

Safety-enhanced Design

Edaris Health Emergisoft

Version 5.5

170.315 (a)(7) Medication List

Report content based on NISTR 7742, Customized Common Industry Format Template for Electronic Health Record Usability Testing.

Feature Tested: Edaris Health's Emergisoft 5.5

Date of Usability Testing: 3/15/2018

Edaris Health
Carolyn Doucette, Director of Emergisoft

1550 Soldiers Field Road Boston, MA 02135

All rights reserved. None of the content may be reproduced or transmitted in any form or by any means without the written permission of the distributor.

Table of Contents

| | |
|---------------------------------------|----|
| 1 EXECUTIVE SUMMARY | 3 |
| 2 INTRODUCTION | 6 |
| 3 METHOD | 7 |
| 3.1 PARTICIPANTS | 7 |
| 3.2 STUDY DESIGN | 8 |
| 3.3 TASKS | 8 |
| 3.4 PROCEDURE | 10 |
| 3.5 TEST LOCATION | 11 |
| 3.6 TEST ENVIRONMENT | 11 |
| 3.7 TEST FORMS AND TOOLS | 11 |
| 3.8 PARTICIPANT INSTRUCTIONS | 11 |
| 3.9 USABILITY METRICS | 12 |
| 4 RESULTS | 13 |
| 4.1 DATA ANALYSIS AND REPORTING | 13 |
| 4.2 DISCUSSION OF THE FINDINGS | 14 |

1 EXECUTIVE SUMMARY

Usability tests of Edaris Health's Emergisoft Version 2.0 Electronic Healthcare Records software were conducted on March 15, 2018 at with participants joining by web conference. The purpose of these tests was to validate the usability of the participant interface being developed and released in version 5.5 of the Emergisoft software, and provide evidence of usability in the EHR Under Test (EHRUT). During the usability tests, ten healthcare professionals matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative, tasks.

This study collected performance data on one measure for which certification was being sought for by demonstration. The following measure was tested during the usability testing event:

- 170.315 (a)(7) Medication List

During the 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 from participation at any time. None of the participants had any prior exposure to Emergisoft. 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, kept count of mouse clicks and monitored for alternate functional paths. The administrator gave the participants minor assistance in how to complete the task if needed, and such guidance was documented on the note taker tracking sheet.

Prior to testing, the test administrator reviewed the clinical workflow requirements that were being executed with the EHR and spent time with each candidate navigating similar tasks in the EHR to provide the candidate an introduction to the Emergisoft application.

Participant feedback was recorded for subsequent review and have been provided to the product development department. Each participant was given the opportunity to record their perception of ease of use and overall effectiveness in meeting clinical workflow requirements on each feature tested. Participants also completed a System Usability Survey (SUS) at the end of their testing experience.

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 posttest questionnaire and were compensated with a \$25 gift card for their time.

The following types of data were collected for each participant:

- Number of tasks successfully completed within the allotted time
- Time to complete the tasks

- Number and types of errors
- Path deviations
- Participant's verbalizations
- Participant's satisfaction ratings of the system

The UCD process used was based on NISTIR 7741 and various recommended metrics were used to evaluate the usability of Emergisoft. 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 Electronic Health Record Under Test (EHRUT.)

| Measure Task | N | Task Success | Path Deviation | Task Time | | Errors | Task Ratings 5=Easy |
|-------------------|-----------|--------------|--------------------------------|------------|-------------------------------|-----------|------------------------|
| | # of Task | Mean (SD) | Deviations (Observed /Optimal) | Mean (SD) | Deviations (Observed/Optimal) | Mean (SD) | Mean (SD) |
| Record Medication | 10 | 0.9 (0.3) | 1.13 | 185 (80) | 0.95 | 0.2(0.63) | 4.2 (0.6) |
| Change Medication | 10 | 0.95 (.16) | 1.0 | 148 (60.8) | 0.70 | 0.1(0.3) | 4.4 (0.5) |
| Access medication | 10 | 1.0 (0.0) | 1.1 | 185 (80) | 1.10 | 0.2(0.6) | 3.9 (1.3) |

An explanation of the summary table 1 is as follows:

- Number of tasks is a sum of the total number of tasks testing participants were asked to complete for the measure being tested.
- The success rate was calculated by taking the number of tasks completed successfully by all participants and dividing it by the total number of tasks assigned to all participants.
- Path deviation rate was calculated by the total number of path deviations observed divided by the total number of tasks completed by all test participants.
- Errors were defined as variances to tasks that the participant introduced, such as clicking on the wrong field or not selecting an item as specified in the script, and the measure failed
- Average measure time is the sum of the average times for each bank of tasks completed.

- Task efficiency is the participant's perception on how easy the task was to complete (time and navigation being considered)

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

- Major finding:

- Areas for improvement:

2 INTRODUCTION

The EHRUT tested for this study was the Edaris Health Emergisoft Medication List. Designed to present medical information to healthcare providers in emergency medicine settings, the EHRUT consists of an electronic chart with computerized provider order entry capabilities. The usability testing attempted to represent realistic exercises and conditions and used scripts and content as defined in the ONC 2015 Edition EHR Certification Scripts.

The purpose of this study was to test and validate the usability of the current participant interface and workflows, and provide evidence of usability in the EHR Under Test (EHRUT). To this end, measures of efficiency (pathway deviations, time to complete) and participant satisfaction, such as perceived ease of use, and feature navigation were captured during the usability testing.

3 METHOD

3.1 PARTICIPANTS

A total of ten participants were tested on the EHRUT. Participants in the test were familiar with patient care workflows and ranged in clinical experience. Participants were recruited by an Edaris Health employee based on clinical background and did not have any responsibilities or roles in the development of the Emergisoft product. Participants were given the opportunity to have the same orientation and level of training as the actual end participants would receive. For the test purposes, end-participant characteristics were identified and translated into a participant persona which was used to screen potential participants. This included clinicians with a strong understanding of the medication management process, which included management of orders, documentation of medications and allergies, documenting problems, working with clinical decision support, and performing clinical information reconciliation.

Table 2 below, summarizes participants by characteristics, including demographics, professional experience and computing experience. Recruited participants had a mix of backgrounds and demographic characteristics consistent with the user population found in an Emergency

settings. Participant names were replaced with ID numbers so that an individual's data cannot be tied back to the participant.

Participants were scheduled for one hour sessions, which included time for debrief by the administrator. A spreadsheet was used to keep track of the participant schedule.

Table 2

| Id | Gender | Credentials | Setting | Years of Professional Experience | Years of Personal or Professional Computer Use |
|-----------|---------------|--------------------|----------------|---|---|
| ID01 | M | MD | ED | 20 | 10 |
| ID02 | F | PA-C | ED | ED | 10+ |
| ID03 | F | PA-C | ED | 9 | 25 |
| ID04 | F | PA-C | ED | 14 | 30 |
| ID05 | F | Medical Assistant | ED | 5 | 10 |
| ID06 | F | PA-C | ED | 2 | 25 |
| ID07 | F | RN | ED | 8 | 10 |
| ID08 | M | BS | ED | 8 | 26 |
| ID09 | M | DDS | ED | 17 | 30 |
| ID10 | M | BS | ED | 0 | 10 |

3.2 STUDY DESIGN

Overall, the objective of this test was to uncover areas where the application performed well – that is, efficiency (pathway deviations, time to complete) and participant satisfaction, such as perceived ease of use– 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 new versions 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 the Edaris Health Emergisoft EHR software. Individual testing events were held on March 15, 2018 from various remote locations via web meeting. The same instructions were provided for all participants. A participant test guide was used to provide task instructions, record task results and record participant feedback.

Each feature was evaluated for efficiency, effectiveness, and satisfaction as defined by measures collected and analyzed for each participant:

- Number of tasks successfully completed within the allotted time
- Time to complete the tasks
- Number and types of errors
- Path deviations
- Participant's verbalizations (comments)
- Participant's satisfaction ratings of the EHR software

3.3 TASKS

Tasks were constructed that would be realistic and representative of the kinds of activities a user might do with this EHR in the Emergency settings.

a.7 Medication List

1. Record active medication
2. Change active medication
3. Access active medication list

3.4 PROCEDURES

Upon arrival, participants were greeted and their identity was verified. Participants signed sign-in register and were assigned a participant ID. Each participant reviewed and signed an informed consent and release form. The testing administrator witnessed the participant's signature.

To ensure that the test ran smoothly, individual instructions were given concerning the collection of measurement data.

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. The administrator tracked time, errors, path deviations, and comments.

Following the session, the administrator gave the participant the post-test questionnaire.

3.5 TEST LOCATION

The test facilities included a waiting area and a quiet testing room with a table and computer with an information and instruction guide with a list of tasks to be executed.

3.6 TEST ENVIRONMENT

To ensure that the environment was comfortable for participants, noise levels were kept to a minimum with the ambient temperature within a normal range as expected in the typical physician office or community health center environment. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants. The database used for testing was reset between participants to ensure that settings were the same at the start of each participants set.

3.7 TEST FORMS AND TOOLS

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

1. Informed Consent
2. Non-Disclosure
3. Acknowledgement of Receipt
4. Demographic Sheet
5. System Usability Survey
6. Task Usability Scale Survey
7. Moderator's Guide
8. Participant's Guide
9. Stopwatch
10. Go To Meeting for recording of sessions

3.8 PARTICIPANT INSTRUCTIONS

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

- As quickly as possible making as few errors and deviations as possible.
- Perform each task without assistance.

Administrators were allowed to give immaterial guidance and clarification on tasks, with limited instructions on use.

For each task, the participants were given a written copy of the task. Task timing began once the administrator finished reviewing the test script and ensured the participant understood the test objectives. 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 System Usability Survey.

Participants' demographic information, task success rate, time on task, errors, deviations, verbal responses, and system usability survey were recorded into a spreadsheet.

3.9 USABILITY METRICS

Usability Metrics

| Measures | Rationale and Scoring |
|--|--|
| Effectiveness: Task Success | <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. Task times were recorded for successes.</p> <p>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, was recorded when constructing tasks.</p> <p>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 a factor 2 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 $[60 * 2]$ seconds. This ratio was aggregated across tasks and reported with mean and variance scores.</p> |
| Effectiveness: Task Failures | <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 an "Failures." No task times for failed tasks or tasks that exceeded the target task time were used in calculations.</p> |
| Efficiency: Task Deviations | <p>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. The number of mouse clicks was collected and the standard deviation calculated.</p> <p>Path deviations are reported on a qualitative level for use in recommendations for improvement.</p> |
| Efficiency: Task Time | <p>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.</p> |
| Satisfaction: Task Rating | <p>Participant's subjective impression for efficiency and effectiveness were measured by administering a simple post-task question as well as a post-session questionnaire.</p> <p>After each task, the participant was asked to rate efficiency based upon number of mouse clicks, navigation and time it took to complete the task: "Overall, this task was."</p> |

| | |
|--|---|
| | <p>on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants.</p> <p>After each task, the participant was asked to rate effectiveness based upon meeting clinical requirements: "Overall, this task was:" on a scale of 1 (Very Difficult) to 5 (Very Easy). These data are averaged across participants.</p> <p>At the end of each session the participant was asked to complete the Software Usability Survey.</p> <p>To measure participants' confidence in and likeability of the Emergisoft system 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."</p> |
|--|---|

4 RESULTS

4.1 DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. 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.

| Measure Task | N | Task Success | Path Deviation | Task Time | | Errors | Task Ratings 5=Easy |
|-------------------|-----------|--------------|--------------------------------|------------|-------------------------------|-----------|------------------------|
| | # of Task | Mean (SD) | Deviations (Observed /Optimal) | Mean (SD) | Deviations (Observed/Optimal) | Mean (SD) | Mean (SD) |
| Record Medication | 10 | 0.9 (0.3) | 1.13 | 185 (80) | 0.95 | 0.2(0.63) | 4.2 (0.6) |
| Change Medication | 10 | 0.95 (.16) | 1.0 | 148 (60.8) | 0.70 | 0.1(0.3) | 4.4 (0.5) |
| Access medication | 10 | 1.0 (0.0) | 1.1 | 185 (80) | 1.10 | 0.2(0.6) | 3.9 (1.3) |

The results should be seen in light of the objectives and goals outlined in Section 3.2 Study Design. The data yields actionable results that, if corrected, yield material, positive impact on participant performance and improved usability of EHRUT.

4.2 DISCUSSION OF THE FINDINGS

SATISFACTION

All of the users were provided a system usability scale test with the intent to measure their overall feelings toward the Emergisoft product. An important step in the process of executing this test was to accurately measure the end users' satisfaction in handling and executing the requested tasks. While some participants had some difficulty the overwhelming reaction was in favor of satisfaction. The vast majority of the participants were not on either extreme (i.e., 1 or 5) of the scale and it was reported, when asked if the user felt "very" confident using the system, users scored Emergisoft 2.0 with an average score of 3.85.

MAJOR FINDINGS

4.2 – a.7 Medication List

Recording Medications in two failed attempts to add medications properly. Both of the users that failed the task entered the data in the wrong module. The error occurred when they added the medication—as described—but in the wrong area of the application.

AREAS FOR IMPROVEMENT

4.2 – a.7 Medication List

Enhance and link current medication charting screen to IV screen for IVPB documentation. Charting a medication with a route of IVPB links documentation over to IV charting screen.