



*2015 Edition Usability Testing Report
September 2019*

Usability Testing Report

DocLinks™ EHR, version 9.0

This report format is adapted from NISTIR 7742, ver. 0.2

**Customized Common Industry Format for Electronic Health
Record**

Usability Testing.

Customized Common Industry Format Template for Electronic Health Record Usability Testing

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EHR Usability Test Report for

DocLinks™ EMR, version 9.0

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Executive Summary

A usability study of DocLinks EMR version 9.0 was completed on September 4, 2019 in Olympia, Washington by LIN Software, LLC. The purpose of the test was to review, test and validate the usability of the current DocLinks user interface with regards to potential risks associated with patient safety, and to provide evidence of this in the EHR Under Test (EHURT).

During the course of the test, 10 healthcare participants matching the target demographics, served as participants in simulated, but representative tasks listed below.

1. (a.1) CPOE –Meds
2. (a.2) CPOE – Labs
3. (a.3) CPOE – Diagnostic Imaging
4. (a.4) Drug-drug, drug-allergy interaction checks for CPOE
5. (a.5) Demographics
6. (a.6) Problem List
7. (a.7) Medication list
8. (a.8) Medication allergy list
9. (a.9) Clinical Decision support
10. (a.14) Implantable Device List
11. (b.2) Clinical Information Reconciliation and Incorporation
12. (b.3) e-Prescribing

During the 60-90-minute one-on-one usability tests, each user signed an informed consent for remote usability and digital release form (included in Appendix 3 & 4). As part of the instructions, users were instructed they could withdraw at any time.

Written instructions were provided to each participant prior to the start of the test (included in Appendix 6). The moderator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. The moderator performed the tasks prior to having the participant complete the task and allowed the participant to ask questions before each task began. During the testing, the moderator timed the test and, along with the data logger, recorded user performance data on paper and electronically. The moderators did not give the participants assistance in how to complete the task during the test.

The following types of data were collected for each participant:

1. Number of tasks successfully completed within the allotted time without assistance
2. Time to complete the tasks
3. Success/Failure
4. Number and types of errors
5. Path deviations
6. Participant’s verbalizations
7. Participant’s satisfaction ratings of the system

All participant data was de-identified – no correlation could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire. Various recommended metrics, in accordance with the examples set forth in the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, were used to evaluate the risks and usability of the EHRUT. The following is a compiled summary of the performance and rating data collected on the EHRUT.

<u>*Total Tasks</u>	<u>Measures Tested</u>	<u>Task Success</u>	<u>Task Deviation Count</u>	<u>Avg Satisfaction Rating 1-5 (5=easy)</u>
a.6	Problem List	80%	1	4.7
a.7	Medication list	100%	4	5
a.8	Medication allergy list	100%	4	4.8
a.4	Drug-drug, drug-allergy interaction checks for CPOE	100%	2	5
a.14	Implantable Device List	100%	2	4.2
a.9	Clinical Decision support	90%	2	4.2
a.1	CPOE –Meds	100%	1	5
a.2	CPOE – Labs	100%	2	4.9
a.3	CPOE – Diagnostic Imaging	100%	1	5
b.2	Clinical Information Reconciliation and Incorporation	100%	4	3.5
b.3	e-Prescribing	100%	2	4.8
a.5	Demographics	100%	1	5

*See the complete breakdown of subtasks in TASK section of report beginning on page 11

The results from the System Usability Scale scored participant satisfaction during EHRUT: 89.6%

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

Major findings

- ◆ System is easy to use and very intuitive
- ◆ No potential patient safety errors were identified
- ◆ Satisfaction surveys were all positive
- ◆ Tasks times started slower however times got faster as participants completed multiple tasks in the same parts of the system
- ◆ Task a.9 was the most difficult for all participants
- ◆ New features were very well received

Recommended areas for improvement

- ◆ Allow users to select multiple handouts in Plan (like current system lab set-up)
- ◆ When importing Problems from the problem list, have ability to check multiple items like the medication list (vs to drag and drop)

INTRODUCTION

The EHRUT for this study was DocLinks, version 9.0. The EHR Under Test (EHRUT) consists of the recording, storage and retrieval of patient demographics, out-patient clinical information, medication prescription and tracking, ordering of procedures and labs, patient access to medical data, clinical decision tools, and numerous health reports. In DocLinks, providers can use the system live and interactively with patients as well as privately off site. The usability testing attempted to represent realistic exercises and conditions as utilized in medical practices to best test the system for potential user errors and ease of use.

The purpose of this study was to test and validate the usability of the current user interface and identify potential risks to patient safety and provide evidence of usability in the EHR. To this end, measures of effectiveness, efficiency and user satisfaction, such as completion of tasks, accuracy of completed tasks, and confidence in said tasks were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants were tested with the EHRUT. Participants in the test were Nurses, Medical Assistants, a Medical Resident and Medical Ancillary Staff. Participants were recruited by LIN Software, LLC and were compensated with \$50 Amazon gift card for their time. Participants had no direct connection with the development of producing the EHRUT. Participants were not from the testing organization.

Recruited participants had a mixture of backgrounds and demographic characteristics conforming to typical users of EHRs. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology.

ID	Gender	Age	Education	Occupation / Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
001	Female	40-49	Trade/technical/vocational training	CMA	66	300	72	No
002	Female	40-49	Some college credit, no degree	Human Resource Director	252	252	6	No
003	Male	20-29	Bachelor's Degree	Medical Resident Student	48	48	48	No
004	Female	50-59	Associate degree	RN	360	288	120	No
005	Female	30-39	Some college credit, no degree	RIA/EMR Super User	240	216	72	No
006	Female	60-69	Trade/technical/vocational training	CMA	540	240	216	No
007	Female	60-69	Associate degree	LPN	504	252	252	No
008	Male	40-49	Master's Degree	Medical Recruiter	41	300	41	No
009	Female	30-39	Bachelor's Degree	CNA/WA DOL&I	240	192	180	No
010	Female	60-69	Associate degree	RN	480	180	180	No

Participant breakdown regarding knowledge of the DocLinks system:

3 of the 10 participants had prior user experience with the DocLinks system

2 of the 10 participants are current users of the DocLinks system

2 of the 10 participants had indirect knowledge of the system, however, were not an end user

3 of the 10 participants had no direct knowledge of the DocLinks system prior to the EHRUT

Participants were scheduled for a 2-hour session with 45 minutes allotted for debrief. Between each participant test, the system was reset to proper test conditions. A spreadsheet was used to keep track of the participant schedule and included each participant's demographic characteristics. Participant names were replaced with Participant IDs so an individual's data could not tie back to individual identities.

All participants were provided step by step instructions, as well as visual instruction and time to ask questions prior to each task.

STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, 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 may serve as a baseline for future tests with an updated version of the same EHR and/or comparison with other EHRs provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability and identify areas of improvement.

During the usability test, participants interacted with one EHR (DocLinks v9). In the test session, each participant used the DocLinks system by connecting through a GoToMeeting allowing access to the administrator's computer. They were instructed to call the GoToMeeting conference number provided and share their web cam on their laptop. All meetings were recorded via GoToMeeting and Screencast-O-Matic.

Each Participant was provided with the same instructions and materials for testing.

The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

1. Number of tasks successfully completed without assistance
2. Time to complete the tasks
3. Number and types of errors
4. Path deviations
5. Participant's verbalizations (comments)
6. Participant's satisfaction ratings of the system

TASKS

Several tasks were constructed that would be realistic and representative of the kinds of activities a user might do with this EHR, including:

1. Problem List – A.6 (low risk)

a6.1 Record a problem to the problem list

a6.2 Change a problem on the problem list

a6.3 Display the active problem list

a6.4 Display the historical problem list

2. Medication List – A.7 (low risk)

a7.1 Record a medication to the medication list

a7.2 Change a medication on the medication list

a7.3 Display the active medication list

a7.4 Display the historical medication list

3. Medication allergy list – A.8 (*low risk*)

a8.1 Record a medication allergy

a8.2 Change a medication allergy

a8.3 Display the active medication allergy list

a8.4 Display the historical medication allergy list

4. Drug-drug, drug-allergy interaction checks for CPOE – A.4 (*low risk*)

a4.1 Using CPOE, trigger a drug-drug interaction by entering a new medication order

a4.2 Using CPOE, trigger a drug-allergy interaction by entering a new medication order

a4.3 Adjust the severity level of a displayed drug-drug interaction

5. Implantable Device List – A.14 (*moderate risk*)

a14.1 Record UDI: (01)00643169007222(17)160128(21)BLC200461H

a14.2 Change UDI Status

a14.3 Access UDI, device description, identifiers, and attributes

6. Clinical Decision support – A.9 (*high risk*)

a9.1 Add a CDS intervention and/or reference resource for each of the required elements

- Problem list
- Medication list

- Medication Allergy List
- At least one Demographic
- Laboratory Test
- Vital Signs
- And a combination of at least 2 of the elements listed above

a9.2 Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements

a9.3 View the intervention/resource information using the Info button standard for data elements in the problem list, medication list, and demographics

(a9.4 completed during b.2.1, as best flow with system for usability)

a9.5 Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date

7. CPOE – Medications – A.1 (low risk)

- a1.1 Record a medication via CPOE
- a1.2 Change a medication via CPOE
- a1.3 Display changed CPOE medication order

8. CPOE – Laboratory – A.2 (low risk)

- a2.1 Record a Lab order via CPOE
- a2.2 Change a Lab order via CPOE
- a2.3 Display changed CPOE Lab order

9. CPOE – Diagnostic Imaging – A.3 (low risk)

- a3.1 Record imaging order via CPOE
- a3.2 Change imaging order via CPOE

a3.3 Display changed CPOE imaging order

10. Clinical Information Reconciliation and Incorporation – B.2 (low risk)

b2.1 Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record

a9.4 Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary (*task completed with b2.1 as DocLinks has automatic CDS flags which trigger when new data is brought into the system*)

b2.2 Generate a new CCDA with reconciled data

11. e-Prescribing – B.3 (moderate risk)

b3.1 Create new prescription:

b3.2 Change prescription (dosage or duration):

b3.3 Cancel prescription:

b3.4 Refill prescription

b3.5 Receive fill status notification

b3.6 Request and receive medication history information

12. Demographics – A.5 (low risk)

a5.1 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sex orientation, gender identity

a5.2 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

a5.3 Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity

The 12 tasks/ 41 sub tasks covered measures are guided by NISTIR 7742 (2015 edition) SED requirements. Tasks were selected based on their frequency of use, criticality of function, and those which may be most erroneous/troublesome for users. Tasks were constructed considering the study objectives.

RISK ASSIGNMENT

Prior to testing, we identified each task to a risk category of High, Moderate, Low as indicated above. For purposes of assigning potential risk, we choose to identify the entire task vs subtasks which would be more representative of usability. Our risk assignment was based on potential typos, long tasks, new feature difficulty and tasks which are not intuitive as performed.

PROCEDURES

Upon arrival to the GoToMeeting, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then di-identified and assigned a participant ID. Each participant reviewed and signed an informed consent and release form (See Appendix 3 & 4). A representative from the test team witnessed the participant's signature. To ensure the test ran smoothly, two staff members participated in this test, the usability moderator and the data logger.

The testing staff conducting the EHRUT were experienced in usability practices with several years' experience on DocLinks EMR, as well as, within the healthcare field. The administrator moderated the session including administering instructions and tasks. The administrator also obtained post-task rating data and took notes on participant comments. The data logger monitored task times, 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):

- *For each task, I will first demonstrate the task for you and explain the steps, you may take notes if you like but it is not required to do so. If there are any specific details that you need to complete a task, they will be provided to you in writing. Once I have completed the instructions for the task I will ask if you have any questions. I will then give you control of the computer and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not think aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you have completed the task. Please make sure to vocalize when you are done so that we can stop the timer.*

For each task, the participants were given a written copy of the task and visually shown the task step by step prior to being asked to complete it. They were given a chance to ask questions prior to beginning each task. Each participant was asked to hold all comments until completion of test.

Task timing began once the administrator finished demonstrating the task and the participant verbalized, they understood the task requirements and were given control of the computer. The task time was stopped once the participant indicated they had successfully completed the task by saying “DONE.”

Scoring is discussed below in Section DATA SCORING.

Following the session, the administrator gave the participant the post-test questionnaire (System Usability Scale, see Appendix 7), compensated them for their time, and thanked each individual for their participation.

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

Participants that received compensation; signed a receipt and acknowledgement form (See Appendix 2) indicating that they had received the compensation.

TEST LOCATIONS & TEST ENVIRONMENT

Each participant chose their testing environment in their home or workspace. They utilized their personal computers (running MS Windows 8 or MS Windows 10) and a phone to connect via GoToMeeting with testing Administrators. Prior to the meeting, participants were emailed forms and test scripts for printing.

Testing Administrators were supplied a recording laptop computer (MS Windows 10) with dual monitors and a phone in a quiet, secure office environment. The data logger worked from a separate location where they were able to monitor the participant's screen and face shot as well as listen to the audio being recorded.

Only the participants and administrator were unmuted and active in the virtual environment.

The DocLinks application was set up by the EHR vendor, LIN Software LLC. The application itself was running on a remote server using a test medical practice via an Internet connection.

Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation via Internet connection.

TEST FORMS AND TOOLS

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

1. Informed Consent
2. Participants Demographics
3. Incentive Receipt and Acknowledgment Form
4. Moderator's Guide
5. Participant's Guide
6. Post-test Questionnaire

Examples of these documents can be found in the Appendices 1-6.

The Moderator's Guide was devised to capture required data.

The participants interaction with the EHRUT was captured and recorded digitally with screen capture software, Screencast-o-Matic, on the test machine. A web cam recorded each participant's facial expressions synced with the screen capture, and verbal comments were recorded through the GoToMeeting audio conference line where the data logger as well as the administrator were able to observe the participants screen and facial expressions.

PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to each participant (also see the full moderator's guide in the Appendix 5):

Thank you for participating in this study today. Your input is very important.

Our session today will last about 60-90 minutes. During that time, you will be using DocLinks EMR to perform specific usability tasks. I will provide detailed instructions prior to asking you to complete the task. Some tasks have several steps therefore you can take notes if you like.

This session will be recorded (audio and visual) However you will remain completely anonymous throughout this experience and will only be referenced by your participant number.

Once the time starts for a task 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 once the testing has started. I will ask you a few questions at the end of each task and you will be asked to complete a survey at the conclusion of our time together today.

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 the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Lastly, should you feel it necessary you can withdraw at any time during the testing.

Following the procedural instructions, participants were given the opportunity to ask questions and make comments.

Once this was complete, the administrator gave the following instructions:

For each task, I will first demonstrate the task for you and explain the steps, you may take notes if you like but it is not required to do so. If there are any specific details that you need to complete a task, they will be provided to you in writing. Once I have completed the instructions for the task I will ask if you have any questions. I will then give you control of the computer and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not "think" aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you have completed the task. Please make sure to vocalize when you are done so that we can stop the timer.

Participants were then given each task one at a time which included the subtasks. Tasks are listed in the moderator's and participants guides in the Appendix 5 & 6.

USABILITY METRICS

According to the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, EHRs should support a process which 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 *DocLinks* EHR by measuring participant success rates and errors
2. Efficiency of *DocLinks* EHR by measuring the average task time and path deviations
3. Satisfaction with *DocLinks* EHR by measuring ease of use ratings

DATASCORING

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

Measure	Rational and Scoring
Effectiveness: Task Success	<p>A task was counted as a “Success” if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.</p> <p>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency.</p> <p>Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator’s Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by a factor of 2.0 that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 90 seconds then allotted task time performance was 180 seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</p>
Effectiveness: Task Failures	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a “Failure.” The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant.</p> <p>On a qualitative level, an enumeration of errors and error types are collected.</p>
Efficiency: Task Deviations	<p>The participant’s path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control.</p>
Efficiency: Task Time	<p>Each task was timed from when the administrator said “Begin” until the participant said, “Done.” If he or she failed to say “Done,” the time was stopped when the participant stopped performing the task.</p> <p>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.</p>
Satisfaction: Task Rating	<p>Participant’s subjective impression of the ease of use of the application was measured by administering both a simple post- task question as well as a post-session questionnaire. After each task, the participant was asked to rate “Overall, this task was:” on a scale of 1 (Very Difficult) to 5 (Very Easy).</p>

	<p>These data are averaged across participants. Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of the [EHRUT] overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, "I think I would like to use this system frequently," "I thought the system was easy to use," and "I would imagine that most people would learn to use this system very quickly." See full System Usability Score questionnaire in the Appendix.</p>
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RESULTS

DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses. There were no exclusions in this test based on that criteria.

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

Task #	Measures Tested	*Task Success	*Mean Time (sec)	*Task Time Optimal (sec)	*Max Deviation Observed	*Likert Rating 1-5 (5=easy)
a.6	Problem List	80%	102.1	110	1	4.7
a.7	Medication list	100%	59.5	81	4	5
a.8	Medication allergy list	100%	41.8	54	4	4.8
a.4	Drug-drug, drug-allergy interaction checks for CPOE	100%	44.7	81	2	5
a.14	Implantable Device List	100%	42.5	81	2	4.2
a.9	Clinical Decision support	90.00%	362	278	2	4.2
a.1	CPOE –Meds	100%	33.64	56	1	5
a.2	CPOE – Labs	100%	31.3	56	2	4.9
a.3	CPOE – Diagnostic Imaging	100%	28.2	56	1	5

b.2	Clinical Information Reconciliation and Incorporation	100%	280.8	290	4	3.5
b.3	e-Prescribing	100%	192.3	203	2	4.8
a.5	Demographics	100%	163.3	203	1	5

*These results represent overall scores for entire task. Please see SED spreadsheet for breakdown of subtask times and results.

The results from the Likert scale scored the subjective satisfaction with the system based on performance with these tasks to be: 4.675 which is 95.67% The satisfaction survey yields a single number that represents a composite measure of the overall perceived usability of the system.

Satisfaction scores have a range of 1 to 5, 1 being least satisfied and 5 being most satisfied. The score is a relative benchmark used against other iterations of the system. Broadly interpreted, % satisfaction scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Participant Identifier	Satisfaction Likert Score (5 being the best)	% Satisfaction
001	4.83	96.67%
002	4.94	98.33%
003	5	100.00%
004	4.58	91.67%
005	4.92	98.33%
006	4.67	93.33%
007	4.75	95.00%
008	4.83	96.67%
009	5	100.00%
010	4.33	86.67%

DISCUSSION OF THE FINDINGS

EFFECTIVENESS

Of the 41 sub-tasks, most were performed with a 100% success rate. We experienced three (3) failures and zero (0) errors. 2 of the 3 failures occurred in task [a.6 Problems List](#). The moderator notes reflect the failures to be attributed mostly to nerves as it was the first task of the session and both participants were very nervous. The third failure was in task [a.9 Clinical Decision Support](#) which proved challenging for all participants.

EFFICIENCY

We recognize optimal times can vary widely depending on the environment our users are working in. For this test we chose to consider the user working under calm conditions with ample time to complete each task. Out of the 12 tasks, we had 5 where 1 or more participants scored sub-optimal times in at least 1 sub-task. However, the over-all task average was below the Optimal allotted time. With more frequent use of the system, the participant(s) expressed they would easily become faster at completing tasks. We also saw an increase in the task times as participants preformed tasks in the same parts of the system, i.e. Medications.

SATISFACTION

Participant satisfaction rated very high. Task satisfaction ratings averaged 4.7 out of 5.

Participant experience with the EHRUT is as follows:

- 3 of the 10 participants had prior user experience with the DocLinks system
- 2 of the 10 participants are current users of the DocLinks system
- 2 of the 10 participants had indirect knowledge of the system, however were not an end user
- 3 of the 10 participants had no direct knowledge of the DocLinks system prior to the EHRUT

All 10 participants were asked to evaluate their experience only on the tasks and subtasks performed during the EHRUT.

RISK ASSESSMENT

As discussed earlier, prior to testing we ranked all tasks based on which we felt had the highest associated potential risk of user error with a status of high, moderate, low.

After testing our participants, we identified only two tasks with minimal possibility of user error posing a potential risk to patient safety. We now identify only these items as low risk.

<u>Tasks</u>	<u>Measures Tested</u>	<u>Task Success</u>	<u>Pre-test Risk Assignment</u>	<u>Post-test Risk Assessment</u>
a.6	Problem List	80%	low	
a.7	Medication list	100%	low	
a.8	Medication allergy list	100%	Low	
a.4	Drug-drug, drug-allergy interaction checks for CPOE	100%	low	
a.14	Implantable Device List	100%	moderate	
a.9	Clinical Decision support	90%	high	low
a.1	CPOE –Meds	100%	low	
a.2	CPOE – Labs	100%	Low	
a.3	CPOE – Diagnostic Imaging	100%	Low	
b.2	Clinical Information Reconciliation and Incorporation	100%	low	low
b.3	e-Prescribing	100%	moderate	
a.5	Demographics	100%	low	

1) **Tasks a.9 (Clinical Decision Support):**

Pre-Test analysis - Due to the number of various screens and steps the user would need to take to complete all subtasks, we felt there was a high risk of task failure or a high risks of errors during this task. If this were performed in a normal clinical workflow, there would be a patient safety risk.

Post test results: Although we did not receive any errors during testing, we did document several deviations, as well as, failed sub tasks in this section. As more clearly defined below in areas for improvement there are ways, we can streamline some of the processes within the DocLinks system to enhance the user experience. However, we feel the overall design of the task itself was cumbersome and participants expressed it did not truly depict standard workflow. At this point, this is now identified as a very low risk.

2) **Task a.14 (Implantable Device List):**

Pre-Test analysis – Due to the length of implantable Device codes and the amount of information needed, we scored this as a moderate risk.

Post-test results: No errors. Participants felt confident in entering information. We find no risk associated with this portion of DocLinks.

3) Task b.3 (e-prescribing):

Pre-test analysis – This section has new features. We anticipated confusion and questions which would cause errors and set the risk as moderate.

Post test results: No errors identified and no questions as to the features. We removed the risk status.

4) Task b.2 (Clinical Information Reconciliation and Incorporation)

Pre-Test analysis – We identified this as a low risk for DocLinks. It is a feature most end users would not necessarily do without a patient there to truly reconcile the information. As such, we felt it could pose a little confusion and/or a potential to place information in an incorrect chart.

Post test results: No errors on this task and a 100% completion rate. To our surprise, the participants loved this feature. The end user was able to understand the workflow minimizing what we identified as a potential risk. Participants did still suggest a more consistent approach to importing data elements which we have incorporated into our area for improvement. Even though the success was 100%, we still identify this as a low risk for error until we make some additional improvements.

MAJOR FINDINGS

Overall, the participants were aptly able to maneuver through the EHRUT adequately and easily to perform the 41 subtasks within the 12 major tasks.

When asked what the overall impression of the system after the EHRUT, the overwhelming response from the participants was the ease of use and intuitiveness, as well as, a nice workflow design and the lack of unnecessary clicks to complete tasks.

Task a.9 Clinical Decision Support was the most difficult for all participants and identified as a potential risk. It was a lengthy task with a lot of steps. We found it required participants to go into several areas of the DocLinks system which is not intuitive for most medical staff when collecting information within a normal work setting. Understandably, this task presented the most feedback from participants and the slowest task times. Although identified as a potential risk, our findings indicate in a normal clinical environment, this would not actually be a risk.

Additionally, we found the new system features were very well received in the after-test questionnaire with the majority of participants reporting they really liked the medication task (b.3), as well as, the clinical information and reconciliation (b.2) portion, even though participants struggled with the tasks themselves.

AREAS FOR IMPROVEMENT

Based on the feedback received during and after the EHRUT there were two (2) areas that we can improve:

1. Based on feedback from task A.9 (Clinical Decision Support)
 - a. Improve the design in the Plan to allow for users to select multiple handouts to pull into the plan instead selecting them individually. This would eliminate additional clicks and work similar to another area within the Plan. This will reduce risk of errors or missed information by streamlining the process and allowing users to stay in area and reduce the amount of clicks it takes to complete the task.
2. Based on feedback from task B.2 (Clinical Information Reconciliation and Incorporation)
 - a. Suggested change to importing the problem list to match how the medication and allergy lists are imported using a check box system rather than drag and drop. This change would further eliminate errors as it would reduce the chance that a problem was not *"dragged"* to the appropriate area thus resetting to its original section in the unreconciled *"other"* list.

Appendix #1

Participant Demographics:

Name:

Address:

Best Contact #(s)

Email:

Verify valid ID:

Gender:

Age:

Highest Education:

Occupation/Role:

Professional Experience in months:

Computer Experience in months:

EHR Experience in months:

Do you have access to a computer with a laptop and internet?

Appendix # 2

Receipt Form: Usability Test Compensation (Adult)

Please sign below to indicate that you have received the promised compensation for your participation in testing today.

Amount received: \$50 Amazon Gift Card

Date: _____

Please print your name: _____

Please sign your name: _____

Subject's Signature or eSignature <your name>

Thank you!

We appreciate your participation.

Please return the signed document to Jessica via email, fax or physical mail.

Appendix # 3

Digital Recording Release Form

I agree to participate in an audio and digital recording during the Usability Test by DocLinks.

I understand and consent to the use and release of the recording by DocLinks. I understand the information and recording is for research purposes only and my name will not be used for any other purpose. I relinquish any rights to the recording and understand the recording may be duplicated and used by DocLinks without further permission for certification purposes.

I agree to immediately raise any concerns or feelings of discomfort with the study administrator and am free to end the session at any time.

Date: _____

Please print your name: _____

Please sign your name: _____

Subject's Signature or eSignature <your name>

Thank you!

We appreciate your participation.

Please return the signed document to Jessica via email, fax or physical mail.

Appendix # 4

Consent Form: Remote Usability Test (Adult)

Please read, sign and return this form.

During this DocLinks test, I agree to participate in an online session using my computer and telephone. During the session I will be interviewed about the site, asked to find information, complete tasks using the site and asked to complete a questionnaire about the experience.

I understand and consent to the use and release of the recording by DocLinks. I understand the information and recording are for research purposes only and my name will not be used for any other purpose. I relinquish any rights to the recording and understand the recording may be copied and used by DocLinks without further permission for the use of certification.

I understand participation is voluntary.

Please sign below to indicate you have read and understand the information on this form and that any questions you might have about the session have been answered.

If you have any questions after today, please contact Jessica Johnson at 360-413-8444.

Date: _____

Please print your name: _____

Please sign your name: _____

Subject's Signature or eSignature <your name>

Thank you!

We appreciate your participation.

Please return the signed document to Jessica via email, fax or physical mail.

Appendix # 5

EHRUT Usability Test

Moderator's Guide

Administrator _ Jessica McRae-Johnson

Data Logger _ Kale Meese

Date _____ Time _____

Participant # _____

Location LIN Software, LLC Offices

Prior to testing

- Confirm schedule with Participants
- Ensure EHRUT lab environment is running properly
- Ensure lab and data recording equipment is running properly

Prior to each participant:

- Reset application
- Set up Participants work station with consent forms, instructions, pen and water

Prior to each test:

- Obtain consent forms and complete demographic survey then assign participant ID #
- Read the Orientation and Task Instructions and answer any questions
- Start session recordings with *GoToMeeting and Screen-O-Matic*

Prior to each task:

- Reset stop watch to zero for next task
- Administer Overall rating scale for previous task 1-5
- Resume control of the computer controls

After conclusion of each test:

- Administer the Post-Test Questionnaire and record responses.
- Ask participant to complete the SUS, while they are doing that end the recordings.
- Thank them and walk them out of the facility.

After each participant:

- Save both *GoToMeeting and screencast-o-matic* files to computer then *merge the GoToMeeting with the Screen-O- Matic file.*
- Email participant \$50 Amazon gift card to email provided.

After all testing

- Back up all files to NOVA01 and separate thumb drive and store with CJW

Orientation

Thank you for participating in this study today. Your input is very important.

Our session today will last about 60-90 minutes. During that time, you will be using DocLinks EMR to perform specific usability tasks. I will provide detailed instructions prior to asking you to complete the task. Some tasks have several steps therefore you can take notes if you like.

This session will be recorded (audio and visual) However you will remain completely anonymous throughout this experience and will only be referenced by your participant number. Once the time starts for a task 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 once the testing has started. I will ask you a few questions at the end of each task and you will be asked to complete a survey at the conclusion of our time together today.

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 the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Lastly, should you feel it necessary You can withdraw at any time during the testing.

TASK INSTRUCTIONS

For each task, I will first demonstrate the task for you and explain the steps, you may take notes if you like but it is not required to do so. If there are any specific details that you need to complete a task, they will be provided to you in writing. Once I have completed the instructions for the task I will ask if you have any questions. I will then give you control of the computer and say "Begin." At that point, please perform the task and say "Done" once you believe you have successfully completed the task. I would like to request that you not "think" aloud or verbalize while you are doing the tasks. I will ask you your impressions about the task once you have completed the task. Please make sure to vocalize when you are done so that we can stop the timer.

DATA LOGGERS SHEET:

Example of tracking sheet moderator and data logger used for every task with every participant to capture times, optimal path or errors, deviations, any verbalizations and comments during the test. Moderator and Data logger compiled information at the end of each test.

Task 1: CPOE Medications (A.1)

Moderator reads then demonstrates each sub-task individually:
In this section we will ask you to complete **3 tasks**. You will be asked to:

1. Record a medication via CPOE

Sub Task Time: _____ Seconds

Optimal Path:

- Correct
- Minor Deviations
- Major Deviations: Details below
- Observed Errors and Verbalizations:

Comments:

2. Change a medication via CPOE

Sub Task Time: _____ Seconds

Optimal Path:

- Correct
- Minor Deviations
- Major Deviations: Details below
- Observed Errors and Verbalizations:

Comments:

3. Display changed CPOE medication order

Sub Task Time: _____ Seconds

Optimal Path:

- Correct
- Minor Deviations
- Major Deviations: Details below
- Observed Errors and Verbalizations:

Comments:

SUCCESS:

- Easily completed
- Completed with difficulty or help: Details below
- Not completed

Comments:

TOTAL Task Time: _____ Seconds

Rating:

Overall, this task was: _____ Scale of 1-5 (1=Very difficult to 5= Very easy)

Administrator Notes/Comments:

Appendix # 6

Participant's Instructions and Guide

Problem list (a.6) - PATIENT SYNOPSIS PAGE

1. Record a problem to the problem list: Select new problem/ in master diagnosis list select **Abdominal Pain, generalized**/save
2. Change a problem on the problem list: Select > next to **Abdominal Pain, generalized**/ select the paper and pencil icon and select **Abdominal Pain Left upper quadrant pain** from master diagnosis list/save
3. Display the active problem list: This happens automatically when you save.
4. Display the historical problem list: Select problem list history from top menu.- THIS WILL COMPLETE YOUR TASK
5. SAY DONE

Medication list (a.7) - PATIENT SYNOPSIS PAGE

1. Record a medication to the medication list: Meds by name/Toprol 25mg/select existing med/save
2. Change a medication on the medication list: change strength to 25mg two tabs a qday
3. Display the active medication list: select save and mark review
4. Display the historical medication list: select meds pull down menu/select show complete med list history- THIS WILL COMPLETE YOUR TASK
5. SAY DONE

Medication allergy list (a.8) - PATIENT SYNOPSIS PAGE

1. Record a medication allergy: enter penicillin (only need to enter first 4 characters)
2. Change a medication allergy: change from allergy to intolerance
3. Display the historical medication allergy list: select entire allergy history button at bottom of page
4. Display the active medication allergy list: save will automatically display list- THIS WILL COMPLETE YOUR TASK
5. SAY DONE

Drug-drug/drug allergy (a.4) - PATIENT SYNOPSIS PAGE

1. Using CPOE, trigger a drug-drug interaction by entering a new medication order: Meds by name/metoprolol and penicillin/select existing med/save
2. Adjust the severity level of a displayed drug-drug interaction: Advisory Interactions/select [DUP] next to Toprol and trigger the advisory for the patient to red-THIS WILL COMPLETE YOUR TASK
3. SAY DONE

Implantable device list (a.14) - PATIENT SYNOPSIS PAGE

1. Record UDI: (01)00643169007222(17)160128(21)BLC200461H
2. Access UDI, device description, identifiers, and attributes
3. Change UDI Status- THIS WILL COMPLETE YOUR TASK
4. SAY DONE

Clinical decision support (a.9)-IN COMMAND NOTE

- 1) Add a CDS intervention and/or reference resource for each of the required elements: **select handout and select the following handouts for each element.**
- 2) Medication Allergy List- [Anaphylaxis \(ALLERGY\)](#)
- 3) Problem list- [High Blood Pressure - What It Means To Have It \(CARDIOLOGY\)](#)
- 4) Laboratory Test- [Cholesterol Chart \(CARDIOLOGY\)](#)
- 5) Vital Signs- [Cigarettes- Enemies Of A Healthy Heart \(CARDIOLOGY\)](#)
- 6) At least one Demographic- [Sexual Reassignment Therapy \(DEMOGRAPHICS\)](#)
- 7) Medication list- [Beginning Lipitor \(MEDICATION\)](#)
- 8) And a combination of at least 2 of the elements listed above- [Diabetes Goal Setting \(DIABETES\)/
Interpretation Of Lipid Results \(CARDIOLOGY\)](#)
- 9) Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements: **End of Visit Summary/Go to Print orders and show the handouts (no need to print).**
- 10) Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary: **Performed in b.2.1**
- 11) View the intervention/resource information using the Info button standard for data elements in the : Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date
 - a) **problem list: Open Problem list/ expand Hyperlipidemia/click [i] (info) button/ select [Medline Plus Link](#) scroll to bottom to display bibliography.**
 - b) **medication list: Open current medication/click [i] next to Lipitor**
 - c) **demographics: minimize command note and open contact information click [i] on admin gender--THIS WILL COMPLETE YOUR TASK SAY DONE**

CPOE Medication (a.1)-IN COMMAND NOTE

1. Record medication via CPOE: Meds by name/add ASA 325mg one tablet daily
2. Change medication via CPOE: change to 80mg qday
3. Display changed CPOE medication order: save and mark reviewed scroll to orders where the med is displayed--THIS WILL COMPLETE YOUR TASK
4. SAY DONE

CPOE Laboratory (a.2)- IN COMMAND NOTE

1. Record Lab order via CPOE: Unspecified labs: Select Basic Metabolic Panel/ Abdominal Pain, Left Upper Quadrant/ At this Time
2. Change Lab order via CPOE: select the pencil and paper and select date 04/12/2019 in drop down
3. Display changed CPOE Lab order: Will display in order summary --THIS WILL COMPLETE YOUR TASK
4. SAY DONE

CPOE Diagnostic Imaging (a.3)- IN COMMAND NOTE

5. Record Imaging order via CPOE: Unspecified Radiology: select GNRL - Chest, 2vAbdominal Pain, Left Lower Quadrant/ At this Time
1. Change Imaging order via CPOE: select the pencil and paper and select date 04/12/2019 in drop down
2. Display changed CPOE Imaging order: Will display in order summary--THIS WILL COMPLETE YOUR TASK
3. SAY DONE

Clinical information reconciliation and incorporation (b.2)

1. Incorporate a CCDA: On main page go to Your Files and find CCDA under Imported Documents/ assign to chart by entering pt name Cummings, Cecilia conduct reconciliation of

(a.9) Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary (this subtask from a.9 fit best during this portion of the test)

Medications: Go to medications and select other list/ select CCDA information MEDS (CCDA - Neighborhood Physicians Practice)

Medication Allergies: Repeat above steps with Allergies – Main medication screen displays CDS for Medications and Allergies.

Problems : Go to Problems and select other list/ select CCDA information Problems (CCDA - Neighborhood Physicians Practice) – Main Problem List screen displays CDS for Problems.

in the CCDA with the information currently in the patient’s record

2. Generate a new CCDA with reconciled data: **On patient synopsis page go to letters drop down menu and select create CCD summary**
3. **SAY DONE**

E-Prescribing (b.3)

1. Refill prescription: **On the main page under your files select Surescripts, select first rx, scroll to bottom and enter Authorization number 123456/ select approval obtained.**
2. Create new prescription: **Select Lipitor on the patient medication list and send the rx via e-rx**
3. Change prescription (dosage or duration): **next to the medication you filled select the RX box and change the dose and to 40mg and duration to QHS**
4. Cancel prescription: **Next to the medication you filled select the RX box and select cancel the rx**
5. Receive fill status notification: **select RX box and see the notification next to the medication ie: expired, pending, filled, cancelled**
6. Request and receive medication history information: **Select Surescripts from the menu list in the pt chart. (note: nothing will show as this is not live data)**
7. **SAY DONE**

Demographics - a.5- PATIENT SYNOPSIS PAGE

1. ***Record the below demographics:***
 - a. Date of birth: **07/01/1970 DOB is already recorded for you so leave as is.**

- b. Administrative Gender (sex): **currently F (Female) leave as Female**
 - c. Preferred language: Left side Demographics sections Language drop down menu select a language: **YOUR CHOICE**
 - d. Ethnicity: Directly below language drop down menu is Ethnicity(s) drop down menu, select an Ethnicity: **YOUR CHOICE**
 - e. Sexual Orientation: Below Ethnicity drop down menu is the sexual orientation drop down menu, select an orientation: **YOUR CHOICE**
 - f. Race: Directly across from Ethnicity drop down menu, select a race: **YOUR CHOICE**
 - g. Gender identity: Directly across from sexual orientation is the Gender Identity drop down menu, select and Identity: **YOUR CHOICE**
2. ***Change the below demographics:***
- a. Date of birth: **Change the DOB to 12/16/1978 enter with correct format of mm/dd/yyyy**
 - b. Administrative Gender (sex): **Change to M (Male)**
 - c. Preferred language: **Change to English**
 - d. Ethnicity: **Change to DECLINED**
 - e. Sexual Orientation: **Change to Straight**
 - f. Race: **Change to OTHER**
 - g. Gender identity: **Change to Male**
 - h. **Save changes at the top of the page- THIS WILL COMPLETE YOUR TASK**
3. **SAY DONE**

Appendix #7

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
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 to be 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					

Please return the signed document to Jessica via email, fax or physical mail.