EHR Usability Test Report of Cyfluent version 3.2

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

Product Name: Cyfluent

Product Version: 3.2

Date of Usability Test: December 2017

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EXECUTIVE SUMMARY

A usability test of Cyfluent Version 3.2, Ambulatory was conducted in December 2017 via WebEx by Cyfluent. 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/or 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 [39] tasks typically conducted on an EHR:

1. CPOE Medications
   a) Record data
   b) Change Data
   c) Access data
2. CPOE Lab
   a) Record data
   b) Change Data
   c) Access data
3. CPOE Radiology
   a) Record data
   b) Change Data
   c) Access data
4. Drug-Allergy/ Drug-Drug Interaction Checks
   a) Enter prescription to view Drug-Allergy Interactions
   b) Enter prescription to view Drug-Drug interactions
   c) Adjust DUR preferences
5. Demographic data
   a) Record data
   b) Change data
   c) Access data
6. Problem's List
   a) Record (Enter new SNOMED)
   b) Change-enter resolution date
   c) Access-view previously resolved/inactive code
7. Medication List
   a) Record data
   b) Change data
   c) Access data
8. Medication Allergy List
   a) Record data
   b) Change data
   c) Access data
9. Clinical Decision Support
   a) Acknowledge Medication Alert
   b) Acknowledge Lab Alert
   c) Access/download reference document attached to Alert
10. Unique device identifier (UDI)
    a) Record (Enter device)

        b) Deactivate device
        c) Access UDI, device description, identifiers, and attributes
11. Clinical Information Reconciliation and Incorporation
        a) Reconciliation of Medications
        b) Reconciliation of Problems
        c) Reconciliation of Allergies
        d) Generate a new CCDA with reconciled data
12. E-Prescribing
        a) Electronically issue a prescription
        b) Change prescription (dosage or duration)
        c) Cancel prescription
        d) Refill prescription
        e) Receive fill status notification
        f) Request and receive medication history information

During the 60-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, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

Participant screens, headshots and audio were recorded for subsequent analysis. The following type 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 and were not compensated 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	N	Task Success	Path Deviation	Task Time	Errors (L)	Task Rating	Risk Rating
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)	5=Easy	5= Least Risky
1. Enter reported medication of Avandia 2mg order	10	42.1	9.9/8	92.5	20%	4	4
2. Change the medication order from Avandia 2mg to Avandia 4mg	10	42.1	8.4/7	65.2	20%	4	4
3. Access the Avandia 4mg medication order	10	42.1	5.2/4	46.7	20%	4	5
4. Enter a lab order of Creatinine 24 Hour	10	0	8.2/8	45.3	0%	5	5
5. Edit the lab order of Creatinine 24 Hours and add results value of 8	10	42.1	7.9/7	52.1	20%	4	4
6. Access the lab order of Creatinine 24 hours	10	31.6	4.5/4	30.0	10%	5	5
7. Enter a radiology order of Chest X-Ray	10	0	8.5/8	41.6	0%	5	5
8. Edit a radiology order of Chest X-Ray and assign to Medical Assistant	10	0	6.2/6	35.8	0%	5	5
9. Access the Chest X-Ray radiology order	10	31.6	4.5/4	26.7	10%	5	5
10. Enter a prescription for Amoxicillin to view DUR Warning for drug-allergy interaction for prescriber William Mayfield	10	51.6	9.3/6	115.1	40%	4	1
11. Enter a prescription for Warfarin to view DUR warning for drug-drug interaction for prescriber William Mayfield	10	42.1	8.2/6	78.8	20%	4	1
12. Adjust the DUR preferences for William Mayfield	10	52.7	7.3/5	52.7	50%	3	2
13. Enter Race: African American	10	0	6.5/5	58.5	0%	5	5
14. Enter Ethnicity: Argentinean	10	0	5.9/5	34.3	0%	5	5

Task	N	Task Success	Path Deviation	Task Time	Errors (L)	Task Rating	Risk Rating
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)	5=Easy	5= Least Risky
15. Enter Sexual Orientation: Straight or Heterosexual	10	42.2	4.8/4	34.9	20%	5	5
16. Enter Gender Identity: Identifies as Genderqueer, neither exclusively Male or Female	10	0	4.8/4	29.2	0%	5	5
17. Change Race: Unknown	10	0	7.2/5	46.6	0%	5	5
18. Change Ethnicity: Bolivian	10	0	6.8/6	27.1	0%	5	5
19. Change Sexual Orientation: Choose not to disclose	10	42.2	4.6/4	25.4	20%	5	5
20. Change Gender Identity: Choose not to disclose	10	0	4.6/4	27.4	0%	5	5
21. Problems List Enter: SNOMED 59621000	10	0	5.9/5	49.1	0%	5	4
22. Problems List-Enter Resolution date of 11/30/17 for SNOMED 59621000	10	0	6.9/6	47.7	0%	5	5
23. Problems List-View previously resolved SNOMED 59621000	10	0	4/4	30.3	0%	5	5
24. Enter a reported medication of Simvastatin 10mg	10	42.2	7.3/7	60.6	20%	5	4
25. Change reported medication from Simvastatin 10mg to reported Simvastatin 20mg	10	51.2	9.9/9	69.0	40%	4	2
26. Access Simvastatin 20 mg reported medication	10	42.2	3.5/3	28.4	20%	4	4
27. Record allergy to Carbamazepine with reaction of skin rash	10	31.6	6.1/6	48.4	10%	5	5

Task	N	Task Success	Path Deviation	Task Time	Errors (L)	Task Rating	Risk Rating
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)	5=Easy	5= Least Risky
28. Change allergy from Carbamazepine to Codeine	10	0	6.7/6	44	0%	5	5
29. Access Codeine Allergy	10	31.6	3.1/3	21.7	10%	4	5
30. Acknowledge Avandia Alert	10	0	4.9/5	21.1	0%	5	5
31. Acknowledge Fasting Blood Glucose Alert	10	31.6	5.4/5	25.0	10%	5	5
32. Open Therapeutic Reference Information for Diabetes Alert	10	0	4.9/5	28.4	0%	5	5
33. Create a gender-based alert in administration	10	48.3	9.4/9	73.1	30%	4	3
34. Add Unique Device Identifier: (01)10884521062856(11) 141231(17)150707(10) A213B1(21)1234	10	42.2	7.4/6	57.3	20%	4	4
35. Deactivate Unique Device Identifier: (01)10884521062856(11) 141231(17)150707(10) A213B1(21)1234	10	51.6	6.8/6	48.6	60%	4	2
36. Access UDI, device description, identifiers, and attributes	10	31.6	3.1/3	31	10%	5	5
37. Reconcile patient's active medication list	10	42.2	6.5/6	46.3	20%	5	4
38. Reconcile patient's active problems list	10	31.6	5.4/5	47.3	20%	5	4
39. Reconcile patient's allergy list	10	0	5/5	24.3	0%	5	5
40. Generate a new CCDA with reconciled data	10	30	8.9/10	103.7	70%	3	3
41. Issue a prescription for Hydrochlorothiazide 50 mg for provider William Mayfield	10	48.3	5.9/6	71.4	30%	4	3
42. Change a prescription for Synthroid 25 mcg to	10	51.63	11.8/12	92.4	40%	5	3

Task	N	Task Success	Path Deviation	Task Time	Errors (L)	Task Rating	Risk Rating
	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)	5=Easy	5= Least Risky
50 mcg for provider Internist Butler							
43. Discontinue a prescription for Synthroid 50 mcg for provider Internist Butler	10	0	6.1/6	30.8	0%	5	4
44. Refill a prescription Synthroid 25 mcg for provider Internist Butler	10	51.63	9.7/7	72.5	40%	4	3
45. Receive fill status notification	10	31.62	3.6/2	27.2	10%	5	4
46. Request and received medication history information	10	31.62	3.9/3	34.3	10%	5	5

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 94%. In addition to the performance data, the following qualitative observations were made:

- Major findings
  - Change Sexual Orientation
  - Add Unique Device Identifier
  - Deactivate Unique Device Identifier
  - Generate a new CCDA with reconciled data
- Areas for improvement
  - Change Sexual Orientation
  - Add Unique Device Identifier
  - Deactivate Unique Device Identifier

INTRODUCTION

The EHRUT(s) tested for this study was Cyfluent Version 3.2. Designed to present medical information to healthcare providers in [facility types and specialty setting], the EHRUT consists of [description of system and how it is used]. 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 [list some specific metrics (e.g., time on task)], were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 14 participants were tested on the EHRUT(s). Participants in the test were physicians, nurses, clerks and administrators. Participants were recruited by Gwen Dunn and were not compensated 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; an example of a screener is provided in Appendix.

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.

Part ID	Gender	Occupation/role	Professional Experience	EHR Experience	Assistive Technology Needs
1	Female	RN	20 years	1st EHR in office in 2005. working with ProtoMed/Cyfluent 3 years ago	No
2	Female	Office Manager	15 years	They are much better than paper charts. Sometimes frustrating when we put data in but does not get where we want it to go.	No
3	Female	COA (Certified Ophthalmic Assistant)	2 years	Cyfluent is the only system worked on	No
4	Female	COT (Certified Ophthalmic Technician)	21 years	used 2 different systems, 10 years ago	No
5	Female	Nurse Practitioner	8 months	I have had experience with EHR since 2003. I have utilized EMR throughout my career	No
6	Female	Executive Director	7 years	limited experience, using Cyfluent for 2 years and prior to that using a community health center program	No

Part ID	Gender	Occupation/role	Professional Experience	EHR Experience	Assistive Technology Needs
7	Female	Assistant Clinical Director	1 year	interesting experience, this is very new to me, we have been paper for an extended period of time, however with continued use it has become easier and for the organization as a whole	No
8	Female	Manager	13-15 years	through Cyfluent it has been relatively easy, because they are very helpful making sure we are up to date, the only caveat that I have is the portion of the EHR where the doctor can dictate seems to cut off.	No
9	Female	Scheduling	a little over 1 year	Easy to work with	No
10	Female	RN	12 years	I have worked in 2 different systems	No
11	Female	Manager	10 years	used EHR for 10 yrs	No
12	Female	Asst Practice Manager	17 years	I have used 2 different systems	No
13	Female	Clerk	5 months	just been using it for the last 5 months. Still getting used to the system	No
14	Female	Coding Compliance Analyst	4 months	I say Cyfluent is my first experience. I have volunteered in hospitals but this is my first experience	No

Sixteen participants (matching the demographics in the section on Participants) were recruited and 14 participated in the usability test. Two participants failed to show for the study.

Participants were scheduled for 60 minute sessions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics.

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

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

TASKS

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

1. Enter reported medication of Avandia 2mg order
2. Change the medication order from Avandia 2mg to Avandia 4mg
3. Access the Avandia 4mg medication order
4. Enter a lab order of Creatinine 24 Hour
5. Edit the lab order of Creatinine 24 Hours and add results value of 8
6. Access the lab order of Creatinine 24 hours
7. Enter a radiology order of Chest X-Ray
8. Edit a radiology order of Chest X-Ray and assign to Medical Assistant
9. Access the Chest X-Ray radiology order
10. Enter a prescription for Amoxicillin to view DUR Warning for drug-allergy interaction for prescriber William Mayfield
11. Enter a prescription for Warfarin to view DUR warning for drug-drug interaction for prescriber William Mayfield
12. Adjust the DUR preferences for William Mayfield
13. Enter Race: African American
14. Enter Ethnicity: Argentinean
15. Enter Sexual Orientation: Straight or Heterosexual
16. Enter Gender Identity: Identifies as Genderqueer, neither exclusively Male or Female
17. Change Race: Unknown
18. Change Ethnicity: Bolivian
19. Change Sexual Orientation: Choose not to disclose
20. Change Gender Identity: Choose not to disclose
21. Problems List Enter: SNOMED 59621000
22. Problems List-Enter Resolution date of 11/30/17 for SNOMED 59621000
23. Problems List-View previously resolved SNOMED 59621000

24. Enter a reported medication of Simvastatin 10mg
25. Change reported medication from Simvastatin 10mg to reported Simvastatin 20mg
26. Access Simvastatin 20 mg reported medication
27. Record allergy to Carbamazepine with reaction of skin rash
28. Change allergy from Carbamazepine to Codeine
29. Access Codeine Allergy
30. Acknowledge Avandia Alert
31. Acknowledge Fasting Blood Glucose Alert
32. Open Therapeutic Reference Information for Diabetes Alert
33. Create a gender based alert in administration
34. Add Unique Device Identifier: (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234
35. Deactivate Unique Device Identifier: (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234
36. View UDI list
37. Reconcile patient's active medication list
38. Reconcile patient's active problems list
39. Reconcile patient's allergy list
40. Generate a new CCDA with reconciled data
41. Issue a prescription for Hydrochlorothiazide 50 mg for provider William Mayfield
42. Change a prescription for Synthroid 25 mcg to 50 mcg for provider Internist Butler
43. Discontinue a prescription for Synthroid 50 mcg for provider Internist Butler
44. Refill a prescription Synthroid 25 mcg for provider Internist Butler
45. Receive fill status notification
46. Request and received 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 should always be constructed in light of the study objectives.

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 (See Appendix 3). A representative from the test team witnessed the participant's signature.

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

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

- As quickly as possible making as few errors and deviations as possible.
- Without assistance; administrators were allowed to give immaterial guidance and clarification on tasks, but not instructions on use.
- 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 is discussed below in Section 3.9.

Following the session, the administrator gave the participant the post-test questionnaire (e.g., the System Usability Scale, see Appendix 3), 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 not compensated.

TEST LOCATION

The Test facility included a web conference, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test room. All observers and the data logger worked from a separate room where they could see the participant's screen and face shot, and listen to the audio of the session.

TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in various facilities. For testing, the computer used various laptops running various operating systems. The participants used a mouse and keyboard when interacting with the EHRUT.

The EHRUT used various screen sizes, resolutions and color settings based on the participant's equipment. The application was set up by Cyfluent. The application itself was running on the internet using a test database on a wireless 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).

TEST FORMS AND TOOLS

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. A web camera recorded each participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone. The test session were electronically transmitted to a nearby observation room where the data logger observed the test session.

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant (also see the full moderator's guide in Appendix 2):

> Thank you for participating in this study. Your input is very important. Our session today will last about 60 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 of the information that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.

Following the procedural instructions, participants were shown the EHR and as their first task, were given time (2 minutes) to explore the system and make comments. Once this task was complete, the administrator gave the following instructions:

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

Participants were then given [39] tasks to complete.

USABILITY METRICS

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

1. Effectiveness of Cyfluent by measuring participant success rates and errors

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

3. Satisfaction with Cyfluent by measuring ease of use ratings

DATA SCORING

The following table (Table 1) 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.

Measures	Rationale and Scoring
	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.
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. It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
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). 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 3.

Table 1. Details of how observed data were scored.

RESULTS

DATA ANALYSIS AND REPORTING

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

The usability testing results for the EHRUT are detailed below. 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.

Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
Task	#	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Deviations (Observed / Optimal)	Mean (SD)	Mean (SD)
1.[Find item on patient summary screen]							

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

Appendix 1: Participant Demographics

The report should contain a breakdown of the key participant demographics. A representative list is shown below.

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

Gender	
Men	0
Women	14
Total (participants)	14

Occupation/Role	
RN/BSN	2
Physician	0
Admin Staff	12
Total (participants)	14

Years of Experience	
Years of Experience	8.2
Facility Use of EHR	14
All paper	0
Some paper, some electronic	0
All electronic	14
Total (participants)	14

Appendix 2: Moderator's Guide

Administrator: Gwen Dunn

Data Logger: Gwen Dunn

Date/Time: December 2017

Participant #: 14

Location: Web Conference

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

Prior to each participant:
- Reset application
- Start session recordings with *tool*

Prior to each task:
- Reset application to starting point for next task

After each participant:
- End session recordings with *tool*

After all testing
- Back up all video and data files

Participant Instructions (*2* minutes)

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 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.

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.

Orientation (*2* minutes)

Do not do anything more than asked. If you get lost or have difficulty I cannot answer help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

The product you will be using today is Cyfluent version 3.2. Some of the data may not make sense as it is placeholder data.

We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?

Preliminary Questions (*2* minutes)
What is your job title / appointment?

How long have you been working in this role?

What are some of your main responsibilities?

Tell me about your experience with electronic health records.

What is your age?

What is your education?

How many years of computer experience do you have?

How many years of Cyfluent experience do you have?

First Impressions (*90 Seconds*)
This is the application you will be working with. Have you heard of it? If so, tell me what you know about it.
Yes No
- *Show test participant the EHRUT.*
- Please don't click on anything just yet. What do you notice? What are you able to do here? Please be specific.
Notes / Comments:

1. Task A1.1: Enter Medication order (80 Seconds)
Take the participant to the starting point for the task.
After examining the patient, you want to Enter a medication order of Avandia 2mg in CPOE. I will enter medication information in the chat, Say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

2. Task A1.2: Change Medication order (*55 Seconds*)
Take the participant to the starting point for the task.

After examining the patient, you want to Edit the medication order from Avandia 2mg to Avandia 4mg in CPOE. I will enter medication information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

3. Task A1.3: Access previously changed Medication order (*55 Seconds*)
Take the participant to the starting point for the task.
After examining the patient, you want to View the Avandia 4mg medication order. I will enter medication information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

4. Task A2.1: Enter lab order (*48 Seconds*)
Take the participant to the starting point for the task.
After examining the patient, you want to Enter a lab order of Creatinine 24 Hour. I will enter lab information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

5. Task A2.2: Change lab order (*47 Seconds*)
Take the participant to the starting point for the task.
After examining the patient, you want to Edit the lab order of Creatinine 24 Hours and add results value of 8. I will enter lab information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

6. Task A2.3: Access lab order (*32 Seconds*)
Take the participant to the starting point for the task.
After examining the patient, you want to Access the lab order of Creatinine 24 hours. I will enter lab information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

7. Task A3.1: Add radiology order (*35 Seconds*)
Take the participant to the starting point for the task.

After examining the patient, you want to Enter a radiology order of Chest X-Ray. I will enter radiology information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

8. Task A3.2: Change radiology order (*35 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Edit a radiology order of Chest X-Ray and assign to Medical Assistant. I will enter radiology information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

9. Task A3.3: Access radiology order (*35 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Access the Chest X-Ray radiology order. I will enter radiology information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task:

One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

10. Task A4.1: Enter Prescription to view DUR warning for drug-allergy interaction (*120 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Enter a prescription for Amoxicillin 125 mg to view DUR Warning for drug-allergy interaction for prescriber William Mayfield. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task:

One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

11. Task A4.2: Enter Prescription to view DUR warning for drug-drug interaction (*60 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Enter a prescription for Warfarin 2mg to view DUR warning for drug-drug interaction for prescriber William Mayfield. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

12. Task A4.3: Adjust DUR preferences for Clinician (*58 Seconds*)

Take the participant to the starting point for the task.

You want to Adjust the DUR preferences for Dr. William Mayfield to "review severe Warnings Only" in the Drug/Drug preferences. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

13. Task A5.1: Patient Race-Add (*60 Seconds*)

Take the participant to the starting point for the task.

Before going into the exam room, you want to Add Patient's Race of African American on the demographics screen for patient JOHN SMITH. I will enter the Race in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

14. Task A5.2: Patient Ethnicity-Add (35 Seconds)

Take the participant to the starting point for the task.

Before going into the exam room, you want to Add Patient's Ethnicity of Argentinean on the demographics screen for patient JOHN SMITH.I will enter the Ethnicity in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

15. Task A5.3: Patient Sexual Orientation-Add (*30 Seconds*)

Take the participant to the starting point for the task.

Before going into the exam room you want to Add Patient's Sexual Orientation:of Straight or heterosexual, on the demographics screen for patient JOHN SMITH. I will enter the Sexual Orientation in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

16. Task A5.4: Patient Gender Identity-Add (*30 Seconds*)

Take the participant to the starting point for the task.

Before going into the exam room you want to Add Patient's Gender Identity: of Genderqueer, neither exclusively Male nor Female on the demographics screen for patient JOHN SMITH. I will enter Gender Identity in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

17. Task A5.5: Patient Race-Change (*45 Seconds*)

Take the participant to the starting point for the task.
Before going into the exam room you want to Change the Patient's Race: to Unknown on the demographics screen for patient JOHN SMITH. I will enter the Race in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

18. Task A5.6: Patient Ethnicity-Change (*30 Seconds*)

Take the participant to the starting point for the task.
Before going into the exam room you want to Change Patient's Ethnicity: to Bolivian on the demographics screen for patient JOHN SMITH. I will enter the Ethnicity in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

19. Task A5.7: Patient Sexual Orientation-Change (*30 Seconds*)

Take the participant to the starting point for the task.
Before going into the exam room you want to Change Patient's Sexual Orientation: to Choose not to disclose on the demographics screen for patient JOHN SMITH. I will enter the Sexual Orientation in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

20. Task A5.8: Patient Gender Identity-Change (*30 Seconds*)

Take the participant to the starting point for the task.
Before going into the exam room you want to Change Patient's Gender Identity: to Choose not to disclose on the demographics screen for patient JOHN SMITH. I will enter the Gender Identity in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

21. Task A6.1: Problems List-Add (*45 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Add a diagnosis to the Problems List using a SNOMED CODE: 59621000 for patient JOHN SMITH. I will enter the SNOMED Code in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

22. Task A6.2: Problems List-Resolve (*50 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Enter a Resolution Date of 11/30/2017 to the Problems List for SNOMED CODE: 59621000 for patient JOHN SMITH. I will enter the SNOMED Code Resolution date in the chat. Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

23. Task A6.3: Problems List-View (*30 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to View details of the SNOMED CODE: 59621000 for patient JOHN SMITH. I will enter the SNOMED Code in the chat. Show the previously resolved/inactive SNOMED CODE and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task

24. Task A7.1: Enter reported Medication (*60 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Enter a reported medication of Simvastatin 10mg in the prescription section. I will enter medication information in the chat, say DONE once you have successfully completed the task.

Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

25. Task A7.2: Change reported Medication (*60 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Change reported medication from Simvastatin 10mg to Simvastatin 20mg in the prescription section. I will enter medication information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

26. Task A7.3: Access reported Medication (*30 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Access Simvastatin 20 mg reported medication in the prescription section. I will enter medication information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

27. Task A8.1: Add Medication Allergy (*50 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Record allergy to Carbamazepine with reaction of skin rash. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

28. Task A8.2: Change Medication Allergy (*45 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Change allergy from Carbamazepine to Codeine. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

29. Task A8.3: Access Medication Allergy List (*25 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Access Codeine Allergy. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

30. Task A9.1: Acknowledge Medication Alert (*20 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Acknowledge the Avandia Alert. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

31. Task A9.2: Acknowledge Lab Alert (*25 Seconds*)

Take the participant to the starting point for the task.

After examining the patient, you want to Acknowledge Fasting Blood Glucose Alert. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

32. Task A9.3: Open Reference Information on an Alert (*30 Seconds*)

Take the participant to the starting point for the task.

After examining the patient, you want to Open Therapeutic Reference Information for Diabetes Alert. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

33. Task A9.4: Create an Alert (*80 Seconds*)

Take the participant to the starting point for the task.

Create a gender-based alert in administration. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

34. Task A14.1: Implantable Devices-Add (*55 Seconds*)

Take the participant to the starting point for the task.

After examining the patient you want to Add a Unique Device Identifier in Implantable Devices on the summary page. The Unique Device identifier will be listed in the chat:
(01)10884521062856(11)141231(17)150707(10)A213B1(21)1234

Enter and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

35. Task A14.2: Implantable Devices-Deactivate (*30 Seconds*)

Take the participant to the starting point for the task.
After examining the patient you want to Deactivate a Unique Device Identifier in Implantable Devices on the summary page. The Unique Device identifier will be listed in the chat: (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234

Deactivate this device and save this information on your patient record and say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

36. Task A14.3: View UDI List (*XXX Seconds*)

Take the participant to the starting point for the task.
After examining the patient, John Smith you want to View the Implantable Devices UDI list. I will enter information in the chat, Say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

37. Task B2.1: Reconcile patient's active medication list (*50 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Reconcile patient's active medication list. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

38. Task B2.2: Reconcile patient's active problems list (*45 Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Reconcile patient's active problems list. I will enter information in the chat. say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

39. B2.3: Reconcile patient's allergy list (*25 Seconds*)

Take the participant to the starting point for the task.

After examining the patient, you want to Reconcile patient's allergy list. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

40. Task B2.4: Generate a new CCDA with reconciled data (*XXX Seconds*)
Take the participant to the starting point for the task.
After examining the patient, Dorothy Schnur, you want to Generate a new CCDA with reconciled data. You will generate the **CCDA** from the **pop up menu**. You will need to view the **formatted** version in documents after uploading to verify. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

41. Task B2.3: Issue a prescription (*70 Seconds*)
Take the participant to the starting point for the task.
After examining the patient, you want to Issue a prescription for Hydrochlorothiazide 50 mg for provider William Mayfield. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

42. Task B3.2: Change a prescription (*XXX Seconds*)
Take the participant to the starting point for the task.
After examining the patient, Dorothy Schur, you want to Change a prescription From Synthroid 25 mcg for provider Internist Butler to Synthroid 50 mcg. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

43. Task B3.3: Cancel/discontinue a prescription (*XXX Seconds*)
Take the participant to the starting point for the task.
After examining the patient, Dorothy Schnur, you want to Cancel/discontinue a prescription for Synthroid 50 mcg for provider Internist Butler. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

44. Task B3.4: Refill; a prescription (*XXX Seconds*)

Take the participant to the starting point for the task.
After examining the patient, Dorothy Schnur, you want to Refill a prescription for Synthroid 25 mcg for provider Internist Butler. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

45. Task B3.5: Receive fill status notification (*XXX Seconds*)

Take the participant to the starting point for the task.
After examining the patient, you want to Receive fill status notification in Rx authorizations for provider William Mayfield. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

46. Task B3.6: Request and received medication history information (*XXX Seconds*)

Take the participant to the starting point for the task.
After examining the patient, Dorothy Schnur, you want to sync from the RXHub to Request and received medication history information. I will enter information in the chat, say DONE once you have successfully completed the task. Would you like me to repeat that? BEGIN.

Rate Task: One a scale of 1 to 5, where 1 is equal to Very Difficult and 5 equals Very Easy, please rate this task:

Final Questions (*2 Minutes*)

What was your overall impression of this system?

What aspects of the system did you like most?

What aspects of the system did you like least?

Were there any features that you were surprised to see?

What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?

Compare this system to other systems you have used.

Would you recommend this system to your colleagues?

Appendix 3: System Usability Scale Questionnaire

		Strongly Disagree				Strongly Agree
		1	2	3	4	5
1.	I think that I would like to use this system frequently					
2.	I found the system unnecessarily complex					
3.	I thought the system was easy to use					
4.	I think that I would need the support of a technical person to be able to use this system					
5.	I found the various functions in this system were well integrated					
6.	I thought there was too much inconsistency in this system					
7.	I would imagine that most people would learn to use this system very quickly					
8.	I found the system very cumbersome to use					
9.	I felt very confident using the system					
10.	I needed to learn a lot of things before I could get going with this system					