EHR Usability Test Report of CloudCraft Software, Version 8.1.1

Report based on ISO/IEC 25062:2006 Common Industry Format for Usability Test Reports

CloudCraft Software, version 8.1.1

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1. EXECUTIVE SUMMARY

A usability test of CloudCraft Software, version 8.1.1 for ambulatory EHR was conducted on December 17, 2019 in Faison, NC for Goshen Medical Center. 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, 16 healthcare providers, intake and checkout personnel matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 43 tasks typically conducted on an EHR:

	Task Identifier	Task Description
1	A1.1	Record CPOE Medication Order
2	A1.2	Change CPOE Medication Order
3	A1.3	Access CPOE Medication Order
4	A2.1	Record Lab order via CPOE
5	A2.2	Change Lab order via CPOE
6	A2.3	Display changed CPOE Lab order
7	A3.1	Record Imaging order via CPOE
8	A3.2	Change Imaging order via CPOE
9	A3.3	Display changed CPOE Imaging order
10	A4.1	Using CPOE, trigger a drug-drug interaction by entering a new medication order
11	A4.2	Using CPOE, trigger a drug-allergy interaction by entering a new medication order
12	A4.3	Adjust the severity level of a displayed drug-drug interaction
13	A5.1	Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)
14	A5.2	Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)
15	A5.3	Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)
16	A6.1	Record a problem to the problem list
17	A6.2	Change a problem on the problem list
18	A6.3	Display the active problem list
19	A6.4	Display the historical problem list
20	A7.1	Record a medication to the medication list
21	A7.2	Change a medication on the medication list
22	A7.3	Display the active medication list
23	A7.4	Display the historical medication list
24	A8.1	Record a medication allergy
25	A8.2	Change a medication allergy

26	A8.3	Display the active medication allergy list
27	A8.4	Display the historical medication allergy list
28	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 above
29	A9.2	Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
30	A9.3	View the intervention/resource information using the Info button standard for data elements in the problem list, medication list, and demographics
31	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
32	A9.5	Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date
33	A14.1	Record UDI
34	A14.2	Change UDI Status
35	A14.3	Access UDI, Device Description, Identifiers and Attributes
36	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
37	B2.2	Generate a new CCDA with reconciled data
38	B3.1	E-prescribe New Prescription
39	B3.2	Change Prescription (dosage or duration)
40	B3.3	Cancel Prescription
41	B3.4	Refill Prescription
42	B3.5	Receive Fill Status Notification
43	B3.6	Request and Receive Medication History Information

During the 30-minute one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form (included in Appendix 3); they were instructed that they could withdraw at any time. Participants had 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 recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

The following types of data were collected for each participant:

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

All participant data was de-identified – no correspondence could be made from the identity of the participant to the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire. 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.

The Likert Scale was used to record how the participant felt each task was after completing it (5-easiest, 1-most difficult). In addition to the performance data, the following qualitative observations were made:

1.1. Major findings

- Tasks were completed within the allotted time, but there is still a lot of improvement that needs to be made.

- Integrations with third parties have to be handled exactly right.

- Dictation is a seminal design feature within CloudCraft. Although heavily used, in order to achieve the level of adaptation we expected, we must allow procedures, referrals, labs, diagnostics, and screenings orders to be a bi-product of the dictation.

- Participant's satisfaction ratings of the system are very mixed. Some people really like it and some people do not. Further usability study needs to be conducted and preference styles need to be allowed as options.

- The Human Resources component needs to be fully integrated.

- The billing system for FQHC requirements need to be completed.

- We have in place a provider steering committee that gives weekly feedback. However, we should consider adding a couple of more diverse providers to that group.

1.2. Areas for improvement

- The e-prescribing module (3rd Party provided) needs to be replaced because of performance, integration, and usability issues. We are in the process of replacing DoseSpot with DrFirst.

- Although CloudCraft provides medical coding support to ensure more accurate billing, while relieving the providers of coding burdens, the communication between provider and medical coder has to be improved. Also, coding mistake patterns have emerged that must be shifted to point of entry through validation warnings.

- Dictation as a secure method of data entry must allow providers to order procedures and medication for e-prescribing automatically. This will greatly speed up the encounter process.

- Small, attention to detail has to be given to each and every screen and field. Sometimes the number of mouse clicks is too much and organization of the information can be greatly improved.

- Labs orders are securely transmitted through the use of a HL7 and VPN connection. However, add-ons are frequently needed after the lab requisition has been created and transmitted. This area needs improvement.

- The use of color coding, although used, should be enhanced.

- The system needs to allow for kiosk intake to speed up the check-in process,

particularly with regard to insurance card scanning and OCR Data Extraction.

- Need to figure out a proper assessment of the customer's WAN / LAN, and associated recommendations in order to avoid negatively impacting performance. CloudCraft is a browser based application. And although this approach carries a lot of benefits, proper data content management, voice over IP phone system traffic and Wifi technology impacts the business application performance.

- Passing ONC certification is very different than implementing these features in production. Sometimes the certification requirements do not apply in all use cases or they get in the way. Users and their workflows and practice types require a significant effort to avoid business disruptions because of imposed certification requirements.

2. INTRODUCTION

The EHRUT tested for this study was CloudCraft Software, version 8.1.1. Designed to present medical information to healthcare providers in Goshen Medical Center, the EHRUT consists of a comprehensive EHR system used to obtain and track patient demographics, medical histories, prescribe medication, send referrals, billing, etc... 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 the task, ease of navigation, and content download speeds were captured during the usability testing.

3. METHOD

3.1. Participants

A total of 15 participants were tested on the EHRUT(s). Participants in the test were Physicians, LPNs, Site Leader, Scribes, Biller, Physician Assistants, and Patient Services. Participants were recruited by CloudCraft LLC.

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. For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; an example of a screener is provided in Appendix 1.

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.

Table 1

Part ID	Gender	Age	Education	Occupation	Professional Experience (mos)	Computer Experience (mos)	Product Experience (mos)	Assistive Tech. Needs
100	Female	30-39	Some college credit, no degree	Patient Services	25	264	10	No
200	Female	20-29	Associate degree	Patient Services	6	120	6	No
300	Female	20-29	Associate degree	Patient Services	24	84	10	No
400	Female	30-39	Trade/technical/ vocational training	LPN	96	192	8	No
500	Female	60-69	Trade/technical/ vocational training	LPN	480	480	10	No

ID	Gender	Age	Education	Role				
600	Male	60-69	Associate degree	Physician Assistant	408	348	10	No
700	Male	50-59	Master's Degree	Physician Assistant	192	192	10	No
800	Female	50-59	Some college credit, no degree	Patient Services	108	108	9	No
900	Female	60-69	Bachelor's Degree	Site Leader	480	480	11	No
1000	Male	60-69	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	204	588	10	No
1100	Female	60-69	Associate degree	Physician Assistant	144	312	12	No
1200	Female	30-39	Some college credit, no degree	Patient Services	48	132	10	No
1300	Female	20-29	Associate degree	Physician Scribe	72	120	11	No
1400	Male	60-69	Doctorate degree (e.g., MD, DNP, DMD, PhD)	MD	516	2	12	No
1500	Female	30-39	Bachelor's Degree	Biller	8	192	8	No
1600	Female	20-29	Associate degree	Physician Scribe	36	12	10	No

16 participants (matching the demographics in the section on Participants) were recruited and 16 participated in the usability test. 0 participants failed to show for the study. Participants were scheduled for 3-minute sessions with 2-minutes in between each session for debrief by the administrator(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics as provided by the recruiting firm.

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 one 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

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

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. Record CPOE medication order
2. Change CPOE medication order
3. Access CPOE medication order
4. Record lab order via CPOE
5. Change lab order via CPOE
6. Display changed CPOE lab order
7. Record imaging order via CPOE
8. Change imaging order via CPOE
9. Display changed CPOE imaging order
10. Trigger a drug-drug interaction by entering new medication
11. Trigger a drug-allergy interaction by entering new medication
12. Adjust the severity level of a displayed drug-drug interaction
13. Record a patient's demographics
14. Change the patient's demographics
15. Display the patient's changed demographics
16. Record a problem on the problem list
17. Change a problem on the problem list
18. Display the active problem list
19. Display the historical problem list
20. Record a medication
21. Change a medication
22. Display the active medications
23. Display the historical medications
24. Record a medication allergy
25. Change a medication allergy
26. Display the active medication allergy list
27. Display the historical medication allergy list
28. Add a CDS intervention and/or reference resource for multiple required elements
29. Trigger the CDS interventions/resources added from the required elements
30. View the CDS intervention/resource information
31. Trigger the CDS interventions/resources
32. Access bibliographic citation, developer, funding source, release/revision date for a triggered CDS intervention/resource
33. Record UDI
34. Change UDI
35. Access UDI for device description, identifiers, and attributes
36. Incorporate a CCDA and conduct reconciliation of the medications, allergies, and problems (based on the information in the patient's record)
37. Generate a new CCDA with reconciled data
38. E-prescribe new prescription
39. Change prescription
40. Cancel prescription
41. Refill prescription
42. Receive fill status notification
43. Request and receive medication history information

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

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.1 Each participant reviewed and signed an informed consent and release form (See Appendix 3). A representative from the test team witnessed the participant's signature.

The usability testing staff conducting the test was an experienced usability practitioner with 13 years in the medical field and an associate degree in Health Care Administration. They moderated the session including administering instructions and tasks. The task times were monitored, post-task rating data obtained, and notes taken on participant comments. Lastly, notes were made on task success, path deviations, number and type of errors, and comments.

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

- As quickly as possible making as few errors and deviations as possible.
- Without assistance; administrator(s) 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 the administrator finished reading the question. The task time was stopped once the participant indicated they had successfully completed the task. Scoring will be discussed below.

Following the session, the administrator gave the participant the post-test questionnaire (e.g., the System Usability Scale, see Appendix 5), and thanked everyone 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.

3.5. TEST LOCATION

The testing was completed in the office of the participant. Only the participant and administrator 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 the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

3.6. TEST ENVIRONMENT

The EHRUT would be used in a healthcare office or facility. In this instance, the testing was conducted in Goshen Medical Center. For testing, multiple computers participants used a Dell computer running Windows 7, a mouse and a keyboard when interacting with the EHRUT. The EHRUT used a Dell 17" monitor with 1366x768 resolution and true color as the color settings. The application was set up according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a Windows platform with a LA connection in the facility and a WAN connection outbound to the internet. This WAN connection was 10 years old and in the process of being upgraded at the time of testing. 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).

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[1] All participant data was de-identified and kept confidential.

3.7. TEST FORMS AND TOOLS

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

1. Informed Consent
2. Moderator's Guide
3. Post-test Questionnaire
4. Acknowledgment Form

Examples of these documents can be found in Appendices 3-6 respectively. The Moderator's Guide was devised to be able to capture the required data.

3.8. PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant (also see the full moderator's guide in Appendix [B4]):

Thank you for participating in this study. Your input is very important. Our session today will last about 30-minutes. During that time, you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. I did not have any involvement in its creation, so 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. Should you feel it necessary you are able to withdraw at any time during the testing.

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

Participants were then given between 5 and 43 tasks to complete. Tasks are listed in the moderator's guide in Appendix B4.

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

Data Scoring

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

Table 2

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. Task times were recorded for successes. Thus, for expert, optimal performance on a task is found to be 10 seconds then the allotted task time performance was 10*1.0 seconds.
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.
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	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	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) based on the Linkert Scale. The data was averaged across participants.

Table 2. 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. The usability testing results for the EHRUT are detailed below (see Table 2). 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.

The results from the Linkert Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 105.8

Table 3

Measure/Task	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD) %	Deviations (Observed/ Optimal)	Mean (SD)	Deviations (Observed/ Optimal)	Mean (SD)	Mean (SD)
1 Record CPOE Medication Order	A1.1	100	12/12	42.572	42.572/35	0	5
2 Change CPOE Medication Order	A1.2	100	9/9	35.097	35.097/25	0	5
3 Access CPOE Medication Order	A1.3	100	2/2	10.061	10.061/7	0	5
4 Record Lab order via CPOE	A2.1	100	15/15	44.21	44.21/25	0	5
5 Change Lab order via CPOE	A2.2	100	7/7	28.13	28.13/20	0	5
6 Display changed CPOE Lab order	A2.3	100	1/1	3.346	3.346/2.5	0	5
7 Record Imaging order via CPOE	A3.1	100	18/18	36.074	36.074/35	0	5
8 Change Imaging order via CPOE	A3.2	100	10/10	31.173	31.173/30	0	5
9 Display changed CPOE Imaging order	A3.3	100	1/1	3.555	3.555/3	0	5
10 Using CPOE, trigger a drug-drug interaction by entering a new medication order	A4.1	100	12/12	45.857	45.857/40.00	0	5
11 Using CPOE, trigger a drug-allergy interaction by entering a new medication order	A4.2	100	12/12	37.192	37.192/40	0	5
12 Adjust the severity level of a displayed drug-drug interaction	A4.3	100	10/10	36.113	36.113/25	0	5

Task	ID						
13 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)	A5.1	100	13/13	51.499	51.499/35	0	5
14 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)	A5.2	100	12/12	39.718	39.718/30	0	5
15 Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)	A5.3	100	2/2	2.985	2.985/2.5	0	5
16 Record a problem to the problem list	A6.1	100	8/8	34.129	34.129/20	0	5
17 Change a problem on the problem list	A6.2	100	2/2	16.874	16.874/7	0	5
18 Display the active problem list	A6.3	100	1/1	3.685455	3.68/3.5	0	5
19 Display the historical problem list	A6.4	100	2/2	5.07	5.07/5	0	5
20 Record a medication to the medication list	A7.1	100	13/13	43.986	43.986/35	0	5
21 Change a medication on the medication list	A7.2	100	9/9	41.111	41.11/25	0	5
22 Display the active medication list	A7.3	100	1/1	7.082	7.082/6.5	0	4.7
23 Display the historical medication list	A7.4	100	1/1	5.979	5.979/6	0	5
24 Record a medication allergy	A8.1	100	8.33/9	41.675	41.675/40	0	5
25 Change a medication allergy	A8.2	100	4.56/4	44.632	44.632/32	0	5
26 Display the active medication allergy list	A8.3	100	1.56/1	7.032	7.032/7	0	5

27 Display the historical medication allergy list	A8.4	100	2/2	5.645	5.645/5.5	0	5
28 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 above	A9.1	90	13.9/13	89.971	89.971/65	0	4.4
29 Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements	A9.2	89.5	13.9/13	52.58	52.58/48.5	0	4.4
30 View the intervention/resource information using the Info button standard for data elements in the problem list, medication list, and demographics	A9.3	95	7.3/7	33.953	33.953/35	0	4
31 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	A9.4	98	5/5	54.256	54.256/49	0	4.4
32 Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date	A9.5	100	8/8	30.014	30.014/29	0	5
33 Record UDI	A14.1	100	9/9	36.25	36.25/23	0	5
34 Change UDI Status	A14.2	100	4/4	6.93	6.93/5.35	0	5
35 Access UDI, Device Description, Identifiers and Attributes	A14.3	100	1/1	2.352	2.352/2	0	5

36 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	B2.1	67	7/7	46.598	46.598/44	0	5
37 Generate a new CCDA with reconciled data	B2.2	100	2/2	2.491	2.491/2	0	5
38 E-prescribe New Prescription	B3.1	100	15/0	57.989	57.989/45	0	5
39 Change Prescription (dosage or duration)	B3.2	100	11/0	46.742	46.742/33	0	5
40 Cancel Prescription	B3.3	100	2/0	13.787	13.787/6.5	0	5
41 Refill Prescription	B3.4	100	6/0	20.788	20.788/19	0	5
42 Receive Fill Status Notification	B3.5	100	0/0	3.832	3.832/3.25	0	5
43 Request and Receive Medication History Information	B3.6	100	2/0	10.123	10.123/4.5	0	4.7

4.2. DISCUSSION OF THE FINDINGS

CloudCraft EHR was used by the participants in our study and the overall results were sufficient in helping to guide further development of the software. All participants were able to navigate and successfully preform the 43 required tasks. Some of the tasks had extra 'clicks' when completing clinical tasks. CloudCraft is still being developed and this study helped to find improvements that can be made to the system.

Effectiveness

Based on the results CloudCraft is a system that is user-friendly and clear to navigate. The participants were able to successfully complete the tasks assigned to them.

Efficiency

The tasks were completed in a satisfactory time frame based on the optimal time for completion. The results were in line with the expectations of the software.

Satisfaction

The Linkert Scale was used when calculating results and a large number of tasks scored highly. The participants completed their tasks quickly and with confidence in their ability to navigate the system.

Major findings

From the study there were areas that received high ratings and some functions that did not.

- Having a high blood pressure in red was well received
- The information button on laboratory orders to help determine the optimal lab to order was well received
- Having to click to save and click to confirm on multiple screens was found to be unnecessary and time consuming
- A hard refresh was needed to be done to update allergy and medication changes
- Integrations with third parties have to be handled exactly right.
- Dictation is a seminal design feature within CloudCraft. Although heavily used, in order to achieve the level of adaptation we expected, we must allow procedures, referrals, labs, diagnostics, and screenings orders to be a bi-product of the dictation.
- Participant's satisfaction ratings of the system are very mixed. Some people really like it and some people do not. Further usability study needs to be conducted and preference styles need to be allowed as options.
- The Human Resources component needs to be fully integrated.
- The billing system for FQHC requirements need to be completed.
- We have in place a provider steering committee that gives weekly feedback. However, we should consider adding a couple of more diverse providers to that group.

AREAS FOR IMPROVEMENT

The responses from the participants were highly valuable, there were suggestions given that will be implemented moving forward. As CloudCraft continues to enhanced, the guidance from the participants will be immeasurably helpful.

- Refreshing screens to update the information in a timely manner will be adjusted.
- Enhancing guidelines for quality care when looking at the patient's problem list.
- Reevaluating the double confirmation for saving in the clinical portion.
- The e-prescribing module (3rd Party provided) needs to be replaced because of performance, integration, and usability issues. We are in the process of replacing DoseSpot with DrFirst.

- Although CloudCraft provides medical coding support to ensure more accurate billing, while relieving the providers of coding burdens, the communication between provider and medical coder has to be improved. Also, coding mistake patterns have emerged that must be shifted to point of entry through validation warnings.

- Dictation as a secure method of data entry must allow providers to order procedures and medication for e-prescribing automatically. This will greatly speed up the encounter process.

- Small, attention to detail has to be given to each and every screen and field. Sometimes the number of mouse clicks is too much and organization of the information can be greatly improved.

- Labs orders are securely transmitted through the use of a HL7 and VPN connection. However, add-ons are frequently needed after the lab requisition has been created and transmitted. This area needs improvement.

- The use of color coding, although used, should be enhanced.

- The system needs to allow for kiosk intake to speed up the check-in process, particularly with regard to insurance card scanning and OCR Data Extraction.

- Need to figure out a proper assessment of the customer's WAN / LAN, and associated recommendations in order to avoid negatively impacting performance. CloudCraft is a browser based application. And although this approach carries a lot of benefits, proper data content management, voice over IP phone system traffic and Wifi technology impacts the business application performance.

- Passing ONC certification is very different than implementing these features in production. Sometimes the certification requirements do not apply in all use cases or they get in the way. Users and their workflows and practice types require a significant effort to avoid business disruptions because of imposed certification requirements.

5. APPENDICES

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

- Usability Recruiting Script
- Participant demographics
- Non-Disclosure Agreement (NDA)
- Informed Consent Form
- System Usability Scale Questionnaire

5.1. Appendix 1: Documents OneDrive Link

https://naiacorp-my.sharepoint.com/:f:/g/personal/bkhakai_naiacorp_net/EmAMdnCAEgRHhRcFo5EtliEBRxvj-fHQYFizn15cifvSng?e=4m58dm

The above link contains the actual signed and executed copies (Usability Recruiting Script, Non-Disclosure Agreements, Informed Consent Forms, and System Usability Scale Questionnaire) for the test participants.

5.2. Appendix 2: Participant Demographics Report

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

Gender	
Men	4
Women	11
Total (participants)	15

Occupation/Role	
LPN	2
Biller	1
Patient Services	5
Physician	2
Physician Assistant	2
Physician Scribe	2
Site Leader	1
Trainer	1
Total (participants)	16

Years of Experience	
Years experience	15
Facility Use of EHR	
All paper	0
Some paper, some electronic	15
All electronic	0
Total (participants)	16

5.3. Appendix 3: Participant Workflow

A1.1 CPOE Medication Order
1   Select Quick Assessment & Plan
2   User keys Location, Provider, Comments, <SAVE & PROCEED>
3   Once the QAP# is assigned, user clicks on Dx to lookup a Problem or select a Problem from the problem list
4   Provider keys in the Assessment & Plan, clicks <SAVE>
5   Provider orders medications by clicking on the medicine bag icon.
6   Provider clicks <ADD PRESCRIPTION> button, then does a medication search
7   Provider selects the strength
8   Provider enters Effective Date, Patient Directions, Dispense Quantity, Dispense Unit of Measure, Refills
         Quantity, Days Supply, <SAVE PRESCRIPTION>
9   Confirmation step: Medication, Pharmacy
10   <APPROVE & SEND> or <PRINT>, user has to key in PIN # on a EPCS prescription

A1.2 Change CPOE Medication Order
1   User clicks <ACTIONS> , Edit Prescription on the medication line requiring edit
2   Warning message pop-up confirming that the provider wants to edit.
3   <PROCEED> takes user back to edit screen allowing the user to click <CHANGE> on the current strength
4   Provider may change Effective Date, Patient Directions, Dispense Quantity, Dispense Unit of Measure,
         Refills Quantity, Days Supply, <SAVE PRESCRIPTION>

A1.3 Access CPOE Medication Order
1   User Clicks on medicine bag icon.
2   User views medication information

A2.1 Record CPOE Laboratory Order
1   Select Quick Assessment & Plan
2   User keys Location, Provider, Comments, <SAVE & PROCEED>
3   Once the QAP# is assigned, user clicks on Dx to lookup a Problem or select a Problem from the problem list
4   Provider keys in the Assessment & Plan, clicks <SAVE>
5   Provider clicks on the Quick Pick list icon (in order to select common labs or lookup lab CPT Codes)
6   Provider clicks on the Outside Lab tab
7   Provider selects the correct lab to order, clicks <SAVE>
8   After SAVE confirmation, then the user clicks ok. Then, closes the lab order window.
9   Provider confirms that the lab ordered is associated with the correct problem. Also mentions that the order is
         in Pending status.

A2.2 Change CPOE Laboratory Order
1   If lab is still in Pending status, user deletes the lab by clicking the trash can button.
2   User must reorder the Lab starting with step 5 of A2.1

A2.3 Access CPOE Laboratory
1   Click on Assessment & Plan Tab
2   Lab is displayed on the Problem list (associated with the lab)

A3.1 Record Imaging order via CPOE
1   Select Quick Assessment & Plan
2   User keys Location, Provider, Comments, <SAVE & PROCEED>
3   Once the QAP# is assigned, user clicks on Dx to lookup a Problem or select a Problem from the problem list
4   Provider keys in the Assessment & Plan, clicks <SAVE>
5   Provider clicks on the Quick Pick list icon (in order to select common labs or lookup Radiology CPT Codes)
6   Provider clicks on the Radiology tab
7   Provider selects the correct procedure to order, clicks <SAVE>
8   After SAVE confirmation, then the user clicks ok.
9   Provider chooses the location the procedure shall be proformed and adds comments, clicks <SAVE>
10   The system displays a successful confirmation to the provider, provider clicks <OK>. User closes the order
         procedure pop-up.
11   Provider confirms that the procedure ordered is associated with the correct problem. Also mentions that the
         order is in Pending status.

A3.2 Change Imaging Order via CPOE
1   If procedure is still in Pending status, user deletes the procedure by clicking the trash can button.
2   User must reorder the procedure starting with step 5 of A3.1

A3.3 Display Changed CPOE Imaging Order
1   Click on Assessment & Plan Tab
2   Procedure is displayed on the Problem list (associated with the lab)

A4.1 Using CPOE, trigger a drug-drug interaction by entering a new medication order
1   Search patient
2   Enter Patient Chart
3   User clicks on the Medication Tab
4   User clicks <Enter Medications & Allergies> button
5   User clicks <Add Prescription> button
6   Search Medication, choose strength, Written Date, Patient Directions, Dispense Quatity, Dispense Unit, Refill
         Quantity, Days Supply
7   Save Prescription [Red alert appears in upper right corner showing drug-drug interaction and severity]

A4.2 Using CPOE, trigger a drug-allergy interaction by entering a new medication order
1   Search patient
2   Enter Patient Chart
3   User clicks on the Medication Tab
4   User clicks <Enter Medications & Allergies> button
5   User clicks <Add Prescription> button
6   Search Medication, choose strength, Written Date, Patient Directions, Dispense Quatity, Dispense Unit, Refill
         Quantity, Days Supply
7   Save Prescription [Red alert appears in upper right corner showing drug-allergy interaction and severity]

A4.3 Adjust the severity level of a displayed drug-drug interaction
1   Enter Medications & Allergies [inside patient chart]
2   On Medication ordered (with drug-drug interaction alert), choose <Action>, Edit
3   Change Medication, choose strength, Written Date, Patient Directions, Dispense Quatity, Dispense Unit,
         Refill Quantity, Days Supply
4   Save Prescription [Red alert appears in upper right corner showing drug-drug interaction severity level has
         changed]

A5.1 Record a patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender identity,
preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)
1   Search patient
2   Enter Patient Chart
3   User clicks on the Demographic Info Tab
4   User clicks on the Characteristics Tab - In order to record each: Preferred Language, Race, Ethnicity, Sexual
         Orientation, Gender Identity. Then, user clicks <Save>
5   User clicks on General Info Tab - In order to record each: Date of Birth, Birth Sex (Gender), Deceased - Add
         Death Date. Then, user clicks <Save>

A5.2 Change the patient's preferred language, date of birth, birth sex, race, ethnicity, sexual orientation, gender
identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)
1   Search patient
2   Enter Patient Chart
3   User clicks on the Demographic Info Tab
4   User clicks on the Characteristics Tab - In order to change each: Preferred Language, Race, Ethnicity, Sexual
         Orientation, Gender Identity. Then, user clicks <Save>
5   User clicks on General Info Tab - In order to change each: Date of Birth, Birth Sex (Gender), Deceased -
         Add Death Date. Then, user clicks <Save>

A5.3 Display the patient's changed preferred language, date of birth, birth sex, race, ethnicity, sexual orientation,
gender identity, preliminary cause of death (inpatient only), and preliminary date of death (inpatient only)

1   Change in patient Demographic information is displayed upon clicking <Save> without additional steps by the user.

A6.1 Record a problem to the problem list
1   Search patient
2   Enter Patient Chart
3   User clicks on the Problems Tab
4   User clicks <Add Current Problem> button. User types a portion of the problem name and then clicks the <Search> button
5   Users Selects <Add> beside the problem they want to choose.
6   User optionally adds notes in the Comment box and then clicks <Save>
7   User may repeat to add more problems or Exit the pop-up box [Problem is added to Problem List]

A6.2 Change a problem on the problem list
1   User clicks on the Problems Tab
2   Change Active problem to Inactive [Change is reflected immediately]

A6.3 Display the active problem list
1   Search patient
2   Enter Patient Chart
3   User clicks on the Problems Tab

A6.4 Display the historical problem list
1   Search patient
2   Enter Patient Chart
3   User clicks on the Problems Tab
4   The user clicks on the <info button> icon. The system displays the historical event log history for that problem

A7.1 Record a medication to the medication list
1   Search patient
2   Enter Patient Chart
3   User clicks on the Medication Tab
4   User clicks <Enter Medications & Allergies> button
5   User clicks <Add Patient Reported> button
6   Search Medication, choose strength, Written Date, Patient Directions, Dispense Quatity, Dispense Unit, Refill Quantity, Days Supply
7   User clicks <Save Medication>
8   Medication appears in the activie medication list immediately

A7.2 Change a medication on the medication list
1   The user clicks on the <Actions> button, on the medication, in the active medication list.
2   The user clicks on the Edit action.
3   The user clicks on the <Change> button beside the medication name
4   Search Medication, choose strength, Written Date, Patient Directions, Dispense Quantity, Dispense Unit, Refill Quantity, Days Supply
5   User clicks <Save Medication>
6   Medication appears in the active medication list immediately

A7.3 Display the active medication list
1   User clicks on the Facesheet tab
2   Active medication list is displayed.

A7.4 Display the historical medication list
1   User clicks on the Medication tab
2   User clicks on the <Medication History> button
3   Historical medication list is displayed

A8.1 Record a medication allergy

1	Search patient
2	Enter Patient Chart
3	User clicks on the Medication Tab
4	User clicks <Enter Medications & Allergies> button
5	User clicks <Add/Edit Drug Allergy> button
6	User begins typing the name of the allergy, user selects from the list of allergies.
7	User selects the active status for the allergy selected.
8	User selects the reaction type.
9	User optionally adds a comment in the reaction comment box.
10	User selects an onset date from a date control
11	User clicks <SAVE> button. The allergy is displayed.

A8.2 Change a medication allergy
1   User clicks <Add/Edit Drug Allergy> button
2   The user selects edit beside the allergy they wish to change.
3   User changes the status to inactive.
4   User clicks <SAVE> button. The allergy is displayed.

A8.3 Display the active medication allergy list
1   User clicks on the Facesheet tab
2   Active medication allergy list is displayed.

A8.4 Display the historical medication allergy list
1   User clicks on the medication tab.
2   The historical medication allergy list is displayed.

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 above
1   User searches patient
2   User enters patient chart
3   User clicks <info button> icon for: Problem List, Medications, Medication Allergies, Demographics, Laboratory Test, and Vitals
4   User also has an option to Print the information.
Note: The CDS intervention and/or reference resources is automatically triggered when the EP signs off the encounter and there is a checkout event with the patient (C-CDA is triggered and "I" button is available on the Patient Protal).

A9.2 Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
1   View the intervention/resource information using the Info button standard for data elements in the problem list, medication list, and demographics"
2   In vital signs, if the blood pressure is outside of the normal range. Then, the information is displayed in RED.
3   Medication / Allergies drug interaction alerts are automatic when triggered. The system displays a red banner, showing the alert.

A9.3 View the intervention/resource information using the Info button standard for data elements in the problem list, medication list, and demographics"
1   User searches patient
2   User enters patient chart
3   User clicks <info button> icon for: Problem List, Medications, Medication Allergies, Demographics, Laboratory Test, and Vitals
4   User has the option to choose from: Problem List, Medications, Medication Allergies, Demographics, Laboratory Test, and Vitals after step 3 pop-up.

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
1   From Dashboard, user clicks <menu> button
2   User clicks on <Document Management>
3   User clicks on <TOC Documents>

4	User selects document to view
5	User clicks one or more check boxes <elements to bring to chart>
6	User clicks the <Preview> button that shows what the chart will look like after information in incorporated.
7	User clicks <Incorporate> button to make the information part of the patient's chart.

A9.4 Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date
1   After login, this information is displayed on the dashboard (the initial screen after login and choosing team / location).

A14.1 Record UDI
1   User searches patient
2   User enters patient chart
3   User clicks on the History Tab
4   User clicks on Medical Equipment tab
5   User clicks <Add> button
6   User types UDI serial number
7   User types target site
8   User types implant date
9   User selects <Active> status
10   User clicks <Save> button
11   User confirms and clicks <ok>
Note: These steps are also available to EP during the patient encounter.

A14.2 Change UDI Status
1   User clicks on pencil icon to edit UDI entry
2   User clicks to change status to <Inactive>
3   User clicks <Save> button
4   User confirms and clicks <ok>
Note: These steps are also available to EP during the patient encounter.

A14.3 Access UDI, Device Description, Identifiers and Attributes
1   User can access UDI, Device Description, Identifiers and Attributes in the patient chart, under History Tab, Medical Equipment Tab.

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
1   User claims patient on schedule
2   User clicks Medications Tab
3   User clicks <Enter Med.> button
4   User reconciles patient Active Medication List
5   User exits Active Medication List
6   User clicks <Reconciled> button
7   Date and Time Stamp appears stating Medications have been reconciled with patient.
8   User clicks Allergies Tab
9   User clicks <Get Allergies> button
10   User clicks <Reconciled> button
11   Date and Time Stamp appears stating Allergies have been reconciled with patient.
12   The problem list is reconciled during transition of care step. A9.4

B2.2 Generate a new CCDA with reconciled data
1   User enters patient chart by clicking on patient name
2   User clicks Encounter Tab
3   User selects (by checkbox), the desired encounter.
4   Clicks <Generate CCDA> button.

B3.1 E-prescribe New Prescription
1   User searches patient
2   User enters patient chart
3   User clicks on Medication Tab

4	User clicks <Enter Medications & Allergies> button
5	User clicks <Add Prescription>
6	User searches Medication, chooses strength, Written Date, Patient Directions, Dispense Quatity, Dispense Unit, Refill Quantity, Days Supply
7	User clicks <Save Prescription> button
8	User clicks check box, selecting medication to E-prescribe.
9	User clicks <Approve & Send> button.

B3.2 Change Prescription (dosage or duration)

1	User searches patient
2	User enters patient chart
3	User clicks on Medication Tab
4	User clicks <Enter Medication & Allergies> button
5	User clicks on <Actions> button on the medication sent to pharmacy.
6	User clicks <Reorder>
7	User verifies pharmacy to send prescription to
8	User changes patient directions for medication E-prescribing.
9	User changes dispense quantity for medication E-prescribing.
10	User clicks <Save Prescription> button.

B3.3 Cancel Prescription

1	User clicks <Actions> on prescription to cancel.
2	User clicks <Delete> to cancel prescription.
3	User confirms deletion of prescription.
4	Prescription is deleted.

B3.4 Refill Prescription

1	In Active Medication List, the user clicks <Actions> on the Medication to refill.
2	User clicks <Reorder>
3	User verifies pharmacy to send prescription to.
4	User enters Written Date, Patient Directions, Dispense Quatity, Dispense Unit, Refill Quantity, Days Supply
5	User clicks <Save Prescription> button
6	User clicks check box, selecting medication to E-prescribe.
7	User clicks <Approve & Send> button.

B3.5 Receive Fill Status Notification

1	In Active Medication List, under Status Column, a check mark appears to signify medication was E-prescribed successfully

B3.6 Request and Receive Medication History Information

1	In Medication History Tab, user clicks check box for Patient has given consent to retrieve Medication History
2	User clicks <Show Medication History> button.