EHR Usability Test Report - eZDocs EHR Version 5.0

Version 1.0

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EXECUTIVE SUMMARY

A usability test of eZDocs EHR version 5.0 was conducted on 30th October 2019 & December 23rd 2019 in Crest hill & New Lenox IL by Dexter Solutions 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, 10 healthcare providers matching the target demographic criteria served as participants and used the EHRUT in simulated, but representative tasks. This study collected performance data on the below mentioned tasks typically conducted on an EHR:

1. § 170.315 (a)(1) Computerized Provider Order Entry (CPOE) – medications
2. § 170.315 (a)(2) CPOE – laboratory
3. § 170.315 (a)(3) CPOE – diagnostic imaging
4. § 170.315 (a)(4) Drug-drug, Drug-allergy Interaction Checks for CPOE
5. § 170.315 (a)(5) Demographics
6. § 170.315 (a)(6) Problem List
7. § 170.315 (a)(7) Medication List
8. § 170.315 (a)(8) Medication Allergy List
9. § 170.315 (a)(9) Clinical Decision Support
10. § 170.315 (a)(14) Implantable Device List
11. § 170.315 (b)(2) Clinical Information Reconciliation and Incorporation
12. § 170.315 (b)(3) Electronic Prescribing

During the 15 minute one-on-one usability test, each participant was asked to review and sign an informed consent/release form (included in Appendix 3); Participants had prior experience with the EHR. Adequate training was provided to all users as per the normal training procedures.

The administrator introduced the test, and instructed participants to complete a series of tasks using the EZDOCS. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper. The administrator did not give the participant assistance in how to complete the task. The tests were

1) Timed
2) No assistance was provided during the testing.
3) User performance was recorded manually on paper.

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. No compensation was provided.

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 EZDOCS. Following is a summary of the performance and rating data collected on the EZDOCS.

<table>
<thead>
<tr>
<th>Task</th>
<th>Measure</th>
<th>N</th>
<th>Task Success</th>
<th>Path Deviation</th>
<th>Task Time</th>
<th>Errors</th>
<th>Task Ratings 5=Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain Active Medication List</td>
<td>T1</td>
<td>100/ (0)</td>
<td>7/6</td>
<td>39(5)</td>
<td>35/39</td>
<td>0</td>
<td>5(1)</td>
</tr>
<tr>
<td>Maintain Active Allergy List</td>
<td>T2</td>
<td>100/ (0)</td>
<td>7/5</td>
<td>25(1)</td>
<td>25/25</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>CPOE Medication Orders</td>
<td>T3</td>
<td>100/ (0)</td>
<td>22/21</td>
<td>41(4)</td>
<td>40/41</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>CPOE Laboratory Orders</td>
<td>T4</td>
<td>100/ (0)</td>
<td>9/9</td>
<td>37(4)</td>
<td>35/37</td>
<td>0</td>
<td>5(1)</td>
</tr>
<tr>
<td>CPOE Radiology Orders</td>
<td>T5</td>
<td>100/ (0)</td>
<td>9/9</td>
<td>37(4)</td>
<td>35/37</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>Clinical Information Reconciliation</td>
<td>T6</td>
<td>100/ (0)</td>
<td>24/21</td>
<td>60(8)</td>
<td>50/60</td>
<td>0</td>
<td>3(1)</td>
</tr>
<tr>
<td>Maintain Patient Demographics</td>
<td>T7</td>
<td>100/ (0)</td>
<td>7/6</td>
<td>40(8)</td>
<td>35/40</td>
<td>0</td>
<td>4(1)</td>
</tr>
<tr>
<td>Maintain Active Problem List</td>
<td>T8</td>
<td>100/ (0)</td>
<td>7/6</td>
<td>41(9)</td>
<td>35/41</td>
<td>0</td>
<td>4(1)</td>
</tr>
<tr>
<td>Maintain Implantable Device List</td>
<td>T9</td>
<td>100/ (0)</td>
<td>6/4</td>
<td>54(7)</td>
<td>45/54</td>
<td>0</td>
<td>3(1)</td>
</tr>
<tr>
<td>E-Prescription</td>
<td>T10</td>
<td>100/ (0)</td>
<td>12/10</td>
<td>57(8)</td>
<td>60/57</td>
<td>0</td>
<td>5(1)</td>
</tr>
<tr>
<td>Drug to Drug Allergy Notifications</td>
<td>T11</td>
<td>100/ (0)</td>
<td>1/1</td>
<td>11(2)</td>
<td>10/11</td>
<td>0</td>
<td>5(0)</td>
</tr>
</tbody>
</table>
The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be satisfactory.

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

**Maintain Active Medication List:**
User has to click on the “Select to Move to Current Meds” button in order to move the medications to the current medication list. If the user forgets to click on the button then it leaves the medications in an “In Process” state for the doctor to complete the processing. This leads to double work for the user to delete the already entered medications and reenter them.

**E-Prescriptions:**
Pharmacy search is not very intuitive and is very sensitive to searching based on free text. Any typos in the medication name lead to incorrect search results.

**Areas for improvement:**
1) CDS rule notification can be made a little bit more prominent. The Red icon on the top may not be seen every time by the user.
2) Medication Reconciliation process does not give an opportunity to the user to undo deleted medications / problems / allergies.

**INTRODUCTION**
The EHRUT tested for this study was eZDocs EHR Version 5.0, designed to present medical information to healthcare providers in small to medium sized practices. The usability testing attempted to represent realistic exercises and conditions in most commonly used functionality as listed above.

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 average time taken to complete the task, ease of navigation etc were captured during the usability testing.

**UCD PROCESS APPLIED**
No standard process was followed. UCD process followed was home grown process to keep it simple and effective.

Due to the cost and small user base of eZDocs, usage of UCD standards were not found cost effective.

**USER CENTERED DESIGN PROCESS**
User centered design process is broken down into 5 steps
1) SCOPE – First step is to determine the scope of the requirement. It is used to determine the goals, constraints and influence on other modules.

2) ANALYZE – Analyze stage in stage of analyzing the user. Model representation of your ideal user based on their roles

3) DESIGN – Once the scope and analysis phase is completed a wireframe or prototype should be created. Based on the scope and constraints a minimum viable product release can also be done.

4) VALIDATE – In this stage we should validate whether the design is fully effective as per requirements. A usability testing can / should be performed at this stage to validate the requirements.

5) DELIVER – Accept all stages and put your design into production. This stage also means going back to the scope, Reiterating, testing and improving your product.

OUTLINE OF THE TESTING PROCESS

With focus on the end users, the following steps were outlined for conducting the

1) Define the target group – selection of the users was based on their age, education, expertise with the product and computer literacy. We tried to the target group as diverse as possible within our user base

2) Define with user scenarios – User scenarios were designed keeping in mind the stage 3 requirements for PI activities. Users were briefly trained on the scenarios before the actual test.

3) Create Use Cases for each test – A detailed step by step process for created for each task and the expected duration of each task.

4) Test with users – each user was given 3-4 task based on their profile. Readings for each task were recorded.

METHOD

PARTICIPANTS

A total of 10 participants were tested on the EZDOCS. Participants in the test were Doctors and Medical Assistants / Nurses. Participants were from existing practices using current version of EZDOCS. In addition, participants had no direct connection to the development of or organization producing the EZDOCS.

Participants were not from the testing or supplier organization. Participants were given 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]. Participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, professional experience, computing experience and user needs for assistive technology. Participant names were replaced with Participant ID’s so that an individual’s data cannot be tied back to individual identities.
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. 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, 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:

For Medical Assistant / Certified Nurse

1) Maintain Active Medication List (Optimal time: 35 Seconds)
   1. Find Test Patient1 using a few characters of their last name and first name.
   2. Pull the chart
   3. Click on the “Add Current Medications & Allergy” button
   4. Add the following medications
      a. Metformin 1000 mg BID, 90 Days Supply with 3 refills.
      b. Januvia 100 mg 1 Daily, 90 Days Supply
   5. Click on the “Select to move to current Medications” button to add entered medication as current medication.
   6. Close the window to return to EHR.

2) Maintain Active Allergy List (Optimal time: 25 Seconds)
   1. Find Test Patient1 using a few characters of their last name and first name.
   2. Pull the chart
   3. Click on the “Add Current Medications & Allergy” button
   4. Add the following Allergy
      a. Penicillin.
   5. Close the window to go back to the EHR.

3) CPOE:
   Medication Order: (Optimal time: 40 Seconds)
   1. Find Test Patient1 using a few characters of their last name and first name.
   2. Pull the chart
   3. Click on the “e-Prescription” button
   4. Add a medication order with the following details
      a. Amoxicillin 1000 mg BID, 90 Days Supply with 3 refills.
      b. Lasix 1 tablet daily
      c. Digoxin 1 tablet daily
      Drug Search, Select the medication, Add the dosage, Add refills, Click on Save Rx button.
   5. Leave the Medication order for approval and completion by the doctor.
   6. Close the window to go back to the EHR.

   Laboratory Order: (Optimal time: 35 Seconds)
   1. Find Test Patient1 using a few characters of their last name and first name.
   2. Pull the chart
   3. Click on Orders – New Order menu item. Select Laboratory Order as Order Type
   4. Add the following tests
a. Hemoglobin A1C
b. Metabolic Panel
   Select test, Click on add test button (2 times)
5. Save and Leave the order for approval and completion by the doctor.

**Radiology Order: (Optimal time: 35 Seconds)**
1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on Orders – New Order menu item. Select Order type as Radiology Order
4. Add the following tests
   a. X Ray of Chest
5. Save and Leave the order for approval and completion by the doctor.

**4) Clinical Information Reconciliation & Incorporation (Optimal time: 50 Seconds)**
1. Click on the messages tab / link on home page.
2. Select and import the incoming direct email from test referring provider.
3. Map the incoming message to the patient
4. Check on the Incorporate Data check box
5. Click on the Incorporate Data button. Wait for the confirmation message.
6. Click on the reconcile button
7. Reconcile the medications. Select the medication from both internal and external sources and click on the reconcile button. Once you see the final list on the reconcile grid click on the submit button. (4 steps)
8. Reconcile allergies. Select the Allergies from both internal and external sources and click on the reconcile button. Once you see the final list on the reconcile grid click on the submit button. (4 steps)
9. Reconcile problems. Select the Problems from both internal and external sources and click on the reconcile button. Once you see the final list on the reconcile grid click on the submit button. (4 steps)

**5) Maintain Demographics Information (Optimal time: 35 Seconds)**
1. Search for the patient on the home page.
2. Go to Patient Menu -> Administration -> Patient Demographics
3. Enter Patients Name, Date of birth, contact information, race, ethnicity & language preferences.
4. Save and update demographics information

**6) Maintain Active Problem List Information (Optimal time: 35 Seconds)**
1. Search for the patient on the home page.
2. Click on the pull chart button
3. Click on the problem list button
4. Search and enter new ICD 10 code for Hypertension and Diabetes Mellitus and save it to patients chart.
5. Open Patients chart once again and Inactivate Hypertension diagnosis for the patient.
6. Select SNOMED CT as the coding system and find code for “General Encounter” and save the information in the patients chart.
7) Maintain Implantable Device List  (Optimal time: 45 Seconds)
   1. Search for the patient on the home page.
   2. Click on the pull chart button
   3. Click on the Implantable list button
   4. Search and enter new implantable device information
   5. Save it to patients chart.

For Doctor:

1. E-Prescription  (Optimal time: 60 Seconds)
   1. Find Test Patient1 using a few characters of their last name and first name.
   2. Pull the chart
   3. Click on the “e-Prescription” button
   4. Complete the CPOE task as entered by the Medical Assistant and transmit prescription electronically
   5. Compose a new medication order
   6. Search for the Drug
   7. Select the drug and add dosage information
   8. Click on Transmit Rx button
   9. Search and select for Pharmacy
   10. Transmit the medications to the pharmacy electronically.

2. Drug to Drug Allergy Notifications  (Optimal time: 5 Seconds)
   1. Observe the drug to drug and drug to allergy interactions when e-Prescribing.

3. Clinical Decision Support  (Optimal time: 45 Seconds)
   1. Find Test Patient 1 using a few characters of their last name and first name.
   2. Record an encounter
   3. Add
      a. diagnosis 250.02 (DM)
      b. Vitals – BP: 160 / 100
   4. Click on “Save” button to see CDS notifications.
   5. Click on the links on the notification window to see details of the CDS.

PROCEDURES

Upon arrival, participants were assigned a participant ID. Each participant reviewed and signed an informed consent and release form (See Appendix 3). A representative from the test team witnessed the participant’s signature.
To ensure that the test ran smoothly, 1 staff members participated in this test and recorded data. The usability testing staff conducting the test was experienced in using the EZDOCS.

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) and thanked each individual for their participation.

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

**TEST LOCATION & DATE**

The test was performed at the doctor’s office located at

1. 2222 Weber Rd, Crest Hill IL 60403.
   a. Date of Test: 10/31/2019 & 12/23/2019
2. 1480 Silver cross Blvd, New Lenox IL 60415
   a. Date of Test: 10/31/2019 & 12/23/2019

**TEST ENVIRONMENT**

The testing was conducted at the doctor’s office premise. For testing, the computer used an Intel i5 processor running windows 10 operating system. The participants used a mouse and keyboard when interacting with the EZDOCS.

The EZDOCS used standard 21” wide screen monitors with a minimum resolution of 1280 x 1024 pixels. 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 Microsoft .Net Framework using a test database on a LAN connection.

Technically, the system performance (i.e., response time) was representative to what actual users would experience in a field implementation.
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. 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 EZDOCS was captured and recorded manually.
PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant (also see the full moderator’s guide in Appendix [B4]):

Thank you for participating in this study. Your input is very important. Our session today will last about 15 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 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 task. I will ask you your impressions about the task once you are done.

Participants based on their roles (Medical assistant / Doctor) were then given 4 tasks to complete. Tasks are listed in the moderator’s guide in Appendix [B4].

USABILITY METRICS

Metrics for effectiveness, efficiency and user satisfaction were captured during the usability testing. The goals of the test were to assess:

1. Effectiveness of eZDocs EHR by measuring participant success rates and errors
2. Efficiency of eZDocs EHR by measuring the average task time and path deviations
3. Satisfaction with eZDocs EHR by measuring ease of use ratings
**DATA SCORING**

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

<table>
<thead>
<tr>
<th>Measures</th>
<th>Rationale and Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effectiveness:</strong></td>
<td>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 factor of 1.5 that allows some time buffer because the participants are presumably not trained to expert performance. Thus, if expert, optimal performance on a task was 40 seconds then allotted task time performance was 60 seconds.</td>
</tr>
<tr>
<td><strong>Task Success</strong></td>
<td>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 “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.</td>
</tr>
<tr>
<td><strong>Task Failures</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Efficiency:</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Task Deviations</strong></td>
<td>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 the EZDOCS overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, “I think I would like to use this system frequently,” “I thought the system was easy to use,” and “I would imagine that most people would learn to use this system very quickly.” See full System Usability Score questionnaire in Appendix 3.</td>
</tr>
</tbody>
</table>
RESULTS

DATA ANALYSIS AND REPORTING

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

The usability testing results for the EZDOCS are detailed below:

<table>
<thead>
<tr>
<th>Task</th>
<th>Measure</th>
<th>N</th>
<th>Task Success</th>
<th>Path Deviation</th>
<th>Task Time</th>
<th>Errors</th>
<th>Task Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td></td>
<td>Mean / (SD)</td>
<td>Deviations (Observed / Optimal)</td>
<td>Mean (SD)</td>
<td>Deviations (Optimal / Observed)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>T1</td>
<td>Maintain Active Medication List</td>
<td>100/ (0)</td>
<td>3/0</td>
<td>39(5)</td>
<td>35/39</td>
<td>0</td>
<td>5(1)</td>
</tr>
<tr>
<td>T2</td>
<td>Maintain Active Allergy List</td>
<td>100/ (0)</td>
<td>4/0</td>
<td>25(1)</td>
<td>25/25</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>T3</td>
<td>CPOE Medication Orders</td>
<td>100/ (0)</td>
<td>1/0</td>
<td>41(4)</td>
<td>40/41</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>T4</td>
<td>CPOE Laboratory Orders</td>
<td>100/ (0)</td>
<td>0/0</td>
<td>37(4)</td>
<td>35/37</td>
<td>0</td>
<td>5(1)</td>
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<td>T5</td>
<td>CPOE Radiology Orders</td>
<td>100/ (0)</td>
<td>0/0</td>
<td>37(4)</td>
<td>35/37</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>T6</td>
<td>Clinical Information Reconciliation</td>
<td>100/ (0)</td>
<td>9/1</td>
<td>60(8)</td>
<td>50/60</td>
<td>0</td>
<td>3(1)</td>
</tr>
<tr>
<td>T7</td>
<td>Maintain Patient Demographics</td>
<td>100/ (0)</td>
<td>2/0</td>
<td>40(8)</td>
<td>35/40</td>
<td>0</td>
<td>4(1)</td>
</tr>
<tr>
<td>T8</td>
<td>Maintain Active Problem List</td>
<td>100/ (0)</td>
<td>1/0</td>
<td>41(9)</td>
<td>35/41</td>
<td>0</td>
<td>4(1)</td>
</tr>
<tr>
<td>T9</td>
<td>Maintain Implantable Device List</td>
<td>100/ (0)</td>
<td>2/0</td>
<td>54(7)</td>
<td>45/54</td>
<td>0</td>
<td>3(1)</td>
</tr>
<tr>
<td>T10</td>
<td>E-Prescription</td>
<td>100/ (0)</td>
<td>5/0</td>
<td>57(8)</td>
<td>60/57</td>
<td>0</td>
<td>5(1)</td>
</tr>
<tr>
<td>T11</td>
<td>Drug to Drug Allergy Notifications</td>
<td>100/ (0)</td>
<td>0/0</td>
<td>11(2)</td>
<td>10/11</td>
<td>0</td>
<td>5(0)</td>
</tr>
<tr>
<td>T12</td>
<td>Clinical Decision Support</td>
<td>100/ (0)</td>
<td>3/0</td>
<td>48(4)</td>
<td>45/48</td>
<td>0</td>
<td>5(1)</td>
</tr>
</tbody>
</table>

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 95%
DISCUSSION OF THE FINDINGS

EFFECTIVENESS
Users could effectively use the eZDocs EHR, there were no failures observed but some deviations in the steps were observed.

EFFICIENCY
Users could complete most of the task within allocated task time efficiently.

SATISFACTION
Users expressed satisfaction in the general usage of the system, they found the navigation to different sections of the application easy.

MAJOR FINDINGS
Users found it difficult to find and enter Implantable device list as they have never implanted devices in the office.

Users forgot to select Snomed CT as the Coding system when adding Snomed CT codes in patient problem list.

Providers found e-prescribing very intuitive and easy to use.

AREAS FOR IMPROVEMENT
The following areas of improvement were observed.

- Active allergies list should be made visible at all times on the patients chart in red.
- Clinical information Reconciliation process does not let you go back to incorporated data to reconcile clinical information if the user closed the pop up before reconciliation is completed.
- Ethnicity and Language preferences should be defaulted to “Non Hispanic” and English while maintaining demographics information.
- More documentation and training is needed for the implantable devices if this functionality will be used by the practice (in future)
- Snomed CT based diagnosis codes should be listed separately and not combined with ICD 10 codes. These codes should not be displayed when ordering labs and radiology orders.
APPENDICES

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

1: Participant demographics
2: Moderator’s Guide
3: System Usability Scale Questionnaire
4: Incentive receipt and acknowledgment form
Appendix 1:

PARTICIPANT DEMOGRAPHICS

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

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

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>2</td>
</tr>
<tr>
<td>Women</td>
<td>8</td>
</tr>
<tr>
<td>Total (participants)</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation/Role</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RN/BSN</td>
<td>2</td>
</tr>
<tr>
<td>Physician</td>
<td>3</td>
</tr>
<tr>
<td>Admin Staff</td>
<td>1</td>
</tr>
<tr>
<td>Medical Assistants</td>
<td>3</td>
</tr>
<tr>
<td>Office Manager</td>
<td>1</td>
</tr>
<tr>
<td>Total (participants)</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Use of EHR</td>
<td></td>
</tr>
<tr>
<td>All paper</td>
<td>1</td>
</tr>
<tr>
<td>Some paper, some electronic</td>
<td>2</td>
</tr>
<tr>
<td>All electronic</td>
<td>3</td>
</tr>
<tr>
<td>Total (participants)</td>
<td>10</td>
</tr>
</tbody>
</table>
Appendix 2:

MODERATOR’S GUIDE

eZDocs EHR Ver. 5.0 Usability Test

Administrator: Rakesh Vedavyas
Data Logger: Chenise Smith
Date: 10/30/2019
Time: 1:00 PM
Participants: 5
Location: 2222 Weber Rd, Crest Hill IL 60403

Administrator: Rakesh Vedavyas
Data Logger: Chenise Smith
Date: 10/30/2019
Time: 3:00 PM
Participants: 5
Location: 1840 Silver Cross Blvd, New Lenox IL 60415

Prior to testing

- Confirm schedule with Participants
- Ensure eZDOCS lab environment is running properly
- Ensure lab and data recording equipment is running properly

Prior to each participant:

- Reset application
- Start session recordings with tool

Prior to each task:

- Reset application to starting point for next task

After each participant:

- End session recordings with tool

After all testing

- Back up all data files
Orientation (15 minutes)

Thank you for participating in this study. Our session today will last **15 minutes**. During that time you will take a look at an eZDocs EHR.

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 help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

The product you will be using today is eZDocs EHR v 5.0 which is an early release of stage 3 certified versions.

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

Do you have any questions or concerns?
Task 1: Maintain Active Medication List (Optimal time: 45 Seconds)

1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on the “Add Current Medications & Allergy” button
4. Add the following medications
   a. Metformin 1000 mg BID, 90 Days Supply with 3 refills.
   b. Januvia 100 mg 1 Daily, 90 Days Supply
5. Click on the “Select to move to current Medications” button to add entered medication as current medication.
6. Close the window to return to EHR.

Success:

- __Easily completed
- __Completed with difficulty or help :: Describe below
- __Not completed

Comments:

Task Time: ________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ Current Meds & Allergy ➔ “Select to Move to Current Meds” Button ➔ Click X

- __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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 2: Maintain Active Allergy List (Optimal time: 25 Seconds)

1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on the “Add Current Medications & Allergy” button
4. Add the following Allergy
   a. Penicillin.
5. Close the window to go back to the EHR.

Success:

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

Comments:

Task Time: _______ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ Current Meds & Allergy ➔ Click X

- ___ 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 3: CPOE (Optimal time: 150 Seconds)

Medication Order: (Optimal time: 60 Seconds)
1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Add a medication order with the following details
   a. Amoxicillin 1000 mg BID, 90 Days Supply with 3 refills.
   b. Lasix 1 tablet daily
   c. Digoxin 1 tablet daily
4. Leave the Medication order for approval and completion by the doctor.

Laboratory Order: (Optimal time: 45 Seconds)
1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on Orders – New Order menu item. Select Order Type as Laboratory Order
4. Add the following tests
   a. Hemoglobin A1C
   b. Metabolic Panel
5. Save and Leave the order for approval and completion by the doctor.

Radiology Order: (Optimal time: 45 Seconds)
1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on Orders – New Order menu item. Select Order Type as Radiology Order
4. Add the following tests
   a. X-Ray of Chest
5. Save and Leave the order for approval and completion by the doctor.

Success:
- ___Easily completed
- ___Completed with difficulty or help :: Describe below
- ___Not completed

Task Time: ________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ Order ➔ New Order ➔ Click X

- ___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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:

Task 4: Clinical Information Reconciliation (Optimal time: 60 Seconds)

1. Click on the messages tab / link on home page.
2. Select and import the incoming direct email from test referring provider.
3. Reconcile the medications, allergies and problems.

Success:

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

Comments:

Task Time: ________ Seconds

Optimal Path: Home Page ➔ Messages ➔ Import Data ➔ Click X

- ___ 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 5: Maintain Patient Demographics (Optimal time: 60 Seconds)

1. Search for the patient on the home page.
2. Go to Patient Menu -> Administration -> Patient Demographics
3. Enter Patients Name, Date of birth, contact information, race, ethnicity & language preferences.
4. Save and update demographics information

Success:

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

Comments:

Task Time: ________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ ePrescription ➔ Click X

- ____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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 6: Maintain Active Problem List (Optimal time: 60 Seconds)

1. Search for the patient on the home page.
2. Click on the pull chart button
3. Click on the problem list button
4. Search and enter new ICD 10 code for Hypertension and Diabetes Mellitus and save it to patients chart.
5. Open Patients chart once again and Inactivate Hypertension diagnosis for the patient.
6. Select SNOMED CT as the coding system and find code for “General Encounter” and save the information in the patients chart.

Success:

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

Comments:

Task Time: [ ] Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ ePrescription ➔ Click X

- [ ] 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 8: Maintain Implantable Device List (Optimal time: 60 Seconds)

1. Search for the patient on the home page.
2. Click on the pull chart button
3. Click on the Implantable list button
4. Search and enter new implantable device information and save it to patients chart.

Success:

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

Comments:

Task Time: _______ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ ePrescription ➔ Click X

- 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 9: E-Prescription  (Optimal time: 60 Seconds)

1. Find Test Patient1 using a few characters of their last name and first name.
2. Pull the chart
3. Click on the “e-Prescription” button
4. Complete the CPOE task as entered by the Medical Assistant and transmit prescription electronically

Success:

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

Comments:

Task Time: __________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ ePrescription ➔ Click X

- _____ 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 10: Drug to Drug Allergy Notifications  (Optimal time: 15 Seconds)
1. Observe the drug to drug and drug to allergy interactions when e-Prescribing.

Success:

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

Comments:

Task Time: __________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ ePrescription ➔ Click X

- _____ 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker Comments:
Task 11: Clinical Decision Support (Optimal time: 45 Seconds)

1. Find Test Patient 1 using a few characters of their last name and first name.
2. Record an encounter
3. Add
   a. diagnosis E11.85 (DM)
   b. Vitals – BP: 160 / 100
4. Click on “Save” button to see CDS notifications.
5. Click on the links on the notification window to see details of the CDS.

Success:

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

Comments:

Task Time: ________ Seconds

Optimal Path: Home Page ➔ Pull Chart ➔ Record Encounter

- _____ 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 Easy” (1) to “Very Difficult” (5)

Administrator / Note taker 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 3: SYSTEM USABILITY SCALE QUESTIONNAIRE

On a scale of 1 to 5 please rate the following questions. 1 – Strongly Agree. 5 – Strongly Disagree

<table>
<thead>
<tr>
<th>Description</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that I would like to use this system frequently</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found the system unnecessarily complex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought the system was easy to use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think that I would need the support of a technical person to be able to use this system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found the various functions in this system were well integrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought there was too much inconsistency in this system</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I would imagine that most people would learn to use this system very quickly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found the system very cumbersome to use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I felt very confident using the system</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I needed to learn a lot of things before I could get going with this system</td>
<td></td>
<td></td>
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</table>