EHR Usability Test Report of ChartLogic EHR, Version 9
Report based on ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports

ChartLogic EHR, Version 9

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1   EXECUTIVE SUMMARY

Two usability tests of ChartLogic EHR, Version 9, Ambulatory EHR were conducted on 11/16/17 and 11/17/17 at the ChartLogic headquarters by the internal Usability team. The purpose of this test was to test and validate the usability of the current user interface and provide evidence of usability in the EHR Under Test (EHRUT).

During the usability test, 10 healthcare providers and other intended users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 7 tasks typically conducted on an EHR:
1. a.5 - Create a new patient and record, change and view their Demographics
2. a.2 - On a patient record, create a new Lab Order and change and view it
3. a.3 - On a patient record, create a new Imaging Order and change and view it
4. a.6 - On a patient record, create a new Snomed problem to the Problem List
5. a.14 - On a patient record, create a new Implantable Device and change and view it
6. b.2 - Record a CCDA and create a new one with reconciled data
7. a.9 - Create several Clinical Decision support profiles for Problem List Intervention, then trigger those interventions on several patients. 14 sub tasks were created for this section.

During the 4 hour one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form, and they were instructed that they could withdraw at any time. Participants did not have prior experience with the EHR.

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

Training given was a short demonstration introducing the test and which demonstrated a simple walk-through of each task.

Participant screens were recorded for subsequent analysis using video capture software.

The following types of data were collected for each participant:
* Number of tasks successfully completed within the allotted time without assistance
* Time to complete the tasks

- Number and types of errors
- Path deviations
- Participant's verbalizations
- Participant's satisfaction ratings of the system (SUS)

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated a $100 gift card for their time. Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT.

Task Measure	N	Task Success	Path Deviations	Task Time	Task Rating
Create a new patient with demographics, change, and view their Demographics 170.315(a)(5) Demographics	A5.1	90%	2	251	4.3
Add a Lab Order, change, and view it 170.315(a)(2)	A2.1	80%	2	108	4.7
Add a Diagnostic Imaging Order, change, and view it 170.315(a)(3)	A3.1	90%	4	95	4.8
Add a problem to a patient's Problem List 170.315(a)(6)	A6.1	80%	0	120	4.7
Add an Implantable Device, change, and view it 170.315(a)(14)	A14.1	90%	0	75	4.8
Import and reconcile a CCDA 170.315(b)(2)	B2.1	60%	0	73	4.5
Add CDS – Problem 170.315(a)(9) CDS	A9.1	100%	0	116	4.7
Add CDS Medication 170.315(a)(9) CDS	A9.2	70%	0	81	4.7
Add CDS - Medication Allergy 170.315(a)(9) CDS	A9.3	90%	0	58	4.7

Add CDS – Demographic 170.315(a)(9) CDS	A9.4	60%	0	76	4.6
Add CDS – Lab 170.315(a)(9) CDS	A9.5	90%	2	80	4.7
Add CDS – Vitals 170.315(a)(9) CDS	A9.6	80%	0	55	4.9
Add CDS – Combo 170.315(a)(9) CDS	A9.7	100%	0	50	4.6
Trigger CDS – Problem 170.315(a)(9) CDS	A9.8	60%	1	78	4.5
Trigger CDS Medication 170.315(a)(9) CDS	A9.9	70%	0	51	4.7
Trigger CDS - Medication Allergy 170.315(a)(9) CDS	A9.10	80%	0	54	4.7
Trigger CDS – Demographic 170.315(a)(9) CDS	A9.11	90%	0	39	4.6
Trigger CDS – Lab 170.315(a)(9) CDS	A9.12	80%	1	54	4.6
Trigger CDS – Vitals 170.315(a)(9) CDS	A9.13	80%	0	53	4.6
Trigger CDS – Combo 170.315(a)(9) CDS	A9.14	80%	0	95	4.4

Table 1. Results by Task

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 92.8%.

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

MAJOR FINDINGS

Major findings from this test session were as follows:

- A high degree of satisfaction from users not previously exposed to the system.
- Fast and efficient workflows possible within the system, even for more novice computer users.

AREAS FOR IMPROVEMENT

The first day's testing was impacted by a minor database issue which prevented the full testing of one task. This was rectified by the next test session, and we were able to complete the testing without further incident. This issue affected a very small percentage of tasks.

Users were encouraged to leave written notes if they chose, and there were few notes. Two users noted that the Date of Birth field in the Patient Information screen did not work as expected. When entering a birth date, not including the forward slash for the date would reset the field to the current date.

2   INTRODUCTION

The EHRUT tested for this study was ChartLogic EHR, Version 9, Ambulatory. Designed to present medical information to healthcare providers in small practice and hospital environments, the EHRUT consists of several interactive components which allow the medical professional or support staff to complete their daily charting. The usability testing attempted to represent realistic exercises and conditions.

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

3   METHOD

3.1   PARTICIPANTS

A total of 10 participants were tested on the EHRUT(s). Participants in the test were medical assistants, nurses and several other career types. Participants were recruited by the internal Usability and Customer Service teams and were compensated with a $100 gift card for their time. In addition, participants had no direct connection to the development of or organization producing the EHRUT(s). Participants were not from the testing or supplier organization. Participants were given the opportunity to have the same orientation and level of training as the actual end users would have received.

For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants.

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

Participants

ID	Gender	Age	Education	Occupation / Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
d1m1	Female	23	Some College	Counselor	12	120	No	No
d1m2	Female	45	Some College	Physical Therapist	12	96	No	No
d1m3	Male	23	Some College	IT Staff	36	240	No	No
d1m4	Male	24	College Degree	Registered Nurse	12	150	No	No
d2m1	Male	36	Some College	Counselor	240	180	No	No
d2m2	Male	23	Some College	Medical Student	24	120	No	No
d2m3	Female	28	High School	Medical Assistant	24	100	No	No
d2m4	Female	20	Some College	Pediatric Care	60	100	No	No
d3m1	Male	26	College Degree	Medical Student	60	180	No	No
d3m2	Female	28	College Degree	Administrative Staff	12	204	No	No

Table 2. List of Participants & Demographics

16 participants matching the demographics in the section on Participants were recruited and 10 participated in the usability test. 6 participants failed to show for the study. Participants were scheduled for two 2-hour sessions with 10 minutes in between each session for break or other needs. A spreadsheet was used to keep track of the participant schedule and included each participant's demographic characteristics.

3.2   STUDY DESIGN

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

areas where improvements must be made. During the usability test, participants interacted with 1 EHR. Each participant used the system in the same location and was provided with the same instructions. The system was evaluated for effectiveness, efficiency and satisfaction as defined by measures collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant's verbalizations (comments)
- Participant's satisfaction ratings of the system (SUS)

3.3 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. a.5 - Create a new patient and record, change and view their Demographics
2. a.2 - On a patient record, create a new Lab Order and change and view it
3. a.3 - On a patient record, create a new Imaging Order and change and view it
4. a.6 - On a patient record, create a new Snomed problem to the Problem List
5. a.14 - On a patient record, create a new Implantable Device and change and view it
6. b.2 - Record a CCDA and create a new one with reconciled data
7. a.9 - Create several Clinical Decision support profiles for Problem List Intervention, then trigger those interventions on several patients. 14 sub-tasks were created for this section.

Tasks were selected based on their frequency of use, criticality of function, and those that may be most troublesome for users.

3.4 PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID.

Each participant reviewed and signed an informed consent and release form. A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was an experienced usability practitioner with 10 years of experience and a data logger with 10 years of project management experience.

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

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

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

For each task, the participants were given a written copy of the task. Task timing began once each section's training was completed. Using the testing software, task timing was completed automatically when each user was finished with the assigned task.

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

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

Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form indicating that they had received the compensation.

3.5 TEST LOCATION

The test facility included a quiet testing room with a table which held one computer for each participant. Only the participants and administrators were in the test room.

To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instructions and evacuation procedures were valid, in place, and visible to the participants.

3.6   TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in the corporate headquarters of ChartLogic. For testing, the computer used a desktop system running Windows 10.

The participants used a mouse and keyboard when interacting with the EHRUT. The EHRUT used a color monitor of 1920x1080 resolution. The application was set up by the internal technology team according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a desktop system, using a test database on a LAN connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

3.7   TEST FORMS AND TOOLS

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

1. Informed Consent
2. Non-disclosure Agreement
3. Incentive Receipt and Acknowledgment Form
4. System Usability Scale Questionnaire
5. Printed list of task instructions
6. Notepad and pen for participants

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. Following the testing, the recordings were transferred to an administrator's system and analyzed.

3.8   PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant

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

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

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

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

Participants were then given 20 tasks to complete. Tasks are listed in the moderator's guide in Appendix.

3.9 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 EHR by measuring participant success rates and errors

2. Efficiency of EHR by measuring the average task time and path deviations

DATA SCORING

The following table (Table 3) details how tasks were scored, errors evaluated, and the time data analyzed.

Measures	Rationale and Scoring
Effectiveness: Task Success	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. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor [1.25] that allows some time buffer because the

	participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was [30] seconds then allotted task time performance was [30 * 1.25] seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an "Failures." No task times were taken for errors. 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. On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.
Efficiency: Task Time	Using the testing software, task timing was completed automatically when each user was finished with the assigned 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	Participant's subjective impression of the ease of use of the application was measured by administering both a simple

	post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants.
	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 Appendix

Table 3. Details of how observed data were scored.

4 RESULTS

4.1 DATA ANALYSIS AND REPORTING

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

The usability testing results for the EHRUT are detailed below (see Table 3). The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.

Task Measure	N	Task Success	Path Deviations	Task Time	Task Rating
Create a new patient with demographics, change, and view their Demographics 170.315(a)(5) Demographics	A5.1	90%	2	251	4.3
Add a Lab Order, change, and view it 170.315(a)(2)	A2.1	80%	2	108	4.7
Add a Diagnostic Imaging Order, change, and view it 170.315(a)(3)	A3.1	90%	4	95	4.8
Add a problem to a patient's Problem List 170.315(a)(6)	A6.1	80%	0	120	4.7
Add an Implantable Device, change, and view it 170.315(a)(14)	A14.1	90%	0	75	4.8
Import and reconcile a CCDA 170.315(b)(2)	B2.1	60%	0	73	4.5
Add CDS – Problem 170.315(a)(9) CDS	A9.1	100%	0	116	4.7
Add CDS Medication 170.315(a)(9) CDS	A9.2	70%	0	81	4.7
Add CDS - Medication Allergy 170.315(a)(9) CDS	A9.3	90%	0	58	4.7
Add CDS – Demographic	A9.4	60%	0	76	4.6

170.315(a)(9) CDS					
Add CDS – Lab 170.315(a)(9) CDS	A9.5	90%	2	80	4.7
Add CDS – Vitals 170.315(a)(9) CDS	A9.6	80%	0	55	4.9
Add CDS – Combo 170.315(a)(9) CDS	A9.7	100%	0	50	4.6
Trigger CDS – Problem 170.315(a)(9) CDS	A9.8	60%	1	78	4.5
Trigger CDS Medication 170.315(a)(9) CDS	A9.9	70%	0	51	4.7
Trigger CDS - Medication Allergy 170.315(a)(9) CDS	A9.10	80%	0	54	4.7
Trigger CDS – Demographic 170.315(a)(9) CDS	A9.11	90%	0	39	4.6
Trigger CDS – Lab 170.315(a)(9) CDS	A9.12	80%	1	54	4.6
Trigger CDS – Vitals 170.315(a)(9) CDS	A9.13	80%	0	53	4.6
Trigger CDS – Combo 170.315(a)(9) CDS	A9.14	80%	0	95	4.4

Table 4. Task Results

4.1.1 OVERALL SCORING

Measures	Rationale and Scoring
Effectiveness: Task Success	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. This was impacted by a minor database issue for the first testing session. The issue was corrected for the second test. Almost all tasks were completed successfully, but not within the allowable time. **Task Success Score: 81%**

Effectiveness:	Each task was scored for Ease of Use on a 1-3 scale. 1 being the task completed with ease, 2 indicates that it was completed with some difficulty, and 3 representing a noncomplete task.
Ease of Use	
	Completed with Ease: 86% **Completed with some difficulty: 11%** **Noncompleted: 3%**

Table 5. Overall Scoring

4.1.2 TASKS BY TIME

This table demonstrates each task by test day and machine number. A majority of the tasks which did not require extensive data entry were completed in 1 minute or less. This table helps to demonstrate the effectiveness, efficiency and usability of the system, with averaged time across all tasks at 83 seconds.

Task	D1M1	D1M2	D1M3	D1M4	D2M1	D2M2	D2M3	D2M4	D3M1	D3M2	TIME AVG.
1	263	375	295	325	260	199	332	255	168	42	**251**
2	99	134	104	140	111	85	155	82	82	89	**108**
3	82	94	85	87	77	64	66	65	128	200	**95**
4	112	115	118	106	107	120	137	161	72	149	**120**
5	85	116	62	93	55	66	96	87	46	42	**75**
6	41	46	41	133	33	38	37	75	139	142	**73**

7	173	86	174	156	87	80	136	107	83	74	**116**
8	67	239	89	105	42	52	52	50	62	49	**81**
9	54	110	49	72	39	39	52	43	53	66	**58**
10	69	94	50	98	52	56	54	58	119	114	**76**
11	71	125	72	102	66	71	71	76	58	84	**80**
12	43	87	52	79	50	51	48	50	48	44	**55**
13	38	65	58	70	33	41	41	39	59	58	**50**
14	55	158	71	188	62	52	66	58	33	35	**78**
15	48	54	82	57	44	51	41	61	32	44	**51**
16	34	64	97	94	43	45	38	46	33	43	**54**
17	46	58	38	33	31	34	31	37	36	46	**39**
18	74	58	74	109	31	37	30	33	42	*	**54**
19	41	47	82	46	62	42	64	33	64	44	**53**
20	365	39	54	57	32	42	38	35	49	238	**95**
Average	**93**	**108**	**87**	**108**	**66**	**63**	**79**	**73**	**70**	**84**	**83**

4.1.3 SYSTEM USABILITY SCALE RESULTS

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks. The SUS is included below and indicates a high level of subjective usability for the participants, and a low level of frustration or inability to complete tasks as assigned.

AVERAGE RESULTS

Scale Question	Results Average
1. I think that I would like to use this system frequently	**Strongly Agree 4.2**
2. I found the system unnecessarily complex	**Disagree 2**
3. I thought the system was easy to use	**Strongly Agree 4.8**
4. I think that I would need the support of a technical person to be able to use this system	**Disagree 1.8**
5. I found the various functions in this system were well integrated	**Agree 4**
6. I thought there was too much inconsistency in this system	**Disagree 1.7**
7. I would imagine that most people would learn to use this system very quickly	**Agree 4.2**
8. I found the system very cumbersome to use	**Disagree 1.4**
9. I felt very confident using the system	**Strongly Agree 4.7**

10. I needed to learn a lot of things before I could get going with this system	**Strongly Disagree 1.2**

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 92% Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

RESULTS BY QUESTION AND USER

User #	D1M1	D1M2	D1M3	D1M4	D2M1	D2M2	D2M3	D2M4	D3M1	D3M2
1	4	1	5	1	4	1	5	1	5	1
2	5	1	5	1	5	1	5	1	5	1
3	5	1	5	2	5	2	5	1	5	1
4	5	1	5	2	5	2	5	1	5	1
5	4	4	5	1	3	2	4	2	5	1
6	4	2	4	3	2	2	3	2	4	2
7	3	4	5	3	4	2	3	2	4	2
Avg.	4.285714	2	4.857143	1.857143	4	1.714286	4.285714	1.428571	4.714286	1.285714

4.1.4   Verbalizations

The participants were instructed not to use the "think aloud technique" so there was hardly any talking during the test. Following are the recorded verbalizations by task and participant.

> **Task 1**
>   D1M2: "That was pretty easy."
> **Task 2**

No verbalizations.

Task 3

No verbalizations.

Task 4

D1M2: "Easy enough."

D2M1: "Okay."

Task 5

D3M2: "I tried searching for UDI, but…" (shrugs)

Task 6

D3M1: "Can I get some water?"

D3M2: "Yeah, that sounds good."

Task 7

D1M2: (snickers) "Tickler?"

D3M1: "Why does that say Health Maintenance Tickler?"

Task 8

No verbalizations.

Task 9

No verbalizations.

Task 10

No verbalizations.

Task 11

No verbalizations.

Task 12

D3M1: "This is boring."

Task 13

No verbalizations.

Task 14

D1M2: "Hey, I could use a water break."

Task 15

D3M1: "Are there more like these?"

Task 16

No verbalizations.

Task 17

D1M2: "Oh, the rest are about the same."

Task 18

No verbalizations.

Task 19

No verbalizations.

Task 20
> D1M2: "That was pretty easy."
> D1M4: "Much easier than what I work with."
> D2M3: "I thought this would be harder."
> D2M2: "Not bad. It was really straight forward."

4.2 DISCUSSION OF THE FINDINGS

As test administrators, we undertook this project without bias toward the test results. The testing was set up to collect both qualitative data (% Tasks Completed, Time per Task) and subjective data (User Commentary, SUS results). The combination of these test sessions revealed that the system tested rated highly in both usability and efficiency, even among users with little technical knowledge or medical background.

5 EFFECTIVENESS

Overall, the testing was very successful, with few deviations in the processes and tasks that were undergoing testing. The deviations were mostly on the user end, with mis-interpretation of task steps or the user neglecting to close the task recording window. There was one minor database issue affecting a small percentage of tasks.

6 EFFICIENCY

The efficiency of the system was demonstrated through the satisfactory times achieved by each user per task. Most of the tasks not involving extensive data entry required 1 minute or less to accomplish. The average task time across all twenty tasks was 1 minute 22 seconds.

7 SATISFACTION

Utilizing the findings from both the qualitative data and the subjective ratings, we found a high degree of usability within the system and this was correlated by the findings of the SUS.

Verbal user commentary during the sessions indicated statements such as "This is so easy" and "I thought it would be a lot harder", which were interpreted as additional supportive comments to the ease of use for the system as a whole.

In the latter part of the test, users were allowed to complete the final 5 tasks on their own initiative, and these were some of the fastest times recorded in the testing.

8   MAJOR FINDINGS

Major findings from this test session were as follows:

- A high degree of satisfaction from users not previously exposed to the system.
- Fast and efficient workflows possible within the system, even for more novice computer users.

9   AREAS FOR IMPROVEMENT

The first day's testing was impacted by a minor database issue which prevented the full testing of one task. This was rectified by the next test session, and we were able to complete the testing without further incident. This issue affected a very small percentage of tasks.

Users were encouraged to leave written notes if they chose, and there were few notes. Two users noted that the Date of Birth field in the Patient Information screen did not work as expected. When entering a birth date, not including the forward slash for the date would reset the field to the current date.

One user indicated the "Click arrow, double click dropdown" workflow in the Orders area was confusing and could be improved by not requiring the double click or the precise arrow click.

10 APPENDICES

5.1 APPENDIX 1 - User Recruitment Parameters

User Recruitment Requirements Document

1. Testing parameters

Tests will take place on several days that the user can choose from, including weekend and after office hours on weekdays. Full schedule will be available approximately 2 weeks before the test but are expected to take place during the week of November 12-18th and on March 19th, 2018.

Participants will be attending a short training session of approximately 1 hours with a 2 hour test window following the training. The complete session will take no more than 4 hours and could be shorter.

Testing will take place at the ChartLogic, Inc. offices in Salt Lake City, UT.

2. Requirements
- Testing health care industry professionals
- Not too restrictive, few reasons for disqualification
- Different demographics (age, gender, education level)
- Some participants could have familiarity with the product

3. Questionnaire *(Online survey link)*
1. Name
2. Email address
3. Phone Number
4. What is your gender?
5. What is your age?
6. Have you participated in a focus group or usability test in the past 3 months?
7. What is your education level? (High school, some college, college degree)
8. What is your occupation or role?

9. How long have you pursued this career?
10. Do you have any experience using ChartLogic 8? If so, how much?
11. How would you describe your computer experience level? (novice, intermediate, expert)
12. Do you require any assistive technologies to use a computer? [if so, please describe]
13. What days and times would work better for you? (open text field)

5.2   APPENDIX 2 – Participant Demographics

Following is a high-level overview of the participants in this study.

Gender	Female - 5 Male - 5
Ages	20-25 - 5 25-35 - 3 35-45 – 2
Education	High School – 1 Some College – 6 College Degree – 3
Occupation	Health Care Field - 10
Computer Experience	100 < months – 1 100-150 months – 7 150 > months– 2

Table 1. High Level Overview of Participant Demographics

Participants

Part ID	Gender	Age	Education	Occupation / Role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
2	Female	23	Some College	Counseling	12	120	No	No
3	Female	45	Some College	Physical Therapy	12	96	No	No
5	Male	23	Some College	IT Staff	36	240	No	No
7	Male	24	College Degree	Registered Nurse	12	150	No	No
9	Male	36	Some College	Counseling	240	180	No	No
10	Male	23	Some College	Medical Student	24	120	No	No
11	Female	28	High School	Medical Assistant	24	100	No	No
12	Female	20	Some College	Pediatric Care	60	100	No	No
13	Male	26	College Degree	Medical Student	60	180	No	No
14	Female	28	College Degree	Administrative Staff	12	204	No	No

Table 2. List of Participants & Demographics

5.3   APPENDIX 3 – Non-disclosure Agreement & Informed Consent Form

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of [Testing Date], between [user], ("the Participant") and the Usability team at ChartLogic, Inc. located at 3995 S. 700 East, Salt Lake City, UT 84107.

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

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

Any information the Participant acquires relating to this product during this study is confidential and proprietary to ChartLogic, Inc. and is being disclosed solely for the purposes of the Participant's participation in today's usability study.

By signing this form the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Attested By: (user)

Signature: _____   Date:

Informed Consent

ChartLogic, Inc. would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform

several tasks using the EHR, and give your feedback. The study will last between 1-4 hours. At the conclusion of the test, you will be compensated for your time.

Agreement

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

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

I understand and agree that the data collected from this study may be shared with parties outside of ChartLogic, Inc. I understand and agree that data confidentiality is assured, because only de- identified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

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

Please check one of the following:

[ ] YES, I have read the above statement and agree to be a participant.

[ ] NO, I choose not to participate in this study.

Attested By:

Signature: _____   **Date:**

5.4   APPENDIX 4 – Moderator's Guide

Orientation given to participant

Welcome Orientation

Thank you for participating in this study. Our session today will last between 1-4 hours. During that time you will take a look at an electronic health record system.

The product you will be using today is our ChartLogic 9 EHR program in it's production state. Each of your systems 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..

I did not have any involvement in its creation, so please be honest with your opinions.

Getting started, the process will be as follows. I will read the steps of each task aloud, while Trevor will demonstrate. 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, as we can't help you once you have begun the recording.

Do you have any questions or concerns?

On the desktop, you will find a shortcut to Morae Recorder. Once you open it, it will ask you to load a configuration file. Each file represents one task, and they are numbered in order. Feel free to load the next task configuration once you have finished with the last, but please don't start until we have demonstrated the task.

Written list of Tasks given to each participant.

Testing Tasks

Task 1 – a.5 – Demographics

1. Register a new Patient in the system. Record the patient's preferred language, date of birth, gender, race, ethnicity, sexual orientation, gender identity.
2. Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity,
3. Confirm patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity.

Task 2 – a.2 Labs

1. On the patient record you created, find New Orders on the menu, Choose Manual Lab.
2. Set the Send to Facility to "Lab Corp" and Requisition Template to "Labs"
3. Choose the Panel "CBC", Save
4. Open the Lab order just created, Delete CBC, Add Lipids, Save
5. Open and Confirm Changed Lab order

Task 3 – a.3 – Diagnostic Imaging

1. On the patient record you created, find New Orders on the menu, Choose Radiology.
2. Set the Send to Facility to "Lab Corp" and Requisition Template to "Radiology"
3. Choose the Panel "XRay", Save
4. Open the Radiology order just created, Delete "XRay". Add "CT Scan", Save
5. Open and Confirm Changed Radiology order

Task 4 – a.6 – Problem List

1. On Patient, open History, find Problem List
2. Record a Snomed problem ("Pain" Snomed code: 22253000) to the problem list, Save
3. Add another Snomed problem ("Headache" Snomed code: 25064002) to the problem list, Save
4. Change the problem you just added (Headache) to Inactive, Click "OK" to save
5. Reopen the patient's history and navigate to the Problem List, Display only the active problem list
6. Display only the inactive problem list, confirm visually, close Problem List

Task 5 – a.14 – Implantable Device List

1. In the menu, got to, Patient -> History, the select the Implant Devices tab
2. On Patient Record, record a UDI implanted on today's date, Save
3. Visually Confirm access to UDI, Device Description, Identifiers and Attributes, Close Patient History.

Task 6– b.2 – Clinical Information Reconciliation and Incorporation

1. Navigate to Tools, then CCDA Reconciler.
2. Click Open, go to the Desktop and select "BradMclaughlin_CCDA.xml", then click Open.
3. Click "Merge All", then "Save and Close"

Task 7-20 – a.9 – Clinical Decision Support

7. **Add a Problem List Intervention**

   1. On the Patient Record, open the Configure menu (top left) find Patient intervention

2. Add a New Profile, and name it "Problem: Diabetes Mellitus".
Check Reminder profile box, Choose "Both" for gender
3. Click on the Problems Tab, and click Choose Problems.
Check the Snomed Radio box
4. Search for Diabetes, Select "Diabetes Mellitus", Click OK to save. Click OK to save intervention.

8. Medication List
1. On the Patient Record, open the Configure menu (top left) find Patient intervention
2. Add a New Profile, and name it "Medication: Lipitor"
Check Reminder profile box, Choose "Both" for gender
3. Click on the Medications Tab, and click Choose Medication Items
Search for Lipitor, Select "Lipitor (atorvastatin)", Click OK to save. Click OK to save intervention.

9. Medication Allergy List
1. On the Patient Record, open the Configure menu (top left) find Patient intervention
2. Add a New Profile, and name it "Allergy: Codeine"
Check Reminder profile box, Choose "Both" for gender
3. Click on the Allergies Tab, and click Choose Allergy Items
Select "Codeine sulfate". Click OK to save
Click OK to save intervention.

10. Demographic
1. On the Patient Record, open the Configure menu (top left) find Patient intervention
2. Add a New Profile, and name it "Demographic: 20-25".
Check Reminder profile box, uncheck "ALL Ages"
then Choose "Both" for gender
3. In Starting Age box, enter 20; in Ending Age box, enter 25.
Click OK to save intervention.

11. Laboratory Test
1. On the Patient Record, open the Configure menu (top left) find Patient intervention.

2. Add a New Profile, and name it "Labs: CBC". Check Reminder profile box, Choose "Both" for gender
3. Click on the Labs Tab, and click Choose Lab Items.
   Click the plus icon, then double click the select box in the "Lab Test" column and select "1 – CBC"
4. Select "GREATER THAN" as the validation rule, and enter the number "0" (zero) as the value. Check the checkbox to the left of the row with "1 – CBC".
5. Click OK to add the lab. Click OK to save intervention.

12. Vital Signs

1. On the Patient Record, open the Configure menu (top left) find Patient intervention
2. Add a New Profile, and name it "Vitals: Weight".
   Check Reminder profile box, Choose "Both" for gender
3. Click on the Vitals Tab, and click Edit Vital Item.
   In Weight, add Greater than 150 in lbs. 0 oz.; and Less than 180 lbs 0 oz.
   Click OK to save.
   Click OK to save intervention.

13. Combo Female

Add the Demographic

    i. On the Patient Record, open the Configure menu (top left) find Patient intervention

    ii. Add a New Profile, and name it "Combo: Female". Check Reminder profile box, then Choose "Female" for gender

Add Medication

    iii. Click on the Medications Tab, and click Choose Medication Items Select "Advil (ibuprofen)", Click OK to save. Click OK to save intervention.

14. Lorene Peters – Problem: Diabetes Mellitus

1. Search for patient: Lorene Peters
2. Double click on "General F/U" to open a new exam
3. Ensure that a window titled "Health maintenance Tickler" pops up. Click on the magnifying glass icon for row labeled "Problem: Diabetes Mellitus"
4. Click on the (i) icon next to "Diabetes Mellitus"
5. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam

15. Virgil Ross – Medication: Lipitor

1. Search for patient: Virgil Ross
2. Double click on "General F/U" to open a new exam
3. Ensure that a window titled "Health maintenance Tickler" pops up. Click on the magnifying glass icon for row labeled "Medication: Lipitor"
4. Click on the (i) icon next to "Lipitor (atorvastatin)"
5. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam

16. Kevin Hunt – Medication Allergy: Codeine sulfate

1. Search for patient: Kevin Hunt
   Double click on "General F/U" to open a new exam
2. Ensure that a window titled "Health maintenance Tickler" pops up.
   Confirm visual problem Allergy: Codeine Sulfate
3. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window

Click "Cancel" to close the exam

17. Regina Mack – Demographics

1. Search for patient: Regina Mack
   Double click on "General F/U" to open a new exam
2. Ensure that a window titled "Health maintenance Tickler" pops up. Click on the magnifying glass icon for row labeled "Demographic: 20-25"
3. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam
4.

18. Harry King – Lab results: CBC

1. Search for patient: Harry King.
   Double click on "General F/U" to open a new exam
2. Ensure that a window titled "Health maintenance Tickler" pops up. Click on the magnifying glass icon for row labeled "Labs: CBC"
3. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam

19. Tracy Russell– Vital signs: Weight

1. Search for patient: Tracy Russell.
   Double click on "General F/U" to open a new exam
2. Ensure that a window titled "Health maintenance Tickler" pops up. Click on the magnifying glass icon for row labeled "Vitals: Weight"
3. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam

20. Lindsay Sims – Combination:

1. Search for patient "Lindsay Sims"
   Double click on "General F/U" to open a new exam
2. Ensure that a window titled "Health maintenance Tickler" pops up.
   Click on the magnifying glass icon for row labeled "Combo: Female"
3. Click on the (i) icon next to "Advil (Ibuprofen)"

4. Click "OK" to close the intervention detail window
   Click "OK" to close the Health Maintenance Tickler window
   Click "Cancel" to close the exam

5.5   APPENDIX 5 – System Usability Scale Questionnaire

System Usability Scale Questionnaire

Scale Question	Strongly Disagree				Strongly Agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5

8.I found the system very cumbersome to use	**1** **2** **3** **4** **5**
9.I felt very confident using the system	**1** **2** **3** **4** **5**
10. I needed to learn a lot of things before I could get going with this system	**1** **2** **3** **4** **5**

5.6 APPENDIX 6 – Incentive Receipt & Acknowledgement Form

Incentive Receipt & Acknowledgement Form

I, [user] hereby acknowledge receipt of $100 in the form of a pre-paid Visa card for my participation in a research study run by ChartLogic, Inc..

Participant:

Name

email

Phone

Signature: _____ **Date:**

Test Administrator:

Tara Sudweeks Willgues
ChartLogic, Inc.

Test Administrator Signature: _____ **Date:**

Test Witness:

Trevor Jacobs
ChartLogic, Inc.

Test Witness Signature: _____ **Date:**