EHR Usability Test Report of Centriq Clinic V14 170.315(a)(9) Clinical Decision Support

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

Centriq Clinic V14
Clinical Decision Support

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EXECUTIVE SUMMARY

A usability test of Centriq Clinic V14 was conducted in August, 2017 in Fairhope, Alabama by Healthland, a wholly owned subsidary of CPSI. The purpose of this test was to validate the usability of the current user interface and provide evidence of usability of the Clinical Decision Support in the EHR Under Test (EHRUT). During the usability test, 10 healthcare providers matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

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

1. Configure CDS interventions and reference resources.
2. Trigger CDS interventions using data elements from the problem list and access diagnostic and therapeutic reference information using the Infobutton.
3. Trigger CDS interventions using data elements from the medication list and access diagnostic and therapeutic reference information using the Infobutton
4. Trigger CDS interventions using data elements from the medication allergy list.
5. Trigger CDS interventions using data elements from the demographics and access diagnostic and therapeutic reference information using the Infobutton.
6. Trigger CDS interventions using data elements from the lab tests.
7. Trigger CDS interventions using data elements from the vital signs.
8. Receive CDS interventions based on data elements in the problem list and medication list after incorporating a CCDA.
9. Trigger CDS interventions using a combination of at least two data elements
10. Access the following attributes for a CDS intervention: bibliographic citation, developer, funding source, release/revision date.

During the 180 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 Appendices 1 and 2); they were instructed that they could withdraw at any time. Participants did not have prior experience with the EHR. The administrator introduced the test and instructed participants to complete a series of tasks (given one

at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s), recorded user performance data on paper and electronically. The administrator did not assist with the task. Participant screens, head shots, and audio were recorded for subsequent analysis.

The following types of data were collected for each participant.

- number of tasks successfully completed within the allotted time without assistance
- time required 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 between the identity of the participant and the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated with $75 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.

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Measure→ Task ↓	Number of Users	Success	Path Deviation	Optimal Task Time (seconds)	Task Time		Errors	Task Ratings 1=difficult
	#	Mean	Deviations (Observed/ Optimal)	Multiplied by 1.5	Mean in seconds	Deviations (Observed/O ptimal)	Mean	Mean
1.) Configure CDS interventions and reference resources	10	100%	1:1	45	31	1:1	0%	4.5
2.) Trigger CDS interventions using data elements from the	10	100%	1:1	68	50.6	1:1	0%	4.2

problem list and access diagnostic and therapeutic reference information using the Infobutton								
3.)Trigger CDS interventions using data elements from the medication list and access diagnostic and therapeutic reference information using the Infobutton	10	100%	1.03:1	68	56.4	1.01:1	0%	3.6
4.) Trigger CDS interventions using data elements from the medication allergy list	10	100%	1:1	45	32.3	1:1	0%	4.8
5.) Trigger CDS interventions using data elements from the demographics and access diagnostic and therapeutic reference information using the Infobutton	10	100%	1:1	45	32.7	1:1	0%	4.8
6.)Trigger CDS interventions using data elements from the lab tests	10	100%	1:07:1	68	58.2	1.17:1	0%	2.8
7.)Trigger CDS interventions using data elements from the vital signs	10	100%	1:1	45	34.4	1:1	0%	3.4
8.)Receive CDS	10	100%	1:1	45	36.1	1:1	0%	4.3

interventions based on data elements in the problem list and medication list after incorporating a CCDA								
9.)Trigger CDS interventions using a combination of at least two data elements	10	100%	1:1	45	36.4	1:1	0%	4.5
10.) Access the following attributes for a CDS intervention: bibliographic citation, developer, funding source, release/revision date.	10	100%	1:1	45	26.1	1:1	0%	4.6

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 75.75.

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

Major findings

- The users found it was user friendly and easy to use.
- The work flow was in a logical order.
- After doing repeated steps on various tasks, the users were much quicker at going through the system completing tasks.

Areas for improvement

- Make the search engines more consistent
- There are multiple ways to perform one task, which can be confusing.

INTRODUCTION

The EHRUT tested for this study was Centriq Clinic V14. Designed to present medical information to health care providers in health care facilities, the EHRUT consists of a complete suite of integrated products, all designed to work in concert with each other and provide community hospitals with a complete electronic medical record (EMR). Centriq Clinic is a health information solution that was completely designed and developed by Healthland. It provides all hospital key departments with a single database. Centriq Clinic promotes improved patient care, increased patient safety, and better patient outcomes. 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 Clinical Decision Support in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency, and user satisfaction, such as time on task and reactions to screens, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants tested the EHRUT. Participants in the test were nurse practitioners and registered nurses. Participants were recruited by Healthland and were compensated $75 for their time. In addition, participants had no direct connection to the development of or organization producing the EHRUT. 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.

All 10 of the recruits participated in the usability test. Recruited participants had various backgrounds and demographic characteristics. The following table displays 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 connected back to individual identities.

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience (in years)	Product Experience	Assistive Technology Needs
1	ID01	Female	40-49	Technical	LPN	18.5	25	None	None
2	ID02	Male	50-59	College	MD	28	30	None	None
3	ID03	Male	60-69	College	MD	36	42	None	None
4	ID04	Female	40-49	College- AS	LPN	20	25	None	None
5	ID05	Female	50-59	College- BS	RN	30	28	None	None
6	ID06	Female	40-49	Technical	LPN	17.5	24	None	None
7	ID07	Male	50-59	Doctorate	MD	29	31	None	None
8	ID08	Male	60-69	Doctorate	MD	33	37	None	None
9	ID09	Female	40-49	College- BS	RN	29	29	None	None
10	ID10	Female	50-59	College- AS	LPN	19	21	None	None

Participants were scheduled for 45-minute sessions with 10 minutes in between each session for debrief by the administrator(s) and data logger(s), and to reset systems in order to properly test conditions. A spreadsheet was used to track 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 Centriq Clinic and/or comparison with other EHRs, provided that the same tasks are used. In short, this testing serves as both a method 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 (shown below).

- number of tasks successfully completed within the allotted time without assistance
- time required 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

One task was constructed which would be realistic and representative of the kinds of activities a user might perform with the Medication Allergy List on this EHR:

1. Configure CDS interventions and reference resources.
2. Trigger CDS interventions using data elements from the problem list and access diagnostic and therapeutic reference information using the Infobutton.
3. Trigger CDS interventions using data elements from the medication list and access diagnostic and therapeutic reference information using the Infobutton
4. Trigger CDS interventions using data elements from the medication allergy list.
5. Trigger CDS interventions using data elements from the demographics and access diagnostic and therapeutic reference information using the Infobutton.
6. Trigger CDS interventions using data elements from the lab tests.
7. Trigger CDS interventions using data elements from the vital signs.

8. Receive CDS interventions based on data elements in the problem list and medication list after incorporating a CCDA.

9. Trigger CDS interventions using a combination of at least two data elements

10. Access the following attributes for a CDS intervention: bibliographic citation, developer, funding source, release/revision date.

Tasks were selected based on their frequency of use, criticality of function, and those that may be troublesome for users.The tasks are prioritized in accordance with the risk associated with user errors.

PROCEDURE

Upon arrival, participants were greeted and their identities were verified and matched with names on the participant schedule. Each participant reviewed and signed an informed consent and release form (see Appendix 2). A representative from the test team witnessed the participant's signature.

The participants were given a 15-minute education session to orient them about how to use and interact with Medication Allergy List in Centriq Clinic. After the session participants had the opportunity to ask questions.

To ensure that the test ran smoothly, two staff members participated in this test (the usability administrator and the data logger). The usability testing staff conducting the test comprised of experienced usability practitioners with seven years of experience. The administrator moderated the session and administered 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 according to the following guidelines (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 for tasks, but not instructions for 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 he/she had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participants the post-test questionnaire (see Appendix 5), compensated them for their time, and thanked them for their participation. Participants' demographic information, task success rates, time on task, errors, deviations, verbal responses, and post-test questionnaire were recorded into a spreadsheet. Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form (see Appendix 3) indicating that they had received the compensation.

TEST LOCATION

The test facility included a classroom for application education and a quiet testing room with a table and a computer for the participant. Only the participant and administrator were in the test room. The data logger worked from a separate room where he/she could see the participant's screen and face shot and listen to the audio of the session. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range.   All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

TEST ENVIRONMENT

The EHRUT would be typically be used in a health care office or facility. In this instance, the testing was conducted in a small office setting. The participants used a Lenovo™ ThinkCentre® All-in-one computer

running Windows® 7 as the client machine. The display was a 20-inch monitor at resolution of 1920x1080 with 32-bit color depth. The participants used both mouse and keyboard when interacting with the EHRUT.

The application was set up according to standard Centriq Clinic documentation. The application itself was running on a Red Hat® Enterprise Linux® server using representative test data. The client machine was connected via a wired LAN connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

TEST FORMS AND TOOLS

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

1. Non-Disclosure Agreement
2. Informed Consent
3. Incentive Receipt and Acknowledgment Form
4. Moderator's Guide
5. Post-test Questionnaire

Examples of these documents can be found in Appendices 1-5, respectively.

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. A USB camera recorded each participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone. The test session was recorded for later review by the data logger.

PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to the each participant (see the full moderator's guide in Appendix 4).

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.

Following the procedural instructions, 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 9 tasks to complete. Tasks are listed in the moderator's guide in Appendix 4.

USABILITY METRICS

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

The goals of the test were to assess the following.

1. effectiveness of Centriq Clinic by measuring participant success rates and errors
2. efficiency of Centriq Clinic by measuring the average task time and path deviations
3. satisfaction with Centriq Clinic by measuring ease of use ratings

DATA SCORING

The following table (Table 1) details how tasks were scored, errors were evaluated, and the time data was analyzed.

Measures	Rationale and Scoring

Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide were defined by taking multiple measures of optimal performance and multiplying by a factor of 1.5. This allows some time buffer because the participants are not trained to a level of expert performance. Thus, if an expert, optimal performance on a task was 10 seconds, then allotted task time performance was 15 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 a "Failure." 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 were counted as errors. The results are provided as a percentage. On a qualitative level, an enumeration of all errors and error types were 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. A 1:1 ratio represents perfect completion of a task.
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. The total task time is divided by the optimal task time to provide a ratio of task completion time. For this measure, task times faster than the optimal time were treated as equal to the optimal time. This normalizes successes to a ratio of 1:1.

Satisfaction: Task Rating	A 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). This data was averaged across participants. Common convention is that average ratings for systems judged as easy to use should be 3.3 or above. To measure participants' confidence in and likeability of Centriq Clinic 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 the full System Usability Score questionnaire in Appendix 5.

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 (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.

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Measure→ Task ↓	Number of Users	Success	Path Deviation	Optimal Task Time (seconds)	Task Time		Errors	Task Ratings 1=difficult
	#	Mean	Deviations (Observed/ Optimal)	Multiplied by 1.5	Mean in seconds	Deviations (Observed/O ptimal)	Mean	Mean
1.) Configure CDS intervention s and	10	100%	1:1	45	31	1:1	0%	4.5

reference resources								
2.) Trigger CDS interventions using data elements from the problem list and access diagnostic and therapeutic reference information using the Infobutton	10	100%	1:1	68	50.6	1:1	0%	4.2
3.)Trigger CDS interventions using data elements from the medication list and access diagnostic and therapeutic reference information using the Infobutton	10	100%	1.03:1	68	56.4	1.01:1	0%	3.6
4.) Trigger CDS interventions using data elements from the medication allergy list	10	100%	1:1	45	32.3	1:1	0%	4.8
5.) Trigger CDS interventions using data elements from the demographics and access diagnostic and therapeutic reference information using the Infobutton	10	100%	1:1	45	32.7	1:1	0%	4.8
6.)Trigger CDS interventions using data elements from the lab tests	10	100%	1:07:1	68	58.2	1.17:1	0%	2.8
7.)Trigger	10	100%	1:1	45	34.4	1:1	0%	3.4

CDS intervention s using data elements from the vital signs								
8.)Receive CDS intervention s based on data elements in the problem list and medication list after incorporatin g a CCDA	10	100%	1:1	45	36.1	1:1	0%	4.3
9.)Trigger CDS intervention s using a combination of at least two data elements	10	100%	1:1	45	36.4	1:1	0%	4.5
10.) Access the following attributes for a CDS intervention: bibliographic citation, developer, funding source, release/revis ion date.	10	100%	1:1	45	26.1	1:1	0%	4.6

Table 2. Usability testing results.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 75.75. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

DISCUSSION OF THE FINDINGS

EFFECTIVENESS

Based on the success, failure and path deviation data, the system was laid out logically with some confusion on data and search options. There were no major path deviations that caused a user not to complete a task. The users effectively used the system to complete each task. There were no deviations

on either task; users commented that it was straight forward and simple to add access and activate the alerts.

EFFICIENCY

Every participant was able to complete this task with ease. Because all of the screens on the patient data side operate in basically the same manner, all of the users were able to complete the task quickly.

SATISFACTION

Based on the task ratings, all the users found the tasks to be relatively easy. The SUS score averaged out to be 75.75 with the lowest being 72.5 and the highest being 80. Based on the SUS score, all the users found the system to be average on usability and overall satisfaction.

MAJOR FINDINGS

The users found the tasks to be easy to use and very user friendly. There were no major areas of difficulty. Only comments were that the nurses may not be the ones setting up the alerts, that it would be administration, however it was still stated to be a simple task. Overall the users completed the tasks with few path deviations.

AREAS FOR IMPROVEMENT

Creating a global search mechanism would make utilizing the system more efficient.

APPENDICES

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

1. Non-disclosure Agreement

2. Informed Consent Form

3. Incentive Receipt and Acknowledgement Form

4. Moderator's Guide

5. System Usability Scale (SUS) Questionnaire

Appendix 1: NON-DISCLOSURE AGREEMENT

Usability Testing Non-Disclosure Agreement

This agreement is entered into as of _____ (today's date) between

_____ ("the Participant") and the testing organization, CPSI (Computer

Programs and Systems, Inc.) located at 6600 Wall Street, Mobile, Alabama. The Participant acknowledges

his or her voluntary participation in today's usability study may bring the Participant into possession of

Confidential Information. The term "Confidential Information" means all technical and commercial

information of a proprietary or confidential nature which is disclosed by CPSI, or otherwise acquired by the

Participant, in the course of today's study. By way of illustration, but not limitation, Confidential Information

includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided

design files and other computer files, computer software, ideas, improvements, inventions, training methods

and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts. Any

information the Participant acquires relating to this product during this study is confidential and proprietary to

CPSI and is being disclosed solely for the purposes of the Participant's participation in today's usability

study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for

feedback and will not disclose this confidential information obtained today to anyone else or any other

organizations.

Participant's printed name: _____

Signature: _____ **Date:** _____

Appendix 2: INFORMED CONSENT FORM

Usability Testing Informed Consent

CPSI would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about *180* minutes (or 3 hours). At the conclusion of the test, you will be compensated for your time.

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

I understand and consent to the use and release of the videotape by CPSI. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research. I relinquish any rights to the videotape and understand the videotape may be copied and used by CPSI without further permission.

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

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

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

Please check one of the following:

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

☐   NO, I choose not to participate in this study.

Signature: _____ **Date:** _____

Printed Name: _____

Witness: _____ **Date:** _____

Printed Name & Affiliation:_____

Appendix 3: INCENTIVE RECEIPT AND ACKNOWLEDGEMENT FORM

Usability Acknowledgement of Receipt

I hereby acknowledge that a check in the amount of   *$75*   will be sent to the name and address below for my participation in a research study run by CPSI (Computer Programs and Systems, Inc.).

Printed Name: _____

Address: _____

        _____

Signature: _____ Date: _____

Usability Researcher: _____

Signature of Usability Researcher: _____

Date: _____

Witness: _____

Witness Signature: _____

Date: _____

Appendix 4: MODERATOR'S GUIDE

Usability Testing Moderator's Guide

Administrator _____

Data Logger _____

Date _____ Time _____

Participant # _____

Location _____

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

Prior to each participant:
- Reset application.
- Start session recordings with Webex.

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

After each participant:
- End session recordings with Webex.

After all testing
- Back up all video and data files.

Orientation (5 minutes)
Thank you for participating in this study. Our session today will last approximately **180 minutes (or 3 hours)**. During that time you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. 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. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer or 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.

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

The product you will be using today is the Centriq Clinic EHR. 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 (5 minutes)
What is your job title / appointment?

What are some of your main responsibilities?

How long have you been working in this role?
□Less than 1 year □1 to 3 years □more than 3 years

Have you ever used an electronic health record?   □ Yes   □ No

If yes, do you currently use an electronic health record in your job?   □ Yes   □ No

If yes, how often do you use the EHR?
□Daily   □Weekly   □Monthly   □Less than once a month

How many different EHRs have you used?
□ One   □Two   □Three or more

Data Logger _____

Date _____ Time _____

Participant # _____

Task 9.1:   Configure CDS interventions and reference resources
_____

Take the participant to the starting point for the task.

Path from Maintenance
General > Clinical Decision Support

Read the following to the tester:
You are the system administrator and need to configure the High Hemoglobin CDS intervention for Diabetes care to the status of active.

Success:

- ☐   Completed
- ☐   Completed with difficulty or help::Describe below
- ☐   Not completed
Comments:

Task Time: _____Seconds - Optimal Task Time:__30__ Seconds

Optimal Path:

- Select the All Codes checkbox
- Edit CDS Rule icon
- Select A1C high alert Edit CDS Rule icon
- Check Active > Click Save

- ☐   Correct
- ☐   Minor Deviations/Cycles::Describe below
- ☐   Major Deviations::Describe below
Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.2: Problem List: Trigger CDS interventions using data elements from the problem list and access diagnostic and therapeutic reference information using the Infobutton

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Problem List

Read the following to the tester:

You are the provider and need to enter a diagnosis of **Diabetes Type 1 (SNOWMED 46635009)**. Once entered access alerts and view additional clinical information regarding the alert triggered.

Success:

- ☐ Completed
- ☐ Completed with difficulty or help::Describe below
- ☐ Not completed
- _Comments:_

Task Time: _____Seconds - **Optimal Task Time:__45__** Seconds

Optimal Path:
- Add Problem
- Type "Type 2 Diabetes"
- Select Type 2 Diabetes Mellitus (SNOMED code 44054006)
- Select Chronicity of Chronic
- Save and Close

From the Provider Center
- Select our patient
- Select Alerts
- Select Diabetes Alert
- Review the Infobutton information

- ☐ Correct
- ☐ Minor Deviations/Cycles::Describe below
- ☐ Major Deviations::Describe below
- _Comments:_

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.3:   Medication List: Trigger CDS interventions using data elements from the medication list and access diagnostic and therapeutic reference information using the Infobutton

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > CPOE

Read the following to the tester:

You are the provider and need to enter an order for Warfarin. Once entered access alerts and view additional clinical information regarding the alert triggered.

Success:

□   Completed
□   Completed with difficulty or help::Describe below
□   Not completed
Comments:

Task Time: _____Seconds - **Optimal Task Time:__45__** Seconds

Optimal Path:
- Select CPOE
- Type "Warfarin"
- Select Warfarin 1 mg tablet
- If receive Conflict alert, enter required information to Proceed
- Click Save
- If receive Corollary ordert message, close
- Click Submit

From the Provider Center
- Select our patient
- Select Alerts
- Select Medication Alert
- Review the Infobutton information

□   Correct
□   Minor Deviations/Cycles::Describe below
□   Major Deviations::Describe below
Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.4:   Medication Allergy List: Trigger CDS interventions using data elements from the medication allergy list

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Allergy

Read the following to the tester:

You are the provider and you need to enter a patient allergy to Aranesp..

Success:

□   Completed
□   Completed with difficulty or help::Describe below
□   Not completed
Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- Add an allergy
- Select Aranesp Albumin Free 100mcg/0.5
- Enter severity Mild
- Select Reaction of Rash
- Select Source of Friend
- Save and Close

From the Provider Center
- Select our patient
- Select Alerts
- Select Allergy Alert

□   Correct
□   Minor Deviations/Cycles::Describe below
□   Major Deviations::Describe below
Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.5:   Demographics: Trigger CDS interventions using data elements from the demographics and access diagnostic and therapeutic reference information using the Infobutton

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Select Quick Registration

Read the following to the tester:

You are the provider and you need to review the patient's alerts for a geriatric patient.

Success:

        ☐ Completed
        ☐ Completed with difficulty or help::Describe below
        ☐ Not completed
        Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- Enter DOB : 1/1/1916
- Patient Class : IP
- Facility : HMH
- Attending : Test3, Doctor
- Save

From the Provider Center
- Select our patient
- Select Alerts
- Select Demograpics Alert
- Review the Infobutton information

        ☐ Correct
        ☐ Minor Deviations/Cycles::Describe below
        ☐ Major Deviations::Describe below
        Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.6: Laboratory Test: Trigger CDS interventions using data elements from the lab tests

_____

Take the participant to the starting point for the task.

Path from Laboratory Module
Go to Results

Read the following to the tester:

You are the provider and need add a lab result to your patient. Once entered access the patients alerts.

Success:

       ☐ Completed
       ☐ Completed with difficulty or help::Describe below
       ☐ Not completed
       Comments:

Task Time: _____Seconds - **Optimal Task Time:__45__** Seconds

Optimal Path:

- Select our patient
- Enter result 7.0 for the ordered hemoglobin A1c
- Click Final Report
- Cancel printing the report

From the Provider Center
- Select our patient
- Select Alerts
- Select Lab Alert

       ☐ Correct
       ☐ Minor Deviations/Cycles::Describe below
       ☐ Major Deviations::Describe below
       Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.7:   Vital Signs: Trigger CDS interventions using data elements from the vital signs

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Vitals

Read the following to the tester:

You are the provider and you need to review the patient's alerts for your adult patient. Select on triggered alerts to review the alert detail.

Success:

        ☐ Completed
        ☐ Completed with difficulty or help::Describe below
        ☐ Not completed
        Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- Add Vitals
- Add measure for heart rate of 210 bpm
- Save and Close

From the Provider Center
- Select our patient
- Select Alerts
- Select Vital Signs Alert

        ☐ Correct
        ☐ Minor Deviations/Cycles::Describe below
        ☐ Major Deviations::Describe below
        Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.8:   Incorporate CCDA: Receive CDS interventions based on data elements in the problem list and medication list after incorporating a CCDA

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Medical Summary

Read the following to the tester:

You are the provider and your nurse has just informed you he/she has incorporated updated clinical information from your patient's most recent transition of care document. Please access the patient's alerts to see any new interventions based on this data.

Success:

☐   Completed
☐   Completed with difficulty or help::Describe below
☐   Not completed
Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- Click Clinical Information Reconciliation icon
- Proceed with all three actions
- (select warfarin medication, aranesp allergy and diabetes problem)
- Click Verify Reconciliation
- Submit
- Enter in any required data
    o   medication frequency – twice daily
    o   allergy source - patient

From the Provider Center
- Select our patient
- Select Alerts
- Select each Alert

☐   Correct
☐   Minor Deviations/Cycles::Describe below
☐   Major Deviations::Describe below
Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.9: Combination of Elements: Trigger CDS interventions using combination of at least two data elements

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > Problem List

Read the following to the tester:

You are the provider and you need to review the patient's alerts for your adult patient. Select on triggered alerts to review the alert detail.

Success:

   ☐ Completed
   ☐ Completed with difficulty or help::Describe below
   ☐ Not completed
   Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- Add Problem
- Type "At Risk for Falls"
- Select At risk for falls (SNOMED code 129837007)
- Select Chronicity of Chronic
- Save and Close

From Home Medications
- Add Home Medication
- Type Vicodin
- Select Vicodin (Acetaminophen-Hydrocodone) [C]
- Enter a dosage of 5mg
- Save

From the Provider Center
- Select our patient
- Select Alerts
- Select Combination Alert

   ☐ Correct
   ☐ Minor Deviations/Cycles::Describe below
   ☐ Major Deviations::Describe below
   Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Task 9.10:   Clinical Decision Support: Access the following attributes for a CDS intervention: bibliographic citation, developer, funding source, release/revision date

_____

Take the participant to the starting point for the task.

Path from Main
Select patient > PWC

Read the following to the tester:

You are the provider and you need to review the patient's alerts for your adult patient. Select on triggered alerts to review the alert detail

Success:

        ☐ Completed
        ☐ Completed with difficulty or help::Describe below
        ☐ Not completed
        Comments:

Task Time: _____Seconds - **Optimal Task Time:__30__** Seconds

Optimal Path:
- From the Alerts screen
- Select Problem Alert
- Review the Infobutton information
- View the bibliographic citation, developer, funding source, and release/revision date

        ☐ Correct
        ☐ Minor Deviations/Cycles::Describe below
        ☐ Major Deviations::Describe below
        Comments:

Observed Errors and Verbalizations:

Comments:

Rating:

Overall, this task was:

Show participant written scale: "Very Difficult"(1) to "Very Easy"(5)

Administrator / Notetaker Comments:

Appendix 5: SYSTEM USABILITY SCALE (SUS) QUESTIONNAIRE

System Usability Scale – Centriq Clinic

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

<u>Administrator Use Only</u>

Raw score: _____   SUS Score: _____

EHR Usability Test Report of Centriq Clinic V14 170.315(b)(2) Clinical Information Reconciliation and Incorporation

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

Centriq Clinic V14
Clinical Information Reconciliation and Incorporation

Date of Usability Test: August 2017
Date of Report: August 30, 2017
Report Prepared By: Healthland
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EXECUTIVE SUMMARY

A usability test of Centriq Clinic V14 was conducted in August, 2017 in Fairhope, Alabama by Healthland, a wholly owned subsidiary of CPSI. The purpose of this test was to validate the usability of the current user interface and provide evidence of usability of the Clinical Information Reconciliation and Incorporation list in the EHR Under Test (EHRUT). During the usability test, 10 healthcare providers matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on a task typically conducted on an EHR:

1. Perform Clinical Information Reconciliation and Incorporation.

During the 180 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 Appendices 1 and 2); they were instructed that they could withdraw at any time. Participants did not have prior experience with the EHR. The administrator introduced the test and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s), recorded user performance data on paper and electronically. The administrator did not assist with the task. Participant screens, head shots, and audio were recorded for subsequent analysis.

The following types of data were collected for each participant.

- number of tasks successfully completed within the allotted time without assistance
- time required 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 between the identity of the participant and the data collected. Following the conclusion of the testing, participants were asked to complete a post-test questionnaire and were compensated with $75 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.

170.315(b)(2) Clinical Information Reconciliation and Incorporation

Measure→ Task ↓	Number of Users	Success	Path Deviation	Optimal Task Time (seconds)	Task Time		Errors	Task Ratings 1=difficult
	#	Mean	Deviations (Observed/ Optimal)	Multiplied by 1.5	Mean in seconds	Deviations (Observed/Optimal)	Mean	Mean
1.) Perform Clinical Information Reconciliation and Incorporation	10	100%	1:1	86	75	1:1	0%	4.6

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 75.75.

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

Major findings

- The users found it was user friendly and easy to use.
- The work flow was in a logical order.
- After doing repeated steps on various tasks, the users were much quicker at going through the system completing tasks.

Areas for improvement

- Make the search engines more consistent

- There are multiple ways to perform one task, which can be confusing.

INTRODUCTION

The EHRUT tested for this study was Centriq Clinic V14. Designed to present medical information to health care providers in health care facilities, the EHRUT consists of a complete suite of integrated products, all designed to work in concert with each other and provide community hospitals with a complete electronic medical record (EMR). Centriq Clinic is a health information solution that was completely designed and developed by Healthland. It provides all hospital key departments with a single database. Centriq Clinic promotes improved patient care, increased patient safety, and better patient outcomes. 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 Clinical Decision Support in the EHR Under Test (EHRUT). To this end, measures of effectiveness, efficiency, and user satisfaction, such as time on task and reactions to screens, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants tested the EHRUT. Participants in the test were nurse practitioners and registered nurses. Participants were recruited by Healthland and were compensated $75 for their time. In addition, participants had no direct connection to the development of or organization producing the EHRUT. 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.

All 10 of the recruits participated in the usability test. Recruited participants had various backgrounds and demographic characteristics. The following table displays 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 connected back to individual identities.

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience (in years)	Product Experience	Assistive Technology Needs
1	ID01	Female	40-49	Technical	LPN	18.5	25	None	None
2	ID02	Male	50-59	College	MD	28	30	None	None
3	ID03	Male	60-69	College	MD	36	42	None	None
4	ID04	Female	40-49	College- AS	LPN	20	25	None	None
5	ID05	Female	50-59	College- BS	RN	30	28	None	None
6	ID06	Female	40-49	Technical	LPN	17.5	24	None	None
7	ID07	Male	50-59	Doctorate	MD	29	31	None	None
8	ID08	Male	60-69	Doctorate	MD	33	37	None	None
9	ID09	Female	40-49	College- BS	RN	29	29	None	None
10	ID10	Female	50-59	College- AS	LPN	19	21	None	None

Participants were scheduled for 45-minute sessions with 10 minutes in between each session for debrief by the administrator(s) and data logger(s), and to reset systems in order to properly test conditions. A spreadsheet was used to track 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 Centriq Clinic and/or comparison with other EHRs, provided that the same tasks are used. In short, this testing serves as both a method 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 (shown below).

- number of tasks successfully completed within the allotted time without assistance
- time required 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

One task was constructed which would be realistic and representative of the kinds of activities a user might perform with the Medication Allergy List on this EHR:

1. Perform Clinical Information Reconciliation and Incorporation

Tasks were selected based on their frequency of use, criticality of function, and those that may be troublesome for users.The tasks are prioritized in accordance with the risk associated with user errors.

PROCEDURE

Upon arrival, participants were greeted and their identities were verified and matched with names on the

participant schedule. Each participant reviewed and signed an informed consent and release form (see Appendix 2). A representative from the test team witnessed the participant's signature.

The participants were given a 15-minute education session to orient them about how to use and interact with Medication Allergy List in Centriq Clinic. After the session participants had the opportunity to ask questions.

To ensure that the test ran smoothly, two staff members participated in this test (the usability administrator and the data logger). The usability testing staff conducting the test comprised of experienced usability practitioners with seven years of experience. The administrator moderated the session and administered 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 according to the following guidelines (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 for tasks, but not instructions for 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 he/she had successfully completed the task. Scoring is discussed below in Section 3.9.

Following the session, the administrator gave the participants the post-test questionnaire (see Appendix 5), compensated them for their time, and thanked them for their participation. Participants' demographic information, task success rates, time on task, errors, deviations, verbal responses, and post-test

questionnaire were recorded into a spreadsheet. Participants were thanked for their time and compensated. Participants signed a receipt and acknowledgement form (see Appendix 3) indicating that they had received the compensation.

TEST LOCATION

The test facility included a classroom for application education and a quiet testing room with a table and a computer for the participant. Only the participant and administrator were in the test room. The data logger worked from a separate room where he/she could see the participant's screen and face shot and listen to the audio of the session. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range.   All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

TEST ENVIRONMENT

The EHRUT would be typically be used in a health care office or facility. In this instance, the testing was conducted in a small office setting. The participants used a Lenovo™ ThinkCentre® All-in-one computer running Windows® 7 as the client machine. The display was a 20-inch monitor at resolution of 1920x1080 with 32-bit color depth.   The participants used both mouse and keyboard when interacting with the EHRUT.

The application was set up according to standard Centriq Clinic documentation. The application itself was running on a Red Hat® Enterprise Linux® server using representative test data. The client machine was connected via a wired LAN connection. Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation. Additionally, participants were instructed not to change any of the default system settings (such as control of font size).

TEST FORMS AND TOOLS

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

1. Non-Disclosure Agreement

2. Informed Consent

3. Incentive Receipt and Acknowledgment Form

4. Moderator's Guide

5. Post-test Questionnaire

Examples of these documents can be found in Appendices 1-5, respectively.

The participant's interaction with the EHRUT was captured and recorded digitally with screen capture software running on the test machine. A USB camera recorded each participant's facial expressions synced with the screen capture, and verbal comments were recorded with a microphone. The test session was recorded for later review by the data logger.

PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to the each participant (see the full moderator's guide in Appendix 4).

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.

Following the procedural instructions, 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 9 tasks to complete. Tasks are listed in the moderator's guide in Appendix 4.

USABILITY METRICS

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

The goals of the test were to assess the following.

1.   effectiveness of Centriq Clinic by measuring participant success rates and errors

2.   efficiency of Centriq Clinic by measuring the average task time and path deviations

3.   satisfaction with Centriq Clinic by measuring ease of use ratings

DATA SCORING

The following table (Table 1) details how tasks were scored, errors were evaluated, and the time data was analyzed.

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide were defined by taking multiple measures of optimal performance and multiplying by a factor of 1.5. This allows some time buffer because the participants are not trained to a level of expert performance. Thus, if an expert, optimal performance on a task was 10 seconds, then allotted task time performance was 15 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 a "Failure." 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 were counted as errors. The results are provided as a percentage. On a qualitative level, an enumeration of all errors and error types were 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. A 1:1 ratio represents perfect completion of a task.

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. The total task time is divided by the optimal task time to provide a ratio of task completion time. For this measure, task times faster than the optimal time were treated as equal to the optimal time. This normalizes successes to a ratio of 1:1.
Satisfaction: Task Rating	A 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). This data was averaged across participants. Common convention is that average ratings for systems judged as easy to use should be 3.3 or above. To measure participants' confidence in and likeability of Centriq Clinic 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 the full System Usability Score questionnaire in Appendix 5.

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 (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.

170.315(b)(2) Clinical Information Reconciliation and Incorporation

Measure→ Task ↓	Number of Users	Success	Path Deviation	Optimal Task Time (seconds)	Task Time		Errors	Task Ratings 1=difficult
	#	Mean	Deviations (Observed/ Optimal)	Multiplied by 1.5	Mean in seconds	Deviations (Observed/O ptimal)	Mean	Mean
1.) Perform Clinical Information Reconciliatio n and Incorporatio n	10	100%	1:1	86	75	1:1	0%	4.6

Table 2. Usability testing results.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 75.75. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

DISCUSSION OF THE FINDINGS

EFFECTIVENESS

Based on the success, failure and path deviation data, the system was laid out logically with some confusion on data and search options. There were no major path deviations that caused a user not to complete a task. The users effectively used the system to complete each task. There were no deviations on either task; users commented that it was straight forward and simple to perform a reconciliation.

EFFICIENCY

Every participant was able to complete this task with ease. Because all of the screens on the patient data side operate in basically the same manner, all of the users were able to complete the task quickly.

SATISFACTION

Based on the task ratings, all the users found the tasks to be relatively easy. The SUS score averaged out

to be 75.75 with the lowest being 72.5 and the highest being 80. Based on the SUS score, all the users found the system to be average on usability and overall satisfaction.

MAJOR FINDINGS

The users found the tasks to be easy to use and very user friendly. There were no major areas of difficulty. Users commented that having the system essentially walk you through the reconciliation for each area was time saving and very useful.

AREAS FOR IMPROVEMENT

Creating a global search mechanism would make utilizing the system more efficient.

APPENDICES

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

1. Non-disclosure Agreement
2. Informed Consent Form
3. Incentive Receipt and Acknowledgement Form
4. Moderator's Guide
5. System Usability Scale (SUS) Questionnaire

Appendix 1: NON-DISCLOSURE AGREEMENT

Usability Testing Non-Disclosure Agreement

This agreement is entered into as of _____ (today's date) between

_____ ("the Participant") and the testing organization, CPSI (Computer

Programs and Systems, Inc.) located at 6600 Wall Street, Mobile, Alabama. The Participant acknowledges

his or her voluntary participation in today's usability study may bring the Participant into possession of

Confidential Information. The term "Confidential Information" means all technical and commercial

information of a proprietary or confidential nature which is disclosed by CPSI, or otherwise acquired by the

Participant, in the course of today's study. By way of illustration, but not limitation, Confidential Information

includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided

design files and other computer files, computer software, ideas, improvements, inventions, training methods

and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts. Any

information the Participant acquires relating to this product during this study is confidential and proprietary to

CPSI and is being disclosed solely for the purposes of the Participant's participation in today's usability

study. By signing this form the Participant acknowledges that s/he will receive monetary compensation for

feedback and will not disclose this confidential information obtained today to anyone else or any other

organizations.

Participant's printed name: _____

Signature: _____ **Date:** _____

Appendix 2: INFORMED CONSENT FORM

Usability Testing Informed Consent

CPSI would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about *180* minutes (or 3 hours). At the conclusion of the test, you will be compensated for your time.

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

I understand and consent to the use and release of the videotape by CPSI. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research. I relinquish any rights to the videotape and understand the videotape may be copied and used by CPSI without further permission.

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

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

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

Please check one of the following:

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

☐   NO, I choose not to participate in this study.

Signature: _____ **Date:** _____

Printed Name: _____

Witness: _____ **Date:** _____

Printed Name & Affiliation:_____

Appendix 3: INCENTIVE RECEIPT AND ACKNOWLEDGEMENT FORM

Usability Acknowledgement of Receipt

I hereby acknowledge that a check in the amount of   **$75**   will be sent to the name and address below for my participation in a research study run by CPSI (Computer Programs and Systems, Inc.).

Printed Name: _____

Address: _____

_____

Signature: _____ Date: _____

Usability Researcher: _____

Signature of Usability Researcher: _____

Date: _____

Witness: _____

Witness Signature: _____

Date: _____

Appendix 4: MODERATOR'S GUIDE

Usability Testing Moderator's Guide

Administrator _____

Data Logger _____

Date _____ Time _____

Participant # _____

Location _____

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

Prior to each participant:
- Reset application.
- Start session recordings with Webex.

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

After each participant:
- End session recordings with Webex.

After all testing
- Back up all video and data files.

Orientation (5 minutes)
Thank you for participating in this study. Our session today will last approximately **180 minutes (or 3 hours)**. During that time you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. 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. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer or 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.

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

The product you will be using today is the Centriq Clinic EHR. 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 (5 minutes)
What is your job title / appointment?

What are some of your main responsibilities?

How long have you been working in this role?
□Less than 1 year □1 to 3 years □more than 3 years

Have you ever used an electronic health record?   □ Yes   □ No

If yes, do you currently use an electronic health record in your job?   □ Yes   □ No

If yes, how often do you use the EHR?
□Daily   □Weekly   □Monthly   □Less than once a month

How many different EHRs have you used?
□ One   □Two   □Three or more

Data Logger _____

Date _____ Time _____

Participant # _____

Task 10– Patient Test'X': Clinical Information Reconciliation and Incorporation

[Time Allotted: 57 seconds]
[Start user from within patient record]

Patient Test **'X'** has been admitted. You need to reconcile the patient's medication list, allergy list and problem list from an external medical summary with the information currently in the patient's record. Please show me how you would do that.

Check off the path that was used

Optimal Path:
 	
1. Select 'Back to Main'
2. Select 'Medical Summary' tile
3. Click the Clinical Information Reconciliation button next to the external summary
4. Select all items in each section (Medications, Medication Allergies, Problems)
5. Click the Verify Reconciliation button
6. Review selections on each tab
7. Select 'Submit' button
 	
Alternate Path1:
 	
1. Select 'Back to Main'
 	
    End point: Home Medications list updated
 	
      ❑ Minor Deviations
      ❑ Major Deviations

Task Time: _____ seconds
 	
Success:
 	
      ❑ Successfully Completed
      ❑ Completed with difficulty/help
      ❑ Not Completed

Observed Errors and User Comments:

On a scale of 1 to 5, how would you rate your experience with the application when completing this task?

Very difficult to
use
                                                                                Very easy to use

1   2   3   4   5

Moderator/Notetaker Comments:

Appendix 5: SYSTEM USABILITY SCALE (SUS) QUESTIONNAIRE

System Usability Scale – Centriq Clinic

	Strongly disagree				Strongly agree
	1	2	3	4	5

1. I think that I would like to use this system frequently

| | 1 | 2 | 3 | 4 | 5 |

2. I found the system unnecessarily complex

| | 1 | 2 | 3 | 4 | 5 |

3. I thought the system was easy to use

| | 1 | 2 | 3 | 4 | 5 |

4. I think that I would need the support of a technical person to be able to use this system

| | 1 | 2 | 3 | 4 | 5 |

5. I found the various functions in this system were well integrated

| | 1 | 2 | 3 | 4 | 5 |

6. I thought there was too much inconsistency in this system

| | 1 | 2 | 3 | 4 | 5 |

7. I would imagine that most people would learn to use this system very quickly

| | 1 | 2 | 3 | 4 | 5 |

8. I found the system very cumbersome to use

| | 1 | 2 | 3 | 4 | 5 |

9. I felt very confident using the system

| | 1 | 2 | 3 | 4 | 5 |

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

| | 1 | 2 | 3 | 4 | 5 |

Administrator Use Only

Raw score: _____   SUS Score: _____