	5
23	100	9	33	4	4
24	100	8	22	5	5
25	100	8	21	5	5
26	100	8	22	5	5
27	100	8	20	5	5
28	100	9	34	4	4
29	100	8	26	5	5
30	100	8	25	5	5
Mean	100	8.2	24.7	4.8	4.8
Standard Deviation	0.0	0.42	5.17	0.42	0.42

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170.315(a)(14) Implantable Device List

a14.2 – Access implantable device list and details

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**3**	**10**	**5**	**5**
21	100	3	12	5	5
22	100	3	11	5	5
23	100	3	14	5	5
24	100	3	16	5	5
25	100	3	11	5	5
26	100	3	13	5	5
27	100	3	12	5	5
28	100	3	12	5	5
29	100	3	11	5	5
30	100	4	15	4	5
Mean	100	3.1	12.7	4.9	5
Standard Deviation	0.0	0.32	1.77	0.32	0.00

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170.315(a)(14) Implantable Device List

a14.3 – Change UDI status

Participant	Task Success	Task Path	Task Time (s)	Task Ratings 1-5 (5 = Very Easy)	Task Efficiency 1-5 5 = Very Efficient
Optimal	**100**	**9**	**15**	**5**	**5**
21	100	9	17	5	5
22	100	9	16	5	5
23	100	9	15	4	5
24	100	9	18	5	5
25	100	9	22	5	5
26	100	9	19	4	5
27	100	9	20	5	5
28	100	9	26	5	5
29	100	9	22	4	5
30	100	9	21	5	5
Mean	100	9	19.6	4.7	5
Standard Deviation	0.0	0.00	3.31	0.48	0.00

Discussion of the Findings

The test result tables provide insight into the success of each of the tasks by analyzing the number of path deviations, task time, number of errors, task ratings, and the task efficiency rating. All 30 task attempts were completed successfully. Three errors were logged, each one step beyond the optimal path: participants 23 and 28 in Task a14.1, while waiting on the device search, and participant 30 in Task a14.2. In each case the participant recovered and completed the task without assistance. No participant recorded the wrong device, saved incorrect identifiers, or left a device in the wrong status. The observed errors were classified as low risk to patient safety: they were infrequent, they were corrected within the task, and their only consequence was a short delay. They were documented and shared with the design and development teams for potential future product improvements.

Effectiveness

Participants completed the tasks effectively. All ten participants completed Tasks a14.1, a14.2 and a14.3 without assistance, a task success rate of 100% for each task, and there were no task failures.

Efficiency

Participants followed the optimal path in 27 of 30 task attempts. Mean task times were 25 seconds to record a UDI (a14.1, optimal 15), 13 seconds to access the device list and a device's details (a14.2, optimal 10), and 20 seconds to change a device's status and view all devices (a14.3, optimal 15). The largest time deviation was in a14.1: the two participants who took an extra step (33 and 34 seconds) commented that the device search was slow to return results. Task a14.3 had no path deviations, though at 9 steps it is the longest of the three tasks.

Satisfaction

Participants rated the tasks easy to complete, with mean ease ratings of 4.8 (a14.1), 4.9 (a14.2) and 4.7 (a14.3) on a 5-point scale, and mean efficiency ratings of 4.8, 5.0 and 5.0. The mean System Usability Scale score was 94.0 (range 90 to 97.5). Comments were positive, for example "Clean layout. Makes this simple," "That's kind of a nice little search," and "That will save time. Other systems I've used take a little longer." The lower ratings (4) related to the device search response time in a14.1, an extra step in a14.2, and the number of steps in a14.3 ("Not hard, but takes a few steps").

Major Findings

Participants were able to record a UDI, review the parsed identifiers and FDA device details, review the implantable device list, and change a device's status without assistance and with few errors. Automatic parsing of the UDI into its device and production identifiers, with the device description and safety attributes shown alongside, was well received ("This will be helpful"; "I like it. This is useful since it shows up on the chart."). The main source of delay was the time the device search took to return results when recording a new device.

Areas for Improvement

Three areas were identified for future improvement. First, the response time of the device search used when recording a new implantable device, the source of both errors in Task a14.1. Second, the status change workflow in Task a14.3, which participants completed accurately but which requires the most steps of the three tasks. Third, brief in-product guidance for first-time users of the implantable device list, as suggested by one participant ("adding a quick tutorial for first-time users would be nice").

Appendix

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

Appendix 1: Sample Recruiting Screener
Appendix 2: System Usability Scale Questionnaire
Appendix 3: Non-Disclosure Agreement and Informed Consent Form
Appendix 4: Administrator's Guide

Appendix 1
Recruiting Script for Recruiting Firm

Hello, my name is _____, calling from myhELO. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested and qualify for the study, you will be paid to participate.

Can I ask you a few questions?

1. (If not obvious) Are you male or female? (Recruit a mix of participants)
    a. Male
    b. Female

2. Have you participated in a focus group or usability test in the past xx months?
    a. Yes (Terminate)
    b. No

3. Do you, or does anyone in your home, work in marketing research, usability research, web design or related areas?
    a. Yes (Terminate)
    b. No

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]
    a. Yes (Terminate)
    b. No

5. Which of the following best describes your age? (Recruit Mix)
    a. 23 to 39
    b. 40 to 59
    c. 60 - to 74
    d. 75 and older

6. Which of the following best describes your race or ethnic group?
    a. Caucasian
    b. Asian
    c. Black/African-American
    d. Latino/a or Hispanic
    e. Other _____

7. Do you require any assistive technologies to use a computer? (if so, please describe)
    a. Yes, please describe _____
    b. No

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Professional Demographics

8. What is your current position and title? (Must be healthcare provider)
    a. RN: Specialty _____
    b. Physician: Specialty _____
    c. Physician's Assistant: _____
    d. Medical Assistant: _____
    e. Resident: Specialty _____
    f. Administrative Staff
    g. Other _____

9. How long have you held this position? _____

10. Describe your work location (or affiliation) and environment? _____

11. Which of the following describes your highest level of education?
    a. High school graduate/GED
    b. Some college
    c. College graduate (RN, BSN)
    d. Postgraduate (MD/PhD)
    e. Other _____

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? (If no computer use at all, Terminate)
    a. EHR Access
    b. Research
    c. Reading news
    d. Shopping/banking
    e. Digital pictures
    f. Programming/word processing
    g. Other _____

13. About how many hours per week do you spend on the computer?
    a. 0 to 10 hours
    b. 11 to 25 hours
    c. 26+ hours per week

14. What computer platform do you usually use?
    a. Mac
    b. Windows
    c. Other _____

15. What Internet browser(s) do you usually use?
    a. IE
    b. Chrome
    c. Firefox
    d. Safari
    e. Other _____

16. In the last month, how often have you used an electronic health record? _____

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

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

19. How does your work environment maintain patient records?
    a. On paper
    b. Some paper, some electronic
    c. All electronic

Contact Information

(If the person matches your qualifications, continue.)

Those are all the questions I have for you. Your background matches the people we're looking for. Would you be able to participate in the next couple weeks? (Schedule Date and Time)

May I get your contact information?

Name of participant:
Address:
City, State, Zip:
Daytime phone number:
Evening phone number:
Cell phone number:
Email address:

Before your session starts, we will ask you to sign a release form allowing us to record your session. The recording will only be used internally for further study if needed. Will you consent to be recorded?

(Confirm scheduled date, time and location.) I will confirm your appointment again a couple of days before your session and provide you with directions if needed. What time is the best time to reach you?

Thank you.

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Appendix 2

System Usability Scale

	System Usability Scale	Rating Scale 1-5 1 = Strongly Disagree 5 = Strongly Agree				
		1	2	3	4	5
1	I think that I would like to use this system frequently					
2	I found the system unnecessarily complex					
3	I thought the system was easy to use					
4	I think that I would need the support of a technical person to be able to use this system					
5	I found the various functions in this system were 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					

Tullis, T. & Albert, W. (2008). Measuring the User Experience. Burlington, MA: Morgan Kaufman (p. 138)

All comments, concerns and questions may be directed to: info@myhelo.com.

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Appendix 3

Non-Disclosure Agreement and Informed Consent Form

I voluntarily agree to participate in an evaluation being conducted by myhelo, Inc., (“myhELO”). This evaluation will test the usability of myhELO ("moxee").

The purpose of this study is to gather feedback about the effectiveness and efficiency of moxee. By participating in this study, I agree and consent to the following:

I authorize myhELO to keep, preserve, use in any manner and dispose of the findings from this evaluation, including my feedback and suggestions expressed. I relinquish any rights to my feedback and suggestions about moxee. myhELO will not associate my name or organization name with the results of this evaluation.

I give my permission for myhELO to make video and audio records and to take photos of me during this evaluation. I understand that these recordings and photos can be used only for the purpose of evaluating the moxee and showing the results of the evaluations and not for any other purpose.

I understand that during the usability study, I will come into contact with Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by myhELO, or otherwise acquired by the Participant, during the usability study.

Any information I acquire relating to this product during this study is confidential and proprietary to myhELO and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study.

By signing this form, I confirm I will not disclose this confidential information obtained today to anyone else or any other organizations.

I understand that my participation is completely voluntary and I may withdraw my consent and discontinue my participation at any time without penalty.

_____	_____	_____
Name (Please Print)	Signature	Date

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Appendix 4

Administrator's Guide

Thank you for participating in this study. Our session today will last about 1 hour. During that time, you will take a look at an electronic health record system. The product you will be using today is myhELO.

The system has been set up with a default testing database. Don't worry about making changes or mistakes in this environment, as it is only loaded with test data. We are recording only the screens 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.

I will ask you to complete a few tasks using this system and answer some questions at the end of the session. We are interested in how easy (or how difficult) this system is to use, and how we could improve it. You will be asked to complete these tasks on your own. Do not do anything more than asked. Please save your detailed comments until the end of the session. You can write notes about each task if you choose but it is not required.

Please be honest with your opinions. This is a test of the system and not of your abilities.

Getting started, the process will be as follows. We will provide the steps, and allow time for you to review them. Then you may open and start the task recording. Don't worry if you make errors or don't understand a step, just do your best. We're not allowed to help you once you have begun the recording. Do you have any questions or concerns?

Open your browser of choice, and go to the site: provider.myhelo.com. Enter your username, password and organization ID. Your Participant ID is: __ .

Testing Tasks

Implantable Device List
Task a14.1 – Record a Unique Device Identifier (UDI) for a patient's implantable device and confirm the parsed identifiers and device description.
Task a14.2 – Access the patient's implantable device list and view the details of an active implantable device.
Task a14.3 – Change the status of a recorded implantable device to inactive and access the list of all implantable devices, including inactive devices.

Response Form

Task:
Participant ID:
Were you able to complete the Task?
How many steps did it take?
How long did it take?
How easy was it? (5 = Very Easy)
How efficient was it? (5 = Very Efficient)