

NISTIR 7742

Customized Common Industry Format Template for Electronic Health Record Usability Testing

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EHR Usability Test Report of Team Chart Concept Version 7.1

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

Team Chart Concept – Version 7.1

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EXECUTIVE SUMMARY

A usability test of Team Chart Concept – Version 7.1 was conducted between November 13th and November 23rd, in Paducah, Kentucky, by Ulrich Medical Concepts. 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).

During the usability test, ten users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

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

- Computerized provider order entry – medications
- Computerized provider order entry - labs
- Computerized provider order entry - imaging
- Drug-drug, drug-allergy interaction checks
- Medication list
- Medication allergy list
- Record patient demographics information
- Document implantable device data

During the one-hour, one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form and non-disclosure agreement (included in Appendix 3); they were instructed that they could withdraw at any time. 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.

The participant’s interaction with the EHRUT was observed and the results recorded.

The following types of data were collected for each participant:

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

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

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)	
Computerized provider order entry - medication	10	80% (40)	1.125	170 (52)	1.037	20% (40)	4.1	
Computerized provider order entry - labs	10	90% (30)	1	32 (8)	1	10% (30)	4.9	
Computerized provider order entry - imaging	10	100% (0)	1	29 (8)	0.906	0 (0)	4.9	
Drug-drug, drug-allergy interaction checking	10	100% (0)	1.125	197 (32)	1.005	0 (0)	4.2	
Medication list	10	80% (40)	1.167	141 (45)	1.007	20% (40)	4.0	
Medication allergy list	10	80% (40)	1.091	133 (39)	1.008	20% (40)	4.1	
Record patient demographic information	10	80% (40)	1.125	95 (34)	1	20% (40)	4.5	
Document implantable device data	10	80% (40)	1.167	41 (16)	.976	20% (40)	4.9	

Addendum

Additional testing on task a9 was done at a later date to determine functionality on Clinical Decision Support (CDS).

- Enable intervention and reference resources.
- Activate intervention and reference resources.
- View intervention and reference resources.

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)	
Enable intervention and reference resources	10	87% (7.9)	1.45	115 (32)	0.96	12.5% (7.9)	4.8	
Activate intervention and reference resources	10	88.5% (8.2)	1.26	117 (54)	0.65	11.5% (8.2)	4.6	
View intervention and reference resources	10	87.0 % (8.23)	1.625	99 (44)	0.83	13.0 % (8.23)	4.7	

Addendum (2)

Additional testing on task b11 was done between 11/18 and 11/21/20224 to determine functionality on Decision Support Interventions (DSI).

- Activate predictive decision support.

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)	
Activate predictive decision support	10	93% (14.28)	1.26	193 (59)	1.57	7% (14.28)	4.2	

Usability Testing Results

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 89.

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

- Major findings
 - Participants reported overall satisfaction.
 - Majority of the participants rated the system as easy to use.

- Areas for improvement
 - The electronic medication order screens seemed to cause some confusion as to where or how to proceed. This caused some extra time to be spent on these screens.

INTRODUCTION

The EHRUT tested for this study was Team Chart Concept – Version 7.1. Designed to present medical information to healthcare providers in any facility type in an ambulatory setting the EHRUT consists of a full-featured suite, including electronic health records, practice management, high-level clinical data and interoperability. 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 ease of use, time on task, and consistency of the system, were captured during the usability testing.

METHOD

DESIGN STANDARD

The NISTIR 7741 usability standard was incorporated in the product design of the Team Chart Concept EHR system.

Name: NISTIR 7741

Description: The NISTIR 7741 standard is a user-centered design (UCD) established for improving the useability of electronic health record software to ensure the EHR is efficient and effective.

Citation: <https://www.nist.gov/publications/nistir-7741-nist-guide-processes-approach-improving-usability-electronic-health-records>

PARTICIPANTS

A total of ten participants were tested on the EHRUT(s). Participants were recruited by Ulrich Medical Concepts and were compensated with a certificate of appreciation for their time. 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 1.

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following are tables 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.

Participant Demographics – Tasks 1-8

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
25	F	60-96	High School	Medical Office Support	156	156	156	None
50	M	20-29	Bachelor's Degree	Medical Office Support	6	120	0	None
75	M	20-29	Some College	Medical Office Support	12	144	0	None
100	F	30-29	Bachelor's Degree	Registered Nurse	60	180	0	None
125	F	40-49	Bachelor's Degree	Medical Billing	18	174	18	None
150	F	30-39	Master's Degree	SLP	84	240	0	None
175	F	40-49	Master's Degree	SLP	204	300	0	None
200	F	20-29	Bachelor's Degree	Registered Nurse	36	192	0	None
225	F	30-39	Some College	CNA	36	222	0	None
250	M	20-29	Some College	Student	36	120	0	None

Participants – Tasks 9.1 – 9.3

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
500	Female	60-69	Bachelor's degree	Certified Professional Coder	120	144	36	None
550	Male	20-29	Associate degree	Analyst	48	96	48	None
600	Male	30-39	Associate degree	Medical Office Support	120	60	6	None
650	Male	30-39	Bachelor's degree	Medical Office Support	39	294	39	None
700	Female	40-49	Bachelor's degree	Medical Office Support	240	360	96	None
750	Male	20-29	Bachelor's degree	Medical Office Support	96	204	2	None
800	Male	30-39	Bachelor's degree	Medical Office Support	100	360	2	None
850	Male	40-49	Bachelor's degree	Medical Office Support	300	300	108	None
900	Male	30-39	Associate degree	Medical Office Support	43	324	43	None
950	Female	30-39	Bachelor's degree	Medical Office Support	20	200	20	None

Eleven were recruited and ten participated in the usability test. One individual declined the

invitation to participate. (*Ten additional participants were gathered for testing on task a9 and b11*).

Participants were scheduled for one-hour sessions with twenty minutes in between each session for debrief by the administrator(s) and data logger(s), and to reset systems to proper test conditions. A spreadsheet was used to keep track of the participant schedule, and included each participant's demographic characteristics.

Participants – Task 10

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
1000	Female	30-39	Bachelor's degree	Client Support Specialist	120	120	120	None
1050	Male	20-29	Associate degree	Client Support Specialist	48	120	12	None
1100	Female	40-49	Associate degree	Client Support Specialist	240	240	240	None
1150	Male	40-49	Bachelor's degree	Implementation Spec.	180	336	96	None
1200	Female	20-29	Bachelor's degree	Configuration Spec.	60	240	48	None
1250	Male	30-39	Some college credit	Configuration Spec.	204	360	72	None
1300	Male	20-29	Associate degree	Technical Analyst	96	120	72	None
1350	Male	30-39	Associate degree	Client Support Specialist	180	240	72	None
1400	Female	40-49	Bachelor's degree	Technical Writer	240	240	120	None
1450	Female	30-39	Some college credit	Client Services & Config.	132	240	132	None

STUDY DESIGN

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

During the usability test, participants interacted with one EHR. Each participant used the same database, 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. Computerized provider order entry – medications
2. Computerized provider order entry – labs
3. Computerized provider order entry - imaging
4. Drug-drug, drug-allergy interaction checks
5. Medication list
6. Medication allergy list
7. Record patient demographics
8. Document implantable device data
- 9.1 Enable intervention and reference resources
- 9.2 Activate intervention and reference resources
- 9.3 View intervention and reference resources
10. Activate predictive decision support

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

PROCEDURE

Upon arrival, participants were assigned a participant ID. Each participant reviewed and signed a non-disclosure agreement and an informed consent form (See Appendix 3). A representative from the test team witnessed the participant's signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test was usability practitioners with no previous usability testing experience.

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 (System Usability Scale, see Appendix 5), presented them with a certificate of appreciation, and thanked each individual for their participation. Participants signed a receipt and acknowledgement form (See Appendix 6) indicating that they had received the certificate.

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

TEST LOCATION

The test facility included a 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 during 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 healthcare office or facility. In this instance, the testing was conducted in a professional office building. For testing, a Lenovo Think Pad laptop running Windows 7 Professional was used. The laptop contained 4 GB of RAM on a 64 bit operating system. The participants used a mouse and keyboard when interacting with the EHRUT.

Team Chart Concept used a 15" laptop display with a 1366 x 768 resolution. The application was set up by the vendor according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a Windows platform using a test database on a WAN 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:

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

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

The participant's interaction with the EHRUT was observed and recorded.

PARTICIPANT INSTRUCTIONS

The administrator read the following instructions aloud to each participant (also 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 one hour. 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 (15 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 8 tasks to complete (task 9 was given to a separate list of participants). 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 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 Team Chart Concept by measuring participant success rates and errors
2. Efficiency of Team Chart Concept by measuring the average task time and path deviations
3. Satisfaction with Team Chart Concept 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
<p>Effectiveness: Task Success</p>	<p>A task was counted as a “Success” if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis.</p> <p>The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage.</p> <p>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency.</p> <p>Target task times used for task times in the Moderator’s Guide were operationally defined by taking multiple measures of optimal performance and multiplying by 1.25 that allowed a time buffer because the participants were not trained to expert performance.</p>
<p>Effectiveness: Task Failures</p>	<p>If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as a “Failure.” No task times were taken for errors.</p> <p>The total number of errors was calculated for each task and then divided by the total number of times that task was attempted.</p>

Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task.
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. To measure participants' confidence in and likeability of Team Chart Concept 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 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. All Participants followed session and task instructions. There were no testing irregularities or issues that affected data collection or interpretation of the results.

The usability testing results for the EHRUT are detailed below (see Tables 2, 3 and 4).

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
		#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)
Computerized provider order entry - medication		10	80% (40)	1.125	170 (52)	1.037	20% (40)	4.1

Computerized provider order entry - labs	10	90% (30)	1	32 (8)	1	10% (30)	4.9
Computerized provider order entry - imaging	10	100% (0)	1	29 (8)	0.906	0 (0)	4.9
Drug-drug, drug-allergy interaction checking	10	100% (0)	1.125	197 (32)	1.005	0 (0)	4.2
Medication list	10	80% (40)	1.167	141 (45)	1.007	20% (40)	4.0
Medication allergy list	10	80% (40)	1.091	133 (39)	1.008	20% (40)	4.1
Record patient demographic information	10	80% (40)	1.125	95 (34)	1	20% (40)	4.5
Document implantable device data	10	80% (40)	1.167	41 (16)	.976	20% (40)	4.9

Table 2. Usability Testing Results.

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)	
Enable intervention and reference resources	10	87.5% (7.91)	1.45	115 (32)	0.96	12.5% (7.91)	4.8	
Activate intervention and reference resources	10	88.5% (8.18)	1.26	117 (54)	0.65	11.5% (8.18)	4.6	
View intervention and reference resources	10	87% (8.23)	1.625	99 (44)	0.83	13% (8.23)	4.7	

Table 3. Additional Usability Testing Results.

Task	Measure	N	Task Success	Path Deviation	Task Time		Errors	Task Ratings 5=Easy
	#	Mean (SD)	Deviations (Observed /Optimal)	Mean (SD)	Deviations (Observed /Optimal)	Deviations (Observed/ Optimal)	Mean (SD)	
Activate predictive decision support	10	93% (14.28)	1.26	193 (59)	1.57	7% (14.28)	4.2	

Table 4. Additional 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: 89.

DISCUSSION OF THE FINDINGS

The effectiveness, efficiency, satisfaction, major findings, and areas of improvement were all evaluated through the data that was gathered as part of the usability testing. Those findings are described in separate sections below.

EFFECTIVENESS

Based on the success, failure, and path deviation data, Team Chart Concept receives positive ratings for effectiveness. The success rate was high among the participants with their limited familiarity of the system. With additional user training and practice, these scores would be expected to be near or equal to 100% based on the current data.

EFFICIENCY

Based on the observations of the task time and deviation data, the efficiency of the system was found to be very good. The participants were able to complete tasks within a reasonable amount of time when compared to the time that is required for experienced users to complete the same tasks.

SATISFACTION

Based on the task ratings and SUS results data, participants were very satisfied with the usability of Team Chart Concept to complete the tasks set forth as part of the usability testing. With a wide variety of experiences and backgrounds, all users were receptive to the system, and gave it high marks both on individual tasks and overall usage. Each participant noted that among the aspects that they liked the most, the consistency of the system is what stood out. Additionally, the overall impression of the system among participants was its ease of use.

MAJOR FINDINGS

In reviewing the data from the usability testing, Team Chart Concepts was found to have overall positive reviews. Each task was completed with at least an 80% success rate or better. Tasks were completed in comparable time to experienced users performing the

same task. There were very few path deviations among the inexperienced users.

Participants reported overall satisfaction with their experience. Most participants stated that they found the system overall easy to use. Participants verbally indicated that the more they used the system the easier they were able to navigate to the expected screens.

The test administrator did not denote any significant frustration

AREAS FOR IMPROVEMENT

The screens related to the computer order entry of medications, were a consistent topic for comments. Participants seemed to find these screens more confusing and not as intuitive to use. Many seemed to have a hard time locating the button or link for the function they wished to perform. This caused increase time to be needed in order to complete the task. However, as subsequent tasks required the use of these screens, participants became more familiar and more at ease with these screens, thus improving task completion times.

APPENDICES

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

- 1: Recruiting screener
- 2: Participant demographics
- 3: Non-Disclosure Agreement (NDA) and Informed Consent Form
- 4: Example Moderator's Guide
- 5: System Usability Scale Questionnaire
- 6: Incentive receipt and acknowledgment form

Appendix 1: RECRUITING SCREENER**Recruiting Script**

Hello, my name is _____, calling from Ulrich Medical Concepts. We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if you would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. Can I ask you a few questions?

1. Are you male or female?
2. Have you participated in a focus group or usability test in the past six months?
3. Do you, or does anyone in your home, work in marketing research, usability research, web design or related field? (If yes, Terminate)
4. Which of the following best describes your age? (23 to 39; 40 to 59; 60 - to 74; 75 and older)
5. Which of the following best describes your race or ethnic group? (Caucasian, Asian, Black/African-American, Latino and/or Hispanic, etc.)
6. Do you require any assistive technologies to use a computer? If so, please describe.

Professional Demographics

7. What is your occupation? _____
8. How long have you held this position?
9. Which of the following describes your highest level of education? (high school graduate/GED, some college, college graduate, postgraduate, other-explain)

Computer Expertise

10. Besides reading email, what professional activities do you do on the computer? (e.g., access EHR, research; reading news; shopping/banking; digital pictures; programming/word processing, etc.)
11. About how many hours per week do you spend on the computer? (0 to 10, 11 to 25, 26+ hours per week)
12. What computer platform do you usually use?
13. What Internet browser(s) do you usually use?
14. In the last month, how often have you used an electronic health record?
15. How many years have you used an electronic health record?
16. How many EHRs do you use or are you familiar with?

Contact Information

Those are all the questions I have for you. Your background matches the people we're looking for.

May I get your contact information?

- Name of participant:
- Address:
- City, State, Zip:
- Daytime phone number:
- Evening phone number:
- Alternate [cell] phone number:
- Email address:

This study will take place at Ulrich Medical Concepts located at 2929 Broadway Street, in Paducah, Kentucky. I will confirm your appointment a couple of days before your session and provide you with directions to our office. What time is the best time to reach you?

Appendix 2: PARTICIPANT DEMOGRAPHICS

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

Gender

Men	3
Women	7
Total (participants)	10

Occupation/Role

Nursing Provider	3
Admin Staff	2
Total (participants)	5
Total (participants)	10

Years of Experience

Years experience >1-20 years (Average of 5.4 years by all participants)

Facility Use of HER	
All paper	0
Some paper, some electronic	8
All electronic	2
Total (participants)	10

Full Participant Breakdown

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
25	F	60-96	High School	Medical Office	156	156	156	None
50	M	20-29	Bachelor's Degree	Medical Office	6	120	0	None
75	M	20-29	Some College	Medical Office	12	144	0	None
100	F	30-29	Bachelor's Degree	Registered Nurse	60	180	0	None
125	F	40-49	Bachelor's Degree	Medical Billing	18	174	18	None
150	F	30-39	Master's Degree	SLP	84	240	0	None
175	F	40-49	Master's Degree	SLP	204	300	0	None
200	F	20-29	Bachelor's Degree	Registered Nurse	36	192	0	None
225	F	30-39	Some College	CNA	36	222	0	None
250	M	20-29	Some College	Student	36	120	0	None

Participants – Tasks 9.1 – 9.3

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
500	Female	60-69	Bachelor's degree	Certified Professional Coder	120	144	36	None
550	Male	20-29	Associate degree	Analyst	48	96	48	None
600	Male	30-39	Associate degree	Medical Office Support	120	60	6	None
650	Male	30-39	Bachelor's degree	Medical Office Support	39	294	39	None
700	Female	40-49	Bachelor's degree	Medical Office Support	240	360	96	None
750	Male	20-29	Bachelor's degree	Medical Office Support	96	204	2	None
800	Male	30-39	Bachelor's degree	Medical Office Support	100	360	2	None
850	Male	40-49	Bachelor's degree	Medical Office Support	300	300	108	None
900	Male	30-39	Associate degree	Medical Office Support	43	324	43	None
950	Female	30-39	Bachelor's degree	Medical Office Support	20	200	20	None

Participants – Task 10

Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
1000	Female	30-39	Bachelor's degree	Client Support Specialist	120	120	120	None
1050	Male	20-29	Associate degree	Client Support Specialist	48	120	12	None
1100	Female	40-49	Associate degree	Client Support Specialist	240	240	240	None
1150	Male	40-49	Bachelor's degree	Implementation Spec.	180	336	96	None
1200	Female	20-29	Bachelor's degree	Configuration Spec.	60	240	48	None
1250	Male	30-39	Some college credit	Configuration Spec.	204	360	72	None
1300	Male	20-29	Associate degree	Technical Analyst	96	120	72	None
1350	Male	30-39	Associate degree	Client Support Specialist	180	240	72	None
1400	Female	40-49	Bachelor's degree	Technical Writer	240	240	120	None
1450	Female	30-39	Some college credit	Client Services & Config.	132	240	132	None

Appendix 3: NON-DISCLOSURE AGREEMENT AND INFORMED CONSENT FORM

Non-Disclosure Agreement

THIS AGREEMENT is entered into as of _____, 2024, between _____ ("the Participant") and the testing organization Ulrich Medical Concepts located at 2929 Broadway Street, Paducah, Kentucky.

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 Ulrich Medical Concepts, 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 Ulrich Medical Concepts 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 not disclose this confidential information obtained today to anyone else or any other organizations.

Participant's printed name: _____

Signature: _____

Date: _____

Informed Consent

Ulrich Medical Concepts 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 should last less than two hours.

Agreement

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

I understand and consent to the use and release of any recorded material by Ulrich Medical Concepts. I understand that the information 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 recorded material and understand any recorded material may be copied and used by Ulrich Medical Concepts 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 outside of Ulrich Medical Concepts and Ulrich Medical Concept'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:** _____

Appendix 4: MODERATOR'S GUIDE

Teach Chart Concept Usability Test Moderator's Guide

Administrator _____

Data Logger _____

Date _____

Time _____

Participant # _____

Location _____

Prior to testing

- Confirm schedule with Participants
- Ensure Team Chart Concept lab environment is running properly
- Ensure lab and data recording equipment is running properly

Prior to each participant:

- Reset application
- Start session recordings

Prior to each task:

- Reset application to starting point for next task

After each participant:

- End session recordings

After all testing

- Save all data files
-

Orientation

Thank you for participating in this study. Our session today will about one hour. 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 a new production version with test data. Some of the data may not make sense as it is placeholder data.

We are recording the 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.

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.

Do you have any questions or concerns?

Preliminary Questions

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.

Introduction: First Impression

Show test participant Team Chart Concept.

Please don't click on anything just yet. What do you notice? What are you able to do here?
Please be specific.

Notes / Comments:

Task 1: Computerized provider order entry - medications (3 minutes, 25 seconds)

During a routine visit with a patient, Tom Test, you need to create a medication order.

Please create the following (details provided to participants):

1. New electronic prescription for Simvastatin, 20 mg tablet by mouth once daily; dispense 30; 1 refill RxNorm code: 312961

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Prescription button Select a Patient Drug Search Select Drug Complete dosing information and "Save Rx" Button "Transmit Rx" Select Pharmacy "Transmit Rx/Add to Record" Close ePrescribing session

- 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 2: Computerized provider order entry - labs (40 seconds)

During a routine visit with a patient, Tom Test, you need to create a lab order.

Please create the following (details provided to participants):

1. New lab requisition for Cholesterol in HDL in Serum or Plasma LOINC Code: 2085-9

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Requisition – Cholesterol (2058-9) button Select a Patient Select Ordering provider
 Check “Completed On” Select “Send Requisition” Select “Save and Close”

- 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 3: Computerized provider order entry - imaging (40 seconds)

During a routine visit with a patient, Tom Test, you need to create a radiology order.

Please create the following (details provided to participants):

1. New radiology requisition for a CT head/brain without contrast material CPT: 70450

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

*Requisition – CT head/brain (70450) button Select Ordering provider
 Select Ordering provider Check “Completed On” Select “Send Requisition”
 Select “Save and Close”*

- 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 4: Drug-drug, drug-allergy interaction checks (4 minutes, 5 seconds)

Take the participant to the starting point for the task. Ensure that this patient has a drug-drug and a drug-allergy interaction to the drug chosen. This will force the participant to find other drugs and use other elements of the application.

During a routine visit, you need to prescribe new medication to a patient, Jack P Test. You must verify any drug-drug, or drug-allergy interactions with the new medication. If there is an interaction, the prescription should not be completed.

Please prescribe the following medications (details provided to participants):

1. Amoxicillin, 250 mg capsule by mouth three times a day for 10 days; no refills
2. Lanoxin, 125 mcg tablet by mouth one time daily for 30 days; 1 refill
3. Isordil, 40 mg tablet by mouth twice daily for 30 days; 1 refill

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Prescription button Select a Patient Drug Search Select Drug Complete dosing information and "Save Rx" or "Delete" Button "Transmit Rx" Select Pharmacy "Transmit Rx/Add to Record" Close ePrescribing session

- 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 5: Medication list (2 minutes, 55 seconds)

Take the participant to the starting point for the task.

After examining a patient, Lisa Test, you decide to review both her active and discontinued medications. You then prescribe the following medication:

Lorazepam 0.5 mg tablet by mouth three times daily

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Search Contact button Select a Patient Deselect "active" in medication list "Add" button Drug Search Select Drug Complete dosing information and "Save Rx" Button "Transmit Rx" Select Pharmacy "Transmit Rx/Add to Record" Close ePrescribing session

- 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 6: Medication allergy list (2 minute, 46 seconds)

Take the participant to the starting point for the task.

At the beginning of an exam with a patient, Mike Test, you review his current medication allergies. You must enter new allergies, as well as modify previously listed allergies.

Add the allergy sulfasalazine with a reaction of wheezing.
Change the allergy of penicillin V to penicillin G.

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Search Contacts Select a Patient Select "Add Allergy" Select Allergy Add reaction Save and Close Select Allergy Edit Allergy Save and Close

- 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 7: Record patient demographics (1 minutes, 59 seconds)

During a routine visit with a patient, Tom Test, you need to record patient demographics.

Please create the following (details provided to participants):

1. Assign a race to the patient.
2. Assign an ethnicity to the patient.
3. Assign a preferred language for the patient
4. Assign a sex value to the patient.
5. Assign a sexual orientation value to the patient.
6. Assign a gender identity to a patient.

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

- Registration button
- Select a Patient
- Demographics Tab
- Select race
- Select ethnicity
- Select language
- Select sex
- Select sexual orientation
- Select gender

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 8: Document implantable device data (53 seconds)

During a routine visit, you need to document an implantable device for patient, Jenny Test. Please document the following (details provided to participants):

1. Pacemaker (UDID: (01)00802526536625(11)141231(17)150707(10)A213B1(21)1234)

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

- Implantable Device button
- Select a Patient
- Enter UDID
- Find button
- Set Status
- Save and Close

- 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 9.1: Enable intervention and reference resources

User JSMITH cannot edit Alert Dictionary. User FTEST can edit Alert Dictionary.

Login as FTEST

Open Alert Dictionary (Dictionaries Ribbon, Timeline category, Alerts Dictionary)

Confirm the following alerts are enabled: Problem List, Med List, Allergy List, Demographics, Lab Results, Vital Signs, Combo of at least 2.

Login as JSMITH

Verify JSMITH cannot enable/disable alerts.

Log back in as FTEST.

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

- Dictionaries Ribbon Timeline category Alerts Dictionary Find Alert and click Edit
- Uncheck "Disable" box Save and Close

- 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: Activate intervention and reference resources

Trigger Clinical Decision Support Interventions

Select patient “Jenny Test” who has the following:

Current Problem: Sinusitis

Medication: Amoxicillin

Allergy: Penicillin

Demographics: age > 50

Lab Results: INR > 3

Add the Vital Sign of temperature 101 degrees.

Confirm all CDS interventions displayed the appropriate alert for each category.

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

- Search Contacts
- Registration
- New
- Vital Signs
- Save and close

- 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: View intervention and reference resources

Access diagnostic and therapeutic reference info using "general capability" OR HL7 Context-Aware Knowledge Retrieval (Infobutton) Standard based on the following: Problem List, Med List, Lab Results, Combo of Problem, Med Allergy, Demo, Lab, and/or Vital Signs.

Success:

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

Comments:

Task Time: _____ Minu

Optimal Path:

Search Patient Open Chart Add Problem Click Save and Ed Resource

- 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 10: Activate Predictive Decision Support

Follow these steps to complete Task 10. Please log using the following credentials:

1. Login as username NURSE.
2. Click the Green **Lung Cancer Screening** button on the TCC Fast Track Desktop.
3. **Search for Patient:**
 - In the **Search Key** field, type "Test" and press **Search**.
 - Select one of the following patients aged between 55-80:

Testpatient	Marion	(61)
Testpatient	Billy	(62)
Testprovider	Sam	(62)
Testpatient	Juno	(63)
Testpatient	ATest	(64)
Testpatient	Georgia	(68)
Testpatient	Ryan	(68)
Testpatient	George	(69)
Testpatient	Grahm	(69)
Testpatient	Lola	(69)
Testpatient	Bonnie	(70)
Testpatient	Larry	(70)
Testpatient	Leia	(70)
Testpatient	Kent	(72)
Testpatient	Leo	(72)
Testpatient	Baxter	(74)
Testpatient	Faith	(76)
Testpatient	Freddy	(76)
Testpatient	YoYo	(76)

4. Begin documenting by clicking the '**Click Here to Begin Documenting**' option.
5. As the template advances, read the **blue text** to determine what to answer from the options provided.
 - Document the **Number of Packs Per Day**
 - Document the **Number of Years Smoked**
 - Update the **patients smoking Status**
 - Use the drop-down menu to select either "Current" or "Former" status (required to trigger the alert).
6. **Acknowledge and Respond to Alert:**
 - The alert will now trigger displaying the **Display Pending Actions** dialog box.
 - In the **Display Pending Actions** box, select the **Yes** button.

7. **Select Follow-up Action(s):**

- In the **Pending Actions** section, choose one or both of the following:
 - Choose **Order** for **Lung CT Appointment** - click **Create**, then click **Complete Task** in the **Create New Order** window, then fill out the **Referral Screen** by selecting **Clinic Testing** as the referral recipient. Click **Save and Close**.
 - Choose **Education Resource** for **Lung Cancer Screening** – Click **Create**, choose **Delivery Method** from the drop-down menu, then either print or save externally. Click **Save and Close**.
 - **Close** the **Pending Actions** window.

8. Click **Feedback UDR** to document any **Feedback**. The screen will automatically save and close.

Success:

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

Comments:

Task Time: _____ Minutes

Optimal Path:

Click workflow button Search Patient Click through template Display Pending Actions Create Order / Education Resource Choose Delivery Method, Print, then Save and Close

- Correct
- Minor Deviations :: 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:

Final Questions (5 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?

Administer the SUS

Appendix 5: SYSTEM USABILITY SCALE QUESTIONNAIRE

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

Appendix 6: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Acknowledgement of Receipt

I hereby acknowledge receipt of a certification of appreciation for my participation in a research study run by Ulrich Medical Concepts.

Printed Name: _____

Signature: _____ Date: _____

Witness: _____

Witness Signature: _____ Date: _____