

# MEDITECH

## **ARRA Meaningful Use Stage 3 Usability Study Usability Issues and Recommendations**

### **Ambulatory 6.1x**

**Medication Allergy List**

**Medication List**

**Drug-Drug, Drug-Allergy Interaction Checks**

**Electronic Prescribing**

**Computerized Provider Order Entry - Medications**

**Computerized Provider Order Entry - Laboratory**

**Computerized Provider Order Entry - Diagnostic Imaging**

**Clinical Information Reconciliation and Incorporation**

**Clinical Decision Support**

**Demographics**

**Problem List**

**Implantable Device List**

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## SUMMARY

From September 2016 to December 2016, we conducted a usability test of the Ambulatory 6.1x MEDITECH platform, in accordance with National Institute of Standards and Technology (NIST) and Meaningful Use certification guidelines. In these tests, end users completed a variety of tasks throughout the system; these tasks were designed to assess how easily users could complete representative clinical workflows and to identify areas to improve the usability of our software.

To meet Meaningful Use requirements, we had to assess the usability of twelve features throughout the system:

- Medication Allergy List
- Medication List
- Drug-drug, Drug-allergy Interaction Checks
- Computerized Provider Order Entry - Medications
- Computerized Provider Order Entry - Laboratory
- Computerized Provider Order Entry - Diagnostic Imaging
- Electronic Prescribing
- Clinical Information Reconciliation and Incorporation
- Clinical Decision Support
- Demographics
- Problem List
- Implantable Device List

After conducting tests with end users to analyze the usability to each of those features, we analyzed each test to evaluate the usability of our software based on three metrics.

### **This metric:**

### **Analyzes:**

Effectiveness

Whether or not participants completed the task

Efficiency

The time required and steps taken to complete the task

User Satisfaction

Participant feedback on ease of use and areas for improvement

While gathering and analyzing testing sessions, we noted areas users struggled in the system, the cause of those struggles, and ways to improve the usability of those areas. From these observations, we crafted a list of usability issues and recommendations.

This document describes the usability issues we found in Ambulatory 6.1x MEDITECH and our recommendations for these issues.

## **TESTING PROCESS**

This section provides a brief outline of our testing process, including participant profiles, testing procedure, evaluative metrics, and issue identification.

### ***Participants***

We tested a total of 25 representative participants for this usability test. All of the participants are active users and prospective users of the Ambulatory 6.1x MEDITECH software representing clinical, administrative, and IT staff. Participants were asked to perform tasks for functions that most closely matched their daily workflow. On average, these participants had, at the time of testing, 10+ years of EHR experience.

### ***Testing Procedure***

Participants each completed 32 tasks across the system to test multiple functionality points. We composed the tasks to mimic a representative clinical workflow, with different tasks spread across a patient visit. Here's an example task:

Amanda has taken nitrofurantoin for her urinary tract infection, but has had dyspnea, cough, and chest and back pain since starting the medication. Discontinue this medication.

Each participant performed each task without assistance to the best of his or her ability, as quickly as possible, and with the fewest possible deviations. After each task, we asked the participant to rate the ease or difficulty of the task and gathered any participant feedback about the task.

### ***Test Environment***

Following is a summary of the participants' computing environments:

<b>Tested product:</b>	MEDITECH EHR, version 6.1x
<b>Computer platforms:</b>	Microsoft Surface Pro 2 HP Elite x2
<b>Display:</b>	n/a
<b>Screen resolution:</b>	Microsoft Surface Pro 2: 1920 x 1080 resolution HP Elite x2: 1920 x 1080
<b>Operating system:</b>	Windows 7

*Morae© software was used to assist with data collection.*

## ***Evaluative Metrics***

To analyze testing results, we captured seven primary pieces of data: task success, task errors, task deviations, task performance time, task time standard deviations, task rating, and System Usability Scale scores.

### **Task Success**

We counted a task as a success if the participant was able to achieve the correct outcome without assistance. We compiled the overall success rate for a task by dividing the number of task successes by the number of task attempts.

### **Task Errors**

While each participant worked through a task, we recorded his or her path to complete the task. We noted an error if the participant, for example, went to a wrong screen, clicked on an incorrect menu item, or followed an incorrect link *and* was not able to complete the task without returning to a previous step in the intended path.

### **Task Deviations**

While each participant worked through a task, we recorded his or her path to complete the task. We noted a deviation if the participant performed an unexpected or unnecessary action, navigated to an incorrect screen, or selected an incorrect item, but was able to continue towards completing the task.

### **Task Time**

We recorded the time from when a participant started a task to the time they finished it, expressed in seconds. Participants reported when they finished a task. We stopped task times when a participant failed to finish a task and continued task times when participants finished a task but failed to recognize they had completed it.

### **Task Time Standard Deviation**

We calculated the standard deviation of task performance times. The task time standard deviation captures the number of seconds that constitutes one standard deviation from the mean task performance time. For example, a standard deviation of 10 seconds indicates that one standard deviation from the mean task time is equal to the mean task time plus or minus 10 seconds.

### **Task Rating**

After each task, participants scored the ease or difficulty of the task on a scale of 1 (very difficult) to 5 (very easy). We computed the average rating for each task. In addition, during this process, we gathered participant feedback about the task—what they liked, disliked, thought could be improved, etc.

### **System Usability Scale (SUS)**

The SUS is an industry-standard, 10-item questionnaire that assesses the usability of the system under test. We administered the SUS to each participant following each testing session and compiled the overall SUS scores. During this process, we asked participants for their feedback on the entire system.

## ***Issue Identification***

After completing each testing session and compiling test data and observations, we identified areas where participants struggled in using the system. For example, if a task had a low task success rate and high task time, we analyzed the task to see if participants made common deviations to increase task time and prevent them from completing the task. If a task had low task ratings, we reviewed feedback to determine if participants had common complaints about the functionality in the task.

Conversely, we noted areas where the system performed well to determine what sort of workflows participants liked. We can use positive findings to help identify intuitive areas of the system and expand that functionality when possible to less intuitive functions.

For each issue, we calculated the number of participants who struggled with that issue, where the issue occurred in the participants' workflow, how the issue affected the outcome of the task, and whether or not the issue may affect patient safety. With that information, we assigned a priority to each issue, on a scale of 1 -3.

**Severity 1:** Severe usability issue that caused multiple or significant task failures or has room to improve patient safety.

**Severity 2:** Major usability issue that caused major struggles, or significantly slowed down users, or caused an isolated task failure.

**Severity 3:** Efficiency usability issue. Efficiency or workflow could be improved but the issue did not cause significant disruption.

In addition to identifying the details and priority of each issue, we composed a recommendation to each issue.

## MEDICATION ALLERGY LIST

### Task Data

The Medication Allergy List portion of the usability study was composed of three tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these three tasks.

Task	Effectiveness (% Success)	Efficiency	User Satisfaction (Rating)
Access Allergies	100%	Time (sec): <b>44</b> Std Dev (sec): <b>21</b> Errors: <b>0</b> Deviations: <b>4</b>	<b>4.5/5.0</b>
Change Allergy	100%	Time (sec): <b>22</b> Std Dev (sec): <b>12</b> Errors: <b>0</b> Deviations: <b>0</b>	<b>4.5/5.0</b>
Record Allergy	100%	Time (sec): <b>44</b> Std Dev (sec): <b>21</b> Errors: <b>0</b> Deviations: <b>4</b>	<b>4.5/5.0</b>

### Medication Allergy List Issues

#### *Issue 1: User added an uncoded allergy*

##### Issue Data

Severity: **1**      Patient Safety: **No**      Number of users: **3**

##### Findings

Three participants added the allergy as an uncoded allergy. Adding an allergy as uncoded is too simple and can accidentally occur when a user mistypes an allergy.

Because the allergy search field is type-ahead and search results do not appear as quickly as users expect, a user typically types in a value and presses the Enter key.

However, users commonly mistype words during searches, especially complicated allergy names. The system is not quick enough to alert the user of no search results before the user presses Enter. Since the only actionable item is to "add as free text" when the system finds no search results, hitting Enter selects the "add as free text" option for the mistyped allergy and adds the allergy to the patient's list as uncoded. To top it all off, since the search results are not fast enough, the user assumes that the complete accepted their entry and that it is entered as any other allergy.

Uncoded allergies cannot be used for interaction checking, so therefore the data is not as helpful for clinical decision support as it should be. This may cause patient safety issues if a user does not manually review the allergy list.

## Quotes

None

## Recommendations

When a user with access to enter uncoded allergies enters a value and the system finds no search results, we will remove the uncoded allergy as the default selection and force the user to find and select the uncoded option if they desire to have the value added as an uncoded allergy. We will no longer present the user with a default option of adding as free text. Users can then reevaluate why they are not getting search results. Ensure that users make a purposeful decision to add a free text allergy, rather than inadvertently accepting a default.

### ***Issue 2: User attempted to file before completing all required fields***

#### **Issue Data**

Severity: **3**      Patient Safety: **No**      Number of users: **1**

#### **Findings**

One participant attempted to file before completing all required fields, which caused them to have to dismiss a warning message. A required field contains an asterisk (\*) before the field label. The field labels are too far away from the input fields to allow users to quickly see which fields are required so they can fill them out before attempting to save.

## Quotes

None

## Recommendations

Close the spacial gap between the field labels and the input fields.

## MEDICATION LIST

### Task Data

The Medication List portion of the usability study was composed of three tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these three tasks.

Task	Effectiveness (% Success)	Efficiency	User Satisfaction (Rating)
Access Medication	63%	Time (sec): <b>126</b> Std Dev (sec): <b>68</b> Errors: <b>10</b> Deviations: <b>19</b>	3.1/5.0
Change Medication	100%	Time (sec): <b>54</b> Std Dev (sec): <b>29</b> Errors: <b>0</b> Deviations: <b>7</b>	3.8/5.0
Record Medication	63%	Time (sec): <b>126</b> Std Dev (sec): <b>68</b> Errors: <b>10</b> Deviations: <b>19</b>	3.1/5.0

### Medication List Issues

#### *Issue 1: Users failed to add the medication as a reported medication*

##### Issue Data

Severity: **2**      Patient Safety: **No**      Number of users: **5**

##### Findings

Users had trouble adding a medication as a reported medication. It is not apparent that users can toggle between searching for a medication to prescribe or searching for a medication to add it as reported.

##### Quotes

None

##### Recommendations

Consider adding the Reported functionality not as a separate search but as an attribute for a medication. That way, users do not have to remember the additional step of marking in the system that they are searching for a reported medication. They can search like they would for prescribing a medication and when filling out the medication details they can mark that the medication is reported.

## **DRUG-DRUG, DRUG-ALLERGY INTERACTION CHECKS**

### **Task Data**

The Drug-Drug, Drug-Allergy Interaction Checks portion of the usability study was composed of two tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these two tasks.

<b>Task</b>	<b>Effectiveness</b> (% Success)	<b>Efficiency</b>	<b>User Satisfaction</b> (Rating)
<b>Adjustment of Severity Level for Drug-Drug Interaction Check</b>	<b>83%</b>	Time (sec): <b>93</b> Std Dev (sec): <b>86</b> Errors: <b>1</b> Deviations: <b>0</b>	<b>4.0/5.0</b>
<b>Drug-Allergy Interaction</b>	<b>100%</b>	Time (sec): <b>45</b> Std Dev (sec): <b>24</b> Errors: <b>0</b> Deviations: <b>6</b>	<b>4.4/5.0</b>

### **Drug-Drug, Drug-Allergy Interaction Checks Issues**

#### ***Issue 1: User turned off all medication interaction checking***

##### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **1**

##### **Findings**

Instead of modifying the severities of which interactions alert the user, the user turned off all interaction checking for medications.

##### **Quotes**

None

##### **Recommendations**

Do not let users completely turn off interaction checking. Only allow users to modify which severities alert the user.

## ELECTRONIC PRESCRIBING

### Task Data

The Electronic Prescribing portion of the usability study was composed of two tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these two tasks.

<b>Task</b>	<b>Effectiveness</b> (% Success)	<b>Efficiency</b>	<b>User Satisfaction</b> (Rating)
<b>Locating Rx Fill Status</b>	<b>54%</b>	Time (sec): <b>92</b> Std Dev (sec): <b>63</b> Errors: <b>6</b> Deviations: <b>9</b>	<b>2.9/5.0</b>
<b>Generate a Refill</b>	<b>83%</b>	Time (sec): <b>21</b> Std Dev (sec): <b>15</b> Errors: <b>2</b> Deviations: <b>3</b>	<b>4.4/5.0</b>

### Electronic Prescribing Issues

#### ***Issue 1: Users cannot easily locate the Rx Fill Status***

##### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **7**

##### **Findings**

Several users did not instinctively go to the Audit Trail to find the status of the prescription. Some users went into documentation while others accessed some additional ordering routines in attempt to find the proper information.

##### **Quotes**

None

##### **Recommendations**

When pharmacies begin to utilize Rx Fill Status messages, evaluate any points in the workflow where the system could more prominently display Rx Fill Status.

#### ***Issue 2: Users failed to refill the medication.***

##### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **2**

##### **Findings**

Two participants attempted to search for the medication and reorder it because it was not immediately clear there was an action button to refill the medication.

### **Quotes**

None

### **Recommendations**

Refilling should be a flat, one-click process without any need to navigate to medication actions.

### ***Issue 3: Users misstepped trying to access the Refill button.***

#### **Issue Data**

Severity: **3**      Patient Safety: **No**      Number of users: **2**

#### **Findings**

Two participants opened up the medication details instead of expanding the medication's accordion functionality, because clicking on the chevron of the medication accordion performs a different action than clicking on the medication name.

### **Quotes**

None

### **Recommendations**

Accessing the medication details and opening up the accordion should fit user expectations, and users expect clicking anywhere on an accordion will open the accordion.

## COMPUTERIZED PROVIDER ORDER ENTRY

### Task Data

The Computerized Provider Order Entry (CPOE) portion of the usability study was composed of nine tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these nine tasks.

<b>Task</b>	<b>Effectiveness</b> (% Success)	<b>Efficiency</b>	<b>User Satisfaction</b> (Rating)
<b>Record CPOE Medication</b>	<b>100%</b>	Time (sec): <b>98</b> Std Dev (sec): <b>70</b> Errors: <b>0</b> Deviations: <b>12</b>	<b>3.8/5.0</b>
<b>Change CPOE Medication</b>	<b>85%</b>	Time (sec): <b>80</b> Std Dev (sec): <b>53</b> Errors: <b>2</b> Deviations: <b>19</b>	<b>3.1/5.0</b>
<b>Access CPOE Medication</b>	<b>100%</b>	Time (sec): <b>98</b> Std Dev (sec): <b>70</b> Errors: <b>0</b> Deviations: <b>12</b>	<b>3.8/5.0</b>
<b>Record CPOE Laboratory</b>	<b>100%</b>	Time (sec): <b>57</b> Std Dev (sec): <b>43</b> Errors: <b>0</b> Deviations: <b>2</b>	<b>4.2/5.0</b>
<b>Change CPOE Laboratory</b>	<b>100%</b>	Time (sec): <b>29</b> Std Dev (sec): <b>12</b> Errors: <b>0</b> Deviations: <b>5</b>	<b>4.3/5.0</b>
<b>Access CPOE Laboratory</b>	<b>100%</b>	Time (sec): <b>57</b> Std Dev (sec): <b>43</b> Errors: <b>0</b> Deviations: <b>2</b>	<b>4.2/5.0</b>
<b>Record CPOE Diagnostic Imaging</b>	<b>100%</b>	Time (sec): <b>114</b> Std Dev (sec): <b>110</b> Errors: <b>0</b> Deviations: <b>7</b>	<b>3.3/5.0</b>
<b>Change CPOE Diagnostic Imaging</b>	<b>88%</b>	Time (sec): <b>90</b> Std Dev (sec): <b>51</b> Errors: <b>2</b> Deviations: <b>17</b>	<b>3.6/5.0</b>
<b>Access CPOE Diagnostic Imaging</b>	<b>100%</b>	Time (sec): <b>114</b> Std Dev (sec): <b>110</b> Errors: <b>0</b> Deviations: <b>7</b>	<b>3.3/5.0</b>

## **Computerized Provider Order Entry Issues - Medications/Laboratory/Diagnostic Imaging**

### ***Issue 1: User entered a medication as free-text/uncoded***

#### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **1**

#### **Findings**

When a user searched for a medication, they selected the dropdown arrow for the search field. This action cleared out their search. Two participants proceeded to selected Free Text, which will add a medication that is not system defined, and thus cannot be used for interaction checking.

#### **Quotes**

None

#### **Recommendations**

Entering free text should be a last resort option, if no system defined entry will work for the patient's chart. Evaluate how users can enter in free text entries and make sure that entering a system defined entry is easy, and only if no system defined entry exists should uncodified data be used.

### ***Issue 2: User attempted to search for a medication in the wrong search field***

#### **Issue Data**

Severity: **3**      Patient Safety: **No**      Number of users: **3**

#### **Findings**

Users must select on an icon in order to add a medication, but right next to the icon is a search box for non-medication orders. Three participants attempted to search for a medication in the non-med orders search box.

#### **Quotes**

None

#### **Recommendations**

Split up the add medication icon and the Search Orders/Sets field so that users are not tempted to search for medications in the wrong field.

### ***Issue 3: User failed to discontinue a medication***

#### **Issue Data**

Priority: **2**      Patient Safety: **No**      Number of users: **2**

#### **Findings**

Two participants failed to find the Stop button because it is hidden under a click and is also not accessible from the medication details screen.

#### **Quotes**

None

#### **Recommendations**

Make discontinuing a medication a flat process and more accessible from different places of the EHR.

## CLINICAL INFORMATION RECONCILIATION AND INCORPORATION

### Task Data

The Clinical Information Reconciliation and Incorporation portion of the usability study was composed of three tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these three tasks.

Task	Effectiveness (% Success)	Efficiency	User Satisfaction (Rating)
Consume CCD - Allergies	75%	Time (sec): <b>146</b> Std Dev (sec): <b>83</b> Errors: <b>4</b> Deviations: <b>25</b>	<b>3.4/5.0</b>
Consume CCD - Problems	50%	Time (sec): <b>193</b> Std Dev (sec): <b>112</b> Errors: <b>8</b> Deviations: <b>21</b>	<b>3.1/5.0</b>
Consume CCD - Medications	37%	Time (sec): <b>224</b> Std Dev (sec): <b>149</b> Errors: <b>10</b> Deviations: <b>16</b>	<b>2.7/5.0</b>

### Clinical Information Reconciliation – Problems/Medications/Allergies

**Issue 1: Users are confused by how to access external data**

#### Issue Data

Severity: **1**      Patient Safety: **No**      Number of users: **6**

#### Findings

Users attempted to manually enter the information from the imported raw CCD document that appears under the patient's reports. They never found the Reconcile External Data button on the Allergies or Problem List pop-overs.

#### Quotes

None

#### Recommendations

When external data is available for processing, display the information flat with the other allergies and problems, and make it apparent that the user should determine whether to add or discard the allergy information from the CCD.

## ***Issue 2: 'Add Selected External...' footer button is confusing***

### **Issue Data**

Severity: **1**      Patient Safety: **No**      Number of users: **10**

### **Evidence**

Users struggled to locate the 'Add Selected External...' footer button in order to properly reconcile external data.

### **Quotes**

None

### **Recommendations**

Eliminate the need for a button and present the information to be reconciled flat.

## ***Issue 3: Not intuitive where to reconcile external medications***

### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **2**

### **Findings**

Two participants had difficulty finding external medications when trying to consume external medications.

### **Quotes**

None.

### **Recommendations**

Evaluate where and how the Reconcile button appears for users. Its availability should be consistent.

## ***Issue 4: Not intuitive when matching system entries to CCD entries***

### **Issue Data**

Severity: **1**      Patient Safety: **No**      Number of users: **3**

### **Findings**

Three participants struggled selecting a system entry to match a CCD entry. It is not apparent to users what they need to do since they expect the system to automatically select a system entry if there is a 1-to-1 match for the CCD entry.

### **Quotes**

None

**Recommendations**

Automatically import 1-to-1 matches between the system and CCD. Ensure users can review, confirm, and edit any auto-imported data, as needed.

## CLINICAL DECISION SUPPORT

### Task Data

The Clinical Decision Support portion of the usability study was composed of eight tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these eight tasks.

<b>Task</b>	<b>Effectiveness</b> (% Success)	<b>Efficiency</b>	<b>User Satisfaction</b> (Rating)
<b>Generate Problem List Interventions</b>	<b>100%</b>	Time (sec): <b>98</b> Std Dev (sec): <b>70</b> Errors: <b>0</b> Deviations: <b>12</b>	<b>3.8/5.0</b>
<b>Generate Medication List Interventions</b>	<b>100%</b>	Time (sec): <b>51</b> Std Dev (sec): <b>33</b> Errors: <b>0</b> Deviations: <b>2</b>	<b>4.3/5.0</b>
<b>Generate Medication Allergy Interventions</b>	<b>100%</b>	Time (sec): <b>45</b> Std Dev (sec): <b>24</b> Errors: <b>0</b> Deviations: <b>5</b>	<b>4.4/5.0</b>
<b>Generate Demographics Interventions</b>	<b>100%</b>	Time (sec): <b>45</b> Std Dev (sec): <b>32</b> Errors: <b>0</b> Deviations: <b>1</b>	<b>4.2/5.0</b>
<b>Generate LAB Test and Result Interventions</b>	<b>100%</b>	Time (sec): <b>45</b> Std Dev (sec): <b>32</b> Errors: <b>0</b> Deviations: <b>1</b>	<b>4.2/5.0</b>
<b>Generate Vital Signs Interventions</b>	<b>100%</b>	Time (sec): <b>54</b> Std Dev (sec): <b>29</b> Errors: <b>0</b> Deviations: <b>7</b>	<b>3.8/5.0</b>
<b>Identify User Diagnostic and Therapeutic Reference Information</b>	<b>33%</b>	Time (sec): <b>104</b> Std Dev (sec): <b>40</b> Errors: <b>10</b> Deviations: <b>9</b>	<b>2.2/5.0</b>
<b>Enable Clinical Decision Support Interventions</b>	<b>83%</b>	Time (sec): <b>167</b> Std Dev (sec): <b>152</b> Errors: <b>1</b> Deviations: <b>2</b>	<b>3.8/5.0</b>

## **Clinical Decision Support Issues**

### ***Issue 1: Users had trouble locating the InfoButton to search for more information about an order***

#### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **11**

#### **Findings**

Eight participants failed to use the right-click functionality or an order's audit trail overlay to locate the InfoButton in order to search for more information about an order.

#### **Quotes**

"I'm not sure what I'm supposed to do here."

#### **Recommendations**

This issue is likely due to lack of training on this feature. Users can right-click or use an order's audit trail overlay to find the InfoButton. However, since right-clicking is not a typical user interaction with MEDITECH's EHR, there may be better alternatives to let users know about the functionality.

## PROBLEM LIST

### Task Data

The Problem List portion of the usability study was composed of two tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these two tasks.

Task	Effectiveness (% Success)	Efficiency	User Satisfaction (Rating)
<b>Access and Add to Active Problem List</b>	<b>87%</b>	Time (sec): <b>45</b> Std Dev (sec): <b>29</b> Errors: <b>2</b> Deviations: <b>4</b>	<b>4.4/5.0</b>
<b>Access and Change Active Problem List</b>	<b>94%</b>	Time (sec): <b>166</b> Std Dev (sec): <b>59</b> Errors: <b>1</b> Deviations: <b>18</b>	<b>2.7/5.0</b>

### Problem List Issues

#### *Issue 1: Difficulty changing an existing problem*

##### Issue Data

Severity: **2**      Patient Safety: **No**      Number of users: **8**

##### Findings

Eight participants had difficulty changing the status of an existing diabetes problem to uncontrolled. Some attempted to right click the problem, while others simply removed the current problem and added a new one with the proper details.

##### Quotes

"I'd expect to be able to change it from controlled to uncontrolled."

"I right clicked, but nothing happened."

##### Recommendations

Evaluate whether to allow users to re-qualify problems to change the details of a particular problem, such as changing controlled diabetes to uncontrolled diabetes.

## DEMOGRAPHICS

### Task Data

The Demographics portion of the usability study was composed of four tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these four tasks.

Task	Effectiveness (% Success)	Efficiency	User Satisfaction (Rating)
<b>Record Patient Demographics (Race, Ethnicity, Preferred Language, Sex, Sexual Orientation, Gender Identity, Date of Birth)</b>	Physician users: <b>82%</b>	Time (sec): <b>148</b> Std Dev (sec): <b>115</b> Errors: <b>3</b> Deviations: <b>26</b>	<b>2.5/5.0</b>
	Scheduling Users: <b>66%</b>	Time (sec): <b>346</b> Std Dev (sec): <b>198</b> Errors: <b>0</b> Deviations: <b>0</b>	<b>2.0/5.0</b>
<b>Access and Edit Patient Demographics (Race, Ethnicity, Preferred Language, Sex, Sexual Orientation, Gender Identity, Date of Birth)</b>	Physician users: <b>88%</b>	Time (sec): <b>52</b> Std Dev (sec): <b>42</b> Errors: <b>2</b> Deviations: <b>2</b>	<b>3.8/5.0</b>
	Scheduling Users: <b>66%</b>	Time (sec): <b>176</b> Std Dev (sec): <b>68</b> Errors: <b>1</b> Deviations: <b>5</b>	<b>2.7/5.0</b>

### Demographics Issues

***Issue 1: Users struggled with opening up a view-only Social History screen where they cannot add or edit new information.***

#### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **8**

#### **Findings**

Eight participants opened up a view-only version of the Social History screen from the patient's chart and wondered why they could not edit the information when they are able to see it. This information must be edited within the visit document.

#### **Quotes**

"I don't see why I can't edit this."

#### **Recommendations**

Allow users to edit the information from the Chart's social history screen.

## IMPLANTABLE DEVICE LIST

### Task Data

The Implantable Device List portion of the usability study was composed of two tasks. The following table outlines the mean effectiveness, efficiency, and user satisfaction data of these two tasks.

<b>Task</b>	<b>Effectiveness</b> (% Success)	<b>Efficiency</b>	<b>User Satisfaction</b> (Rating)
<b>Record Unique Device Identifiers Associated with Implantable Device</b>	<b>91%</b>	Time (sec): <b>93</b> Std Dev (sec): <b>59</b> Errors: <b>1</b> Deviations: <b>1</b>	<b>3.9/5.0</b>
<b>Change Status of Unique Device Identifier</b>	<b>73%</b>	Time (sec): <b>56</b> Std Dev (sec): <b>52</b> Errors: <b>3</b> Deviations: <b>11</b>	<b>3.6/5.0</b>

### Implantable Device List Issues

#### *Issue 1: User never found the functionality*

##### **Issue Data**

Severity: **3**      Patient Safety: **No**      Number of users: **1**

##### **Findings**

One participant had difficulty finding the implantable device list in the patient's chart. The location of the implantable device list is dependant on facility set up.

##### **Quotes**

None

##### **Recommendations**

Consider having a specific location for the Implantable Device List on the chart. Users can manage the appearance of the chart by editing which information appears and the order in which it appears. Ensure users are trained how to manage the chart, and supply recommendations for how to incorporate the Implantable Device List.

## ***Issue 2: User failed to explant the device***

### **Issue Data**

Severity: **2**      Patient Safety: **No**      Number of users: **1**

### **Findings**

One participant had difficulty explanting the device because of extraneous and confusing buttons not related to the explanting process.

### **Quotes**

None

### **Recommendations**

Evaluate the button that toggles between the implanted list and the explanted list. It currently does not have a label, so users may think that it is a command button for explanting or implanting a device, rather than a button to toggle views.

## **SYSTEM USABILITY SCALE (SUS) SCORE**

The System Usability Scale (SUS) analyses subjective user feedback to the system, on a numeric scale from 0 - 100. Generally, anything above 68 is considered usable. In this test, the SUS was 57.7, indicating that there is room for usability improvements, as outlined in the key issues described above.

<b>Overall SUS Score</b>
<b>57.7</b>

## **APPENDIX A: CLINICAL PARTICIPANT SCRIPT**

### ***Scenario One***

Harriet Thompson is a 67-year-old female who has a visit with you today. Harriet has diabetes and chronic kidney disease.

Harriet has a winter residence in Arizona and has been seeing a physician there over the last few months. Harriet has a CCD from that practice. You need to reconcile Harriet's medical information with her record at her other provider. You also want to gather additional clinical information to ensure that Harriet's chart is up to date.

**Task 1:** Reconcile the allergies on Harriet's CCD with those on her allergy list.

**Task 2:** Reconcile the problems on Harriet's CCD with those on her problem list.

**Task 3:** Reconcile the medications on Harriet's CCD with those on her medication list.

**Task 4:** Harriet reports that she has started an aspirin regimen. Add this to her medication list as a reported medication.

**Task 5:** Your organization has begun to capture gender identity and sexual orientation in social history.

Update Harriet's PFSH to record this information. Record Harriet's gender identity as female.

**Task 6:** Next, update her sexual orientation to homosexual.

**Task 7:** While updating Harriet's clinical information, you noticed that she has an outstanding order for a mammogram. Harriet indicates that she has not had a mammogram in over a year.

Update the service date on the mammogram so that Harriet gets the mammogram in the next month.

**Task 8:** You also noticed Harriet has an outstanding HbA1c order. You decide to perform the procedure while she is in today.

Update the order's service date to today.

**Task 9:** Harriet has high blood pressure today. You decide to prescribe a medication for her hypertension.

Order Nifedipine ER 30 mg PO Q4H. If Nifedipine is contraindicated do not place the order.

**Task 10:** Because Nifedipine was contraindicated you decide to increase her Metoprolol succinate dose from 25 mg to 50 mg.

Make this change. If contraindicated do not place the order.

**Task 11:** Because an increase in Metoprolol dosage was contraindicated you decide to order Metformin HCl 500 mg. If contraindicated do not place the order.

**Task 12:** Because Metformin was contraindicated, order Glyburide 2.5 mg.

**Task 13:** Because Harriet has CKD and high blood pressure, you are concerned about renal artery stenosis.

Order a Lumbar MRI. If contraindicated do not place the order.

**Task 14:** Because the Lumbar MRI was contraindicated you want to consider a different diagnostic procedure. Find more info about alternative diagnostics for a Lumbar MRI to analyze renal artery stenosis.

**Task 15:** Based on the information you found, you decide to order a Abdomen Ultrasound.

Place this order. If the order is contraindicated, do not place the order.

**Task 16:** Harriet has been complaining of minor headaches. Prescribe prescription-strength ibuprofen. If contraindicated, do not place the order.

**Task 17:** You decide to update Harriet's problem list based on your observations from this visit. Update her diabetes diagnosis to uncontrolled.

**Task 18:** Add hypertension as problem.

### ***Scenario Two***

Your next patient is 26-year-old Amanda Sullivan. Amanda has a urinary tract infection for which she has received antibiotics, but she's still symptomatic. In addition, she's been having side effects from her antibiotic.

**Task 19:** Amanda has taken Nitrofurantoin for her urinary tract infection but has had dyspnea, cough, and chest and back pain since starting the medication.

Discontinue this medication.

**Task 20:** You decide to order a urinalysis to determine if Amanda's UTI has been resolved.

Order this test for today.

**Task 21:** Based on results from Amanda's urinalysis you want to prescribe another antibiotic.

Order trimethoprim 100 mg. If contraindicated do not place the order.

**Task 22:** Because Amanda is allergic to Trimethoprim, order Fosfomycin Tromethamine. If contraindicated do not place the order.

**Task 23:** Update Amanda's allergies based on today's visit. Add Nitrofurantoin to her allergies.

**Task 24:** Update the severity on her Trimethoprim allergy to severe.

**Task 25:** Amanda has asthma and has a refill ordered for her inhaler. She's curious if the pharmacy has filled her prescription.

Check the fill status on the prescription.

**Task 26:** Amanda needs a refill of her Imitrex.

If contraindicated do not place the order.

**Task 27:** During this visit, Amanda would like to have her Omniflex Diaphragm changed.

Explant the Omniflex Diaphragm from her implantable device list.

**Task 28:** After replacing her diaphragm, add the new Omniflex Diaphragm details to her implantable device list.

### ***Scenario Three***

You have received a phone call from Ademaro Reynoso. He plans to come into your clinic for his first appointment next week.

**Task 29:** Create a new patient entry for Ademaro Reynoso for Practice LSSMPMA GP and book a NEW PT VIS appointment for him.

He gives his address as 574 3rd Ave for Saint Paul, MN, 55103.

His birth date is 08/09/1982, he is male, he chooses not to give his Social Security, he is married, he says he is Hispanic or Latino for race, and his preferred language is Spanish.

His home phone is 651-555-7844.

The visit reason will be New Pt and book the appointment 7 days from now for 10:00 am.

### ***Scenario Four***

You have received a phone call from patient Helen Potter. She has decided to disclose some additional demographics to you.

**Task 30:** Access Helen Potter's account and update her demographics with the following:

Her preferred language is English.

Her race is White.

### ***Scenario Five***

A provider at your clinic, Dr. Mark Jones, is frustrated with receiving mild drug-drug interaction warnings.

**Task 31:** Edit the necessary settings for the MARKJONES entry in the MIS Interaction/Conflict Groups Dictionary to remove mild drug-drug interaction warnings.

### ***Scenario Six***

Your organization has noted that pregnant women are not getting the recommended DTaP immunization in the third trimester of pregnancy. In the interest of increasing compliance with this recommendation, your organization plans to edit an existing pregnancy order set.

**Task 32:** Modify the 28 Week Pregnancy Visit order set in the AOM Ordre Set Dictionary to include a DTaP immunization procedure. Set the item to be checked as a default for the set.

## APPENDIX B: CLINICAL PARTICIPANT DEMOGRAPHICS

### Gender

Female	17	68%
Male	8	32%

### Age

Choose not to disclose	0	0%
Under 18	0	0%
18-24	1	4%
25-34	6	24%
35-44	12	48%
45-54	4	16%
55-64	2	8%
65-74	0	0%
Over 75	0	0%

### What is the highest level of education you have completed?

Choose not to disclose	0	0%
No schooling	0	0%
8th grade or under	0	0%
High school graduate, or equivalent	2	8%
Trade/technical/vocational training	2	8%
Associate degree	6	24%
Bachelor's degree	5	20%
Master's degree	2	8%
Professional degree	1	4%

Doctorate degree	7	28%
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**What is your occupation/role? (Select all that apply)**

Registered Nurse	6
Certified Medical Assistant	0
Nurse Practitioner	0
Physician	7
Resident	0
Administrative	2
IT Staff	13
Other	2

**How many years have you been working in your current profession?**

Less than 1 year	0	0%
1-3 years	7	28%
4-6 years	8	32%
7-9 years	2	68
Over 10 years	8	32%

**How many hours per week do you spend on a computer?**

0-10	0	0%
11-25	2	8%
26+	23	92%

**How many years experience do you have with any EHR?**

Less than 1 year	0	0%
1-3 years	3	12%
4-6 years	6	24%
7-9 years	4	16%
Over 10 years	7	28%

**How many EHRs do you use or are you familiar with?**

0	0	0%
1	9	36%
2	7	28%
3	3	12%
4	4	16%
5+	2	8%