EHR

Usability Test Report

EproMedical
Version 2.7.0

Ambulatory

EHR Usability Test Report of Epro Medical Version 2.7.0

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

EproMedical Version 2.7.0

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EXECUTIVE SUMMARY

A usability test of EproMedical Version 2.7.0 was conducted on 03/12/2018 in Simi Valley CA by Eprosystem Inc.. The purpose of this test was to test and validate the usability of the current user interface, and provide evidence of usability in the EHR Under Test (EHRUT).

During the usability test, 5 healthcare providers and 5 users matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks.

This study collected performance data on 12 tasks typically conducted on an EHR. The SUS score average for all 10 participants was 85.

1. Computerized Provider Order Entry (CPOE) - Medications
2. CPOE - Laboratory
3. CPOE - Diagnostic Imaging
4. Drug-drug, Drug-allergy interaction Checks for CPOE
5. Demographics
6. Problem List
7. Medication List
8. Medication Allergy List
9. Clinical Decision Support
10. Implantable Device List
11. Clinical Information Reconciliation and Incorporation
12. Electronic Prescribing

During the 45 Minute one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form; they were instructed that they could withdraw at any time. Participants had prior experience with the EHR. The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHR. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

Participant screens, 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 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 compensated with $50.00 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 EHR. Following is a summary of the performance and rating data collected on the EHR. There were no areas for improvement.

Task Measure	# of Participants	Task Success		Path Deviation			Task Time	Errors		Task Rating	
				Deviations			Deviations			Deviations	
		Mean %	SD	Observed/Optimal/Mean(SD)			Observed/Optimal/Mean(SD)			Rating	SD
1. Computerized provider Order Entry(CPOE)Med	10	100%	0	7	6	1	:21	:30	:30	3	3
2. CPOE - Laboratory	10	100%	0	7	7	0	:19	:30	0	4	3
3. CPOE – Diagnostic Imaging	10	100%	0	7	7	0	:23	:30	0	4	3

4. Drug-Drug, Drug Allergy Interactions Check	10	100%	0	4	3	1	:41	:30	:42	4	3
5. Demographics	10	100%	0	8	8	0	:46	:60	0	3	3
6. Problem List	10	100%	0	5	5	0	:53	:60	0	2	3
7. Medication List	10	100%	0	4	4	0	:23	:30	0	4	3
8. Medication Allergy List	10	100%	0	4	4	0	:41	:60	0	4	3
9. Clinical Decision Support	10	100%	0	3	3	0	:32	:60	0	3	3
10. Implantable Device List	10	100%	0	4	4	0	:54	:60	0	4	3
11. Clinical Information Reconciliation & Incorp	10	100%	0	4	4	0	:56	:60	0	3	3
12. Electronic Prescribing	10	100%	0	7	7	0	:60	:60	0	3	3

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be 85.

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

- Major findings

    There were no major findings that would need to be improved for patient safety.

- Areas for improvement

    There were no areas for improvement.

INTRODUCTION

The EHR tested for this study was EproMedical Version 2.7.0

Ambulatory.   Designed to present medical information to healthcare

providers in a physician's clinic. The EHR consists of a electronics

health records program for a physician. 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 electronic prescribing medication

, were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants were tested on the EHRUT(s). Participants

in the test were Medical doctors and MA's. Participants were

recruited by Arthur Runyan (An employee of Eprosystem) and were

compensated $50.00

 for their time. In addition, participants had no direct connection to the

development of or organization producing the EHRUT(s). Participants

were not from the testing or supplier organization. Participants were

given the opportunity to have the same orientation and level of training

as the actual end users would have received.

For the test purposes, end-user characteristics were identified and

translated into a recruitment screener used to solicit potential

participants. Appendix 1

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology. .

	Part ID	Gender	Age	Education	Occupation/ role	Professional Experience	Computer Experience	Product Experience	Assistive Technology Needs
1	901	Male	20-29	College	M/A	48	72	24	None
2	902	Female	30-39	College	M/A	48	48	24	None
3	903	Female	20-29	College	M/A	60	60	24	None
4	904	Female	30-39	College	M/A	72	48	24	None
5	905	Female	40-50	College	Physician	96	36	24	None
6	906	Male	50-60	College	Physician	228	60	24	None
7	907	Male	50-60	College	Physician	240	36	18	None
8	908	Male	40-50	College	Physician	96	48	24	None
9	909	Male	30-40	College	Physician	36	36	36	None
10	910	Male	40-50	College	M/A	48	60	36	None

10 participants (matching the demographics in the section on Participants) were recruited and 10 persons participated in the Usability test. 0 participants failed to show for the study.

Participants were scheduled for 45 minute sessions with 5 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 as provided by the recruiting firm.

STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, effectively, efficiently, and with satisfaction – and areas where the application failed to meet the needs of

the participants. The data from this test may serve as a baseline for future tests with an updated version of the same EHR and/or comparison with other EHRs provided the same tasks are used. In short, this testing serves as both a means to record or benchmark current usability, but also to identify areas where improvements must be made.

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

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

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

TASKS

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

1. Computer Provider Order Entry(CPOE) Med - Go to Medication tab - Select a medication- select a dosage- select refills - Save.
2. CPOE Laboratory - Go to Lab Orders - Choose a lab company - Choose a test order -Click EZ Lab - Choose ICD 10 Codes - Click Send
3. CPOE Diagnostic Imaging - Go to Digital Imaging - Choose a template - Choose QTY -Click on Scan - Name Image - Choose scanner - Click Scan
4. Drug To Drug Allergy - Go to Medication tab - View red light system below- Double click on Drug to Drug Allergy light- Review Information.

5. Demographics - Go to Patient Information - Enter Name - Enter Address - Enter Any additional information - Choose responsible party - Enter Contacts - Click Save
6. Problem List - Go to the assessment section - Right click in the code section - Click on "List" - Choose ICD10 Code - Click submit - Any additional codes - Click Save.
7. Medication List - Go to Medication tab - Click on Medication History - Review list
8. Medication Allergy - Go to Medication tab - Click on Allergy add located in the red box to the right - Click on Allergy History- Click on all listed Allergies-Click Add to Allergy log.
9. Clinical Decision Support - Click on the light bulb located at the top right of the main screen - Click on a support plan listed - review info.
10. Implantable Device List - Go to the Procedure section - Right click in the code section - Click on "List" - Choose the implantable device codes - Click Save.
11. Clinical Information Reconciliation - Click on Assessment tab - Click on Problem history button - Click on previous problems - Click add to "Problem list".
12. Electronic Prescribing - Go to Medication tab - Choose a medication - Choose a dosage - select refills - select a pharmacy - Click Send Rx - Click Send

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

PROCEDURES

Upon arrival, participants were greeted; their identity was verified and matched with a name on the participant schedule. Participants were then assigned a participant ID. Each participant reviewed and signed an informed consent and release form. 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 experienced usability practitioners with 8 years of background experience in EHR environments.

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.

Following the session, the administrator gave the participant the post-test questionnaire compensated them for their time, and thanked each individual for their participation.

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

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

TEST LOCATION

The test facility included a waiting area and a quiet testing room with a table, computer for the participant, and recording computer for the administrator. Only the participant and administrator were in the test

room. All observers and the data logger worked from a separate room where they could see the participant's screen and face shot, and listen to the audio of the session. 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 EHR would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in physician's office. For testing, the computer used a Dell PC running Windows 7 Pro. The participants used a basic mouse and keyboard when interacting with the EHR.

The EHRUT used a 20" LED Monitor with 1920x1080 resolution. The application was set up by the Epromedical according to the vendor's documentation describing the system set-up and preparation. The application itself was running on a Full version of EproMedical using a training/testing database on a LAN/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

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

PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to the each participant:

Thank you for participating in this study. Your input is very important. Our session today will last about 45 minutes. During that time you will use an instance of an electronic health record. I will ask you to complete a few tasks using this system and answer some questions. You should complete the tasks as quickly as possible making as few errors as possible. Please try to complete the tasks on your own following the instructions very closely. Please note that we are not testing you we are testing the system, therefore if you have difficulty all this means is that something needs to be improved in the system. I will be here in case you need specific help, but I am not able to instruct you or provide help in how to use the application.

Overall, we are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. I did not have any involvement in its creation, so please be honest with your opinions. All of the information

that you provide will be kept confidential and your name will not be associated with your comments at any time. Should you feel it necessary you are able to withdraw at any time during the testing.

Following the procedural instructions, participants were shown the EHR and as their first task, were given time (45 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 12 tasks to complete. Tasks are listed in the moderator's guide.

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

DATASCORING

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

Measures	Rationale and Scoring
Effectiveness: Task Success	A task was counted as a "Success" if the participant was able to achieve the correct outcome, without assistance, within the time allotted on a per task basis. The total number of successes were calculated for each task and then divided by the total number of times that task was attempted. The results are provided as a percentage. Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used for task times in the Moderator's Guide must be operationally defined by taking multiple measures of optimal performance and multiplying by some factor that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 60 seconds then allotted task time performance was 75 (x 1.25) seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.
Effectiveness: Task Failures	If the participant abandoned the task, did not reach the correct answer or performed it incorrectly, or reached the end of the allotted time before successful completion, the task was counted as an "Failures." No task times were taken for errors. The total number of errors was calculated for each task and then divided by the total number of times that task was attempted. Not all deviations would be counted as errors. This should also be expressed as the mean number of failed tasks per participant. On a qualitative level, an enumeration of errors and error types should be collected.
Efficiency: Task Deviations	The participant's path (i.e., steps) through the application was recorded. Deviations occur if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, followed an incorrect link, or interacted incorrectly with an on-screen control. This path was compared to the optimal path. The number of steps in the observed path is divided by the number of optimal steps to provide a ratio of path deviation.

	It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.
Efficiency: Task Time	Each task was timed from when the administrator said "Begin" until the participant said, "Done." If he or she failed to say "Done," the time was stopped when the participant stopped performing the task. Only task times for tasks that were successfully completed were included in the average task time analysis. Average time per task was calculated for each task. Variance measures (standard deviation and standard error) were also calculated.
Satisfaction: Task Rating	Participant's subjective impression of the ease of use of the application was measured by administering both a simple post-task question as well as a post-session questionnaire. After each task, the participant was asked to rate "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across Participant's.[12] Common convention is that average ratings for systems judged easy to use should be 3.3 or above. To measure participants' confidence in and likeability of EproMedical 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."

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. We did not have any participants fail so we did not have to exclude any data.

The usability testing results for the EHRUT are detailed below. The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data should yield actionable results that, if corrected, yield material, positive impact on user performance.   The task time includes a buffer of 1.25 for 4 of the 10 users. (Part ID 901,902,903, &904) We gave a buffer to 4 of the 10 participants because 4 of the participants were less proficient with EHR than the other 4.

Measure Tasks	#	Task Success		Task Path			Task Time			Task Ratings 5=Easy
		Mean	SD%	Obs	Opt	SD'	Obs	Errors	Opt	
1. Computerized Provider Order Entry	10	100%	0%	7	6	1	.21	:30	:30	3
2. CPOE - Laboratory	10	100%	0%	7	7	0	.19	0	:30	4
3. CPOE – Diagnostic Imaging	10	100%	0%	7	7	0	.23	0	:30	4
4. Drug – Drug, Drug Allergy Interactions Check	10	100%	0%	4	3	1	.41	:42	:30	4
5. Demographics	10	100%	0%	8	8	0	.46	0	:60	3
6. Problem List	10	100%	0%	5	5	0	.53	0	:60	2
7. Medication List	10	100%	0%	4	4	0	.23	0	:30	4
8. Medication Allergy List	10	100%	0%	4	4	0	.41	0	:60	4
9. Clinical Decision support	10	100%	0%	3	3	0	.32	0	:60	3
10. Implantable Device List	10	100%	0%	4	4	0	.54	0	:60	4
11. Clinical Information Reconciliation & Incorp	10	100%	0%	4	4	0	.56	0	:60	3
12. Electronic Prescribing	10	100%	0%	7	7	0	.60	0	:60	3

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be 85. Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

Results Narrative

- 10 Participants were tested for CPOE - Medication and the results were passed for all 10 participants with the average time of 21 seconds. Participant 901 deviated from the path by clicking on the medication history button. The participant closed the box and continued on to finish the task.
- 10 Participants were tested for CPOE - Laboratory and the results were passed for all 10 participants with the average time of 19 seconds.
- 10 Participants were tested for CPOE - Diagnostic Imaging and the results were passed for all 10 participants with the average time of 23 seconds.

-10 Participants were tested for Drug to Drug allergy interactions checks and the results were passed for all 10 participants with the average time of 41 seconds. Participant 904 did deviate from the path by clicking the arrow to go to the next page. The participant clicked the back arrow to go back to the correct screen and continued on to finish the task.
- 10 Participants were tested for Demographics and the results were passed for all10 participants with the average time of 46 seconds.
- 10 Participants were tested for Problem List and the results were passed for all 10 participants with the average time of 53 seconds.
- 10 Participants were tested for Medication List and the results were passed for all 10 participants with the average time of 23 seconds.
-10 Participants were tested for Medication Allergy List and the results were passed for all 10 participants with the average time of 41 seconds.
- 10 Participants were tested for Clinical Decision Support and the results were passed for all 10 participants with the average time of 32 seconds.
- 10 Participants were tested for Implantable Device List and the results were passed for all 10 participants with the average time of 54 seconds.
- 10 Participants were tested for Clinical Information Reconciliation and the results were passed for all 10 participants with the average time of 56 seconds.
- 10 Participants were tested for Electronic Prescribing and the results were passed for all 10 participants with the average time of 1 minute.

EFFECTIVENESS

This program was a success. I believe this was a great learning lesson and the individuals that were in the program also felt the same way.

EFFICIENCY

While we were watching the individuals taking our test complete each item we were able to view how efficient the software is and what we can change down the road if anything.

SATISFACTION

All of the individuals taking our test were very satisfied with our modules and how they worked.

MAJOR FINDINGS

There were no major findings.

AREAS FOR IMPROVEMENT

There were no areas for improvement.

Recruiting Script   (Appendix 1)

Hello my name is _____ from Eprosystem. 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 would like to participate. This should only

take a few minutes of your time. This is strictly for research purposes. If you are

interested and qualify for the study, you will be paid to participate. Can I ask you a few

questions?

1. Are you in the medical field?

2. Have you participated in a focus group or usability test in the past *12* months? [If yes, Terminate]

3. Do you, or does anyone in your home, work in marketing research, usability research, web design […etc.]? [If yes, Terminate]

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company? [If yes, Terminate]

5. Which of the following best describes your age? [23 to 39; 40 to 59; 60 - to 74; 75 and older] [Recruit Mix]

6. Do you require any assistive technologies to use a computer? [if so, please describe]

7. Do you have experience with computers? If so how much?

Professional Demographics

8. What is your current position and title? (Must be healthcare provider)
    - ☐ RN: Specialty   _____
    - ☐ Physician: Specialty   _____ __
    - ☐ Resident: Specialty   _____
    - ☐ Administrative Staff
    - ☐ Other [Terminate]

9. How long have you held this position?

10. Describe your work location (or affiliation) and environment?

11. Which of the following describes your highest level of education? [e.g., high school graduate/GED, some college, college graduate (RN, BSN), postgraduate (MD/PhD), other (explain)]

Computer Expertise

12. Besides reading email, what professional activities do you do on the computer? [If no computer use at all, Terminate]

13. About how many hours per week do you spend on the computer?

14. What computer platform do you usually use?

15. What Internet browser(s) do you usually use?

16. In the last month, how often have you used an electronic health record?

17. How many years have you used an electronic health record?

18. How many EHRs do you use or are you familiar with?

19. How does your work environment patient records?
    - ☐ On paper
    - ☐ Some paper, some electronic
    - ☐ All electronic

Contact Information

Those are all the questions I have for you. Your background matches the people we're looking for. For your participation, you will be paid $50.00. [If so collect contact information]

May I get your contact information?

- Name of participant:
- Address:
- City, State, Zip:
- Cell phone number:
- Email address: