EHR Usability Test Report of BESTCare 2.0B


BESTCare 2.0B

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15-Nov-10
EXECUTIVE SUMMARY

A usability test of BESTCare 2.0B was conducted on 01/11/2018 in Healthcare Innovation Park (HIP), South Korea by ezCaretech. 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 9 tasks typically conducted an EHR:

- Find a patient on Patient List
- Give orders to a patient and check drug-allergy interaction
- Check drug-drug interaction and change the severity level
- Change orders and display CPOE
- Record, change, and display a patient’s demographics
- Record, change, and display a patient’s problem list
- Record, change, and access a patient’s medication list
- Record, change, and access a patient’s medication allergy list
- Record and parse a Unique Device Identifier (UDI) and display an implantable device list

During the 120 minutes’ one-on-one usability test, each participant was greeted by the administrator and asked to review and sign an informed consent/release form (included in Appendix 3); they were instructed that they could withdraw at any time. Some participants had prior experience with the EHR.

The administrator explained the processes of the 9 tasks to all participants. The administrator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHRUT. During the testing, the administrator timed the test and, along with the data logger(s) recorded user performance data on paper and electronically. The administrator did not give the participant assistance in how to complete the task.

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 $300 for their time.

Various recommended metrics, in accordance with the examples set forth in the *NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records*, were used to evaluate the usability of the EHRUT. Following is a summary of the performance and rating data collected on the EHRUT. [Table1]

<table>
<thead>
<tr>
<th>Measure</th>
<th>Task</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 (Observed / Optimal)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>1. Find a patient on Patient List</td>
<td>10</td>
<td>90% (31.6)</td>
<td>3/3</td>
<td>29 (11)</td>
<td>29 / 20</td>
<td>10% (31.6)</td>
<td>4.8 (0.4)</td>
</tr>
<tr>
<td>2. Give orders to the patient and check drug-allergy interaction</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/7</td>
<td>130 (40)</td>
<td>130 / 110</td>
<td>10% (31.6)</td>
<td>4.2 (0.6)</td>
</tr>
<tr>
<td>3. Check drug-drug interaction and change the severity level</td>
<td>10</td>
<td>90% (31.6)</td>
<td>11/10</td>
<td>141 (44)</td>
<td>141 / 120</td>
<td>10% (31.6)</td>
<td>4.0 (0.8)</td>
</tr>
<tr>
<td>4. Change orders and display CPOE</td>
<td>10</td>
<td>90% (31.6)</td>
<td>11/10</td>
<td>147 (32)</td>
<td>147 / 130</td>
<td>10% (31.6)</td>
<td>4.1 (0.6)</td>
</tr>
<tr>
<td>5. Record, change, and display the patient’s demographics</td>
<td>10</td>
<td>90% (31.6)</td>
<td>24/23</td>
<td>385 (54)</td>
<td>385 / 320</td>
<td>10% (31.6)</td>
<td>3.6 (1.0)</td>
</tr>
<tr>
<td>6. Record, change, and display the patient’s problem list</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/8</td>
<td>139 (37)</td>
<td>139 / 130</td>
<td>10% (31.6)</td>
<td>4.0 (0.8)</td>
</tr>
<tr>
<td>7. Record, change, and access the patient’s medication list</td>
<td>10</td>
<td>100% (0)</td>
<td>10/10</td>
<td>193 (44)</td>
<td>193 / 180</td>
<td>0% (0)</td>
<td>3.8 (0.8)</td>
</tr>
<tr>
<td>8. Record, change, and access the patient’s medication allergy list</td>
<td>10</td>
<td>80% (42.2)</td>
<td>10/9</td>
<td>237 (55)</td>
<td>237 / 200</td>
<td>20% (42.2)</td>
<td>4.0 (0.7)</td>
</tr>
<tr>
<td>9. Record and parse a UDI and display an implantable device list</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/7</td>
<td>104 (28)</td>
<td>104 / 100</td>
<td>10% (31.6)</td>
<td>4.5 (0.7)</td>
</tr>
</tbody>
</table>

Table 1. Summary of the performance and rating data

The results from the System Usability Scale scored the subjective satisfaction with the system based on performance with these tasks to be: 84 (SD = 12)

In addition to the performance data, the following qualitative observations were made:
- Major findings and Areas for improvement

  **Order Entry (CPOE)**

  Some participants had difficulty finding the ‘reason for order’ field. It would be important to instruct end-users on the data entry of this field. It also appears necessary that an error message should be displayed when the field is left blank.

  **Patient’s demographics**

  The screen contains too much information, displayed with myriads of columns. Participants expressed confusion, and found the task arduous, especially when locating and entering a given data. All participants were not familiar with the idea of race and ethnicity, and had a difficult time understanding and recording the data. It appears necessary to simplify and redesign the screen layout.

  **Medication Allergy List**

  Participants notified spelling mistakes on the allergy screen. The mistakes should be corrected and all information on screen should be free of errors.
INTRODUCTION

The EHRUT tested for this study was BESTCare 2.0B. Designed to present medical information to healthcare providers in ambulatory and inpatient settings; the EHRUT consists of various modules, named Clinical Care, Nursing, Pharmacy, Nutrition, Patient Administration, HIM, and etc. 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 success rate, time on task, path deviation, ratings for each task, and SUS score were captured during the usability testing.

METHOD

PARTICIPANTS

A total of 10 participants were tested on the EHRUT(s). Participants in the test were 4 doctors and 6 nurses. Participants were recruited by ezCaretech supporting team and were compensated $300 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 a similar orientation and level of training as the actual end users would have received.

For the test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants; an example of a screener is provided in Appendix [1].

Recruited participants had a mix of backgrounds and demographic characteristics conforming to the recruitment screener. The following is a table of participants by characteristics, including demographics, education, professional experience, computing experience and user needs for assistive technology. Participant names were replaced with Participant IDs so that an individual’s data cannot be tied back to individual identities.
<table>
<thead>
<tr>
<th>Part ID</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Occupation/role</th>
<th>Professional Experience (months)</th>
<th>Computer Experience (months)</th>
<th>Product Experience (months)</th>
<th>Assistive Technology Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>30-39</td>
<td>Master’s Degree</td>
<td>RN</td>
<td>144</td>
<td>312</td>
<td>144</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>30-39</td>
<td>Bachelor’s Degree</td>
<td>RN</td>
<td>180</td>
<td>336</td>
<td>180</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>30-39</td>
<td>Doctorate degree</td>
<td>Physician (Family Medicine)</td>
<td>132</td>
<td>336</td>
<td>156</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>40-49</td>
<td>Bachelor’s Degree</td>
<td>RN</td>
<td>180</td>
<td>240</td>
<td>180</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>30-39</td>
<td>Bachelor’s Degree</td>
<td>RN</td>
<td>144</td>
<td>216</td>
<td>144</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>40-49</td>
<td>Master’s Degree</td>
<td>Physician</td>
<td>120</td>
<td>360</td>
<td>180</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>40-49</td>
<td>Doctorate degree</td>
<td>Physician (Nuclear Medicine)</td>
<td>204</td>
<td>216</td>
<td>204</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>Male</td>
<td>40-49</td>
<td>Doctorate degree</td>
<td>Physician (Family Medicine)</td>
<td>120</td>
<td>276</td>
<td>120</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>Female</td>
<td>30-39</td>
<td>Bachelor’s Degree</td>
<td>RN</td>
<td>86</td>
<td>240</td>
<td>84</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>30-39</td>
<td>Bachelor’s Degree</td>
<td>RN</td>
<td>108</td>
<td>180</td>
<td>120</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 2. Participants’ demographics

10 participants (matching the demographics in the section on Participants) were recruited and 10 participated in the usability test. No participants failed to show for the study.

Participants were scheduled for a 120-minute session, including a total of 30-minute session debriefing 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 the various modules of the BESTCare 2.0B. 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. Find a patient on Patient List
2. Give orders to the patient and check drug-allergy interaction
3. Check drug-drug interaction and change the severity level
4. Change orders and display CPOE
5. Record, change, and display the patient’s demographics
6. Record, change, and display the patient’s problem list
7. Record, change, and access the patient’s medication list
8. Record, change, and access the patient’s medication allergy list
9. Record and parse a UDI and display an implantable device list

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.

**TASK MAPPING**

In this part, each scenario is mapped to the ONC certification criteria as follows:

- 170.315(a)(1): Computerized Provider Order Entry (CPOE) – Medications
→ Task 2: Enter and select ‘Atorvastatin Calcium Oral Tablet 10 MG’
→ Task 4: Select ‘Atorvastatin Calcium Oral Tablet 10 MG’ and change ‘Days Supply’ to 60.

■ 170.315(a)(2): Computerized Provider Order Entry (CPOE) – Laboratory
→ Task 2: Enter and select ‘CBC with Differential/Platelet’
→ Task 4: Select ‘CBC with Differential/Platelet’ and discontinue it.
    Enter and select ‘Cholesterol Total’

■ 170.315(a)(3): Computerized Provider Order Entry (CPOE) – Diagnostic Imaging
→ Task 2: Enter and select ‘Knee X-ray’
→ Task 4: Select ‘Knee X-ray’ and discontinue it.
    Enter and select ‘Knee US’

■ 170.315(a)(4): Drug-Drug, Drug-Allergy Interaction Checks for CPOE
→ Task 2: Before completing the orders, Drug-allergy interaction alerts are shown
→ Task 3: Before completing the orders, Drug-Drug interaction alerts are shown
    Change the severity level of ‘Drug&Drug Severity Major’ and save
    Check whether the severity level was changed or not

■ 170.315(a)(5): Demographics
→ Task 5 (entire)

■ 170.315(a)(6): Problem List
→ Task 6 (entire)

■ 170.315(a)(7): Medication List
→ Task 7 (entire)

■ 170.315(a)(8): Medication Allergy List
→ Task 8 (entire)

■ 170.315(a)(14): Implantable Device List
→ Task 9 (entire)

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 (See Appendix 3). A representative from the test team witnessed the participant’s signature.

To ensure that the test ran smoothly, two staff members participated in this test, the usability administrator and the data logger. The usability testing staff conducting the test has an average of five years of experience in clinical care and health IT.

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 data logger 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 3.10.

Following the session, the administrator gave the participant the post-test questionnaire (the System Usability Scale, see Appendix 5), 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 (See Appendix 6) 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, administrator,
and data logger were in the test room. To ensure that the environment was comfortable for users, noise levels were kept to a minimum with the ambient temperature within a normal range. All of the safety instruction and evacuation procedures were valid, in place, and visible to the participants.

TEST ENVIRONMENT

The EHRUT would be typically be used in a healthcare office or facility. In this instance, the testing was conducted in ‘HealthCare Innovation Park(HIP)’. For testing, the computer used a LG laptop connected to a LG 22-inch monitor with resolution of 1920 x 1080-pixels, running Windows. The participants used a mouse and keyboard when interacting with the EHRUT.

The application was set up by the ezCaretech supporting team according to the documentation describing the system set-up and preparation. The application itself was running on a Windows 7 or 10 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. 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. Non-disclosure agreement and Informed Consent
2. Moderator’s Guide
3. Post-test Questionnaire (System Usability Scale)
4. Incentive Receipt and Acknowledgment Form

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

The participant’s interaction with the EHRUT was captured and recorded digitally using ‘Gom Studio’. A web 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 saved on the computers, so that the data logger and administrator could monitor and review the test session.
PARTICIPANT INSTRUCTIONS

The administrator reads the following instructions aloud to each participant (also see the full moderator’s guide in Appendix 4):

Thank you for participating in this study. Your input is very important. Our session today will last about 120 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 do not click or open anything if it is not directed. Every action you take will be recorded for analysis. 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 (5 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 9 tasks to complete. Tasks are listed in the moderator’s guide in Appendix 4.

USABILITY METRICS

According to the NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records, EHRs should support a process 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 BESTCare 2.0B by measuring participant success rates and errors
2. Efficiency of BESTCare 2.0B by measuring the average task time and path deviations
3. Satisfaction with BESTCare 2.0B by measuring ease of use ratings

### DATA SCORING

The following table (Table 3) 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></td>
</tr>
<tr>
<td>Task Success</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.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>The standard deviation for each success rate is provided in Table 1, as required by ONC. This value, however, may be inappropriate, for a success rate can either be 100% or 0%.</td>
</tr>
<tr>
<td></td>
<td>Task times were recorded for successes. Observed task times divided by the optimal time for each task is a measure of optimal efficiency.</td>
</tr>
<tr>
<td></td>
<td>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 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 100 seconds then allotted task time performance was 150 seconds. This ratio should be aggregated across tasks and reported with mean and variance scores.</td>
</tr>
<tr>
<td>Task Failures</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 an “Failures.” No task times were taken for errors.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>On a qualitative level, an enumeration of errors and error types should be collected.</td>
</tr>
<tr>
<td><strong>Efficiency:</strong></td>
<td></td>
</tr>
<tr>
<td>Task Deviations</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.</td>
</tr>
</tbody>
</table>
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 participants.

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 the BESTCare 2.0B overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, “I think I would like to use this system frequently,” “I thought the system was easy to use,” and “I would imagine that most people would learn to use this system very quickly.” See full System Usability Score questionnaire in Appendix 5.

| Table 3. Details of how observed data were scored. |
RESULTS

DATA ANALYSIS AND REPORTING

The results of the usability test were calculated according to the methods specified in the Usability Metrics section above. Participants who failed to follow session and task instructions had their data excluded from the analyses. There were 9 task failures; 6 failures were due to exceeding the allotted task time and 3 failures occurred because of manipulation mistakes or of omission of task steps.

The usability testing results for the EHRUT are detailed below (see Table 1). 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.

| Measure | Task Success | Path Deviation | Task Time | Errors | Task Ratings
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>N</td>
<td>Mean (SD)</td>
<td>Deviations (Observed / Optimal)</td>
<td>Mean (SD)</td>
<td>Deviations (Observed / Optimal)</td>
</tr>
<tr>
<td>---------</td>
<td>---</td>
<td>-----------</td>
<td>------------------</td>
<td>-----------</td>
<td>------------------</td>
</tr>
<tr>
<td>1. Find a patient in patient list</td>
<td>10</td>
<td>90% (31.6)</td>
<td>3/3</td>
<td>29 (11)</td>
<td>29 / 20</td>
</tr>
<tr>
<td>2. Give orders to the patient and check drug-allergy interaction</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/7</td>
<td>130 (40)</td>
<td>130 / 110</td>
</tr>
<tr>
<td>3. Check drug-drug interaction</td>
<td>10</td>
<td>90% (31.6)</td>
<td>11/10</td>
<td>141 (44)</td>
<td>141 / 120</td>
</tr>
<tr>
<td>4. Change orders and display CPOE</td>
<td>10</td>
<td>90% (31.6)</td>
<td>11/10</td>
<td>147 (32)</td>
<td>147 / 130</td>
</tr>
<tr>
<td>5. Record, change, and display the patient’s demographics</td>
<td>10</td>
<td>90% (31.6)</td>
<td>24/23</td>
<td>385 (54)</td>
<td>385 / 320</td>
</tr>
<tr>
<td>6. Record, change, and display the patient’s problem list</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/8</td>
<td>139 (37)</td>
<td>139 / 130</td>
</tr>
<tr>
<td>7. Record, change, and access the patient’s medication list</td>
<td>10</td>
<td>100% (0)</td>
<td>10/10</td>
<td>193 (44)</td>
<td>193 / 180</td>
</tr>
<tr>
<td>8. Record, change and access the patient’s medication allergy list</td>
<td>10</td>
<td>80% (42.2)</td>
<td>10/9</td>
<td>237 (55)</td>
<td>237 / 200</td>
</tr>
<tr>
<td>9. Record and parse a UDI and display an implantable device list</td>
<td>10</td>
<td>90% (31.6)</td>
<td>8/7</td>
<td>104 (28)</td>
<td>104 / 100</td>
</tr>
</tbody>
</table>

Table 1. Summary of the performance and rating data

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 84 (SD = 12) Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 would be considered above average.

15-Nov-10
DISCUSSION OF THE FINDINGS

Generally, the participants were satisfied with the BESTCare 2.0B and they commented that it is easy to use. Some participants failed to complete the tasks properly, because they exceeded the allotted time, entered wrong data, or skipped a step. Most participants, however, successfully completed the tasks without any assistance or question.

There were no major path variations. Since the BESTCare 2.0B was designed to follow the real medical practice, participants were able to operate the tasks easily. In addition, BESTCare 2.0B received the score 4.1 and 84 for task ratings and System Usability Scale questionnaire respectively. These are above the average. Based on this data, users would be able to familiarize themselves with the system in short time.

EFFECTIVENESS

The mean task success rate is 90.0%(81/90), which implies that BESTCare 2.0B is user-friendly and easy to use. Although 9 tasks were recorded as ‘failed’, they were not system related errors. Some participants could not complete tasks during the allotted time (6 failures), while other participants committed manipulation mistakes, such as clicking a wrong button or the same button twice (3 failures).

EFFICIENCY

Almost all participants completed the tasks within the allotted time. Observed task time was divided by optimal task time, and observed path deviations were divided by optimal path deviations. The time deviation(observed/optimal) range from 1.03~1.46, which means that the most of participants finished the tasks close to the optimal time. Also, the path deviation(observed/optimal) range from 1.00~1.11, which means that there were no major path deviations among the participants.

SATISFACTION

Based on the task ratings and SUS results data, BESTCare 2.0B seem to meet the participants’ expectation and to be easy to use. The followings are task rating for each task and SUS results data. Overall, mean task rating is 4.1 [Table 4], and the mean SUS results is 84 [Table5]

SUS scores range from 0 to 100 and this score is a relative benchmark against other iterations
of the system. The SUS is a reliable and valid measure of system satisfaction. According to the research (https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html), a SUS score above a 68 is considered above the average and anything below 68 is below the average.

![Graph showing SUS scores for different tasks]

Table 4. Task ratings

![Graph showing SUS results data]

Table 5. SUS results data

**MAJOR FINDINGS**

Through this usability test, it was revealed that BESTCare 2.0B is user-friendly and easy to use.

- For CPOE, some users were confused by the ‘reason for order’ field, because this information is scarcely entered by clinical care providers in South Korea.
- For patient demographics, the participants had difficulty locating the fields to enter data.
for they come from clinical care and nursing sectors, rather than patient administration department.

- For medication allergy list, some spelling mistakes were detected by participants.

**AREAS FOR IMPROVEMENT**

- Display a message when 'reason of order' is not filled.
- Simplify the patient demographics screen layout.
- Review and correct the terms on the medication allergy list.
- Reduce the loading time for certain screens.
APPENDICES

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

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

The purpose of a screener to ensure that the participants selected represent the target user population as closely as possible.

**Recruiting Script for Recruiting Firm**

We are recruiting individuals to participate in a usability study for an electronic health record. We would like to ask you a few questions to see if you qualify and if you would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. 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 male or female?
   - □ Male
   - □ Female

2. Have you participated in a focus group or usability test in the past 6 months?
   - □ Yes (If Yes, Terminate)
   - □ No

3. Do you, or does anyone in your home, work in marketing research, usability research, web design?
   - □ Yes (If Yes, Terminate)
   - □ No

4. Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company?
   - □ Yes (If Yes, Terminate)
   - □ No

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

6. Which of the following best describes your race or ethnic group? [e.g., Caucasian, Asian, Black/African-American, Latino/a or Hispanic, etc.]
   - □ Caucasian
   - □ Asian
   - □ American
   - □ Latino or Hispanic

7. Do you require any assistive technologies to use a computer? [if so, please describe]
   - □ Yes (If Yes, please describe: )
   - □ No
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?
   ( __ months)

10. Describe your work location (or affiliation) and environment? [e.g., private practice, health system, government clinic, etc.]
    ( __ )

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)]

- No high school degree
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor’s degree
- Master’s degree
- Doctorate degree (e.g., MD, DNP, DMD, PhD)
12. Besides reading email, what professional activities do you do on the computer? [e.g., access EHR, research; reading news; shopping/banking; digital pictures; programming/word processing, etc.]

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

- □ 0 ~ 10 hours per week
- □ 11 ~ 25 hours per week
- □ 26 ~ hours per week

14. What computer platform do you usually use? [e.g., Mac, Windows, etc.]

- □ Mac
- □ Windows
- □ Other:

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

- □ Internet Explorer
- □ FireFox
- □ Chrome
- □ Other:

16. How many years have you used a computer?

( )

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

( )

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

( )

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

( )

20. 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 $300. Would you be able to participate on Jan / 01 / 2018?

May I get your contact information?

- Name of participant:

- Address:

- Phone number:

- Email address:
Appendix 2: PARTICIPANT DEMOGRAPHICS

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

<table>
<thead>
<tr>
<th>User ID</th>
<th>Sex</th>
<th>Age</th>
<th>Occupation</th>
<th>Occupation period (months)</th>
<th>Education</th>
<th>Computer experience (month)</th>
<th>EHRs experience (month)</th>
<th>Number of EHRs worked with</th>
<th>Facility Use of EHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>F</td>
<td>23~39</td>
<td>RN</td>
<td>144</td>
<td>Master’s degree</td>
<td>312</td>
<td>144</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>02</td>
<td>F</td>
<td>23~39</td>
<td>RN</td>
<td>180</td>
<td>Bachelor’s degree</td>
<td>336</td>
<td>180</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>03</td>
<td>M</td>
<td>23~39</td>
<td>Physician</td>
<td>132</td>
<td>Doctorate degree</td>
<td>336</td>
<td>156</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>04</td>
<td>F</td>
<td>40~59</td>
<td>RN</td>
<td>180</td>
<td>Bachelor’s degree</td>
<td>240</td>
<td>180</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>05</td>
<td>F</td>
<td>23~39</td>
<td>RN</td>
<td>144</td>
<td>Bachelor’s degree</td>
<td>216</td>
<td>144</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>06</td>
<td>M</td>
<td>40~59</td>
<td>Physician</td>
<td>120</td>
<td>Master’s degree</td>
<td>360</td>
<td>180</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>07</td>
<td>M</td>
<td>40~59</td>
<td>Physician</td>
<td>204</td>
<td>Doctorate degree</td>
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<td>204</td>
<td>1</td>
<td>All electronic</td>
</tr>
<tr>
<td>08</td>
<td>M</td>
<td>40~59</td>
<td>Physician</td>
<td>120</td>
<td>Doctorate degree</td>
<td>276</td>
<td>120</td>
<td>2</td>
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</tr>
<tr>
<td>09</td>
<td>F</td>
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<td>Bachelor’s degree</td>
<td>240</td>
<td>84</td>
<td>1</td>
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</tr>
<tr>
<td>10</td>
<td>F</td>
<td>23~39</td>
<td>RN</td>
<td>108</td>
<td>Bachelor’s degree</td>
<td>180</td>
<td>120</td>
<td>1</td>
<td>All electronic</td>
</tr>
</tbody>
</table>
Non-Disclosure Agreement

THIS AGREEMENT is entered into as of 11/Jan/2018, between (name)__________________ and the ezCaretech located at 307, Toegyero, Jung-gu, Seoul, 100-710 Korea.

The Participant acknowledges his or her voluntary participation in today's usability study may bring the Participant into possession of Confidential Information. The term "Confidential Information" means all technical and commercial information of a proprietary or confidential nature which is disclosed by ezCaretech, or otherwise acquired by the Participant, in the course of today's study.

By way of illustration, but not limitation, Confidential Information includes trade secrets, processes, formulae, data, know-how, products, designs, drawings, computer aided design files and other computer files, computer software, ideas, improvements, inventions, training methods and materials, marketing techniques, plans, strategies, budgets, financial information, or forecasts.

Any information the Participant acquires relating to this product during this study is confidential and proprietary to ezCaretech and is being disclosed solely for the purposes of the Participant's participation in today's usability study. By signing this form, the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Participant's printed name: ______________________________________________________

Signature: ____________________________         Date: ______________________________
Informed Consent

*ezCaretech* would like to thank you for participating in this study. The purpose of this study is to evaluate an electronic health records system. If you decide to participate, you will be asked to perform several tasks using the prototype and give your feedback. The study will last about 120 minutes. At the conclusion of the test, you will be compensated for your time.

**Agreement**

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

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

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

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

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

**Please check one of the following:**

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

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

**Signature:** __________________________________________________________

**Date:** ______________________________________________________________
Appendix 4: MODERATOR’S GUIDE

**EHRUT Usability Test**
Moderator’s Guide

Administrator ____________________________

Data Logger ______________________________

Date _________________________________ Time ______________________________________

Participant # ________________________

Location ______________________________

<table>
<thead>
<tr>
<th>Prior to testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Confirm schedule with Participants</td>
</tr>
<tr>
<td>▪ Ensure EHRUT lab environment is running properly</td>
</tr>
<tr>
<td>▪ Ensure lab and data recording equipment is running properly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prior to each participant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Reset application</td>
</tr>
<tr>
<td>▪ Start session recordings with tool <em>(GOM Studio)</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prior to each task:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Reset application to starting point for next task</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After each participant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ End session recordings with tool <em>(GOM Studio)</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After all testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Back up all video and data files</td>
</tr>
</tbody>
</table>

15-Nov-10
Orientation (5 minutes)

Thank you for participating in this study. Our session today will last about 120 minutes. During that time, you will take a look at an electronic health record system.

I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what in it would be useful to you, and how we could improve it. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty, I cannot answer help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely.

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

The product you will be using today is BESTCare 2.0B. Some of the data may not make sense as it is placeholder data.

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

Do you have any questions or concerns?

Preliminary Questions (10 minutes)

What is your job title / appointment?

How long have you been working in this role? What are some of your main responsibilities?

Tell me about your experience with electronic health records.
Task 1: First Impressions (5 minutes)
This is the application you will be working with. Have you heard of it? If so, tell me what you know about it.

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

Notes / Comments:
Task 2: Patient List Screen (30 Seconds)
You want to give orders to a patient. Find a patient first.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 3
Main Screen
→ Patient List (On the Left)
→ Click ‘C North’
→ Find the patient and double-click the patient

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:
☐ Very Difficult (1) ☐ Difficult (2) ☐ Moderate (3) ☐ Easy (4) ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 3: Order Entry, Drug-Allergy Interaction (a.1, a.2, a.3, a4) (165 Seconds)
A patient has hyperlipidemia and the patient is allergic to Atorvastatin. Give the orders to the patient.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 7

→ Order Entry

→ Enter and select ‘Atorvastatin Calcium Oral Tablet 10 MG’
  ● Rationale/Indication as ‘Hyperlipidemia, unspecified (E78.5)’
→ Enter and select ‘CBC with Differential/Platelet’
  ● Rationale/Indication as ‘(Free Text) Regular exam’, and click Enter
→ Enter and select ‘Knee X-ray’
  ● Mandatory fields (Type/Position/Comment, Body Side, Rationale/Indication)
→ Click ‘Sign’ to complete the orders.
→ Before completing, Drug-allergy interaction alerts are shown
→ Input the reason for overriding (red alert), Click ‘Accept’

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

☐ Very Difficult (1)  ☐ Difficult (2)  ☐ Moderate (3)  ☐ Easy (4)  ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 4: Drug-Drug Interaction (a4) (180 Seconds)

Success:
- [ ] Completed
- [ ] Not completed

Task Time: Seconds

Optimal Path: 10

→ Order Entry

→ Enter and select ‘Itraconazole Oral Capsule 100 MG’
  - Rationale/Indication as ‘Aspergillosis, unspecified (B44.9)’

→ Click ‘Sign’ to complete the orders.
→ Before completing, Drug-Drug interaction alerts are shown
→ Check drug-drug interactions and drug allergy, and close the Medi-Span alert page
→ Access ‘MediSpan Code Management’ to change the severity level
→ Change the severity level for 'Drug&Drug Severity Major' (Red to Orange) and Save.
→ Return to ‘Order Entry’ and Click 'Sign' again
→ Check whether the severity level was changed or not
→ Click ‘Confirm’ button (orange alert), and Click ‘Accept’

[ ] Correct
[ ] Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

- [ ] Very Difficult (1)
- [ ] Difficult (2)
- [ ] Moderate (3)
- [ ] Easy (4)
- [ ] Very Easy (5)

Administrator / Notetaker Comments:
Task 5: Change orders, Display changed CPOE (a.1, a.2, a.3) (195 Seconds)

After signing the orders, you realized that some of the orders are wrong. Change the orders and display the modified orders.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 10

Order Entry

→ Select ‘CBC With Differential/Platelet’ and **Discontinue it**
→ Enter and select ‘Cholesterol, Total’
  ● Rationale/Indication as ‘Hyperlipidemia, unspecified (E78.5)’

→ Select ‘Knee X-ray’ and **Discontinue it**
→ Enter and select ‘Knee US’
  ● Mandatory fields (Type/Position/Comment, Body Side, Rationale/Indication)

→ Select ‘Atorvastatin Calcium Oral Tablet 10 MG’ and change **Days Supply to 60.**
→ Select ‘Itraconazole Oral Capsule 100 MG’ and **Discontinue it**

→ Click ‘Sign’ to complete the orders

→ Select ‘Reason for discontinuation’
  ● Reason for discontinuation as ‘Inappropriate rationale’

→ **Input the reason for overriding, and Click ‘Accept’**
→ **Check the active orders**
  ● Atorvastatin Calcium Oral Tablet 10 MG, 60 Days
  ● Cholesterol, Total
  ● Knee US

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

☐ Very Difficult (1) ☐ Difficult (2) ☐ Moderate (3) ☐ Easy (4) ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 6: Record, Change, and Display a patient’s demographic (a.5) (480 Seconds)
A new patient has arrived. You need to record, change, and display the patient’s demographics.

Success:
□ Completed
□ Not completed

Task Time: Seconds

Optimal Path: 23

→ Patient Demographics

→ Record Birth Sex as ‘Female’
→ Record Date of Birth as ‘03/30/1977’
→ Record Detail Race as ‘Samoan’ (Native Hawaiian or Other Pacific Islander)
→ Record Ethnicity as ‘Not Hispanic or Latino’
→ Record Preferred Language as ‘English(en)’
→ Record Gender Identity as ‘Identifies as Female’
→ Record Sexual Orientation as ‘Lesbian, gay, or homosexual’
→ Select File Closed as ‘Y’ and select the file closed reason as ‘Expired Patient’
→ Record Death Reason as ‘Cardiac Arrest’
→ Record Date of Death as ‘10/01/2016’
→ Save the Patient Demographics

→ Change Birth Sex as ‘Male’
→ Change Date of Birth as ‘09/17/1954’
→ Change Race as ‘Declined to Specify’
→ Change Ethnicity as ‘Declined to Specify’
→ Change Preferred Language as ‘Declined to Specify’
→ Change Gender Identity as ‘Genderqueer, neither exclusively male nor female’
→ Change Sexual Orientation as ‘Don’t know’
→ Change Death Reason as ‘Head Trauma’
→ Change Date of Death as ‘01/30/2016’
→ Save the Patient Demographics

→ Delete the MRN and click enter to access the patient’s demographics again

□ Correct
□ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

□ Very Difficult (1)    □ Difficult (2)    □ Moderate (3)    □ Easy (4)    □ Very Easy (5)

Administrator / Notetaker Comments:
Task 7: Record, Change, and Access a patient’s Problem List (a.6) (195 Seconds)
A patient was found to have several problems. Record, Change, and display problems.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 8

→ Fact & Interest (Medical Record Review)

Following problems are already recorded before testing
- Essential hypertension (disorder) (2 days before testing)
- Diabetes mellitus (disorder) (1 day before testing)

Record the problems as below
→ Acquired Hypothyroidism (disorder)
→ Chronic Rejection of Renal Transplant (disorder)

Change Problem List
→ Diabetes Mellitus → Solved Diabetes Mellitus Type 2
→ Acquired Hypothyroidism (disorder) → Delete
→ New Problem: Severe Hypothyroidism (disorder)

→ Access Active Problem List
- Severe Hypothyroidism (disorder)
- Chronic Rejection of Renal Transplant (disorder)
- Essential hypertension (disorder)

→ Access Problem List History (Deleted/Solved List)

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

☐ Very Difficult (1) ☐ Difficult (2) ☐ Moderate (3) ☐ Easy (4) ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 8: Record, Change and Access a patient’s Medication List (a.7) (270 Seconds)
You have found that some medications should be changed.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 10
→ Order Entry

The following medications were already recorded before testing
- Ceftriaxone Sodium Injection Solution Reconstituted 250 MG twice daily (2 days before testing)
- Tylenol Extra Strength Oral Tablet 500 MG oral as needed (1 day before testing)

Record the medications as below
→ Darbepoetin Alfa 0.5 MG/ML once a week; injection
  - Rationale/Indication as ‘Anemia in chronic kidney disease (D63.1)’
→ Amoxicillin 500 MG one capsule by mouth every 12 hours
  - Rationale/Indication as ‘Acute upper respiratory infection, unspecified (J06.9)’
→ Click ‘Sign’ to complete the orders.

Change Mediation List (Active Orders)
→ Discontinue Ceftriaxone 250 MG/ML
→ Select the ‘Reason for discontinuation’ as ‘Drug change’

→ Tylenol 500 MG oral as needed → Tylenol 500 MG oral twice daily for 3 days
→ Click ‘Sign’ to complete the orders.

→ Access Active Medication List
  - Tylenol Extra Strength Oral Tablet 500 MG
  - Darbepoetin Alfa Injection Solution Prefilled Syringe 500 MCG/ML
  - Amoxicillin Oral Capsule 500 MG

→ Access Active Medication List History (On the left top – Type – Canceled Order)

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

☐ Very Difficult (1)  ☐ Difficult (2)  ☐ Moderate (3)  ☐ Easy (4)  ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 9: Record, Change and Access a patient’s Medication Allergy List (a.8) (300 Seconds)
It was revealed that a patient has allergy to some medications. Record, change and display them.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 9

→ Patient’s Precautions

Record the following medication allergies
→ Sulfasalazine; Symptoms: Ventilator-Coughing; RxNorm code: 9524,
→ Penicillin V; Symptoms: Nerve-Dizziness; RxNorm code: 7984,
→ Carbamazepine; Symptoms: Skin-rash; RxNorm code: 2002,

Change Medication Allergy List
→ Delete Sulfasalazine
→ Penicillin V: delete, then record a new medication allergy: Penicillin G; Symptoms: Nerve-Dizziness; RxNorm code: 7980
→ Carbamazepine: delete, then record a new medication allergy: Codeine; Symptoms: Skin-rash; RxNorm code: 2670

→ Access Active Medication Allergy List
  • Penicillin G
  • Codeine

→ Access Medication Allergy List History by clicking ‘Change History’

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:
☐ Very Difficult (1)  ☐ Difficult (2)  ☐ Moderate (3)  ☐ Easy (4)  ☐ Very Easy (5)

Administrator / Notetaker Comments:
Task 10: Record and Parse a UDI, and Display Implantable Device List (a.14) (150 Seconds)
The patient has implantable devices. You’ll need to register them into the system and display them.

Success:
☐ Completed
☐ Not completed

Task Time: Seconds

Optimal Path: 7

→ Implantable Device List

Add and parse the following Unique Device Identifiers:
→ (01)10884521062856(11)41231(17)150707(10)A213B1(21)1234
→ +8066000325011NS1/SS$420020216LOT1234567890123456/SXYZ456789012345678/16D20130202C1
→ /=W4146EB0010T0475=,000025=A99971312345600=>014032=>013032&,100000000000XYZ123

→ Change Status for Unique Device Identifier of ‘Polyester suture’ and Save
→ Display only active Implantable Device List by clicking ‘Exclude Inactive UDI’ checkbox
  ● Cardiopulmonary bypass system filter, arterial blood line
  ● Cadaveric-donor/synthetic mineral bone graft

→ Access Implantable Device List by clicking ‘More’ button

☐ Correct
☐ Deviations :: Describe below

Comments:

Observed Errors:

Rating: Overall, this task was:

☐ Very Difficult (1)  ☐ Difficult (2)  ☐ Moderate (3)  ☐ Easy (4)  ☐ Very Easy (5)

Administrator / Notetaker Comments:
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?
Appendix 5: SYSTEM USABILITY SCALE QUESTIONNAIRE

In 1996, Brooke published a “low-cost usability scale that can be used for global assessments of systems usability” known as the System Usability Scale or SUS. Lewis and Sauro (2009) and others have elaborated on the SUS over the years. Computation of the SUS score can be found in Brooke’s paper, in at http://www.usabilitynet.org/trump/documents/Suschapt.doc or in Tullis and Albert (2008).

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

Appendix 6: INCENTIVE RECEIPT AND ACKNOWLEDGMENT FORM

Acknowledgement of Receipt

I hereby acknowledge receipt of $300 for my participation in a research study run by Test Company.

Printed Name: ________________________________________________________________

Address: ________________________________________________________________
                                                      ________________________________________________________________

Signature: ____________________________ Date: __________________________

Usability Researcher: ____________________________

Signature of Usability Researcher: ____________________________

Date: __________________________

Witness: ____________________________

Witness Signature: ____________________________

Date: __________________________